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Invitation for Sealed Bids

Solicitation Title	Construction of an Affordable Housing Development at Five Points Phase 4
Solicitation Number	C19013
Due Date	January 15, 2019
Due Time	2:00 p.m. EST
Deliver Responses to	Knoxville's Community Development Corporation Procurement Division 901 N. Broadway Knoxville, TN 37917 The Procurement Building is behind the main office building.
Electronic Copies	Electronic copies are available on KCDC's webpage or by email at **purchasinginfo@kcdc.org**.
Responses may be emailed to KCDC	☐ Yes ☒ No
Printed responses required	☒ Yes ☐ No
Solicitation Meeting	☒ Yes ☐ No
Solicitation Meeting is Mandatory	☐ Yes ☒ No
Solicitation Meeting Date	December 20, 2018
Solicitation Meeting Time	10:00 a.m.
Solicitation Meeting Location	In KCDC's Board Room at 901 N Broadway in Knoxville.
Questions About This Solicitation	KCDC will not accept questions via telephone. Submit questions to **purchasinginfo@kcdc.org by** 4:00 p.m. on January 3, 2019**.**
Award Results	KCDC posts a summary of the proposals received and the award decision to its web page: **http://www.kcdc.org/procurement/**
Open Records/Public Access to Documents	All document provided to KCDC are subject to the Tennessee Open Meetings Act (TCA 8-44-101) and open records requirements.
Plans/Blueprints	Blueprints/plans are available from ACS Printing, 201 Center Park Drive Suite 1120, Knoxville, TN 37922. Call 675-3020 or **craig@acsprint.com**

Check KCDC's webpage for addenda and changes before submitting your response

General Information

1. **Background and Intent**

a. Knoxville's Community Development Corporation (KCDC) is the public housing and redevelopment agency for the City of Knoxville and for Knox County in Tennessee. KCDC's affordable housing property portfolio includes 20 sites with approximately 3,525 dwelling units. Several of the properties include Low Income Housing Tax Credits units and KCDC is both the General Partner and the management company for those sites. Those properties include Eastport Development, LP; Five Points 1, LP; Five Points 2, LP; Five Points 3, LP; Lonsdale, LP; North Ridge Crossing, LP; and Vista at Summit Hill, LP. KCDC also oversees approximately 3,958 Section 8 Vouchers, 82 Moderate Rehabilitation units and 20 Redevelopment areas.

b. KCDC, on behalf of the Five Points 4 LP, has issued this solicitation for the construction work. The Five Points 4 LP is a KCDC affiliated entity for which KCDC is the managing partner. Hereafter this document attempts to refer to "KCDC" and "Five Points 4 LP" as "Owner" for clarity. The reader must understand that there are two separate owners for the two separate portions of this project. Any accidental reference to "KCDC" or to "Five Points 4 LP" shall be understood to be the same as "Owner."

c. This solicitation is for the fourth and final phase of owner's Five Points Redevelopment and consists of the construction of 82 housing units and related sitework work. The units will be in 31 buildings and include 14 -1 bedroom, 23 - 2 bedroom, 23 - 3 bedroom, 18 - 4 bedroom and 4 - 5 bedroom unit types. The project also includes the site preparation and infrastructure improvements that support the development. This work includes clearing and grading, site utility systems, site stormwater system, roadways, sidewalks and street lighting. See the drawings and specifications for details.

d. Financing and legal restrictions require this work to be completed with two separate contracts, owners have packaged the two scopes of work together in one document and will require the cost of the work to be identified separately. Owners intend to award to the supplier offering the lowest overall total bid cost.

e. The successful supplier will sign two separate contracts: one for the infrastructure work and one for the construction of the units. The contract for the infrastructure will be with KCDC and the contract for the construction will be with Five Points 4 LP-a KCDC affiliated entity.

2. **Bonds**

Bid, payment and performance bonds are required if the bid exceeds $100,000 in value. Bonding requirements include:

a. All bonding companies must be listed in the Federal Register, Department of the Treasury Fiscal Service, Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies; Notice. Companies licensed to do business in the State of Tennessee must issue all required bonds.

b. Bid bonds from each supplier equivalent to five percent (5%) of the total bid price for **each contract**.

Separate bids bonds are required for the infrastructure and for the construction of the housing units. For the infrastructure work bonds are for the benefit of Knoxville's Community Development Corporation. For the construction work bonds are for the benefit of Five Points 4 LP. Such bid bonds must accompany the bid. Bid bonds will not be returned until a contract is signed.

c. Performance and payment bonds for 100% of the contract price for **each contract.** Separate bonds (bids, payment and performance) are required for the infrastructure and for the construction of the housing units. For the infrastructure work bonds are for the benefit of Knoxville's Community Development Corporation. For the construction work bonds are for the benefit of Five Points 4 LP. It is anticipated a financial partner Home Federal, will require a Dual Obligee rider on the bonds for Five Points 4 LP.

3. **Changes after Award**

It is possible that after award owners will need to revise the service needs or requirements specified in this document. Owners reserve the right to make such changes after consultation with the supplier. Should additional costs arise, the supplier must document increased costs. Owners reserve the right to accept or reject and negotiate these charges.

4. **Codes and Ordinances**

All work covered is to be done in full accord with national, state and local codes and ordinances and orders that are in effect at the time the work is performed.

5. **Contact Policy**

The supplier may not contact owners' staff or Board members, other than the KCDC's Procurement Division, about matters pertaining to this solicitation, from the issuance of this solicitation until its award. Information obtained from an unauthorized officer, agent or employee of owners will not affect the risks or obligations assumed by the supplier or relieve the supplier from fulfilling any of the conditions of the project. Such contact can disqualify the supplier from participation in the solicitation process.

6. **Contract Approval**

The resulting contracts are subject to KCDC's Board approval (infrastructure) and Five Points 4 Corporation Board approval (construction) at their January meetings.

7. **Contract Documents**

Owners have posted a prototype of the standard contract and rider that will be used to its webpage. Please review these documents before submitting a bid.

8. **Damage**

The supplier is responsible for all damage to buildings, equipment, grounds, premises and all other types of potential damage resulting from the provision of the services requested herein.

9. **Employees**

Supplier will:

a. Allow only personnel thoroughly trained and skilled to work on the job.

b. Have sufficient personnel to complete the work in a timely manner.

c. Enforce strict discipline and good order among his/her employees.

d. Provide at least one employee on every job assignment with the ability to speak, read, write and understand English so owner's staff can communicate effectively with them.

e. Employ the quantity and quality of supervision necessary for both effective and efficient management at all times.

f. Ensure that employees have proper identification displayed while on the job site. Employees must wear a company uniform or have photo identification badges at all times.

g. Employees parking vehicles (whether corporately or privately owned) must ensure that company identification is on the vehicles. This may be by placards on the vehicle's side, laminated paper with the company name placed on the dashboard or other means.

10. **Entrance to Sites**
Supplier employees are not to be on owners' premises unless they are working on the project. Acquaintances, family members, assistants, or any person not working on owner's behalf will not accompany employees on owners' sites.

11. **Equipment**
Supplier shall provide all necessary equipment, materials, supplies, et cetera needed for the work. Include the cost for such equipment, materials and supplies in the price quoted.

12. **Evaluation**
Owners will evaluate this as a formal sealed bid and the award is to the "lowest and best." Owners alone determine (using NIGP's definition and other relevant sources as appropriate) the supplier's "responsive" and "responsible" status prior to award. Responsible means a business with the financial and technical capacity to perform the requirements of the solicitation and subsequent contract. A responsive bid is one that fully conforms in all material respects to the solicitation document and all of its requirements, including all form and substance. Owners reserve the right to request additional information to assist in the evaluation process; this includes references and business capacity information.

13. **General Instructions**
Owners do not insert "General Instructions to Suppliers" in solicitation documents. These instructions are at www.kcdc.org. Click on "Procurement" and the link to the instructions. The supplier's submittal means acceptance of the terms and conditions set forth in KCDC's "General Instructions to Suppliers."

14. **Insurance**
See Appendix A.

15. **Invoicing**

a. Infrastructure Contract: Payments will be made via ACH on the 15th of the month.

b. Construction Contract: Payment will run through the LP construction account. And there is not a specific date each month. Payment may be made via "paper checks".

c. Concerning the infrastructure work, owner's purchases of goods are exempt from Tennessee sales and use tax pursuant to Tennessee Code Annotated 67-6-329(a) (4) and owner is generally exempt from the Federal Excise tax.

Suppliers are subject to Tennessee sales and use tax on all materials and supplies used in the performance of a contract, whether such materials and supplies are purchased by the supplier, produced by the supplier, or provided to the supplier by owner, pursuant to Tennessee Code Annotated 67-6-209. The supplier will pay all taxes incurred in the performance of an awarded contract. Upon the placement of a purchase order or the award of a contract, owner will provide a State of Tennessee Sales Tax Exemption form to the supplier. Owner will not pay taxes on invoices.

d. Concerning the construction work, purchases made for the Five Points 4 LP are not tax exempt.

16. **Licensure**

a. Suppliers must possess and maintain proper licensure from the State of Tennessee and all other authorities having jurisdiction throughout the term of this award.

b. In addition to any City or County licenses that may be required, all suppliers must be licensed as required by the State of Tennessee's "Contractor's Licensing Act of 1994."

c. The Executive Director of the State Contractor Licensing Board says one of these licenses is required:

- BC
- BC-B

d. Any subsequent rulings by the State Licensing Board automatically revise these specifications-irrespective of the timing of the notice from the State and irrespective of the status of this solicitation.

17. **Liquidated Damages**
Liquidated damages of $300.00 per calendar day for each day beyond the scheduled completion date apply and are included in the award. This applies to both the infrastructure and the construction work. Owners will consider explanatory information if it provides a valid reason for delays in schedule.

18. **Materials and Workmanship**
All materials and equipment furnished shall be new and of high quality. Work shall be accurate, skilled and subject to owner's approval.

All materials and equipment provided shall conform to regulations of enforcement bodies having jurisdiction. Supplier shall furnish material samples for approval if desired by owners.

19. **Measurements and Drawings**
Complete responsibility for the final determination of dimensions lies with the supplier. The supplier shall verify all dimensions with the actual on-site conditions. Where the supplier's work is to join another trade, the supplier's shop drawings shall show actual dimensions and the method of joining the work of those trades.

20. **Permits**
The supplier shall obtain and pay for or cause its subcontractors to obtain and pay for all permits required to complete required work. In addition, supplier shall arrange, schedule and pay for or cause its subcontractors to arrange, schedule and pay for all required final inspections by state, local, or independent certified inspecting authorities necessary for issuance of all required owner utilization permits for the work.

21. **Questions**
Direct questions to purchasinginfo@KCDC.org with "Construction of Affordable Housing" in the subject line by 4:00 p.m. on January 3, 2019**.**

22. **Representations**
By submitting a response, the supplier represents and warrants:

a. That the supplier is financially solvent and that it is experienced in and competent to perform the type of work, and/or to furnish the personnel, plans, materials, supplies, or equipment to be performed or furnished by it; and

b. That the supplier is familiar with all federal, state, municipal and county laws, ordinances and regulations, which may in any way affect the work of those employed therein, including but not limited to any special acts relating to the work or to the project of which it is a part; and

c. That the supplier carefully examined the plans, specifications and the worksite and that from its own investigations, has satisfied itself as to the nature and location of the work, the character, quality, quantity of surface and subsurface materials likely to be encountered, and character of equipment and other facilities needed for the performance of the work, the general and local conditions and all other materials which may in any way affect the work or its performance.

23. **Responsibilities**
At no expense to owners, the supplier will:

a. Provide quality control for all services provided.

b. Provide competent supervision.

c. Provide competent workers.

d. Take precautions necessary to protect persons or property against injury and/or damage and be responsible for any such damage or injury that occurs because of their fault or negligence.

e. Perform work without unnecessary interference with the activities of owners, residents, or suppliers.

24. **Safety**

a. The supplier is responsible for providing and placing barricades, tarps, plastic, flag tape and other safety/traffic control equipment to protect the public, surrounding areas, equipment and vehicles.

b. The safety of staff and the public is of prime concern to owners and all costs associated are the responsibility of the supplier.

c. The supplier shall ensure that its employees exercise all necessary caution and discretion to avoid injury to persons or damage to property.

d. The supplier will protect all buildings, appurtenances and furnishings from damage. The supplier shall, at his expenses, repair such damages (or replace the items) by approved methods to restore the damaged areas to their original condition.

e. Supplier shall use caution signs as required by OSHA Regulation 1910.144 and 1910.145 at no cost to owners. Caution signs shall be on-site at commencement of contract.

f. Supplier shall comply with all other OSHA and TOSHA safety standards that apply.

25. **Section 3 of the HUD Act of 1968**

Section 3 is a provision of the Housing and Urban Development Act of 1968 which requires that programs of direct financial assistance administered by the U.S. Department of Housing and Urban Development (HUD) provide, to the greatest extent feasible, opportunities for job training and employment to lower income residents in connection with projects in their neighborhoods. Further, to the greatest extent feasible, contracts in connection with these projects are to be awarded to local businesses. Section 3 is a tool for fostering local economic development, neighborhood economic improvement and individual self-sufficiency.

a. Recipients and suppliers must make a good faith effort to utilize Section 3 area residents as trainees and employees in connection with the project. Targeted recruitment and the selection of Section 3 area residents for available positions are two examples of good faith efforts to meet this requirement.

b. Recipients and suppliers must make a good faith effort to award contracts to Section 3 business concerns for work in connection with the project. An example of a good faith effort to meet this requirement is the implementation of an affirmative action plan, which includes targets for the number and dollar value for awarding contracts to Section 3 business concerns.

c. Recipients and suppliers must keep records and submit reports to HUD documenting the good faith efforts taken and the results of these actions. Examples of such documentation include letters to community organizations, employment development and business development centers, copies of solicitations for bids or proposals; and copies of affirmative action plans.

d. How can businesses find Section 3 residents to work for them? This can be accomplished by recruiting in the neighborhood and public housing developments to tell about available training and job opportunities.

Distributing flyers, posting signs, placing ads, and contacting resident organizations and local community development and employment agencies to find potential workers are a few effective ways of getting jobs and people together.

e. All contracts awarded are subject to Section 3 requirements. Supplier shall seek to fill any and all positions that are needed and unfilled with residents of KCDC communities. For additional information, please go to http://www.hud.gov/offices/fheo/section3/Section3.pdf. The successful supplier will supply owners with job announcements for any position that must be filled as a result of the award of owner's work.

   Additionally the successful supplier will supply the same job announcement to the Knoxville-Knox County Committee Action Committee's Workforce Connections group. These can be faxed to 544-5269.

f. A Section 3 resident is one who lives within a public housing authority's site. It is also people who live in an area with a HUD assisted program and whose income is below HUD's low income requirements.

g. A Section 3 business is one that:

   1. Is at least 51% owned by a Section 3 resident; or

   2. Employs Section 3 residents for at least 30% of its employee base; or

   1. Makes a commitment to sub contract at least 25% of the project's dollars to a Section 3 business.

h. Upon award, the successful supplier will supply two documents to owners:

   1. A Section 3 Business determination (forms supplied by owners) provided one is not already on file.

   2. A Section 3 Business plan for this work.

26. **Security**

The successful supplier is responsible for providing (if necessary) any and all security to equipment, materials, personnel, tools and the site that are required for this job. Owners are not responsible for damage or losses to equipment, materials, personnel, tools or the site.

27. **Site Examination**

a. Suppliers are required to visit the site and become fully acquainted and familiar with conditions, as they exist and the required operations. The supplier shall make such investigations as necessary so that they may fully understand the scope of the work and related facilities and possible complexities when executing the work.

b. The failure or omission of the supplier to receive or examine the solicitation document or any part of the specifications, or to visit the site(s) and acquaint themselves as to the nature and location of the work, the general and local conditions and all matters which may in any way affect performance shall not relieve the supplier of any obligation to perform as specified herein.

Supplier understands the intent and purpose hereof and its obligations hereunder and that it shall not make any claim for, or have any right to damages resulting from any misunderstanding or misinterpretation of the resulting agreement, or because of any lack of information.

c. By submitting a response to this solicitation, each supplier is certifying that they have inspected the site and have read the solicitation and all appendices and addenda. The failure or omission of any supplier to receive or examine any form, instrument, or document shall in no way relieve the supplier from any obligation in respect to its bid.

28. **Smoking Policy**

Owners have a Smoke Free policy that applies to you, your employees and all subcontractors. Specifically, the policy (which is HUD required) mandates:

- No smoking on owner's property
- No e-vape or similar usage on owner's property
- The Smoke Free policy applies in personal or corporate vehicles on owner's property

HUD definitions include:

- ✓ "Smoking" means inhaling, exhaling, burning or carrying any lighted or heated cigar, cigarette or pipe, or any other lighted or heated tobacco or plant product intended for inhalation, including hookahs and marijuana, whether natural or synthetic, in any manner or in any form. "Smoking" also includes the use of an electronic smoking device which creates an aerosol or vapor, in any manner or in any form.

- ✓ "Electronic Smoking Device" means any product containing or delivering nicotine or any other substance intended for human consumption that can be used by a person in any manner for the purpose of inhaling vapor or aerosol from the product. The term includes any such device, whether manufactured, distributed, marketed or sold as an e-cigarette, e-cigar, e-pipe, e-hookah or vape pen or under any other product name or descriptor.

- ✓ Property means all buildings, parking lots, streets, structures and **land** owned by owners.

Should supplier staff be observed violating these requirements, KCDC's Procurement Division will notify the corporate level contact about the problem. Should there be recurrences; owners may ask the supplier to not send the employee to owner's property. Repeated offenses may result in forfeiture of your awarded "contract."

29. **Storm Water and Street Ordinances**

The City of Knoxville's Storm Water and Street Ordinances apply to this solicitation. The successful supplier will comply with all aspects of the City's ordinances. Compliance includes but is not limited to:

a. Retaining all sediments on the project site using structural drainage controls. Drainage control costs are incidental to the work.

b. Not discharging any construction or demolition related materials, wastes, spills, or residues from the project site to streets, drainage facilities, or adjacent properties by wind or runoff.

c. Containing non-storm water runoff from equipment and vehicle washing and any other activity at the project site.

d. Additional information about NPDES, BMPs and the Land Development Manual at http://www.cityofknoxville.org/engineering/stormwater/npdes.asp**.**

e. The successful supplier is responsible for all work, remediation, repair and monetary penalties or fines arising out of a Notice of Violation of the City of Knoxville's Storm Water and Street Ordinances. The supplier will be charged costs owners incurs to install structural drainage controls or remedy a Notice of Violation. Owners shall also charge a $50 fee per violation for related administrative costs.

f. Owners will prepare, submit and pay the permitting fees. Upon award, the successful supplier will be required to sign onto the permit and be responsible for implementing and maintaining all erosion control measures as required on the SWPPP.

30. **Subcontractors**
Subcontractors must:

a. Be approved by owners prior to beginning work.

b. Carry the insurance coverages as outlined herein.

c. Comply with the federal Davis Bacon requirements and State of Tennessee Highway wage rates and submit certified payrolls.

d. Not be on HUD's Debarment List.

e. Not be changed without owner's permission.

31. **Time for Completion**
Supplier will complete the entire project within 16 months from the date of the Notice To Proceed. Upon award, the successful supplier will work with owners to develop a schedule that is satisfactory to owners. The schedule will include buildings being completed and turned over to owners in multiple phases to be determined. Liquidated damages will apply to the completion dates for each phase.

32. **Wage Compliance (Davis Bacon Requirements)**

a. The City of Knoxville provided the funding for the infrastructure portion of the work and the City's prevailing wage requirements apply to this portion of the work.

1. The supplier agrees to comply with and to post the prevailing wage laws as provided in the "Prevailing Wage Act of 1975," Tennessee Code Annotated § Tennessee Code Annotated 12-4-401 et seq. For the purpose of this contract, the prevailing wage rates shall be the wage rates incorporated in these documents.

   Owners reserve the right to demand the payroll records of supplier at any time to monitor compliance with the wage rate/discrimination clause(s). Failure by supplier to provide owners with said records within ten working days of the written notice shall constitute a breach of this contract.

2. The supplier must display the wage rates and laws at the job site. Highway classification descriptions are in the State of Tennessee Department of Labor & Workforce Development's document "Classification of Workers Under Tennessee's Prevailing Wage Law – Highway Construction Crafts" at http://www.state.tn.us/labor-wfd/ClassificationHighway9-13-2006.htm

3. The supplier and subcontractors shall submit certified payrolls to owners each week in which any work occurs. During construction, if the work of the supplier or subcontractor will be interrupted for a week or more, the supplier will place the following statement on the signature sheet of the payroll for the last week in which work occurred: "No additional work will be performed until further notice."

4. In the event a work stoppage of a week or more occurs which is not anticipated, owners shall be furnished the following statement on the signature sheet of the payroll form for the week immediately after the week in which work was interrupted: "No work performed, and no work will be performed until further notice."

5. When work has ceased in either case as stipulated above, the supplier or subcontractor shall note the following statement on the payroll for the week on which work is resumed: "Last previous work was performed the week ending _____."

6. Fringe benefits are not required.

7. For more information see:
   https://www.tn.gov/content/dam/tn/workforce/documents/employers/2018%20Revised%20Highway%20Prevailing%20Wage%20Rates.pdf

2018 REVISED HIGHWAY PREVAILING WAGE RATES

** The four (4) rates below were miscalculated and have been corrected.

CLASSIFICATION	CRAFT NUMBER	2018
Bricklayer	1	15.47
Carpenter/Leadsperson	2	19.01
Class "A" Operators	3	20.77
Class "B" Operators	4	18.53
Class "C" Operators	5	19.26
Class "D" Operators	6	17.88
Concrete Finisher	7	16.87
Drill Operator (Cassion)	8	27.40
**Electrician	9	27.66
Farm Tractor Operator (Power Broom)	10	14.65
Ironworkers Reinforcing	11	17.67
Ironworkers (Structural)	12	18.33
Mechanic (Class I) Heavy Duty	13	23.29
**Mechanic (Class II) Light Duty	14	20.91
Painter/Sandblaster	15	28.60
Powder Person Blaster	16	21.46
Skilled Laborer	17	16.57
**Survey Instrument Operator	18	21.95
Sweeping Machine (Vacuum) Operator	19	16.89
Truck Driver (2 axles)	20	16.66
Truck Driver (3/4 axles)	21	16.12
**Truck Driver (5 or more axles)	22	17.83
Unskilled Laborer	23	14.22
Worksite Traffic Coordinator	24	18.32
Crane Operator	25	22.18

Effective 05/21/2018

b. Federal Davis Bacon Wage Requirements apply to work in building the affordable housing. The successful supplier will:

1. Submit certified payrolls showing compliance with the Davis Bacon requirements herein. Failure to do so will be sufficient cause for withholding payment and/or termination of the contract.

2. Must pay its employees at least weekly pursuant to the Davis Bacon determination listed herein.

3. Will display all pages of Wage Posters, in a “prominent spot” at the job site. These are available from the Procurement Division.

4. Will allow owners to conduct on-site Davis Bacon interviews of the supplier's employees. Owners will use HUD forms and record the information.

5. Classify employees by the applicable Davis Bacon classification. Classifications are determined by the work performed and the tools used-not by job titles.

6. General Decision Information for the non-parking lot work:

General Decision Number	TN180023
Date	01-05-2018
State	Tennessee
Construction Types	Residential
Counties	Anderson and Knox Counties in Tennessee
Residential	Residential Construction Projects (consisting of single-family homes and apartments up to and including 4 stories.
Modification Number	0

Classifications and rates:

Classifications and Rates	Rate	Fringe 1
Bricklayer	$12.72	$0.00
Carpenter Including Cabinet Installation	$13.89	$0.00
Cement Mason/Concrete Finisher	$16.00	$0.00
Electrician	$18.52	$2.32
Laborer: Common or General	$8.00	$0.00
Laborer: Landscape	$12.33	$0.30
Operator: Backhoe	$13.17	$0.00
Plumber	$17.50	$0.00
Roofer: Including Shake and Shingle	$10.25	$0.00
Welders: Receive rate prescribed for craft performing operation to which welding is incidental.		

7. Suppliers may not "use a classification" because there is not one listed that exactly identifies the work performed. Unlisted Classifications needed for work not included within the scope of the classifications listed above may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)). To request an additional classification:

8. Write a brief letter to owners (upon award) stating the title needed and the proposed pay rate. Indicate that the employees agree with the rate and are in agreement with the rate. The rate must bear a reasonable resemblance to other rates on the classification.

9. If the additional classification is for a subcontractor, the subcontractor writes a similar letter to the General Supplier who then sends a cover letter to owners officially requesting the classification.

10. Owners will review the request and forward it to HUD and officially request it or owners will suggest that the supplier revise the request.

11. HUD will review the request and approve it (or decline it) and send it to the Department of Labor for final approval.

12. The Department of Labor will either approve the request or recommend a different minimum rate.

13. HUD will notify owners of the decision.

14. Should either HUD or the Department of Labor require a higher minimum rate, owners will notify the supplier. The higher minimum rate, if any, must be paid for work completed (back wages) and for all future work under this project.

15. These requirements apply to all subcontractors that are used by the successful supplier.

16. Davis Bacon rates are locked in at the bid opening provided that a contract is awarded within 90 days. If a contract is not awarded within 90 days after the bid opening and if a new decision is released, it will apply. Modifications released 10 days or less before a bid opening are not applicable as there is not time to incorporate the changes in the bid.

17. In all cases however, owners are required to adhere to Davis Bacon standards as the Department of Labor determines - irrespective of any announcements owners may have made.

33. **Weather**

Owners are providing allowances for excessive inclement weather since this solicitation calls for liquidated damages, provided the supplier exceeds the guaranteed number of days for completion.

a. Extensions of Contract Time

If the basis exists for an extension of time in accordance with this solicitation, then an extension of time based on weather may be granted only for the number of weather delay days in excess of the number of weather days listed as the Standard Baseline for that month.

b. Standard Baseline for Average Climatic Range

The Standard Baseline is the normal and anticipated number of calendar days for each month during which adverse weather will prevent activity. Suspension of activity for the number of days each month as listed in the Standard Baseline is to be included in the work and not eligible for an extension of the contract time. The baseline is:

Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
7.4	7.5	8.1	7.3	7.9	7.1	7.8	6.0	4.8	5.2	7.2	7.9

c. Adverse Weather and Weather Delay Days

1. Adverse weather is the occurrence of one or more of the following conditions which prevents only exterior activity or access to the site within a twenty-four hour period:

    a. Precipitation (rain, snow or ice) in excess of one-tenth inch (0.10”) liquid measure.

b. Temperatures which do not rise above 32 degrees Fahrenheit by 10:00 a.m.

c. Standing snow in excess of one inch (1.00”).

2. Adverse weather may include, if appropriate, “dry-out” or “mud” days when all of the following are met:

a. For rain above the Standard Baseline.

b. Only if there is a hindrance to site access or site work, such as excavation, backfill and footings.

c. At a rate no greater than one make-up day for each day or consecutive days or rain beyond the Standard Baseline that total 1.0 inch or more, liquid measure, unless specifically recommended otherwise by the owners.

3. A weather delay day occurs only if adverse weather prevents work on the project for 50 percent or more of the supplier’s scheduled workday, including a weekend day or holiday if the supplier has scheduled construction activity that day.

d. Documentation and Submittals

1. Submit Daily Jobsite Work Log showing which and to what extent activities were affected by weather on a monthly basis.

2. Submit actual weather data to support a claim for the time extension obtained from nearest NOAA weather station or other independently verified source approved by the owners at the beginning of the project.

3. Maintain a rain gauge, thermometer and clock at the jobsite. Keep daily records of precipitation, temperature and the time of each occurrence throughout the project.

4. Use the Standard Baseline data provided in this section when documenting actual delays due to weather in excess of the average.

5. Organize claim documentation on calendar month periods and submit in accordance with the procedures for claims established by the owners.

e. Approval by Owners

1. If the extension of the contract time is appropriate, it will occur in accordance with the provisions of this solicitation.

2. Owners shall not incur extra costs for any extra time increase to the contract.

34. **Work Hours**

Acceptable work hours are Monday through Friday from 7:30 a.m. until 4:00 p.m. Work on Saturdays, Sundays or holidays requires owner's approval. After 4:00, owner's staff may not be available to assist you. However, this does mean that owners expect you to stop at exactly 4:00 if a few additional minutes will allow you to get to a reasonable stopping point.

Scope of Work (Provided by BarberMcMurry Architects)

P R O J E C T M A N U A L

FOR THE CONSTRUCTION OF

FIVE POINTS PHASE 4
KNOXVILLE'S COMMUNITY DEVELOPMENT CORPORATION
400 MCCONNELL STREET
KNOXVILLE, TENNESSEE 37915

07 DECEMBER 2018

BMa 177700

Architect: BarberMcMurry Architects
505 Market Street, Suite 300
Knoxville, Tennessee 37902-2175
Phone: 865-934-1915
Fax: 865-546-0242

Civil: Civil & Environmental Consultants, Inc.
2704 Cherokee Farm Way, Suite 101
Knoxville, TN 37920
Phone: 865.977.9997

Landscape: CRJA
524 S. Gay Street, Suite 201
Knoxville, TN 37902
Phone: 865.522.2752

Structural: Chad Stewart & Associates, Inc.
800 South Gay Street, Suite 1625
Knoxville, TN 37929
Phone: 865.329.9920

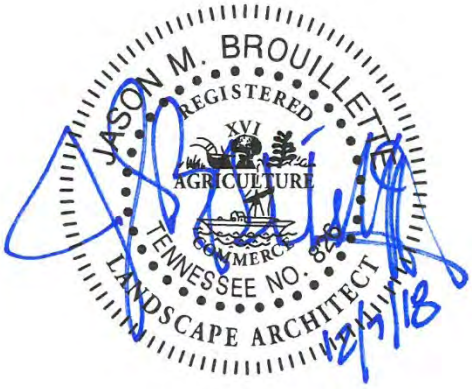
M, P, & E: Facility Systems Consultants, LLC
713 South Central Street, Suite 101
Knoxville, TN 37902
Phone: 865.246.0164

SECTION 00 01 07 - SEALS PAGE

The specifications for this project have been developed by, or under the direct supervision of, the following design professionals.

ARCHITECT:

LANDSCAPE:



STRUCTURAL:

MECHANICAL:

ELECTRICAL:

END OF SECTION 00 01 07

SECTION 00 01 10 - TABLE OF CONTENTS

DIVISION 00 PROCUREMENT AND CONTRACTING REQUIREMENTS

END OF TABLE OF CONTENTS

SECTION 00 01 15 - LIST OF DRAWING SHEETS

1.01 LIST OF DRAWINGS

A. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

SHEET NUMBER	SHEET NAME
GENERAL	
A000	COVER SHEET
CIVIL	
C200	SITE LAYOUT PLAN
C201	
C202	
C203	
C300	SITE GRADING PLAN
C301	
C302	
C303	
C400	SITE DRAINAGE
C401	
C402	
C403	
C500	SITE UTILITIES
C501	
C502	
C503	
LANDSCAPE	
L1.0	SITE LANDSCAPE PLAN
L1.1	DETAILED LANDSCAPE PLANS
L1.2	DETAILED LANDSCAPE PLANS
L1.3	DETAILED LANDSCAPE PLANS
L1.4	DETAILED LANDSCAPE PLANS
L1.5	DETAILED LANDSCAPE PLANS
L1.6	DETAILED LANDSCAPE PLANS
L1.7	DETAILED LANDSCAPE PLANS
L1.8	DETAILED LANDSCAPE PLANS
L1.9	DETAILED LANDSCAPE PLANS
L2.0	LANDSCAPE DETAILS & NOTES
IR1.0	IRRIGATION SCOPE PLAN
ARCHITECTURAL	
A010	LIFE SAFETY PLANS
A011	LIFE SAFETY PLANS
A012	LIFE SAFETY PLANS
A020	ARCHITECTURAL OVERALL SITE PLAN

A021	ARCHITECTURAL SITE PLAN - 1
A022	ARCHITECTURAL SITE PLAN - 2
A023	ARCHITECTURAL SITE PLAN - 3
A024	ARCHITECTURAL SITE PLAN - 4
A025	ARCHITECTURAL SITE PLAN - 5
A030	SITE DETAILS
A050	STANDARD MOUNTING HEIGHTS, PARTITION TYPES & UL RATED ASSEMBLIES
A051	UL RATED ASSEMBLIES
A-A101	TYPE A - FIRST FLOOR PLANS & SCHEDULES (VICTORIAN)
A-A102	TYPE A - SECOND FLOOR PLANS (VICTORIAN)
A-A103	TYPE A - ENLARGED PLANS & INTERIOR ELEVATIONS (VICTORIAN)
A-A301	TYPE A - BUILDING ELEVATIONS (VICTORIAN)
A-A302	TYPE A - BUILDING SECTIONS (VICTORIAN)
B-A101	TYPE B - FIRST FLOOR PLANS & SCHEDULES (COLONIAL REV.)
B-A102	TYPE B - SECOND FLOOR PLANS (COLONIAL REV.)
B-A103	TYPE B - ENLARGED PLANS & INTERIOR ELEVATION (COLONIAL REV.)
B-A104	TYPE B - INTERIOR ELEVATIONS (COLONIAL REV.)
B-A301	TYPE B - BUILDING ELEVATIONS (COLONIAL REV.)
B-A302	TYPE B - BUILDING SECTIONS (COLONIAL REV.)
C-A101	TYPE C - FIRST FLOOR PLANS & SCHEDULES (CRAFTSMAN)
C-A102	TYPE C - SECOND FLOOR PLANS (CRAFTSMAN)
C-A103	TYPE C - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
C-A301	TYPE C - BUILDING ELEVATIONS (CRAFTSMAN)
C-A302	TYPE C - BUILDING SECTIONS (CRAFTSMAN)
D1-A101	TYPE D1 - FIRST FLOOR PLANS & SCHEDULES (CRAFTSMAN)
D1-A102	TYPE D1 - SECOND FLOOR PLANS (CRAFTSMAN)
D1-A103	TYPE D1 - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
D1-A104	TYPE D1 - INTERIOR ELEVATIONS (CRAFTSMAN)
D1-A301	TYPE D1 - BUILDING ELEVATIONS (CRAFTSMAN)
D1-A302	TYPE D1 - BUILDING SECTIONS (CRAFTSMAN)
D2-A101	TYPE D2 - COMMUNITY ROOM ADDITION PLANS AND ELEVATIONS
E-A101	TYPE E - BUILDING PLANS & SCHEDULES (CRAFTSMAN)
E-A102	TYPE E - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
E-A301	TYPE E - BUILDING ELEVATIONS (CRAFTSMAN)
E-A302	TYPE E - BUILDING SECTIONS (CRAFTSMAN)
F-A101	TYPE F - FIRST FLOOR PLANS & SCHEDULES (COLONIAL REV.)
F-A102	TYPE F - SECOND FLOOR PLANS (COLONIAL REV.)
F-A103	TYPE F - ENLARGED PLANS & INTERIOR ELEVATIONS (COLONIAL REV.)
F-A301	TYPE F - BUILDING ELEVATIONS (COLONIAL REV.)
F-A302	TYPE F - BUILDING SECTIONS (COLONIAL REV.)
G1-A101	TYPE G1 - FIRST FLOOR PLANS & SCHEDULES (CRAFTSMAN)
G1-A102	TYPE G1 - SECOND FLOOR PLANS (CRAFTSMAN)
G1-A103	TYPE G1 - ENLARGED PLANS & INTERIOR ELEVATIONS (CRAFTSMAN)
G1-A301	TYPE G1 - BUILDING ELEVATIONS (CRAFTSMAN)
G1-A302	TYPE G1 - BUILDING SECTIONS (CRAFTSMAN)
G2-A101	TYPE G2 - FIRST FLOOR PLANS & SCHEDULES (VICTORIAN)
G2-A102	TYPE G2 - SECOND FLOOR PLANS (VICTORIAN)
G2-A103	TYPE G2 - ENLARGED PLANS & INTERIOR ELEVATIONS (VICTORIAN)
G2-A301	TYPE G2 - BUILDING ELEVATIONS (VICTORIAN)

G2-A302	TYPE G2 - BUILDING SECTIONS (VICTORIAN)
H1-A101	TYPE H1 - BUILDING PLANS & SCHEDULES (COLONIAL REV.)
H1-A102	TYPE H1 - ENLARGED PLANS & INTERIOR ELEVATIONS (COLONIAL REV.)
H1-A301	TYPE H1 - BUILDING ELEVATIONS (COLONIAL REV.)
H1-A302	TYPE H1 - BUILDING SECTIONS (COLONIAL REV.)
H2-A101	TYPE H2 - BUILDING PLANS & SCHEDULES (VICTORIAN)
H2-A102	TYPE H2 - ENLARGED PLANS & INTERIOR ELEVATIONS (VICTORIAN)
H2-A301	TYPE H2 - BUILDING ELEVATIONS (VICTORIAN)
H2-A302	TYPE H2 - BUILDING SECTIONS (VICTORIAN)
A401	SECTION DETAILS
A402	SECTION DETAILS
A403	SECTION DETAILS
A501	PLAN DETAILS
A502	ENLARGED STAIR PLANS & SECTIONS
A503	ENLARGED STAIR PLANS & SECTIONS
A504	ENLARGED STAIR PLANS & SECTIONS
A505	ENLARGED STAIR PLANS, SECTIONS & DETAILS
A601	CASEWORK DETAILS
A701	DOOR AND FRAME TYPES, DOOR AND FRAME DETAILS
A702	WINDOW ELEVATIONS AND DETAILS

STRUCTURAL

S001	ABBREVIATIONS, SYMBOLS AND LEGENDS
S002	GENERAL NOTES
S003	SPECIAL INSPECTIONS
S004	TYPICAL DETAILS
S005	TYPICAL DETAILS
S006	TYPICAL DETAILS
A-S101	TYPE A FOUNATION PLAN
A-S102	SECOND FLOOR FRAMING PLAN
A-S103	ROOF FRAMING PLAN
B-S101	FOUNDATION PLAN
B-S102	SECOND FLOOR FRAMING PLAN
B-S103	ROOF FRAMING PLAN
C-S101	FOUNDATION PLAN
C-S102	SECOND FLOOR FRAMING PLAN
C-S103	ROOF FRAMING PLAN
D1-S101	FOUNDATION PLAN
D1-S102	SECOND FLOOR FRAMING PLAN
D1-S103	ROOF FRAMING PLAN
D2-S101	FOUNDATION PLAN
D2-S102	SECOND FLOOR FRAMING PLAN
D2-S103	ROOF FRAMING PLAN
E-S101	FOUNDATION & ROOF FRAMING PLAN
F-S101	FOUNDATION PLAN
F-S102	SECOND FLOOR FRAMING PLAN
F-S103	ROOF FRAMING PLAN
G1-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
G1-S102	ROOF FRAMING PLAN
G2-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN

G2-S102	ROOF FRAMING PLAN
H1-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
H1-S102	ROOF FRAMING PLAN
H2-S101	FOUNDATION & SECOND FLOOR FRAMING PLAN
H2-S102	ROOF FRAMING PLAN
S201	SECTIONS & DETAILS
S301	SECTIONS & DETAILS
S401	SECTIONS & DETAILS
S402	SECTIONS & DETAILS

MECHANICAL

M001	HVAC NOTES, LEGENDS AND SCHEDULES
M002	HVAC DETAILS
A-M101	BUILDING A - FIRST AND SECOND FLOOR HVAC PLANS
B-M101	BUILDING B - FIRST AND SECOND FLOOR HVAC PLANS
C-M101	BUILDING C - FIRST AND SECOND FLOOR HVAC PLANS
D1-M101	BUILDING D1 - FIRST AND SECOND FLOOR HVAC PLANS
D2-M101	BUILDING D2 - FIRST AND SECOND FLOOR HVAC PLANS
E-M101	BUILDING E - FIRST AND SECOND FLOOR HVAC PLANS
F-M101	BUILDING F - FIRST AND SECOND FLOOR HVAC PLANS
G1-M101	BUILDING G1 - FIRST AND SECOND FLOOR HVAC PLANS
G2-M101	BUILDING G2 - FIRST AND SECOND FLOOR HVAC PLANS
H1-M101	BUILDING H1 - FIRST AND SECOND FLOOR HVAC PLANS
H2-M101	BUILDING H2 - FIRST AND SECOND FLOOR HVAC PLANS

PLUMBING

P0.0	PLUMBING NOTES, LEGENDS AND SCHEDULES
A-P101	BUILDING A - FIRST AND SECOND FLOOR SANITARY PLANS
A-P102	BUILDING A - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
B-P101	BUILDING B - FIRST AND SECOND FLOOR SANITARY PLANS
B-P102	BUILDING B - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
C-P101	BUILDING C - FIRST AND SECOND FLOOR SANITARY PLANS
C-P102	BUILDING C - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
D1-P101	BUILDING D1 - FIRST AND SECOND FLOOR SANITARY PLANS
D1-P102	BUILDING D1 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
D2-P101	BUILDING D2 - FIRST AND SECOND FLOOR SANITARY PLANS
D2-P102	BUILDING D2 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
E-P101	BUILDING E - FIRST FLOOR SANITARY PLANS
E-P102	BUILDING E- FIRST FLOOR DOMESTIC WATER PLANS
F-P101	BUILDING F - FIRST AND SECOND FLOOR SANITARY PLANS
F-P102	BUILDING F - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
G1-P101	BUILDING G1 - FIRST AND SECOND FLOOR SANITARY PLANS
G1-P102	BUILDING G1 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
G2-P101	BUILDING G2 - FIRST AND SECOND FLOOR SANITARY PLANS
G2-P102	BUILDING G2 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
H1-P101	BUILDING H1 - FIRST AND SECOND FLOOR SANITARY PLANS
H1-P102	BUILDING H1 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS
H2-P101	BUILDING H2 - FIRST AND SECOND FLOOR SANITARY PLANS
H2-P102	BUILDING H2 - FIRST AND SECOND FLOOR DOMESTIC WATER PLANS

FIRE PROTECTION

A-FP101	BUILDING A - FIRST AND SECOND FLOOR FIRE PROTECTION PLANS
B-FP101	BUILDING B - FIRST AND SECOND FLOOR FIRE PROTECTION PLANS
C-FP101	BUILDING A - FIRST AND SECOND FLOOR FIRE PROTECTION PLANS
FP001	FIRE PROTECTION NOTES, LEGENDS, SCHEDULES, AND DETAILS

ELECTRICAL

ES1.1	ELECTRICAL SITE LIGHTING PLAN
ES2.1	ELECTRICAL SITE POWER PLAN
ES3.1	ELECTRICAL SITE COMMUNICATIONS PLAN
E001	ELECTRICAL LEGENDS, DETAILS, NOTES, AND SCHEDULES
A-E101	BUILDING A - ELECTRICAL COMPOSITE PLAN
B-E101	BUILDING B - FIRST FLOOR COMPOSITE ELECTRICAL PLAN
B-E102	BUILDING B - SECOND FLOOR COMPOSITE ELECTRICAL PLAN
B-E105	BUILDING A - ELECTRICAL COMPOSITE PLAN
B-E106	BUILDING A - ELECTRICAL COMPOSITE PLAN
C-E101	BUILDING C - ELECTRICAL COMPOSITE PLAN
D1-E101	BUILDING D1 - FIRST AND SECOND FLOOR LIGHTING PLANS
D1-E201	BUILDING D1 - FIRST AND SECOND FLOOR POWER AND COMM. PLAN
D2-E101	BUILDING D2 - FIRST AND SECOND FLOOR LIGHTING PLANS
D2-E102	BUILDING D2 - FIRST AND SECOND FLOOR POWER AND COMM. PLAN
E-E101	BUILDING E - COMPOSITE ELECTRICAL PLANS
F-E101	BUILDING F - FIRST AND SECOND FLOOR LIGHTING PLANS
F-E102	BUILDING F - FIRST AND SECOND FLOOR POWER AND COMM PLAN
G1-E101	BUILDING G1 - COMPOSITE PLAN
G2-E101	BUILDING G2 - COMPOSITE PLAN
H1-E101	BUILDING H1 - ELECTRICAL COMPOSITE PLAN
H2-E101	BUILDING H2 - ELECTRICAL COMPOSITE PLAN

DRAWINGS ARE BOUND WITH PROJECT MANUAL

END OF SECTION 00 01 15

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Work by Owner.
   4. Owner-furnished products.
   5. Access to site.
   6. Work restrictions.
   7. Specification and drawing conventions.
   8. Miscellaneous provisions.

1.02 PROJECT INFORMATION

A. Project Identification: Five Point – Phase 4.
   1. Project Location: 400 McConnell Street, Knoxville, TN 37915.

B. Owner: Knoxville Community Development Corporation, 901 Broadway, N.E., Knoxville, Tennessee 37917-6699.
   1. Owner's Representative: Mr. Orlando Diaz, Partners Development, 501 Union Avenue, Knoxville, Tennessee 37902. Phone: 865-524-7777.

C. Architect: BarberMcMurry Architects, 505 Market Street, Suite 300, Knoxville, TN 37902-2175. Phone: 865-934-1915. Fax: 865-546-0242.

D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
   1. Civil: Civil & Environmental Consultants, Inc., 2704 Cherokee Farm Way, Suite 101, Knoxville, TN 37920. Phone: 865.977.9997.
   2. Landscape: CRJA, 524 S. Gay Street, Suite 201, Knoxville, TN 37902. Phone: 865.522.2752.
   3. Structural: Chad Stewart & Associates, Inc., 800 South Gay Street, Suite 1625, Knoxville, TN 37929. Phone: 865.329.9920.
   4. Mechanical, Plumbing, and Electrical: Facility Systems Consultants, LLC, 713 South Central Street, Suite 101, Knoxville, TN 37902. Phone: 865.246.0164.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. Construction of buildings with living units for Phase 4 of Five Points Redevelopment.

B. Type of Contract:
   1. Project will be constructed under a single prime contract.

1.04 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
   1. Purchase, delivery and installation of residential appliances.

1.05 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.06 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
   1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
   2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
   3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
   4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.07 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

C. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.08 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 21 00 – ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:
   1. Lump-sum allowances.
   2. Unit-cost allowances.

1.02 DEFINITIONS

A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.03 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.04 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.05 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.06 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

D. At Project closeout, credit unused amounts remaining in the lump-sum allowance to Owner by Change Order.

1.07 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

D. At Project closeout, credit unused amounts remaining in the unit-cost allowance to Owner by Change Order.

1.08 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
   3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
   4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Include the sum of $65,000 for playground equipment.
   1. This allowance includes material cost, receiving, handling, and installation, and Contractor overhead and profit.

B. Allowance No. 2 Unit-Cost Allowance: Include the sum of $450.00 per thousand for face brick as specified in Section 04 20 00 "Unit Masonry" and as shown on Drawings.

END OF SECTION 01 21 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.02 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.03 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. Certificates and qualification data, where applicable or requested.
      g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.04 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.05 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Requested substitution provides sustainable design characteristics that specified product provided for achieving LEED prerequisites and credits.
      c. Substitution request is fully documented and properly submitted.

d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.02 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.03 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.04 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.05 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.02 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.03 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule for each building.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values for each building to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one-line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.
   3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.

g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
    1) Labor.
    2) Materials.
    3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
    a. Include separate line items under Contractor and principal subcontracts for sustainable design documentation and other Project closeout requirements.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.04 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit five signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Sustainable Design submittal for project materials cost data.

4. Contractor's construction schedule (preliminary if not final).
5. Products list (preliminary if not final).
6. Sustainable Design action plans.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.
13. Performance and payment bonds.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
   5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
   6. AIA Document G707, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Requests for Information (RFIs).
   3. Project meetings.

1.02 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.03 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.04 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.05 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Architect.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.06 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. SUSTAINABLE DESIGN requirements.
    m. Preparation of record documents.
    n. Use of the premises and existing building.
    o. Work restrictions.
    p. Working hours.
    q. Owner's occupancy requirements.
    r. Responsibility for temporary facilities and controls.
    s. Procedures for moisture and mold control.
    t. Procedures for disruptions and shutdowns.
    u. Construction waste management and recycling.
    v. Parking availability.
    w. Office, work, and storage areas.
    x. Equipment deliveries and priorities.
    y. First aid.
    z. Security.
    aa. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Sustainable Design Coordination Conference: Owner's Representative will schedule and conduct a Sustainable Design coordination conference before starting construction, at a time convenient to Owner, Architect, and Contractor.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect meeting requirements for sustainable design certification, including the following:
      a. Sustainable Design Project Checklists.
      b. General requirements for sustainable design-related procurement and documentation.
      c. Project closeout requirements and sustainable design certification procedures.
      d. Role of Sustainable Design coordinator.
      e. Construction waste management.
      f. Construction operations and Sustainable Design requirements and restrictions.
   3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Sustainable Design requirements
      i. Review of mockups.
      j. Possible conflicts.
      k. Compatibility requirements.
      l. Time schedules.
      m. Weather limitations.
      n. Manufacturer's written instructions.
      o. Warranty requirements.
      p. Compatibility of materials.
      q. Acceptability of substrates.
      r. Temporary facilities and controls.
      s. Space and access limitations.
      t. Regulations of authorities having jurisdiction.
      u. Testing and inspecting requirements.

v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for completing Sustainable Design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

F. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    1) Review schedule for next period.
b. Review present and future needs of each entity present, including the following:
    1) Interface requirements.
    2) Sequence of operations.
    3) Status of submittals.
    4) Status of sustainable design documentation.
    5) Deliveries.
    6) Off-site fabrication.
    7) Access.
    8) Site utilization.
    9) Temporary facilities and controls.
    10) Progress cleaning.
    11) Quality and work standards.
    12) Status of correction of deficient items.
    13) Field observations.
    14) Status of RFIs.
    15) Status of proposal requests.
    16) Pending changes.
    17) Status of Change Orders.
    18) Pending claims and disputes.
    19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

G. Coordination Meetings: Conduct Project coordination meetings at biweekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be

expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:
   1) Interface requirements.
   2) Sequence of operations.
   3) Status of submittals.
   4) Deliveries.
   5) Off-site fabrication.
   6) Access.
   7) Site utilization.
   8) Temporary facilities and controls.
   9) Work hours.
   10) Hazards and risks.
   11) Progress cleaning.
   12) Quality and work standards.
   13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's construction schedule.
   2. Construction schedule updating reports.
   3. Material location reports.
   4. Site condition reports.
   5. Special reports.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.03 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. PDF electronic file.

B. Startup construction schedule.
   1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Material Location Reports: Submit at monthly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

1.04 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including work stages and interim milestones.
   4. Review delivery dates for Owner-furnished products.
   5. Review submittal requirements and procedures.
   6. Review time required for review of submittals and resubmittals.

7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for Project closeout and Owner startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review procedures for updating schedule.

1.05 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
   4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
   6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.
6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
    1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is [14] <Insert number> or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.

f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing.
j. Punch list and final completion.
k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
   a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, Sustainable Design documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
   a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
   b. Total cost assigned to activities shall equal the total Contract Sum.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.

4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
   a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.03 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.

2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.04 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.03 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's final release or approval.
      g. Scheduled date of fabrication.

1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 15 days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
   5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Paper Submittals: Not allowed.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number, numbered consecutively.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   2. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   3. Action Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Architect will return one copy with comments.
   4. Informational Submittals: Submit one electronic copy of each submittal unless otherwise indicated. Architect will not return copies.
   5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:
    a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
    1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
        a. Identification of products.
        b. Schedules.
        c. Compliance with specified standards.
        d. Notation of coordination requirements.
        e. Notation of dimensions established by field measurement.
        f. Relationship and attachment to adjoining construction clearly indicated.
        g. Seal and signature of professional engineer if specified.
    2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
    3. Submit Shop Drawings in the following format:
        a. PDF electronic file.
        b. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
    1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
    2. Identification: Attach label on unexposed side of Samples that includes the following:
        a. Generic description of Sample.
        b. Product name and name of manufacturer.
        c. Sample source.
        d. Number and title of applicable Specification Section.
        e. Specification paragraph number and generic name of each item.
    3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
    4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
        a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
        b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
    5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. PDF electronic file.

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

K. LEED Submittals: Comply with requirements specified in Section 018113.13 "Sustainable Design Requirements."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests

performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.02 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action as follows:
   1. "Reviewed": Work may proceed providing it complies with Contract Documents.
   2. "Furnish as Noted": Work may proceed providing it complies with notations on submittal and with the Contract Documents.
   3. "Revise and Resubmit": Do not proceed with work. Revise submittal in accordance with notations thereon and resubmit to obtain a different action marking. Do not allow submittals with this action marking to be used in connection with performance of the work. In resubmitting, limit corrections to the items marked.
   4. "Rejected": Do not proceed with the work. Submittal is rejected for non-compliance with the Contract Documents or other justified cause. Correct the submittal and resubmit to obtain a different action marking. Do not allow submittals with this action marking to be used in connection with the performance of the work.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Specific test and inspection requirements are not specified in this Section.

1.02 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
   2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.03 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.04 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
   1. Indicate manufacturer and model number of individual components.
   2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.05 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
   1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
   2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

1.06 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
   1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.07 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.08 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.

5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    a. Allow seven days for initial review and each re-review of each mockup.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

1.09 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences,

examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
   1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.01 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.03 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association (The) www.aluminum.org	(703) 358-2960
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association	(202) 824-7000

	www.aga.org	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, andRefrigeration Institute, The www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917

ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The)	(703) 620-0010

	www.bia.org	
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175

CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200 (800) 328-6306
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electrical Components Association www.ec-central.org	(703)907-8024
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee http://content.asce.org/ejcdc/	(703) 295-6000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek-etlsemko.com	(800) 967-5352
FIBA	Federation Internationale de Basketball	41 22 545 00 00

	(The International Basketball Federation) www.fiba.com	
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI) www.ahrinet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association	(703) 435-2900

	www.hpva.org	
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAPSC	International Association of Professional Security Consultants www.iapsc.org	(515) 282-8192
ICBO	International Conference of Building Officials www.iccsafe.org	(888) 422-7233
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
ICPA	International Cast Polymer Association www.icpa-hq.org	(703) 525-0320
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society of North America www.iesna.org	(703) 525-0320
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISA	Instrumentation, Systems, and Automation Society, The www.isa.org	(919) 549-8411
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (801) 341-7360
ITS	Intertek Testing Service NA (Now ETL SEMCO)	

ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LGSEA	Light Gauge Steel Engineers Association www.arcat.com	(202) 263-4488
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International)	(800) 797-6223 (281) 228-6200

	www.nace.org	
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 222-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890

NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.org	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
PTI	Post-Tensioning Institute www.post-tensioning.org	(248) 848-3180
RCSC	Research Council on Structural Connections www.boltcouncil.org	

RFCI	Resilient Floor Covering Institute www.rfci.com	 (706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	 (925) 935-1499
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SCAQMD	South Coast Air Quality Management District www.aqmd.com	(909) 396-2000
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611

SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association www.swpa.org	(847) 681-1868
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association www.tema.org	(914) 332-0040
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball	(888) 786-5539

	www.usavolleyball.org	(719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut fur Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc.	(800) 423-6587

www.icc-es.org (562) 699-0543

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478

OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science http://www.hhs.gov/ophs/	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772
USPS	Postal Service www.usps.com	(202) 268-2000

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	

FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil/	(215) 697-2664
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CDHS	California Department of Health Services www.dhcs.ca.gov	(916) 445-4171
CDPH	California Department of Public Health, Indoor Air Quality Section www.cal-iaq.org	

CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforestservice.tamu.edu	(979) 458-6606

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.02 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.03 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
   1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
   2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
   3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air-filtration system discharge.
   4. Waste handling procedures.
   5. Other dust-control measures.

1.04 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.05 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.02 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10. individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
   3. Drinking water and private toilet.
   4. Coffee machine and supplies.
   5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.03 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Delete "Toilets" Subparagraph below if facilities are unavailable or if their use is not permitted even if available. Indicate location of Owner's existing toilets in Section 011000 "Summary" or show on Drawings.
   2. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
a. Provide a dedicated telephone line for each facsimile machine in each field office.
2. At each telephone, post a list of important telephone numbers.
a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

L. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.05 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace, or clean stored or installed material that begins to grow mold.
   7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
      c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.02 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.03 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.06 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with

requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Correction of the Work.

1.02 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products to be used for patching and firms or entities that will perform patching work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

E. Certified Surveys: Submit two copies signed by land surveyor.

F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.04 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are

indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.08 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Use containers intended for holding waste materials of type to be stored.
   4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.09 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

1.02 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.03 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

B. Comply with 2015 Enterprise Green Communities Criteria, Section 6.12 Construction Waste Management.

1.04 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.05 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Sustainable Design Submittal: Sustainable Design letter template, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

H. Qualification Data: For waste management coordinator and refrigerant recovery technician.

I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.06 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs an Accredited Professional, certified as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.07 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
   2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
   3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
   4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
   6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
   1. Total quantity of waste.
   2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
   3. Total cost of disposal (with no waste management).
   4. Revenue from salvaged materials.
   5. Revenue from recycled materials.
   6. Savings in hauling and tipping fees by donating materials.
   7. Savings in hauling and tipping fees that are avoided.
   8. Handling and transportation costs. Include cost of collection containers for each type of waste.
   9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.02 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.03 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
   a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.04 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
   1. Crush asphaltic concrete paving and screen to comply with requirements in Section 31 20 00 "Earth Moving" for use as general fill.

B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
   1. Pulverize concrete to maximum 1-1/2-inch size.
   2. Crush concrete and screen to comply with requirements in Section 31 20 00 "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Pulverize masonry to maximum 1-inch size.
      a. Crush masonry and screen to comply with requirements in Section 31 20 00 "Earth Moving" for use as general fill.
      b. Crush masonry and screen to comply with requirements in Section 32 93 00 "Plants" for use as mineral mulch.
   2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

K. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

L. Conduit: Reduce conduit to straight lengths and store by type and size.

3.05 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.06 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

1.02 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.03 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion

construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit sustainable design submittals.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
    1. Advise Owner of pending insurance changeover requirements.
    2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
    3. Complete startup and testing of systems and equipment.
    4. Perform preventive maintenance on equipment used prior to Substantial Completion.
    5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
    6. Advise Owner of changeover in heat and other utilities.
    7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
    8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
    9. Complete final cleaning requirements, including touchup painting.
    10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
    1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
    2. Results of completed inspection will form the basis of requirements for final completion.

1.06 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
   1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
   2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
   4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Contractor.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. Three paper copies. Architect will return two copies.

1.08 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components

that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Operation manuals for systems, subsystems, and equipment.
   3. Product maintenance manuals.
   4. Systems and equipment maintenance manuals.

1.02 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.03 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Contractor.
   6. Name and contact information for Construction Manager.
   7. Name and contact information for Architect.
   8. Name and contact information for Commissioning Authority.
   9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.03 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.
   6. Normal shutdown instructions.
   7. Seasonal and weekend operating instructions.
   8. Required sequences for electric or electronic systems.
   9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.04 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and three sets of prints.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and three sets of prints.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record

data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.03 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.04 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.
   1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.02 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.03 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.04 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project record documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.

f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

SECTION 01 81 13 – SUSTAINABLE BUILDING REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Summary of sustainable building requirements for project as necessary for certification of this project through the 2015 Criteria.
   2. Related performance and administrative requirements.

1.02 REFERENCES

A. 2015 Enterprise Green Communities Criteria.

B. 2015 Enterprise Green Communities Multifamily Specifications.

C. THDA Multifamily Specifications.

1.03 COORDINATION

A. Contractor is responsible for all requirements of the 2015 Criteria that are contained throughout these Specifications, including successful compliance with and passage of visual inspections and performance tests by verifying party.

B. Contractor is responsible for all requirements of the Version 3 (Rev. 08) ENERGY STAR Certified Homes National Program Requirements.

C. ENERGY STAR: Contractor is responsible for coordinating with appropriate verification team members to ensure inspections and leakage tests can be performed at the appropriate times and without delaying construction progress;
   1. Coordinate framers, plumbers, HVAC, insulators, and drywall trades to minimize uncontrolled air leakage pathways between residential units by sealing all penetrations in walls, ceilings, and floors in the units and by sealing all vertical chases adjacent to the units.

1.04 SUBMITTALS

A. Site Improvements
   1. 3.1 Environmental Remediation:
      a. Submit Phase I Environmental Site Assessment, Tier II Environmental Review Assessment, environmental site assessment approved by HUD through the Part 50 or Part 58 process, an environmental assessment approved by USDA through the 1940-G or 1794 process.
      b. If Environmental Site Assessment reveals hazardous materials submit abatement reports as necessary.
   2. 3.2 Erosion and Sedimentation Control:
      a. Submit photo documentation of erosion control measures throughout construction.
   3. 3.4 Landscaping:

a. Submit product data for plantings indicating only native or adaptive species.

B. Water Conservation
1. 4.1 Water-Conserving Fixtures
   a. Submit product data for toilets and urinals documenting flush rate in gallons per flush (gpf); for showerheads, kitchen and lavatory faucets, documenting flow rate in gallons per minute (gpm).
   b. Submit product data for toilets, urinals, showerheads, and lavatory faucets documenting fixture is WaterSense-labeled.
2. 4.2 Advanced Water Conservation
   a. Submit product data for toilets and urinals documenting flush rate in gallons per flush (gpf); for showerheads, kitchen and lavatory faucets documenting flow rate in gallons per minute (gpm).
   b. Submit product data for toilets, urinals, showerheads, and lavatory faucets documenting fixture is WaterSense-labeled.

C. Energy Efficiency
1. 5.1a Building Performance Standard: New Construction: Multifamily.
   a. Submit ENERGY STAR New Home certificate for each dwelling unit in the development.
2. 5.3 Sizing of Heating and Cooling Equipment
   a. Submit heating and cooling load calculations and equipment selection performed in accordance with the Air Conditioning Contractors of America (ACCA) Manuals J and S or ASHRAE handbooks.
3. 5.4 ENERGY STAR Appliances
   a. If providing appliances, submit clothes washer, dishwasher and refrigerator product details generated directly from ENERGY STAR's list of certified products.
4. 5.5 Lighting
   a. Submit product data for all lighting fixtures, lighting and lamps documenting efficacy in lumens per watt (lm/W).
   b. Submit product data for all lighting controls.
5. 5.6 Electricity Meter
   a. Submit product data for individual dwelling unit electric meter/submeter.

D. Materials
1. 6.1 Low / No VOC Paints, Coatings and Primers
   a. Submit VOC level in grams per liter for all interior paints, coatings, and primers.
2. 6.2 Low / No VOC Adhesives and Sealants
   a. Submit VOC level in grams per liter for all interior adhesives, sealants, and caulks.
3. 6.3 Recycled Content Materials
   a. Submit product information that identifies post-consumer recycled content and post-industrial recycled content. Eligible products include: Framing: wood, concrete, steel, aluminum, Siding: fiber cement, Flooring, Paving: cement slab (urbanite), Roofing: asphalt shingles, Insulation: fiberglass batt, Sheathing: plywood, OSB.
4. 6.4 Regional Material
   a. Submit product information that confirms exact location where the material was extracted, processed, and manufactured. Eligible products include:

Framing materials, Exterior materials, Flooring materials, Concrete / cement and aggregate materials, Drywall / interior sheathing materials.

5. 6.6 Composite Wood Products that Emit Low / No Formaldehyde
    a. Submit product documentation demonstrating that all composite wood products installed within the weather resistive barrier (WRB) are compliant with California 93120 Phase 2.
    b. If non-compliant products are used, submit photo documentation and confirmation that all exposed edges and sides have been sealed with low-VOC sealants in accordance with Criterion 6.2.
6. 6.7a Environmentally Preferable Flooring
    a. Submit product documentation to confirm that all hard surface flooring meets the Scientific Certification System's FloorScore program criteria, including for pre-finished hardwood flooring.
    b. Submit product documentation to confirm all carpet products meet the Carpet and Rug Institute's Green Label Plus certification and all carpet pads and adhesives meet Green Label certification.
7. 6.9 Mold Prevention: Tub & Shower Enclosures
    a. Submit product documentation demonstrating all drywall behind tub and shower enclosures meets ASTM #D3273.
8. 6.10 Asthmagen-free Materials
    a. For insulation, submit product documentation demonstrating no formaldehyde in fiberglass batts and no spray polyurethane foam is used.
    b. For flooring, submit product documentation demonstrating non-flexible vinyl (PVC) roll or sheet flooring was used and that carpets are not backed with vinyl or phthalates.
    c. For wall coverings, submit product documentation demonstrating flooring materials do not contain vinyl, phthalates, epoxy-based coatings or polyurethane-based coatings.
    d. For composite wood, submit product documentation demonstrating ULEF or NAF compliance.
9. 6.11 Reduced Heat-Island Effect: Roofing
    a. Submit: product documentation demonstrating ENERGY STAR-certified roofing product.
10. 6.12 Construction Waste Management
    a. Refer to 017419 for general information and submittals related to Enterprise Green Communities criterion 6.12 Construction Waste Management.

E. Healthy Living Environment
1. 7.1 Ventilation:
    a. Submit product data for in-unit ventilation system(s) in compliance with ASHRAE 62.2-2010 requirements for
    b. local mechanical exhaust system in bathrooms;
    c. local mechanical exhaust system in kitchens; and
    d. whole-house mechanical ventilation.
    e. Submit product data for any individual bathroom fans demonstrating ENERGY STAR label and humidistat sensor, timer or other control.
    f. Submit product data for any central ventilation systems in compliance with ASHRAE 62.1-2010 requirements for any corridors, stair wells, common and amenity areas and retail/commercial/office spaces.
    g. Submit product data for any central rooftop fans showing direct-drive and variable-speed capability.

h. Submit product data for any fan providing central ventilation with design CFM 300-2000 showing an electronically commutated motor (ECM).

2. 7.3 Combustion Safety:
   a. Submit product data for any combustion water heating or space heating equipment showing compliant venting.
   b. Submit product data for hard-wired carbon monoxide alarms with battery backup.
3. 7.5 Vapor Retarder Strategies
   a. For new or replacement concrete slabs (basements, crawl spaces, and slab on grade construction), submit product data for capillary break and polyethylene sheeting.
   b. For crawl spaces with no slab, submit product data for polyethylene sheeting.
4. 7.8 Radon Mitigation
   a. For all new construction projects in EPA Radon Zone 1, submit photographs of installed radon-resistant construction features: below slab, vent pipe, and adjacent electrical outlet.
   b. For all substantial rehab projects in EPA Radon Zone 1, submit test results (conducted by a radon professional in accordance with ANSI-AARST MAMF-2012). If test results exceed 4 pCi/L (pico curies per liter), submit photographs of installed radon-reduction measures outlined in ANSI/AARSTR RMS-MF (PS) 2013 or ASTM E 2121-11.
5. 7.10 Integrated Pest Management
   a. Submit product data for nontoxic sealing methods including window screens, door sweeps, escutcheon plates, and rodent- and corrosion-proof screens for openings greater than ¼ inch.
6. 7.12 Active Design: Promoting Physical Activity Within the Building
   a. Submit photographs of signage located at building entrance and corridor intersections promoting use of stairs over elevator; or photographs of strategies installed to increase frequency and duration of physical activity.
7. 7.13 Active Design: Staircases and Building Circulation
   a. Submit product data or photographs demonstrating 10 square feet of glazing in or adjacent to stair doors or magnetic door holds on all doors leading to the stairs.

F. Operations, Maintenance and Resident Engagement
1. 8.1 Building Operations & Maintenance (O&M) Manual and Plan:
   a. Submit a manual with thorough building operations and maintenance guidance and a complementary plan, including all of the following components:
   b. Operations and maintenance guidance for all mechanical, electrical and plumbing equipment and appliances for building-level equipment and dwelling-unit equipment, including HVAC and plumbing as-built information and O&M schedules;
   c. O&M and replacement requirements for any other specialized systems within the project;
   d. Floor plans specifically highlighting the location of mechanical, electrical, gas, and water-system turnoffs;
   e. As-built lighting fixture and lamp schedules, specifications, and replacement guidance;

f. As-built landscaping and hardscaping plant lists, specifications, maintenance requirements and schedules, and any specific instructions for community gardens or growing spaces;
g. As-built irrigation plans, including zone delineation, control sequence, maintenance instructions, seasonal O&M schedule, and indication if irrigation is solely for establishment (indication # years) or is permanent;
h. Green cleaning product specifications and cleaning schedules for any finish materials requiring special treatment;
i. Pest Control Guidelines that reference the IPM strategies developed in 7.10 Integrated Pest Management;
j. Clear O&M requirements for building accessibility systems for residents, including but not limited to security and safety systems, door locking devices such as card keys or other; and
k. Maintenance requirements for equipment installed in active recreation and play spaces.

2. 8.2 Emergency Management Manual
   a. Submit information critical to an Emergency Management Manual related to operations such as infrastructure and building shutdown procedures, potable water protection and supply.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Site Improvements:
   1. 3.4 Landscaping:
      a. All trees, shrubs, groundcover, grasses, and plantings must be native or adapted to the region.
      b. All new plants must be appropriate to the site's soil and microclimate, and none should be invasive species.

B. Water Conservation:
   1. 4.1 Water-Conserving Fixtures:
      a. Toilets, WaterSense-labeled and ≤ 1.28 gallons per flush (gpf)
      b. Urinals, WaterSense-labeled and ≤ 0.5 gpf
      c. Showerheads, WaterSense-labeled and ≤ 2.0 gallons per minute (gpm)
      d. Kitchen faucets, ≤ 2.0 gallons per minute (gpm)
      e. Lavatory faucets, WaterSense-labeled and ≤ 1.5 gallons per minute (gpm)
   2. 4.2 Advanced Water Conservation:
      a. Toilets, WaterSense-labeled and ≤ 1.1 gallons per flush (gpf)
      b. Showerheads, WaterSense-labeled and ≤ 1.5 gallons per minute (gpm)
      c. Lavatory faucets, WaterSense-labeled and ≤ 1.0 (gpm)
   3. 4.6 Access to Potable Water during Emergencies:
      a. Install potable water storage tanks capable of providing at least 20 gallons per resident or drilled well with means for pumping water when the electric grid is down.

C. Energy Efficiency:
   1. 5.1a Building Performance Standard: New Construction: single family and low-rise multifamily.

a. Provide products that meet ENERGY STAR program requirements.

2. 5.3 Sizing of Heating and Cooling Systems
   a. Install equipment that meets the sizing calculations in accordance with the Air Conditioning Contractors of America (ACCA) Manuals J and S or ASHRAE handbooks. Equipment capacity shall not exceed calculated sizing by more than 20% (unless smaller capacity equipment is unavailable).
3. 5.4 ENERGY STAR Appliances:
   a. The following appliances shall be ENERGY STAR certified:
      1) Clothes washers; and
      2) Dishwashers; and
      3) Refrigerators.
4. 5.5 Lighting:
   a. Permanently installed lighting fixtures shall have efficacy ≥ 40 lumens per watt.
   b. Recessed lights are ballasted compact fluorescent fixtures or use ENERGY STAR qualified LED lamps; and
      1) Fixtures are Insulation Contact Air-Tight rated.
   c. Common area lighting are ballasted compact fluorescent fixtures or use ENERGY STAR qualified LED lamps; and
      1) Are controlled by occupancy sensors or automatic bi-level controls
   d. Exterior lamps are fluorescent or LED; and
      1) ENERGY STAR certified when available in the product category; and
      2) Dark-Sky approved; and
      3) Have motion sensor controls, integrative photo cells, photo sensors or astronomic time-clock operation.
   e. Exit signs shall consume ≤ 5 watts and have battery backup when located above stairwell doors and other forms of egress.
5. 5.6 Electricity Meter:
   a. Electric meter or submeter shall be installed that is capable of individually metering each dwelling unit's electricity.

D. Materials:
1. 6.1 Low / No VOC Paints, Coatings and Primers:
   a. All interior paints and primers must have volatile organic compound (VOC) levels, in grams per liter, less than or equal to the thresholds established by South Coast Air Quality Management District (SCAQMD) Rule 1113. Projects must follow the most recent revision available at the time of product specification. For the latest rules: www.aqmd.gov/home/regulations/rules; as of July 1, 2013 SCAQMD Rule 1113 thresholds are listed as:
   b. Primers and sealers: 100g/L
   c. Coatings, flats and non-flats: 50 g/L
   d. Opaque floor coatings: 50 g/L
   e. Rust preventative coatings: 100 g/L
   f. Clear wood finishes: 275 g/L
2. 6.2 Low / No VOC Adhesives and Sealants:
   a. All interior adhesives and sealants (including caulks) must have volatile organic compound (VOC) levels, in grams per liter, less than or equal to the thresholds established by South Coast Air Quality Management District (SCAQMD) Rule 1168. Projects must follow the most recent revision available at the time of product specification. For the latest rules:

www.aqmd.gov/home/regulations/rules; as of January 7, 2005, SCAQMD Rule 1168 thresholds are listed as:

1) Indoor carpet adhesives: 50 g/L
2) Carpet pad adhesives: 50 g/L
3) Outdoor carpet adhesives: 150 g/L
4) Wood flooring adhesives: 100 g/L
5) Rubber floor adhesives: 60 g/L
6) Subfloor adhesive: 50 g/L
7) Ceramic tile adhesives: 65 g/L
8) VCT and asphalt tile adhesives: 50 g/L
9) Drywall and panel adhesives: 50 g/L
10) Cove base adhesives: 50 g/L
11) Multipurpose construction adhesives: 100 g/L
12) Structural glazing adhesives: 100 g/L
13) Single-ply roof membrane adhesives: 250 g/L
14) Structural wood member adhesive: 140 g/L
15) Architectural sealants, including caulk: 250 g/L

3. 6.3 Recycled Content Materials:
   a. Use building materials that feature recycled content. The building material must make up 75% (by weight or cost) of a project component, and must be composed of at least 25% post-consumer recycled content or at least 50% post-industrial recycled content. Eligible products include: Framing: wood, concrete, steel, aluminum, Siding: fiber cement, Flooring, Paving: cement slab (urbanite)], Roofing: asphalt shingles, Insulation: fiberglass batt, Sheathing: plywood, OSB.
4. 6.4 Regional Material:
   a. Use products that were extracted, processed, and manufactured within 500 miles of the project for a minimum of 50%, based on cost, of the building materials' value. Building material types that can qualify include: Framing materials, Exterior materials (e.g. siding, masonry, roofing), Flooring materials, Concrete/cement and aggregate material, Drywall/interior sheathing materials.
5. 6.6 Composite Wood Products that Emit Low / No Formaldehyde
   a. All composite wood products (plywood, OSB, MDF, cabinetry, etc.) installed within the weather-resistive barrier (WRB) must either be certified as compliant with California 93120 Phase 2, and/or;
   b. For composite wood products installed within the WRB that do not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with low-VOC sealants per Criterion 6.2.
6. 6.7a Environmentally Preferable Flooring
   a. All hard surface flooring must be a product that meets the Scientific Certification System's FloorScore program criteria, including for pre-finished hardwood flooring.
   b. All carpet products must meet the Carpet and Rug Institute's Green Label Plus certification and all carpet pads and adhesives must meet Green Label certification.
7. 6.7b Environmentally Preferable Flooring Throughout
   a. Use only non-vinyl, non-carpet floor coverings throughout the building.
8. 6.9 Mold Prevention: Tub & Shower Enclosures:

a. Use moisture-resistant backing materials such as cement board, fiber cement board, or equivalent per ASTM #D3273 behind tub/shower enclosures.

9. 6.10 Asthmagen-free Materials
   a. For insulation, do not use spray polyurethane foam (SPF) or formaldehyde-containing fiberglass batts.
   b. For flooring, do not use flexible vinyl (PVC) roll or sheet flooring or carpet backed with vinyl or phthalates. Do not use fluid applied finish floor.
   c. For wall coverings, do not use wallpaper made from vinyl (PVC) with phthalates or site-applied high-performance coatings that are epoxy-based or polyurethane-based.
   d. For composite wood, use only Ultra Low Emitting Formaldehyde (ULEF) or No Added Formaldehyde (NAF) products for cabinetry, subflooring, and other interior composite wood uses.
10. 6.11 Reduced Heat-Island Effect: Roofing
   a. Use an ENERGY STAR-certified product for 100% of the non-vegetated roof area.
   b. Use an intensive or extensive vegetated roof system with waterproof layer, drainage layer, growing medium and containment with appropriate planting and irrigation for the vegetated portion of the roof area.

E. Healthy Living Environment
1. 7.1 Ventilation
   a. In-unit ventilation system(s) shall comply with ASHRAE 62.2-2010 requirements for local mechanical exhaust system in bathrooms and kitchens, and whole-house mechanical ventilation. Design/measured flow rates shall not exceed ASHRAE 62.2-2010 requirements by more than 50%.
   b. Individual bathroom fans shall be
      1) ENERGY STAR labeled; and either
   c. turn on with the light switch and off with associated automatic delay timer, or
   d. be activated by motion sensor, humidistat or other appropriate control.
   e. Central ventilation system (s) shall comply with ASHRAE 62.1-2010 requirements for any corridors, stair wells, common and amenity areas and retail/commercial/office spaces. Design/measured flow rates shall not exceed ASHRAE 62.1-2010 requirements by more than 50%.
   f. Any central rooftop fans shall be direct-drive and variable-speed.
   g. Any fan providing central ventilation with design CFM 300-2000 shall be equipped with an ECM motor.
2. 7.3 Combustion Safety
   a. Any combustion water heating or space heating equipment located within the conditioned envelope shall be power-vented or direct-vented.
   b. Carbon monoxide alarms shall be hard-wired with battery backup.
3. 7.5 Vapor Retarder Strategies
   a. Polyethylene sheeting used as a vapor retarder beneath any new or replacement concrete slabs (including basements, crawl spaces, or slab on grade construction) shall be at least 10mm thick.
   b. Polyethylene sheeting used as a vapor retarder in crawl spaces (with no concrete slab) shall be at least 8mm thick.
4. 7.7 Mold Prevention: Water Heaters
   a. Drain pans under tank water heaters shall be sloped and corrosion-resistant (e.g., stainless steel or plastic).

5. 7.10 Integrated Pest Management
    a. Sealants shall be low-VOC.
    b. Openings greater than ¼" shall be equipped with rodent- and corrosion-proof screens.
    c. Operable windows shall have screens.
    d. All exterior doors and apartment entry doors shall be equipped with weatherstripping and door sweeps.
6. 7.13 Active Design: Staircases and Building Circulation
    a. All stairwell doors shall incorporate 10 square feet of glazing in door or side light or be equipped with magnetic door holds.

PART 3 - EXECUTION

3.01 ENTERPRISE GREEN COMMUNITIES – GENERAL

A. Meet all Mandatory criterion and all Optional criterion as identified and specified by the design team, as required to achieve certification through Enterprise Green Communities.

3.02 EXECUTION REQUIREMENTS

A. Site Improvements
    1. 3.1 Environmental Remediation:
        a. Execute mitigation steps as determined by environmental assessment.
    2. 3.2 Erosion and Sedimentation Control:
        a. Follow all Best Management Practices (BMPs) within the Total Erosion and Sedimentation Control (TESC) Plan.
        b. Photograph all erosion control measures used throughout construction, including representative photos during rain events (as applicable) to document no visible off-site discharge.
    3. 3.4 Landscaping:
        a. Any disturbed area must be reseeded or xeriscaped with plants that meet product requirements.

B. Energy Efficiency:
    1. 5.1a Building Performance Standard: New Construction: single family and low-rise multifamily:
        a. Certify each dwelling unit under ENERGY STAR Certified Homes program; and meet all Program Requirements of the applicable program.
        b. Co-ordinate with a qualified third-party Energy Rater to field verify compliance with all requirements of the applicable program.
    2. 5.3 Sizing of Heating and Cooling Equipment
        a. Use HVAC load calculation software programs reviewed by ACCA to perform Manual J and S calculations; and;
        b. Select and install HVAC equipment according to ACCA Manual J and S procedures to ensure right-sizing.

C. Materials:
    1. 6.6 Composite Wood Products that Emit Low/No Formaldehyde

a. For composite wood products installed within the WRB, that do not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with low-VOC sealants per Criterion 6.2 prior to installation.

D. Healthy Living Environment:
1. 7.1 Ventilation:
   a. Install the following ventilation systems and ductwork in full accordance with ASHRAE 62.2-2010 and manufacturer's recommendations (This includes following guidelines for minimum straight duct length from fan boxes prior to first bend, type and size of duct, and number of bends to exterior wall termination):
   b. Local mechanical exhaust system in each bathroom and wire individual bathroom fans to turn on with light switch;
   c. Local mechanical exhaust system in each kitchen;
   d. Whole-house ventilation system.
   e. In the common spaces and hallways of multifamily buildings 4 stories or taller, install mechanical ventilation systems in full accordance with ASHRAE 62.1-2010 and manufacturer's recommendations.
2. 7.2 Clothes Dryer Exhaust:
   a. Install rigid-type exhaust ductwork to connect all vented clothes dryers directly to outdoors.
   b. Install a plumbed drain for all condensing or heat pump clothes dryers.
3. 7.3 Combustion Safety:
   a. Install hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone and placed per National Fire Protection Association (NFPA) 720.
   b. For rehab projects with any atmospheric combustion space or water heating equipment within the conditioned envelope, conduct combustion safety testing for minimum 10% of dwelling units in accordance with RESNET or BPI Combustion Safety Test Procedures. Report any deficiencies immediately to the owner or owner's representative.
4. 7.5 Vapor Retarder Strategies:
   a. Install products in accordance with ENERGY STAR program requirements.
   b. For projects with new concrete slab (for basements, crawl spaces, or slab on grade construction), install a capillary break as follows:
   c. Install 4-inch layer of half-inch diameter or greater clean aggregate, or a 4-inch uniform layer of sand, overlain with a layer or strips of geotextile drainage matting installed according to the manufacturer's instructions.
   d. Immediately above the aggregate/sand capillary break, install 10 mil (or thicker) polyethylene sheeting, overlapped 6 inches (or greater) at the seams, in direct contact with the concrete slab above.
   e. For projects with crawl spaces that have no concrete slab, install a vapor retarder as follows:
   f. Install 8 mm minimum thickness cross-laminated polyethylene on the crawl floor, extended at least 12 inches upward on piers and foundation walls, and overlap joints at least 12 inches minimum.
   g. Line "high-traffic" areas of the crawl space with foam board to avoid disturbing polyethylene.
5. 7.6 Water Drainage:
   a. Install waterproofing and water management systems to direct water away from walls, windows, doors, and roofs.

b. Provide a continuous weather resistive barrier and drainage plane in accordance with manufacturer's instructions:
    1) Install housewrap with sheets lapped single-style to prevent bulk water from penetrating the building cavity.
c. Provide a means for bulk water to drain out from beneath cladding, i.e. weep holes.
d. Install flashing at all roof/wall intersections and wall penetrations that is integrated with the weather-resistive barrier and drainage plane. Penetrations to be flashed include any plumbing, electrical, vent, and HVAC refrigerant line penetrations. Provide pan, side, and head flashings for any openings.
e. Install drip edge at entire perimeter of roof.
f. At wall/roof intersections, maintain minimum 2-inch clearance between wall cladding and roofing materials, fully flash the intersection, and install kick-out flashing.

6. 7.7 Mold Prevention: Water Heaters:
    a. Install non-water-sensitive floor coverings in rooms with water heaters.
    b. Install plumbed floor drains or plumbed drain pans under all tank water heaters, and ensure that floor slope or drain pan slope allows for adequate drainage.
    c. Direct all condensate lines into a plumbing system; do not deposit condensate under concrete slabs.
7. 7.8 Radon Mitigation:
    a. For all new construction projects in EPA Radon Zone 1, install passive radon-resistant construction features as follows:
        1) Seal the foundation with polyurethane caulk or the equivalent at all slab openings, penetrations, and control or expansion joints and sump covers.
        2) Install below-slab venting and a vertical vent pipe that extends to daylight above the roofline.
        3) Install a junction box and electrical outlet within 10' of the vent pipe termination to allow for future conversion to an active radon reduction system.
    b. For all substantial rehab projects in EPA Radon Zone 1, conduct a test for radon by a radon professional in accordance with ANSI-AARST MAMF-2012). If test results exceed 4 pCi/L (pico curies per liter), install radon-reduction measures outlined in ANSI/AARSTR RMS-MF (PS) 2013 or ASTM E 2121-11.
8. 7.10 Integrated Pest Management
    a. Seal all interior and exterior wall, floor, and joint penetrations with low-VOC caulking or other appropriate nontoxic sealing method (window screens, door sweeps, escutcheon plates, elastomeric sealant) to prevent pest entry.
    b. Install rodent- and corrosion-proof screens (copper or stainless steel mesh, or rigid metal cloth) for openings greater than ¼ inch.
    c. Thoroughly seal entry points under kitchen and bathroom sinks to prevent pest entry.

E. Operations and Maintenance:
1. 8.4 Resident and Property Staff Orientation:
    a. Use materials provided under Criterion 8.1 and 8.2 to deliver training to facility management and building maintenance staff on all relevant systems.

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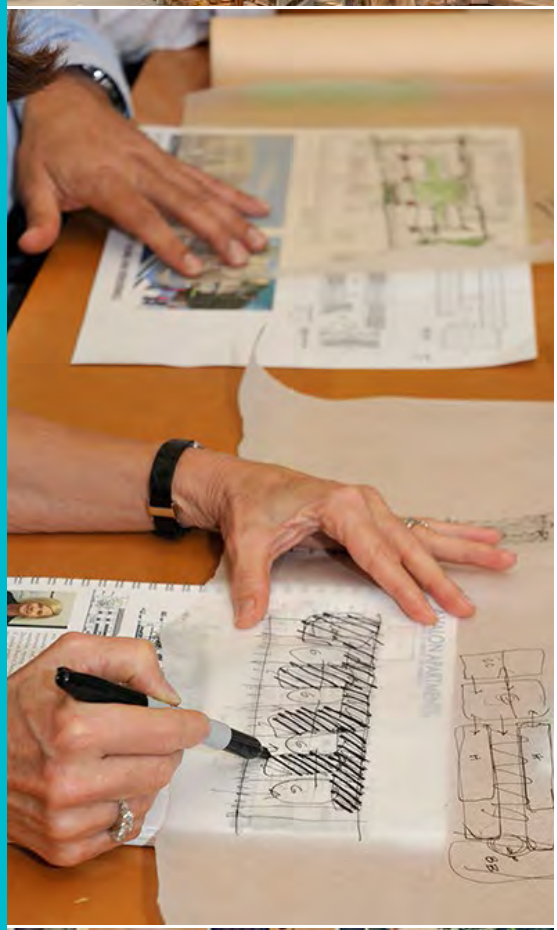

2015 ENTERPRISE GREEN COMMUNITIES CRITERIA

Enterprise green communities®

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We also thank the hundreds of developers and project teams now integrating the Enterprise Green Communities Criteria into affordable housing across the country.

Any errors in this document are the sole responsibility of Enterprise Green Communities.

Design: Landesberg Design

Contents

CONTENTS (CONTINUED)

The American Heart Association is proud to serve as a scientific advisor to Enterprise Community Partners, Inc. in support of the 2015 Green Communities Criteria update. With its strong focus on improving the health of low-income families and communities, the Criteria aligns directly with the American Heart Association's mission to build healthier lives, free of cardiovascular diseases and stroke.

The Green Communities Criteria is the leading U.S. standard for the design, construction and operation of healthy, energy efficient and environmentally responsible affordable housing. Since its first release in 2004, the Criteria has played a leading role in advancing the widespread adoption of healthy design and building practices across the affordable housing field and has served as the blueprint for the development and preservation of tens of thousands of affordable homes throughout the country.

At the American Heart Association, we understand that healthy, high-quality affordable housing has the potential to help address some of the most urgent health challenges facing low-income families and communities today. To that end, we have worked with Enterprise to enhance strategies that align with our **Life's Simple 7™ Heart Health Factors** to support healthy families and communities, including promoting physical activity, increasing access to nutritional food and reducing tobacco use in the environment.

The Enterprise Green Communities Criteria supports the American Heart Association's commitment to building a culture of health. Together, we envision low-income Americans living free of cardiovascular diseases and stroke in quality, affordable housing located in healthy, service-enriched communities. We are committed to working with Enterprise to increase awareness and adoption of these standards across the country over the next five years.

Eduardo Sanchez, MD, MPH
Chief Medical Officer for Prevention
American Heart Association

Introduction

Enterprise Green Communities is improving the health and well-being of low-income people by transforming the quality of affordable housing in America. By aligning affordable housing investment strategies with environmentally responsive building practices, Enterprise is leading the national effort to ensure that people living in affordable housing are healthier, spend less money on utilities, and have more opportunities through their connections to transportation, quality food and health care services. The building stock is also improved: **Certified Enterprise Green Communities properties cost less to operate and maintain, use fewer natural resources, generate less waste and contain fewer toxic materials, contributing to a healthier environment**.

The 2015 Enterprise Green Communities Criteria continue our 10-year tradition of capturing the collective experience of affordable housing developers and leading housing and green building organizations and experts. This collaborative approach provides a clear, cost-effective framework for affordable housing. Our commitment to a thorough integrative design process, optimized location and site features, water conservation, energy efficiency, and property operations practices is re-doubled in the 2015 Criteria. And for the first time, we have included thoughtful integration of resilient design features and have expanded our emphasis on residents' health. The Criteria are suitable for all development types, including **New Construction**, **Substantial Rehab**, and **Moderate Rehab** in both multifamily and single-family projects. Where relevant, exemptions based on project location or on development type are identified within each criterion.

The 2015 Enterprise Green Communities Criteria are grouped into the following eight categories:

1. Integrative Design
2. Location + Neighborhood Fabric
3. Site Improvements
4. Water Conservation
5. Energy Efficiency
6. Materials
7. Healthy Living Environment
8. Operations, Maintenance, and Resident Engagement

WHY USE THE CRITERIA?

Consider this: 70% of design decisions are made in the first 10% of a project—a fact that's critically relevant to Enterprise given our commitment to creating healthy and sustainable homes. To maximize time and resources, planning ahead is essential. First, project teams should familiarize themselves with the full Criteria. Then, using a thorough integrative design process, they should consider the goals for the project—and goals for the future residents—when evaluating which criteria to incorporate into their building(s). Taking a human-centered approach to design and development will lead to a comprehensive planning process and a careful selection of materials and technologies that will better meet project aspirations.

Not all of the criteria have directly measurable financial impacts, but these criteria are no less important to meeting a project's mission. Projects will exhibit improved occupant health and well-being through reduced exposure to environmental pollutants, improved connectivity to services and walkable neighborhoods, and good lighting. The benefits extend beyond the occupants to the neighboring community by supporting local community services and activating neighborhood streets, as well as improving water quality and reducing the impact of stormwater run-off on neighboring sewer systems. We suspect that when these benefits are quantified, they will dwarf the energy and water savings benefits we can count today.

Our pipeline includes projects that avoid upfront cost premiums when meeting the Enterprise Green Communities Criteria as compared to standard practice after implementing a robust integrative design approach. And overall, the median incremental cost of complying with the Enterprise Green Communities Criteria tends to be minimal: In an evaluation report from 2012, Enterprise found a median 2% increase to total development cost. The average project analyzed in this study achieved lifetime utility savings that exceed the cost of integrating the Enterprise Green Communities Criteria, with a simple payback of 5.59 years.

DEFINITION OF REHABS

Given that the scope of work on existing buildings can vary widely (from minor repairs to gut rehabs), we have defined two levels of rehabs, to guide project team planning.

A *Substantial Rehab* is defined as a project where the work area exceeds 50% of the aggregate area of the building: an ICC level 3 alteration scope of work.

A *Moderate Rehab* is defined as a project where the work area does not exceed 50% of the aggregate area of the building (the work scope is less than an ICC level 3 alteration), yet is still able to comply with the energy performance requirements of Criterion 5.1.

While Substantial and Moderate Rehabs are defined as specifically as possible above, each project will most likely have more nuance than can be captured here. Please use these definitions as the start of this guidance, strive for the most inclusive level of integrating the Criteria, and note that compliance with the energy performance requirements of Criterion 5.1 often is the factor that places a project in the New Construction pathway (possible for some gut rehabs), Substantial Rehab pathway or Moderate Rehab pathway, or precludes Certification all together.

CERTIFICATION

Enterprise Green Communities Certification is available for any housing project that includes affordable dwelling units. The Certification process provides a means for teams to validate their efforts in successfully incorporating the Criteria into their project and, more important, a guide for development teams to navigate critical details of achieving a green building.

Certification involves a two-step online submission and review process: *PreBuild* and *PostBuild*. Project teams submit their PreBuild application near the end of the design phase, prior to the start of

Online Resources

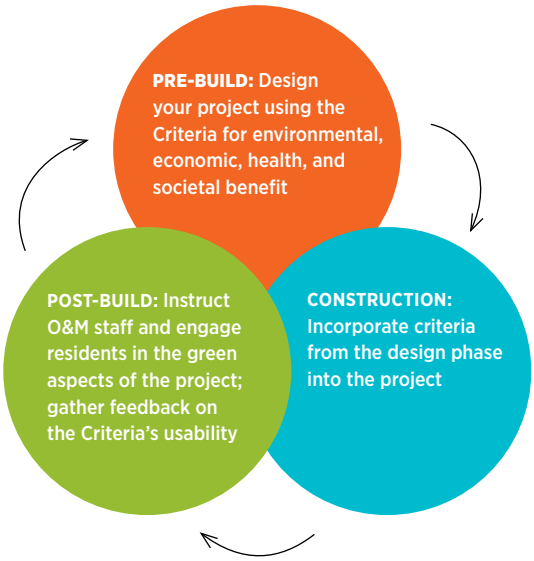
Enterprise Green Communities website: www.enterprisecommunity.org/green

Enterprise Resource Center: www.enterprisecommunity.com/resources

construction. Project teams submit their PostBuild application shortly after the project has received its Certificate of Occupancy. Upon submission of each application, Enterprise Green Communities conducts a thorough review of the materials and provides feedback to the project team as necessary, clearly indicating whether the application was approved or needs further work. Enterprise also provides tools and resources to assist with the design, development and operations of affordable housing projects. Many of these can be found in the Enterprise Resource Center.

All projects must achieve compliance with the mandatory Criteria measures applicable to that construction type. Additionally, New Construction projects must achieve 35 optional points, Substantial Rehab projects must achieve 30 optional points, and Moderate Rehab projects must also achieve 30 optional points. For projects that receive PreBuild and PostBuild approval, Enterprise Green Communities certifies that the Criteria were met in full, and recognizes the project team for their accomplishment.

For a full description of the Enterprise Green Communities certification process, including required parameters for the PreBuild and PostBuild submissions, go to *www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities/certification*. If you have questions about Enterpise Green Communities certification, email *certification@enterprisecommunity.org*.



M = MANDATORY
# = OPTIONAL POINTS

2015 Enterprise Green Communities Criteria Checklist

This checklist provides an overview of the technical requirements within the Enterprise Green Communities Criteria. **To achieve Enterprise Green Communities Certification, all projects must achieve compliance with the Criteria mandatory measures applicable to that construction type. Additionally, New Construction projects must achieve 35 optional points, Substantial Rehab projects must achieve 30 optional points, and Moderate Rehab projects must also achieve 30 optional points.**

1. INTEGRATIVE DESIGN

◯ YES ◯ NO ◯ MAYBE — M

1.1a Goal Setting

Develop an integrative design process that works best for your project team and intentions. At minimum, document:

1. A statement of the overall green development goals of the project and the expected intended outcomes from addressing those goals.
2. A summary of the integrative process that was used to select the green building strategies, systems and materials that will be incorporated into the project.
3. A description of how progress and success against these goals will be measured throughout the completion of design, construction and operation to ensure that the green features are included and correctly installed.

◯ YES ◯ NO ◯ MAYBE — M

1.1b Criteria Documentation

Create design and construction documentation to include information on implementation of appropriate Enterprise Green Communities Criteria.

◯ YES ◯ NO ◯ MAYBE — 9

1.1c Designing for Project Performance

Identify how the expected performance of your project compares to the actual performance of other projects in your portfolio and/or community.

◯ YES ◯ NO ◯ MAYBE — M

1.2a Resident Health and Well-Being: Design for Health

Identify potential resident health factors and design your project to address resident health and well-being by using the matrix provided on pages 22 and 23.

◯ YES ◯ NO ◯ MAYBE — 12

1.2b Resident Health and Well-Being: Health Action Plan

At pre-design and continuing throughout the project life cycle, collaborate with public health professionals and community stakeholders to assess, identify, implement and monitor achievable actions to enhance health-promoting features of the project and minimize features that could present health risks. Specifically, create a Health Action Plan and integrate the selected interventions and a plan for monitoring and evaluating progress per the full criterion.

◯ YES ◯ NO ◯ MAYBE — M

1.3a Resilient Communities: Design for Resilience *(New Construction and Substantial Rehab only)*

Given your project building type, location and expected resident population, identify a project characteristic that would most likely impact your project's ability to withstand an unexpected weather event or loss of power. Select at least one criterion from the given list that would help mitigate that impact, and incorporate this within your project plans and design. Include a short narrative providing your rationale for selecting this criterion above the others.

M = MANDATORY
# = OPTIONAL POINTS

INTEGRATIVE DESIGN *(continued)*

◯ YES ◯ NO ◯ MAYBE — 15

1.3b Resilient Communities: Multi-Hazard Risk / Vulnerability Assessment

Carry out a Vulnerabilities Assessment and implement building elements designed to enable the project to adapt to, and mitigate, climate impacts given the project location, building/construction type and resident population.

SUBTOTAL OPTIONAL POINTS

2. LOCATION + NEIGHBORHOOD FABRIC

New Construction: All new construction projects must earn optional points under Criterion 2.8 Access to Public Transportation, **OR** earn 8 optional points through selecting one or more of the following:

- 2.7 Preservation of and Access to Open Space
- 2.9 Improving Connectivity to the Community
- 2.12 Access to Fresh, Local Foods
- 2.13 LEED for Neighborhood Development Certification
- 2.14 Local Economic Development and Community Wealth Creation

◯ YES ◯ NO ◯ MAYBE — M

2.1 Sensitive Site Protection

Do not locate new projects, including buildings, built structures, roads or parking areas, on portions of sites that meet any of the following provisions:

1. Land within 100 feet of wetlands, including isolated wetlands or streams. Maintain or establish riparian buffer using native vegetation where possible. Bike and foot paths are allowed if at least 25 feet from the wetlands boundary.
2. Land on slope greater than 15%.
3. Land with prime soils, unique soils or soils of state significance per USDA designations.
4. Public parkland.
5. Land that is specifically identified as an existing habitat for any species on federal or state threatened or endangered lists.
6. Land that is within the Special Flood Hazard Areas (SFHA) as identified by FEMA on the Flood Insurance Rate Map.

◯ YES ◯ NO ◯ MAYBE — M

2.2 Connections to Existing Development and Infrastructure *(Except for projects located on rural tribal lands, in colonias communities, or in communities with populations of less than 10,000)*

Locate the project on a site with access to existing roads, water, sewers and other infrastructure within or contiguous to (having at least 25% of the perimeter bordering) existing development. Connect the project to the pedestrian grid.

◯ YES ◯ NO ◯ MAYBE — M

2.3 Compact Development

At a minimum, build to the residential density (dwelling units/acre) of the census block group in which your project is located.

◯ YES ◯ NO ◯ MAYBE — 5 or 7

2.4 Compact Development

Exceed the residential density (dwelling units/acre) of the census block group in which your project is located. Exceed by 2x for *[5 points]*; exceed by 3x for *[7 points]*.

M = MANDATORY
# = OPTIONAL POINTS

LOCATION + NEIGHBORHOOD FABRIC *(continued)*

YES NO MAYBE — M

2.5 Proximity to Services

Locate the project within a 0.5-mile walk distance of at least four, or a 1-mile walk distance of at least seven, of the listed services. For projects that qualify as Rural/Tribal/Small Town, locate the project within 5 miles of at least four of the listed services.

YES NO MAYBE — M

2.6 Preservation of and Access to Open Space for Rural/Tribal/Small Towns

Set aside a minimum of 10% (minimum of 0.25 acre) of the total project acreage as non-paved open space for use by all residents **OR** locate the project within a 0.25-mile walk distance of dedicated public non-paved open space that is a minimum of 0.75 acres.

YES NO MAYBE — 6 max

2.7 Preservation of and Access to Open Space

Set aside a percentage of non-paved open space for use by all residents. 20% *[2 points]*; 30% *[4 points]*; 40% + written statement of preservation/conservation policy for set-aside land *[6 points]*.

YES NO MAYBE — 8 or 10

2.8 Access to Public Transportation

Locate projects within a 0.5-mile walk distance of transit services combined (bus, rail and/or ferry), constituting at least 60 or more transit rides per weekday, with some type of weekend ride option. *[8 points]*

For projects that qualify as Rural/Tribal/Small Town, locate the project within a 5-mile distance of at least one of the following transit options: 1) vehicle share program; 2) dial-a-ride program; 3) employer vanpool; 4) park-and-ride; or 5) public–private regional transportation. *[8 points]*

For an additional 2 points: Locate the project along dedicated bike trails or lanes that lead to transit services or stations (bus, rail and ferry) within 3 miles.

YES NO MAYBE — 2 to 8

2.9 Improving Connectivity to the Community

Improve access to community amenities through at least one of the transit, auto or biking mobility measures listed.

YES NO MAYBE — 5 max

2.10 Passive Solar Heating/Cooling

Design and build with passive solar design, orientation and shading that meet specificed guidelines.

YES NO MAYBE — 4

2.11 Brownfield Site or Adaptive Reuse Building

Rehabilitate an existing structure that was not previously used as housing or locate the project on a brownfield site.

YES NO MAYBE — 6

2.12 Access to Fresh, Local Foods

Pursue one of three options to provide residents and staff with access to fresh, local foods, including neighborhood farms and gardens, community-supported agriculture, or proximity to farmers markets.

YES NO MAYBE — 4

2.13 LEED for Neighborhood Development Certification

Locate building(s) in a Stage 2 Pre-Certified or Stage 3 Certified Neighborhood Development.

YES NO MAYBE — 6 max

2.14 Local Economic Development and Community Wealth Creation

Demonstrate that local preference for construction employment and subcontractor hiring was part of your bidding process *[2 points]* **OR** demonstrate that you achieved at least 20% local employment *[3 points]* **OR** provide physical space for small business, nonprofits, and/or skills and workforce education *[3 points]*.

SUBTOTAL OPTIONAL POINTS

M = MANDATORY
# = OPTIONAL POINTS

3. SITE IMPROVEMENTS

YES NO MAYBE — M

3.1 Environmental Remediation

Conduct an environmental site assessment to determine whether any hazardous materials are present on-site; mitigate any found.

YES NO MAYBE — M

3.2 Erosion and Sedimentation Control *(Except for infill sites with buildable area smaller than one acre)*

Implement EPA's Best Management Practices for Construction Site Stormwater Runoff Control, or local requirements, whichever is more stringent.

YES NO MAYBE — M

3.3 Low-Impact Development

Projects located on greenfields must meet the list of low-impact development criteria.

YES NO MAYBE — M

3.4 Landscaping

If providing plantings, all should be native or adapted to the region, appropriate to the site's soil and microclimate, and none of the new plants is an invasive species. Reseed or xeriscape all disturbed areas.

YES NO MAYBE — M

3.5a Efficient Irrigation and Water Reuse

If irrigation is used, install an efficient irrigation or water reuse system per the guidelines.

YES NO MAYBE — 4 or 8

3.5b Efficient Irrigation and Water Reuse

Install an efficient irrigation system equipped with a WaterSense-labeled weather-based irrigation controller (WBIC) **OR** at least 50% of the site's irrigation should be satisfied by reusing water.

YES NO MAYBE — 4 or 8

3.6 Surface Stormwater Management

Retain, infiltrate and/or harvest the first 1.0 inch of rain that falls *[4 points]* **OR** as calculated for a 24-hour period of a one-year (1) storm event, so that no stormwater is discharged to drains/inlets. *[8 points]* For both options, permanently label all storm drains and inlets.

YES NO MAYBE — 1

3.7 Reducing Heat-Island Effect: Paving

Use light-colored, high-albedo materials and/or an open-grid pavement, with a minimum solar reflectance of 0.3, over at least 50% of the site's hardscaped area.

SUBTOTAL OPTIONAL POINTS

4. WATER CONSERVATION

YES NO MAYBE — M

4.1 Water-Conserving Fixtures

Install water-conserving fixtures in all units and any common facilities with the following specifications. *Toilets:* WaterSense-labeled and 1.28 gpf; *Urinals*: WaterSense-labeled and 0.5 gpf; *Showerheads:* WaterSense-labeled and 2.0 gpm; *Kitchen faucets*: 2.0 gpm; *Lav faucets*: WaterSense-labeled and 1.5 gpm

AND for all single-family homes and all dwelling units in buildings three stories or fewer, the static service pressure must not exceed 60 psi.

M = MANDATORY
# = OPTIONAL POINTS

WATER CONSERVATION *(continued)*

YES NO MAYBE — 6 max

4.2 Advanced Water Conservation

Reduce water consumption either by installing water-conserving fixtures in all units and all common space bathrooms with the following specifications: *Toilets:* WaterSense-labeled and 1.1 gpf *[1 point]*; *Showerheads*: WaterSense-labeled and 1.5 gpm *[1 point]*; *Kitchen faucets:* 1.5 gpm and *lav faucets:* WaterSense-labeled and 1.0 gpm *[1 point]*

OR

Reduce total indoor water consumption by at least 30% compared to the baseline indoor water consumption chart, through a combination of your choosing. *[6 points maximum]*

YES NO MAYBE — 4

4.3 Leaks and Water Metering

Conduct pressure-loss tests and visual inspections to determine if there are any leaks; fix any leaks found; and meter or submeter each dwelling unit with a technology capable of tracking water use. Separately meter outdoor water consumption.

YES NO MAYBE — 4

4.4 Efficient Plumbing Layout and Design

To minimize water loss from delivering hot water, the hot water delivery system shall store no more than 0.5 gallons of water in any piping/manifold between the hot water source and any hot water fixture.

YES NO MAYBE — 6 max

4.5 Water Reuse

Harvest, treat, and reuse rainwater and/or greywater to meet a portion of the project's total water needs: 10% reuse *[3 points]*; 20% reuse *[4 points]*; 30% reuse *[5 points]*; 40% reuse *[6 points]*

YES NO MAYBE — 8

4.6 Access to Potable Water During Emergencies

Provide residents with access to potable water in the event of an emergency that disrupts normal access to potable water, including disruptions related to power outages that prevent pumping water to upper floors of multifamily buildings or pumping of water from on-site wells, per one of the three options.

SUBTOTAL OPTIONAL POINTS

5. ENERGY EFFICIENCY

YES NO MAYBE — M

5.1a Building Performance Standard *(New Construction: single-family and low-rise multifamily)*

Certify each dwelling unit in the project through the ENERGY STAR New Homes program.

YES NO MAYBE — M

5.1b Building Performance Standard *(New Construction: mid-rise and high-rise multifamily, with some exceptions)*

Certify the project through the ENERGY STAR Multifamily High-Rise program (MFHR) **OR** follow the combined MFHR and LEED Commissioning Path outlined in the criterion.

Exception: Multifamily buildings that are four or five stories, in which all dwelling units have their own heating, cooling and hot water systems, should comply with Criterion 5.1a and certify each dwelling unit per ENERGY STAR Certified New Homes.

M = MANDATORY
# = OPTIONAL POINTS

ENERGY EFFICIENCY *(continued)*

YES NO MAYBE — M

5.1c Building Performance Standard *(Substantial and Moderate Rehab: single-family and low-rise multifamily)*

For each dwelling unit, achieve a HERS Index score of 85 or less.

Exception: Substantial rehabs of buildings with walls made only of brick/masonry that are three stories or fewer and built before 1980, as well as moderate rehabs of buildings that are three stories or fewer and built before 1980, are permitted to instead achieve a HERS Index score of 100 or less for each dwelling unit.

YES NO MAYBE — M

5.1d Building Performance Standard *(Substantial and Moderate Rehab: mid-rise and high-rise)*

Demonstrate that the energy performance of the completed building will be equivalent to ASHRAE 90.1-2010 using an energy model created by a qualified energy services provider per Appendix G.

YES NO MAYBE — 5 to 12

5.2a Additional Reductions in Energy Use

Design and construct a building that is projected to be at least 5% more efficient than what is required of the project by Criteria 5.1a–d. (Projects receiving points in Criterion 5.2a may not receive points per Criterion 5.2b)

YES NO MAYBE — 12

5.2b Advanced Certification: Nearing Net Zero

Certify the project in a program that requires advanced levels of building envelope performance such as PHIUS, Living Building Challenge and/or DOE Zero Energy Ready Home. (Projects receiving points in Criterion 5.2b may not receive points per Criterion 5.2a)

YES NO MAYBE — M

5.3 Sizing of Heating and Cooling Equipment

Size and select heating and cooling equipment in accordance with the Air Conditioning Contractors of America (ACCA) Manuals J and S or ASHRAE handbooks.

YES NO MAYBE — M

5.4 ENERGY STAR Appliances

If providing appliances, install ENERGY STAR clothes washers, dishwashers and refrigerators. If appliances will not be installed or replaced at this time, specify that, at the time of installation or replacement, ENERGY STAR models must be used.

YES NO MAYBE — M

5.5 Lighting

Follow the guidance for high-efficacy lighting controls and other characteristics for all permanently installed lighting fixtures in project dwelling units, common spaces and exterior

5.6 Electricity Meter

YES NO MAYBE — M — *New Construction and Substantial Rehab*

YES NO MAYBE — 6 — *Moderate Rehab (Except for single-room occupancy and designated supportive housing dwelling units)*

Install individual or submetered electric meters for all dwelling units.

YES NO MAYBE — 4

5.7a Photovoltaic / Solar Hot Water Ready

Orient, design, engineer, wire and/or plumb the development to accommodate installation of photovoltaic (PV) or solar hot water system in the future.

M = MANDATORY
# = OPTIONAL POINTS

ENERGY EFFICIENCY *(continued)*

YES NO MAYBE — 10 max

5.7b Renewable Energy

Install photovoltaic (PV) panels or other electric-generating renewable energy source to provide a specified percentage of the project's estimated total energy demand or water heating energy demand. *(Projects may earn points through Criterion 5.7b or 5.8b, but not both.)*

	5%	10%	20%	30%	40%
Single-story/Single-family	—	—	6	8	10
2 to 3 stories	—	6	8	10	—
4 stories or more	6	8	10	—	—

YES NO MAYBE — 8

5.8a Resilient Energy Systems: Floodproofing

Conduct floodproofing, including perimeter floodproofing (barriers/shields), of lower floors. Design and install building systems as specified by the full criterion so that the operation of those systems will not be grossly affected in case of a flood.

YES NO MAYBE — 4 to 8

5.8b Resilient Energy Systems: Islandable Power

Provide emergency power through an islandable photovoltaic (PV) system or an efficient and portable generator that will offer at least limited electricity for critical circuits during power outages per one of the three options listed. *(Projects may earn points through Criterion 5.7b or 5.8b, but not both.)*

SUBTOTAL OPTIONAL POINTS

6. MATERIALS

YES NO MAYBE — M

6.1 Low/No VOC Paints, Coatings and Primers

All interior paints and primers must have VOC levels, in grams per liter, less than or equal to the thresholds established by South Coast Air Quality Management District (SCAQMD) Rule 1113.

YES NO MAYBE — M

6.2 Low/No VOC Adhesives and Sealants

All adhesives and sealants (including caulks) must have VOC levels, in grams per liter, less than or equal to the thresholds established by the South Coast Air Quality Management District Rule 1168.

YES NO MAYBE — 3 max

6.3 Recycled Content Material

Incorporate building materials that are composed of at least 25% post-consumer recycled content or at least 50% post-industrial recycled content. *[1 point]*

Building materials that make up at least 75% of their project component each receive *1 point*.

YES NO MAYBE — 4 max

6.4 Regional Materials

Use products that were extracted, processed and manufactured within 500 miles of the project for a minimum of 50%, based on cost, of the building materials' value.

Select any or all of these options (each material can qualify for *1 point*):

- Framing materials
- Exterior materials (e.g., siding, masonry, roofing)
- Flooring materials
- Concrete/cement and aggregate material
- Drywall/interior sheathing materials

M = MANDATORY
# = OPTIONAL POINTS

MATERIALS *(continued)*

YES NO MAYBE | 1

6.5 Certified, Salvaged and Engineered Wood Products

For at least 25% of all structural wood products, by cost or value, commit to using either FSC-certified, salvaged products or engineered framing materials without urea formaldehyde.

YES NO MAYBE | M

6.6 Composite Wood Products that Emit Low/No Formaldehyde

All composite wood products must be certified as compliant with California 93120 Phase 2 **OR**, if using a composite wood product that does not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with low-VOC sealants, per Criterion 6.2.

YES NO MAYBE | M

6.7a Environmentally Preferable Flooring

Do not install carpets in building entryways, laundry rooms, bathrooms, kitchens/kitchenettes, utility rooms or any rooms built on foundation slabs. Where installed, all carpet products must meet the Carpet and Rug Institute's Green Label or Green Label Plus certification for carpet, pad and carpet adhesives. Any hard surface flooring products must be either ceramic tile or solid unfinished hardwood floors, or meet the Scientific Certification System's FloorScore program criteria (including pre-finished hardwood flooring).

YES NO MAYBE | 6

6.7b Environmentally Preferable Flooring: Throughout Building

Use non-vinyl, non-carpet floor coverings throughout each building in the project.

YES NO MAYBE | M

6.8 Mold Prevention: Surfaces

Use materials that have durable, cleanable surfaces throughout bathrooms, kitchens and laundry rooms. Materials installed in these rooms should not be prone to deterioration due to moisture intrusion or encourage the growth of mold.

YES NO MAYBE | M

6.9 Mold Prevention: Tub and Shower Enclosures

Use moisture-resistant backing materials such as cement board, fiber cement board or equivalent per ASTM #D3273 behind tub/shower enclosures. Projects using a one-piece fiberglass tub/shower enclosure are exempt from this requirement.

YES NO MAYBE | 12 max

6.10 Asthmagen-Free materials

Do not install products that contain ingredients that are known to cause or trigger asthma. Key products to avoid are:

- *Insulation:* Do not use spray polyurethane foam (SPF) or formaldehyde-containing fiberglass batts. *[4 points]*
- *Flooring:* Do not use flexible vinyl (PVC) roll or sheet flooring or carpet-backed with vinyl with phthalates. Do not use fluid applied finish floors. *[4 points]*
- *Wall coverings:* Do not use wallpaper made from vinyl (PVC) with phthalates or site-applied high-performance coatings that are epoxy or polyurethane based. *[4 points]*
- *Composite wood:* Use only ULEF products for cabinetry, subflooring and other interior composite wood uses. *[4 points]*

YES NO MAYBE | 5

6.11 Reduced Heat-Island Effect: Roofing

Use an ENERGY STAR–certified roofing product for 100% of the roof area **OR** install a "green" (vegetated) roof for at least 50% of the roof area and ENERGY STAR–certified roofing product for the remainder of the roof area.

M = MANDATORY
# = OPTIONAL POINTS

MATERIALS *(continued)*

YES NO MAYBE — M or 6 max

6.12 Construction Waste Management

Commit to following a waste management plan that reduces non-hazardous construction and demolition waste through recycling, salvaging or diversion strategies through one of the three options. Achieve optional points by going above and beyond the requirement.

YES NO MAYBE — 3

6.13 Recycling Storage

Provide separate bins for the collection of trash and recycling for each dwelling unit and all shared community rooms (if applicable).

Additionally, in multifamily buildings, provide at least one easily accessible, permanent and dedicated indoor area for the collection and storage of materials for recycling. In single-family homes, points will be accrued only if curb-side recycling pickup is available.

Collected materials should include, at a minimum, paper, cardboard, glass, metals and plastics.

SUBTOTAL OPTIONAL POINTS

7. HEALTHY LIVING ENVIRONMENT

7.1 Ventilation

YES NO MAYBE — M — *New Construction and Substantial Rehab*

YES NO MAYBE — 12 max — *Moderate Rehab*

For each dwelling unit, in full accordance with ASHRAE 62.2-2010, install a local mechanical exhaust system in each bathroom *[4 points]*, a local mechanical exhaust system in each kitchen *[4 points]*, and a whole-house mechanical ventilation system *[4 points]*.

For each multifamily building of four stories and more, in full accordance with ASHRAE 62.1-2010, install a mechanical ventilation system for all hallways and common spaces *[3 points]*.

For all project types, in addition to the above requirements:

- All systems and associated ductwork must be installed per manufacturer's recommendations.
- All individual bathroom fans must be ENERGY STAR labeled, wired to turn on with the light switch, and equipped with a humidistat sensor, timer or other control (e.g., occupancy sensor, delay off switch, ventilation controller).
- If using central ventilation systems with rooftop fans, each rooftop fan must be direct-drive and variable-speed with speed controller mounted near the fan. Fans with design CFM 300-2000 must also have an ECM motor.

YES NO MAYBE — M

7.2 Clothes Dryer Exhaust

Clothes dryers must be exhausted directly to the outdoors using rigid-type ductwork (except for condensing dryers, which must be plumbed to a drain).

M = MANDATORY
# = OPTIONAL POINTS

HEALTHY LIVING ENVIRONMENT *(continued)*

YES NO MAYBE — M

7.3 Combustion Equipment

For new construction and rehab projects, specify power-vented or direct vent equipment when installing any new combustion appliance for space or water heating that will be located within the conditioned space.

In Substantial and Moderate Rehabs, if there is any combustion equipment located within the conditioned space for space or water heating that is not power-vented or direct vent and that is not scheduled for replacement, conduct initial combustion safety testing per the given guidelines.

Install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone, placed per National Fire Protection Association (NFPA) 720.

YES NO MAYBE — 9 or 11

7.4 Elimination of Combustion Within the Conditioned Space

No combustion equipment may be used for cooking (to include, but not limited to ranges, cooktops, stoves, ovens) as part of the building project *[9 points]* **OR** no combustion equipment may be used as part of the building project *[11 points]*.

YES NO MAYBE — M

7.5 Vapor Retarder Strategies

Install vapor barriers that meet specified criteria appropriate for the foundation type.

YES NO MAYBE — M

7.6 Water Drainage *(For all New Construction projects and those Rehab projects that include replacing particular assemblies called out below)*

Provide drainage of water away from walls, windows and roofs by implementing the list of techniques.

YES NO MAYBE — M

7.7 Mold Prevention: Water Heaters

Provide adequate drainage for water heaters that includes drains or catch pans with drains piped to the exterior of the dwelling.

YES NO MAYBE — M

7.8 Radon Mitigation

For New Construction in EPA Zone 1 areas, install passive radon-resistant features below the slab and a vertical vent pipe with junction box within 10 feet of an electrical outlet in case an active system should prove necessary in the future. For Substantial Rehab projects in EPA Zone 1, test and mitigate per the specified protocols.

YES NO MAYBE — M

7.9 Garage Isolation

- Provide a continuous air barrier between the conditioned space and any garage space to prevent the migration of any contaminants into the living space. Visually inspect common walls and ceilings between attached garages and living spaces to ensure that they are air-sealed before insulation is installed.
- Do not install ductwork or air handling equipment in a garage.
- Fix all connecting doors between conditioned space and garage with gaskets or otherwise make substantially airtight with weather stripping.
- Install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone of the project, placed per National Fire Protection Association (NFPA) 720.

YES NO MAYBE — M

7.10 Integrated Pest Management

Seal all wall, floor, and joint penetrations with low-VOC caulking or other appropriate nontoxic sealing methods to prevent pest entry.

M = MANDATORY
# = OPTIONAL POINTS

HEALTHY LIVING ENVIRONMENT *(continued)*

YES NO MAYBE — 9

7.11a Beyond ADA: Universal Design *(New Construction)*
Design a minimum of 15% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. Design the remainder of the ground-floor units and elevator-reachable units in accordance with ICC/ANSI A117.1, Type B.

YES NO MAYBE — 7 or 9

7.11b Beyond ADA: Universal Design *(Substantial and Moderate Rehab)*
Design a minimum of 10% of the dwelling units (one, at minimum) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. *[7 points]*

For an additional 2 points: Design the remainder of the ground-floor units and elevator-reachable units with accessible unit entrances designed to accommodate people who use a wheelchair.

YES NO MAYBE — M

7.12 Active Design: Promoting Physical Activity Within the Building
Situate at least one building stairway per the criterion to encourage use **OR** emphasize at least one strategy inside the building designed to increase frequency and duration of physical activity per the criterion.

YES NO MAYBE — 10

7.13 Active Design: Staircases and Building Circulation
A staircase must be accessible and visible from the main lobby as well as visible within a 25-foot walking distance from any edge of lobby. Ensure that no turns or obstacles prevent visibility of or accessibility to the qualifying staircase from the lobby, and that the staircase is encountered before or at the same time as the elevators.

From the corridor, accessible staircases should be made visible by: Providing transparent glazing of at least 10 square feet (1 square meter) at all stair doors or at a side light **OR** providing magnetic door holds on all doors leading to the stairs **OR** removing door enclosures/vestibules.

YES NO MAYBE — 9

7.14 Interior and Outdoor Activity Spaces for Children and Adults
Provide an on-site dedicated recreation space with exercise or play opportunities for adults and/or children that is open and accessible to all residents; see criterion for specifics.

YES NO MAYBE — M

7.15 Reduce Lead Hazards in Pre-1978 Buildings *(Substantial Rehab)*
Conduct lead risk assessment or inspection to identify lead hazards, then control for these per EPA or state/local laws and requirements.

YES NO MAYBE — 10

7.16 Smoke-Free Building
Implement and enforce a no-smoking policy in all common and individual living areas, and within a 25-foot perimeter around the exterior of all residential projects.

SUBTOTAL OPTIONAL POINTS

M = MANDATORY
# = OPTIONAL POINTS

8. OPERATIONS, MAINTENANCE + RESIDENT ENGAGEMENT

YES NO MAYBE | M

8.1 Building Operations & Maintenance (O&M) Manual and Plan *(For all multifamily projects)*

Develop a manual with thorough building operations and maintenance guidance and a complementary plan. The manual and plan should be developed over the course of the project design, development and construction stages, and should include sections/chapters addressing the list of topics.

YES NO MAYBE | M

8.2 Emergency Management Manual *(For all multifamily projects)*

Provide a manual on emergency operations targeted toward operations and maintenance staff and other building-level personnel. The manual should address responses to various types of emergencies, leading with those that have the greatest probability of negatively affecting the project. The manual should provide guidance as to how to sustain the delivery of adequate housing throughout an emergency and cover a range of topics, including but not limited to:

- communication plans for staff and residents
- useful contact information for public utility and other service providers
- infrastructure and building "shutdown" procedures

YES NO MAYBE | M

8.3 Resident Manual

Provide a guide for homeowners and renters that explains the intent, benefits, use and maintenance of their home's green features and practices. The Resident Manual should encourage green and healthy activities per the list of topics.

YES NO MAYBE | M

8.4 Resident and Property Staff Orientation

Provide a comprehensive walk-through and orientation for all residents, property manager(s) and buildings operations staff. Use the appropriate manuals (see Criteria 8.1, 8.2, 8.3) as the base of the curriculum, and review the project's green features, operations and maintenance procedures, and emergency protocols.

YES NO MAYBE | M

8.5 Project Data Collection and Monitoring System: 100% Owner-Paid Utility Accounts; 15% Tenant-Paid Utility Accounts

For rental properties: Collect and monitor project energy and water performance data for 100% of owner-paid utilities and 15% of tenant-paid utilities for at least 5 years. This data must be maintained in a manner that allows staff to easily access and monitor it, enabling them to make informed operations and capital planning decisions. Also allow Enterprise access to this data.

For owner-occupied units: Collect and monitor energy and water performance data in a manner that allows for easy access and review and provides the ability to influence home operations. Also allow Enterprise access to this data.

YES NO MAYBE | 7 or 11

8.6 Project Data Collection and Monitoring System: Greater than 15% Tenant-Paid Utility Accounts

Collect and monitor project energy and water performance data for at least 5 years. This data must be maintained in a manner that allows staff to easily access and monitor it, enabling them to make informed operations and capital planning decisions. Also allow Enterprise access to this data. 16–60% of units *[7 points]*; 60–100% of units *[11 points]*.

SUBTOTAL OPTIONAL POINTS

TOTAL OPTIONAL POINTS

INTEGRATIVE DESIGN

A successful integrative design process facilitates the design and development team's achievement of their objectives throughout the project life cycle.

1.1a *Mandatory* Goal Setting

REQUIREMENTS

A successful integrative design process is more art than science. It also is often the determining factor in ultimately achieving a successful project. Develop an integrative design process that works best for your project team and intentions. At minimum, document:

1. A statement of the overall green development goals of the project and the expected intended outcomes from addressing those goals.
2. A summary of the integrative process that was used to select the green building strategies, systems and materials that will be incorporated into the project.
3. A description of how progress and success against these goals will be measured throughout the completion of design, construction and operation to ensure that the green features are included and correctly installed.

RATIONALE

Integrative design is used to maximize project budget and effective solutions with a holistic, comprehensive approach. As a result, it is supported by criteria in all of the other categories. An integrative project delivery process facilitates the design and development team's achievement of green objectives throughout the project life cycle. The outcomes of an integrative project delivery process can include substantially lower development costs and greater health, economic and environmental benefits for residents, property owners and communities.

RECOMMENDATIONS

- Review the Enterprise Green Communities Pre-Development Design Toolkit, Project Management Guide, Green Charrette Toolkit and Green Development Plan (see Resources). These help you set the framework for a meaningful integrative design process for your project. For instance, the Pre-Development Design Toolkit includes a template and a description of creating a project Design Brief (essentially an owner's project requirements [OPR] document) and guidance on how to select the most qualified architect for the project. The Project Management Guide relays the iterative process of how the Enterprise Green Communities Criteria weave throughout a typical project's development timeline. The Green Charrette Toolkit includes sample agendas and facilitator guides.
- Use data from your previous projects as baselines to inform your goals for your current project. For example: Portfolio energy and water consumption per bedroom, health needs assessment data and financial data, including pro-forma assumptions broken down more finely regarding operating expense categories. Measure and share your progress.
- Evaluate your project's compliance with Criteria 1.2a and 1.3a as part of the process you undertake for Criterion 1.1a.

- A charrette is an intensive workshop in which various stakeholders and experts are brought together to address a particular design issue, from a single building to an entire project. The term can also be applied to shorter, focused meetings. Charrette attendance might include participants from the following disciplines or interests:
  - Prospective or current residents, including potential community and/or neighborhood stakeholders
  - Architecture or residential building design
  - Mechanical or energy engineering
  - Building science or performance testing
  - Green building or sustainable design
  - Civil engineering, landscape architecture, habitat restoration or land-use planning
  - General Contractor
  - Building management and maintenance
  - Asset management
  - Planning and building officials with jurisdiction over the project, or city green building reps
  - Funders and key donors
  - Resident services
  - Environmental science
  - Public health

  Green design charrettes can be powerful opportunities to educate and align stakeholders with the goals and objectives of a project and to tap into collective wisdom of the group. In later stages of design development, these large group meetings can be important opportunities to check that the design is on course for the project goals from all perspectives. This is also the opportunity to ensure that lessons learned through maintenance of other projects are woven into design decisions of current projects. Smaller multi-disciplinary teams may also be brought together to analyze and develop integrated solutions to complex design challenges that require multiple perspectives to resolve perceived conflict, between first cost and best practice for example.

- Best practices in documenting the integrative design process required of project teams submitting for Certification also includes a description of which members of the design and development team are responsible for implementing the green features.
- Project performance and durability can be dramatically affected by decisions and processes established during the integrative design phase. Advanced Energy developed the following list of recommendations for project teams to consider during integrative design, based on an evaluation of Enterprise Green Communities projects (for full details, see the Enterprise Green Communities Project Management Guide):
  - Consider adding specific energy consumption thresholds or goals for each project that will be evaluated after project completion.
  - Document your process for approaching and complying with the Criteria for use in your future green projects. Include specific options for complying with Criteria, contact information for useful resources (organizations, websites, product distributors, etc.) and lessons learned.
  - Adjust the scopes of all of the projects in your portfolio to match the Criteria to avoid confusion with changing expectations.

– Add building envelope and mechanical installation details to your plans and specifications for the most critical project components, paying particular attention to: air handler closet air sealing, floor system and band air sealing, party wall air sealing, proper insulation installation, ventilation system installation, and duct sealing with "bucket" mastic. Also provide the construction team with installation guides for the measures above.
– Consider creating incentives for your construction team based on the performance of various building components.
– Add self-verification requirements for your construction team for certain project items that demand proper installation (e.g., testing of water fixtures, testing of bath fans, air sealing of air handler closets). Self-verification for product-based measures (submitting cut-sheets for appropriate paints, carpets, etc.) is most likely unnecessary.

RESOURCES

- Enterprise Green Communities offers a variety of resources to support the integrative design process, particularly the Pre-Development Design Toolkit, Green Charrette Toolkit, Green Development Plan and Project Management Guide. *www.enterprisecommunity.org/resources*
- Enterprise Green Communities maintains a comprehensive registry of qualified green affordable housing technical assistance (TA) providers that are available for support on the design, construction, rehabilitation and operations of green affordable housing. To find a Green TA provider near you, search the list found at *www.greencommunitiesonline.org/tools/resources/technical_assistance.asp*
- Whole Building Design Guide: This website describes the core elements of "whole building design," which includes the combination of an integrative design approach and an integrative team process. This site helps users identify design objectives and organize their processes to meet those objectives. *www.wbdg.org/wbdg_approach.php*
- *The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability.* 7group and Bill Reed (2009). This book provides guidance to building professionals on incorporating integrative design into every phase of a project.

1.1b *Mandatory* Criteria Documentation

REQUIREMENTS

Create design and construction documentation (e.g., plans, details, specifications, subcontractor scopes of work) to include information on implementation of appropriate Enterprise Green Communities Criteria, and other mission-critical design features. Plans and specs should include a performance specification, examples of products that meet the specification, the metrics used to measure compliance and how compliance will be confirmed.

RATIONALE

Projects that explicitly address accountability among project team members and implementation details for Enterprise Green Communities Criteria in design and construction documentation tend to successfully implement the Criteria on-site during the construction phase. The intent of this criterion is for measures selected through Criterion 1.1a to be thoroughly integrated into that design and the construction documents.

RECOMMENDATIONS

Incorporate all Enterprise Green Communities Criteria mandatory and optional measures that the project intends to meet as indicated in the Green Development Plan.

RESOURCES

- Building America's Climate-Specific Guidance: *http://energy.gov/eere/buildings/building-america-climate-specific-guidance* and the Building America Solution Center: *http://energy.gov/eere/buildings/building-america-solution-center* provide residential building professionals with access to expert information on hundreds of high-performance design and construction topics. They include contracting documents and specifications, installation guidance, CAD drawings, "right and wrong" photographs of installation practices and training videos.
- Enterprise Green Communities Single-Family Rehabilitation Specifications, Multifamily Rehabilitation Specifications and Universal Design Specifications for both multifamily and single-family residences include customizable specifications for you to copy, adjust and use for your projects. *www.enterprisecommunity.org/resources*

1.1c *Optional | 9 points*
Designing for Project Performance

REQUIREMENTS

Identify how the expected performance of your project compares to the actual performance of other projects in your portfolio and/or community. Performance may be defined in terms of energy consumption or energy use intensity (EUI), water consumption and/or specific resident health indicators, and should explicitly tie into the project goals identified through Criterion 1.1a.

RATIONALE

Portfolio performance tracking enables organizations to better plan and manage their individual properties, comparing one to another. Evaluating projected project performance against the actual performance of a similar stock of buildings enables project teams to make informed design decisions.

RECOMMENDATIONS

- Track projected project performance against actuals for your selected indicators (energy consumption, water consumption, resident health indicators, other).
- Plan, design, construct and operate your projects in a way that demonstrates continually improved project performance.

RESOURCES

- See Resources identified for Criterion 8.5 Project Data Collection and Monitoring.

1.2a *Mandatory*
Resident Health and Well-Being: Design for Health

REQUIREMENTS

Identify potential resident health factors and design your project to address resident health and well-being. Using the matrix on the pages 22 and 23, the project team will:

- Use readily accessible community health data sets and/or community engagement processes and identify at least one relevant Resident Health Campaign *(left-hand column)* for their project.
- Indicate which sources of information were used to select the most relevant Resident Health Campaign *(complete second column)*. These may include specific local and regional health data, insights from community meetings or resident surveys, or reports from local health professionals.
- Identify building design and programming factors that can optimize the health of the residents *(column three)*.
- Incorporate at least one optional criterion *(column four)* associated with the selected Resident Health Campaign(s) into project documents.

RATIONALE

Health and well-being are influenced by a range of factors, including individual genetics and behaviors, social determinants of health, overarching political and economic influences, and, most important for developers and designers, determinants in the built environment. Where you live, work, learn and play impacts health outcomes. Unfortunately, data shows that low-income and certain racial and ethnic minority populations are disproportionately affected by these factors, and often suffer from poor health. Low-income communities often suffer from higher rates of asthma, cardiovascular disease, diabetes, cancer, mental health issues, and injury and death (resulting from violence, substance abuse and transportation-related incidents), relative to higher-resourced surrounding communities. These inequities have an impact on the length and quality of residents' lives, as well as their ability to work, learn and be productive members of society. Project teams can learn more about the connections between the built environment and health outcomes through materials provided in the Resources section of this criterion.

RESIDENT HEALTH CAMPAIGNS AND ASSOCIATED CRITERIA MATRIX

RESIDENT HEALTH CAMPAIGNS	SOURCE(S) OF INFORMATION	BUILDING DESIGNS AND PROGRAMMING THAT INFLUENCE PHYSICAL AND MENTAL HEALTH	RELATED CRITERIA
Injury and Accessibility		• Physical accessibility of the site and building • Mobility • Presence of traffic calming measures • Speed limits • Urbanicity • Social cohesion • Access to health and community services and supports • Fall prevention features such as stair gates, window guards, handrails, grab bars and improved lighting • Safety of bicycle environment, infrastructure and facilities • Outdoor safety and security/crime • Safety of sidewalks and pedestrian environment, infrastructure and facilities • Safety of transit and vehicle environment, infrastructure and facilities • Access to affordable transportation services	**Mandatory Criteria** 2.5 Proximity to Services **Optional Criteria** 2.8 Access to Public Transportation 2.9 Improving Connectivity to the Community 2.13 LEED-ND Certification 7.11a Beyond ADA: Universal Design—New Construction 7.11b Beyond ADA: Universal Design—Substantial and Moderate Rehab
Asthma and Respiratory Health		• Outdoor air quality • Indoor air quality • Indoor humidity and temperature • Mold • Plant allergens • Use of toxic/carcinogenic products (e.g., for cleaning) • Smoking • Access to affordable chronic disease management services and resources • Presence of pests	**Mandatory Criteria** 5.1a–d Building Performance Standard 5.3 Sizing of Heating and Cooling Equipment 6.7a Environmentally Preferable Flooring 7.1 Ventilation 7.2 Clothes Dryer Exhaust 7.5 Vapor Retarder Strategies 7.7 Mold Prevention: Water Heaters 7.10 Integrated Pest Management 8.1 Building O&M Manual and Plan 8.3 Resident Manual **Optional Criteria** 6.5 Certified, Salvaged and Engineered Wood Products 6.7b Environmentally Preferable Flooring: Throughout Building 6.10 Asthmagen-Free Materials 7.16 Smoke-Free Building

RESIDENT HEALTH CAMPAIGNS (CONTINUED)

RESIDENT HEALTH CAMPAIGNS	SOURCE(S) OF INFORMATION	BUILDING DESIGNS AND PROGRAMMING THAT INFLUENCE PHYSICAL AND MENTAL HEALTH	RELATED CRITERIA
Cardiovascular Disease, Diabetes (Type II), and Obesity		• Proximity to essential goods and services (e.g., grocery stores, retail, schools, medical care) • Proximity and access to public transportation • Air temperature (avoidance of extreme heat and cold) • Air quality • Access to safe, affordable places to be active (both indoor and outdoor facilities) • Physical activity rate • Smoking • Access to affordable chronic disease management services and resources • Proximity and access to affordable, healthy food • Healthy food consumption • Walkability	**Mandatory Criteria** 2.5 Proximity to Services 2.6 Preservation of and Access to Open Space for Rural/Tribal/Small Towns 7.12 Active Design: Promoting Physical Activity within the Building **Optional Criteria** 2.7 Preservation of and Access to Open Space 2.8 Access to Public Transportation 2.9 Improving Connectivity to the Community 2.12 Access to Fresh, Local Foods 2.13 LEED-ND Certification 7.13 Active Design: Staircases and Building Circulation 7.14 Interior and Outdoor Activity Spaces for Children and Adults 7.16 Smoke-Free Building
Cancer and Health Outcomes Related to Toxin Exposure (e.g., child development and learning, cognitive function)		• Access to affordable healthy food and water • Exposure to toxins: indoor and outdoor • Indoor and outdoor water quality • Air quality • Access to safe, affordable places to be active • Healthy food consumption • Use of toxic/carcinogenic products (e.g., for cleaning) • Access to affordable health screening and treatment	**Mandatory Criteria** 3.1 Environmental Remediation 6.1 Low/No VOC Paints, Coatings and Primers 6.2 Low/No VOC Adhesives and Sealants 7.10 Integrated Pest Management 7.15 Reduce Lead Hazards in Pre-1978 Buildings (Substantial Rehab) 8.1 Building O&M Manual and Plan 8.3 Resident Manual **Optional Criteria** 2.11 Brownfield Site or Adaptive Reuse Building 2.12 Access to Fresh, Local Foods 3.6 Surface Stormwater Management 6.5 Certified, Salvaged and Engineered Wood Products 7.16 Smoke-Free Building
Mental Health (depression, anxiety, etc.)		• Views of nature (e.g., natural lighting, green spaces) • Noise levels • Crime levels • Access to employment and educational resources • Amount and quality of sleep • Social cohesion • Access to affordable mental health providers	**Mandatory Criteria** 2.5 Proximity to Services 2.6 Preservation of and Access to Open Space for Rural/Tribal/Small Towns **Optional Criteria** 2.7 Preservation of and Access to Open Space for Rural/Tribal/Small Towns 7.14 Interior and Outdoor Activity Spaces for Children and Adults

RECOMMENDATIONS

The following strategies emphasize the connections between physical design and health, as well as the positive health benefits of supportive resident services and programming to promote health education and healthy behaviors. These strategies support consideration of health throughout the life cycle of a project, from initial design to evaluation and monitoring of the project's impacts on health over time.

- Project teams can rely on existing local health data and resources (see examples in the Resources section of this criterion) to identify the most prevalent health challenges affecting the proposed project's surrounding community. Whenever possible, project teams should use neighborhood-level data specific to the communities most likely to be directly affected by the proposed project. Neighborhood-level data may be available, and project teams could consult their local health department (or other local partners, such as hospitals and schools) for available sources. For example, local health departments or nonprofit hospitals and health systems may be able to provide data from community health needs assessments. When neighborhood-level sources are not available, project teams can rely on county-level resources such as the County Health Ranking website (*www.countyhealthrankings.org*) and/or other databases listed within the Resources section of this criterion.
- Conduct community meetings and/or resident surveys to engage and better understand the perspectives of community stakeholders as well as to collect data directly from them regarding the health-related issues that matter most to them. Community stakeholders may include: community members who live in or may be served directly by the project; individuals who live, work or learn in the neighborhood surrounding the project; and those who provide services or programming in the building or in the neighborhood surrounding the project. This may be accomplished by adding health-focused conversations to community meetings already scheduled as part of the project planning and design process. Local public health professionals may also be well-positioned to support project teams in conducting these conversations. Project teams should strive to collect information from a diverse group of community stakeholders to ensure consideration of a range of perspectives. In particular, engagement should focus on including individuals and groups that may be directly affected by the project and/or that may not typically be involved in the planning and design process.
- Consider partnering with local health providers and public health professionals, such as staff from local or state health departments, to identify priority health issues. Public health professionals monitor, address and prevent health concerns at a community or population level, rather than at an individual level. Examples of public health professionals include, but are not limited to, professionals with training or education in fields such as public health and community health. In most communities, the local or state health department is the primary organization that employs public health professionals. However, many colleges and universities have public or community health programs that also employ and train public health professionals. In addition, there is an increasing number of public health nonprofit organizations such as state or regional public health institutes that could help support a project. Examples of local health providers include those who are providing direct care to individuals. This may or may not include people with medical training, such as nurses, physician assistants and physicians.

RESOURCES

Connections between the built environment and health outcomes

Project teams can learn more about the connections between the built environment and health outcomes through resources such as these and others:

- The Robert Wood Johnson Foundation Social Determinants of Health Series provides issue briefs on connections between neighborhoods and health, housing and health, and social factors and health behaviors. *www.rwjf.org/en/search-results.html?cs=content_series%3Awhat-shapes-health&s=0*
- The Build Healthy Places Network provides access to research and best-practice models in connecting community development and health efforts. *www.buildhealthyplaces.org/network_resources/*
- The Urban Land Institute's "Intersections: Health and the Built Environment" report explores the relationships between health and the way buildings and neighborhoods are built. *http://uli.org/report/intersections-health-and-the-built-environment/*
- The Centers for Disease Control and Prevention, Guide to Community Preventive Services summarizes evidence of community-level programs and policies to improve health and prevent disease based on a scientific systematic review process. *www.thecommunityguide.org*
- City of New York. Active Design Guidelines, 2010. *www.nyc.gov/html/doh/downloads/pdf/environmental/active-design-guidelines.pdf*

Neighborhood or community-level health data sets

Some jurisdictions provide readily available health data at the neighborhood level. Here are examples:

- The Baltimore Neighborhood Indicators Alliance: *http://bniajfi.org/*
- San Francisco's Sustainable Communities Index: *www.sustainablecommunitiesindex.org/profiles.php*
- San Francisco Open Data Portal: *https://data.sfgov.org/*
- New York Open Data Portal: *https://data.ny.gov/*; New York City Environmental Tracking and Sustainability Portal*: www.nyc.gov/health/tracking*; and NYC Interactive Health Data: *http://a816-healthpsi.nyc.gov/epiquery/*
- The Boston Indicators Project: *www.bostonindicators.org/indicators/health*
- City of Chicago Public Health Indicators by community: *https://data.cityofchicago.org/Health-Human-Services/Public-Health-Statistics-Selected-public-health-in/iqnk-2tcu*
- Philadelphia Community Health Database: *www.chdbdata.org/*
- Metro Atlanta Health Equity Atlas: *http://atlantaequityatlas.com/* and Neighborhood Nexus: *www.neighborhoodnexus.org/*
- PLAN for a Healthy L.A.: *http://healthyplan.la/the-health-profiles/*
- Minnesota Compass: *www.mncompass.org*

Project teams can also contact local or state health departments to inquire about the availability of neighborhood-level health data. Additionally, project teams can consult the Centers for Disease Control and Prevention's guidance on "Creating a Health Profile of Your Neighborhood." This document outlines the basic steps and provides online resources for creating a neighborhood health profile. *www.cdc.gov/healthyplaces/toolkit/sources_of_health_data.pdf*

- Community Commons: This is an interactive mapping, data and networking tool to support organizations in their efforts to create healthy, sustainable and equitable communities. *www.communitycommons.org*
- County Health Rankings: The County Health Rankings use county-level measures from a variety of state and national data sources to assess and rank the population health of nearly all counties in the U.S. This website allows users to view the rankings and to explore and download data, including statistics on length of life, self-reported general health, and a subset of health influences. *www.countyhealthrankings.org*
- Community Action Partnership: This website provides selected demographic, employment, educational attainment, income, housing, nutrition and health care indicators at the county and state levels and can be summarized using online tables and charts. *www.communityactioncna.org*
- Centers for Disease Control, Field Guide for Community Needs Assessment: This document details the steps of conducting a community needs assessment. *www.cdc.gov/globalhealth/fetp/training_modules/15/community-needs_fguidelines_final_09252013.pdf*
- University of Kansas, Work Group for Community Health and Development, "The Community Toolbox, Chapter 7. Conducting Needs Assessment Surveys": This online toolbox describes the process and provides examples of conducting a needs assessment survey to identify important needs of the community. *http://ctb.ku.edu/en/table-of-contents/assessment/assessing-community-needs-and-resources/conducting-needs-assessment-surveys/main*
- Robert Wood Johnson Foundation—DataHub: This website allows users to customize state-level data on key health and health care topics and visualize facts and figures. *www.rwjf.org/en/research-publications/research-features/rwjf-datahub.html*
- Health Statistics You Can Visualize, Customize & Share, Centers for Disease Control, State and Local Tracking Portals: This website provides links to health and environmental data from 23 states and one city. *http://ephtracking.cdc.gov/showStateTracking.action*
- Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System: This is an annual, state-by-state phone survey of self-reported health outcomes used to determine national and state disease rates. *www.cdc.gov/brfss/*
- Johns Hopkins Center for Injury Research and Policy, NYC Department of Health and Mental Hygiene, Society for Public Health Education, Active Design Supplement: Promoting Safety, Version 2, 2013. This document offers design guidelines on increasing safety while also promoting health and physical activity within the built environment. *www.nyc.gov/html/doh/downloads/pdf/environmental/promoting-safety.pdf*
- National Network of Public Health Institutes—Community Health Improvement: This website provides webinars, case studies and resources regarding community health assessments and community health improvement tools and techniques. *www.nnphi.org/program-areas/community-health-improvement*

1.2b *Optional | 12 points*
Resident Health and Well-Being: Health Action Plan

REQUIREMENTS

At pre-design and continuing throughout the project life cycle (design, construction, operations), collaborate with public health professionals and community stakeholders to assess, identify, implement and monitor achievable actions to enhance health-promoting features of the project and minimize features that could present risks to health. As compared to satisfying the requirements of Criterion 1.2a, compliance with this criterion requires a more rigorous association with public health professionals and more robust follow-up actions. Specifically, comply with Step 1 and Step 2 outlined here:

Step 1: Create a Health Action Plan

Purpose

Conduct additional research on resident health factors identified in 1.2a. Using public health data and community input, characterize how the project may impact—both positively and negatively—social, environmental and economic outcomes for residents and, in turn, promote or produce unintended negative consequences for health. Based on the best available evidence, prioritize actions that will protect and promote health in response to these potential social, environmental and economic impacts.

Participants

The primary participants are those on the project team, which will be guided by input from community stakeholders likely to be affected by the project, as well as technical assistance from public health professionals (ideally those with Health Impact Assessment [HIA] expertise). As described in Criterion 1.2a, community stakeholders may include community members who live in or may be served directly by the project; individuals who live, work or learn in the neighborhood surrounding the project; and those who provide services or programming in the building or in the neighborhood surrounding the project. Public health professionals may include those with expertise in public health or community health. Faculty or graduate students of public health programs, and staff of local health departments, public health institutes and/or community-based public health organizations are suggested examples of partners. See Resources for more suggested contacts.

Process

Gather information and solicit feedback regarding critical health aspects affecting the community (including social, environmental and economic factors that impact health). Hold a series of meetings with key stakeholders, including public health professionals and community stakeholders to facilitate collaboration and develop a plan for analyzing the project's potential impacts on health, including:

- Conduct a scoping conversation with public health professionals and community stakeholders to identify the project's potential connections to health. Prior to this scoping conversation, project teams could review and familiarize themselves with the connections between building design, construction and operation; neighborhood characteristics; and health. See the Resources section in Criterion 1.2.a for information about these connections to health.

- Gather evidence (including existing data sources, new qualitative research and/or public hearings, meetings with public health professionals) about the project's potential connections to health and the baseline health of the community groups that could be impacted by the project.
- Outline the distribution of health issues among impacted communities and describe how different groups may be disproportionately impacted by the project (positively and negatively).
- Identify actions that could be taken to enhance health-supportive features of the project and those that could minimize potential health risks. Identify actions that can be taken within the project's design, construction or operation that will promote health equity. As listed in Resources, Promoting Equity Through the Practice of Health Impact Assessment can provide guidance.
- Using the list of actions produced, prioritize actions to protect and promote health in consultation with public health professionals and community stakeholders. In identifying priority actions, project teams and stakeholders should use factors that include the actions' likelihood of having significant effects on health and equity, responsiveness to community concerns, and feasibility of implementation to guide the prioritization process. Teams should consider the extent to which the actions will address health impacts of higher concern as well as the feasibility of implementation (in terms of cost, resources, technical constraints, etc.). Teams should provide a rationale for the selected strategies, as shown in the sample table found in Recommendations.

Products

- A description of key health issues (including social, environmental and economic factors) identified by stakeholders in the scoping conversation for assessing the project's connections to health. See Recommendations for a sample chart that captures this information.
- A description of how engaging public health professionals and community stakeholders informed the list of key health issues to be addressed by this project. Submit separately from sample chart seen in Recommendations.
- List (or asset map) of public health and community stakeholders involved. Submit separately from sample chart seen in Recommendations.
- List of potential actions to protect and promote health. See Recommendations for a sample chart that captures this information.
- List of selected interventions; description of reasons for implementing selected actions and rationale for not selecting the other identified potential interventions for implementation; and summary of how the selected actions may address health equity. See Recommendations for a sample chart that captures this information.

Step 2: Project Implementation and Monitoring

Purpose

Integrate the list of selected interventions and a plan for monitoring and evaluating your progress into the plan for project development.

Process

- Document and demonstrate how the analysis in Step 1 informed building and site design decisions, including modifications that were made in response to the findings and recommended actions that were identified in the information-gathering and health action plan phases.
- Develop a monitoring plan with performance metrics to evaluate the project's impact on resident health throughout the project life cycle (design, construction and operations).

Product

The plan should include:

- A summary of which modifications were made in response to the findings and recommended actions identified in the earlier phases. See Recommendations for a sample chart that captures this information.
- The performance metrics to be monitored. Include design metrics (metrics to determine how well the design team integrated the selected strategies into the project in a manner that will promote positive health outcomes), operations metrics (metrics that can be measured on a routine basis while the building is in operation to determine whether or not the building is performing as intended), and health metrics (metrics regarding resident health factors and, where possible, incidence or prevalence of key health outcomes in the resident and/or community population). See Recommendations for a sample chart that captures this information.
- Specific information on indicators, data sources, frequency, and roles and responsibilities for monitoring different information as per the sample chart in Recommendations in this section.
- Identify the individual or organization responsible for implementing and monitoring the selected strategy as well as the rate of how often the associated performance metrics will be monitored. See Recommendations for a sample chart that captures this information.

RATIONALE

Health Impact Assessments (HIAs) identify the potential effects of a proposed policy, project or program and offer practical options for maximizing health benefits and minimizing health risks. The process outlined in Criterion 1.2b does not include all steps of an HIA, but builds upon core HIA elements to allow project teams to identify and address important health issues. This process facilitates the identification of ways to optimize a project's impacts on the health and engagement of key stakeholders, including public health experts and community stakeholders, throughout the project life cycle through a more cost-effective approach. To learn more about HIA, please reference the National Resource Council guidance on HIAs (see Resources section).

RECOMMENDATIONS

Step 1: Create a Health Action Plan

EXAMPLE OF PARTIAL PRODUCT FOR CRITERION 1.2B, STEP 1:

KEY HEALTH ISSUE AND POPULATION GROUP	POTENTIAL INTERVENTIONS	EXAMPLES OF STRATEGIES	WAS THIS STRATEGY ELECTED? (YES/NO)	IF SELECTED, INDICATE HOW THIS STRATEGY WILL BE IMPLEMENTED	RATIONALE FOR SELECTING OR REJECTING THE EXAMPLE STRATEGY
High incidence of childhood asthma	Eliminate or reduce use of potential asthmagens	Prioritize the specification of hard surface flooring	Yes	Specification of linoleum for kitchens; cork flooring for bedrooms	High-impact strategy in terms of addressing health issue; also a flooring choice that reduces ongoing maintenance and replacement costs. Given the disparities in asthma rates by race, ethnicity and income in our community, this strategy will also help to address health equity.
Above-average prevalence of childhood obesity	Prioritize features that promote physical activity	Street infrastructure improvements to safely accommodate users of all ages, abilities and transportation modes	No	N/A	Our project team does not have the capacity to affect local transportation infrastructure
Above-average prevalence of childhood obesity	Prioritize features that promote physical activity	Playground	Yes	We will be including a 100-square-foot playground as part of our project	This feature will provide a local, safe space for the families living in our development to play and socialize. Otherwise, closest playspace is 2 miles from project; not easily accessible. Given the disparities in childhood obesity rates by race, ethnicity and income in our community, this strategy will also help to address health equity.

Project teams may also want to identify programming features you intend to provide to residents, such as nutritional classes, cooking courses, etc.

Step 2: Implement and Monitor

Definitions

Potential Performance Metrics: List of methods that could be used to evaluate the impact of the selected strategies on the population need.

Design Metrics: Metrics to determine how well the design team, at the design stage, integrated the selected strategies into the project in a manner that will promote positive health outcomes.

Operations Metrics: Metrics that can be measured on a routine basis while the building is in operation to determine whether or not the building is performing as intended.

Health Metrics: Metrics regarding resident health factors and, where possible, incidence or prevalence of key health outcomes in the resident and/or community population.

Selected Performance Metrics: List of the specific Potential Performance Metrics that will be implemented.

Roles, Responsibilities and Responsible Individual(s) and/or Organization(s): List of the roles and responsibilities necessary to measure the Selected Performance Metrics, including the specific individual and/or organization selected to fill that role and/or responsibility. Identify individual(s) or organization(s) that would be accountable to take action if any adverse results are found.

Frequency: The rate of how often the Selected Performance Metrics will be evaluated.

EXAMPLE OF PRODUCT FOR CRITERION 1.2B, STEP 2

INFORMATION IDENTIFIED IN STEP 1			NEW TABLE CELLS IN STEP 2			
POPULATION NEED	**SELECTED INTERVENTION(S)**	**SELECTED STRATEGY**	**POTENTIAL PERFORMANCE METRICS**	**SELECTED PERFORMANCE METRICS**	**RESPONSIBLE INDIVIDUAL(S) AND/OR ORGANIZATION(S)**	**FREQUENCY**
High incidence of childhood asthma	Eliminate or reduce use of potential asthmagens	Specification of linoleum for kitchens, cork flooring for bedrooms, etc.	**Design Metrics** No carpet is specified in the project plans and specs. All flooring materials specified are hard surfaces. **Operations Metrics** Screen indoor air for presence of asthmagens **Health Metrics** Incidence rate of acute asthma events	**Design Metrics** No carpet is specified in the project plans and specs. All flooring materials specified are hard surfaces. **Operations Metrics** Screen indoor air for presence of asthmagens **Health Metrics** Incidence rate of acute asthma events	**Design Metrics** Architect to certify that no carpet was utilized in the project design/ specifications. John Smith, ACME Inc., 123.456.7890 **Operations Metrics** Property manager will engage an IEQ consultant to measure formalde-hyde levels in air once each quarter. Jane Doe, Company Inc., 234.456.5678 **Health Metrics** Housing provider will annually collect self-reported rates of asthma incidents among residents and track them over the life of the project. Or, housing provider will work with local hospital or health system to track and monitor rates of admission and re-admission for asthma incidents. Johnny Rocket, XYZ Company, 456.678.6789	**Design Metrics** To be certified on final plan set before construction start **Operations Metrics** To be measured once each quarter **Health Metrics** Annual survey

EXAMPLE OF PRODUCT FOR CRITERION 1.2B, STEP 2 (CONTINUED)

INFORMATION IDENTIFIED IN STEP 1			NEW TABLE CELLS IN STEP 2			
POPULATION NEED	**SELECTED INTERVENTION(S)**	**SELECTED STRATEGY**	**POTENTIAL PERFORMANCE METRICS**	**SELECTED PERFORMANCE METRICS**	**RESPONSIBLE INDIVIDUAL(S) AND/OR ORGANIZATION(S)**	**FREQUENCY**
Above average prevalence of childhood obesity	Prioritize physical activity promoting features; add outdoor lighting to playgrounds to allow use for more hours; add bike racks and storage	Add lighting to exterior park/ playground areas	**Design Metrics** Specific type of light used **Operations Metrics** Area is well lit during all hours of operation **Health Metrics** Self-reported rates of physical activity among residents; frequency of events/opportunities for physical activity and participation rates in these events; operations staff monitor playground use by keeping tally	**Design Metrics** Specified lighting for park/ playground areas complies with Criterion 5.5 as well as foot candle recommendations **Operations Metrics** Lighting density **Health Metrics** Frequency of events and opportunities for physical activity (e.g., "community field day" or walking groups) and associated participation rates	**Design Metrics** Architect to certify that specs include appropriate lighting fixtures. John Smith, ACME Inc., 123.456.7890 **Operations Metrics** Maintenance technician to measure lighting density once each quarter. Jane Doe, Company Inc., 234.456.5678 **Health Metrics** Residential Services Coordinator Beth Smith 123.456.7890	**Design Metrics** To be certified on final plan set before construction start **Operations Metrics** To be measured once each quarter **Health Metrics** Quarterly tracking of events and number of participants

Transparency

- Share your Step 2 table through the Green Building Information Gateway (*gbig.org*) and the Health Impact Project (*healthimpactproject@pewtrusts.org*).
- Produce an acknowledgment page or letter(s) of support from public health professionals and community stakeholders. Receive documentation from community stakeholders regarding their involvement in the identification and prioritization of actions to protect and promote health (completed in Step 2) and their level of support for the health action plan. Note that project teams need to obtain consent from any community and team members to be listed in the acknowledgments page.
- Note where health-related items have been incorporated into project documentation, including plans and specifications.

RESOURCES

- Data sources for measuring baseline health: Provided in the Resources section of Criterion 1.2a. See also the Human Impact Partners resources listed below.
- The American Planning Association and the National Association of County and City Health Officials webinar, "Planning for Healthy Places with Health Impact Assessments": This online course explains the value of and the steps involved in conducting an HIA. *http://advance.captus.com/Planning/hia2/home.aspx*
- The Mariposa Healthy Living Toolkit: This toolkit provides a guide for assessing the health conditions of residents and identifying opportunities to improve health during community redevelopment projects. *http://mithun.com/special/Mariposa_Healthy_Living_Initiative/*
- Health Impact Project's interactive map of HIAs: This interactive map allows users to sort and analyze data on completed and in-progress HIAs in the U.S. *www.pewtrusts.org/en/projects/health-impact-project*
- The Surgeon General's National Prevention Strategy: Healthy Communities factsheet: This document outlines actions that different organization types can take to support healthy and safe community environments. *www.surgeongeneral.gov/initiatives/prevention/strategy/healthy-safe-environments.pdf*
- Guidance and Best Practices in Stakeholder Participation in HIAs: This document provides recommended strategies for collaborating with stakeholders. *www.pewtrusts.org/en/projects/health-impact-project*
- Promoting Equity through the Practice of HIA: This document highlights strategies for and case examples of promoting equity through Health Impact Assessments. *www.pewtrusts.org/en/~/media/Assets/External-Sites/Health-Impact-Project/PromotingEquityHIA_final.pdf*
- Human Impact Partners: *www.humanimpact.org/capacity-building/hia-tools-and-resources/* Some suggested tools and resources for your use are:
  - *Roles for Collaborators:* This document provides examples of different partners that might be involved in a Health Impact Assessment and their roles.
  - *Rapid HIA Model:* This document provides guidance for conducting a Health Impact Assessment within a short timeline, while maintaining a high level of stakeholder engagement.
  - *Data sources table:* This table outlines data sources that may be useful in a Health Impact Assessment.
- Mithun Cultural Audit Tool: The Cultural Audit attempts to collect diverse community input from a broad constituency and helps to form a more inclusive picture of the community. *http://stage2.mithun.com/projects/type/culturalaudit/*
- National Research Council Improving Health in the United States: The Role of Health Impact Assessment and related brief: These documents provide an overview and a definition of "health impact assessment," examples of methods for analyzing potential health impacts of a project, and best practices for monitoring the project's impacts on health. *www.nap.edu/catalog/13229/improving-health-in-the-united-states-the-role-of-health* and *http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/Health-Impact-Assessment-Report-Brief-Final.pdf*
- Minimum Elements of Health Impact Assessment (v3): This document describes the essential elements of and standards for a Health Impact Assessment. *http://hiasociety.org/wp-content/uploads/2013/11/HIA-Practice-Standards-September-2014.pdf*

1.3a

Mandatory

Resilient Communities: Design for Resilience

New Construction and Substantial Rehab only

REQUIREMENTS

Given your project building type, location and expected resident population, identify a project characteristic that would most likely impact your project's ability to withstand an unexpected weather event or loss of power. Select at least one of the optional Design for Resilience Criteria listed below that would help mitigate that impact, and incorporate this within your project plans and design. Include a short narrative providing your rationale for selecting this criterion above the others.

Design for Resilience Criteria

1.3b: Resilient Communities: Multi-Hazard Risk/Vulnerability Assessment*
2.10: Passive Solar Heating/Cooling
3.6: Surface Stormwater Management
4.2: Advanced Water Conservation [Must achieve at least 3 points if selecting this criterion]
4.5: Water Reuse [Must achieve at least 3 points if selecting this criterion]
4.6: Access to Potable Water during Emergencies*
5.2a: Additional Reductions in Energy Use
5.2b: Advanced Certification: Nearing Net Zero
5.8a: Resilient Energy Systems: Floodproofing*
5.8b: Resilient Energy Systems: Islandable Power*

*These criteria provide a project with the capacity to respond in the near-term to emergencies. These emergency response items are critical for addressing immediate resiliency needs. The other criteria listed here enhance overall project efficiency and performance, creating a more resilient project in more general terms.

RATIONALE

Per the Resilient Design Institute, resilience is the capacity to adapt to changing conditions and to maintain or regain functionality ("bounce forward") and vitality in the face of stress or disturbance. It is the capacity to bounce back after a disturbance or interruption of some sort. At various levels—individuals, households, communities and regions—through resilience we can maintain livable conditions in the event of natural disasters, loss of power or other interruptions in normally available services. Relative to climate change, resilience involves adaptation to the wide range of regional and localized impacts that are expected with a warming planet: more intense storms, greater precipitations, coastal and valley flooding, longer and more severe droughts in some areas, wildfires, melting permafrost, warmer temperatures and power outages. Resilient design is the intentional design of buildings, landscapes, communities and regions in response to these vulnerabilities.

RECOMMENDATIONS

- Note that while the criteria listed in the table above are those explicitly designed to address resilience, many other criteria are also meaningful in terms of contributing to a project's capacity to withstand a severe interruption. For instance, compliance with optional Criterion 5.7a Photovoltaic/Solar Hot Water Ready would result in a building better prepared to adjust per changing project needs in the future.

- To foster social resilience in a multifamily property, consider co-locating the features listed above. For instance, a community room in a multifamily property could become a hub during an emergency, including postings of community information by management, serving as a gathering spot for neighbors, providing access to potable water during emergencies, being supplied by islandable power systems for critical services, and including charging stations for residents and community members.
- Enterprise's Multifamily Resilience Manual includes more than a dozen strategies and specific guidance for building property resilience in the event of an emergency. Consider incorporating one or more of these measures into your property.

RESOURCES

- Green Building and Climate Resilience: Understanding Impacts and Preparing for Changing Conditions, University of Michigan; U.S. Green Building Council; 2011. This document identifies climate-related vulnerabilities at the regional level and prioritizes design, construction and operation strategies that will increase resilience and facilitate climate adaptation. *www.usgbc.org/Docs/Archive/General/Docs18496.pdf*
- Enterprise's Multifamily Resilience Manual: *www.enterprisecommunity.org/resources*
- Building Resiliency Task Force Full Report, June 2013, Urban Green: Provides resiliency-related recommendations for communities and buildings. *http://issuu.com/urbangreen/docs/brtf_full_report#/freeSignupNamePassword*

1.3b *Optional | 15 points*
Resilient Communities: Multi-Hazard Risk/Vulnerability Assessment

REQUIREMENTS

Carry out a Vulnerabilities Assessment and implement building elements designed to enable the project to adapt to, and mitigate, climate impacts given the project location, building/construction type and resident population. Your Vulnerabilities Assessment should prioritize evaluation of issues (e.g., wildfires, flooding, etc.) identified in the state or county hazard mitigation plan for which your project is located. Implement strategies to address at least the top three risk factors identified for your project. Also ensure that these measures are incorporated in response to Criterion 8.2 Emergency Management Manual.

RATIONALE

Creating affordable housing projects that will perform well during natural disasters requires careful planning. The exercise of assessing vulnerabilities and creating a plan to mitigate appropriate risks will result in greater focus on this issue. Engaging in this exercise during the integrative design process will allow for input from a variety of stakeholders and incorporation of measures that enhance resilience throughout the project design and construction documents.

RECOMMENDATIONS

- Hold a series of facilitated charrettes and community meetings focused explicitly on identifying how the issues identified in your project's state or county hazard mitigation plan apply to your project and your resident population.
- Identify solutions appropriate for your project, evaluate how these strategies overlap with the other criteria selected for your project, and determine best means of implementation.

RESOURCES

- FEMA's hazard mitigation planning resources include a Mitigation Planning Handbook, guidelines for Sustainability in Mitigation Planning, Planning Advisory Service Reports, and examples of Mitigation Activities. *www.fema.gov/hazard-mitigation-planning-resources*
- The National Hazard Mitigation Association (NHMA): Promotes natural hazard risk reduction and climate adaptation through planning, adaptation and mitigation. The NHMA promotes steps to reduce the risk and consequences of natural events with a special emphasis on protecting the most vulnerable populations in our communities. *www.nhma.org*
- The Built Environment Coalition (BEC): Develops analytical approaches, methodologies and tools to help communities and organizations identify opportunities to improve their built environment and make informed decisions on potential investments. *www.builtenvironmentcoalition.org*
- The Federal Alliance for Safe Homes (FLASH): The country's leading consumer advocate for strengthening homes and safeguarding families from natural and manmade disasters. *www.flash.org*
- Metropolitan Washington Council of Governments' climate adaptation planning initiatives report *www.mwcog.org/uploads/pub-documents/pl5cXls20130701111432.pdf*
- Rocky Mountain Land Use Institute: Resource focused on sustainable and adaptive land use and development practices, focused on the western U.S. *www.law.du.edu./index.php/rmlui/about*
- FEMA Building Vulnerability Assessment Checklist may be used as a screening tool for preliminary design vulnerability assessment. *www.fema.gov/media-library-data/20130726-1524-20490-4937/fema452_a.pdf*
- Kaiser Permanente Hazard and Vulnerability Assessment Tool: Naturally Occurring Events is a sample Hazard Vulnerability Analysis Tool: *www.rhpc.us/go/doc/4207/1598819/Hazard-Vulnerability-Analysis*
- California Association of Health Facilities Hazard Vulnerability Worksheet may be used as a template to score and assess your project for potential mitigative actions that can reduce identified vulnerabilities. *www.cahfdownload.com/cahf/dpp/HVA-UHCA.pdf*

LOCATION + NEIGHBORHOOD FABRIC

Locating a project within an existing neighborhood and in close proximity to infrastructure, transportation and services encourages more resource-efficient development of land, reduces development costs, conserves energy and adds to the vitality of the overall community.

INSTRUCTIONS

Guidance for New Construction Projects

Access to reliable transportation networks is critical to ensuring that affordable housing residents are well connected to amenities. To confirm this, all new construction projects must either earn optional points under Criterion 2.8 Access to Public Transportation, or earn 8 optional points through the criteria listed below drawn from Category 2: Location + Neighborhood Fabric.

2.7 Preservation of and Access to Open Space
2.9 Improving Connectivity to the Community
2.12 Access to Fresh, Local Foods
2.13 LEED for Neighborhood Development Certification
2.14 Local Economic Development and Community Wealth Creation

Guidance for Moderate and Substantial Rehab Projects

Moderate and Substantial Rehab projects are exempt from all mandatory measures in the Enterprise Green Communities Category 2: Location + Neighborhood Fabric.

Guidance for Rural/Tribal/Small Towns

Projects that meet one or more of the criteria below qualify for the special Rural/Tribal/Small Towns pathways throughout the Location + Neighborhood Fabric category:

- Projects classified as rural as defined in Section 520 of the Housing Act of 1949 (42 U.S.C. 1490), located within any open country or any town, village, city or place that is not part of or associated with an urban area, and that:
  1. has a population in excess of 2,500 but not in excess of 10,000 if it is rural in character, or
  2. has a population in excess of 10,000 but not in excess of 20,000 and is not contained within a standard metropolitan statistical area
- Projects located on Native American Reservations and land owned by Native Alaskans
- Projects located in colonias communities as defined by HUD and certified by one of the four border states: Texas, New Mexico, Arizona and California
- Projects eligible for funding under USDA Rural Housing Services (RHS) programs

Instructions: Determining USDA RHS funding eligibility

Obtain information on your project site at the USDA Rural Development (RD) web page that identifies USDA RD-eligible areas, as determined by USDA's housing programs: *eligibility.sc.egov.usda.gov/eligibility/welcomeAction.do*

Under "Property Eligibility," select the program type. Once the page refreshes, do one of these things:

1. Enter the project address in the appropriate fields or select a state from the map.
2. Click the "Text Description" button for information on eligibility by state.
3. Click on your county.

2.1 Sensitive Site Protection

Mandatory

See exemptions in Criteria

REQUIREMENTS

Do not locate new projects, including buildings, built structures, roads or parking areas, on portions of sites that meet any of the following provisions:

1. Land within 100 feet of wetlands, including isolated wetlands or streams. Maintain or establish riparian buffer using native vegetation where possible. Bike and foot paths are allowed if at least 25 feet from the wetlands boundary.
2. Land on slope greater than 15%.
3. Land with prime soils, unique soils or soils of state significance per USDA designations.
4. Public parkland.
5. Land that is specifically identified as an existing habitat for any species on federal or state threatened or endangered lists.
6. Land that is within the Special Flood Hazard Areas (SFHA) as identified by FEMA on the Flood Insurance Rate Map.

EXEMPTIONS

- Projects on previously developed sites are exempt from provision 1 above.
- Infill sites are exempt from provisions 2 and 3 above. (See Glossary for detail on what can be classified as an infill site.)
- Infill projects that are designated to meet the American Society of Civil Engineers ASCE 24 Flood Resistant Design and Construction Standard are exempt from provision 6 above.

RATIONALE

Proper site selection avoids damage to or loss of fragile and scarce environmental resources. It also reduces the risk of building damage from flooding, which is likely to be more frequent and more severe with the advent of climate change.

RECOMMENDATIONS

Use federal, state and local lists to identify habitats of potential endangered species and their habitats.

RESOURCES

- U.S. Fish and Wildlife Service, Endangered Species Database: *www.fws.gov/endangered/*
- U.S. Fish and Wildlife Service, National Wetlands Inventory: *www.fws.gov/wetlands/*
- U.S. Department of Energy, Building Technologies Office: Addresses methods that can help to minimize impacts to the site. *www.eere.energy.gov/buildings/info/design/buildingsiting/index.html*
- American Society of Civil Engineers (ASCE), ASCE 24-05 Flood Resistant Design and Construction (2010): *www.fema.gov/media-library/assets/documents/14983?id=3515*

- U.S. Department of Agriculture, Natural Resources Conservation Service's Web Soil Survey: *http://websoilsurvey.nrcs.usda.gov/app/*
- Federal Emergency Management Agency (FEMA), FEMA's Flood Map Service Center: *http://msc.fema.gov/portal*

2.2 *Mandatory* Connections to Existing Development and Infrastructure

Except for projects located on rural tribal lands, in colonias communities or in communities with populations of less than 10,000

REQUIREMENTS

Locate the project on a site that has access to existing roads, water, sewers and other infrastructure within or contiguous to (having at least 25% of the perimeter bordering) existing development.

Connect the project to the pedestrian grid by creating new or enhancing existing sidewalks or other all-weather pathways to link the project to public spaces, open spaces and adjacent development.

Do not build on tracts of land that require installing a septic tank within 1,000 feet or more of the property line of the tract being developed or a sanitary sewer line extension of 2,500 feet or more from the property line of the tract being developed.

RATIONALE

Locating a project within an existing neighborhood and in close proximity to infrastructure encourages more resource-efficient development of land, reduces development costs, conserves energy, adds to the vitality of the overall community, and safeguards a community during significant weather events. Ensuring that pedestrian and cycling infrastructure is included encourages safe, active transportation, which can improve health by significantly increasing daily physical activity.

RECOMMENDATIONS

- Provide enhanced pedestrian crossings at intersections using elements such as curb extensions, medians, crosswalk count-down clocks, daylighting, street treatments (e.g., different color or texture pavement in crosswalks) or sidewalk expansion. On streets with large blocks, consider mid-block pedestrian crossings.
- Dedicated pedestrian and bicycle paths are important even on dead-end streets.
- Design engaging and safe sidewalk experiences appropriate for expected pedestrian flows and uses.

RESOURCES

- NYC Departments of City Planning, Health and Mental Hygiene, and Design and Construction. *Active Design Supplement: Shaping the Sidewalk Experience*, 2013. *www.nyc.gov/html/dcp/pdf/sidewalk_experience/active_design.pdf*
- Task Force on Community Preventive Services. *The Community Guide—What Works to Promote Health*. *www.thecommunityguide.org/pa/environmental-policy/communitypolicies.html*

- Center for Active Design: The Center for Active Design maintains an urban design checklist that includes best practices for sidewalk design to encourage their vibrant use, including features like trees, lighting and wayfinding. *http://centerforactivedesign.org/*
- The Community Preventive Services Task Force, Environmental and Policy Approaches to Increase Physical Activity: Street-Scale Urban Design Land Use Policies. *www.thecommunityguide.org/pa/environmental-policy/streetscale.html*
- Smart Growth America: Complete Streets. *www.smartgrowthamerica.org/complete-streets*

2.3 *Mandatory* Compact Development

REQUIREMENTS

At a minimum, build to the residential density (dwelling units/acre) of the census block group in which your project is located. Find the density of your census block group by typing your project address into the Center for Neighborhood Technology "Residential Density of a Location" calculator found at *http://apps.cnt.org/residential-density*.

Any acreage maintained as open space per Criteria 2.6 and 2.7 may be deducted from total project acreage in terms of determining project density.

In Rural/Tribal/Small Towns that do not have zoning requirements, use the following: Build to a minimum net density of 5 units per acre for single-family houses; 10 units per acre for multifamily buildings, single and two-story; and 15 units per acre for multifamily buildings greater than two-stories.

RATIONALE

Compact development encourages more resource-efficient development of land, reduces project cost, conserves energy and supports demand for other infrastructure such as public transportation and commercial development. Compact development also correlates with walking behavior and physical activity through active transportation. To the extent that communities want to foster safe, active transportation and a healthy lifestyle, compact development is critical to success.

RECOMMENDATIONS

- To determine if your project qualifies as Rural/Tribal/Small Town, reference the Instructions at the beginning of Category 2: Location + Neighborhood Fabric.
- Net density calculations do not include land that is set aside for future building phases or development. For multi-phased projects, the project net density should include only the portion of the parcel that is being used for that particular phase.

RESOURCES

- Congress for the New Urbanism: This nonprofit organization provides tools and resources for promoting walkable, neighborhood-based development as an alternative to sprawl. *www.cnu.org*
- Smart Growth Network: This website outlines smart growth principles, provides a guide through smart growth terms and technical concepts, and hosts a searchable catalog of reports, websites, tools and case studies. *www.smartgrowth.org*

- Urban Land Institute: This nonprofit organization promotes the responsible use of land to enhance the total environment. ULI's online bookstore includes numerous publications regarding compact and higher-density development. *www.uli.org*
- Reconnecting America: This website offers multiple resources providing detailed information about the link between land use, including density, and transit ridership/performance. *www.reconnectingamerica.org*

2.4 Compact Development

Optional | 5 or 7 points

REQUIREMENTS

Exceed the residential density (dwelling units/acre) of the census block group in which your project is located. Find the density of your census block group by typing your project address into the Center for Neighborhood Technology "Residential Density of a Location" calculator found at *http://apps.cnt.org/residential-density/*.

EXCEED THE CNT RESIDENTIAL DENSITY	OPTIONAL POINTS
2x	5 points
3x	7 points

In Rural/Tribal/Small Towns that do not have zoning requirements, build to a minimum net density of 7.5 units per acre for single-family houses; 12 units per acre for multifamily buildings, single and two-story; and 20 units per acre for multifamily buildings greater than two-stories. *[5 points]*

RATIONALE

See Rationale for Criterion 2.3.

RECOMMENDATIONS

See Recommendations for Criterion 2.3.

RESOURCES

See Resources for Criterion 2.3.

2.5 *Mandatory* Proximity to Services

REQUIREMENTS

- Locate the project within a 0.5-mile walk distance of at least four, or a 1-mile walk distance of at least seven, services.
- Each "service" type may not be counted more than twice. For example, if there are five banks within the required distance, only two may be counted.
- For projects that qualify as Rural/Tribal/Small Town, locate your project within 5 miles of at least four services.

RETAIL	AMENITIES	CIVIC AND COMMUNITY FACILITIES
Supermarket	Bank (with teller hours)	Adult or senior care (licensed)
Other food store with produce	Gym, health club, exercise studio	Child care (licensed)
Farmers market	Hair care	Community or recreation center, potentially including performance space
Clothing store or department store selling clothes	Laundry, dry cleaner	Cultural arts facility (museum, performing arts)
Hardware store	Restaurant, café, diner	Educational facility (including K–12 school, university, adult education center, vocational school, community college)
Pharmacy		Entertainment venue (theater, sports)
Other retail		Government office that serves public on-site
		Place of worship
		Medical clinic or office that treats patients
		Police or fire station
		Post office
		Public library
		Public park
		Social services center

List adapted from the LEED 2009 Neighborhood Development Rating System

RATIONALE

Proximity to neighborhood services, including grocery stores, community centers, health services and some retail shops correlate highly with a physically healthy lifestyle. To the extent that communities want to foster active transportation and a healthy lifestyle, linking housing to the types of destinations listed above is critical to success. Additionally, proximity and access to active recreation facilities such as parks, playgrounds and other exercise amenities are associated with increased physical activity and decreased weight.

Compact development encourages more resource-efficient development of land, reduces project costs and conserves energy. Additionally, it supports demand for other infrastructure such as public transportation and commercial development. Residents with services within a close, safe, accessible physical proximity will fare better during natural disasters in the event of a loss of automobile access or other major events when gasoline and public transportation may be limited.

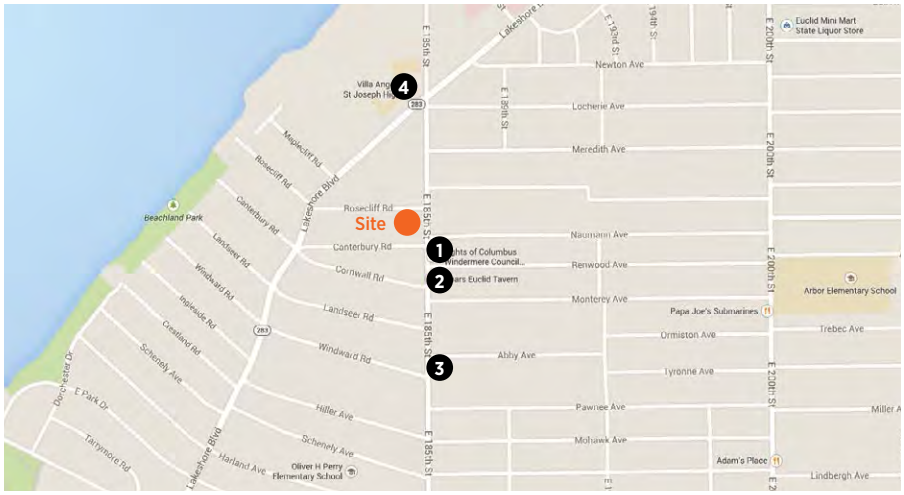
RECOMMENDATIONS

- Use a context map to demonstrate that the center of the site is within the required walk distance of services.
- Walking paths and pedestrian street crossings should be safe and should include sidewalks, crosswalks and signals.

- City, municipal and county governments (e.g., local planning department, health department) can serve as valuable resources to better understand community amenities.

RESOURCES

- Google Maps offers a function to demonstrate walk distance. On Google Maps, go to "Directions" and select "Walk Directions" to obtain this information. *www.google.com/maps*
- To determine if your project qualifies as Rural/Tribal/Small Town, reference the Instructions at the beginning of Category 2: Location + Neighborhood Fabric. Walkscore: *www.walkscore.com/*
- Safe Routes to School National Partnership: This network of more than 300 nonprofit organizations, government agencies, schools and professionals works to advance the Safe Routes to School (SRTS) movement in the United States. SRTS can provide a variety of important benefits to children and their communities, including increasing physical activity, reducing traffic congestion, improving air quality and enhancing neighborhood safety. *www.saferoutespartnership.org/home*
- The National Association of Area Agencies of Aging (n4a): This resource can be used to find aging-in-place service providers in your area. *www.n4a.org/*
- U.S. Department of Health and Human Services, U.S. Administration on Aging, Eldercare Locator: This resource can be used to find home- and community-based service providers in your area. *www.eldercare.gov/*
- Consider using a technology like TransitScreen in your building's common space(s) to provide real-time transportation information to building residents and staff. *http:/transitscreen.com*
- Professor Anne Vernez-Moudon's papers on walkability, College of Built Environments, Department of Architecture, University of Washington. *http://urbdp.be.washington.edu/people/faculty/departmental/profiles/moudon.html*



PROXIMITY TO SERVICES

1. Educational facility (elementary school): < 0.1 mile
2. Pharmacy: < 0.1 mile
3. Hardware: 0.2 mile
4. Educational facility (hIgh school): 0.3 mile

2.6 *Mandatory*
Preservation of and Access to Open Space for Rural/Tribal/Small Towns

REQUIREMENTS

Option 1

Set aside a minimum of 10% (minimum of 0.25 acre) of the total project acreage as non-paved open space for use by all residents.

OR

Option 2

Locate the project within a 0.25-mile walk distance of dedicated public non-paved open space that is a minimum of 0.75 acres.

Note: For either option, land that is set aside for future development cannot be included as open space in these calculations.

RATIONALE

Open space is more than just a land asset for development; it is an amenity that attracts the broader community. Access to safe open space and other natural resources improves quality of life, enhances opportunities for physical activity and social interaction, and provides the opportunity to better understand the importance of the natural environment.

RECOMMENDATIONS

- Create a site plan with total acres and the number of acres of the proposed open space, and a narrative plan for security and maintenance for the preservation of the open space.
- When calculating open space, be sure to deduct buildings, private outdoor areas, streets and roadways from your total site area.
- To determine if your project qualifies as Rural/Tribal/Small Town, reference the Instructions at the beginning of Category 2: Location + Neighborhood Fabric. Design building massings to enhance nearby parks, plazas and open spaces.
- Open spaces should be safe and designed to promote active use by residents. Features such as active bike and walking trails/paths, lighting, seating options, native plantings and recreation facilities to make open space a community amenity. Open spaces should compliment the cultural preferences of the local population and accommodate people of all ages.

RESOURCES

- U.S. Environmental Protection Agency, Smart Growth and Open Space Conservation. *www.epa.gov/smartgrowth/openspace.htm*
- The Trust for Public Land: Creates parks and protects land for people, ensuring healthy, livable communities for generations to come. *www.tpl.org/*
- The Trust for Public Land, ParkScore Index: A rating system developed to measure how well U.S. cities are creating parks. *http://parkscore.tpl.org/*

2.7 Preservation of and Access to Open Space

Optional | 6 points maximum

REQUIREMENTS

Set aside a percentage of non-paved open space for use by all residents.

PERCENTAGE OF OPEN SPACE SET ASIDE	NUMBER OF OPTIONAL POINTS
20%	2 points
30%	4 points
40% + submitted written statement of preservation/ conservation policy for set-aside land (for 15 years)	6 points

Green Roofs can be used in open space calculations if the square footage is accessible to all residents.

Land that is set aside for future development cannot be included as open space in these calculations.

RATIONALE

See Rationale for Criterion 2.6.

RECOMMENDATIONS

See Recommendations for Criterion 2.6.

RESOURCES

See Resources for Criterion 2.6.

2.8 Access to Public Transportation

Optional | 8 or 10 points

New Construction projects: see Instructions on page 38

REQUIREMENTS

Locate projects within a 0.5-mile walk distance of transit services (bus, rail and/or ferry) combined, constituting at least 60 or more transit rides per weekday, with some type of weekend ride option. *[8 points]*

For projects that qualify as Rural/Tribal/Small Town, locate the project within a 5-mile distance of the following transit options: 1) vehicle share program; 2) dial-a-ride program; 3) employer vanpool; 4) park-and-ride; or 5) public–private regional transportation. *[8 points]*

For an additional [2 points]: Locate the project along dedicated bike trails or lanes that lead to transit services or stations (bus, rail and ferry) within 3 miles.

RATIONALE

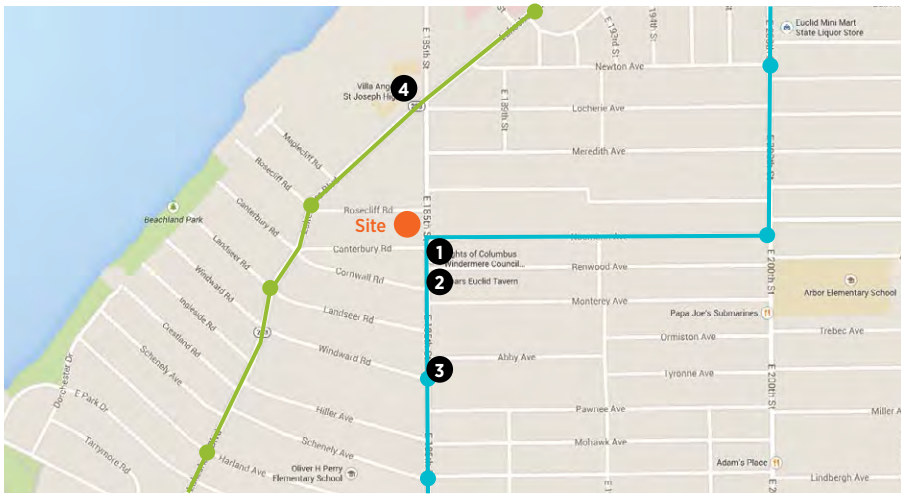
Projects located near transit reduce a resident's need to own a car, thereby eliminating or lowering the costs of auto ownership. Transit use reduces related emissions of air pollutants and carbon dioxide. In addition, locating near high-frequency transit typically allows project residents to access major employment centers, and can provide opportunities for increased physical activity through active transportation, improving health. Bicycle facilities can significantly increase the area served by public transit, as distances too long to walk are often easily accessible by bicycle.

RECOMMENDATIONS

- Use a context map to demonstrate that the center of the site is within the required walk distance of combined transit options that provide an adequate number of rides per weekday.
- Bike lanes are defined as a portion of the roadway that is designated by striping, signage and/or pavement markings for preferential or exclusive use by bicyclists.

RESOURCES

- To determine if your project qualifies as Rural/Tribal/Small Town, reference the Instructions at the beginning of Category 2: Location + Neighborhood Fabric. Google Maps offers a function to demonstrate walk distances and to identify bicycle trail and route maps. On Google Maps, go to "Get Directions" and select "Walking" or "Bicycling," as applicable, to obtain this information. *www.google.com/maps*
- Many cities and counties provide bicycle trail and route maps for free download through their websites.
- Consider using a technology like TransitScreen in your building's common space(s) to provide real-time transportation information to building residents and staff. *http:/transitscreen.com/*
- Reconnecting America: *www.reconnectingamerica.org*
- Victoria Transportation Policy Institute: This independent research organization provides consulting and publicly available research about solutions to emerging transportation issues, such as transportation demand management. *www.vtpi.org*
- Community Transportation Association of America, "Profiles of Innovative Rural Vanpool Programs": This resource describes several exceptional vanpool programs around the country. *web1.ctaa.org/webmodules/webarticles/articlefiles/Profiles_of_Innovative_Rural_Vanpool_Programs.pdf*
- National Association of City Transportation Officials, "Bike Lanes." *http://nacto.org/cities-for-cycling/design-guide/bike-lanes/*



ACCESS TO PUBLIC TRANSPORTATION

- Route 129—40 stops/weekday, 20 stops/weekend day: <0.1 mile from site
- Route 200—60 stops/weekday, 25 stops/weekend day: 0.3 mile from site

2.9 Improving Connectivity to the Community

Optional | 2–8 points

REQUIREMENTS

Improve access to community amenities through at least one of the measures below:

Improving Access

Transit

- Provide residents with discounted transportation passes for a period of at least 12-months. *[2 points]*
- Provide residents with free transportation passes for a period of at least 12-months. *[3 points]*

Auto

- Include car-share services (parking) on property. *[1 point]*
- Provide all eligible residents with discounted car-share memberships for a period of at least 12-months. *[2 points]*
- Provide a minimum of 50% of eligible residents with free car-share memberships for a period of at least 12-months. *[3 points]*

Incentivize Biking Mobility

- Provide outdoor bicycle racks that are accessible for visitors and residents. *[1 point]*
- Provide secure, lockable, sheltered and accessible bicycle storage. Provide one bicycle parking space for every two residential units. Post signage directing residents to bicycle parking areas and programs. *[2 points]*
- Provide bicycles and equipment (e.g., helmets, locks, tire pumps, maintenance equipment) for resident use. *[3 points]*
- Promote use of, and access to, one or more bicycle-share programs within 0.25-mile of the building. Bicycles need to be accessible to occupants at all hours. Maps to the nearest bike station should be posted in a visible location within a common area in the building and included in the Resident Manual (Criterion 8.3). *[1 point]*
- Provide residents with discounted bicycle-share memberships. for a period of at least 12-months *[2 points]*
- Provide residents with free bicycle-share memberships for a period of at least 12-months. *[3 points]*

RATIONALE

Connections to adjacent development and public, open spaces promote recreational walking, biking and other healthy lifestyle choices, as well as promoting alternative means of commuting.

RECOMMENDATIONS

- Pedestrian activity and improved safety should be encouraged when considering opportunities for biking, walking, driving and parking.
- Provide orientation materials and maps to the nearest bus, transit stations and car-share facilities (general orientation materials are acceptable for floating car-share services such as Car2go). Information about these amenities should be posted in a visible location in a common area in the building and included in the Resident Manual (Criteria 8.3).

- Consider including a small amount of credit ($10) for residents to try their local car-share service. Contact the car-share services to see if they would like to offer discount or credit to encourage use.
- Promote designs that encourage slow-speed, low-volume roadways, thereby enhancing walkers' and bikers' safety.
- For ease of use, bicycle storage is ideally incorporated on the ground floor with direct roll-in access that is separate and distinct from automobile access. Push-button doors make roll-in access even more convenient for riders, especially during inclement conditions.
- Provide bicycle storage for staff as well as residents.
- Consider designing the building exterior and massing to encourage physical activity by maximizing variety, detail and continuity on the lower one-to-two floors of the building exterior; by providing multiple entries and maximum transparency; and by incorporating canopies and awnings into building façade.
- Consider using porous pavement for sidewalks and other paved surfaces to reduce stormwater runoff and the distribution of pollutants to streams, rivers and water bodies. Design sidewalks to distribute stormwater to open space for recharge and to prevent flooding.
- Make bicycle and pedestrian routes to parks and public spaces safe and visible.
- Conduct an assessment to determine most likely routes of pedestrian and bicycle use when laying out paved pathways/sidewalks from the project to the surrounding neighborhood. Build the pathways/sidewalks where there is visible evidence of pedestrian and bicycle use.
- To encourage pedestrian activity, minimize addition of mid-block vehicular curb cuts on streets with heavy foot traffic; construct curb extensions along sections of the sidewalk that tend to attract greater pedestrian congestion and that are close to pedestrian crossings.
- Dedicated pedestrian and bicycle paths are important even on dead-end streets.
- Design vehicular driveways and ramps to improve pedestrian safety and encourage walkability.
- Incorporate street furniture such as benches, trash receptacles and bicycle racks to create an active streetscape.
- Install street features that have been shown to effectively calm traffic, including curb extensions, medians, roundabouts and raised speed reducers.

RESOURCES

- NYC Departments of City Planning, Health and Mental Hygiene, and Design and Construction. Active Design Supplement: Shaping the Sidewalk Experience, 2013. *www.nyc.gov/html/dcp/pdf/sidewalk_experience/active_design.pdf*
- Robert Wood Johnson Foundation, Active Living Research. *http://activelivingresearch.org/active-design-supplement-affordable-designs-affordable-housing*
- Task Force on Community Preventive Services, The Community Guide—What Works to Promote Health. *www.thecommunityguide.org/pa/environmental-policy/communitypolicies.html*
- Task Force on Community Preventive Services, The Community Guide—Street-Scale Urban Design Land Use Policies. *www.thecommunityguide.org/pa/environmental-policy/streetscale.html*

2.10 Passive Solar Heating/Cooling

Optional | 5 points maximum

REQUIREMENTS

Design and build project with passive solar design, orientation and shading that meets the following guidelines. Documentation must include sun angles and a wall section showing compliance with the project's Climate Zone (see 2012 IECC Climate Zone Map in the *Appendix*), and a site plan indicating true north. Also include documentation of compliance with all guidelines noted below.

PROJECT TYPE	POTENTIAL POINTS	REQUIREMENTS
New Construction: Stand-alone building	5	Meet all guidelines
New Construction: Projects with multiple buildings	2	25% of the homes meet all guidelines
	3	50% of the homes meet all guidelines
	4	75% of the homes meet all guidelines
	5	100% of the homes meet all guidelines
Rehabs: Moderate or Substantial	3	All new windows must comply with the windows guidelines by Climate Zone rehab projects (Guideline 3)
	2	All south-facing elevations must comply with shading guidelines (Guideline 4)

Guidelines

1. *Building orientation:* Elongate the building on an east–west axis with a minimum ratio of width to depth of 2:1 and orient the east–west axis of the building to be within 20 degrees of true east–west.
2. *Glazing:* Climate Zones 1–3: The glazing area on the north- and south-facing façades should be 50% greater than the sum of the glazing areas on the east- and west-facing walls; Climates Zones 4–7: The glazing area on the south-facing façade should be 30% greater than the sum of the glazing areas on the east-, west- and north-facing façades.
3. *Glazing type:* Provide windows with U-values and solar heat gain coefficients (SHGC) by orientation and Climate Zone that meet the requirements in the following table and map.
4. *Shading:* For south-facing windows, follow the shading requirements in the following table and the map in the *Appendix*.

Requirements for Glazing and Shading

To find your Climate Zone, see 2012 IECC Climate Zone Map in the *Appendix*. As of December 10, 2014, those requirements are as listed:

CLIMATE ZONE	U-FACTOR	MINIMUM SOLAR HEAT GAIN COEFFICIENT	PERCENTAGE OF WINDOW THAT NEEDS TO BE SHADED BY JUNE 21
1, 2	0.40	0.25	100%
3, 4 except Marine	0.30	0.27	75%
4 Marine, 5, 6, 7	0.27	Any	50%

Note: Projects must follow the most recent prescriptive path requirements (U-factor, SHGC) of the Department of Energy (DOE) Zero Energy Ready Home National Program at time of product specification.

RATIONALE

The use of passive solar energy through design minimizes reliance on mechanical heating, lowers the cooling load, and provides more residents with access to daylight. Passive solar heating and cooling-load-avoidance strategies become critically important during extended power outages or interruptions in heating fuel.

RECOMMENDATIONS

- Interior spaces requiring the most lighting, heating and cooling should be along the south face of the building.
- Include a narrow floor plate (less than 40 feet), single-loaded corridors and an open floor plan to optimize daylight and natural ventilation.
- Thermal Massing, Climate Zones 2–7
  - Locate a material with high thermal mass on the southern portion of the house where sunlight hits during the heating season.
  - Materials with thermal mass include brick, concrete, stone, water and any other material of a similar high density and specific heat capacity.
  - The thermal mass location must be shown in the schematic wall section of the southern façades.
- Additional potential passive cooling strategies
  - Plant deciduous shade trees at the south façades.
  - Maximize cross ventilation by installing operable windows at the leeward and windward sides of the building.
  - Install reflective roofing or coat existing roofs with reflective elastomeric coatings

RESOURCES

- U.S. Department of Energy, Building Technologies Office, Passive Solar Heating and Cooling. *http://energy.gov/energysaver/articles/tips-passive-solar-heating-and-cooling*
- U.S. Department of Energy, Building Technologies Office, Passive Solar Design Fact Sheet: A part of the department's "Building Toolbox," this site includes tips and techniques for passive solar heating, passive solar cooling, thermal storage and daylighting. *www.buildingscience.com/doctypes/enclosures-that-work/etw-building-profiles*
- 2012 IECC Climate Zones Map: A detailed map that shows Climate Zones zoomed into each state and county as well as the basic 2012 IECC Building Code requirements for each Climate Zone (see the *Appendix*).
- U.S. Department of Energy, National Renewable Energy Laboratory, "Passive Solar Design for the Home," Report #DOE/GO-102001-1105, February 2001. *www.nrel.gov/docs/fy01osti/27954.pdf*
- U.S. Department of Energy, Passive Solar Design. *http://energy.gov/energysaver/articles/passive-solar-home-design*
- U.S. Department of Energy, Cool Roof. *http://energy.gov/energysaver/articles/cool-roofs*
- *Passive Solar Architecture* by David Bainbridge and Ken Haggard, Chelsea Green Publishing, 2011.
- U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy: Zero Energy Ready Home National Program. *www.energy.gov/eere/buildings/zero-energy-ready-home*

2.11 Brownfield Site or Adaptive Reuse Building

Optional | 4 points

REQUIREMENTS

To receive credit for adaptive reuse building, rehabilitate an existing structure that was not previously used as housing.

To receive credit for brownfield site development, locate the project on a site for which part or all is documented as contaminated by means of an ASTM E1903-97 Phase II Environmental Site Assessment or a local Voluntary Cleanup Program, or on a site defined as a brownfield by a local, state or federal government agency. Remediate site contamination such that the controlling public authority approves the protective measures and/or cleanup as effective, safe and appropriate for the future use of the site.

RATIONALE

Use of brownfields reduces pressure on undeveloped land. Reuse of existing structures reduces the need for new materials.

RESOURCES

- U.S. Environmental Protection Agency, Brownfields and Land Revitalization: There is information on this site about EPA's Brownfields Program, including the brownfields law, EPA Brownfields Grants, technical tools and resources, and brownfield projects across the country. *www.epa.gov/brownfields/index.html*
- Municipal Research and Services Center of Washington, Infill Development Strategies for Shaping Livable Neighborhoods: This site contains an overview of strategies for encouraging and implementing infill development patterns. *www.mrsc.org/Publications/textfill.aspx*
- Center for Community Progress: This website provides information, resources, tools and assistance to support vacant property revitalization efforts. *www.communityprogress.net*

2.12 Access to Fresh, Local Foods

Optional | 6 points

REQUIREMENTS

Option 1: Neighborhood Farms and Gardens *[6 points]*

a) Dedicate permanent and viable growing space and/or related facilities (such as greenhouses) within the project equal or greater in size to 10 square feet per dwelling unit of the project. Provide solar access, fencing, watering systems, garden bed enhancements (such as raised beds), secure storage space for tools and pedestrian access for these spaces. Ensure that the spaces are owned and managed by an entity that includes occupants of the project in its decision-making, such as a community group, homeowners' association or public body.

   Established community gardens outside the project boundary but within a 0.5-mile walk distance of the project's geographic center can satisfy this option if the garden otherwise meets all of the option requirements. Ensure that the gardens are built and maintained in a manner to minimize pests and in keeping with Integrated Pest Management practices. *OR*

b) Dedicate permanent and viable growing space and/or related facilities (such as greenhouses) within the project equal or greater in size to 10 square feet per dwelling unit of the project, and establish an agreement with a local farming operation to farm the land. Ensure in the agreement that at least 50% of the produce is made available for purchase by the project's residents. Provide solar access, fencing, watering systems, garden bed enhancements (such as raised beds) and secure storage space for tools.

OR

Option 2: Community-Supported Agriculture *[6 points]*

Offer a specified location within the project boundaries for delivery of community-supported agriculture (CSA) program shares for residents, project staff and surrounding community members, as appropriate. The working lands supplying the CSA shares must be within 400 miles of the project site, or be within the same state. Shares must be delivered to the specified delivery point on a regular schedule at least twice a month for at least four months of the year.

OR

Option 3: Proximity to Farmers Market *[6 points]*

Locate the project's geographic center within a 0.5-mile walk distance of an existing or planned farmers market that is open or will operate at least once a week for at least five months of the year. Farmers market vendors may sell only items grown within 400 miles of the project site, or from within the same state. A planned farmers market must have firm commitments from farmers and vendors that the market will meet all of the above requirements and be in full operation by the time there is 50% occupancy of the project's dwelling units.

RATIONALE

Access to fresh produce offers healthy food options for residents, and purchase of fresh produce directly from farmers demystifies the cycle of food production. This measure also supports local economic development that increases the economic value and production of farmlands and community gardens. An ability to obtain local food offers important resilience benefits should major U.S. agricultural areas in the Midwest and California be threatened, for instance.

RECOMMENDATIONS

- For projects pursuing Option 1a, consider bringing in an individual or a group (e.g., a master gardener or a garden club) to work with the residents to establish the garden and maintain productivity.
- Encourage fresh food providers, including those who organize farmers markets and run food cooperatives (co-ops), to accept Electronic Benefit Transfer (EBT) and Supplemental Nutrition Assistance Program (SNAP).
- Incorporating cooking classes for residents into your resident engagement program (see Category 8: Operations, Maintenance + Resident Engagement) is an excellent way to incentivize residents to eat healthy and prepare meals with fresh foods.

RESOURCES

- Local Harvest: This website offers a search function to find farmers markets, family farms and other sources of local, sustainably grown food in a given area. *www.localharvest.org*
- U.S. Department of Agriculture, National Agricultural Library, Food and Nutrition Information Center, Community Food Systems: This website links to dozens of publications, programs and other sites. *http://fnic.nal.usda.gov/*
- U.S. Department of Agriculture, Agricultural Marketing Service, "Food Desert": The USDA, Treasury Department and HHS have defined a "food desert" as a census tract with a substantial share of residents who live in low-income areas that have low levels of access to a grocery store or healthy, affordable food retail outlet. Use this resource to determine if your project is located in a food desert. *http://apps.ams.usda.gov/fooddeserts/fooddeserts.aspx*
- Centers for Disease Control and Prevention (CDC), Community Food Assessment: The purpose of a community food assessment (CFA) is to determine the locations and incidence of food deserts—that is, areas with limited access to healthy and fresh food—and inform decision-makers of those areas that need intervention. *www.cdc.gov/healthyplaces/healthtopics/healthyfood/community_assessment.htm*
- Enterprise Community Partners, "Fresh, Local Food Access Toolkit": This toolkit, which is designed to provide step-by-step instructions and resources to implement a fresh food access model that meets the Enterprise Green Communities Access to Fresh, Local Food Criteria, best addresses the needs of your development, and leverages the assets of your organization and neighborhood. *www.enterprisecommunity.com/resources/ResourceDetails?ID=74962.pdf*

2.13 LEED for Neighborhood Development Certification

Optional | 4 points

REQUIREMENTS

Locate building(s) in a LEED for Neighborhood Development project. Demonstrate that the project has earned either Stage 2 Pre-Certified or Stage 3 Certified Neighborhood Development status through LEED for Neighborhood Development at the time of construction completion of your building(s).

RATIONALE

Projects located in LEED for Neighborhood Development Certified Developments have taken steps to minimize the environmental impact of land development practices. LEED for Neighborhood Development is designed to certify exemplary development projects that perform well in terms of smart growth, urbanism and green building.

RESOURCES

U.S. Green Building Council, LEED for Neighborhood Development: This page has links to the LEED-ND rating system, a project checklist and information on certification. *www.usgbc.org/leed#rating*

2.14 Local Economic Development and Community Wealth Creation

Optional | 6 points maximum

REQUIREMENTS

Option 1: Local Hiring Preference *[2 points]*

Demonstrate that local preference for construction employment and subcontractor hiring was part of your bidding process, and how it functioned during actual construction. Provide your local preference procurement and subcontractor set-aside.

Note: Indian Preference can be solely that, without a miles-to-project requirement.

OR

Option 2: Local Hiring *[3 points]*

Demonstrate that you achieved at least 20% local employment as a result of your local preference procurement/training plan. Provide proof that subcontractors are local and/or that local crews have members within 10 miles of your project site.

Note: Indian Preference can be solely that, without a miles-to-project requirement.

OR

Option 3: Physical Space for Business, Nonprofits, and/or Skill and Workforce Education *[3 points]*

Provide physical space for business, nonprofits, and/or skills and workforce education. Points can be achieved with documentation of compliance with *one* of the below:

- Providing space to conduct job skills training for building residents and community. This training could focus on a variety of topics, including but not limited to, computer training, resume building, financial skills training or other similar jobs skills training. If training is to be completed with internal staff, provide a 12-month training curriculum and outreach plan. If training is to be completed by a third-party provider, provide evidence of at least a two-year contract for these services. *OR*
- Providing reduced-cost space for educational institutions and/or public education, demonstrated through signed leases. *OR*
- Providing mixed-use space specifically to local/small businesses or nonprofits to accommodate economic development, demonstrated through signed leases. Local and small business must meet prevailing national definitions (i.e., no national chains, even if they are locally owned franchises or registered B Corporations). *OR*
- Asset Development: Providing on-site financial services and asset development to residents and community. This could be through annual tax assistance (e.g. EITC, free tax filing), savings programs (IDAs, financial literacy) or affordable lending (payday loan alternatives). A Community Development Financial Institution (CDFI) office or satellite in the facility would qualify for these points.

RATIONALE

Housing often has the opportunity to act as an economic catalyst within a neighborhood and community. Housing projects offer opportunities to directly enhance the lives of residents when they include physical space that can accommodate various programs for learning, job skill development and other social interactions. Numerous studies have documented the ways in which affordable housing projects have positive economic impacts on their surrounding neighborhoods.

RECOMMENDATIONS

- If providing physical space for business, nonprofits, and/or skill and workforce education, prioritize leasing to tenants that would bolster the building and become neighborhood assets. For instance, if your project has access to bike routes or trails, leasing space to a bicycle workshop or cooperative (co-op) would be one way to promote bicycle use and provide a valuable amenity to residents and the community at large. Innovative bike programming may teach people how to ride bicycles, mentor people through using bicycles safely for everyday needs (e.g., winter biking), let people check out bicycles, teach bicycle maintenance and more.
- Ideally these commercial or educational spaces would have doors or direct access to the pedestrian realm at grade; at the least, they should have visual connections to the public space.

RESOURCES

- Enterprise Community Partners, New Market Tax Credit: NMTC applications factor in number of jobs created, living-wage jobs during and after construction, and can serve as a valuable resource for understanding the impacts of local hiring. *www.enterprisecommunity.com/about-nmtc*
- National Cooperative Highway Research Program: More information on local (city, county) hiring preferences. *http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_LRD_59.pdf*
- Slow Money "Principles for local investment": *https://slowmoney.org/principles*
- 1% for the Planet: Connects businesses, consumers and nonprofits, empowering all of us to drive big, positive change. *http://onepercentfortheplanet.org/*

SITE IMPROVEMENTS

Low-impact design and development principles minimize the site's environmental footprint and lower infrastructure costs associated with stormwater management.

3.1 *Mandatory* Environmental Remediation

REQUIREMENTS

Determine whether there are any hazardous materials present on-site by conducting either 1) a Phase I Environmental Site Assessment, 2) a Tier II Environmental Review Assessment per HUD funding requirements, 3) an environmental site assessment approved by HUD through the Part 50 or Part 58 process, or 4) an environmental assessment approved by USDA through the 1940-G or 1794 process, and any additional required assessments.

If an environmental site assessment reveals any hazardous materials, mitigate these before proceeding with development.

RATIONALE

The environmental site assessment determines the potential environmental liabilities associated with property acquisition and ownership.

RESOURCES

- HUD, Environmental Review Procedures for Entities Assuming HUD Environmental Responsibilities (24 CFR Part 58 process): *www.hud.gov/offices/pih/ih/codetalk/onap/docs/24cfr58.pdf*
- HUD, Part 50 process: *www.hud.gov/offices/pih/ih/codetalk/docs/24cfr50.pdf*
- USDA, Environmental Review Process, 1794: *www.rurdev.usda.gov/uwp-ea.htm*
- USDA, Environmental Review Process, 1940-G: *www.rurdev.usda.gov/*

3.2 *Mandatory* Erosion and Sedimentation Control

Except for infill sites with buildable area smaller than one acre

REQUIREMENTS

Implement EPA's Best Management Practices for Construction Site Stormwater Runoff Control, or local requirements, whichever is more stringent.

RATIONALE

Erosion and sedimentation control during site development keeps valuable topsoil on-site and reduces pollution, limits stormwater runoff (especially during storm events), and limits sedimentation associated with construction activities from contaminating local waterways. Soils compacted from construction activities are less able to absorb water, resist plant root penetration and lack the porosity needed for adequate aeration.

RECOMMENDATIONS

Common erosion control measures include:

- Stockpile and protect disturbed topsoil from erosion for reuse.
- Control the path and velocity of runoff with silt fencing or comparable measures.

- Protect on-site storm sewer inlets, streams and lakes with straw bales, silt fencing, silt sacks, rock filters or comparable measures.
- Provide swales to divert surface water from hillsides.
- If soil in a sloped area is disturbed during construction, use tiers, erosion blankets (geotextile mats), compost blankets, filter socks and berms, or some comparable approach, to keep soil stabilized.
- Consider opting for one of the following methods—phasing, seeding, grading, protecting on-site vegetation, directing runoff to on-site depressions, or swales—instead of using silt fencing. Additionally, the measures that are employed should result in no visible off-site discharge.

RESOURCES

- U.S. Environmental Protection Agency, "Construction Site Stormwater Runoff Control." *http://water.epa.gov/polwaste/npdes/swbmp/*
- EnviroCert International, Inc.: Use the Certificant Search on this website to find erosion and sedimentation control professionals in your state. *www.cpesc.net*

3.3 *Mandatory* Low-Impact Development

Mandatory for projects located on greenfields

REQUIREMENTS

Projects located on greenfields must meet the following low-impact development criteria:

- Retain, infiltrate and/or harvest the first 1.0 inch of rain that falls on the entire site in a 24-hour period. (Option 1 of Criterion 3.6 Surface Stormwater Management).
- Design roadways to be along topographic contours and ridgelines so as to avoid erosion and unnecessary cut and fill.
- Design roadway plans to utilize the minimum necessary pavement required by code, such as narrower roads, minimized parking and thoughtful road layout. Consult with local fire department(s) regarding roadway sizing as needed.
- Design roadway sections with localized retention such as swales, retention basins, plantings and permeable paving to convey, capture, infiltrate and/or reuse stormwater. This can be accomplished in a manner that also complies with Option 2 of Criterion 3.6 Surface Stormwater Management.
- For projects located in Rural/Tribal/Small Towns as defined in Introduction of the Location + Neighborhood Fabric category, do not implement a curb and gutter system. Minimize sidewalks or pathways to one side of the road where people would naturally travel. Projects located in municipalities that require curb and gutter infrastructure for all developments are exempt from this sub-requirement.

RATIONALE

Low-impact design and development principles minimize the site's environmental footprint while helping to control and mitigate stormwater runoff during significant storm events.

RECOMMENDATIONS

- Keep existing trees and vegetation to the extent feasible.
- Best practices include a grade of one-half inch per foot, or approximately a 4% pitch. EPA recommends a 2% pitch (one-quarter inch per foot) for hard surfaces such as patio slabs, walks and driveways.

RESOURCES

- U.S. Environmental Protection Agency, Low-Impact Development: An Integrated Design Approach. *http://water.epa.gov/polwaste/green/upload/lidnatl.pdf*
- U.S. Environmental Protection Agency, Low-Impact Development. *http://water.epa.gov/polwaste/green*

3.4 *Mandatory* Landscaping

REQUIREMENTS

If providing plantings, all (trees, shrubs and groundcover, including grasses) should be native or adapted to the region. All new plants must be appropriate to the site's soil and microclimate, and none should be invasive species. All disturbed areas should be reseeded or xeriscaped.

RATIONALE

Native and adaptive plants are well suited to the climate and provide excellent erosion, sediment, dust and pollution control, and, when carefully sited, plantings can help to control unwanted solar gain (which can be critically important during times of power outages). Native and adaptive plants are more resistant to naturally occurring disease, insects, drought, low levels of nutrients and major storm events, while reducing or eliminating the need for fertilizers, pesticides, herbicides and irrigation.

RECOMMENDATIONS

- Consult a landscape architect or your local arborist in the integrative design process to identify appropriate areas for landscaping and shading.
- Consider "naturescaping," a landscaping strategy that conserves water and reduces runoff while providing habitat for beneficial insects, birds and other wildlife. In areas where water shortages are common, consider "xeriscaping," a landscaping strategy that uses drought-resistant plants to significantly reduce or eliminate the need for irrigation.
- Integrate the landscape plans with the stormwater management plan to provide water and drainage that is complementary with plantings.

- While turf may be appropriate for some landscaping, such as for play areas, it should be minimized wherever possible, except in climates where no irrigation is needed. Non-native turf needs about 35 inches of water per year to thrive, whereas native turf needs much less. Turf grass also requires mowing, and the cumulative effects of electric and gas mowing equipment contribute to the deterioration of local air quality.
- The project team should strive to use only organic and nontoxic fertilizers, pesticides, herbicides, fungicides and pre-emergents.
- Where possible, create at least one walking pathway and seating to encourage pedestrian activity.
- If possible, existing invasives should also be mitigated/removed. Local cooperative extensions often maintain best practices for mitigation.
- Provide visually appealing environments along paths of travel with visually interesting landscaping (e.g., a variety of colors, textures and flowering times).
- Ensure that the expected heights of plants adjacent to pedestrian walkways or seating areas are appropriate to maintain visibility into and out of the corridor in order to facilitate a safe and secure environment.
- If possible, limit turf or high-water-using species to 20% of the total landscape area, as suggested by the City of Santa Monica (Calif.) Landscape Standards.

RESOURCES

- Native Plant Information Network: This site, maintained by the Lady Bird Johnson Wildflower Center, includes a database of native wildflowers, plants and landscapes throughout North America. The website also includes a National Suppliers Directory. *www.wildflower.org/explore/*
- U.S. Environmental Protection Agency, GreenScapes: This "naturescaping" program provides cost-efficient and environmentally friendly solutions for landscaping. Designed to help preserve natural resources and prevent waste and pollution, GreenScapes encourages holistic decisions regarding waste generation and disposal and the associated impacts on land, water, air and energy use. *www.epa.gov/epawaste/conserve/tools/greenscapes/index.htm*
- University of Arizona Cooperative Extension, Xeriscape Plant Listing: *http://ag.arizona.edu/yavapai/anr/hort/xeriscape/*
- USDA National Invasive Species Information Center: As part of the USDA's National Agricultural Library, NISIC serves as a reference gateway to information, organizations and services about invasive species. *www.invasivespeciesinfo.gov/plants/main.shtml*
- USDA Agricultural Cooperative Extension System: Lists of local drought-tolerant plants may be available from local USDA Agricultural Cooperative Extension System offices, as well as through numerous online resources. *www.csrees.usda.gov/Extension/index.html*
- U.S. Forest Service, "Celebrating Wildflowers": This site has extensive information on native gardening, selecting appropriate native plants and invasive plant species, and has basic instructions for restoration and native landscaping projects. *www.fs.fed.us/wildflowers/Native_Plant_Materials/Native_Gardening/index.shtml*
- City of Santa Monica (Calif.) Office of Sustainability and the Environment, Landscape Standards Overview: *www.smgov.net/Departments/OSE/Categories/Landscape/Landscape_Standards_Overview.aspx*

3.5a

Mandatory

Efficient Irrigation and Water Reuse

If irrigation is utilized

REQUIREMENTS

If irrigation is utilized, install an efficient irrigation or water reuse system. These irrigation requirements are mandatory only for permanent landscaping that requires regular irrigation.

An efficient irrigation system must include the following at a minimum:

- a drip irrigation system for landscape planting beds
- separately zoned turf and bedding areas, based on watering needs of turf/plantings
- a timer/controller that activates the valves for each watering zone at the best time of day to minimize evaporative losses while maintaining healthy plants and obeying local regulations and water-use guidance
- a moisture sensor controller or rain delay controller

For all projects, watering tubes for trees are allowed for a period of two years.

RATIONALE

Accurate delivery of water reduces evaporation and eliminates overspray and overwatering. Proper scheduling eliminates fluctuations between wet and dry states that stress plants. These strategies will help to maintain plantings during drought and when outdoor watering restrictions may be in place.

RECOMMENDATIONS

- Follow the WaterSense Criteria for distribution uniformity (DU) of 65% or greater. DU shall be measured on the largest spray-irrigated area during a post-construction audit. This may include conventional rotors, multi-stream rotors or high-efficiency spray heads, but the DU of these spray systems must be verified by third-party tests.
- Consider "naturescaping," a landscaping strategy that conserves water and reduces runoff while providing habitat for beneficial insects, birds and other wildlife. In areas where water shortages are common, consider "xeriscaping," a landscaping strategy that uses drought-resistant plants to significantly reduce or eliminate the need for irrigation.

RESOURCES

- City of Santa Monica (Calif.) Office of Sustainability and the Environment, Landscape Standards Overview. *www.smgov.net/Departments/OSE/Categories/Landscape/Landscape_Standards_Overview.aspx*
- American Society of Landscape Architects (ASLA): ASLA is the national professional association representing landscape architects. Their site provides information about members, products, services, publications and events. *www.asla.org*
- U.S. Environmental Protection Agency, WaterSense: This site provides information on the EPA WaterSense labeling program for water-efficient landscape irrigation products, plus tips and recommendations for water-efficient irrigation. Follow the link to Weather- or Sensor-Based Irrigation Control Technologies for related information on high-efficiency irrigation controllers. *www.epa.gov/watersense/*

- U.S. Environmental Protection Agency, Water-Smart Landscapes: This manual provides information about reducing water consumption through creative landscaping techniques. *www.epa.gov/owm/water-efficiency/docs/water-efficient_landscaping_508.pdf*
- The Irrigation Association, Irrigation Audit Guidelines. *www.irrigation.org/Resources/Audit_Guidelines.aspx*
- American Water Works Association, WaterWiser®: The Water Efficiency Clearinghouse: This clearinghouse provides articles, reference materials and papers on all forms of water efficiency. *www.awwa.org/waterwiser/*
- U.S. Environmental Protection Agency, GreenScapes: This "naturescaping" program provides cost-efficient and environmentally friendly solutions for landscaping. Designed to help preserve natural resources and prevent waste and pollution, GreenScapes encourages holistic decisions regarding waste generation and disposal and the associated impacts on land, water, air and energy use. *www.epa.gov/epawaste/conserve/tools/greenscapes/index.htm*
- University of Arizona Cooperative Extension, Xeriscape Plant Listing. *http://ag.arizona.edu/yavapai/anr/hort/xeriscape/*

3.5b

Optional | 4 or 8 points

Efficient Irrigation and Water Reuse

If irrigation is utilized

REQUIREMENTS

Projects must meet the mandatory requirement of Criterion 3.5a Efficient Irrigation and Water Reuse, and:

Option 1 *[4 points]*

Design and install an efficient irrigation system equipped with a WaterSense-labeled weather-based irrigation controller (WBIC).

OR

Option 2 *[8 points]*

A minimum of 50% of the site's irrigation should reuse water from one of the following sources:

- treated greywater
- rainwater, collected from the roof or site
- water from a municipal recycled water system

For all projects, watering tubes for trees are allowed for a period of two years.

RATIONALE

See Rationale for Criterion 3.5a.

RECOMMENDATIONS

See Recommendations for Criterion 3.5a.

RESOURCES

See Resources for Criterion 3.5a.

3.6 Surface Stormwater Management

Optional | 4 or 8 points

REQUIREMENTS

Option 1 *[4 points]*

Retain, infiltrate and/or harvest the first 1.0 inch of rain that falls on the entire site in a 24-hour period.

Note: Option 1 is required for all projects built on greenfields, as noted in Criterion 3.3 Low-Impact Development.

OR

Option 2 *[8 points]*

Retain, infiltrate and/or harvest all stormwater, as calculated for a 24-hour period of a one-year storm event, on-site or on adjacent site(s), so that no stormwater is discharged to drains/inlets.

For either option, assure that the project plans and specifications call for permanent labeling of all storm drains or storm inlets to clearly indicate where the drain or inlet leads.

RATIONALE

Reducing or eliminating stormwater runoff through design and management techniques increases on-site filtration, reduces total suspended solids (TSS) and other pollutants from entering waterways, and reduces soil erosion. From a resiliency standpoint, minimizing stormwater runoff and storm sewer flows also helps reduce downstream flooding—an important concern with more intense storms predicted in the future. Water storage and nutrient collection processes reduce the need for irrigation and contribute to forming a healthier ecological community within the landscape.

RECOMMENDATIONS

- This criterion may be met by using a combination of multiple strategies and technologies, as long as there exists the capacity to retain the first 1.0 inch of rainfall that falls on the entire site. Stormwater management strategies could include disconnected downspouts (reducing the amount of water going into the local sewers), permeable paving, swales, retention basins, green roofs, sidewalk planters, xeriscaping and naturescaping. See Criteria 3.4–3.6 for synergistic measures.
- For Option 2, local resources can be used to determine the projected rainfall for a one-year storm event at the project site.
- If a rainwater harvesting and storage strategy is considered in addition to infiltration, check with state and local governments to verify that capture and/or reuse of rainwater is permitted. If not, consider appealing local rules.
- Attempt to make use of innovative, low-impact techniques such as disconnected downspouts, permeable paving, swales, retention basins, rain gardens, green roof, rain barrels and cisterns to convey, capture, infiltrate and/or reuse stormwater.
- Minimize impervious areas (surfaces that do not allow stormwater infiltration), including roofs, driveways, sidewalks and streets, or use porous materials for such areas. Water-permeable materials include pervious interlocking concrete paving blocks, concrete grid pavers, perforated brick pavers and compacted gravel.

- To provide a visual reminder that storm sewer inlets connect to area waterways and groundwater storages, use a plaque, tile, painted or pre-cast message such as "No Dumping. Drains to [name of water source]." If project is unable to label storm inlets due to jurisdictional constraints, the project team must provide documentation.
- Best practices include a grade of one-half inch per foot, or approximately a 4% pitch. EPA recommends a 2% pitch (one-quarter inch per foot) for hard surfaces such as patio slabs, walks and driveways.

RESOURCES

- U.S. Environmental Protection Agency, Storm Drain Marking. *http://water.epa.gov/polwaste/npdes/swbmp/Storm-Drain-Marking.cfm*
- U.S. Environmental Protection Agency, Low-Impact Development: An Integrated Design Approach. *http://water.epa.gov/polwaste/green/upload/lidnatl.pdf*
- U.S. Environmental Protection Agency, Low-Impact Development. *http://water.epa.gov/polwaste/green*
- U.S. Environmental Protection Agency, GreenScapes: This "naturescaping" program provides cost-efficient and environmentally friendly solutions for landscaping. Designed to help preserve natural resources and prevent waste and pollution, GreenScapes encourages holistic decisions regarding waste generation and disposal and the associated impacts on land, water, air and energy use. *www.epa.gov/epawaste/conserve/tools/greenscapes/index.htm*
- University of Arizona Cooperative Extension, Xeriscape Plant Listing. *http://ag.arizona.edu/ yavapai/anr/hort/xeriscape/*
- National Association of Home Builders Research Center ToolBase Services, Permeable Pavement: A resource provided through a partnership with the Department of Housing and Urban Development, the Partnership for Advancing Technology in Housing, and the National Association of Home Builders Research Center, this site provides details, lists of manufacturers, and related information on permeable paving options. *www.toolbase.org/Technology-Inventory/Sitework/permeable-pavement*
- TreePeople: TreePeople is an environmental nonprofit that unites the power of trees, people and nature-based solutions. *www.treepeople.org/*
- *Low Impact Development and Sustainable Stormwater Management*, by Thomas Cahill, John Wiley & Sons, 2012.
- *Porous Pavements: Integrative Studies in Water Management and Land Development*, by Bruce Ferguson, CRC Press, 2005.

3.7 *Optional | 1 point*
Reducing Heat-Island Effect: Paving

REQUIREMENTS
Use light-colored, high-albedo materials and/or an open-grid pavement, with a minimum solar reflectance of 0.3, over at least 50% of the site's hardscaped area.

RATIONALE
Urban heat islands increase local air temperatures due to the absorption of solar energy by the built environment. Reducing the heat-island effect decreases energy consumption by decreasing loads on cooling systems.

RECOMMENDATIONS
Consider using paving materials that both reduce urban heat-island effect and that are water permeable.

RESOURCES
- U.S. Environmental Protection Agency, Heat Island Effect: This site contains information about heat-island effect, its social and environmental costs, and strategies to minimize its prevalence, including shading and coloration of hardscapes. *www.epa.gov/heatisland*
- Lawrence Berkeley National Laboratory, Heat Island Group: The Lawrence Berkeley National Laboratory conducts research to find, analyze and implement solutions to minimizing heat-island effects. Its current efforts focus on the study and development of more reflective surfaces for roadways and buildings. *http://heatisland.lbl.gov/*

WATER CONSERVATION

Water conservation translates into direct utility savings for residents and building owners and conserves a precious national resource.

4.1 *Mandatory* Water-Conserving Fixtures

REQUIREMENTS

Install water-conserving fixtures in all units and any common facilities with the following specifications:

- *Toilets:* WaterSense-labeled and 1.28 gpf (gallons per flush) or less, including dual-flush toilets and pressure-assisted toilets
- *Urinals:* WaterSense-labeled and 0.5 gpf or less
- *Showerheads:* WaterSense-labeled and 2.0 gpm (gallons per minute) or less
- *Kitchen faucets:* 2.0 gpm or less (WaterSense label not available)
- *Lav faucets:* WaterSense-labeled and 1.5 gpm or less

AND

For all single-family homes and all dwelling units in buildings three stories or fewer:

The static service pressure must not exceed 60 pounds per square inch (psi) (414 kilopascal [kPa]). For units in multifamily buildings, the service pressure within each unit must not exceed 60 psi. Compliance for homes supplied by groundwater wells shall be achieved by use of a pressure tank. Compliance for single-family homes with publicly supplied water may be achieved by one of the following methods:

- Use of a pressure-regulating valve (PRV) downstream of the point of connection. All fixture connections shall be downstream of the PRV.
- Determination that the service pressure at the home is 60 psi or less at the time of inspection and documentation from the public water supplier that service pressure is unlikely to regularly exceed 60 psi at the home on a daily or seasonal basis.

Piping for fire sprinkler systems is excluded from this requirement and should comply with state and local codes and regulations.

RATIONALE

Water conservation translates into direct utility savings for residents and building owners, and lowers infrastructure costs associated with stormwater management and water treatment facilities. Reduced water pressure saves water, conserves energy and helps ensure proper operation of fixtures and appliances.

RECOMMENDATIONS

- Install WaterSense-labeled fixtures. The WaterSense specification sets maximum flow rates of the fixtures listed above. Labeled fixtures also meet key performance attributes to ensure optimal user satisfaction. Note that bathroom sink faucets intended for public use and residential kitchen sink faucets are currently not eligible to earn the WaterSense label.
- Certain existing fixtures, such as bathroom faucets, can be retrofitted with aerators rather than be replaced to reduce water flow to the requisite level. Note that WaterSense-labeled aerators are available and recommended.

- Dual-flush toilets have an average flow rate calculated and provided by the manufacturer. However, if you are not able to locate this information on the packaging, use a 2:1 ratio for low-volume flush to high-volume flush to determine the average flow rate.

  For example, with a dual-flush toilet that has a 0.8 low-volume flush and a 1.6 high-volume flush, the calculation to determine the average would be:

$$\frac{(0.8\,\text{gpf} \times 2) + (1.6\,\text{gpf} \times 1)}{3} = 1.067\,\text{gpf}$$

- For senior projects, consider using single-flush toilets that meet the criterion flow rates rather than dual-flush toilets. Feedback from past Enterprise Green Communities projects suggests that senior populations may be unsure of the dual-flush technology, which may lead to their having difficulty in operating the toilets in an effective and appropriate way.

RESOURCES

- Products and services that have earned the WaterSense label have been certified to be at least 20% more efficient than the baseline, without sacrificing performance. For instance, not all toilets—even high-efficiency toilets—operate equally well. Poor performance can lead to the need for multiple flushes, creating higher than anticipated water consumption. To correct for this, the EPA's WaterSense program certifies toilets that achieve water efficiency and operational effectiveness. Information on WaterSense products and services is available at *www.epa.gov/watersense*.
- Maximum Performance (MaP™) Testing, California Urban Water Conservation Council: The MaP™ testing project was initiated in 2003 to test toilet models' performance. This testing protocol simulates real-world use to help consumers identify high-efficiency toilets that not only save water but also work well. The current MaP testing report provides performance information on 470 toilet models. This site provides access to the complete listings of the tested toilets. *www.map-testing.com*
- WaterSense-labeled new homes are designed to reduce residential water use indoors and out. Find the EPA WaterSense Resource Manual for Building WaterSense® Labeled New Homes here: *www.epa.gov/watersense/docs/newhome_builder_resource_manual508.pdf*

4.2 Advanced Water Conservation

Optional | 6 points maximum

REQUIREMENTS

Reduce water consumption by one of the two following methods:

Option 1 *[3 points maximum]*

Install water-conserving fixtures in all units and all common space bathrooms with the following specifications:

- *Toilets:* WaterSense-labeled and 1.1 gpf (gallons per flush) or less *[1 point]*
- *Showerheads:* WaterSense-labeled and 1.5 gpm (gallons per minute) or less *[1 point]*
- *Kitchen faucets:* 1.5 gpm or less AND *Lav faucets:* WaterSense-labeled and 1.0 gpm or less *[1 point]*

OR

Option 2 *[6 points maximum]*

Reduce total indoor water consumption by at least 30% compared to the baseline indoor water consumption chart below through a combination of fixtures of your choosing.

Calculate and compare your project per-person per-day indoor water consumption to the baseline water consumption chart below [adapted from: LEED for Homes v4, Table 1: Indoor Water Baseline Consumption (per person per day)]. When making your comparison, assume that the baseline project has the same type of fixtures as your project in question. For instance, if your project does not include dishwashers, do not include dishwasher water consumption in your baseline project calculation for comparison.

PERCENTAGE OF REDUCTION IN TOTAL INDOOR WATER CONSUMPTION	NUMBER OF OPTIONAL POINTS
30%	4 points
50%	5 points
70%	6 points

BASELINE INDOOR WATER CONSUMPTION (PER PERSON PER DAY)

FIXTURE	BASELINE FLUSH OR FLOW RATE	ESTIMATED FIXTURE USAGE	ESTIMATED WATER USAGE
Shower (per compartment)	2.5 gpm	6.15 minutes	15.4 gallons
Lav, Kitchen faucet	2.2 gpm	5.0 minutes	11 gallons
Toilet	1.6 gpf	5.05 flushes	8 gallons
Clothes washer	8.4 WF* top loading and 4.7 WF front loading	0.37 cycles @ 3.5 ft^3	13.2 gallons top loading 7.4 gallons front loading
Dishwasher	5.0 gpc standard and 3.5 gpc small	0.1 cycles	0.5 gallons standard and 0.4 gallons small

*WF = Water Factor

RATIONALE

Water conservation translates into direct utility savings for residents and building owners, and lowers infrastructure costs associated with stormwater management and water treatment facilities.

RECOMMENDATIONS

- See Recommendations for Criterion 4.1: Water-Conserving Fixtures.
- Water consumption calculation for example project with 1.5 gpm showerheads, 1.0 gpm lav faucets, 1.5 gpm kitchen faucets, 1.1 gpf toilets, 8.4 WF clothes washers and no dishwashers:

  (1.5 gpm)(6.15 min.) + (1.0 gpm)(5.0 min) 2) + (1.5 gpm)(5.0 min) + (1.1 gpf) (5.05 flushes) + 13.2 gal = 40.475 gal

  compared to a baseline. Calculate a baseline by refering to the proper type of fixtures in the Baseline Indoor Water Consumption chart.

  15.4 gal + 11 gal + 11 gal + 8 gal + 13.2 gal = 58.6 gal

  The proposed project has reduced indoor water consumption per person by 31% compared to the baseline.

RESOURCES

See Resources for Criterion 4.1: Water-Conserving Fixtures.

4.3 *Optional | 4 points* Leaks and Water Metering

REQUIREMENTS

Conduct pressure-loss tests and visual inspections to determine if there are any leaks; fix any leaks found. Visual inspections should include checking for leaks at all accessible, visible water supply connections and valves for water-using fixtures, appliances and equipment.

AND

Meter or submeter each dwelling unit with a technology capable of tracking water use. Also separately meter outdoor water consumption.

For single-family buildings, install a whole-house water meter. Attached single-family homes that are pursuing Enterprise Green Communities Certification may share a whole-building water meter if their irrigation is also commonly metered. Homes that use only well water and are not connected to a municipal water system are exempt from this measure.

For multifamily projects, install a water meter or submeter for each of the project's dwelling units. Alternatively, for multifamily projects with riser-fed systems, install a water meter or submeter for each of the project's risers rather than for each of the project's dwelling units.

RATIONALE

In some cases, leaks may be the largest driver of project water consumption. Properly installed water-using fixtures, equipment and appliances should not leak.

Individual metering or submetering of each unit allows building managers and residents to understand and better manage their water use. Monitoring individual units also enables property managers to more easily identify and manage potential issues such as leaks that might be occurring within a specific unit.

RECOMMENDATIONS

- For single-family homes with only one water supply to the home, the inspector will attach a pressure gauge to an outside faucet, take a reading and then shut off the municipal water supply to the house. After several minutes, the inspector will determine if the pressure has dropped. A loss of pressure indicates an unseen leak. For homes with more than one water supply or without an outdoor faucet, inspectors will attach a pressure gauge to the cold water faucet for the washing machine hookup or other cold water faucet and take the pressure reading. Conducting a pressure-loss test on dwelling units in multifamily buildings will vary based on the plumbing system design. Dwelling units that are supplied through a single line with a shut-off can be tested at any point of use.
- As a first step, when designing the plumbing system for a multifamily building, consider supplying each unit with a single pipe source for the water to facilitate individual unit submetering. This will reduce costs associated with having to install multiple meters for several points of use attached to a single riser pipe.
- Second, choose equipment that is best suited for accurately measuring water use in each unit. Because water use within individual units will fluctuate between low and peak flows, depending on the unit's occupancy and the time of day, positive displacement meters are often the best option. Also, work with the meter manufacturer to select an appropriately sized submeter. It is critical to understand both the building's and the individual units' size, function, fixture types, usage occupancy and peak population in order to select an appropriately sized meter. These statistics determine the minimum and maximum flow rates and will assist in the selection of a properly sized water meter for each unit.
- Follow manufacturers' instructions closely so that proper installation can occur. Improper installation can lead to metering inaccuracies. In general, meters (including submeters for individual units) should be installed in an accessible location to allow for reading and repair. In addition, the meter location should be protected from potential damage. To ensure uniform flow entering and exiting the meter, the meter should be located where there is sufficient length of straight pipe above and below the meter. Also, install a strainer to prevent debris and sediment from entering the meter and causing reading inaccuracies.
- Several options exist for monitoring water use on a per-unit basis. Meters are typically owned by the water purveyor and represent separate accounts. In order to be separately metered, each unit must typically represent a wholly separate plumbing system attached to the main line. Submetering typically involves using smaller meters to monitor the different uses of water under a single account. Several alternative technologies are emerging that give property managers the ability to track water use on a per-unit basis without installing physical meters or submeters for each unit.

RESOURCES

- U.S. EPA conducted a study of multifamily housing that showed submetering reduced water use by 16.4%: *www.aquacraft.com/Projects/submeter.htm*
- American Water Works Association Offers information and articles on submetering: *www.awwa.org*
- California Apartment Association has articles on submetering: *www.caanet.org*
- California Urban Water Conservation Council has articles on submetering: *www.cuwcc.org*
- WaterSense-labeled New Homes: *www.epa.gov/watersense/new_homes/*
- Alliance for Water Efficiency, 2010, "Submetering Introduction." *www.allianceforwaterefficiency.org/submetering.aspx*
- "Water-Meter Selection and Sizing," Timothy A. Smith, April 22, 2008. *www.park-usa.com/skins/park/standard.aspx?elid=71&arl=108*

4.4 *Optional | 4 points*
Efficient Plumbing Layout and Design

REQUIREMENTS

To minimize water loss from delivering hot water, the hot water delivery system shall store no more than 0.5 gallons of water in any piping/manifold between the hot water source and any hot water fixture. To account for the additional water that must be removed from the system before hot water can be delivered, no more than 0.6 gallons of water shall be collected from the hot water fixture before hot water is delivered. Recirculation systems must be demand-initiated. Systems that are activated based solely on a time and/or temperature sensor do not meet this requirement.

RATIONALE

Efficiently designed hot water delivery systems reduce the amount of time it takes hot water to reach a fixture, saving both water and energy. Approximately 10–15% of the energy use associated with the hot water delivery system is wasted in distribution losses, and studies have shown that the average home wastes more than 3,650 gallons of water per year waiting for hot water to arrive at the point of use.

RECOMMENDATIONS

- Effective and efficient distribution of hot water requires a whole-system approach and can be challenging to many builders. Considering the hot water delivery system early in the design phase and carefully following a plumbing design can deliver superior homes and reduced installation costs.
- A hot water distribution system with less stored water in its piping will waste less water and energy. The length of piping between the water heater and each fixture, the pipe diameter and piping material can have a great cumulative impact on the efficiency of hot water delivery.

- Insulation of hot water pipes can improve the efficiency of a hot water distribution system. Insulation of hot water pipes reduces the rate of heat loss and can deliver water that is 2°F to 4°F hotter than uninsulated pipes can. Pipe sleeves made with polyethylene or neoprene foam with thicknesses of either ½ or ¾ inch are the most commonly used insulation. The pipe sleeve inside diameter should match the diameter of the pipe for a close fit. Securing insulation every one or two feet using tape, wire or cable tie will also help to fit insulation close to the pipe. Insulation should be used along the entire length of hot water pipes, including elbows and joints, but should be kept 6 inches away from the flue of gas water heaters. Insulation performs better with an R-value of R-3.0 or greater.
- Consider central core plumbing, and/or multiple stacked central core plumbing layout, locating the water heater very close to hot water fixtures.

RESOURCES

- EPA Hot Water Volume Tool: This editable tool allows project teams to design their plumbing system with a variety of materials to minimize waste in delivery. *http://epa.gov/watersense/excel/hw_volume_tool_v1.xlsm*
- EPA WaterSense-labeled New Homes—Hot Water Delivery Systems. *www.epa.gov/watersense/docs/newhome_builder_resource_manual508.pdf*
- EPA's Guide for Efficient Hot Water Delivery Systems. *www.epa.gov/watersense/docs/hw_distribution_guide.pdf*
- "Hot-Water Distribution Systems Part 1," *Plumbing Systems & Design*, Gary Klein, Mar/Apr 2004.

4.5 Water Reuse

Optional | 6 points maximum

REQUIREMENTS

Harvest, treat and reuse rainwater and/or greywater to meet a portion of the project's water needs.

To achieve optional points, provide the defined percentage of the project's total water needs through rainwater and/or greywater (using either one or a combination of both strategies). Total water needs include all exterior and interior water use.

TOTAL WATER NEEDS SUPPLIED BY RAINWATER AND/OR GREYWATER	NUMBER OF OPTIONAL POINTS
10%	3 points
20%	4 points
30%	5 points
40%	6 points

RATIONALE

Rainwater and greywater reuse strategies reduce the need for municipal water supplies and sewage treatment. This is also an important resilience strategy, as it offers some level of protection against drought or interruptions in water supply.

RECOMMENDATIONS

- Non-potable water recommended for residential application can be provided by harvested rainwater using rain barrels or cisterns or by obtaining reclaimed water from the municipality. Rainwater and reclaimed water do not meet potable water standards, and therefore have limited use applications. These water sources can supply water for non-spray irrigation and other outdoor water needs during periods of drought but are never suitable for human consumption. Proper signage should be displayed on the structure to caution users that the water source is non-potable.
- Rainwater can be harvested from impervious surfaces such as roofs and carried via gutters and downspouts to a storage tank or cistern where it can be treated or filtered for potable uses. Untreated rainwater may be used for non-potable uses.
- Greywater may be stored and treated for non-potable uses such as toilet flushing and irrigation.
- Rainwater and greywater systems are subject to state and local regulations and special requirements. In some jurisdictions, rainwater or greywater systems may not be allowed. Check with your local building code officials for requirements.
- Refer to Criterion 4.2 to calculate total project water consumption.
- Consider striving for rainwater and greywater utilization of at least 20%. In some cases, employing rainwater and greywater harvesting, treatment and reuse can provide for all of a project's water needs.

RESOURCES

- American Water Works Association, WaterWiser®: The Water Efficiency Clearinghouse: This clearinghouse provides articles, reference materials and papers on water recycling, greywater and rainwater reuse. *www.awwa.org/waterwiser/*
- International Living Building Institute, Achieving Water Independence in Buildings: This downloadable publication explains water reuse systems and regulatory barriers, and provides information for those wishing to explore the possibilities of water reuse in buildings and to reform limiting regulation. *ilbi.org/resources/reports/water/oregon*

4.6 *Optional | 8 points*
Access to Potable Water During Emergencies

REQUIREMENTS

Provide residents with access to potable water in the event of an emergency that disrupts normal access to potable water, including disruptions related to power outages that prevent pumping water to upper floors of multifamily buildings or pumping of water from on-site wells. Choose *one* of the following options:

Option 1

In high-rise buildings in which gravity-flow brings water to the building, but on-site electrical pumps are used to pump water to upper floors, provide residents with access to potable water at a location where containers can be filled and brought to apartments. Ensure that this access point is located above flood level and that it may be accessed safely and relatively easily in times of power loss (e.g., a public restroom on a lower floor).

OR

Option 2

Provide stored potable water that can be used during times of emergency totaling 10 gallons per resident per day for a minimum of two days. Note potability as well as storage size and weight considerations.

OR

Option 3

Provide a drilled well with a means for pumping water when the electric grid is down (e.g., hand pump, portable generator serving pump, gravity-flow spring).

RATIONALE

During power outages, access to water for drinking and sanitation needs is often one of the greatest challenges. During a power failure, residential buildings using electric pumps lose their supply of potable water.

RECOMMENDATIONS

- In many cities, gravity pressure typically brings water up to the fifth or sixth floor of taller buildings, with pumps used to deliver water to higher floors. If the power grid fails and backup generators are not connected to water pumps or if they fail, residents should have access to a place in a common room to fill containers with potable water. This could be a centrally accessible corridor or utility closet. Specifics will vary by project.
- In more rural areas that rely on on-site water rather than municipal water, advanced, modern hand pumps can provide a resilient water supply.
- Harvested rainwater or pumped water can be stored on top of buildings, in utility space in buildings or in separate water tanks.

RESOURCES

- NYC Building Resiliency Task Force Report. *http://urbangreencouncil.org/sites/default/files/2013_brtf_fullreport.pdf*
- Enterprise's Multifamily Resilience Manual includes more than a dozen strategies and specific guidance for building property resilience in the event of an emergency, including access to potable water. *www.enterprisecommunity.org/resources*

ENERGY EFFICIENCY

Improvements in building energy performance result in utility cost savings from more efficient heating, cooling, hot water, lights and appliances, which improves residents' comfort, lowers operating costs, and provides environmental benefit.

5.1a

Mandatory

Building Performance Standard

Criteria for NEW CONSTRUCTION of the following project types:

- Single-family detached and attached homes
- Multifamily buildings with four dwelling units or fewer
- Multifamily buildings with three stories or fewer
- Multifamily buildings with up to five stories, where each dwelling unit has its own heating, cooling and hot water system

REQUIREMENTS

Certify each dwelling unit in the project through the ENERGY STAR New Homes program. Use the appropriate specification version of ENERGY STAR New Homes depending on when the project is permitted, when construction will be completed and local ENERGY STAR guidelines. To determine the appropriate specification version for each project: *www.energystar.gov/homes*.

RATIONALE

ENERGY STAR Certified New Homes are independently verified to be energy-efficient and durable. These high-performance homes achieve energy savings in heating, cooling, hot water, lighting and appliance efficiencies, which improve resident comfort, reduce operating costs and decrease greenhouse gas emissions.

RECOMMENDATIONS

- Project teams must engage a certified Home Energy Rating System (HERS) rater to certify any dwelling unit to ENERGY STAR New Homes. We recommend that project teams engage a HERS rater as early in their project design stage as possible. Find a HERS rater here: *www.energystar.gov/partnerlocator*. For additional information: *www.resnet.us/choose-the-right-contractor*
- Review and follow the ENERGY STAR Certified New Homes partnership and training guidelines found at *www.energystar.gov/homes*
- During the design phase, work with the HERS rater to set energy-efficiency goals that comply with ENERGY STAR Certified New Homes. You may either follow a prescriptive path with a pre-determined set of construction details, or you may follow a performance path by creating your own package of compliant measures through modeling completed by the HERS rater. With both paths, you must also incorporate all measures from the Inspection Checklists. After the project team has decided on a compliant energy package, build these measures into the project plans and specs, and work with the HERS rater to create and implement a verification plan throughout construction. Once all measures are found to be compliant for a dwelling unit, the HERS rater will submit for you to receive an ENERGY STAR Certified New Home certificate for the dwelling unit.
- ENERGY STAR Certified New Homes offers a sampling protocol that allows a builder with a large volume of projects to qualify a group of dwelling units to meet ENERGY STAR guidelines based on pre-analysis of building plans and subsequent testing and inspections of a sample set of the dwelling units. For more information on these sampling protocols, see the adopted 2006 Enhancements to National Home Energy Ratings Standards: *www.resnet.us/standards/sampling_standard.pdf*

RESOURCES

- For more information regarding ENERGY STAR Certified New Homes: *www.energystar.gov/homes*
- To identify a Home Energy Rater in your area: *www.energystar.gov/partnerlocator*
- For more information on the sampling protocols: *www.resnet.us/standards/sampling_standard.pdf*

5.1b

Mandatory

Building Performance Standard

Criteria for NEW CONSTRUCTION of the following project types:

- Multifamily buildings with four or five stories wherein each dwelling unit does not have its own heating, cooling and hot water system
- Multifamily buildings with six or more stories

REQUIREMENTS

Option 1

Certify the project through the ENERGY STAR Multifamily High Rise program (MFHR).

OR

Option 2

First, follow either the ENERGY STAR MFHR prescriptive path design details or perform modeling per the ENERGY STAR MFHR performance path to demonstrate that the project will perform at least 15% better than the baseline code designated by the ENERGY STAR MFHR program. For projects in California, this baseline code is 2013 Title 24. For projects outside of California, this baseline code is ASHRAE 90.1 per Appendix G; refer to the latest ENERGY STAR MFHR guidance to determine which version of ASHRAE 90.1 is applicable for your project.

Second, for verification of the above measures, follow the LEED for Homes v4 EA Prerequisite: Minimum Energy Performance Midrise Prescriptive Commissioning Path.

RATIONALE

Buildings meeting the ENERGY STAR Multifamily High Rise program guidelines are designed to be energy-efficient and durable. These high-performance buildings achieve energy savings in heating, cooling, hot water, lighting and appliance efficiencies, which improve resident comfort, reduce operating costs and decrease greenhouse gas emissions.

RECOMMENDATIONS

- Projects participating in the ENERGY STAR MFHR program are designed to perform at least 15% better than ASHRAE 90.1-2007, or 15% better than ASHRAE 90.1-2010 in states that have adopted ASHRAE 90.1-2010/2012 IECC, or 15% better than 2013 Title 24 in California. All MFHR-certified projects must meet initial program requirements and be verified and field-tested according to the ENERGY STAR MFHR Testing and Verification Protocols.
- Review and follow the ENERGY STAR MFHR Certification Process and Training Resources found at *www.energystar.gov/mfhr* if certifying to that program.

- For MFHR certification, partner with ENERGY STAR (*www.energystar.gov/mfhr*) and work with a qualified Licensed Professional to meet program requirements. With the Licensed Professional, design the project to meet program requirements and submit a set of designs and a Project Application to EPA, then construct the project as designed, and test to ensure proper installation by following the ENERGY STAR MFHR Testing and Verification Protocols throughout construction. After the final inspection, the Licensed Professional will submit an As-Built Submittal to EPA. Once approved, EPA will notify the project team that the units in the building have earned the ENERGY STAR.
- If using the ENERGY STAR MFHR Performance Path, to calculate the energy performance target the project team must:
  - Identify a qualified professional who has experience with performing energy modeling per ASHRAE Standard 90.1, Appendix G. In the early design stage, the qualified professional should prepare the energy model and work with the integrative design team to identify cost-effective strategies for meeting the energy performance target.
  - Calculate the baseline building performance rating according to the EPA's Multifamily High Rise Simulation Guidelines building performance rating method, which is based on Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda).
- Appendix G of Standard 90.1 is the method for calculating the baseline and projected energy consumption of a building through the Performance Path. This method includes all energy costs associated with the building project.
  - The baseline building performance standard (5.1b) can only be met through building performance improvements, and not through the addition of electric-generating renewable energy systems. However, other "renewable" technologies, such as solar domestic hot water collectors and geothermal H/AC systems (ground source heat pumps), can be included.

Examples of software that meet ASHRAE 90.1 Appendix G requirements include:

- DOE2
- eQuest
- VisualDOE
- EZDOE
- TRACE
- HAP
- TRNSYS
- EnergyPlus

RESOURCES

- EPA's ENERGY STAR Multifamily High Rise program details, including the prescriptive and performance path guidelines and the testing and verification protocols. *www.energystar.gov/mfhr*
- LEED for Homes v4 EA Prerequisite: Minimum Energy Performance Midrise Prescriptive Commissioning Path. *www.usgbc.org/node/2611843?return=/credits*

5.1c

Mandatory

Building Performance Standard

Criteria for Moderate or Substantial REHABS of the following project types:

- Single-family detached and attached homes
- Multifamily buildings with four dwelling units or fewer
- Multifamily buildings with three stories or fewer
- Multifamily buildings with four or five stories, where each dwelling unit has its own heating, cooling and hot water system

REQUIREMENTS

For each dwelling unit in the project types identified above, achieve a HERS Index score of 85 or less.

The software used for the energy modeling during the design stage and to generate the HERS Index and certificate must be approved by either RESNET or, for projects in California, the California Energy Commission. Any method or strategy, except for electric-generating renewable energy systems, can be implemented to satisfy the targeted minimum energy performance.

Exception: Substantial rehabs of buildings with walls made only of brick/masonry that are three stories or fewer* and built before 1980, as well as moderate rehabs of buildings that are three stories or fewer* and built before 1980, are permitted to instead achieve a HERS Index score of 100 or less for each dwelling unit.

*or four or five stories, where each dwelling unit has its own heating, cooling and hot water system

RATIONALE

Dwelling units rehabilitated to a HERS Index score of 85 will achieve approximately 2009 IECC energy performance levels in heating, cooling, hot water, lighting and appliance efficiencies, which improve resident comfort, reduce operating costs and decrease greenhouse gas emissions. In California, the HERS Index is based on the Title 24 Building Energy Efficiency Standards.

Certain existing buildings undergoing rehabilitation are unable to achieve a HERS Index score of 85 without making drastic changes to the building envelope; these buildings will be permitted to achieve a HERS Index score of 100 (approximately 2006 IECC energy performance levels).

RECOMMENDATIONS

- To achieve a HERS Index score of no more than 85 (or, if applicable, 100) at project completion, we recommend that project teams engage a HERS rater as early in their project design stage as possible. Find a HERS rater here: *www.energystar.gov/partnerlocator*. For additional information: *www.resnet.us/choose-the-right-contractor*
- The HERS rater will be responsible for:
  - creating an energy model during the design stage of the project, with plans and specifications showing the building's projected energy performance
  - conducting a mid-construction pre-drywall thermal enclosure, using the ENERGY STAR version 3 "Thermal Enclosure System Rater Checklist"
  - verifying the final performance of the building with post-construction performance testing, including a blower door and duct blaster test of the home and/or units

RESOURCES

- To identify a Home Energy Rater in your area: *www.energystar.gov/partnerlocator*
- List of software approved by Residential Energy Services Network (RESNET) to generate HERS Index score: *www.resnet.us/professional/programs/energy_rating_software*
- Building Performance Institute, Inc. (BPI): Develops standards for energy-efficiency retrofit work, certifies professional workers, and accredits BPI GoldStar Contractors. *www.bpi.org*
- Residential Energy Services Network (RESNET): A resource where residents can learn about the energy audit and rating process. *www.resnet.us*
- Enterprise Green Communities Single-Family Rehabilitation Specifications: A set of green single-family specifications for insulation, air sealing and other details that can be customized to your project. *www.enterprisecommunity.org/resources*
- U.S. Department of Energy, Air Sealing, Technology Fact Sheet: This fact sheet describes the importance of sealing air leaks and providing controlled ventilation. *apps1.eere.energy.gov/buildings/publications/pdfs/building_america/26290.pdf*
- 2009 IECC Climate Zones Map: A detailed map that shows Climate Zones zoomed into each state and county as well as the basic 2009 IECC Building Code requirements for each Climate Zone. *energycode.pnl.gov/EnergyCodeReqs*
- ENERGY STAR Certified New Homes offers a sampling protocol that allows a builder with a large volume of projects to qualify a group of dwelling units to meet ENERGY STAR guidelines based on pre-analysis of building plans and subsequent testing and inspections of a sample set of the dwelling units. You may apply these protocols to generate the HERS Index score for each dwelling unit undergoing rehab. See the adopted 2006 Enhancements to National Home Energy Ratings Standards: *www.resnet.us/standards/sampling_standard.pdf* and RESNET Guidelines for Multifamily Energy Ratings: *www.resnet.us/professional/standards*

5.1d Building Performance Standard

Mandatory

Criteria for Moderate or Substantial REHABS of the following project types:

- Multifamily buildings with four or five stories wherein each dwelling unit does not have its own heating, cooling and hot water system
- Multifamily buildings with six or more stories

REQUIREMENTS

Demonstrate that the energy performance of the completed building will be equivalent to ASHRAE 90.1-2010 using an energy model created by a qualified energy services provider according to Appendix G.

This performance requirement shall only be met through building performance improvements, rather than through the addition of electric-generating renewable energy systems. Also, in order to ensure long-term optimal building performance and to better situate a building for withstanding power outages, prioritize envelope improvements over mechanicals and lighting.

Projects in California must use the version of Title 24 under which the project is permitted to calculate the targeted minimum energy performance.

RATIONALE

Buildings rehabilitated to ASHRAE 90.1-2010 energy performance levels achieve energy savings in heating, cooling, hot water, lighting and appliance efficiencies, which improve resident comfort, lower operating costs and decrease greenhouse gas emissions.

RECOMMENDATIONS

- To demonstrate energy performance equivalent to ASHRAE 90.1-2010, contract with an energy services provider. We would recommend that the energy services provider be responsible for:
  - creating an energy model during the design stage of the project, with plans and specifications showing the building's projected energy performance
  - conducting a mid-construction pre-drywall thermal enclosure inspection
  - verifying the final performance of the building with performance testing
- Follow all envelope code requirements of ASHRAE 90.1 2010; otherwise meet the minimum whole building energy performance target that was calculated by the model.
- Appendix G of Standard 90.1-2010 is the method for calculating the baseline and projected energy consumption. This method includes all energy costs associated with the building project.
  - The baseline building performance standard (5.1d) can only be met through building performance improvements, and not through the addition of electric-generating renewable energy systems. However, other "renewable" technologies such as solar domestic hot water collectors and geothermal H/AC systems (ground source heat pumps) can be included.

Examples of software that meet ASHRAE 90.1 Appendix G requirements include:

- DOE2
- eQuest
- VisualDOE
- EZDOE
- TRACE
- HAP
- TRNSYS
- EnergyPlus

RESOURCES

- For more information on ASHRAE 90.1-2010: *www.ashrae.org*
- Enterprise Green Communities Multifamily Rehabilitation Specifications: A set of model green building specifications for Multifamily Rehab projects that includes details on insulation, air sealing and performance testing that can be customized for your project. *www.greencommunitiesonline.org/resources*
- U.S. Department of Energy, Air Sealing, Technology Fact Sheet: This fact sheet describes the importance of sealing air leaks and providing controlled ventilation. *apps1.eere.energy.gov/buildings/publications/pdfs/building_america/26290.pdf*
- California Building Energy Efficiency Standards (Title 24) and compliance manuals: *www.energy.ca.gov/title24/index.html*

5.2a

Optional | 5–12 points

Additional Reductions in Energy Use

REQUIREMENTS

Design and construct a building that is projected to be at least 5% more efficient than what is required of the project by Criteria 5.1a–d:

New Construction, projects following performance path of Criterion 5.1a: 5 optional points for HERS Index score 5 lower than required; additional 1 optional point for each additional 1 point decrease in HERS Index score, up to maximum of 12 total optional points.

New Construction, projects following performance path of Criterion 5.1b: 5 optional points for 5% greater efficiency than required; additional 1 optional point for each additional 1% greater efficiency, up to maximum of 12 total optional points.

Substantial and Moderate Rehab, projects following Criterion 5.1c: 5 optional points for HERS Index score of 5 lower than required; additional 1 optional point for each additional 1 point decrease in HERS Index score, up to a maximum of 12 total optional points.

Substantial and Moderate Rehab, projects following Criterion 5.1d: 5 optional points for 5% greater efficiency than required; additional 1 optional point for each additional 1% great efficiency, up to maximum of 12 total optional points.

These additional reductions in energy use must be captured by energy conservation measures associated with improved building component systems and not through the addition of electric-generating renewable energy systems. See Criterion 5.7b for renewable energy points. Projects following the prescriptive path of Criteria 5.1a–5.1d are not eligible for these points. Projects acquiring points through Criterion 5.2b are not eligible for these points.

RATIONALE

Improvements in building energy performance result in utility cost savings from more efficient heating, cooling, hot water, lights and appliances, which improve residents' comfort, lower operating costs and decrease greenhouse gas emissions. From a resilience standpoint, a highly energy-conserving building envelope will help to ensure that habitable temperatures will be maintained in the event of extended loss of power or interruptions in heating fuel (passive survivability).

RECOMMENDATIONS

Using the baseline energy model created in Criteria 5.1a–5.1d, analyze, identify and adopt energy improvements to achieve additional energy reductions beyond the mandatory levels.

RESOURCES

The DOE Building Technologies Office offers free research publications, tools, webinars and newsletters on cost-effective, energy-efficient building strategies. *www1.eere.energy.gov/buildings/building_america/*

5.2b *Optional | 12 points*
Advanced Certification: Nearing Net Zero

REQUIREMENTS

Certify the project in a program that requires advanced levels of building envelope performance such as PHIUS, Living Building Challenge and/or DOE Zero Energy Ready Home.

Projects acquiring points through this criterion are not eligible for points through Criterion 5.2a.

RATIONALE

These complementary whole building certification programs emphasize strategies that aggressively reduce whole building energy loads, reducing the need to heat and cool, reducing utility bills, reducing associated greenhouse gas emissions, and increasing project capacity to sustain habitability during loss of power.

RECOMMENDATIONS

Each of these programs requires a significant commitment to ensure significant levels of project performance. Begin strategizing how to achieve your project goals through dual certification with these programs as early in the integrative design process as possible.

RESOURCES

- Passive House Institute US (PHIUS): PHIUS is committed to making high-performance passive building the mainstream market standard. A Passive House is a set of design principles and a quantifiable performance standard applied to any building project, producing radically less energy needs, unparalleled comfort and supreme air quality. *www.passivehouse.us* and *www.phaus.org*
- Living Building Challenge Net Zero Energy Building Certification: Net Zero Energy Building Certification is a program operated by the International Living Future Institute using the structure of the Living Building Challenge. Net Zero Energy Building Certification verifies that the building is truly operating as claimed, provides a platform for the building to inform other efforts throughout the world and accelerate the implementation of restorative principles, and celebrates a significant accomplishment and differentiates those responsible for the building's success in this quickly evolving market. *http://living-future.org/netzero*
- DOE Zero Energy Ready Home: The DOE Zero Energy Ready Home is a program that builds upon ENERGY STAR for Homes Version 3, along with proven Building America innovations and best practices. These homes are third-party verified, meet all DOE Zero Energy Ready Home National Program Requirements, and follow provisions from the Consolidated Renewable Energy Ready Home (RERH) checklist for climates with significant solar insulation. *http://energy.gov/eere/buildings/guidelines-participating-doe-zero-energy-ready-home*

5.3 *Mandatory*
Sizing of Heating and Cooling Equipment

REQUIREMENTS

Size and select heating and cooling equipment in accordance with the Air Conditioning Contractors of America (ACCA) Manuals J and S or ASHRAE handbooks.

Note that projects in compliance with Criterion 5.1a automatically meet this Criterion 5.3 by virtue of their ENERGY STAR New Homes certification requirements.

RATIONALE

Appropriately sized equipment can save money, ensure adequate dehumidification and prevent short-cycling that can lead to premature motor default.

RECOMMENDATIONS

- The HVAC contractor generates a Manual J load calculation to determine the heating and cooling loads of a particular project. A room-by-room Manual J is recommended, in order to properly determine room-by-room airflows best suited for the space's associated heating and cooling loads. A Manual S is used to determine which space heating and cooling equipment best match the load of the project calculated per Manual J. The Manual J accounts for factors such as the dwelling unit's solar orientation, window design and insulation R-value, installation quality, and building air leakage. Consult *www.acca.org/standards/software* for a list of software programs reviewed by ACCA to perform Manual J calculations.
- Consider locating heating and cooling equipment and the distribution system within the building envelope in order to reduce thermal distribution losses. Do not locate air handler or ductwork within the garage space (see Criterion 7.9 for more information).

RESOURCES

- Air Conditioning Contractors of America, Manuals J: Residential Load Calculation and Manual S: Residential Equipment Selection. *www.acca.org/standards/*
- Air Conditioning Contractors of America, "HVAC Quality Installation Specification: Residential and Commercial Heating, Ventilating, and Air Conditioning Applications": The site also includes links to various articles and other ANSI and ACCA standards. *www.acca.org/tech*
- California Energy Commission, Procedures for HVAC System Design and Installation: This site provides an overview of good practices for designing and installing the HVAC system, as well as detailed strategies and measures for the "house as a system" approach to construction. *www.energy.ca.gov/efficiency/qualityhomes/procedures.html*
- For additional information on duct sealing details: *www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_ducts*

5.4 *Mandatory* ENERGY STAR Appliances

If providing appliances

REQUIREMENTS

If providing appliances, install ENERGY STAR clothes washers, dishwashers and refrigerators. If appliances will not be installed or replaced at this time, specify that, at the time of installation or replacement, ENERGY STAR models must be used via Criterion 8.1 Building Operations & Maintenance (O&M) Manual and Plan and Criterion 8.4 Resident and Property Staff Orientation.

RATIONALE

ENERGY STAR products meet strict energy-efficiency criteria set by EPA. These products reduce utility costs and greenhouse gas emissions.

RECOMMENDATIONS

The specifications of the installed appliances should be reflected in the energy modeling building input data report.

RESOURCES

- For bulk orders of ENERGY STAR products, use the web-based purchasing tool "Quantity Quotes": This site connects purchasing groups with suppliers. *www.quantityquotes.net*
- When preparing project specifications, find ENERGY STAR product information, including model numbers and savings calculators: *www.energystar.gov/products/certified-products*

5.5 *Mandatory* Lighting

REQUIREMENTS

General

For all permanently installed lighting fixtures, install high-efficacy lighting (including compact fluorescent bulbs, LEDs, and T-8 or smaller diameter linear fluorescents) with an efficacy of at least 40 to 60 lumens per watt.

Recessed light fixtures (recessed cans): If recessed light fixtures are used anywhere in the project, install ballasted compact fluorescent fixtures or ENERGY STAR–qualified LED lamps. All recessed light fixtures must be Insulation Contact Air-Tight (ICAT) models.

Common Area Lighting

Non-apartment building spaces must use ballasted compact fluorescents and/or LED bulbs and be controlled by occupancy sensors or automatic bi-level lighting controls.

Emergency Lighting

Any new exit signs shall consume 5 watts or less. Fixtures located above stairwell doors and other forms of egress shall contain a battery backup feature. Photoluminescent exit signs may be used.

Exterior Lighting

100% of outdoor lighting must use fluorescent and/or LED bulbs, and lamps must be ENERGY STAR–certified when that certification is available for the product category.

All exterior lighting must be a Dark-Sky–approved "Friendly Fixture" and have motion sensor controls, integrative photovoltaic cells, photosensors or astronomic time-clock operation.

Note: Exterior emergency lighting and lighting required by code for health and safety purposes are exempt.

RATIONALE

Energy reductions through efficient lighting products contribute to lower utility costs and lower greenhouse gas emissions. Dedicated and screw-based CFLs and linear fluorescent lighting as well as LED lights are an energy-efficient alternative to standard incandescent and T-12 fluorescent lighting. Automatic lighting controls can significantly reduce lighting energy use. Battery backup in emergency lighting features allows for ease of egress during power blackouts.

RECOMMENDATIONS

- Consider incorporating daylighting practices throughout your project. Include controlled admission of natural light as well as a daylight-responsive lighting control system.
- Review ENERGY STAR product and design information regarding fixture and bulb selection and design.
- Incorporate stairwell skylights as a multi-purpose design feature, providing light, egress and ventilation.
- Install occupancy sensors in closets and rooms that will be occupied only intermittently. If installed in restrooms, position occupancy sensors to recognize the presence of someone in a toilet stall.
- Ensure that stairway lighting is consistent with or better than building corridor lighting to encourage use.
- Design outdoor lighting to eliminate light trespass from the project site and to minimize impact on nocturnal environments.
- Design outdoor lighting to meet IES guidelines (Lighting for Exterior Environments, IESNA publication, RP-33-1999).

RESOURCES

- For more information on lighting design and product selection: *www.energystar.gov/lighting*
- The Lighting Research Center: This university-based, independent lighting research and education group provides objective and timely information about lighting technologies and applications, and about human response to light. *www.lrc.rpi.edu/*
- Whole Building Design Guide, Daylighting: *www.wbdg.org/resources/daylighting.php*
- Lamp Recycle lists locations where fluorescent lamps and ballasts may be taken for recycling: *www.lamprecycle.org*
- Illuminating Engineering Society of North America's Recommended Practice Manual: Lighting for Exterior Environments includes lighting design guidelines.
- International Dark-Sky Association (IDA) is a recognized authority on light pollution. Information on Dark-Sky–approved fixtures can be found online at: *www.darksky.org/outdoorlighting*

5.6 Electricity Meter

Mandatory: New Construction and Substantial Rehab
Optional: Moderate Rehab | 6 points

Except for single-room occupancy and designated supportive housing dwelling units

REQUIREMENTS

Install individual or submetered electric meters for all dwelling units.

RATIONALE

Providing information to residents on the cost and usage associated with the electricity consumption in their unit may reduce energy use. Owners being cognizant of per dwelling unit energy consumption can use a proactive operations and maintenance approach, addressing outlier conditions in real-time.

RECOMMENDATIONS

Individual metering and/or submetering should be specified in the Integrative Design stage, tracked through O&M procedures, and shared with residents.

5.7a Photovoltaic/Solar Hot Water Ready

Optional | 4 points

REQUIREMENTS

Orient, design, engineer, wire and/or plumb the development to accommodate installation of photovoltaic (PV) or solar hot water system in the future.

Minimum required south-facing exposure:

- Single-Family and Low-Rise Buildings: 250 aggregated square feet for photovoltaic and 60 aggregated square feet for solar water heating of unobstructed roof area that is oriented within +/– 45 degrees of true south
- Mid- and High-Rise Multifamily Buildings: a minimum of 30% of aggregated unobstructed roof area that is oriented within +/– 45 degrees of true south

If projects plan to install this equipment on the roof, demonstrate that there are still 20 years of useful life in the roof.

RATIONALE

Designing for the future installation of photovoltaics or solar hot water systems allows a building owner the flexibility to transition to increased energy generation through renewable energy sources, as resources become available. Installation of renewable energy systems is a hedge against rising costs for purchased energy.

RECOMMENDATIONS

- At the least, consider designing stand-alone laundry buildings for multifamily properties as solar water heating ready.
- When designing a photovoltaic or solar hot water ready system, include the following in the project plans and specifications (as applicable to each technology):
  - Site map showing that the building(s) have a southern orientation and unobstructed access to sunlight
  - A design schematic of the future solar array, indicating the south face, slope and any rooftop equipment that could obstruct the array
  - The type of roof to be installed (e.g., asphalt, standing seam metal, tile)
  - The future location within the building for the inverter
- For solar hot water, run piping from the designed or current location of the water heater up to the prospective solar hot water collectors.
- Work with an engineer to calculate that the roof can carry the dead load of the solar equipment and withstand the wind loads.
- Determine if the roof has a warranty and if the placement of the solar equipment voids the warranty.
- General Contractor, PV and/or solar hot water contractor must document the information on the roof load, location of conduit and piping, and the potential location of the dash box. GC, PV and solar hot water contractor should provide documentation to building owner and manager.
- Design roof and pluming vents so be installed in a way that does not obstruct future renewable energy system installation.
- The first cost of PV can be high, but grants and subsidies are available in many states.

RESOURCES

- EPA Renewable Energy Ready Homes (RERH): The RERH Specifications were developed by the U.S. Environmental Protection Agency (EPA) to educate builders on how to assess and equip new homes with a set of features that make it easier and less expensive for homeowners to install solar energy systems after the home is constructed. *www.energystar.gov/index.cfm?c=rerh.rerh_index*
- National Renewable Energy Laboratory, "Solar Ready Buildings Planning Guide," NREL Technical Report (NREL/TP-7A2-46078): A paper published by NREL in December 2009 that details design guidelines and checklists for designing solar-ready buildings. *www.nrel.gov/docs/fy10osti/46078.pdf*
- Database of State Incentives for Renewables & Efficiency (DSIRE): DOE and the North Carolina Clean Energy Technology Center developed this database to collect information on state financial and regulatory incentives (e.g., tax credits, grants and special utility rates) designed to promote the application of renewable energy technologies. DSIRE also offers additional features, such as preparing and printing reports that detail the incentives on a state-by-state basis. *www.dsireusa.org*

5.7b *Optional | 10 points maximum*
Renewable Energy

REQUIREMENTS

Install photovoltaic (PV) panels or other electric-generating renewable energy source to provide a specified percentage of the project's estimated energy demand. Refer to the table below for the point structure.

	5%	10%	20%	30%	40%
Single-story / Single-family	—	—	6 points	8 points	10 points
2–3 stories	—	6 points	8 points	10 points	—
4 stories or more	6 points	8 points	10 points	—	—

When calculating points for Criterion 5.7b, you may evaluate either the percentage of your project's total energy demand that is satisfied by a renewable energy source or the percentage of your project's water heating energy demand that is satisfied by a renewable energy source. Demonstrate the energy demand in question with the energy model your project team created in compliance with Criterion 5.1. Projects using a prescriptive path for Criterion 5.1 compliance will not be able to obtain points under Criterion 5.7b.

Projects may acquire points through Criterion 5.7b or Criterion 5.8b, but not both.

RATIONALE

Renewable energy reduces environmental impacts such as greenhouse gas emissions that are associated with energy sourced and produced from fossil fuels. Use of on-site renewable energy technologies can also result in energy cost savings.

RECOMMENDATIONS

- To provide a higher percentage of the project's estimated annual energy consumption with electric-generating renewable energy sources, focus on reducing the building's overall energy consumption in Criteria 5.1 and 5.2 with energy-efficiency measures, which are generally more cost-effective and longer lasting than renewables.
- Consider installing solar water heating systems for stand-alone laundry facilities in multifamily projects.
- Evaluate and review your maintenance contract to ensure that it includes all renewable systems and appropriate reviews and protocols for their maintenance, as well as the associated implications of roof-mounted systems.

RESOURCES

- American Solar Energy Society (ASES): A nonprofit organization committed to a sustainable energy economy, ASES accelerates the development and use of solar and other renewable energy resources through advocacy, education, research and collaboration among professionals, policymakers and the public. *www.ases.org*

- Florida Solar Energy Center (FSEC): This is a resource for basic information on types of photovoltaic solar electric systems, sizing, installation and system ratings. FSEC also has an industry resources page that includes its Photovoltaic System Design Course Manual, available at *www.fsec.ucf.edu/en/education/cont_ed/manuals/orderform_pvmanual.htm*
- National Renewable Energy Laboratory (NREL): Photovoltaic research at NREL provides a clearinghouse on all aspects of photovoltaic solar cell systems. *www.nrel.gov/ncpv*
- U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy: This website provides information on renewable energy technologies and energy efficiency. *www.eere.energy.gov*
- DSIRE is the most comprehensive source of information on incentives and policies that support renewables and energy efficiency in the United States. Operated by the North Carolina Clean Energy Technology Center at North Carolina State University, with support from the Interstate Renewable Energy Council, Inc., DSIRE is funded by the U.S. Department of Energy. *www.dsireusa.org*

5.8a

Optional | 8 points

Resilient Energy Systems: Floodproofing

REQUIREMENTS

Conduct floodproofing, including perimeter floodproofing (barriers/shields), of lower floors.

Design and install building systems in such a way that, in the case of an emergency, the operation of these systems will not be grossly affected:

- Locate any and all central space and water heater equipment above design flood elevations.
- Locate the service disconnect at a readily accessible location above the design flood elevation.
- Locate at least one exit door above the design flood elevation.
- On plan sets, identify water entry points at basements and foundation walls and demarcate all penetrations, wall assemblies and doors/openings to ensure that future renovations do not compromise the integrity of floodproof construction.

RATIONALE

When raising services, equipment and building portions above design flood level is not possible, dry floodproof ("bunkerize") such services and spaces in order to better ensure building service in the case of a major flood event. The first and lower floors of buildings are often at risk because they are below flood level. Any essential building equipment should be located elsewhere, if flooding is a risk. Submersion of electrical utility services to the first point of switch disconnect is a safety concern and can lead to excessive or irreparable damage to both utility and building systems and increase the recovery time for such systems.

RECOMMENDATIONS

- Project teams should, in accordance with Criterion 1.3, identify whether or not floods are of concern for the project in question. If not, it may be wise to choose different optional criteria instead of this one.

- Project teams will need to identify suitable space, with accessible entry, for locating this equipment above design flood elevation.
- See ASCE 24-05 Flood Resistant Design and Construction for further guidance regarding design and placement of building services.

RESOURCES

- Building Resiliency Task Force Full Report, June 2013, Urban Green. *http://issuu.com/urbangreen/docs/brtf_full_report#/freeSignupNamePassword*
- ASCE 24-05 Flood Resistant Design and Construction (2010). *www.fema.gov/media-library/assets/documents/14983?id=3515*
- Flood-Fight Handbook: Preparing for a Flood, 2009 Edition. U.S. Army Corp of Engineers, St. Paul District. *www.wsask.ca/Global/Lakes%20and%20Rivers/Flood%20Watch/Flood%20Fight%20Handbook.pdf*
- Enterprise's Multifamily Resilience Manual includes more than a dozen strategies and specific guidance for building property resilience in the event of an emergency, including floodproofing strategies. *www.enterprisecommunity.org/resources*

5.8b

Optional | 4, 6 or 8 points

Resilient Energy Systems: Islandable Power

REQUIREMENTS

Provide emergency power through an islandable photovoltaic (PV) system or an efficient and portable generator that will offer at least limited electricity for critical circuits during power outages. Size this system to satisfy the common space energy loads of the project.

Option 1 *[8 points]*

With PV systems, install inverters that provide limited access to solar-generated power during outages when the sun is shining.

OR

Option 2 *[6 points]*

Provide a PV system with battery storage and a system to switch to battery backup when the electric grid goes down.

OR

Option 3 *[4 points]*

Allow for the connection of an efficient portable generator to provide reliable power to critical systems in the case of an emergency power outage.

Projects may acquire points through Criterion 5.7b or Criterion 5.8b, but not both.

RATIONALE

With more intense storms, flooding, wildfires and heat waves forecast with climate change, the frequency and duration of power outages may increase. So-called "islandable" electrical systems offer a significant level of resilience in such situations for supplying power to critical building systems.

RECOMMENDATIONS

- Prioritize which electrical equipment will run on backup power so buildings can remain habitable during extended blackouts. Because cogeneration and solar power systems are always in use, they can be more reliable than generators that are turned on only during emergencies. In substantial rehab projects where the installation of a PV system is not feasible, a generator may be used as a backup power source.
- Prioritize emergency systems such as egress lighting, extended life safety systems (fire alarms), water, parking egress, improved habitability for mobility-impaired occupants (elevator car operation), small critical heating and cooling loads, and convenience power for building occupants (charging stations).
- At least one inverter manufacturer was producing a solar inverter in 2014 that allows access to solar-generated electricity when the utility grid is down and the sun is out, and other manufacturers will likely follow suit. Most grid-connected inverters do not function at all when the grid is down.
- A bi-modal solar system that can both feed power into the electric grid (net-metering) and shunt power to and from a battery bank offers great flexibility and resilience (including power at night during power outages).
- Where a permanent connection is being made for a portable generator, a disconnecting means and overcurrent protection should be provided at the point of connection. For a temporary generator hookup, the project should provide easy access to an electrical connection point. Connections shall be administered by qualified people who maintain and supervise the installation.

RESOURCES

- Enterprise Community Partners, Multifamily Resilience Manual includes more than a dozen strategies and specific guidance for building property resilience in the event of an emergency, including backup power strategies. *www.enterprisecommunity.org/resources*
- Database of State Incentives for Renewables & Efficiency (DSIRE): DOE and the North Carolina Clean Energy Technology Center developed this database to collect information on state financial and regulatory incentives (e.g., tax credits, grants and special utility rates) designed to promote the application of renewable energy technologies. DSIRE also offers additional features, such as preparing and printing reports that detail the incentives on a state-by-state basis. *www.dsireusa.org*
- Urban Green, Building Resiliency Task Force Full Report, Backup Power Chapter; June 2013. *http://issuu.com/urbangreen/docs/brtf_full_report#/freeSignupNamePassword*

MATERIALS

Purchasing green materials and recycling and reusing materials whenever possible can improve conditions for resident health, enhance project durability, and reduce waste and disposal costs.

6.1 *Mandatory*
Low / No VOC Paints, Coatings and Primers

REQUIREMENTS

All interior paints and primers must have volatile organic compound (VOC) levels, in grams per liter, less than or equal to the thresholds established by South Coast Air Quality Management District (SCAQMD) Rule 1113. Projects must follow the most recent revision available at time of product specification. For the latest rules: *www.aqmd.gov/home/regulations/rules*.

As of July 1, 2013, SCAQMD Rule 1113 thresholds are listed as:

PAINT TYPE	MAXIMUM VOC LIMIT
Primers and sealers	100 g/L
Coatings, flats and non-flats	50 g/L
Opaque floor coatings	50 g/L
Rust preventative coatings	100 g/L
Clear wood finishes	275 g/L

RATIONALE

Interior paints, coatings and primers may release VOCs, particularly when newly applied. Exposure to individual VOCs and mixtures of VOCs can cause or aggravate health conditions, including allergies, asthma and irritation of the eyes, nose and airways; however, no health-based standards for indoor non-occupational exposure have been set.

RECOMMENDATIONS

Avoid epoxy-based paints, even those that comply with VOC standards, as these contain the chemical Bisphenol A, which was identified by the EPA on March 29, 2010, as a "chemical of concern." *www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html*.

Products do not have to be certified by the Materials Performance Institute (MPI) or Green Seal to comply with this criterion, but they may be helpful in locating products that do not exceed the maximum VOC levels.

RESOURCES

- The Master Painters Institute (MPI) Green Performance Standard for Paints & Coatings GPS-2-08 list of products: *www.specifygreen.com/APL/Introduction.html*
- Green Seal: Provides information on environmentally preferable products and services. *www.greenseal.org/Home.aspx*

6.2 *Mandatory* Low / No VOC Adhesives and Sealants

REQUIREMENTS

All adhesives and sealants (including caulks) must have volatile organic compound (VOC) levels, in grams per liter, less than or equal to the thresholds established by the South Coast Air Quality Management District (SCAQMD) Rule 1168. Projects must follow the most recent revision available at time of product specification. For the latest rules: *www.aqmd.gov/home/regulations/rules*.

As of January 7, 2005, SCAQMD Rule 1168 thresholds are listed as:

VOC LIMIT PRODUCT TYPE	(G / L)
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single-ply roof membrane adhesives	250
Structural wood member adhesive	140
Architectural sealants, including caulk	250

RATIONALE

Interior adhesives and sealants may release VOCs, particularly when wet. Exposure to individual VOCs and mixtures of VOCs can cause or aggravate health conditions, including allergies, asthma and irritation of the eyes, nose and airways; however, no health-based standards for indoor non-occupational exposure have been set.

RECOMMENDATIONS

- Many construction adhesives are not capable of adhering at temperatures below 40°F. Projects located in cold climates only (Climate Zones 6 and 7, based on IECC 2012) may be exempted from the required low-VOC adhesives and sealants if they prove problematic due to this reason. In this instance, please identify in the project submittal documents if other adhesives and/or sealants were needed and at what stage of construction the project team was unable to use required low-VOC products.

- Avoid epoxy-based caulks and epoxy-based sealants, as these contain Bisphenol A, which was listed on March 29, 2010, by the EPA as a "chemical of concern." *www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html*

RESOURCES

- U.S. Department of Energy, National Renewable Energy Laboratory, "Weatherize Your Home — Caulk and Weather Strip": *www.nrel.gov/docs/fy01osti/28039.pdf*
- 2012 IECC Climate Zones Map: A detailed map that shows Climate Zones zoomed into each state and county as well as the basic 2012 IECC Building Code requirements for each Climate Zone (see the *Appendix*).

6.3 *Optional | 3 points maximum*
Recycled Content Material

REQUIREMENTS

Use building materials that feature recycled content.

The building material must make up 75% (by weight or cost) of a project component, and must be composed of at least 25% post-consumer recycled content or at least 50% post-industrial recycled content to achieve *1 point*.

The following table provides a sample of project components and example building materials that a team can incorporate for optional points. Each building material that meets the requirements of this criterion is worth *1 point*.

PROJECT COMPONENT	BUILDING MATERIAL (EXAMPLES)
Framing	Wood, concrete, steel, aluminum
Siding or masonry	Wood, metal, masonry
Flooring (non-structural)	Linoleum, cork, bamboo, reclaimed wood, sealed concrete, carpet
Paving	Cement slab (Urbanite)
Roofing	Wood shingles, asphalt shingles, tile, metal
Insulation	Fiberglass batt, cellulose, rigid panel
Sheathing	Plywood, OSB

Note: The list above is a partial list and does not include all possible building materials; mechanical, electrical and plumbing components cannot be included in this calculation.

RATIONALE

Use of building materials with recycled content reduces the negative environmental impact resulting from extraction and processing of virgin materials.

RECOMMENDATIONS

Consider the incorporation of recycled-content building materials from the early stages of project design.

RESOURCES

- Federal Trade Commission, "Guides for the Use of Environmental Marketing Claims," 16 CFR 260: Many commonly used products, such as metals, concrete, masonry, acoustic tile, drywall, carpet, ceramic tile and insulation, are now available with recycled content. *www.ftc.gov/enforcement/rules/rulemaking-regulatory-reform-proceedings/guides-use-environmental-marketing-claims*
- GreenSpec Directory, Building Green: The online GreenSpec Directory lists product descriptions for more than 2,000 environmentally preferable products. *http://greenspec.buildinggreen.com/*
- Pharos Project, Healthy Building Network: The Pharos Project provides health and environmental data about the manufacture, use and end of life of building materials specified in a web-based tool. *www.pharosproject.net*

6.4 *Optional | 4 points maximum*
Regional Materials

REQUIREMENTS

Use products that were extracted, processed and manufactured within 500 miles of the project for a minimum of 50%, based on cost, of the building materials' value.

Building material types that can qualify for these points include the following (each material can qualify for *1 point*):

- Framing materials
- Exterior materials (e.g., siding, masonry, roofing)
- Flooring materials
- Concrete / cement and aggregate material
- Drywall / interior sheathing materials

Note: Mechanical, electrical and plumbing components cannot be included in this calculation.

RATIONALE

Building materials that are extracted, processed and manufactured locally to the project site minimize the energy embedded in their transportation and contribute to the local economy.

RECOMMENDATIONS

Natural building materials that are approved by HUD or USDA can qualify for points under this measure.

RESOURCES

- GreenSpec Directory, Building Green: The online GreenSpec Directory lists product descriptions for more than 2,000 environmentally preferable products. *http://greenspec.buildinggreen.com/*
- Pharos Project, Healthy Building Network: The Pharos Project provides health and environmental data about the manufacture, use and end of life of building materials specified in a web-based tool. *www.pharosproject.net*

6.5 Certified, Salvaged and Engineered Wood Products

Optional | 1 point

REQUIREMENTS

For at least 25% of all structural wood products, by cost or value, commit to using either:

- Structural wood products certified in accordance with the Forest Stewardship Council
- Salvaged wood products
- Engineered framing materials (note that these may not include urea formaldehyde–based binders (see Criterion 6.2)

$$\frac{\text{Sum of the value of all structural wood products that are certified, salvaged or engineered wood}}{\text{The value of all structural wood products}} = \text{Percentage of total wood products that meet this criterion}$$

RATIONALE

Less than 10% of the old growth forest remains in the United States. The use of salvaged wood and engineered wood products throughout your building for major structural components reduces the need to use old-growth lumber. Forest Stewardship Council–certified wood encourages forestry practices that are environmentally responsible.

RESOURCES

- For help in locating FSC-certified products, fill out the form found at *https://us.fsc.org*. FSC will circulate it to certified companies, and these companies will contact you if they have the desired product(s) available.
- Building Materials Reuse Association: *www.bmra.org*
- Rainforest Alliance, "SmartGuide to Green Building Wood Sources": This site lists U.S. suppliers, manufacturers and distributors of FSC-certified building products. *www.rainforestalliance.org/smartguides*

6.6 Composite Wood Products that Emit Low/No Formaldehyde

Mandatory

REQUIREMENTS

All composite wood products (plywood, OSB, MDF, cabinetry, etc.) must be certified as compliant with California 93120 Phase 2. Or, if using a composite wood product that does not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with low-VOC sealants, per Criterion 6.2.

RATIONALE

Composite wood products using formaldehyde-based binders will emit formaldehyde, which is a volatile organic compound. Symptoms of exposure vary widely and include a host of bodily reactions, including eye, nose and throat irritation, and difficulty breathing. Avoiding products that emit formaldehyde will reduce the quantity of harmful indoor air contaminants.

RECOMMENDATIONS

- Make this requirement part of the specifications for subcontractor submittals. Obtain the manufacturer's specifications to determine whether materials meet this requirement. Seek composite wood products compliant with California 93120 Phase 2. California 93120 is a regulation issued by the California Air Resources Board (CARB) limiting allowable formaldehyde emissions from composite wood products.
- Seek composite wood products with no added formaldehyde-based compounds in the contents. Seek composite wood products with CARB No Added Formaldehyde (NAF) certification.
- If feasible, specify formaldehyde-free hardwood, plywood, particleboard or medium-density fiberboard.

RESOURCES

- In July 2010, the U.S. Congress passed Public Law No: 111–199, the S. 1660: Formaldehyde Standards for Composite Wood Products Act, which updates the Toxic Substances Control Act of 1976 to align with the recent California legislation 93120. More information on Public Law No: 111–199 S.1660 can be found online at *www.govtrack.us/congress/bill.xpd?bill=s111-1660*. A summary of the Toxic Substances Control Act of 1976 can be found online at the EPA's website at *www.epa.gov/lawsregs/laws/tsca.html*.
- The California EPA Air Resources Board, FAQ on Composite Wood Products. *www.arb.ca.gov/toxics/compwood/consumer_faq.pdf*
- The California EPA Air Resources Board approved an Airborne Toxic Control Measure in April 2007 to reduce formaldehyde emissions from composite wood products, including hardwood plywood, medium-density fiberboard and particleboard (Title 17, California Code of Regulations 93120-93120.12, or California 93120). More information can be found at: *www.arb.ca.gov/toxics/atcm/atcm.htm*
- Scientific Certification Systems (SCS): Offers an SCS Indoor Air Advantage + Formaldehyde Free Certification for composite wood products. *www.scscertified.com/products/index.php*

6.7a *Mandatory* Environmentally Preferable Flooring

REQUIREMENTS

Prohibited Locations

Do not install carpets in building entryways, laundry rooms, bathrooms, kitchens/kitchenettes, utility rooms or any rooms with floors that are in direct contact with the foundation slabs.

Products

Any hard surface flooring products must be either ceramic tile or solid unfinished hardwood floors, or must meet the Scientific Certification System's FloorScore program criteria (including pre-finished hardwood flooring).

All carpet products must meet the Carpet and Rug Institute's Green Label or Green Label Plus certification for carpet, pad and carpet adhesives.

RATIONALE

New carpets, padding and adhesives also release VOCs that may pose health hazards to residents and workers. In addition, carpets trap dust and other allergens. Carpets have a short lifespan (studies suggest 3–5 years), and thus may need frequent replacement. More durable flooring options that last longer and wear better than carpet promote resource conservation through their longevity.

RECOMMENDATIONS

- The use of reclaimed flooring is encouraged, and such flooring need not meet the FloorScore certification. Reclaimed wood flooring should be free of lead-based paint, and tiles should be free of asbestos.
- Throughout the home, consider non-carpet flooring alternatives such as natural linoleum, Forest Stewardship Council (FSC)–certified or salvaged hardwoods, cork, bamboo, ceramic or stone tile, or sealed concrete.
- Make this requirement part of the specifications for subcontractor submittals.

RESOURCES

- The SCS FloorScore program website includes information about the program, as well as a list of certified products that is updated regularly. *www.scscertified.com/iaq/floorscore.html* and *www.rfci.com*.
- The Carpet and Rug Institute maintains a list of manufacturers and products meeting the Green Label Plus standard. *www.carpet-rug.org/CRI-Testing-Programs/Green-Label-Plus.aspx*
- For online comparison of flooring alternatives, see the Healthy Building Network's Pharos Project. *www.pharosproject.net*

6.7b

Optional | 6 points

Environmentally Preferable Flooring: Throughout Building

REQUIREMENTS

Use non-vinyl, non-carpet floor coverings throughout each building in the project.

RATIONALE

Natural and renewable alternative flooring materials have demonstrated environmental benefits, including low levels of volatile organic compounds (VOC) emissions and environmentally friendly production methods. These products are good substitutes for standard products linked with certain health hazards.

RECOMMENDATIONS

- Whenever possible, select resilient flooring that has passed a California 01350 test (FloorScore, CHPS) or NSF/ANSI 332. For California 01350, give highest preference to those that pass the residential version of the test, as the residential test is more stringent.

- Use alternative flooring materials such as natural linoleum, ceramic tile, bamboo, cork or hardwood (especially salvaged wood).
- For basements, leave the slab exposed and stain with low-VOC material rather than providing any floor treatments.

RESOURCES

- GreenSpec Directory, Building Green: The online GreenSpec Directory lists product descriptions for more than 2,000 environmentally preferable products. *http://greenspec.buildinggreen.com/*
- Pharos Project, Healthy Building Network: The Pharos Project provides health and environmental data about the manufacture, use and end of life of building materials specified in a web-based tool. *www.pharosproject.net*
- The U.S. Environmental Protection Agency identified phthalates, a chemical used to make sheet vinyl pliable, as a "chemical of concern" on December 30, 2009. *www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html*

6.8 *Mandatory* Mold Prevention: Surfaces

REQUIREMENTS

Use materials that have durable, cleanable surfaces throughout bathrooms, kitchens and laundry rooms. Materials installed in these rooms should not be prone to deterioration due to moisture intrusion or encourage the growth of mold.

RATIONALE

The use of durable, cleanable materials in wet areas reduces the potential for damage due to moisture, reduces odors and potentially reduces health hazards to residents. These materials reduce long-term maintenance costs as well.

RECOMMENDATIONS

When possible, avoid using materials such as unsealed grout, which traps and holds moisture and can facilitate mold growth.

RESOURCES

- GreenSpec Directory, Building Green: The online GreenSpec Directory lists product descriptions for more than 2,000 environmentally preferable products. *http://greenspec.buildinggreen.com/*
- GreenGuard Microbial Resistance Listing: *www.greenguard.org/en/CertificationPrograms/listingprograms_copy1/CertificationPrograms_microbialProgram.aspx*

6.9 Mold Prevention: Tub and Shower Enclosures

Mandatory

Except for projects that do not have shower or bathroom work in scope

REQUIREMENTS

Use moisture-resistant backing materials such as cement board, fiber cement board or equivalent per ASTM #D3273 behind tub/shower enclosures. Projects using a one-piece fiberglass tub/shower enclosure are exempt from this requirement.

RATIONALE

The use of moisture-resistant materials in wet areas reduces moisture buildup, diminishing the potential for indoor mold growth that may yield odors and pose health hazards to residents. Proper moisture detailing also improves durability.

RECOMMENDATIONS

When possible, avoid using materials such as unsealed grout, which traps and holds moisture and can facilitate mold growth.

RESOURCES

- American Society for Testing and Materials (ASTM) International: *www.astm.org/*
- GreenGuard Microbial Resistance Listing: *www.greenguard.org/en/CertificationPrograms/listingprograms_copy1/CertificationPrograms_microbialProgram.aspx*

6.10 Asthmagen-Free Materials

Optional | 12 points maximum

REQUIREMENTS

Do not install products that contain ingredients that are known to cause or trigger asthma. Key products to avoid are:

- *Insulation:* Do not use spray polyurethane foam (SPF) or formaldehyde-containing fiberglass batts. *[4 points]*
- *Flooring:* Do not use flexible vinyl (PVC) roll or sheet flooring or carpet backed with vinyl with phthalates. Do not use fluid applied finish floors. *[4 points]*
- *Wall coverings:* Do not use wallpaper made from vinyl (PVC) with phthalates or site-applied high-performance coatings that are epoxy- or polyurethane-based. *[4 points]*
- *Composite wood:* Use only ULEF (Ultra Low Emitting Formaldehyde) or NAF (No Added Formaldehyde) products for cabinetry, subflooring and other interior composite wood uses. *[4 points]*

For all material installation, be sure to closely follow the manufacturer's instructions. Many products require increased ventilation during installation and curing and should be applied/installed only when wearing appropriate safety gear, including, but not limited to, eye protection, respirators, gloves and skin protection. If residents are in place while potentially hazardous materials are being used, take extra precautions. Residents should be moved out of the building during the product application and for the duration of the curing period noted by the manufacturer.

RATIONALE

Research has shown that asthma may be triggered by certain chemicals that are widely used in certain building materials.

- Isocyanates are used in SPF, fluid applied floors and polyurethane high performance coatings.
- Phthalates are used to make PVC/vinyl flexible.
- BADGE, a binder material formed from Bisphenol A and epichlorohydrin, is used to make fluid applied floors and epoxy high-performance paints and other epoxy coatings applied on-site.
- Formaldehyde, a carcinogen, is used in binders for some fiberglass insulation batts and in plywood, particleboard and other composite woods.

RECOMMENDATIONS

- *Insulation:* Alternatives include recycled cotton, cellulose, wool and fiberglass with no binder. The majority of fiberglass insulation manufacturers now offer formaldehyde-free batts.
- *Flooring:* In place of vinyl or other PVC-based resilient flooring, use natural linoleum, rubber, cork, ceramic tile or pre-finished solid wood flooring. If you must use vinyl, ensure that it does not have phthalates. If possible, use a floor system that can feature mechanical attachments (e.g., nails, floating wood flooring) instead of glues. This approach makes flooring easier to recycle in the future.
- *Wall coverings and window treatments:* If you must use vinyl, ensure that it does not have phthalates.
- *Composite wood:* The most common alternative binder for wood is MDI, which is made with isocyanates. MDI is a lower hazard than formaldehyde as it cures more completely in the factory, but use alternative binders instead of MDI where possible. Seek resins that are more than half biobased. Many "soy-based" polyurethanes have only 5–20% soy and are mostly still made with asthma-causing isocyanates.
- Other areas to watch for:
  - PVC roofing membranes use phthalates as well. Use thermoplastic polyolefin (TPO) based roofing instead.
  - Many adhesives are epoxy-based (made with BADGE) or polyurethane-based (made with isocyanates). Minimize large volume usage of adhesives where possible and use lowest VOC types where needed.
  - Avoid furniture made with particleboard and other composite woods made with formaldehyde-based binders.
  - Carpet backings are sometimes made with flexible PVC or polyurethane. Choose carpets with phthalate-free PVC or other thermoplastic backings such as polyethylene or polypropylene. Avoid carpets and interior textiles with perfluorocarbons (PFCs, in particular PFBS and PFHxA).
- Alternatives may not be available for every product, but when possible prioritize those with low VOC content and emissions by receiving indoor air quality (IAQ) certifications that meet or exceed CA 01350 standard for VOC emissions, including SCS Indoor Advantage Gold and GreenGuard Gold or laboratory tests for the CDPH/EHLB Standard Method V1.1–Residential scenario.

RESOURCES

- The Pharos Project is an online building material selection tool that maintains listings of product contents disclosed by manufacturers and supplemented by Healthy Building Network (HBN) staff research, and identifies hazards associated with the contents. Products can be screened for asthmagens. *www.pharosproject.net*
- The Health Product Declaration (HPD) is a standardized format for manufacturer disclosure of product content, emissions and health hazards associated with the content. Manufacturers voluntarily use the format and may distribute it as they do MSDS's or Technical Data Sheets. The Health Product Declaration Collaborative maintains the HPD Standard and a list of tool providers who offer databases of HPDs. *http://hpdcollaborative.org/*
- "Full Disclosure Required: A Strategy to Prevent Asthma through Building Product Selection" is a report by the Healthy Building Network identifying asthmagens that are included as contents in building materials and making recommendations for product improvement. *www.healthybuilding.net/content/research-and-reports*
- The Carpet and Rug Institute maintains a list of manufacturers and products meeting the Green Label Plus standard. *www.carpet-rug.org/CRI-Testing-Programs/Green-Label-Plus.aspx*

6.11 *Optional | 5 points*
Reduced Heat-Island Effect: Roofing

REQUIREMENTS

Option 1

Use an ENERGY STAR–certified roofing product for 100% of the roof area.

OR

Option 2

Install a "green" (vegetated) roof for at least 50% of the roof area and ENERGY STAR–certified roofing product for the remainder of the roof area.

RATIONALE

Urban heat islands increase local air temperatures due to the absorption of solar energy by the built environment. Reducing the heat-island effect decreases energy consumption by decreasing loads on cooling systems, and it enhances resilience by reducing overheating of buildings in the event of power outages when air conditioning cannot operate.

RECOMMENDATIONS

Avoid PVC membrane roofing, which is manufactured using phthalates, a chemical listed on December 30, 2009, by EPA as a "chemical of concern" to human health: *www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html*

RESOURCES

- Cool Roof Rating Council (CRRC), Directory of Rated Products: CRRC maintains a third-party rating system of radiative properties of roof surfacing materials. *http://coolroofs.org/products/results*

- U.S. Environmental Protection Agency, Heat Island Effect: This site contains information about heat-island effect, its social and environmental costs, and strategies to minimize its prevalence, including shading and coloration of hardscapes. *www.epa.gov/heatisland*
- Lawrence Berkeley National Laboratory, Heat Island Group: The Lawrence Berkeley National Laboratory conducts research to find, analyze and implement solutions to minimizing heat-island effects; its current efforts focus on the study and development of more reflective surfaces for roadways and buildings. *http://eetd.lbl.gov/*

6.12 Construction Waste Management

Mandatory or Optional | 6 points maximum

REQUIREMENTS

Commit to following a waste management plan that reduces non-hazardous construction and demolition waste through recycling, salvaging or diversion strategies.

Mandatory: All projects must select either one pathway in Option 1 (a or b), two pathways in Option 2 (c–h), or one pathway in Option 3 (i or j). No points are accrued for compliance with this mandatory requirement.

Optional: Projects may select additional pathways to accrue optional points. These pathways may be from within a different Option from what the project chose to comply with as mandatory. Not to exceed 6 optional points.

Option 1: Measured by Percentage *(Mandatory: select one)*

a. Provide a waste plan that diverts 50% of the construction waste from the landfill. *[1 point]*
b. Provide a waste plan that diverts 75% of the construction waste from the landfill. *[2 points]*

Option 2: Material Specific *(Mandatory: select two)*

c. Recycle all cardboard. *[1 point]*
d. Recycle all wood. *[1 point]*
e. Recycle all drywall. *[1 point]*
f. Recycle all metals. *[1 point]*
g. Recycle all concrete, brick and asphalt. *[1 point]*
h. Develop and implement a comprehensive efficient framing plan that minimizes all waste by design. *[1 point]*

Option 3: Minimizing Construction Waste — New Construction only *(Mandatory: select one)*

i. Total construction waste to landfill or incinerator <2.5 lbs/SF of building *[1 points]*
j. Total construction waste to landfill or incinerator <1.5 lbs/SF of building *[2 points]*

RATIONALE

Diverting construction debris, and recycling and reusing materials whenever possible, reduces waste and disposal costs. In addition, construction waste management reduces the project's impact on landfills.

RECOMMENDATIONS

- Investigate and document local options for recycling or reusing all anticipated major constituents of the project waste stream, including cardboard packaging and "household" recyclables (e.g., beverage containers).
- Create detailed framing plans or scopes of work and accompanying architectural details for use on the job site. Create a detailed cut list and lumber order prior to construction.
- For projects with limited access to recycling centers, consider waste diversion strategies such as using panelized walls and roof trusses to minimize total materials.
- Consider recycling carpet for rehab projects when carpeting is being removed. The specification language below may be customized and included to determine whether carpet recycling is feasible and cost-effective in your locale.
  - Vendor shall supply a price quote to recycle carpet and carpet components at 100%, 50% and 30% of product tonnage.
  - Property manager shall identify the carpet product and polymer, nylon, polypropylene (which is documented on carpet specification). This will enable the carpet vendor to ascertain the recyclability of the product.
- Some manufacturers of drywall and certain types of ceiling tiles will accept the return of old materials for re-processing.

RESOURCES

- U.S. Environmental Protection Agency, *Waste Management and Recovery: A Field Guide for Residential Remodelers*. *www.epa.gov/osw/conserve/imr/cdm/pubs/remcover.pdf*
- NAHB Research Center, Best Practices for Construction Waste Management: This site includes frequently asked questions, case studies, reports and various links. It includes *A Builder's Field Guide*, which includes guidance for creating a step-by-step construction waste management and recovery plan. *www.toolbase.org/Best-Practices/Construction-Waste/waste-mgmt-field-guide*
- U.S. Environmental Protection Agency, WasteWise Program: This site has information about the WasteWise Building Challenge program, including articles, publications, and various links and resources for more information. *www.epa.gov/wastewise/targeted/challenge/cbres.htm*
- U.S. Environmental Protection Agency, Construction and Demolition Debris: This site includes basic information on construction and demolition debris disposal practices, regional and state programs, publications, and links. *www.epa.gov/epawaste/conserve/imr/cdm/index.htm*
- Construction & Demolition Recycling Association (CDRA): This site includes links to websites on recycling concrete, asphalt roof shingles and drywall, as well as a state-by-state listing of construction waste reusers and recyclers. *www.cdrecycling.org*

6.13 *Optional | 3 points*
Recycling Storage

REQUIREMENTS

Provide separate bins for the collection of trash and recycling for each dwelling unit and all shared community rooms (if applicable).

Additionally, in multifamily buildings provide at least one easily accessible, permanent and dedicated indoor area for the collection and storage of materials for recycling. And in single-family homes, note that points will be accrued only if curb-side recycling pickup is available.

Collected materials should include, at a minimum, paper, cardboard, glass, metals and plastics.

RATIONALE

Recycling prevents usable materials from entering the waste stream. Providing bins within the living space for the separation of recyclables from trash encourages higher rates of recycling. Similarly, a dedicated indoor space for recycling encourages higher adoption rates.

RECOMMENDATIONS

- Ensure that the recycling program has management support.
- Ensure that signage and bin colors are consistent across the project, and with local community norms where applicable.
- Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area.
- Identify local waste handlers and buyers for glass, plastic, metals, office paper, newspaper, cardboard and organic wastes.
- In multifamily buildings, instruct occupants on recycling procedures through clear and visible signs that include pictures and that are translated into a variety of languages spoken by residents.
- Include the recycling policies and procedures in the Resident Manual (Criterion 8.3).
- Ensure that project staff follow procedures for collecting recyclables for your recycling hauler, and include those procedures in the project maintenance manual.

RESOURCES

- Enterprise Community Partners Resource Center: Enterprise Green Communities hosts a variety of resident engagement tools and trainings, including a module on waste reduction and recycling. Search for “Resident Engagement” at this link: *www.enterprisecommunity.com/resources*
- New York City Department of Sanitation, What to Recycle with Sanitation: New York City’s Department of Sanitation maintains a host of good background information on recycling basics. Contact your city/county about local recycling policies and procedures. *www.nyc.gov/html/nycwasteless/html/recycling/recycle_what.shtml*

HEALTHY LIVING ENVIRONMENT

Reducing contaminants and optimizing ventilation improve indoor air quality and project durability, and universal design and active design measures promote physical mobility.

Mandatory: New Construction and Substantial Rehab
Optional: Moderate Rehab | 12 points maximum

7.1 Ventilation

REQUIREMENTS

For each dwelling unit, in full accordance with ASHRAE 62.2-2010, install:

- A local mechanical exhaust system in each bathroom *[4 points if Moderate Rehab]*
- A local mechanical exhaust system in each kitchen *[4 points if Moderate Rehab]*
- A whole-house mechanical ventilation system *[4 points if Moderate Rehab]*

Note: Local exhaust airflow may be credited toward the whole-house ventilation airflow requirement when local exhaust fans are used to provide whole-house mechanical ventilation.

Also, for each multifamily building of four stories or more, in full accordance with ASHRAE 62.1-2010, install:

- A mechanical ventilation system for all hallways and common spaces *[3 points if Moderate Rehab]*

For all project types, in addition to the above requirements:

- All systems and associated ductwork must be installed per manufacturer's recommendations.
- All individual bathroom fans must be ENERGY STAR–labeled, wired to turn on with the light switch, and equipped with a humidistat sensor, timer or other control (e.g., occupancy sensor, delay off switch, ventilation controller).
- If using central ventilation systems with rooftop fans, each rooftop fan must be direct-drive and variable-speed with speed controller mounted near the fan. Fans with design CFM 300-2000 must also have an ECM motor.

Note: For Substantial and Moderate Rehab projects, particularly those of a historic or landmark nature, consult Appendix A of ASHRAE 62.2-2010 for compliance options for ventilation in existing buildings.

RATIONALE

Optimal ventilation improves indoor air quality, contributing to a healthier living environment.

Properly sized and controlled exhaust fans in bathrooms and kitchens remove moisture-laden air, lowering the potential for indoor mold growth that may yield odors, pose health hazards to residents and create durability concerns. Kitchen fans also help remove carbon dioxide and carbon monoxide over fuel-burning appliances and other air contaminants that may be byproducts of cooking. And ENERGY STAR–qualified bathroom fans use 65% less energy on average than standard models and move more air per unit of energy used with less noise. Timers and humidistat sensors help to ensure that fans regularly remove moisture and provide adequate ventilation.

RECOMMENDATIONS

- For climate-specific strategies, consult ASHRAE 62.2-2010 and the Resources below.
- For projects located in humid climates, supplemental dehumidification may be necessary to maintain comfort during times of high ambient relative humidity. Design a system with the capacity to meet ASHRAE requirements, and then provide additional accommodations to adjust the outside air introduced as needed.

- Avoid exceeding ventilation requirements, particularly when using local exhaust. Excessive exhaust may depressurize dwelling units, potentially back-drafting combustion appliances.
- Proper installation of each ventilation system is as critical as its design to its performance. Consult the Resources below for best-practice installation techniques. Also consider testing exhaust fan performance at rough-in: Hold two squares of toilet paper to the exhaust fan. If, when on, the fan can hold these squares, as a rule of thumb you may assume that the fan is pulling 50 CFM. If the fan is not able to hold the squares of toilet paper, examine the fan's installation.
- Placing a single multi-port, in-line fan in each dwelling unit to exhaust air from the kitchen and bathroom(s) is an acceptable ventilation strategy. If utilizing this strategy, in addition to meeting local code requirements for the minimum distance of thru-wall exhaust vents from windows, ensure that the placement of the exhaust grill meets code requirements for kitchen ventilation.
- With continuous, demand-controlled or other centralized ventilation systems, the project team (specifically, the designer, installer and maintenance staff) should ensure that the systems are balanced from unit to unit to meet the requirements of ASHRAE 62.2-2010. Also, consider installing fans with ECM motors for fans designed to exhaust more than 250 CFM.
- Consider the following mechanical controls for introducing outside air:
  - Flow control/butterfly damper to regulate the amount of air introduced through an outside air intake.
  - Shut-off damper (electronic or barometric) to close an outside air intake when the HVAC system is not calling for air.
  - Fan timer/cycler on the HVAC system to regulate the length of time an outside air intake remains open.

RESOURCES

- ASHRAE Standard 62.2-2010: This site provides a viewable version of ASHRAE Standard 62.2-2010. *www.ashrae.org/technology/page/548*
- "Ventilate Right: Ventilation Guide for New and Existing California Homes": This site provides this thorough, user-friendly guide to the intent of installing ventilation systems in accordance with ASHRAE 62.2 as well as best practices in ventilation system design and installation. Equally applicable to projects outside the state of California. *www.resaveguide.lbl.gov*
- Building America Solution Center: This searchable database includes pictorial guides for best practices in ventilation system design and installation. *https://basc.pnnl.gov/resource-guides*
- Building Science Corporation, "Review of Residential Ventilation Technologies": This report reviews current and potential ventilation technologies for residential projects, with particular emphasis on North American climates and construction. *www.buildingscience.com/documents/reports*
- ENERGY STAR: This website describes the advantages of ENERGY STAR–labeled ventilation fans and provides product and manufacturer lists. *www.energystar.gov/index.cfm?c=vent_fans.pr_vent_fans*
- Home Ventilating Institute (HVI), Ventilation Systems and Controls: The HVI provides consumers an assurance of product performance. It also works to increase public awareness of the need for good ventilation and provides resources for selecting the proper ventilation products. *www.hvi.org/* and *www.hvi.org/assets/pdfs/Ventilation_Controls_for_Life-Styles.pdf*

- University of Minnesota, Common Questions about Heat and Energy Recovery Ventilators: This site provides a brief, easy-to-understand overview of heat- and energy-recovery ventilators. *www.extension.umn.edu/distribution/housingandclothing/DK7284.html*

7.2 *Mandatory* Clothes Dryer Exhaust

REQUIREMENTS

Clothes dryers must be exhausted directly to the outdoors using rigid-type ductwork, except for condensing dryers, which must be plumbed to a drain.

RATIONALE

Outdoor venting of clothes dryers substantially reduces air moisture that can lead to mold growth. Outdoor venting also removes odors and allergens from scented detergents and fabric softeners that contain volatile organic compounds (VOCs) from the conditioned space.

RECOMMENDATIONS

- It is important to minimize the length of the duct run to avoid buildup of moisture and particles that can inhibit the flow of air. Rigid duct materials are preferred to help ensure clean ducts and reduced buildup of particles and moisture.
- Locating the dryer on an exterior wall will allow a minimized duct run for the exhaust.

7.3 *Mandatory* Combustion Equipment

REQUIREMENTS

For new construction and rehab projects, specify power-vented or direct-vent equipment when installing any new combustion appliance for space or water heating that will be located within the conditioned space.

In Substantial and Moderate Rehabs, if there is any combustion equipment located within the conditioned space for space or water heating that is not power-vented or direct-vent and that is not scheduled for replacement, conduct initial combustion safety testing. Conduct the combustion safety testing for central systems and for 10% of these individual dwelling unit systems per RESNET or BPI Combustion Safety Test Procedures. Report any deficiencies immediately to the owner or owner's representative in any failed tested system.

Install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone, placed per National Fire Protection Association (NFPA) 720.

Projects without any combustion equipment (i.e., space and water heating equipment, cook tops, dryers or any other combustion equipment) and projects with combustion equipment located only in detached utility buildings or open-air facilities are exempt from this measure.

RATIONALE

Direct-vent appliances bring outdoor air through a sealed pipe and help exhaust combustion products directly outdoors through another hard-piped vent. No indoor air is used, so there is very little risk of spillage or back-drafting. Power-vented appliances rely on indoor air, but use a fan to push exhaust products through the flue to the outside. These are much less susceptible to spillage and back-drafting than conventional units.

RECOMMENDATIONS

CO and smoke detectors may be hard wired to the heating and DHW system, thus activating if that equipment malfunctions.

RESOURCES

- U.S. Environmental Protection Agency, Combustion Products and Carbon Monoxide: These two extensive EPA sites describe the sources of carbon monoxide and other combustion gases, their health effects, steps to reduce exposure, and related standards and guidelines, and provide additional resources and links. *www.epa.gov/iaq/combust.html* and *www.epa.gov/iaq/co.html*
- Canada Mortgage and Housing Corporation (CMHC): This site is part of CMHC's "About Your House" series of educational articles. It includes information about combustion gases, the effects of exposure and strategies for limiting exposure. *www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/inaiqu/inaiqu_004.cfm*
- NFPA 720 contains requirements for the performance, installation, operation, inspection, testing and maintenance of CO detection and warning equipment. These requirements address installations of commercial systems and components as well as installations of single- and multiple-station CO alarms and household CO detection systems. *www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=720*
- Underwriters Laboratories, Product Safety Tips: CO Alarms: This site provides a basic overview of the problems associated with carbon monoxide, as well as tips about purchasing and installing carbon monoxide alarms. *www.ul.com/global/eng/pages/corporate/newsroom/storyideas/carbonmonoxide/tips/*
- U.S. Consumer Product Safety Commission: "Carbon Monoxide Questions and Answers": *www.cpsc.gov/cpscpub/pubs/466.html*
- Building Performance Institute, Combustion Safety Procedures: This site provides a set of guidelines regarding combustion safety when conducting audits and diagnostic testing. *www.bpi.org/tools_downloads.aspx?selectedTypeID=1&selectedID=2*

7.4 Elimination of Combustion Within the Conditioned Space

Optional | 9 or 11 points

REQUIREMENTS

Option 1

No combustion equipment used for cooking (to include, but not limited to, ranges, cooktops, stoves, ovens) as part of the building project. *[9 points]*

OR

Option 2

No combustion equipment used as part of the building project. *[11 points]*

RATIONALE

The process of combustion releases pollutants. Natural gas cooking burners have been shown to emit substantial quantities of pollutants. Eliminating combustion equipment from a building project eliminates the possibility of negative resident and staff health impacts due to exposure to combustion byproducts.

RECOMMENDATIONS

Higher-performance building envelopes with very small heating and cooling loads may be satisfied with high-efficiency electric heat.

RESOURCES

- "Pollutant Exposures from Natural Gas Cooking Burners: A Simulation-Based Assessment for Southern California." Jennifer M. Logue, Neil E. Klepeis, Agnes B. Lobscheid, Brett Singer: Residential natural gas cooking burners (NGCBs) can emit substantial quantities of pollutants, and they are typically used without venting range hoods. *http://ehp.niehs.nih.gov/1306673/*
- "Take Care in the Kitchen: Avoiding Cooking-Related Pollutants." Nate Seltenrich: *http://ehp.niehs.nih.gov/122-a154/* or Environmental Health Perspectives 122:A154–A159: *http://dx.doi.org/10.1289/ehp.122-A154*

7.5 Vapor Retarder Strategies

Mandatory

For all New Construction projects and those Rehab projects with foundation work in scope

REQUIREMENTS

Beneath Concrete Slabs *(including those in basements and crawl spaces)*

- Install a capillary break as follows: 4-inch layer of ½-inch diameter or greater clean aggregate
  OR
  Install a 4-inch uniform layer of sand, overlain with a layer or strips of geotextile drainage matting installed according to the manufacturer's instructions
- Immediately above the capillary break, install at least 6-mil polyethylene sheeting overlapped at least 6 inches at the seams to serve as a vapor retarder in direct contact with the slab above.

Beneath Crawl Spaces

- Install at least 8-mil cross-laminated polyethylene on the crawl floor, extended up at least 12 inches on piers and foundation walls, and with joints overlapping at least 12 inches. The 8-mil and the cross-lamination ensure longevity of the poly.
- Line the likely "high-traffic" areas of the crawl space with foam board, so the polyethylene beneath will not be disturbed.

RATIONALE

Water can migrate through concrete and most other masonry materials. Proper foundation drainage prevents water from saturated soils from being pushed by hydrostatic pressure through small cracks. Vapor retarders and waterproofing materials can greatly reduce the migration of moisture that can occur even in non-saturated soils.

RECOMMENDATIONS

- Where a high water table is anticipated or observed or has been documented in the soil boring report, or where specifically recommended by the geotechnical engineer, 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.
- Ensure that subsequent trades' work does not puncture the vapor retarder.

RESOURCES

- Advanced Energy: Comprehensive design and installation guidelines. *www.crawlspaces.org*
- Building Science Corporation: Features articles on conditioned crawl spaces. *www.buildingscience.com/resources/cond-crawlspaces*
- Building Science Corporation: Guidance regarding design and installation of below-grade walls. *www.buildingscience.com/resources/high-r-value-foundation-assemblies*.
- The Energy & Environmental Building Alliance: This organization provides links to building science topics by climate. *www.eeba.org/resources/climate/index.html*
- U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Building America: Free downloads on best building practices. *www1.eere.energy.gov/buildings/building_america/about.html*
- The Partnership for Advanced Technology in Housing: This site has an extensive, searchable resource section with pertinent information about construction solutions. *www.pathnet.org*

7.6 *Mandatory* Water Drainage

For all New Construction projects and those Rehab projects that include replacing particular assemblies called out below

REQUIREMENTS

Provide water drainage away from walls, windows and roofs by implementing the following techniques:

Water Management: Wall Systems

- Provide a continuous housewrap/weather-resistive barrier with sheets lapped shingle-style to prevent bulk water that penetrates the finished exterior cladding system from entering the wall assembly or being introduced through window or door openings or through other penetrations. Alternatively, install a fluid applied weather-resistive barrier in accordance with manufacturer's instructions.
- Flashings at roof/wall intersections and wall penetrations (i.e., plumbing, electrical, vents, HVAC refrigerant lines and the like in addition to windows and doors) must be integrated with the weather-resistive barrier and drainage plane to prevent bulk water from entering the exterior wall assembly.
- Provide a pathway for bulk water that may be behind the exterior cladding system to safely exit the exterior wall assembly. For example, a drainage plane and weep holes for brick-clad structures.

Water Management: Roof Systems

- Install drip edge at entire perimeter of roof.
- At wall/roof intersections, maintain ≥2" clearance between wall cladding and roofing materials, install flashing along the intersection, and use kick-out flashing.

RATIONALE

Diverting water from the project prevents bulk water entry into wall systems, which can contribute to moisture-related problems such as mold and the deterioration of wood and other building materials. Properly installed weather barriers, including flashing and drainage planes, help direct water away from wall cavities.

RECOMMENDATIONS

Ensure that a vapor retarder with an appropriate permeability rating is installed on the correct side of the wall assembly, based on climate considerations and drying potential.

RESOURCES

- U.S. Department of Energy, Building Technologies Office: Free downloads on best building practices. *www1.eere.energy.gov/buildings/building_america/about.html*
- U.S. Environmental Protection Agency, Indoor airPLUS Construction Specifications: Includes detailed construction specifications, several of which are focused on moisture management. *www.epa.gov/indoorairplus/technical/moisture*
- The Energy & Environmental Building Alliance, Water Management Guide: Excellent installation details for weather-resistive barriers and flashing. *www.eeba.org/bookstore/prod-Water_Management_Guide-9.aspx*

7.7 *Mandatory*
Mold Prevention: Water Heaters

REQUIREMENTS

Provide adequate drainage for water heaters that includes drains or catch pans with drains piped to the exterior of the dwelling.

Water heaters should be located in rooms with non–water-sensitive floor coverings. Drain pans should be sloped and corrosion-resistant (e.g., stainless or plastic) with drains at the low point. Condensate lines should be drained to a drainage system, and not just deposited under slab.

Note: Tankless water heaters do not require drains or catch pans with drains piped to the exterior of the building.

RATIONALE

The use of heaters with drains and catch pans prevents moisture problems caused by leakage or overflow. This prevents water from sitting idle, creating excess moisture and allowing mold to germinate.

RECOMMENDATIONS

- Buildings with one or more central water heaters should comply with ASHRAE Standard 188P to assess and manage the risks associated with *Legionella* in building water systems. Private water supplies should be tested to ensure that water does not have biological or chemical contaminants.
- If local code does not permit draining to the exterior of the project, water heaters can be drained directly to the sewer line.

RESOURCES

- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Standard 62.1-2007 User's Manual. *www.techstreet.com/cgi-bin/detail?product_id=1571685*
- International Code Council, "Mold: Tips on Prevention and Control." *www.iccsafe.org/Store/Pages/Product.aspx?id=7310S*
- Canada Mortgage and Housing Corporation's "Fighting Mold": For information on mold identification and remediation in existing homes. *www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo_005.cfm*

7.8 *Mandatory*
Radon Mitigation

New Construction and Substantial Rehab

REQUIREMENTS

New Construction

In EPA Zone 1 areas, install passive radon-resistant features below the slab. Also install a vertical vent pipe with junction box within 10 feet of an electrical outlet in case an active system should prove necessary in the future. Use of the following standard is recommended: ANSI-AARST Standard: *Reducing Radon in New Construction: 1 & 2 Family Dwellings and Townhouses*, CCAH-2013.

Substantial Rehab

Substantial Rehab projects located in EPA Zone 1 areas should be tested under the supervision of a radon professional for the presence of radon in accordance with the American Association of Radon Scientists and Technologists' Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (ANSI-AARST MAMF-2012). In time-sensitive situations, consistent with HUD's radon policy, a radon professional may sample a minimum of 25% of randomly selected ground-level dwelling units.

If the radon level is above the EPA action level of 4 pCi/L (pico curies per liter), install radon-reduction measures per ANSI-AARST Provisional Standard: Radon Mitigation Standards for Multifamily Buildings ANSI/AARSTR RMS-MF (PS) 2013 or ASTM E 2121-11: Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings.

A radon professional shall have:

- Certification from either the American Association of Radon Scientists and Technologists' (AARST) National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB), and
- Certification/License from the state in which the testing or mitigation work is being conducted, if the state has this requirement.

RATIONALE

Radon is the leading environmental cause of cancer mortality in the United States. Exposure to radon is the second leading cause of lung cancer in the U.S., after smoking. A smoker who is also exposed to radon has a much higher risk of lung cancer. The only way to know if homes have elevated radon levels is to test. Testing is easy and inexpensive, and elevated radon levels can be reliably mitigated, if necessary, with simple, durable and commonly available materials and techniques.

RECOMMENDATIONS

- Elevated levels of radon have been found in homes built in all three zones on EPA's Map of Radon Zones. Consult your state radon program for current information about radon in your area. *www.epa.gov/radon/whereyoulive.html*
- EPA recommends that all homes built with radon-resistant features in EPA Radon Zone 1 pre-emptively include a radon vent fan. EPA also recommends radon-resistant features for homes built in EPA Radon Zones 2 and 3, along with testing for radon prior to occupancy. A radon vent fan should be installed when the test result is 4 pCi/L or more.
- Guidance for underground garages:
  - International Mechanical Code (IMC), which requires 0.75 cfm/sf for garages serving multifamily projects, and ASHRAE Standard 62.1-2010 section 5.15, which encourages maintaining attached garage air pressure at or below adjacent occupiable spaces.
  - If the pressure management strategy is not designed to continually maintain negative pressure in the underground garage space relative to the occupied spaces (i.e., if a timer is used for exhaust fan control), then radon control is not assured. In such situations, use either the radon-resistant New Construction techniques summarized in IAP spec 2.1 (*www.epa.gov/indoorairplus/pdfs/construction_specifications.pdf*) and detailed further in EPA guidance and/or test the occupied space for radon.

  - If the underground garage does not cover the entire foundation (i.e., some living space is directly above a slab or crawlspace), then those portions of the project should be handled per Indoor airPLUS specs.
  - Any mechanical or service closets in the garage area that are connected to the conditioned enclosure should be aggressively sealed between the garage and the conditioned space.
- For projects located on brownfields or proximate to industrial operations that are not in EPA Zone 1, consider testing for radon to determine if elevated levels exist on-site. If the radon level is elevated above 4 pCi/L (pico curies per liter), install radon-reduction measures.

RESOURCES

- U.S. Environmental Protection Agency. *www.epa.gov/radon/zonemap.html*. Or contact your state radon coordinator through the state health office to determine if your project is located in a Zone 1 radon area. *www.epa.gov/radon/whereyoulive.html*
- U.S. Environmental Protection Agency, "Protocols for Radon and Radon Decay Product Measurements in Homes." *www.epa.gov/radon/pdfs/homes_protocols.pdf*
- National Center for Healthy Housing, "Radon-Resistant Construction: Low-Rise Multi-Family Housing." *www.nchh.org/Training/Green-and-Healthy-Housing.aspx*
- U.S. Environmental Protection Agency, "Building Radon Out." 2006 (#EPA/402-K-01-002). *www.epa.gov/radon/pdfs/buildradonout.pdf*
- U.S. Environmental Protection Agency, "Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings." *www.epa.gov/radon/pubs/mitstds.html*
- American Lung Association, Radon Fact Sheet: This is a general overview of the health risks associated with radon exposure. *www.lungusa.org/healthy-air/home/resources/radon.html*
- Washington State, Extension Energy Program, "Builder's Field Guide": Chapter 2 of this field guide provides tips, procedures and schematics for understanding how to mitigate radon risks during new construction. *www.energy.wsu.edu/Documents/Builders_Field_Guide-2006.pdf*
- ASTM E 2121-11 Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings. *www.astm.org/Standards/E2121.htm*
- ASTM E 1465-08a Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings. *www.astm.org/Standards/E1465.htm*
- ANSI-AARST Provisional Standard: *Radon Mitigation Standards for Multifamily Buildings* ANSI/AARSTR RMS-MF (PS) 2013. *www.aarst.org/bookstore.shtml*
- ANSI-AARST Standard: *Reducing Radon in New Construction: 1&2 Family Dwellings and Townhouses*, CCAH-2013. *www.aarst.org/bookstore.shtml*
- ANSI-AARST Standard: *Protocols for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings*, MAMF 2012. *www.aarst.org/bookstore.shtml*
- AARST Standard: *Protocols for Radon Measurements in Homes*, MAH September 2005. *www.aarst.org/bookstore.shtml*

7.9 *Mandatory* Garage Isolation

REQUIREMENTS

- Provide a continuous air barrier between the conditioned space and any garage space to prevent the migration of contaminants into the living space. Visually inspect common walls and ceilings between attached garages and living spaces to ensure that they are air-sealed before insulation is installed.
- Do not install ductwork or air handling equipment in a garage.
- Fix all connecting doors between conditioned space and garage with gaskets, or otherwise make substantially airtight with weather stripping.
- Install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone of the project, placed per National Fire Protection Association (NFPA) 720.

RATIONALE

Carbon monoxide inhalation can be dangerous to human health. The air barrier and air sealing will help prevent carbon monoxide migration from the garage to the living space, and the CO alarm will help ensure that residents are alerted in the case of accidental accumulation of the gas.

RECOMMENDATIONS

Refer to ASHRAE 62.2 for garage contaminant isolation measures.

RESOURCES

- National Institute of Standards and Technology, "Air and Pollutant Transport from Attached Garages to Residential Living Spaces." This report provides an overview of the major issues, as well as a review of relevant scientific studies and a series of field studies. *www.fire.nist.gov/bfrlpubs/build03/art068.html*
- The Energy & Environmental Building Alliance, "Builder's Guide" series for specific North American climate zones: Cold Climates, Mixed-Humid Climates, Hot-Humid Climates, and Hot-Dry & Mixed-Dry Climates, by Joseph Lstiburek, Ph.D., P.Eng. Building Science Press: Refer to the discussion and construction details regarding air sealing and connected garages. *www.eeba.org/bookstore/cat-Builders_Guides-4.aspx*
- EPA Indoor airPLUS Construction Specifications. *www.epa.gov/indoorairplus/pdfs/construction_specifications.pdf*

7.10 *Mandatory* Integrated Pest Management

REQUIREMENTS

Design for easy inspection of all pest-prone areas (interior and exterior), and engineer slabs and foundations to minimize pest entry.

Seal all wall, floor and joint penetrations with low-VOC caulking or other appropriate nontoxic sealing methods (window screens, door sweeps, escutcheon plates, elastomeric sealants) to prevent pest entry. Use rodent- and corrosion-proof screens (e.g., copper or stainless steel mesh or rigid

metal cloth) for openings greater than ¼-inch. Also pay close attention to sealing off entry points under kitchen and bathroom sinks.

During all future repair work by building staff, utilities and contractors should reseal these areas once repair or installation work is completed.

RATIONALE

Incorporating pest prevention in the design of new buildings and in retrofits for existing buildings increases the durability of the building and, in the end, saves time and money by proactively taking steps to prevent conditions that attract pests. Sealing of cracks and penetrations will minimize entry points for pests such as rodents and cockroaches. Exposure to allergens from pests is linked with asthma and respiratory issues. Rodents may also carry diseases. Avoiding unnecessary pesticides, improving resident housekeeping, and promptly responding to pest problems and conditions that contribute to pests will reduce the chemicals needed to treat pests and will keep homes pest-free longer than a routine chemical treatment program.

RECOMMENDATIONS

- Refer to Maintenance and Resident Manuals (Criteria 8.1 and 8.3) for complementary practices.
- Plan exterior surfaces, lighting, drainage and landscaping to minimize the attractiveness of the site to pests.
- Preventative pest management work should be completed in conjunction with air sealing. Project teams should work with an air sealing contractor and a pest management professional to ensure that IPM strategies are part of the scope.
- Rehabilitation of an existing building provides the opportunity to address physical barriers that make handling garbage difficult. Engage with residents and building maintenance staff to identify and correct problems with the collection and storage of waste (e.g., inadequate space in trash rooms, narrow stairs, improper signage, unsafe access to exterior trash receptacles, etc.).

RESOURCES

- "Pest Prevention by Design: Authoritative Guidelines for Building Pests Out of Structures," San Francisco Department of the Environment. *www.sfenvironment.org/download/pest-prevention-by-design-guidelines*
- "How to Control Pests Safely: Getting Rid of Cockroaches and Mice," New York City Department of Health and Mental Hygiene, under the header "Guide to Safe Pest Control in the Home." *www.nyc.gov/html/doh/html/pest/pest3.shtml*
- The National Center for Healthy Housing, Integrated Pest Management in Affordable Housing: This webpage has resources dedicated to IPM in affordable housing, including model RFPs and contract language for greener pest control, case studies and training. *http://nchh.org/Training/IntegratedPestManagement.aspx*
- "Integrated Pest Management: A Guide for Affordable Housing." *www.stoppests.org/Guide*
- "Pest Prevention Opportunities During Renovation Work" factsheet, New York City Department of Health and Mental Hygiene, Healthy Homes Program, 2014. *www.nyc.gov/html/doh/downloads/pdf/pest/pestcontrol-during-renovation.pdf*

7.11a *Optional | 9 points*
Beyond ADA: Universal Design—New Construction

REQUIREMENTS
Design a minimum of 15% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. Design the remainder of the ground-floor units and elevator-reachable units in accordance with ICC/ANSI A117.1, Type B.

RATIONALE
Universal Design has been defined as "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design [The Center for Universal Design (1997)]." As applied to residential projects, the principles of Universal Design anticipate and plan for a greater diversity of residents' abilities and needs, both today and in the future, thereby supporting and facilitating both safety and independence for all residents, including older adults, children and individuals with mobility, visual, cognitive or other impairments.

What do we mean by "Beyond ADA"?

As a framework for design, Universal Design is distinct from the goals of accessible or "barrier-free" design. More important, it is also distinct from legally mandated accessibility requirements. Local and federal accessibility laws and regulations provide a base for Universal Design, but define only a minimum level of performance to serve people with disabilities. Furthermore, these laws focus overwhelmingly on requirements for wheelchair users, largely overlooking the broader spectrum of physical, sensory and cognitive disabilities that are far more representative of demographic realities in the United States today.

In referencing "Beyond ADA," we mean to encourage broader thinking beyond the legally mandated accessibility requirements.

RECOMMENDATIONS
- Universal Design features should be considered during the integrative design process and for a maximum percentage of units, if not 100%.
- Make streets and paths universally accessible.
- Create paths that are smooth and sufficiently wide, and that have curb cuts—at street crossings and entry points—and turning radii adequate for a wheelchair or walker.
- Create paths with auditory crossing signals, adequate crossing times, clear signage, visible access ramps, median refuge islands, and connections to walking, cycling and public transit routes.
- Support physical activity among children with disabilities by making parks and playground features accessible for both children and their caregivers.

RESOURCES
- For more information about the ICC/ANSI A117.1 standard: *webstore.ansi.org/RecordDetail.aspx?sku=ICC%2FANSI+A117.1-2003* and *www.iccsafe.org/store/Pages/Product.aspx?id=9033X03#longdesc*
- The Center for Universal Design (1997). The Principles of Universal Design, Version 2.0. Raleigh, N.C.: North Carolina State University. *www.ncsu.edu/ncsu/design/cud/index.htm*

- 2012 Enterprise Green Communities Single and Multifamily Universal Design Specifications. *www.enterprisecommunity.com/resources*
- Mayor's Office for People with Disabilities, New York City Inclusive Design Guidelines. *www.nyc.gov/html/mopd/html/home/home.shtml*

7.11b

Optional | 7 or 9 points

Beyond ADA: Universal Design—Substantial and Moderate Rehab

REQUIREMENTS

Design a minimum of 10% of the dwelling units (one, at minimum) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. *[7 points]*

For an additional 2 points: Design the remainder of the ground-floor units and elevator-reachable units with accessible unit entrances designed to accommodate people who use wheelchairs.

RATIONALE

See Rationale for Criterion 7.11a: Beyond ADA: Universal Design—New Construction.

RECOMMENDATIONS

See Recommendations for Criterion 7.11a: Beyond ADA: Universal Design—New Construction.

RESOURCES

See Resources for Criterion 7.11a: Beyond ADA: Universal Design—New Construction.

7.12

Mandatory

Active Design: Promoting Physical Activity Within the Building

REQUIREMENTS

Option 1: Stairs

Provide at least one building stairway for everyday travel between floors, whether in the form of a grand staircase or fire stairs. Provide access to and from all floors via the staircase. Place point-of-decision signage at building entrance and corridor intersections to promote stair use for health and other benefits. Ensure that stairway lighting is consistent with, or better than, building corridor lighting to encourage use.

OR

Option 2: Pathways

For buildings without stairs, or in an instance when using stairs may be hazardous, incorporate at least one strategy inside the building designed to increase frequency and duration of physical activity. Elements such as natural light along pathways, designated resting areas (seating), grab bars, informational displays about walking paths within the building, incremental distance markers, and/or thoughtfully placed exercise equipment in visible and easily accessible shared areas can improve the duration and frequency of physical activity. Include a narrative describing your selection process and how your selected strategy will increase frequency and duration of physical activity.

RATIONALE

Physical inactivity increases the risk of many chronic diseases and conditions, including obesity, hypertension, heart disease, stroke, some cancers and Type 2 diabetes. Two minutes of stair climbing daily burns enough calories to prevent annual average weight gain. Common stairs also encourage social interactions and improve mental health. Climbing 20–34 floors of stairs per week (~3–5 floors per day) is associated with a reduced stroke risk of 29%, and climbing 100–150 floors of stairs per week is associated with a 10–20% decrease in all-cause mortality.

For those residents for whom stairway travel may be dangerous due to their limited functional mobility, other key design considerations may positively influence their level of physical activity. In these instances, building design measures that increase either frequency or duration of physical activity are encouraged.

RECOMMENDATIONS

- Consider bi-level lighting that increases lighting once residents access the stairs and reduces lighting to minimum code levels when not in use. This also provides energy benefits.
- Stairwell finish should provide a pleasant experience to encourage stair use by able-bodied people.
- Focus on stairs rather than elevators as the principal means of vertical travel for those who are able to climb the stairs.
- In high-rise buildings, provide an integrated vertical circulation system that incorporates stair use for travel between adjacent floors, so that elevators are used primarily for vertical travel of four floors or more.
- Consider programming elevators so they do not return to the ground floor and do not rest in the open position when not in use.
- While maintaining at least one (or more if required by code) ADA-accessible elevator to all floors, consider installing skip-stop elevators, where appropriate for the building.

RESOURCES

- City of New York. Active Design Guidelines, 2010. *www.nyc.gov/html/doh/downloads/pdf/environmental/active-design-guidelines.pdf*
- New York City Stair Prompt. *www.nyc.gov/html/doh/downloads/pdf/tcny/takethestairs.pdf*
- Robert Wood Johnson Foundation, Active Living Research. *http://activelivingresearch.org/active-design-supplement-affordable-designs-affordable-housing*
- Centers for Disease Control and Prevention, Healthier Worksite Initiative: Motivational Signs. *www.cdc.gov/nccdphp/dnpao/hwi/toolkits/stairwell/motivational_signs.htm*
- Task Force on Community Preventive Services. The Community Guide—What Works to Promote Health. *www.thecommunityguide.org/pa/environmental-policy/podp.html*
- OCAD University, Georgia Institute of Technology, NYC Department of Health and Mental Hygiene. Active Design Supplement: Affordable Designs for Affordable Housing, 2013. *www.nyc.gov/html/doh/downloads/pdf/environmental/affordable-designs.pdf*
- Stair use for cardiovascular disease prevention. *www.centreepic.org/files/pdf/Recherche/2009_Meyer_P_Stair_Use_4_CV_diz_prev.pdf*

7.13 Active Design: Staircases and Building Circulation

Optional | 10 points

Applicable for projects with stairs

REQUIREMENTS

A staircase must be accessible and visible from the main lobby as well as visible within a 25-foot walking distance from any edge of the lobby. Ensure that no turns or obstacles prevent visibility of or accessibility to the qualifying staircase from the lobby, and that the staircase is encountered before or at the same time as the elevators.

From the corridor, accessible staircases should be made visible by:

- Providing transparent glazing of at least 10 square feet (1 square meter) at all stair doors or at a side light

  OR

- Providing magnetic door holds on all doors leading to the stairs

  OR

- Removing door enclosures/vestibules

RATIONALE

Physical inactivity increases the risk of many chronic diseases and conditions, including obesity, hypertension, heart disease, stroke, some cancers and Type 2 diabetes. Two minutes of stair climbing daily burns enough calories to prevent annual average weight gain. Common stairs also encourage social interactions and improve mental health. Climbing 20–34 floors of stairs per week (~3–5 floors per day) is associated with a reduced stroke risk of 29%, and climbing 100–150 floors of stairs per week is associated with a 10–20% decrease in all-cause mortality.

RECOMMENDATIONS

- Provide daylighting at each floor/roof level of the stair(s) using windows and/or skylights of at least 8 square feet (1 square meter) in size.
- Incorporate permanent artwork, murals and/or music into the stair environment.
- Incorporate natural ventilation into the stair environment.
- Highlight interesting views, such as prospects onto nature or outdoor gathering areas.
- Integrate the stair with the principal areas of orientation and travel within the building.

RESOURCES

- City of New York. Active Design Guidelines, 2010. *www.nyc.gov/html/doh/downloads/pdf/environmental/active-design-guidelines.pdf*
- Robert Wood Johnson Foundation, Active Living Research. *http://activelivingresearch.org/active-design-supplement-affordable-designs-affordable-housing*
- Johns Hopkins Center for Injury Research and Policy, NYC Department of Health and Mental Hygiene, Society for Public Health Education, Active Design Supplement: Promoting Safety, Version 2, 2013. This document offers design guidelines on increasing safety while also promoting health and physical activity within the built environment. *www.nyc.gov/html/doh/downloads/pdf/environmental/promoting-safety.pdf*

7.14 Interior and Outdoor Activity Spaces for Children and Adults

Optional | 9 points

REQUIREMENTS

Provide an on-site dedicated recreation space with exercise or play opportunities for adults and/or children that is open and accessible to all residents. The space must be at least 400 square feet (37 square meters), include adult exercise and/or children's play equipment for a minimum of 5–10% of building occupants, and ensure minimum operational hours for use of 10 hours/day at least 3 days/week. Complementary resident engagement strategies may promote outdoor play, exercise, gardening or other physical activity.

RATIONALE

Physical inactivity increases the risk of many chronic diseases and conditions, including obesity, hypertension, heart disease, stroke, some cancers and Type 2 diabetes. Child play and adult exercise reduce the risks of obesity, improve mental health and encourage social interactions. Improving access to places for physical activity can result in a 25% increase in the number of people who exercise at least 3 times per week.

RECOMMENDATIONS

- Provide a physical activity room with exercise equipment and indoor activity spaces for use by residents; post and maintain consistent hours of operation. Open this facility at convenient times (before/after traditional work hours), at least 10 hours per day.
- Locate children's active play areas adjacent to adult exercise spaces, allowing parents to exercise and simultaneously watch over their children at play.
- Design a courtyard, garden, terrace or roof that can serve as outdoor space for children's play and/or adult activities. When designing outdoor spaces, include permanent ground markings to indicate dedicated areas for sports, children's play and adult exercise, and to promote increased active play/exercise.
- Provide a designated outdoor physical activity space for adults.
- In the design of parks and playgrounds, create a variety of climate environments to facilitate activity in different seasons and weather conditions. Provide shaded areas as well as areas that are open to sunlight.
- Locate physical activity spaces in a centrally visible location in the building to help increase awareness and use of these spaces, as well as a sense of safety and security.
- Provide lights on sidewalks and active play areas to extend opportunities for physical activity into the evening.
- Provide views to the outdoors from physical activity/play rooms.

RESOURCES

- City of New York. Active Design Guidelines, 2010. *www.nyc.gov/html/doh/downloads/pdf/environmental/active-design-guidelines.pdf*
- Robert Wood Johnson Foundation, Active Living Research. *http://activelivingresearch.org/active-design-supplement-affordable-designs-affordable-housing*
- OCAD University, Georgia Institute of Technology, NYC Department of Health and Mental Hygiene. Active Design Supplement: Affordable Designs for Affordable Housing, 2013. *www.nyc.gov/html/doh/downloads/pdf/environmental/affordable-designs.pdf*
- Johns Hopkins Center for Injury Research and Policy, NYC Department of Health and Mental Hygiene, Society for Public Health Education, Active Design Supplement: Promoting Safety, Version 2, 2013. This document offers design guidelines on increasing safety while also promoting health and physical activity within the built environment. *www.nyc.gov/html/doh/downloads/pdf/environmental/promoting-safety.pdf*
- Task Force on Community Preventive Services. The Community Guide—What Works to Promote Health. *www.thecommunityguide.org/pa/environmental-policy/improvingaccess.html*
- Caring for our children: National health and safety performance standards; Guidelines for early care and education programs. 3rd edition. American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education. *http://nrckids.org*

7.15 *Mandatory*
Reduce Lead Hazards in Pre-1978 Buildings

Substantial rehab on buildings constructed before 1978

REQUIREMENTS

Conduct lead risk assessment or inspection to identify lead hazards. Control identified lead hazards using lead abatement or interim controls, using lead-safe work practices that minimize and contain dust. Follow EPA or state and/or local laws and requirements, where applicable. Alternatively, follow standard lead treatments defined by HUD as a series of hazard reduction measures designed to reduce all lead-based paint hazards in a dwelling unit without the benefit of a risk assessment or other evaluation (25 CFR 34.110).

RATIONALE

Exposure to lead dust, lead in soil and deteriorated lead-based paint poses significant risks to young children (<6 years) and pregnant women, affecting long-term neurological development, IQ and learning issues. In rare cases, extreme lead exposure can result in death. Opportunities exist to control lead hazards in pre-1978 buildings as part of renovation projects.

RECOMMENDATIONS

- Replace windows that have deteriorated lead-based paint with energy-efficient windows.
- With the exception of paint that is tested and found not to contain lead-based paint in accordance with 40 CFR 745.82(a), follow renovation requirements of 40 CFR 745 Subpart E and correct the underlying cause of deterioration.

- Perform dust lead clearance testing at the conclusion of renovation work; compare against EPA dust lead clearance standards.
- Remove or cover lead-contaminated soil so that it is inaccessible to children. For gardening, use raised beds with lead-free soil.

RESOURCES

- Find information from the EPA about lead abatement, inspection and risk assessment, as well as find accredited firms, here: *www2.epa.gov/lead/evaluating-and-eliminating-lead-based-paint-hazards*
- Find information from HUD about lead-safe work practices here: *www.hud.gov/offices/lead*

7.16 *Optional | 10 points* Smoke-Free Building

REQUIREMENTS

Implement and enforce a no-smoking policy in all common and individual living areas, and within a 25-foot perimeter around the exterior of all residential projects. Lease language must prohibit smoking in these locations and specify that it is a violation of the lease to smoke. The no-smoking restriction applies to all owners, tenants, guests and service people. The use of e-cigarettes is prohibited wherever smoking is prohibited.

RATIONALE

Secondhand smoke is the third leading cause of preventable death in this country. Air filtration and ventilation systems do not eliminate the health hazards caused by secondhand smoke. Smoke from one unit may seep through the cracks, be circulated by a shared ventilation system or otherwise enter the living space of another. In addition to the negative health effects, smoking significantly increases fire hazards and increases cleaning and maintenance costs.

RECOMMENDATIONS

- If implementing a no-smoking policy in an occupied building, plan on a 6–8 month resident engagement effort. Excellent resources exist—see below.
- If working with a new or an unoccupied building, all building marketing materials should clearly state the smoke-free policy. Project owners and managers should inform residents that they are prohibited from smoking in or around the property. This information should be incorporated into the Resident Manual as well as manuals for building management and maintenance staff (see Criteria 8.1 and 8.2).
- A designated outdoor smoking area should be provided as an alternative arrangement for those who smoke or vape. Design this area to be as attractive as possible, and provide shelter from the elements in order to encourage smokers to smoke in this location rather than inside the building or within the 25-foot–perimeter no-smoking buffer area.
- Provide suitable receptacles in the designated outdoor smoking area for the disposal of cigarette butt litter. Ensure that the receptacles are inside the project line and do not encroach into public space.

RESOURCES

- National Center for Healthy Housing, "Reasons to Explore Smoke-Free Housing Fact Sheet." *www.nchh.org/Training/Green-and-Healthy-Housing.aspx*
- American Lung Association, Air Quality in the Home: This site includes an entire section devoted to indoor air quality in the home. Choose "Air Quality" at the bottom of the screen and then click "Indoor Air Quality" and "Air Quality in the Home" to find numerous articles and educational pieces about maintaining a healthy indoor environment. *www.lungusa.org*
- U.S. Environmental Protection Agency, Indoor Air Quality Division: This site has numerous resources related to indoor air quality in homes, including reports and web links. *www.epa.gov/iaq*
- HUD Smoke-Free Housing Tool Kit: *http://portal.hud.gov/hudportal/HUD?src=/smokefreetoolkits1*
- Capital District Tobacco-Free Coalition: *www.smokefreecapital.org*
- New York City Department of Health's Smoke-Free Housing Resources: *www.nyc.gov/html/doh/html/environmental/smoke-free-housing.shtml*
- Michigan Smoke-Free Apartments: *www.mismokefreeapartments.org*
- Smoke-Free Housing Coalition of Maine: *www.smokefreeforme.org*
- Minnesota Smoke-Free Housing: *www.mnsmokefreehousing.org*
- Smoke-Free Environments Law Project: *www.tcsg.org/sfelp/home.htm*
- Tobacco Technical Assistance Consortium: *www.ttac.org*
- Online record of LISC webinar: "Going Smoke Free: Best Practices of Multifamily Housing Owners & Managers": *www.lisc.org/content/publication/detail/21022*

OPERATIONS, MAINTENANCE + RESIDENT ENGAGEMENT

Educational materials and orientations help educate residents and staff on green features that were designed to deliver health, economic and environmental benefits, as well as their role in realizing those benefits in their own lives.

8.1 *Mandatory*
Building Operations & Maintenance (O&M) Manual and Plan

For all multifamily projects

REQUIREMENTS

Develop a manual with thorough building operations & maintenance guidance and a complementary plan. The manual and plan should be developed over the course of the project design, development and construction stages and should include sections/chapters addressing the following topics:

- Operations & maintenance guidance for all mechanical and electrical equipment and appliances (building level and dwelling unit level)
- HVAC specifications, and operations & maintenance schedules
- Operations, maintenance and replacement guidance for any other specialized systems (e.g., solar photovoltaics, solar water heating, ground source heating, microgrid) within the project
- Location of mechanical, electrical, gas and water-system turnoffs
- Lighting equipment specifications and replacement guidance
- Landscaping and hardscaping specifications and maintenance plan, including any specific instructions for community gardens or growing spaces
- Green cleaning product specifications and cleaning schedules
- Pest control guidelines, referencing the Integrated Pest Management strategies developed in Criterion 7.10
- Building accessibility for residents, including security and safety protocols, whether by leaving doors unlocked, by using a security device such as a card key, or by other measures
- Maintenance of active recreation and play spaces (e.g., playgrounds, ground markings, exercise equipment) for adults, youth and children
- Information on how energy and water information will be collected and reviewed to ensure that the project is meeting performance goals (see Criteria 1.1c, 8.5 and 8.6)
- An occupancy turnover plan that describes the dwelling unit turnover process, including all materials that are frequently replaced at turnover and the process for educating the residents about proper use and maintenance of all building systems

RATIONALE

Regular building Operations & Maintenance (O&M) practices using green methods minimizes building maintenance needs and utility consumption, and provides a healthy, safe and durable living environment for residents. Developing a building O&M manual and complementary plan throughout the project design, development and construction stages allows the project team to properly customize these documents with the input of project installers.

RECOMMENDATIONS

Begin creating a thorough and well-developed O&M manual and plan well before construction completion. Work with designers, systems installers and operations staff to assemble critical information and schedules for best-practice operations and maintenance strategies.

Prior to, and while the project is under construction:

During the design process, keep a running list of how maintenance and landscaping teams and residents may need to be involved with the building in order to ensure that it will perform as intended. Once the project team has completed the integrative design process (see Category 1), amend templates of O&M documents with project-specific information for maintenance staff and residents. By working in this manner, the building O&M manual and plan will be informed by the development process and completed by the time the project is ready for occupancy.

- Identify the senior management position(s) with oversight responsibility for O&M and the job roles responsible for producing, managing and/or implementing the manual and plan.
- Ensure that the building performance goals/requirements that were established for the project during integrative design will be included in the O&M manual and plan.
- Create a knowledge-transfer plan to ensure that accurate as-built information is captured during construction, start-up and commissioning, and integrated into the O&M manual and plan (e.g., if possible, create a video of the commissioning agent or system installer showing key maintenance checks to use when training staff).
- Discuss your building O&M training plan to ensure that responsible staff will be up to speed on the operation of the building prior to turnover and occupancy.
- Develop a succession plan to ensure that important information is retained from departing staff and transferred to new staff. This could include an exit interview checklist, maintenance log review, etc.

As construction nears completion and into operations:

Finalize your building O&M manual and plan. Clearly identify key operations and maintenance activities, assign those activities to a person/job role and establish a schedule to verify that maintenance is performed.

To enhance your O&M manual and plan, include:

- Account information on your energy and water performance tracking software. Identify who will monitor this account and at what interval, and what procedures will take place if irregularities are discovered.
- HVAC maintenance plans. Develop a maintenance schedule for HVAC systems, and include assignments of key tasks to specific job roles. Create a system to track when/what maintenance tasks were completed.
- Information on lighting equipment, including specs for replacement bulbs and a maintenance strategy for when to replace inaccessible fixtures (e.g., what percentage of bulbs/diodes can fail in any one lamp pylon before you install replacements).
- Location of mechanical, electrical, gas and water-system turnoffs.

- Irrigation system maintenance plans. Develop a periodic visual inspection of functions (since irrigation systems are often scheduled to operate when O&M staff are off duty).
- Landscaping and hardscapes (paved surfaces) review protocols. Develop an inspection schedule of landscaping and paving, and assign key tasks to specific job roles.
- Green cleaning products and cleaning schedules. Specify products, vendors, schedule and assignments of key tasks to specific job roles. Create a system to track when actions are completed.
- A written Integrated Pest Management policy (see Criterion 7.10) aimed at preventing pests and addressing conditions conducive to pests. Repair and maintain structures and grounds to minimize pest-related conditions. Develop resident guidelines related to pesticide use, housekeeping and prompt reporting of pest problems, such as cockroaches, rodents and bed bugs. Ensure that anyone applying pesticides is licensed and working under a scope that includes IPM provisions.
- If the project is utilizing recycled water (greywater), design and institute a policy that requires biodegradable soaps, cleaners and other products if they are going to be flushed down the drains.
- Video-record installers of mechanical systems explaining best practices for regular maintenance and strategies to address common system problems. Use this video as part of your maintenance staff training.
- Provide maintenance staff with local information for handling hazardous waste, including where to recycle fluorescent and compact fluorescent lighting (CFLs).

RESOURCES

- Enterprise Green Communities, Building Maintenance Manual Templates in Information Resources: *www.enterprisecommunity.com/resources/ResourceDetails?ID=63995.doc*
- San Francisco Department of the Environment, "Pest Prevention by Design: Authoritative guidelines for designing pests out of structures": *www.ipminstitute.org/school_ipm_2015/Pest_Prevention_by_Design.pdf*
- For language on residential IPM policy, the University of Minnesota offers the following resource: *www.entomology.umn.edu/cues/em/index.html*
- National Center for Healthy Housing, "Healthy Homes Maintenance Checklist": *www.nchh.org/Portals/0/Contents/Maintenance_Checklist2009.pdf*
- Stewards of Affordable Housing for the Future (SAHF), Multifamily Energy and Water Management Toolkit: This toolkit (including checklists, worksheets and resources) helps improve energy and water management, reduce costs and spending, and minimize environmental impacts over the long-term, while helping to preserve affordable properties. *www.sahfnet.org/energytoolkit.html*
- Federal Energy Management Program (FEMP) Operations & Maintenance Best Practices: A Guide to Achieving Operational Efficiency: *www1.eere.energy.gov/femp/pdfs/omguide_complete.pdf*
- ENERGY STAR Maintenance Checklist: *www.energystar.gov/index.cfm?c=heat_cool.pr_maintenance*
- ASHRAE Guideline 1.4P: 2014—Published Guideline Procedures for Preparing Facility Systems Manuals provides procedures for producing a Systems Manual as a resource for training, operations, maintenance and upgrading of facilities. *www.eeperformance.org/uploads/8/6/5/0/8650231/systemsmanualsgdl1_4-201x_chair_approved.pdf*

- ASHRAE Guideline 32-2012—Sustainable, High-Performance Operations and Maintenance offers guidance for operating and maintaining buildings with goals of sustainability and high performance in mind. *www.ashrae.org/resources--publications/bookstore/guideline-32-2012*
- ASHRAE Training for O&M: *www.ashrae.org/education--certification/self-directed-or-group-learning/fundamentals-of-building-operation-maintenance-and-management*
- GPRO Operations & Maintenance Essentials provides tools for building professionals to transition from conventional to sustainable operations. *http://gpro.org/courses/ome/*

8.2 *Mandatory* Emergency Management Manual

For all multifamily projects

REQUIREMENTS

Provide a manual on emergency operations targeted toward operations and maintenance staff and other building-level personnel. The manual should address responses to various types of emergencies, leading with those that have the greatest probability of negatively affecting the project. The manual should provide guidance as to how to sustain the delivery of adequate housing throughout an emergency and cover a range of topics including but not limited to:

- communication plans for staff and residents to use in the event of an emergency
- useful contact information for public utility and other service providers
- infrastructure and building "shutdown" procedures

Emergency Management Manuals should be responsive to information generated from successful completion of Criterion 1.3a Resilient Communities: Design for Resilience and, if applicable, Criterion 1.3b Resilient Communities: Multi-Hazard Risk/Vulnerability Assessment.

This information should be readily available to all building residents, staff and visitors.

RATIONALE

In the event of an emergency, time is of the essence. Creating and socializing a plan for building managers and residents before an emergency occurs increases the likelihood that disturbances due to the emergency (whether it be flooding, earthquake, power outages or another disturbance) can be appropriately mitigated.

RECOMMENDATIONS

- Emergency Maintenance Manuals should be updated annually (at a minimum) in both digital and hard-copy formats, and located in a well-marked location.
- Reviewing and updating all Emergency Maintenance Manuals should be built into the job description and performance requirements of staff members.
- Consider having staff trained in first aid, cardiopulmonary resuscitation (CPR) and the use of automated external defibrillators (AEDs), and include information about these resources within the Emergency Management Manual.

RESOURCES

- Enterprise Disaster Response Staffing Plan: *www.enterprisecommunity.org/resources*
- "Ready" is a public service campaign designed to education and empower Americans to prepare for and respond to emergencies, including natural and man-made disasters. The goal of the campaign is to get the public involved and ultimately to increase the level of basic preparedness across the nation. *www.ready.gov*
- Federal Emergency Management Agency (FEMA): *www.fema.gov*
- American Red Cross: *www.redcross.org*
- Seattle Office of Emergency Management provides many valuable resources, including a Resident Disaster Recovery Booklet translated into several languages. They can be accessed online at: *www.seattle.gov/emergency/publications*
- Urban Green, Building Resiliency Task Force Report, Chapter 4: Better Planning, June 2013. *http://urbangreencouncil.org/sites/default/files/2013_brtf_summaryreport_0.pdf*

8.3 *Mandatory* Resident Manual

REQUIREMENTS

Provide a guide for homeowners and renters that explains the intent, benefits, use and maintenance of their home's green features and practices. The Resident Manual should encourage green and healthy activities.

A range of topics should be discussed. Those topics should include, but are not limited to:

- a routine maintenance plan, outlining responsibilities of residents and maintenance staff, as applicable
- operations and maintenance guidance for all lights, appliances and fixtures (e.g., dual-flush toilets) (Criteria 4.1, 4.2, 5.1a–d, 5.4, 5.5)
- HVAC operation
- location of electrical, mechanical, gas and water-system turnoffs
- interior finish materials, including paints, caulks and flooring (Criteria 6.1, 6.2, 6.7a, 6.7b, 6.8, 6.9, 6.10)
- paving materials and landscaping (Criterion 3.4)
- recycling and waste management (Criteria 6.12 and 6.13)
- pest control (Criterion 7.10)
- interior Active Design features (e.g., stairwells) and signage (Criteria 7.12, 7.13, 7.14)
- information on community connectivity amenities, including transportation, car-share, bike-share and other accessibility features (Criterion 2.5, 2.8, 2.9)
- community garden and other fresh food resources (Criterion 2.12)

- special health considerations if recycled water (greywater) is used indoors (e.g., do not drink from the toilet in emergency situations)
- energy and water consumption information (Criteria 8.5 and 8.6)
- if applicable, procedures to contact building management in the case of a building-related problem
- green cleaning guidelines
- any other systems that are part of the home

RATIONALE

Education on the operations and maintenance of the home will allow residents to fully realize the environmental, health and economic benefits that green housing offers.

RECOMMENDATIONS

- When developing your Resident Manual and engagement information, be sure to include the fun factor: Graphics, images, videos and social media information make your material more fun and engaging, and in turn make them more useful.
- During the design process, keep a running list of how maintenance and landscaping teams and residents may need to be involved with the building in order to ensure that it will perform as intended. Once the project team has completed the integrative design process (see Category 1), amend templates of the O&M documents and Resident Manual with project-specific information. By working in this manner, these documents will be informed by the development process and completed by the time the project is ready for occupancy.
- Develop an Integrated Pest Management policy (in conjunction with Criterion 7.10) and, as part of that, develop resident guidance related to pesticide use, housekeeping and prompt reporting of pest problems with cockroaches, rodents and bed bugs. Ensure that anyone applying pesticides is licensed and working under a scope that includes IPM provisions.
- Provide residents with information about local transportation options by including maps, public transit schedules, car and bike-share programs, and the building's bicycle amenities.
- Provide residents with maps of neighborhood locations for physical activity and healthy food amenities, including farmers markets, community gardens, walking trails, parks, playgrounds and exercise facilities.
- Amplify the impact of residents having access to fresh food (through gardening spaces or other means) by hosting cooking classes so that they can learn how to use their produce to make healthy meals.
- Consider labeling trash, recycling and composting receptacles throughout the building: Trashcan becomes "landfill" can and is made visually distinct from recycling containers through the use of consistent colors.
- Provide residents with two radon test kits designed for 48-hour exposure or radon meters, and include instructions for use and follow-up action per EPA's Indoor airPLUS program.
- Provide residents with local information for handling household hazardous waste, including compact fluorescent bulbs (CFLs).
- Provide residents with the building's smoking policy (Criterion 7.17).

- If the project is utilizing greywater, design and institute a policy that requires biodegradable soaps, cleaners and any other product types that are going to be flushed down the drains.
- Consider including ENERGY STAR "Best Practices" information in the Resident Manual. Select a product type, click on "Buying Guidance," and scroll down to the bottom of the page to select "Best Practices" products.
  - For washers and dryers: *www.energystar.gov/index.cfm?c=clotheswash.clothes_washers_performance_tips*
  - For refrigerators: *www.energystar.gov/index.cfm?c=refrig.pr_best_practices_refrigerators*
  - For dishwashers: *www.energystar.gov/index.cfm?c=dishwash.pr_best_practices*
  - For additional best practices on ENERGY STAR products: *www.energystar.gov/index.cfm?c=products.pr_find_es_products*

RESOURCES

- Enterprise Community Partners Resource Center: Enterprise Green Communities hosts a variety of resident engagement tools, trainings and sample manuals. Search for "Resident Engagement" at this url: *www.enterprisecommunity.com/resources*
- Connecticut Department of Environmental Protection, "A Green Home Is a Healthy Home": This is a simple brochure with a readable layout and good presentation. *www.ct.gov/deep/lib/deep/p2/individual/healthyhome.pdf*
- Home Energy Resource MN: This site provides information for homeowners on maintaining their home. It includes seasonal checklists and step-by-step instructions for general maintenance, as well as special instructions for new home buyers on maintaining their home during its first year. *www.homeenergyresourcemn.org/index.aspx*
- Canada Mortgage and Housing Corporation, "Fighting Mold—Tenant's Guide to Mold." Information on mold identification and remediation in existing homes. *www.tenants.bc.ca/ckfinder/userfiles/files/Fighting%20Mold.pdf*

8.4 *Mandatory* Resident and Property Staff Orientation

REQUIREMENTS

Provide a comprehensive walk-through and orientation for all residents, property manager(s) and buildings operations staff. Use the appropriate manuals (see Criteria 8.1–8.3) as the base of the curriculum, and review the project's green features, operations and maintenance procedures, and emergency protocols.

For all rental properties, walk-throughs and orientations with residents, property managers and building operations staff should take place annually, at a minimum. For home-ownership properties, walk-throughs and orientations should take place at sale.

RATIONALE

An orientation to the building and community helps educate residents, property manager(s) and building operations staff about the green features that were designed to deliver health, economic and environmental benefits, as well as their role in realizing those benefits in their own lives and the lives of future residents. Without an orientation to the information included in the guides created through Criteria 8.1–8.3, that valuable information may not be put to use, and the project's long-term goals may not be met. Given the frequency of resident and staff turnover in apartments, annual orientations to this information will help to ensure that all occupants are enabled to live and work in the building.

RECOMMENDATIONS

- During Property Management and Resident Services staff trainings, focus on how the features of the building function and are maintained, and how those features help the residents: providing comfort, protecting health, saving money, conserving resources, and also better stewardship of the environment. It is important for all staff to understand how the building and systems were designed to operate so that issues can be identified and addressed promptly.
- Resident orientations should focus on engaging occupants in the process of both creating and maintaining a green and healthy environment as well as increasing resident awareness of on-site and nearby physical activity and healthy food amenities. Engagement orientations should be tailored to residents and their needs (e.g., families, seniors) and educate residents on how to operate key features and building resources (e.g., recycling, thermostats, fans, lighting) and explain why certain building elements/features/materials were selected (e.g., less carpet in favor of smooth flooring improves indoor air quality). This thorough resident orientation will lead to collective improved outcomes, such as how resident behavior affects energy, water and materials use as well as health outcomes. The orientation should also stress the important role that tenants play in reporting building-related problems so that issues can be addressed in a timely fashion.
- Consider providing residents with a green, healthy living packet, including green cleaning materials, healthy recipes, recycling information and important contacts in case of any problems.
- Engage residents at regular intervals (e.g., move-in, 3 months, 1 year, then annually) that coincide with existing tenant engagement to check in on behaviors and the potential need for assistance.
- Provide residents with local information for handling household hazardous waste, including compact fluorescent bulbs (CFLs).
- Educate residents and staff on building protocols for what to do in the case of an evacuation. Consider providing key staff and key residents with additional training and "go-bags" so that they can help residents during an emergency.

8.5 *Mandatory*
Project Data Collection and Monitoring System: 100% Owner-Paid Utility Accounts, 15% Tenant-Paid Utility Accounts

REQUIREMENTS

For rental properties, collect and monitor project energy and water performance data for 100% of owner-paid utilities and 15% of tenant-paid utilities for at least 5 years. This data must be maintained in a manner that allows staff to easily access and monitor it, enabling them to make informed operations and capital planning decisions. Also allow Enterprise access to this data.

For owner-occupied units, residents shall collect and monitor their energy and water performance data in a manner that allows for easy access and review, and that provides the ability to influence home operations. Also allow Enterprise access to this data.

RATIONALE

A data-collection and monitoring system allows project owners, on-site staff and residents to understand project performance. This information should be used to influence future retrofit and repair work, as well as to identify day-to-day performance issues as they arise. If an issue is identified, appropriate actions can be taken to maximize project durability, cost savings and health benefits associated with the green goals of the project.

RECOMMENDATIONS

- Make resident utility release(s) an opt-out, rather than an opt-in, component of lease-up to provide property management with access to utility data for benchmarking/tracking. This data will allow maintenance staff to proactively identify poorly performing systems and identify other comfort issues that often go unreported, leading to major systems failure.
- Ensure that the training for residents and building maintenance staff includes information on how to effectively use the data-collection, monitoring and reporting system.
- Inquire if your utility provider has a landlord portal. If so, building owners may gain access to tenant utility data through the utility at lease-up. Alternatively, inquire if your utility provider participates in the Green Button Challenge, a growing initiative which allows utility data transparency. *www.energy.gov/data/green-button*
- Whole-project energy monitoring systems (also known as smart meters) can help reduce energy consumption. Check to see if your local utility providers provide financial incentives for these.

RESOURCES

- Portfolio Manager Quick Reference Guide for Multifamily Housing: Portfolio Manager is a free, online, interactive energy management tool that allows you to measure and track your building's energy and water consumption, identify investment priorities, and verify improvements over time. Multifamily housing communities can use Portfolio Manager to track weather-normalized energy use intensity (EUI), energy costs, greenhouse gas emissions and water consumption. *www.energystar.gov/ia/business/multifam_housing/QRG_Multifamily_Housing.pdf*
- Private, fee-based, benchmarking and utility tracking tools are available. Among others, these include: WegoWise: *www.wegowise.com*; Energy Score Cards: *www.energyscorecards.com*; eGauge: *www.egauge.net*

8.6 *Optional | 7 or 11 points*
Project Data Collection and Monitoring System: Greater than 15% Tenant-Paid Utility Accounts

REQUIREMENTS
Collect and monitor project energy and water performance data for at least 5 years. This data must be maintained in a manner that allows staff and/or residents to easily access and monitor it, enabling them to make informed operations and capital planning decisions. Also allow Enterprise access to this data.

PERCENTAGE OF UNITS	POINTS
16–60%	7 points
60–100%	11 points

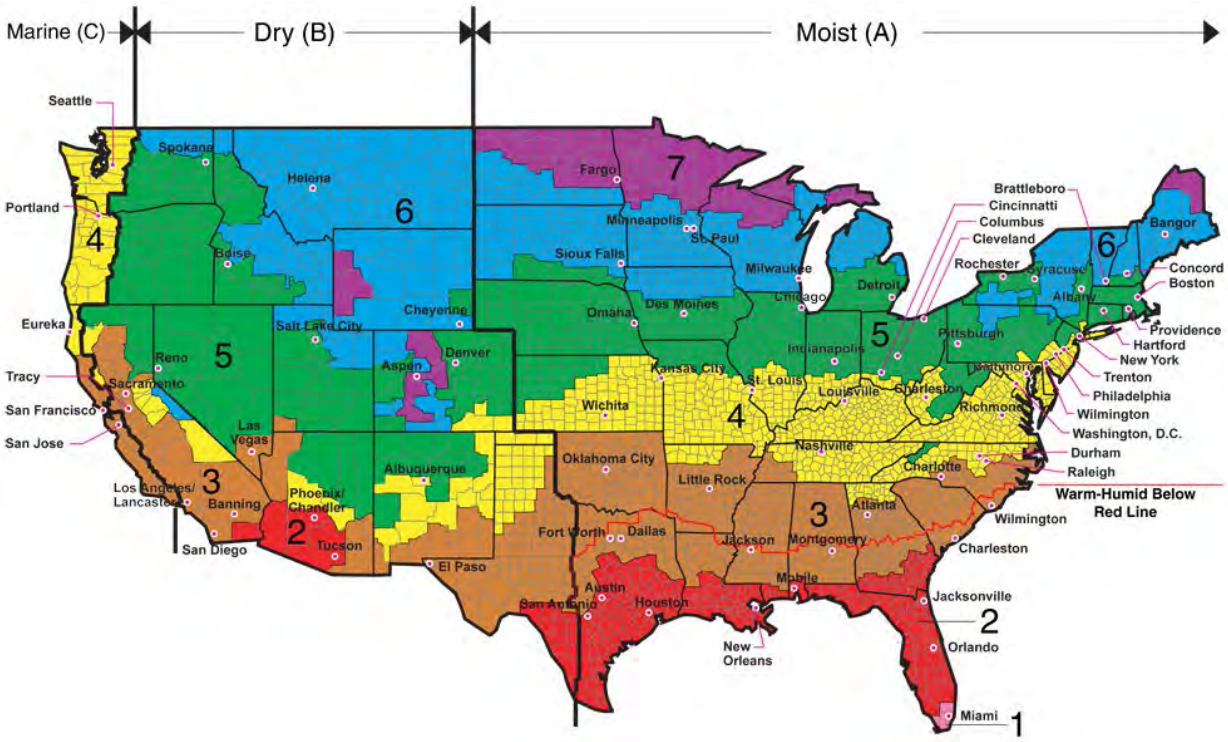
RATIONALE
See Rationale for Criterion 8.5.

RECOMMENDATIONS
See Recommendations for Criterion 8.5.

RESOURCES
See Resources for Criterion 8.5.

APPENDIX

2012 IECC CLIMATE ZONE MAP



Zone 1 includes Hawaii, Guam, Puerto Rico and the Virgin Islands

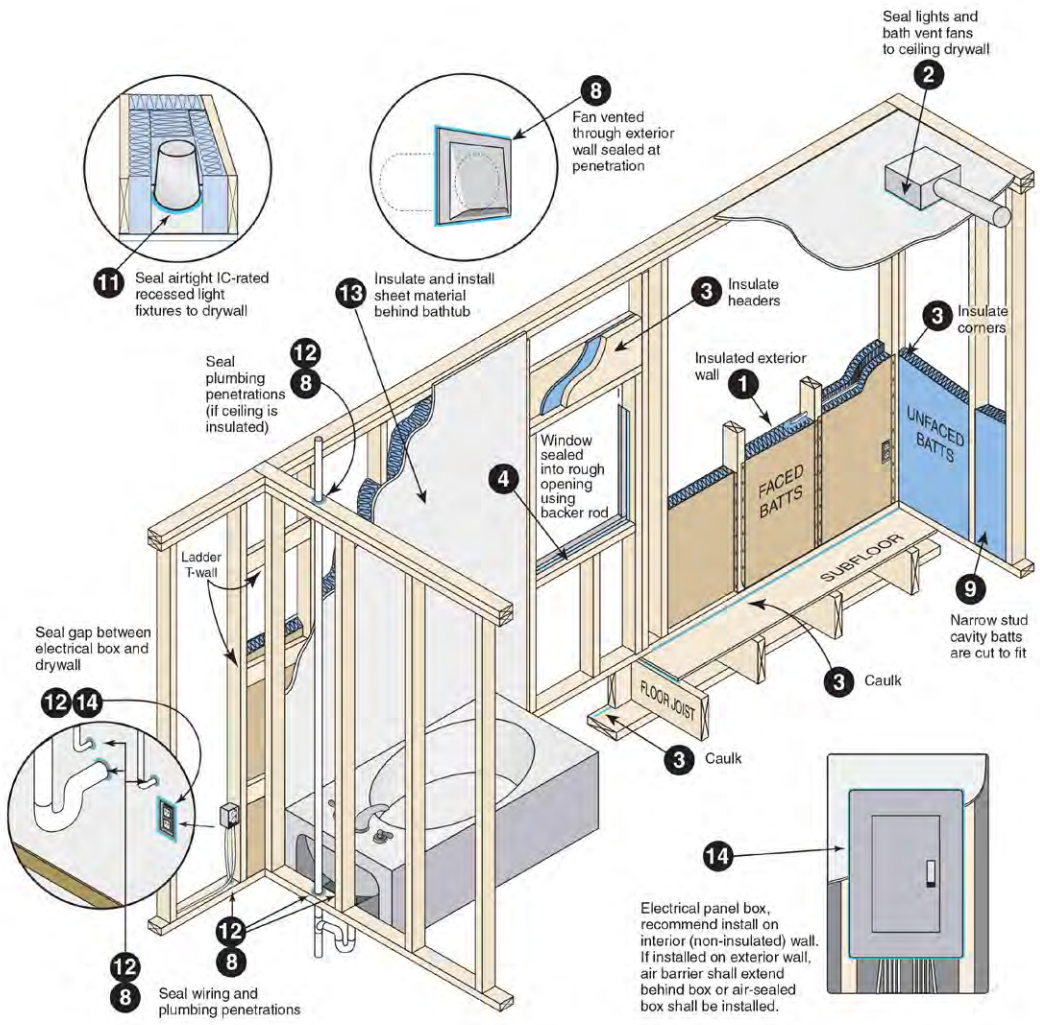
Alaska is Zone 7, except for the following boroughs in Zone 8: Bethel, Dellingham, Fairbanks, North Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton and Yukin-Koyukuk

AIR BARRIER AND INSULATION INSPECTION COMPONENT GUIDE

NO.	COMPONENT	CRITERIA
1	Air barrier and thermal barrier	• Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. • Breaks or joints in the air barrier are filled or repaired. • Air-permeable insulation is not used as a sealing material. • Air-permeable insulation is inside of an air barrier.
2	Ceiling/attic	• Air barrier in any dropped ceiling/soffit is substantially aligned with insulation, and any gaps are sealed. • Attic access (except unvented attic), knee wall door or pull down stair is sealed.
3	Walls	• Corners and headers are insulated. • Junction of foundation and sill plate is sealed.
4	Windows and doors	• Space between window/door jambs and framing is sealed.
5	Rim joists	• Rim joists are insulated and include an air barrier.
6	Floors (including above-garage and cantilevered floors)	• Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
7	Crawl space walls	• Insulation is permanently attached to walls. • Exposed earth in unvented crawl spaces is covered with Class I vapor retarder with overlapping joints taped.
8	Shafts, penetrations	• Duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space are sealed.
9	Narrow cavities	• Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.
10	Garage separation	• Air sealing is provided between the garage and conditioned spaces.
11	Recessed lighting	• Recessed light fixtures are air tight, IC rated and sealed to drywall. • Exception—fixtures in conditioned space.
12	Plumbing and wiring	• Insulation is placed between outside and pipes. • Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
13	Shower/tub on exterior wall	• Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
14	Electrical/phone box on exterior walls	• Air barrier extends behind boxes, or air sealed-type boxes are installed.
15	Common wall	• Air barrier is installed in common wall between dwelling units.
16	HVAC register boots	• HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
17	Fireplace	• Fireplace walls include an air barrier.

This document is intended solely to help graphically demonstrate the air leakage provisions of section 402.4 of the 2009 IECC. It does not cover all airsealing locations or techniques. Other code provisions may be applicable as well.

AIR SEALING KEY POINTS



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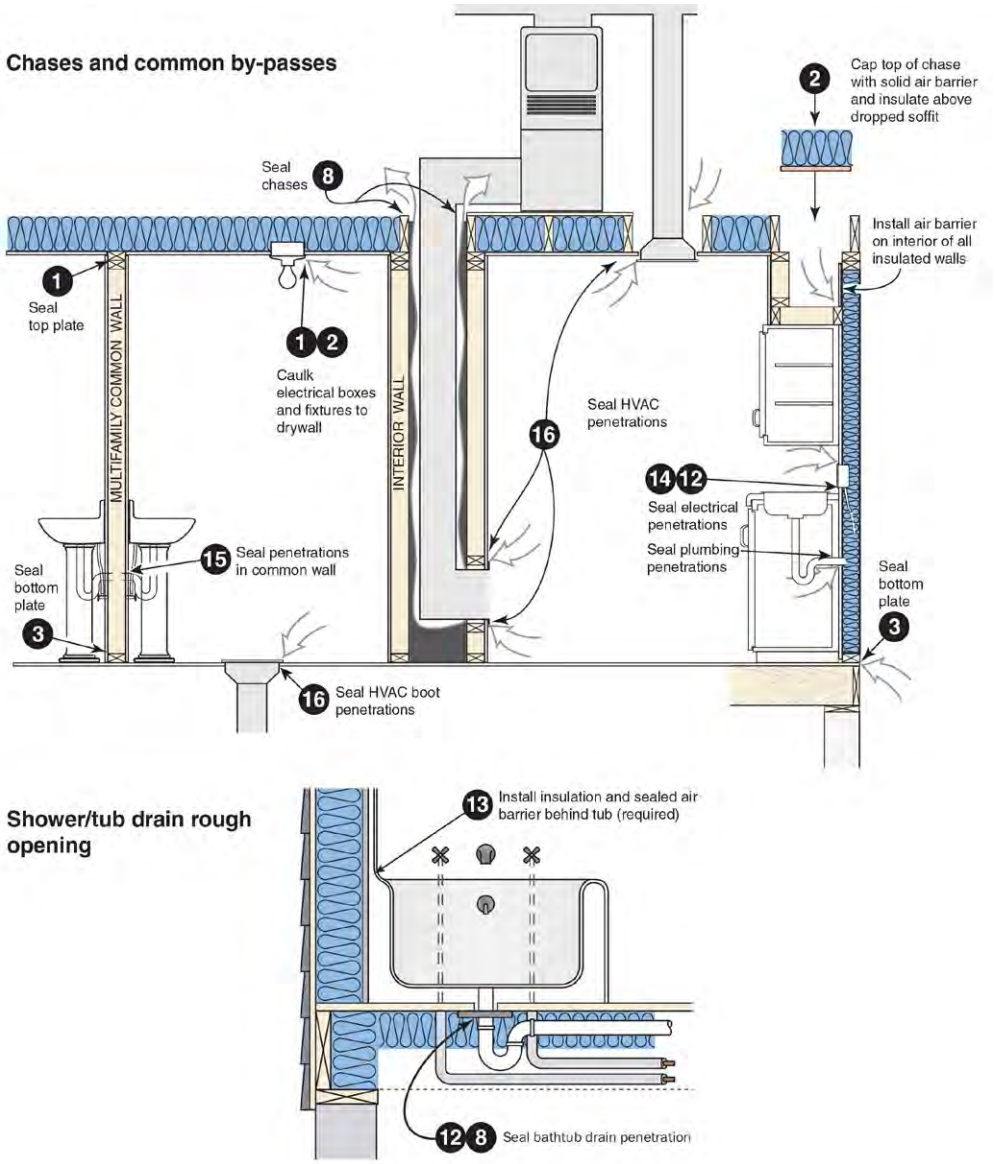
AIR SEALING KEY POINTS (CONTINUED)



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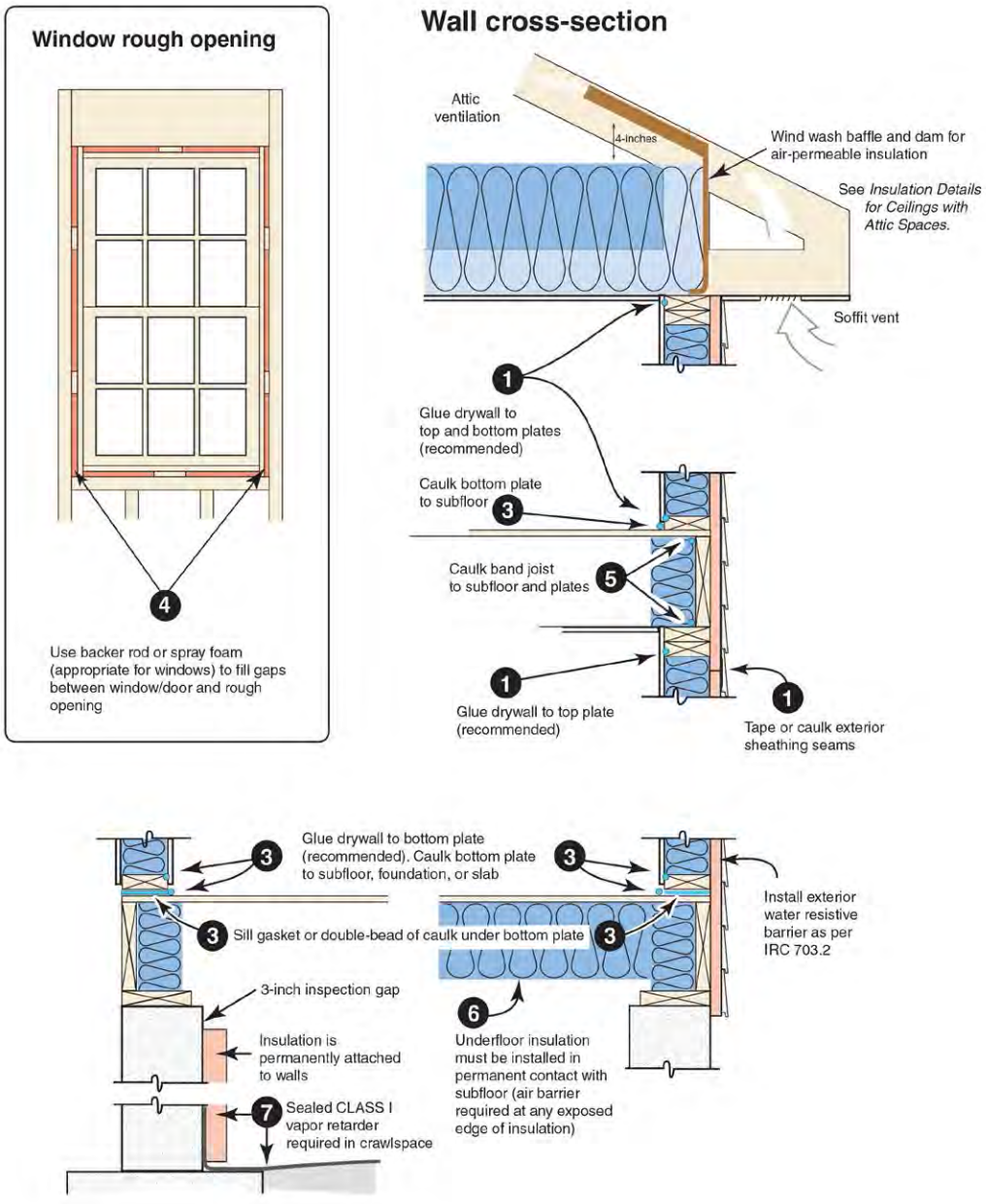
AIR SEALING KEY POINTS (CONTINUED)



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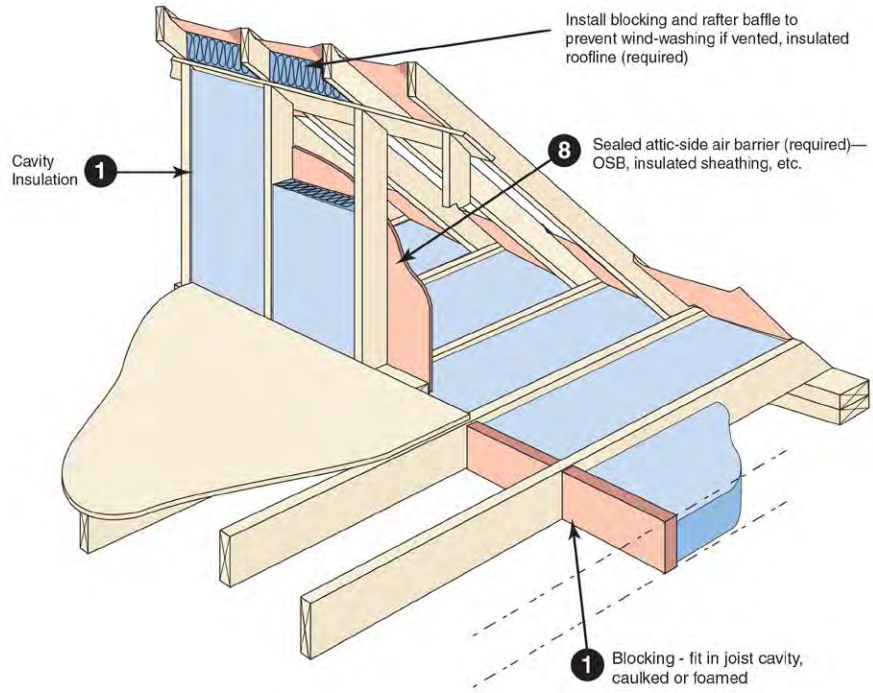
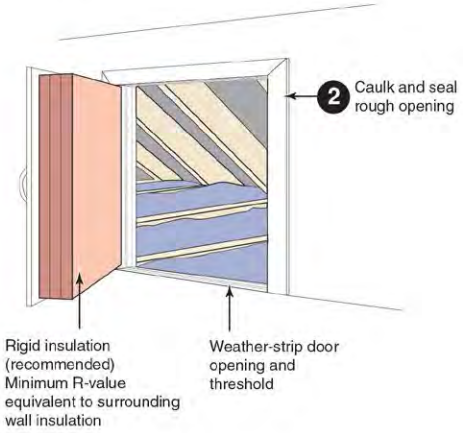
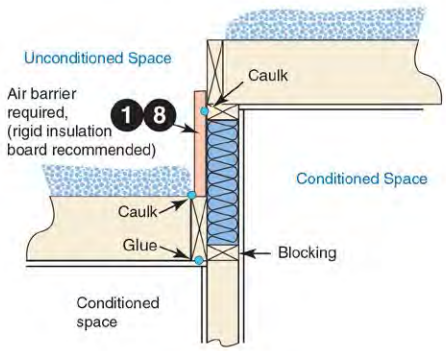
AIR SEALING KEY POINTS (CONTINUED)



Attic knee-walls



Two-level attic



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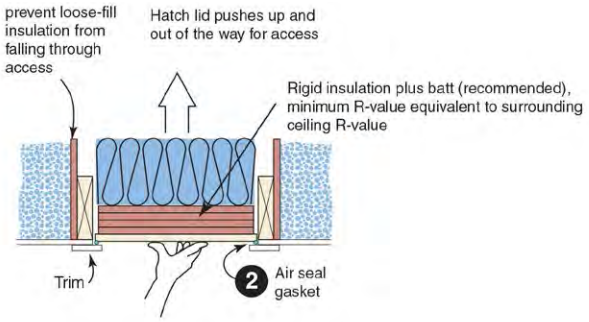
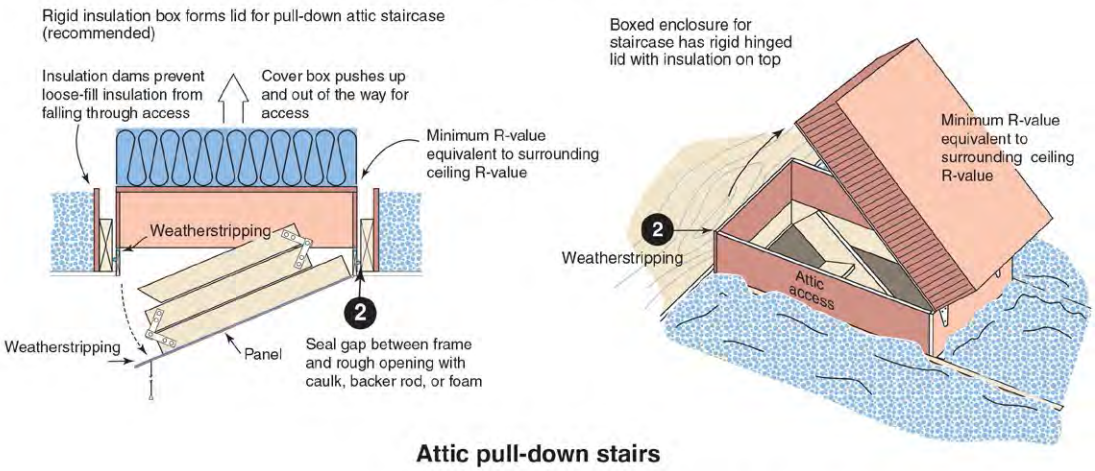
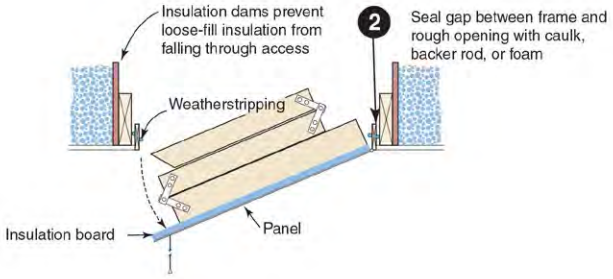
AIR SEALING KEY POINTS (CONTINUED)



Attic pull-down stairs



Attic pull-down stairs



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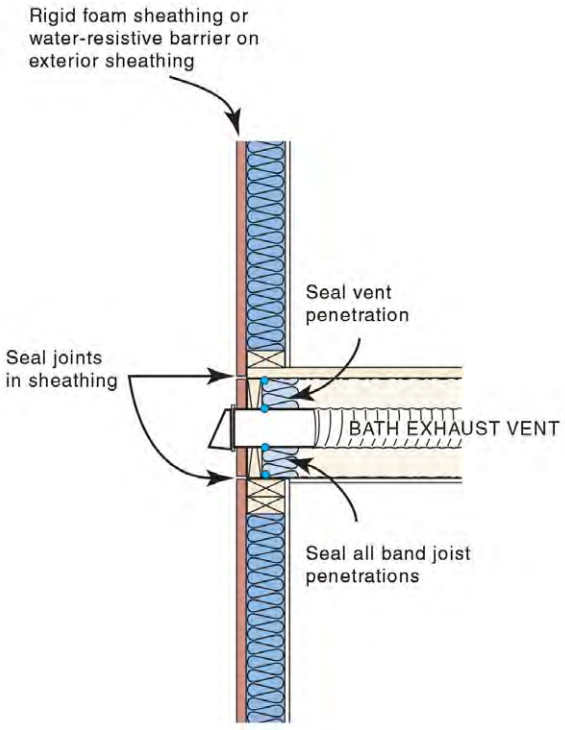
AIR SEALING KEY POINTS (CONTINUED)

Multifamily

1. Cap and seal all chases, including chases for grouped utility lines and radon vents.
2. Seal penetrations in mechanical closet, including penetrations for the:
   - supply plenum
   - outside air ventilation
   - refrigerant line
   - plumbing
   - electrical
   - gas fuel
3. Seal band area at exterior sheathing side and all penetrations through band.
4. Air-seal at drywall finishing for any wall adjacent to stairwell or elevator. Air-seal this gap at every change in floor level.
5. Seal miscellaneous clustered penetrations through building envelope (e.g., refrigerant lines).



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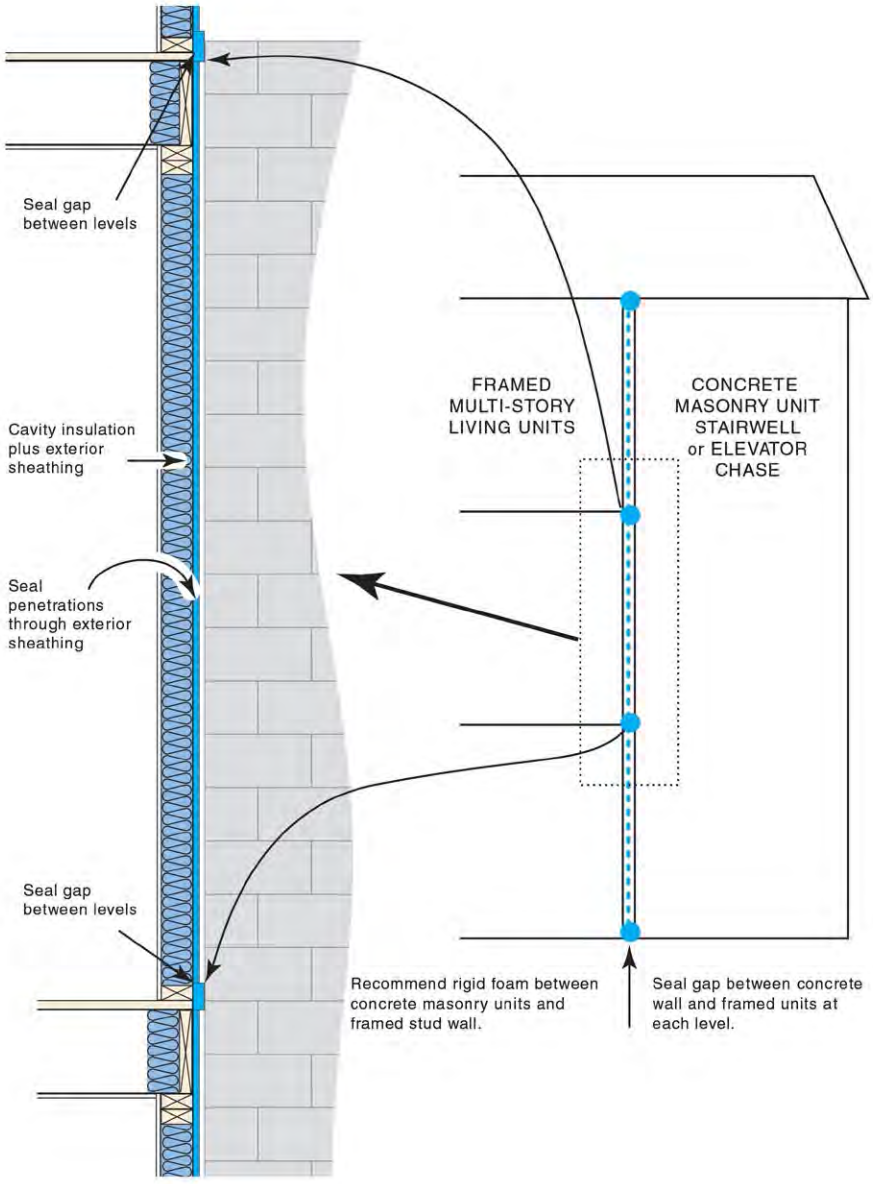
AIR SEALING KEY POINTS (CONTINUED)

Multifamily



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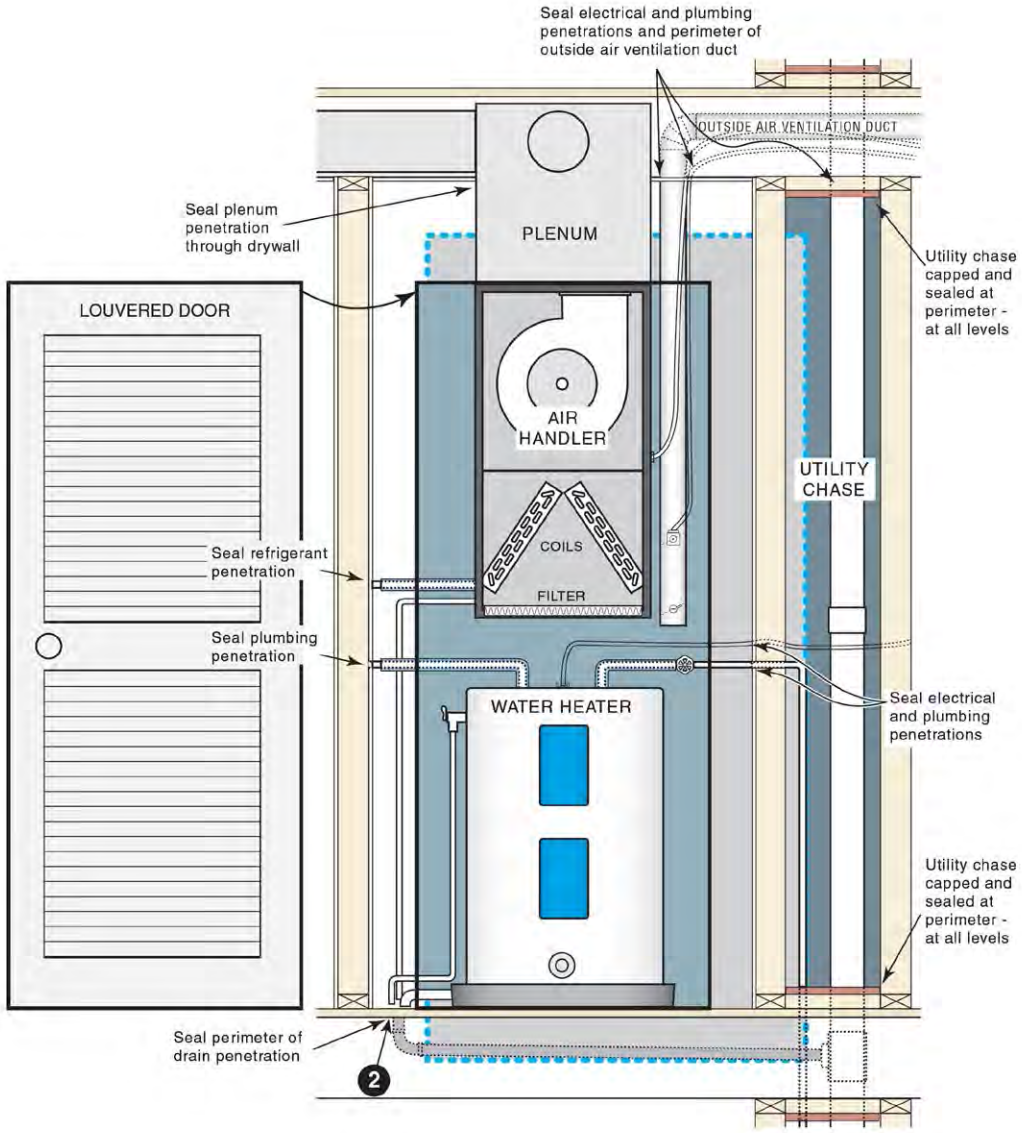
AIR SEALING KEY POINTS (CONTINUED)

Mechanical closet



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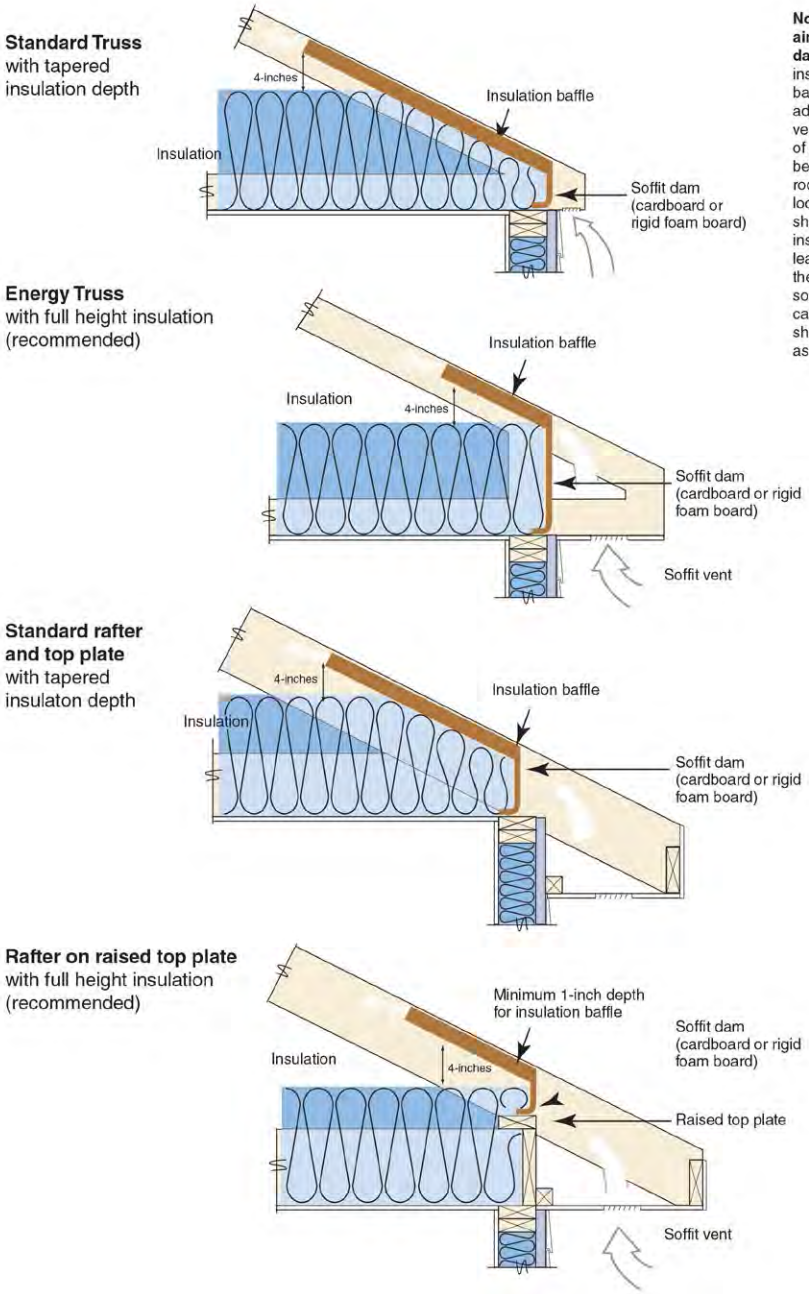
AIR SEALING KEY POINTS (CONTINUED)

Roof and truss



Note: Wind wash baffle and air-permeable insulation dam. For air permeable insulation in vented attics, baffles shall be installed adjacent to soffit and eave vents. A minimum of a 1-inch of space shall be provided between the insulation and the roof sheathing and at the location of the vent. The baffle shall extend over the top of the insulation inward until it is at least 4 inches vertically above the top of the insulation. Any solid material such as cardboard or thin insulating sheathing shall be permissible as the baffle.

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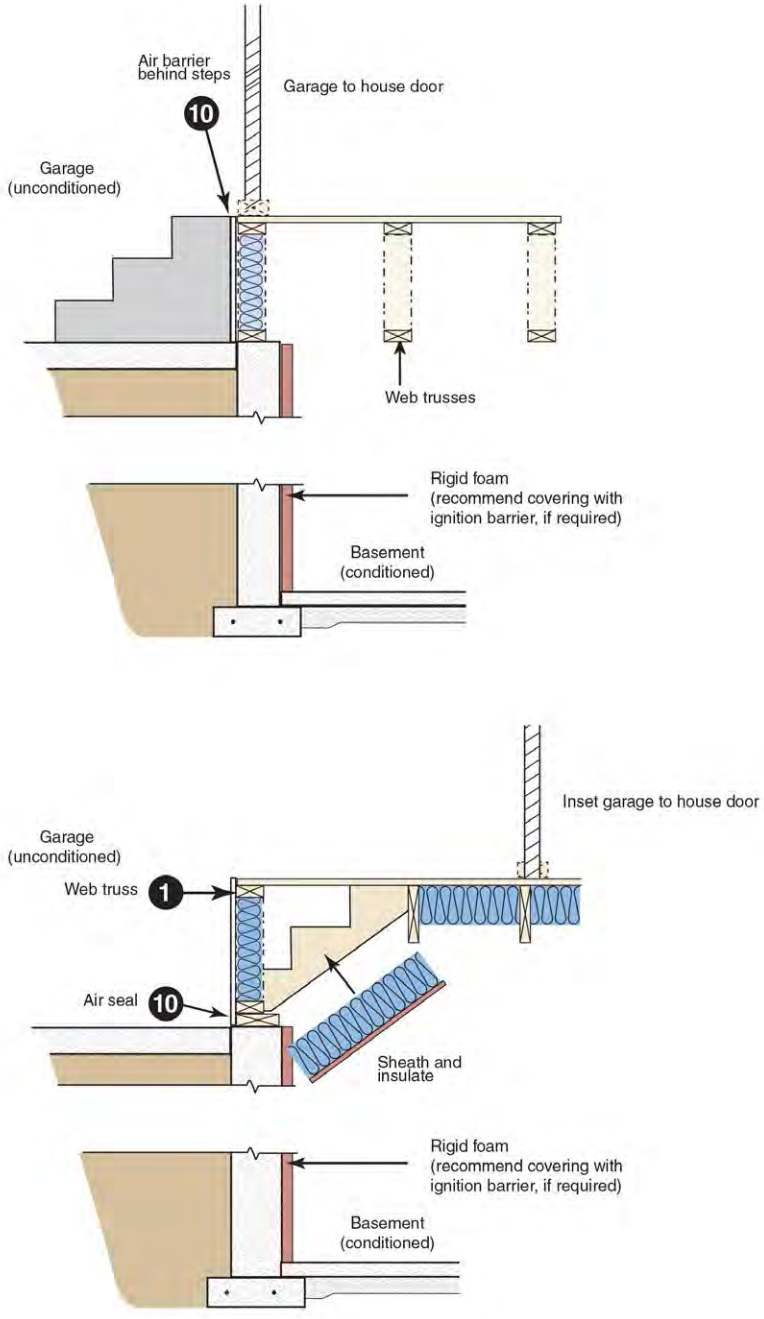
AIR SEALING KEY POINTS (CONTINUED)

Garage



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Glossary

Websites listed were last accessed December 9, 2014. Please note that some of the links below may require subscriptions to access content.

Active Design: An approach to the development of buildings, streets and neighborhoods that uses architecture and urban planning to make daily physical activity and healthy foods more accessible and inviting.

Adaptive plant species: A non-native plant species that performs similarly to a native species in a particular region, state, ecosystem and habitat, and that 1) can survive temperature/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 invasives do.

Adaptive reuse building: An existing building that is being renovated to accommodate a new use, e.g., rehabilitating an old school for use as housing.

Air barrier: Air barriers are systems of materials designed and constructed to control airflow between a conditioned space and an unconditioned space. The air barrier system is the primary air enclosure boundary that separates indoor (conditioned) air and outdoor (unconditioned) air. In multi-unit/townhouse/ apartment construction, the air barrier system also separates the conditioned air from any given unit and adjacent units. *www.buildingscience.com/documents/digests/bsd-104-understanding-air-barriers*

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 62.1 and 62.2-2010: ANSI/ASHRAE Standards 62.1 and 62.2 are the recognized standards for ventilation system design and acceptable IAQ. *www.ashrae.org/standards-research--technology*

ASHRAE Standard 90.1: Provides the minimum requirements for energy-efficient design of most buildings, except low-rise residential buildings. It offers, in detail, the minimum energy-efficient requirements for design and construction of new buildings and their systems, new portions of buildings and their systems, and new systems and equipment in existing buildings, as well as criteria for determining compliance with these requirements.

Berm: A sloped wall or embankment, typically constructed of earth, hay bales or timber framing, used to prevent inflow or outflow of material into or out of an area. *www.epa.gov/OUST/pubs/tum_appx.pdf*

Building Performance Institute (BPI): A national standards development and credentialing organization for residential energy-efficiency retrofit work that provides training through a network of affiliate organizations, individual certifications, company accreditations and quality assurance programs.

California 01350: A Special Environmental Requirements standard specification developed by the state of California to cover key environmental performance and public health considerations for building projects. Contains guidelines for energy, materials, water efficiency, indoor air quality (IAQ), nontoxic performance standards for cleaning and maintenance products, and sustainable site planning and landscaping considerations, among other measures. *www.calrecycle.ca.gov/greenbuilding/specs/section01350/*

CFM (cubic feet per minute): A standard unit of measurement for airflow that indicates how many cubic feet of air are passing through a fixed point per minute.

Charrette: An intense work session that brings together a diverse group of housing professionals as well as funders, policymakers, health practitioners and community stakeholders to integrate sustainable green design principles into affordable housing developments before schematic designs are complete. A charrette sets the stage for a clear vision of project goals and individual responsibilities, but not necessarily final design decisions. *www.enterprisecommunity.com/resources/ResourceDetails?ID=67598.pdf*

Colonias community: Any identifiable community in the U.S.–Mexico border regions of Arizona, California, New Mexico and Texas that is determined to be a colonia on the basis of objective criteria, including lack of a potable water supply, inadequate sewage systems, and a shortage of decent, safe and sanitary housing. The border region means the area within 150 miles of the U.S.–Mexico border, excluding Metropolitan Statistical Areas with populations exceeding one million (according to the National Affordable Housing Act of 1990, Section 916).

Common area: An area available for use by more than one person, including rental or sales offices, entrances, hallways, shared activity or leisure rooms, resident services areas, and laundry rooms.

CSA (Community-Supported Agriculture): A community of individuals who pledge support to a farm operation so that the farmland becomes the community's farm, with the growers and consumers providing mutual support and sharing the risks and benefits of food production. Typically, members of the farm or garden pledge in advance to cover the anticipated costs of the farm operation and the farmer's salary. In return, they receive shares in the farm's bounty throughout the growing season. Members also share in the risks of farming, including poor harvests due to unfavorable weather or pests. *www.nal.usda.gov/afsic/pubs/csa/csadef.shtml*

Compost blanket: A layer of loosely applied compost or composted material that is placed on the soil in disturbed areas to control erosion and retain sediment resulting from sheet-flow runoff. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

CO (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 you before you are aware that it is in your home. At lower levels of exposure, CO causes mild effects that are often mistaken for the flu. These symptoms include headaches, dizziness, disorientation, nausea and fatigue. *www.epa.gov/iaq/co.html*

Dial-a-ride program: A privately or publicly operated program that provides an on-demand ride service, requiring passengers to call ahead to reserve a ride. These programs usually provide connections between different transportation systems and/or employment centers.

Distribution uniformity: A measure of the evenness of irrigation water coverage over a defined area. *www.epa.gov/WaterSense/docs/home_finalspec508.pdf*

Dwelling unit: A single unit providing the complete independent living facilities for one or more people, including permanent provisions for living, sleeping, eating, cooking and sanitation. From Addendum J to ASHRAE 62.2-2010, found online at: *www.ashrae.org/standards-research--technology/standards-addenda*

ECM (electronically commutated motor): Also known as brushless DC motors, ECMs are synchronous motors that are powered by a DC electric source via an integrated inverter/switching power supply that produces an AC electric signal. Used, for example, in HVAC equipment that uses electricity efficiently, particularly at lower speeds.

Emissivity: A unitless measure describing the relative ability of a surface to emit radiation energy ranging from 0.00 (minimum radiation of heat) to 1.00 (maximum radiation of heat). More reflective materials have a lower emissivity.

Employer vanpool: A program in which 5 to 15 people (over the age of 16) ride together to and from work. The vanpool may be public or private, but must carry all passengers more than half the distance to work to qualify. Vanpools may be employer-operated, sponsored by transit agencies, or administered by third-party operators.

ENERGY STAR: A voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Introduced by the EPA in 1992, ENERGY STAR also offers an accepted national standard for certifying new residential construction projects. *www.energystar.gov*

Engineered wood products: Wood building materials manufactured by gluing particles, fibers or veneers to increase strength. For the purposes of Criterion 6.5 Certified, Salvaged and Engineered Wood Products, Green Communities considers prefabricated and precut wood products as "engineered wood products." *www.astm.org/SNEWS/JUNE_2003/yeh_jun03.html*

Entryway: Threshold separating the indoor space from the outdoor space.

Environmental site assessment: An investigation of the site's conditions often performed before acquisition of a property to satisfy the due-diligence requirements of a property transaction.

Erosion blankets or geotextile mats: Porous fabrics used for a variety of purposes, including separators, reinforcement, filtration and drainage, and erosion control. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Filter sock: A mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Formaldehyde: A chemical used widely by industry to manufacture building materials and numerous household products. Formaldehyde is also a byproduct of combustion and certain other natural processes, and thus 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. High levels of exposure may cause some types of cancer. *www.epa.gov/iaq/formaldehyde.html*

Slab: One type of foundation, with many variations (monolithic slabs, floating slabs, rat slabs, in conjunction with a basement, etc.), that may be above, at or below grade. Wood frame crawl foundations are an alternative to slabs.

Greenfield: A previously undeveloped parcel of land.

Green roof: A planted roof that reduces stormwater runoff. *www.epa.gov/heatisland/mitigation/greenroofs.htm*

Greywater: Wastewater produced from baths and showers, clothes washers and lavatories. Greywater gets its name from its cloudy appearance and from its status as being neither fresh (as in potable water) nor heavily contaminated (as in blackwater from toilet waste). *www.epa.gov/watersense/outdoor/rainwater_reuse.html*

HERS Index (Home Energy Rating System Index): A scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2006 International Energy Conservation Code) achieves a HERS Index score of 100, while a net zero energy home achieves a HERS Index score of 0. The lower a home's HERS Index score, the more energy-efficient it is in comparison to the HERS Reference Home. Each 1-point decrease in the HERS Index score corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home; thus a home with a HERS Index score of 85 is 15% more energy-efficient than the HERS Reference Home, and a home with a HERS Index score of 80 is 20% more energy-efficient.

Health Impact Assessment (HIA): A systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project on the health of a population and the distribution of those effects within the population. An HIA provides recommendations on monitoring and managing those effects. *www.pewtrusts.org/en/projects/health-impact-project/health-impact-assessment*

Home Energy Rating: An analysis of a home's construction through plans and on-site inspections. Based on the home's plans, the Home Energy Rater uses an energy-efficiency software package to perform an energy analysis of the home's design. This analysis yields a projected, pre-construction HERS Index. Upon completion of the plan review, the rater will work with the builder to identify the energy-efficiency improvements needed to ensure that the house will meet ENERGY STAR performance guidelines. The rater then conducts on-site inspections, typically including a blower door test (to test the tightness of the dwelling unit envelope) and a duct leakage test (to test the tightness of the ducts). Results of these tests, along with inputs derived from the plan review, are used to generate the HERS Index score for the home.

IECC (International Energy Conservation Code): A model building energy code created by the International Code Council to set a minimum standard for energy efficiency; updated on a three-year schedule. *www.iccsafe.org/*

Infill site: A site with 75% of its perimeter bordering existing development or roads and with access to existing infrastructure.

Integrative design: A design approach that brings together at an early stage in project planning all the members of the building stakeholder community, and the technical planning, design and construction team (including green building consultants such as the green rater, mechanical engineer/energy expert and others) to look at the project objectives, building materials, systems and assemblies from many different perspectives. This approach is a deviation from the typical planning and design process of relying on the expertise of specialists who work in their respective specialties somewhat isolated from each other. *www.enterprisecommunity.com/resources/ResourceDetails?ID=67598.pdf*

Intermittent rate: Ventilation that stops and starts at regular intervals (i.e., the opposite of continuous ventilation).

LED (light-emitting diode): Energy-efficient light technologies that produce less initial heat per lumen, consume less energy, and last longer than conventional incandescent and fluorescent lights.

Low-impact development: A strategy of site design where the goal is to restore the natural, pre-developed ability of an urban site to absorb stormwater. *http://water.epa.gov/polwaste/green/*

Maintained solar reflectance: A measure of a material's ability to maintain its initially rated solar reflectance. Products are tested over a period of three years.

Manual D: Manual prepared by the Air Conditioning Contractors of America (ACCA) on designing residential duct systems. *www.acca.org/technical-manual/manual-d/*

Manual J: Manual prepared by ACCA on determining heating and cooling loads of residential structures. *www.acca.org/technical-manual/manual-j/*

Manual S: Manual prepared by ACCA on selecting residential heating and cooling equipment to match the heating and cooling loads of residential structures. *www.acca.org/technical-manual/manual-s/*

Moderate rehabilitation: A project that does not fully expose the structure and envelope of the building and/or does not include replacement or improvement of two or more major systems of the building, yet is still able to comply with the energy performance requirements of at least one iteration of Criterion 5.1.

Native plant species: A plant species that occurs naturally in a particular region, state, ecosystem and habitat without direct or indirect human actions. *web4.audubon.org/bird/at_home/PlantNativeSpecies.html*

Naturescaping: A method of landscaping that reduces water use, energy consumption and chemical needs by using climate-appropriate plants and maintenance techniques.

Non-buildable land: Land that is not economically feasible to be developed, such as easements, utility fall zones, unsuitable soil, steep grades, water features, wetlands or natural preserves.

Open space: Undeveloped land that is permanently set aside for public use. Open space may be used as community open space or preserved as green space, and includes parcels in conservation easement or land trust, park or recreation areas, and community gardens.

Permeable paving: A porous cover system that encourages groundwater recharge and infiltration. *www.epa.gov/oaintrnt/stormwater/pavers.htm* and *www.epa.gov/greeningepa/stormwater/best_practices.htm*

Phenol-formaldehyde: A resin used in the manufacture of composite wood products primarily for outdoor use, including softwood plywood and flake or oriented strand board. Composite wood products that contain phenol-formaldehyde generally emit formaldehyde at lower rates than those containing urea formaldehyde resin. *www.epa.gov/iaq/formaldehyde.html*

Photocell: A light-sensitive device that detects ambient light and controls exterior fixtures accordingly.

Photovoltaics: Composite materials that convert sunlight directly into electrical power.

Post-consumer waste: Materials or finished products that have served their intended use and so have been diverted or recovered from waste destined for disposal.

Post-industrial waste (also called pre-consumer waste): Materials generated in manufacturing and converting processes such as manufacturing scrap and trimmings and cuttings.

Public–private regional transportation: Private company offering public transit services through a public funding stream, based on a regular schedule and permanent stops.

Radon: A 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 United States. *www.epa.gov/radon*

Recessed light fixture (recessed can): A luminaire that is installed into an opening in the ceiling or wall.

Resilience: The capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance. Relative to climate change, resilience involves adaptation to the wide range of regional and localized impacts that are expected with a warming planet: more intense storms, greater precipitation, coastal and valley flooding, longer and more severe droughts in some areas, wildfires, melting permafrost, warmer temperatures, and power outages. *www.resilientdesign.org/*

Resilient flooring: Flooring products in which the wearing surface is non-textile, including but not limited to rubber, polymeric and linoleum. *www.nsf.org/services/by-industry/sustainability-environment/sustainability-standards-protocols/floor-coverings/*

RESNET (Residential Energy Services Network): A national not-for-profit membership corporation that is a recognized standards-making body for building energy-efficiency rating and certification systems in the United States. *www.resnet.us*

Retention basin: A shallow impoundment, sometimes referred to as a "wet detention pond," designed to capture and retain stormwater runoff during storm events. *http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_wetdtnpn.pdf*

Road section: The cross-section through a street, with particular attention paid to the width of the street and its hydrology. Carefully planned road sections can decrease the amount of impervious surfaces and improve the overall stormwater management for the project site. More information can be found in the document "Low-Impact Development Design Strategies: An Integrated Design Approach," found at *http://water.epa.gov/polwaste/green/*

Rock filter (or filter berm): A permanent or temporary stone structure installed to serve as a sediment-filtering device in drainage ways. Allows a pool to form in an excavated or natural depression, where sediment can settle. The pool is then dewatered through the gravel rock dam. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Silt fencing: A temporary fabric barrier surrounding a site to control stormwater runoff. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Silt sacks: Tube-shaped erosion-control devices. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Solar hot water system: Captures, converts and transfers heat from direct and indirect sunlight to heat an auxiliary water tank and provide hot water for a building's occupants.

Solar reflectance (or albedo): A measure of a material's ability to reflect sunlight (including the visible, infrared and ultraviolet wavelengths) on a scale of 0 to 1. A solar reflectance value of 0.0 indicates that the surface absorbs all solar radiation, and a 1.0 solar reflectance value represents total reflectivity.

Solar south: A measurement of the sun's true position based on its path across the sky. It is different from magnetic south, which is taken from a compass reading. Methods for calculating solar south include the solar noon method or a compass using a magnetic declination chart to correct for magnetic declination.

Static service pressure: The pipeline or municipal water supply pressure when water is not flowing.

Straw bale: A bound block of straw and organic material used to control stormwater runoff. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Substantial rehabilitation: A project that includes the replacement and/or improvement of at least two major systems of the building, including its envelope. Major building systems include roof structures, wall or floor structures, foundations, plumbing, heating and air conditioning, and electrical systems. The building envelope is defined as the air barrier and thermal barrier separating exterior from interior space.

Supportive housing dwelling units: Permanent housing with attached intensive services targeted to populations that have special needs, including people who are currently or formerly homeless; those with serious, chronic mental health issues; people in various stages of recovery from substance abuse; people with HIV/AIDS, or physical or developmental disabilities; the formerly incarcerated, the frail elderly, homeless or emancipated youth, and victims of domestic violence; and other groups that would not be able to live independently and maintain housing without intensive support.

Swales: Shallow grass-covered hydraulic conveyance channels that help to slow runoff and facilitate infiltration. *www.epa.gov/greeningepa/stormwater/best_practices.htm*

T8 fixture: A fixture made up of a tubular fluorescent bulb and an electronic ballast, both operating with a higher efficacy than traditional tubular fluorescent design technology, such as the T12 bulb and magnetic ballast.

Tiers: Earthen embankments that reduce erosion by slowing, collecting and redistributing surface runoff to stable outlets that increase the distance of overland runoff flow. *http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm*

Title 24: The building energy performance standards for the state of California. *www.energy.ca.gov/title24/*

Transit ride: A scheduled stop along a defined route of one form of public transportation (bus, rail or ferry).

Universal Design: The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. The principles of Universal Design are as follows: 1) equitable use, 2) flexibility in use, 3) simple and intuitive use, 4) perceptible information, 5) tolerance for error, 6) low physical effort and 7) size and space for approach and use. *www.ncsu.edu/ncsu/design/cud/about_ud/udprinciplestext.htm*

Urea-formaldehyde: A toxic resin created from formaldehyde that causes similar side effects. Composite wood products made for indoor use, such as particleboard, hardwood plywood paneling and medium-density fiberboard, often contain this resin. *www.epa.gov/iaq/formaldehyde.html*

Vapor retarder: The International Residential Code (IRC) defines vapor retarders as Class I, II or III based on how permeable they are to water vapor—the lower the permeability, the less water vapor that will pass through the vapor retarder.

Class I: Very low permeability vapor retarders—rated at 0.1 perms or less. Sheet polyethylene (visqueen) or unperforated aluminum foil (FSK) are Class I vapor retarders.

Class II: Low permeability vapor retarders—rated greater than 0.1 perms and less than or equal to 1.0 perms. The kraft facing on batts qualifies as a Class II vapor retarder.

Class III: Medium permeability vapor retarders—rated greater than 1.0 perms and less than or equal to 10 perms. Latex and enamel paint qualify as Class III vapor retarders.

For additional information, visit NAIMA at: *www.naima.org/insulation-knowledge-base/residential-home-insulation/insulation-and-vapor-retarders.html*

Vehicle share program: A private system in which a company or a group of individuals share vehicles on a reservation basis and pay for the use on the basis of time or mileage. Programs that qualify under Criterion 2.8 Access to Public Transportation must have an established formal agreement among participants.

Ventilation: The process of supplying outdoor air to, or removing air from, a dwelling by natural or mechanical means. Such air may or may not have been conditioned.

VOCs (volatile organic compounds): A large group of carbon-based chemicals that easily evaporate at room temperature. *www.epa.gov/iaq/voc.html*

Walk distance: The distance a pedestrian must travel between origins and destinations without obstruction, in a safe and comfortable environment on a continuous network of sidewalks, all-weather-surface footpaths, crosswalks or equivalent pedestrian facilities. Any crossing of a street with speeds at or greater than 30 miles per hour requires controlled crossing (e.g., a stop sign or stop light).

Water factor: The quotient of the total weighted per-cycle water consumption divided by the capacity of the clothes washer. Lower numbers indicate more efficient use of water.

Watershed: The area of land where all of the water that is under it or drains off of it goes into the same place. *http://water.epa.gov/type/watersheds/whatis.cfm*

Weather-based irrigation controller (WBIC): An automated "thermostat for your sprinkler system" that operates your irrigation system based on local weather, landscape conditions and plant watering needs. *www.epa.gov/watersense/docs/irrigation_controller_rpt_minireport_508.pdf*

Weekend ride options: A public transit option of either bus, rail or ferry service. Employer-assisted vanpools and dial-a-ride programs are examples of qualifying weekend service.

Well-being: Well-being includes the presence of positive emotions and moods (e.g., contentment, happiness), the absence of negative emotions (e.g., depression, anxiety), satisfaction with life, fulfillment and positive functioning. In simple terms, well-being can be described as judging life positively and feeling good.

Xeriscaping: A method of landscaping aimed at reducing or eliminating excess water from irrigation by using drought-tolerant plants. *www.epa.gov/greeningepa/glossary.htm#xeriscaping*

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Phase 4

11-28-2018

M = MANDATORY
# = OPTIONAL POINTS

2015 Enterprise Green Communities Criteria Checklist

This checklist provides an overview of the technical requirements within the Enterprise Green Communities Criteria. **To achieve Enterprise Green Communities Certification, all projects must achieve compliance with the Criteria mandatory measures applicable to that construction type. Additionally, New Construction projects must achieve 35 optional points, Substantial Rehab projects must achieve 30 optional points, and Moderate Rehab projects must also achieve 30 optional points.**

1. INTEGRATIVE DESIGN

YES ○ NO ○ MAYBE — M

1.1a Goal Setting

Develop an integrative design process that works best for your project team and intentions. At minimum, document:

1. A statement of the overall green development goals of the project and the expected intended outcomes from addressing those goals.
2. A summary of the integrative process that was used to select the green building strategies, systems and materials that will be incorporated into the project.
3. A description of how progress and success against these goals will be measured throughout the completion of design, construction and operation to ensure that the green features are included and correctly installed.

YES ○ NO ○ MAYBE — M

1.1b Criteria Documentation

Create design and construction documentation to include information on implementation of appropriate Enterprise Green Communities Criteria.

○ YES ○ NO ○ MAYBE — 9

1.1c Designing for Project Performance

Identify how the expected performance of your project compares to the actual performance of other projects in your portfolio and/or community.

YES ○ NO ○ MAYBE — M

1.2a Resident Health and Well-Being: Design for Health

Identify potential resident health factors and design your project to address resident health and well-being by using the matrix provided on pages 22 and 23.

○ YES NO ○ MAYBE — 12

1.2b Resident Health and Well-Being: Health Action Plan

At pre-design and continuing throughout the project life cycle, collaborate with public health professionals and community stakeholders to assess, identify, implement and monitor achievable actions to enhance health-promoting features of the project and minimize features that could present health risks. Specifically, create a Health Action Plan and integrate the selected interventions and a plan for monitoring and evaluating progress per the full criterion.

YES ○ NO ○ MAYBE — M

1.3a Resilient Communities: Design for Resilience *(New Construction and Substantial Rehab only)*

Given your project building type, location and expected resident population, identify a project characteristic that would most likely impact your project's ability to withstand an unexpected weather event or loss of power. Select at least one criterion from the given list that would help mitigate that impact, and incorporate this within your project plans and design. Include a short narrative providing your rationale for selecting this criterion above the others.

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INTEGRATIVE DESIGN *(continued)*

○ YES ● NO ○ MAYBE 15

1.3b Resilient Communities: Multi-Hazard Risk/Vulnerability Assessment
Carry out a Vulnerabilities Assessment and implement building elements designed to enable the project to adapt to, and mitigate, climate impacts given the project location, building/construction type and resident population.

SUBTOTAL OPTIONAL POINTS

2. LOCATION + NEIGHBORHOOD FABRIC

New Construction: All new construction projects must earn optional points under Criterion 2.8 Access to Public Transportation, **OR** earn 8 optional points through selecting one or more of the following:

- 2.7 Preservation of and Access to Open Space
- 2.9 Improving Connectivity to the Community
- 2.12 Access to Fresh, Local Foods
- 2.13 LEED for Neighborhood Development Certification
- 2.14 Local Economic Development and Community Wealth Creation

● YES ○ NO ○ MAYBE M

2.1 Sensitive Site Protection
Do not locate new projects, including buildings, built structures, roads or parking areas, on portions of sites that meet any of the following provisions:

1. Land within 100 feet of wetlands, including isolated wetlands or streams. Maintain or establish riparian buffer using native vegetation where possible. Bike and foot paths are allowed if at least 25 feet from the wetlands boundary.
2. Land on slope greater than 15%.
3. Land with prime soils, unique soils or soils of state significance per USDA designations.
4. Public parkland.
5. Land that is specifically identified as an existing habitat for any species on federal or state threatened or endangered lists.
6. Land that is within the Special Flood Hazard Areas (SFHA) as identified by FEMA on the Flood Insurance Rate Map.

● YES ○ NO ○ MAYBE M

2.2 Connections to Existing Development and Infrastructure *(Except for projects located on rural tribal lands, in colonias communities, or in communities with populations of less than 10,000)*
Locate the project on a site with access to existing roads, water, sewers and other infrastructure within or contiguous to (having at least 25% of the perimeter bordering) existing development. Connect the project to the pedestrian grid.

● YES ○ NO ○ MAYBE M

2.3 Compact Development
At a minimum, build to the residential density (dwelling units/acre) of the census block group in which your project is located.

○ YES ○ NO ● MAYBE 5 or 7

2.4 Compact Development
Exceed the residential density (dwelling units/acre) of the census block group in which your project is located. Exceed by 2x for *[5 points]*; exceed by 3x for *[7 points]*.

M = MANDATORY
# = OPTIONAL POINTS

LOCATION + NEIGHBORHOOD FABRIC *(continued)*

◉ YES ○ NO ○ MAYBE	M	**2.5 Proximity to Services** Locate the project within a 0.5-mile walk distance of at least four, or a 1-mile walk distance of at least seven, of the listed services. For projects that qualify as Rural/Tribal/Small Town, locate the project within 5 miles of at least four of the listed services.
◉ YES ○ NO ○ MAYBE	M	**2.6 Preservation of and Access to Open Space for Rural/Tribal/Small Towns** Set aside a minimum of 10% (minimum of 0.25 acre) of the total project acreage as non-paved open space for use by all residents **OR** locate the project within a 0.25-mile walk distance of dedicated public non-paved open space that is a minimum of 0.75 acres.
○ YES ◉ NO ○ MAYBE	6 max	**2.7 Preservation of and Access to Open Space** Set aside a percentage of non-paved open space for use by all residents. 20% *[2 points]*; 30% *[4 points]*; 40% + written statement of preservation/conservation policy for set-aside land *[6 points]*.
○ YES ○ NO ◉ MAYBE	8 or 10	**2.8 Access to Public Transportation** Locate projects within a 0.5-mile walk distance of transit services combined (bus, rail and/or ferry), constituting at least 60 or more transit rides per weekday, with some type of weekend ride option. *[8 points]* For projects that qualify as Rural/Tribal/Small Town, locate the project within a 5-mile distance of at least one of the following transit options: 1) vehicle share program; 2) dial-a-ride program; 3) employer vanpool; 4) park-and-ride; or 5) public–private regional transportation. *[8 points]* *For an additional 2 points:* Locate the project along dedicated bike trails or lanes that lead to transit services or stations (bus, rail and ferry) within 3 miles.
○ YES ○ NO ◉ MAYBE	2 to 8	**2.9 Improving Connectivity to the Community** Improve access to community amenities through at least one of the transit, auto or biking mobility measures listed.
○ YES ◉ NO ○ MAYBE	5 max	**2.10 Passive Solar Heating/Cooling** Design and build with passive solar design, orientation and shading that meet specificed guidelines.
○ YES ◉ NO ○ MAYBE	4	**2.11 Brownfield Site or Adaptive Reuse Building** Rehabilitate an existing structure that was not previously used as housing or locate the project on a brownfield site.
○ YES ◉ NO ○ MAYBE	6	**2.12 Access to Fresh, Local Foods** Pursue one of three options to provide residents and staff with access to fresh, local foods, including neighborhood farms and gardens, community-supported agriculture, or proximity to farmers markets.
○ YES ◉ NO ○ MAYBE	4	**2.13 LEED for Neighborhood Development Certification** Locate building(s) in a Stage 2 Pre-Certified or Stage 3 Certified Neighborhood Development.
○ YES ○ NO ◉ MAYBE	6 max	**2.14 Local Economic Development and Community Wealth Creation** Demonstrate that local preference for construction employment and subcontractor hiring was part of your bidding process *[2 points]* **OR** demonstrate that you achieved at least 20% local employment *[3 points]* **OR** provide physical space for small business, nonprofits, and/or skills and workforce education *[3 points]*.

SUBTOTAL OPTIONAL POINTS

M = MANDATORY
# = OPTIONAL POINTS

3. SITE IMPROVEMENTS

YES ◯ NO ◯ MAYBE — M

3.1 Environmental Remediation
Conduct an environmental site assessment to determine whether any hazardous materials are present on-site; mitigate any found.

YES ◯ NO ◯ MAYBE — M

3.2 Erosion and Sedimentation Control *(Except for infill sites with buildable area smaller than one acre)*
Implement EPA's Best Management Practices for Construction Site Stormwater Runoff Control, or local requirements, whichever is more stringent.

◯ YES ◯ NO ◯ MAYBE — M
N/A

3.3 Low-Impact Development
Projects located on greenfields must meet the list of low-impact development criteria.

YES ◯ NO ◯ MAYBE — M

3.4 Landscaping
If providing plantings, all should be native or adapted to the region, appropriate to the site's soil and microclimate, and none of the new plants is an invasive species. Reseed or xeriscape all disturbed areas.

◯ YES ◯ NO ◯ MAYBE — M
N/A

3.5a Efficient Irrigation and Water Reuse
If irrigation is used, install an efficient irrigation or water reuse system per the guidelines.

◯ YES ◯ NO ◯ MAYBE — 4 or 8
N/A

3.5b Efficient Irrigation and Water Reuse
Install an efficient irrigation system equipped with a WaterSense-labeled weather-based irrigation controller (WBIC) **OR** at least 50% of the site's irrigation should be satisfied by reusing water.

◯ YES NO ◯ MAYBE — 4 or 8

3.6 Surface Stormwater Management
Retain, infiltrate and/or harvest the first 1.0 inch of rain that falls *[4 points]* **OR** as calculated for a 24-hour period of a one-year (1) storm event, so that no stormwater is discharged to drains/inlets. *[8 points]* For both options, permanently label all storm drains and inlets.

◯ YES NO ◯ MAYBE — 1

3.7 Reducing Heat-Island Effect: Paving
Use light-colored, high-albedo materials and/or an open-grid pavement, with a minimum solar reflectance of 0.3, over at least 50% of the site's hardscaped area.

SUBTOTAL OPTIONAL POINTS

4. WATER CONSERVATION

YES ◯ NO ◯ MAYBE — M

4.1 Water-Conserving Fixtures
Install water-conserving fixtures in all units and any common facilities with the following specifications. *Toilets:* WaterSense-labeled and 1.28 gpf; *Urinals*: WaterSense-labeled and 0.5 gpf; *Showerheads:* WaterSense-labeled and 2.0 gpm; *Kitchen faucets*: 2.0 gpm; *Lav faucets*: WaterSense-labeled and 1.5 gpm

AND for all single-family homes and all dwelling units in buildings three stories or fewer, the static service pressure must not exceed 60 psi.

M = MANDATORY
# = OPTIONAL POINTS

WATER CONSERVATION *(continued)*

○ YES ○ NO ● MAYBE — 6 max

4.2 Advanced Water Conservation

Reduce water consumption either by installing water-conserving fixtures in all units and all common space bathrooms with the following specifications: *Toilets:* WaterSense-labeled and 1.1 gpf *[1 point]*; *Showerheads*: WaterSense-labeled and 1.5 gpm *[1 point]*; *Kitchen faucets:* 1.5 gpm and *lav faucets:* WaterSense-labeled and 1.0 gpm *[1 point]*

OR

Reduce total indoor water consumption by at least 30% compared to the baseline indoor water consumption chart, through a combination of your choosing. *[6 points maximum]*

○ YES ● NO ○ MAYBE — 4

4.3 Leaks and Water Metering

Conduct pressure-loss tests and visual inspections to determine if there are any leaks; fix any leaks found; and meter or submeter each dwelling unit with a technology capable of tracking water use. Separately meter outdoor water consumption.

○ YES ● NO ○ MAYBE — 4

4.4 Efficient Plumbing Layout and Design

To minimize water loss from delivering hot water, the hot water delivery system shall store no more than 0.5 gallons of water in any piping/manifold between the hot water source and any hot water fixture.

○ YES ● NO ○ MAYBE — 6 max

4.5 Water Reuse

Harvest, treat, and reuse rainwater and/or greywater to meet a portion of the project's total water needs: 10% reuse *[3 points]*; 20% reuse *[4 points]*; 30% reuse *[5 points]*; 40% reuse *[6 points]*

○ YES ● NO ○ MAYBE — 8

4.6 Access to Potable Water During Emergencies

Provide residents with access to potable water in the event of an emergency that disrupts normal access to potable water, including disruptions related to power outages that prevent pumping water to upper floors of multifamily buildings or pumping of water from on-site wells, per one of the three options.

SUBTOTAL OPTIONAL POINTS

5. ENERGY EFFICIENCY

● YES ○ NO ○ MAYBE — M

5.1a Building Performance Standard *(New Construction: single-family and low-rise multifamily)*

Certify each dwelling unit in the project through the ENERGY STAR New Homes program.

○ YES ○ NO ○ MAYBE — M

N/A

5.1b Building Performance Standard *(New Construction: mid-rise and high-rise multifamily, with some exceptions)*

Certify the project through the ENERGY STAR Multifamily High-Rise program (MFHR) **OR** follow the combined MFHR and LEED Commissioning Path outlined in the criterion.

Exception: Multifamily buildings that are four or five stories, in which all dwelling units have their own heating, cooling and hot water systems, should comply with Criterion 5.1a and certify each dwelling unit per ENERGY STAR Certified New Homes.

M = MANDATORY
# = OPTIONAL POINTS

ENERGY EFFICIENCY *(continued)*

◯ YES ◯ NO ◯ MAYBE — M

5.1c Building Performance Standard *(Substantial and Moderate Rehab: single-family and low-rise multifamily)*

N/A

For each dwelling unit, achieve a HERS Index score of 85 or less.

Exception: Substantial rehabs of buildings with walls made only of brick/masonry that are three stories or fewer and built before 1980, as well as moderate rehabs of buildings that are three stories or fewer and built before 1980, are permitted to instead achieve a HERS Index score of 100 or less for each dwelling unit.

◯ YES ◯ NO ◯ MAYBE — M

5.1d Building Performance Standard *(Substantial and Moderate Rehab: mid-rise and high-rise)*

N/A

Demonstrate that the energy performance of the completed building will be equivalent to ASHRAE 90.1-2010 using an energy model created by a qualified energy services provider per Appendix G.

◯ YES ◉ NO ◯ MAYBE — 5 to 12

5.2a Additional Reductions in Energy Use

Design and construct a building that is projected to be at least 5% more efficient than what is required of the project by Criteria 5.1a–d. (Projects receiving points in Criterion 5.2a may not receive points per Criterion 5.2b)

◯ YES ◉ NO ◯ MAYBE — 12

5.2b Advanced Certification: Nearing Net Zero

Certify the project in a program that requires advanced levels of building envelope performance such as PHIUS, Living Building Challenge and/or DOE Zero Energy Ready Home. (Projects receiving points in Criterion 5.2b may not receive points per Criterion 5.2a)

◉ YES ◯ NO ◯ MAYBE — M

5.3 Sizing of Heating and Cooling Equipment

Size and select heating and cooling equipment in accordance with the Air Conditioning Contractors of America (ACCA) Manuals J and S or ASHRAE handbooks.

◉ YES ◯ NO ◯ MAYBE — M

5.4 ENERGY STAR Appliances

If providing appliances, install ENERGY STAR clothes washers, dishwashers and refrigerators. If appliances will not be installed or replaced at this time, specify that, at the time of installation or replacement, ENERGY STAR models must be used.

◉ YES ◯ NO ◯ MAYBE — M

5.5 Lighting

Follow the guidance for high-efficacy lighting controls and other characteristics for all permanently installed lighting fixtures in project dwelling units, common spaces and exterior

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5.6 Electricity Meter

◉ YES ◯ NO ◯ MAYBE — M *New Construction and Substantial Rehab*

◯ YES ◉ NO ◯ MAYBE — 6 *Moderate Rehab (Except for single-room occupancy and designated supportive housing dwelling units)*

Install individual or submetered electric meters for all dwelling units.

◯ YES ◉ NO ◯ MAYBE — 4

5.7a Photovoltaic/Solar Hot Water Ready

Orient, design, engineer, wire and/or plumb the development to accommodate installation of photovoltaic (PV) or solar hot water system in the future.

M = MANDATORY
# = OPTIONAL POINTS

ENERGY EFFICIENCY *(continued)*

○ YES ● NO ○ MAYBE 10 max

5.7b Renewable Energy

Install photovoltaic (PV) panels or other electric-generating renewable energy source to provide a specified percentage of the project's estimated total energy demand or water heating energy demand. *(Projects may earn points through Criterion 5.7b or 5.8b, but not both.)*

	5%	10%	20%	30%	40%
Single-story/Single-family	—	—	6	8	10
2 to 3 stories	—	6	8	10	—
4 stories or more	6	8	10	—	—

○ YES ● NO ○ MAYBE 8

5.8a Resilient Energy Systems: Floodproofing

Conduct floodproofing, including perimeter floodproofing (barriers/shields), of lower floors. Design and install building systems as specified by the full criterion so that the operation of those systems will not be grossly affected in case of a flood.

○ YES ● NO ○ MAYBE 4 to 8

5.8b Resilient Energy Systems: Islandable Power

Provide emergency power through an islandable photovoltaic (PV) system or an efficient and portable generator that will offer at least limited electricity for critical circuits during power outages per one of the three options listed. *(Projects may earn points through Criterion 5.7b or 5.8b, but not both.)*

SUBTOTAL OPTIONAL POINTS

6. MATERIALS

● YES ○ NO ○ MAYBE M

6.1 Low/No VOC Paints, Coatings and Primers

All interior paints and primers must have VOC levels, in grams per liter, less than or equal to the thresholds established by South Coast Air Quality Management District (SCAQMD) Rule 1113.

● YES ○ NO ○ MAYBE M

6.2 Low/No VOC Adhesives and Sealants

All adhesives and sealants (including caulks) must have VOC levels, in grams per liter, less than or equal to the thresholds established by the South Coast Air Quality Management District Rule 1168.

○ YES ○ NO ● MAYBE 3 max

6.3 Recycled Content Material

Incorporate building materials that are composed of at least 25% post-consumer recycled content or at least 50% post-industrial recycled content. *[1 point]*

Building materials that make up at least 75% of their project component each receive *1 point*.

○ YES ○ NO ● MAYBE 4 max

6.4 Regional Materials

Use products that were extracted, processed and manufactured within 500 miles of the project for a minimum of 50%, based on cost, of the building materials' value.

Select any or all of these options (each material can qualify for *1 point*):

- Framing materials
- Exterior materials (e.g., siding, masonry, roofing)
- Flooring materials
- Concrete/cement and aggregate material
- Drywall/interior sheathing materials

M = MANDATORY
# = OPTIONAL POINTS

MATERIALS *(continued)*

○ YES ● NO ○ MAYBE — 1

6.5 Certified, Salvaged and Engineered Wood Products

For at least 25% of all structural wood products, by cost or value, commit to using either FSC-certified, salvaged products or engineered framing materials without urea formaldehyde.

● YES ○ NO ○ MAYBE — M

6.6 Composite Wood Products that Emit Low/No Formaldehyde

All composite wood products must be certified as compliant with California 93120 Phase 2 **OR**, if using a composite wood product that does not comply with California 93120 Phase 2, all exposed edges and sides must be sealed with low-VOC sealants, per Criterion 6.2.

● YES ○ NO ○ MAYBE — M

6.7a Environmentally Preferable Flooring

Do not install carpets in building entryways, laundry rooms, bathrooms, kitchens/kitchenettes, utility rooms or any rooms built on foundation slabs. Where installed, all carpet products must meet the Carpet and Rug Institute's Green Label or Green Label Plus certification for carpet, pad and carpet adhesives. Any hard surface flooring products must be either ceramic tile or solid unfinished hardwood floors, or meet the Scientific Certification System's FloorScore program criteria (including pre-finished hardwood flooring).

○ YES ● NO ○ MAYBE — 6

6.7b Environmentally Preferable Flooring: Throughout Building

Use non-vinyl, non-carpet floor coverings throughout each building in the project.

● YES ○ NO ○ MAYBE — M

6.8 Mold Prevention: Surfaces

Use materials that have durable, cleanable surfaces throughout bathrooms, kitchens and laundry rooms. Materials installed in these rooms should not be prone to deterioration due to moisture intrusion or encourage the growth of mold.

● YES ○ NO ○ MAYBE — M

6.9 Mold Prevention: Tub and Shower Enclosures

Use moisture-resistant backing materials such as cement board, fiber cement board or equivalent per ASTM #D3273 behind tub/shower enclosures. Projects using a one-piece fiberglass tub/shower enclosure are exempt from this requirement.

○ YES ○ NO ● MAYBE — 12 max

6.10 Asthmagen-Free materials

Do not install products that contain ingredients that are known to cause or trigger asthma. Key products to avoid are:

- *Insulation:* Do not use spray polyurethane foam (SPF) or formaldehyde-containing fiberglass batts. *[4 points]*
- *Flooring:* Do not use flexible vinyl (PVC) roll or sheet flooring or carpet-backed with vinyl with phthalates. Do not use fluid applied finish floors. *[4 points]*
- *Wall coverings:* Do not use wallpaper made from vinyl (PVC) with phthalates or site-applied high-performance coatings that are epoxy or polyurethane based. *[4 points]*
- *Composite wood:* Use only ULEF products for cabinetry, subflooring and other interior composite wood uses. *[4 points]*

○ YES ○ NO ● MAYBE — 5

6.11 Reduced Heat-Island Effect: Roofing

Use an ENERGY STAR–certified roofing product for 100% of the roof area **OR** install a "green" (vegetated) roof for at least 50% of the roof area and ENERGY STAR–certified roofing product for the remainder of the roof area.

M = MANDATORY
# = OPTIONAL POINTS

MATERIALS *(continued)*

YES ○ NO ○ MAYBE — M or 6 max

6.12 Construction Waste Management

Commit to following a waste management plan that reduces non-hazardous construction and demolition waste through recycling, salvaging or diversion strategies through one of the three options. Achieve optional points by going above and beyond the requirement.

○ YES ● NO ○ MAYBE — 3

6.13 Recycling Storage

Provide separate bins for the collection of trash and recycling for each dwelling unit and all shared community rooms (if applicable).

Additionally, in multifamily buildings, provide at least one easily accessible, permanent and dedicated indoor area for the collection and storage of materials for recycling. In single-family homes, points will be accrued only if curb-side recycling pickup is available.

Collected materials should include, at a minimum, paper, cardboard, glass, metals and plastics.

SUBTOTAL OPTIONAL POINTS

7. HEALTHY LIVING ENVIRONMENT

7.1 Ventilation

● YES ○ NO ○ MAYBE — M — *New Construction and Substantial Rehab*

○ YES ● NO ○ MAYBE — 12 max — *Moderate Rehab*

For each dwelling unit, in full accordance with ASHRAE 62.2-2010, install a local mechanical exhaust system in each bathroom *[4 points]*, a local mechanical exhaust system in each kitchen *[4 points]*, and a whole-house mechanical ventilation system *[4 points]*.

For each multifamily building of four stories and more, in full accordance with ASHRAE 62.1-2010, install a mechanical ventilation system for all hallways and common spaces *[3 points]*.

For all project types, in addition to the above requirements:

- All systems and associated ductwork must be installed per manufacturer's recommendations.
- All individual bathroom fans must be ENERGY STAR labeled, wired to turn on with the light switch, and equipped with a humidistat sensor, timer or other control (e.g., occupancy sensor, delay off switch, ventilation controller).
- If using central ventilation systems with rooftop fans, each rooftop fan must be direct-drive and variable-speed with speed controller mounted near the fan. Fans with design CFM 300-2000 must also have an ECM motor.

● YES ○ NO ○ MAYBE — M

7.2 Clothes Dryer Exhaust

Clothes dryers must be exhausted directly to the outdoors using rigid-type ductwork (except for condensing dryers, which must be plumbed to a drain).

M = MANDATORY
# = OPTIONAL POINTS

HEALTHY LIVING ENVIRONMENT *(continued)*

YES ○ NO ○ MAYBE M

7.3 Combustion Equipment

For new construction and rehab projects, specify power-vented or direct vent equipment when installing any new combustion appliance for space or water heating that will be located within the conditioned space.

In Substantial and Moderate Rehabs, if there is any combustion equipment located within the conditioned space for space or water heating that is not power-vented or direct vent and that is not scheduled for replacement, conduct initial combustion safety testing per the given guidelines.

Install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone, placed per National Fire Protection Association (NFPA) 720.

YES ○ NO ○ MAYBE 9 or 11

7.4 Elimination of Combustion Within the Conditioned Space

No combustion equipment may be used for cooking (to include, but not limited to ranges, cooktops, stoves, ovens) as part of the building project *[9 points]* **OR** no combustion equipment may be used as part of the building project *[11 points]*.

YES ○ NO ○ MAYBE M

7.5 Vapor Retarder Strategies

Install vapor barriers that meet specified criteria appropriate for the foundation type.

YES ○ NO ○ MAYBE M

7.6 Water Drainage *(For all New Construction projects and those Rehab projects that include replacing particular assemblies called out below)*

Provide drainage of water away from walls, windows and roofs by implementing the list of techniques.

YES ○ NO ○ MAYBE M

7.7 Mold Prevention: Water Heaters

Provide adequate drainage for water heaters that includes drains or catch pans with drains piped to the exterior of the dwelling.

YES ○ NO ○ MAYBE M

7.8 Radon Mitigation

For New Construction in EPA Zone 1 areas, install passive radon-resistant features below the slab and a vertical vent pipe with junction box within 10 feet of an electrical outlet in case an active system should prove necessary in the future. For Substantial Rehab projects in EPA Zone 1, test and mitigate per the specified protocols.

○ YES ○ NO ○ MAYBE M

N/A

7.9 Garage Isolation

- Provide a continuous air barrier between the conditioned space and any garage space to prevent the migration of any contaminants into the living space. Visually inspect common walls and ceilings between attached garages and living spaces to ensure that they are air-sealed before insulation is installed.
- Do not install ductwork or air handling equipment in a garage.
- Fix all connecting doors between conditioned space and garage with gaskets or otherwise make substantially airtight with weather stripping.
- Install one hard-wired carbon monoxide (CO) alarm with battery backup function for each sleeping zone of the project, placed per National Fire Protection Association (NFPA) 720.

YES ○ NO ○ MAYBE M

7.10 Integrated Pest Management

Seal all wall, floor, and joint penetrations with low-VOC caulking or other appropriate nontoxic sealing methods to prevent pest entry.

M = MANDATORY
# = OPTIONAL POINTS

HEALTHY LIVING ENVIRONMENT *(continued)*

YES ◉ NO ○ MAYBE — 9

7.11a Beyond ADA: Universal Design *(New Construction)*

Design a minimum of 15% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. Design the remainder of the ground-floor units and elevator-reachable units in accordance with ICC/ANSI A117.1, Type B.

YES ○ NO ○ MAYBE — 7 or 9

N/A

7.11b Beyond ADA: Universal Design *(Substantial and Moderate Rehab)*

Design a minimum of 10% of the dwelling units (one, at minimum) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. *[7 points]*

For an additional 2 points: Design the remainder of the ground-floor units and elevator-reachable units with accessible unit entrances designed to accommodate people who use a wheelchair.

YES ◉ NO ○ MAYBE — M

7.12 Active Design: Promoting Physical Activity Within the Building

Situate at least one building stairway per the criterion to encourage use **OR** emphasize at least one strategy inside the building designed to increase frequency and duration of physical activity per the criterion.

YES ○ NO ◉ MAYBE — 10

7.13 Active Design: Staircases and Building Circulation

A staircase must be accessible and visible from the main lobby as well as visible within a 25-foot walking distance from any edge of lobby. Ensure that no turns or obstacles prevent visibility of or accessibility to the qualifying staircase from the lobby, and that the staircase is encountered before or at the same time as the elevators.

From the corridor, accessible staircases should be made visible by: Providing transparent glazing of at least 10 square feet (1 square meter) at all stair doors or at a side light **OR** providing magnetic door holds on all doors leading to the stairs **OR** removing door enclosures/vestibules.

YES ◉ NO ○ MAYBE — 9

7.14 Interior and Outdoor Activity Spaces for Children and Adults

Provide an on-site dedicated recreation space with exercise or play opportunities for adults and/or children that is open and accessible to all residents; see criterion for specifics.

YES ○ NO ○ MAYBE — M

N/A

7.15 Reduce Lead Hazards in Pre-1978 Buildings *(Substantial Rehab)*

Conduct lead risk assessment or inspection to identify lead hazards, then control for these per EPA or state/local laws and requirements.

YES ○ NO ◉ MAYBE — 10

7.16 Smoke-Free Building

Implement and enforce a no-smoking policy in all common and individual living areas, and within a 25-foot perimeter around the exterior of all residential projects.

SUBTOTAL OPTIONAL POINTS

M = MANDATORY
# = OPTIONAL POINTS

8. OPERATIONS, MAINTENANCE + RESIDENT ENGAGEMENT

YES ○ NO ○ MAYBE — M

8.1 Building Operations & Maintenance (O&M) Manual and Plan *(For all multifamily projects)*

Develop a manual with thorough building operations and maintenance guidance and a complementary plan. The manual and plan should be developed over the course of the project design, development and construction stages, and should include sections/chapters addressing the list of topics.

YES ○ NO ○ MAYBE — M

8.2 Emergency Management Manual *(For all multifamily projects)*

Provide a manual on emergency operations targeted toward operations and maintenance staff and other building-level personnel. The manual should address responses to various types of emergencies, leading with those that have the greatest probability of negatively affecting the project. The manual should provide guidance as to how to sustain the delivery of adequate housing throughout an emergency and cover a range of topics, including but not limited to:

- communication plans for staff and residents
- useful contact information for public utility and other service providers
- infrastructure and building "shutdown" procedures

YES ○ NO ○ MAYBE — M

8.3 Resident Manual

Provide a guide for homeowners and renters that explains the intent, benefits, use and maintenance of their home's green features and practices. The Resident Manual should encourage green and healthy activities per the list of topics.

YES ○ NO ○ MAYBE — M

8.4 Resident and Property Staff Orientation

Provide a comprehensive walk-through and orientation for all residents, property manager(s) and buildings operations staff. Use the appropriate manuals (see Criteria 8.1, 8.2, 8.3) as the base of the curriculum, and review the project's green features, operations and maintenance procedures, and emergency protocols.

YES ○ NO ○ MAYBE — M

8.5 Project Data Collection and Monitoring System: 100% Owner-Paid Utility Accounts; 15% Tenant-Paid Utility Accounts

For rental properties: Collect and monitor project energy and water performance data for 100% of owner-paid utilities and 15% of tenant-paid utilities for at least 5 years. This data must be maintained in a manner that allows staff to easily access and monitor it, enabling them to make informed operations and capital planning decisions. Also allow Enterprise access to this data.

For owner-occupied units: Collect and monitor energy and water performance data in a manner that allows for easy access and review and provides the ability to influence home operations. Also allow Enterprise access to this data.

○ YES ○ NO MAYBE — 7 or 11

8.6 Project Data Collection and Monitoring System: Greater than 15% Tenant-Paid Utility Accounts

Collect and monitor project energy and water performance data for at least 5 years. This data must be maintained in a manner that allows staff to easily access and monitor it, enabling them to make informed operations and capital planning decisions. Also allow Enterprise access to this data. 16–60% of units *[7 points]*; 60–100% of units *[11 points]*.

SUBTOTAL OPTIONAL POINTS

TOTAL OPTIONAL POINTS

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

1.02 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.03 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:
   1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
   2. Representatives of the facility user and operation and maintenance personnel.
   3. Architect and engineering design professionals.

1.04 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.05 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
   1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
   2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
   3. Attend commissioning team meetings held on a biweekly basis.
   4. Integrate and coordinate commissioning process activities with construction schedule.
   5. Review and accept construction checklists provided by the CxA.
   6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
   7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
   8. Complete commissioning process test procedures.

1.06 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 91 13

Cost & Savings Estimates

ENERGY STAR Certified Homes, Version 3.1 (Rev. 08)

December 15, 2016

Contents

Section 1: Executive Summary

Overview

This document is intended to provide partners, utility sponsors, and program designers with an estimate of the incremental costs to build, and associated savings from, an ENERGY STAR certified home under Version 3.1 (Rev. 08) of the program in regions that have adopted the 2012 ICC codes (e.g., 2012 IECC, 2012 IRC).

Methodology

To complete this analysis, EPA evaluated thirteen typical homes across hot, mixed, and cold climates.

The architectural characteristics for each home were determined using the U.S. Department of Energy's Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes. Exhibit 1 shows the house parameters that were modeled consistently across all Climate Zones.

Exhibit 1: House Parameters Consistent Across Climate Zones

Parameter	Value
Number of Stories	Two
Conditioned Floor Area per Floor (ft²)	1,200
Total Conditioned Floor Area (ft²)	2,400
Perimeter (ft)	30 x 40
Ceiling Height (ft)	8.5
Bedrooms	4
Window Area (% of Floor Area) & Distribution	15%, Even
Exterior Door Quantity & Total Area	2 Doors, 42 ft^2

Exhibit 2 shows parameters that were modeled with variations across Climate Zones. In Climate Zones 1 through 6, one home in each zone was configured with an electric heat pump and electric water heater, named Configuration A. A second home was configured with a gas furnace, electric air conditioner, and gas water heater, named Configuration B. In Climate Zone 7, only one home was modeled using Configuration B, based on EPA's observation that few electrically-heated homes participate in the program from this region.

Exhibit 2: House Parameters Varied Across Climate Zones

<table>
<tr><th colspan="2">Parameter</th><th>CZ 1</th><th>CZ 2</th><th>CZ 3</th><th>CZ 4</th><th>CZ 5</th><th>CZ 6</th><th>CZ 7</th></tr>
<tr><td colspan="2">Location</td><td>Miami
FL</td><td>Tampa
FL</td><td>Fort Worth
TX</td><td>St. Louis
MO</td><td>Indianapolis
IN</td><td>Burlington
VT</td><td>Duluth
MN</td></tr>
<tr><td colspan="2">Foundation Type</td><td colspan="3">Slab</td><td colspan="4">Unconditioned Basement</td></tr>
<tr><td rowspan="2">Space Heating, Cooling, & DHW</td><td>Config. A</td><td colspan="6">Electric Air-Source Heat Pump & Electric DHW</td><td>n/a</td></tr>
<tr><td>Config. B</td><td colspan="7">Gas Furnace, Electric AC, & Gas DHW</td></tr>
</table>

The energy efficiency features of the baseline homes were aligned with the 2012 IECC prescriptive path, except for the window and door performance in Climate Zone 1. In this location, the 2012 IECC defines a SHGC of 0.25 but no U-factor requirement. Given the relatively stringent SHGC, a corresponding U-factor of 0.50 was assumed. In addition, because no insulation installation grade is defined or required by code, all zones were modeled with Grade III insulation installation in walls and Grade II insulation installation in ceilings and floors, which reflects EPA's experience with typical homes built to code.

The energy efficiency features of the ENERGY STAR certified homes were aligned with the features of the Version 3.1 (Rev. 08) ENERGY STAR Reference Design.

These energy efficiency features of the baseline homes and ENERGY STAR certified homes are summarized in Exhibits 4 through 16.

To estimate energy savings, first, the baseline and ENERGY STAR home configurations were modeled in REM/Rate v15.1. Energy consumption was determined from the resulting Fuel Summary report.

Next, two factors were applied to account for ENERGY STAR program requirements not fully credited in the RESNET standards and which help ensure that the thermal enclosure system and HVAC system in certified homes perform as

designed. Because these program requirements are not required by the 2012 IECC, the factors were applied to the baseline homes, thereby increasing their consumption.

The first factor reflects increased convective losses because the baseline homes are not required to achieve Grade I insulation installation nor, in Climate Zones 4 through 8, alignment of the wall insulation with the interior air barrier. This was estimated to increase heating and cooling consumption in the baseline homes by 5%.

The second factor reflects less efficient operation of the air conditioner and heat pump because the baseline homes are not required to be commissioned, per the HVAC Commissioning Checklist. This is estimated to increase the heating consumption for homes with electric heat pumps and the cooling consumption for homes with air conditioners or heat pumps by 6.9%.

These two factors were applied multiplicatively to the heating and cooling consumption reported by REM/Rate for the baseline homes. The resulting energy consumption for the baseline homes and ENERGY STAR certified homes were then converted to purchased energy costs using a national average rate of $0.121 / kWh and $1.116 / therm, as referenced from the Energy Information Administration's 2014 Annual Energy Outlook. Finally, the purchased energy costs for the ENERGY STAR certified homes were subtracted from those of the baseline homes to determine savings.

The incremental costs of the energy efficiency features for each ENERGY STAR certified home were estimated next. This included both the mandatory measures required by the ENERGY STAR inspection checklists, along with the measures that were not required by the checklists but used to meet the ENERGY STAR HERS Index target required by the program.

Results & Discussion

Exhibit 3 summarizes the annual purchased energy costs for each baseline and ENERGY STAR certified home. In addition, it summarizes the annual purchased energy savings and the total upgrade cost for each ENERGY STAR certified home, and the resulting monthly purchased energy savings, monthly mortgage upgrade cost, and net cash flow. The monthly mortgage upgrade cost was calculated assuming a 30-year fixed mortgage with a 5.0% interest rate.

Exhibit 3: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home, Illustrative Cost & Savings Summary

					2012 IECC	ENERGY STAR Version 3.1					
#	CZ	Location	Found.	HVAC Equipment Type	Annual Purchased Energy Costs	Annual Purchased Energy Costs	Annual Purchased Energy Savings		Total Upgrade Cost	Monthly Purchased Energy Savings	Monthly Mortgage Upgrade Cost	Net Cash Flow
1	1	Miami, FL	Slab	Elec. Air-Source HP	$1,826	$1,457	$368	20%	$1,205	$31	$6	$24
2	1	Miami, FL	Slab	Gas Furnace / Elec. AC	$1,709	$1,347	$363	21%	$1,301	$30	$7	$23
3	2	Tampa, FL	Slab	Elec. Air-Source HP	$1,854	$1,499	$354	19%	$1,111	$30	$6	$24
4	2	Tampa, FL	Slab	Gas Furnace / Elec. AC	$1,716	$1,351	$366	21%	$1,207	$30	$6	$24
5	3	Fort Worth, TX	Slab	Elec. Air-Source HP	$2,092	$1,636	$455	22%	$964	$38	$5	$33
6	3	Fort Worth, TX	Slab	Gas Furnace / Elec. AC	$1,851	$1,446	$405	22%	$1,356	$34	$7	$26
7	4	St. Louis, MO	Bsmt.	Elec. Air-Source HP	$2,485	$1,960	$525	21%	$1,072	$44	$6	$38
8	4	St. Louis, MO	Bsmt.	Gas Furnace / Elec. AC	$2,006	$1,562	$444	22%	$1,461	$37	$8	$29
9	5	Indianapolis , IN	Bsmt.	Elec. Air-Source HP	$2,737	$2,050	$687	25%	$1,249	$57	$7	$51
10	5	Indianapolis , IN	Bsmt.	Gas Furnace / Elec. AC	$2,095	$1,599	$496	24%	$1,474	$41	$8	$33
11	6	Burlington, VT	Bsmt.	Elec. Air-Source HP	$2,991	$2,246	$745	25%	$1,325	$62	$7	$55
12	6	Burlington, VT	Bsmt.	Gas Furnace / Elec. AC	$2,081	$1,617	$464	22%	$1,474	$39	$8	$31
13	7	Duluth, MN	Bsmt.	Gas Furnace / Elec. AC	$2,336	$1,773	$563	24%	$1,474	$47	$8	$39

Section 2 contains Exhibits 4 through 16, which contain a more detailed breakout of the incremental upgrade costs presented for each home in Exhibit 3. While this analysis provides illustrative incremental costs and savings, these values will vary for any specific certified home, dependent on variables such as baseline construction practices, geographic location, house design, and vendor relationships. For example, builders are likely to experience lower incremental costs than stated in this document if they are able to procure equipment or materials below retail rates or if they already build above code-minimum requirements. In addition, many partners achieve decreasing costs over time as they gain experience and develop more cost-effective strategies to meet the program requirements. Therefore, these estimates are only illustrative and are likely to represent the higher end of the cost spectrum.

Sections 3 through 8 provide a more detailed discussion of the incremental costs and savings associated with each of the checklists required by the program. With this analysis, the requirements of the checklists were compared to the requirements of the 2012 IECC and 2012 IRC codes, and only requirements above code were accounted for.

For example, code requires that HVAC systems be designed in accordance with Manual J, D, and S, or equivalent methodologies, so no costs or savings were assumed for meeting these design requirements. In contrast, code does not require commissioning of HVAC systems, so both incremental costs and savings were estimated for these requirements.

In addition, where the ENERGY STAR Certified Homes program requires a Home Energy Rater to verify a code requirement, the cost for such verification was included in the incremental costs for the program, because this third-party verification is above and beyond the oversight required by code.

This approach was pursued for two reasons. The first reason is that code is a well-defined baseline from which costs and savings can be consistently evaluated. In contrast, standard practice often varies from code-minimum requirements (both below-code and above-code) and is therefore difficult to consistently benchmark against. The second reason for this approach is that most utility-sponsored programs are not able to claim savings for improvements from below-code to code-minimum practices. Therefore, estimating the incremental costs and savings only for the above-code measures of the ENERGY STAR v3.1 program requirements makes the analysis more relevant to utility sponsors and partners that wish to improve practices above code.

Despite the fact that many of the items in the ENERGY STAR Checklists are required by code, EPA believes that their inclusion provides significant benefits: code often allows these items to be traded-off for other improvements, while the Checklists help ensure that these details are included in every home to consistently deliver a complete thermal enclosure system, complete HVAC system, and complete water management system; the ENERGY STAR Checklists consolidate critical code-required details in a relatively concise format that improves compliance; the ENERGY STAR Checklists provide a consistent set of building-science details from which to educate and train partners; and many of the items on the ENERGY STAR Checklists are required to be third-party verified by a Home Energy Rater, whereas most jurisdictions do not require such oversight.

Finally, Section 9 provides additional references to support the assumptions used in the analysis.

Section 2: Detailed Incremental Cost Estimates

Exhibits 4 through 16 contain a more detailed explanation of the incremental upgrade costs presented for each home in Exhibit 3. For each home, the costs are divided into seven sections.

The first section in each exhibit contains the energy efficiency measures that are not required by the ENERGY STAR Inspection Checklists, and were used solely to meet the ENERGY STAR HERS Index target.

The next six sections contain the costs required to comply with, respectively, the Thermal Enclosure System section of the Rater Field Checklist (Rater-F), the HVAC System section of Rater-F, the Rater Design Review Checklist (Rater-D), the HVAC Design Report (HVAC-D), the HVAC Commissioning Checklist (HVAC-C), and the Water Management System Builder Requirements (Builder-W), relative to the 2012 ICC codes. The measures included in these sections represent both requirements that improve the HERS Index of the home and those that do not. For example, Grade I insulation installation is mandatory in the Rater-F, unless rigid insulation is used, so that cost is grouped with the Rater-F even though a builder not participating in the ENERGY STAR program might also select that measure to achieve a better HERS Index. In contrast, the Rater-F requires bedroom pressure balancing, which is a mandatory requirement of this checklist, but does not impact the HERS Index of the home.

For each measure, the exhibit lists the 2012 IECC baseline code requirement, the ENERGY STAR Version 3.1 (Rev. 08) requirement, the incremental unit cost, the quantity of units per home, the cost units (e.g., tons, square feet of window area, square feet of conditioned floor area), and the total incremental measure cost.

Exhibit 4: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 1 - Config. A - Electric

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	5 ACH50	4 ACH50	$0.13	2,400	CFA (ft^2)	$312
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-
Heating Equipment	8.2 HSPF / 14 SEER	8.2 HSPF / 15 SEER	$48.00	2.5	Tons	$120
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.95 EF Electric DHW, 40 Gallons	0.95 EF Electric DHW, 40 Gallons	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,403**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-30	R-30	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-
Windows	U-value: 0.50 / SHGC: 0.25	U-value: 0.40 / SHGC:0.25	$0.18	360	Window Area (ft^2)	$65
Doors	R-2.0	R-5.9	$48.53	2	Door	$97
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$50
Sub-Total of Thermal Enclosure System Checklist						**$410**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.07	576	Duct Surface Area (ft²)	-$616
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$366**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	Supply Vent. System with Exhaust Backup	Supply Vent. System with Exhaust Backup	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$696.00	0.5	Tons	-$348
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$343**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,205**

Exhibit 5: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 1 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	5 ACH50	4 ACH50	$0.13	2,400	CFA (ft^2)	$312
Cooling Equipment	14 SEER Central AC	15 SEER Central AC	$84.00	2.5	Tons	$210
Heating Equipment	80 AFUE Gas Furnace	80 AFUE Gas Furnace	-	-	-	-
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,493**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-30	R-30	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-
Windows	U-value: 0.50 / SHGC: 0.25	U-value: 0.40 / SHGC:0.25	$0.18	360	Window Area (ft^2)	$65
Doors	R-2.0	R-5.9	$48.53	2	Door	$97
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$50
Sub-Total of Thermal Enclosure System Checklist						**$410**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.07	576	Duct Surface Area (ft²)	-$616
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$366**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	Supply Vent. System with Exhaust Backup	Supply Vent. System with Exhaust Backup	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$684.00	0.5	Tons	-$342
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$337**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,301**

Exhibit 6: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 2 - Config. A - Electric

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	5 ACH50	4 ACH50	$0.13	2,400	CFA (ft^2)	$312
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-
Heating Equipment	8.2 HSPF / 14 SEER	8.2 HSPF / 15 SEER	$48.00	2.5	Tons	$120
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.95 EF Electric DHW, 40 Gallons	0.95 EF Electric DHW, 40 Gallons	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,403**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-38	R-38	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-
Above-Grade Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-
Windows	U-value: 0.40 / SHGC: 0.25	U-value: 0.40 / SHGC:0.25	-	-	-	-
Doors	R-2.5	R-5.9	$33.82	2	Door	$68
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$50
Sub-Total of Thermal Enclosure System Checklist						**$316**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.07	576	Duct Surface Area (ft²)	-$616
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$366**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	Supply Vent. System with Exhaust Backup	Supply Vent. System with Exhaust Backup	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$696.00	0.5	Tons	-$348
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$343**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,111**

Exhibit 7: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 2 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	5 ACH50	4 ACH50	$0.13	2,400	CFA (ft^2)	$312
Cooling Equipment	14 SEER Central AC	15 SEER Central AC	$84.00	2.5	Tons	$210
Heating Equipment	80 AFUE Gas Furnace	80 AFUE Gas Furnace	-	-	-	-
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,493**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-38	R-38	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-
Windows	U-value: 0.40 / SHGC: 0.25	U-value: 0.40 / SHGC:0.25	-	-	-	-
Doors	R-2.5	R-5.9	$33.82	2	Door	$68
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$50
Sub-Total of Thermal Enclosure System Checklist						**$316**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.07	576	Duct Surface Area (ft²)	-$616
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$366**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	Supply Vent. System with Exhaust Backup	Supply Vent. System with Exhaust Backup	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$684.00	0.5	Tons	-$342
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$337**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,207**

Exhibit 8: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 3 - Config. A - Electric

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-
Heating Equipment	8.2 HSPF / 14 SEER	8.2 HSPF / 15 SEER	$48.00	2.5	Tons	$120
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.95 EF Electric DHW, 40 Gallons	0.95 EF Electric DHW, 40 Gallons	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,091**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-38	R-38	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20	R-20	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-
Windows	U-value: 0.35 / SHGC: 0.25	U-value: 0.30 / SHGC:0.25	$0.64	360	Window Area (ft^2)	$230
Doors	R-2.9	R-5.9	$26.47	2	Door	$53
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$482**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.07	576	Duct Surface Area (ft^2)	-$616
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$366**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	Supply Vent. System with Exhaust Backup	Supply Vent. System with Exhaust Backup	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$696.00	0.5	Tons	-$348
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$343**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$964**

Exhibit 9: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 3 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	14 SEER Central AC	15 SEER Central AC	$84.00	2.5	Tons	$210
Heating Equipment	80 AFUE Gas Furnace	90 AFUE Gas Furnace	$6.60	60	-	$396
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,577**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-38	R-38	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20	R-20	-	-	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-
Windows	U-value: 0.35 / SHGC: 0.25	U-value: 0.30 / SHGC:0.25	$0.64	360	Window Area (ft^2)	$230
Doors	R-2.9	R-5.9	$26.47	2	Door	$53
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$482**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.07	576	Duct Surface Area (ft²)	-$616
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$150
Sub-Total of HVAC System Checklist						**-$466**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	Supply Vent. System with Exhaust Backup	Supply Vent. System with Exhaust Backup	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$684.00	0.5	Tons	-$342
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$337**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,356**

Exhibit 10: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 4 - Config. A - Electric

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-
Heating Equipment	8.2 HSPF / 14 SEER	8.5 HSPF / 15 SEER	$96.00	2.5	Tons	$240
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.95 EF Electric DHW, 40 Gallons	0.95 EF Electric DHW, 40 Gallons	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,211**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20	R-20	-	-	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	R-19 Floor Insulation	R-19 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.35 / SHGC: 0.40	U-value: 0.30 / SHGC:0.40	$0.66	360	Window Area (ft^2)	$238
Doors	R-2.9	R-5.9	$26.47	2	Door	$53
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$675**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$548**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$744.00	0.5	Tons	-$372
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$367**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,072**

Exhibit 11: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 4 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-
Heating Equipment	80 AFUE Gas Furnace	95 AFUE Gas Furnace	$7.85	60	kBtu/h	$471
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Power Vent)	$150.00	1	Water Heater	$150
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,592**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20	R-20	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,118	Ins. Surface Area (ft^2)	$209
Foundation Insulation	R-19 Floor Insulation	R-19 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.35 / SHGC: 0.40	U-value: 0.30 / SHGC:0.40	$0.66	360	Window Area (ft^2)	$238
Doors	R-2.9	R-5.9	$26.47	2	Door	$53
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$675**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$150
Sub-Total of HVAC System Checklist						**-$648**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	3.0 Tons	2.5 Tons	-$528.00	0.5	Tons	-$264
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$259**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,461**

Exhibit 12: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 5 - Config. A - Electric

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-
Heating Equipment	8.2 HSPF / 14 SEER	9.25 HSPF / 15 SEER	$237.00	2	Tons	$474
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.95 EF Electric DHW, 40 Gallons	0.95 EF Electric DHW, 40 Gallons	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,445**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20	R-20	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	2,118	Ins. Surface Area (ft^2)	$96
Foundation Insulation	R-30 Floor Insulation	R-30 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.32 / SHGC: 0.40	U-value: 0.27 / SHGC:0.40	$1.04	360	Window Area (ft^2)	$374
Doors	R-3.1	R-5.9	$22.06	2	Door	$44
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$689**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$548**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	2.5 Tons	2.0 Tons	-$884.63	0.5	Tons	-$442
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$437**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,249**

Exhibit 13: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 5 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-
Heating Equipment	80 AFUE Gas Furnace	95 AFUE Gas Furnace	$7.85	60	kBtu/h	$471
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Power Vent)	$150.00	1	Water Heater	$150
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,592**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20	R-20	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	2,118	Ins. Surface Area (ft^2)	$96
Foundation Insulation	R-30 Floor Insulation	R-30 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.32 / SHGC: 0.40	U-value: 0.27 / SHGC:0.40	$1.04	360	Window Area (ft^2)	$374
Doors	R-3.1	R-5.9	$22.06	2	Door	$44
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$689**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$150
Sub-Total of HVAC System Checklist						**-$648**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	2.5 Tons	2.0 Tons	-$528.00	0.5	Tons	-$264
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$259**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,474**

Exhibit 14: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 6 - Config. A - Electric

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-
Heating Equipment	8.2 HSPF / 14 SEER	9.5 HSPF / 15 SEER	$288.00	2	Tons	$576
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.95 EF Electric DHW, 40 Gallons	0.95 EF Electric DHW, 40 Gallons	$0.00	1	Water Heater	$0
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,547**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20+5	R-20+5	-	-	-	-
AG Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	2,118	Ins. Surface Area (ft^2)	$96
Foundation Insulation	R-30 Floor Insulation	R-30 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.32 / SHGC: 0.40	U-value: 0.27 / SHGC:0.40	$1.04	360	Window Area (ft^2)	$374
Doors	R-3.1	R-5.9	$22.06	2	Door	$44
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$689**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$250
Sub-Total of HVAC System Checklist						**-$548**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	2.5 Tons	2.0 Tons	-$936.00	0.5	Tons	-$468
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$463**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,325**

Exhibit 15: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 6 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-
Heating Equipment	80 AFUE Gas Furnace	95 AFUE Gas Furnace	$7.85	60	kBtu/h	$471
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Power Vent)	$150.00	1	Water Heater	$150
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,592**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20+5	R-20+5	-	-	-	-
AGW Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	2,118	Ins. Surface Area (ft^2)	$96
Foundation Insulation	R-30 Floor Insulation	R-30 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.32 / SHGC: 0.40	U-value: 0.27 / SHGC:0.40	$1.04	360	Window Area (ft^2)	$374
Doors	R-3.1	R-5.9	$22.06	2	Door	$44
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$689**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$150
Sub-Total of HVAC System Checklist						**-$648**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	2.0 Tons	1.5 Tons	-$528.00	0.5	Tons	-$264
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$259**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,474**

Exhibit 16: ENERGY STAR v3.1 Certified Home vs 2012 IECC Home - CZ 7 - Config. B - Gas

Measure	2012 IECC Baseline	ENERGY STAR v3.1	Inc. Unit Cost	Cost Qty	Cost Unit	Inc. Cost
Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						
Infiltration	3 ACH50	3 ACH50	-	-	-	-
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-
Heating Equipment	80 AFUE Gas Furnace	95 AFUE Gas Furnace	$7.85	60	kBtu/h	$471
Duct Location	Unconditioned Space	Ductwork Located in Conditioned Space	$0.39	2,400	CFA (ft^2)	$936
Water Heater	0.62 EF Gas DHW, 40 Gal. (Atmo. Vent)	0.62 EF Gas DHW, 40 Gal. (Power Vent)	$150.00	1	Water Heater	$150
Lighting	75% Fluorescent Lighting	90% ENERGY STAR CFLs	$2.80	7	Lamps	$20
Thermostat	Programmable Thermostat	Programmable Thermostat	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$10.00	1	Dishwasher	$10
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$5.00	1	Refrigerator	$5
Sub-Total of Measures Not Required by Checklists & Used to Meet ENERGY STAR HERS Index Target						**$1,592**
Rater Field Checklist: Thermal Enclosure System						
Ceiling Insulation	R-49	R-49	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.07	1,200	Ins. Surface Area (ft^2)	$89
Above-Grade Wall Insulation	R-20+5	R-20+5	-	-	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	2,118	Ins. Surface Area (ft^2)	$96
Foundation Insulation	R-38 Floor Insulation	R-38 Floor Insulation	-	-	-	-
Foundation Insulation Installation	Grade II Installation	Grade I Installation	$0.16	1,200	Ins. Surface Area (ft^2)	$186
Windows	U-value: 0.32 / SHGC: 0.40	U-value: 0.27 / SHGC:0.40	$1.04	360	Window Area (ft^2)	$374
Doors	R-3.1	R-5.9	$22.06	2	Door	$44
Additional Checklist Measures: Reduced Lumber from Advanced Framing, Rater Verification						-$100
Sub-Total of Thermal Enclosure System Checklist						**$689**
Rater Field Checklist: HVAC System						
Duct Sealing - Total Leakage	4 CFM per 100 ft² of CFA @ Rough-In	4 CFM per 100 ft² of CFA @ Rough-In	-	-	-	-
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	No Ins.; Ducts in Conditioned Space	-$1.39	576	Duct Surface Area (ft²)	-$798
Additional Checklist Measures: Rater Verification of Equipment Model Numbers, Static Pressure, Bedroom Pressure Balancing, Ventilation System, and Filter						$150
Sub-Total of HVAC System Checklist						**-$648**
Rater Design Review Checklist						
Sub-Total of Rater Design Review Checklist: Rater Completion of Checklist						**$25**
HVAC Design Report						
Ventilation	ENERGY STAR Exhaust Fan w/ Controller	ENERGY STAR Exhuast Fan w/ Controller	-	-	-	-
HVAC Equipment Right-Sizing	2.0 Tons	1.5 tons	-$528.00	0.5	Tons	-$264
Additional Checklist Measures: Checklist Completion by Designer						$5
Sub-Total of HVAC Design Report						**-$259**
HVAC Commissioning Checklist						
Sub-Total of HVAC Commissioning Checklist: Credential Cost, Refrigerant Charge Check, Air Handler Airflow Check, Completion of Checklist						**$75**
Water Management System Builder Requirements						
Sub-Total of Water Management System Builder Requirements: Relative to Code, No Incremental Tasks are Required						**$0**
Total Incremental Cost for the Home						**$1,474**

Section 3: Incremental Cost & Savings of the Rater Field Checklist: Thermal Enclosure System

Average Estimated Incremental Cost

The requirements of the Thermal Enclosure System sections of the Rater Field Checklist (Rater-F TES) were grouped into two categories – those that impact the HERS Index and those that do not. This is an important distinction, because partners have expressed an interest in knowing what the cost of the checklist is, yet many of the requirements are efficiency measures that might also be included as part of a standard HERS rating.

As can be seen in Exhibits 4 through 16, the net cost for complying with the Rater-F TES was estimated to be between $316 and $689, depending on Climate Zone and house configuration, and encompasses both requirements that improve the HERS Index and those that do not.

Excluding the requirements that only improve the HERS Index, the remaining checklist requirements address reduced thermal bridging requirements and Rater verification of the Rater-F TES and actually result in a net savings of $50 in Climate Zone 1 and 2 and net savings of $100 in Climate Zones 3 through 8. Net savings occur due to reduced lumber costs as a result of the reduced thermal bridging requirements.

The Rationale section, below, discusses the costs for all measures in more detail.

Average Estimated Incremental Savings

The savings for any requirement of the Rater-F TES that impacts the HERS Index was captured within REM/Rate. The only impact that was estimated outside of REM/Rate was to increase the heating and cooling consumption for each baseline home by 5% to account for the increased convective losses because these baseline homes are not required to achieve the Grade I insulation installation or fully-aligned air barriers that are required by the Rater-F TES. By minimizing gaps, voids, and compressions in the ENERGY STAR certified homes, fewer air spaces will be created within the wall cavity, thereby reducing the potential for convective loops.

The Rationale section, below, discusses the approach to estimating savings for all measures in more detail.

Rationale

Section 1 of the Rater-F TES requires high-performance fenestration. The incremental cost for improving fenestration from the requirements of the 2012 IECC to ENERGY STAR certified windows was captured in Exhibits 4 through 16. The energy savings from this measure were captured within REM/Rate.

Section 1 also requires quality-installed insulation that meets 2012 IECC levels and achieves Grade I insulation installation (or Grade II for surfaces that contain a layer of continuous, air impermeable insulation that meets a minimum specified insulation level).

The insulation levels were modeled to be consistent with the 2012 IECC requirements and, therefore, no incremental cost or energy savings were estimated. In contrast, an incremental cost was estimated for achieving Grade I insulation installation. This incremental cost was estimated for each home configuration and each relevant assembly (i.e., ceiling, wall, floor) as shown in Exhibits 4 through 16. The conductive savings from Grade I insulation installation were estimated within REM/Rate. In addition, achieving Grade I insulation installation will minimize gaps, voids, and compressions, resulting in fewer air spaces within assemblies and reduced convective losses. As noted above, the heating and cooling consumption for each baseline home was increased by 5% to account for the increased convective losses because these baseline homes are not required to meet these requirements.

Section 2 requires fully-aligned air barriers in walls, floors, and ceilings. These details are generally implicitly or explicitly required by the 2012 IECC. For example, code requires that the exterior thermal envelope insulation for framed walls be installed in substantial contact and continuous alignment with the building envelope air barrier, that insulation be installed to maintain permanent contact with the underside of subfloor decking, that a minimum of a 1-inch space be provided between insulation and the roof sheathing to not block the free flow of air at the location of the vent, and that air barriers in any dropped ceiling or soffit be substantially aligned with insulation. Because these requirements are required by code, no incremental cost or energy savings were estimated. The one detail not required by code that is required by this Section of the Rater-F TES is that, in Climate Zones 4 through 8, an air barrier must be included on the interior surface of wall insulation. This is anticipated to be accomplished by achieving Grade I insulation installation, per Section 1, which will minimize gaps, voids, and compressions that would prevent alignment with drywall. Therefore, no additional incremental cost or energy savings were estimated for this Section.

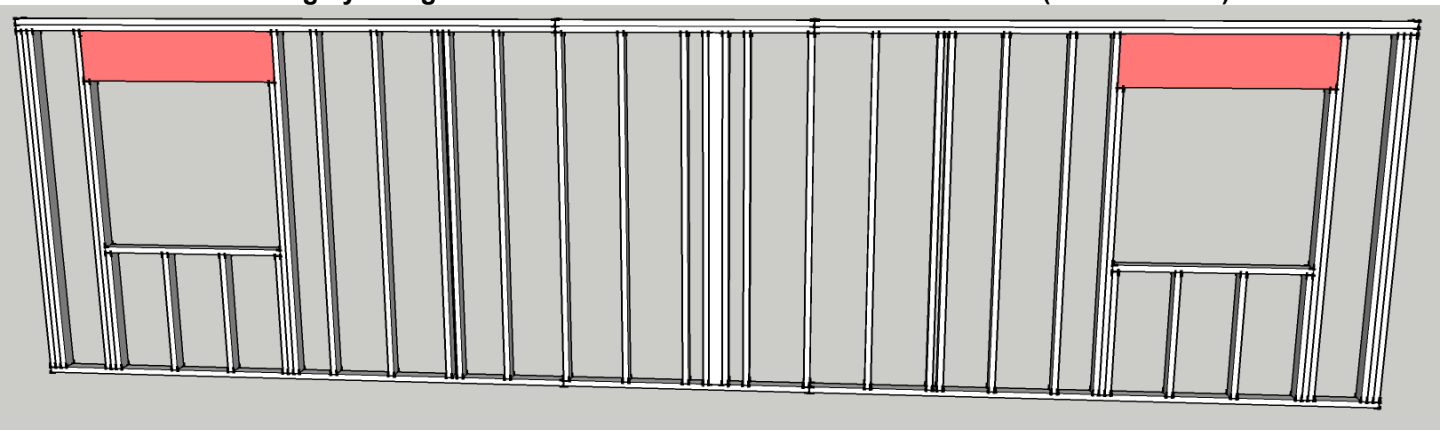
Section 3 requires the use of details that reduce thermal bridging. Several of these details are required by the 2012 IECC, such as extending full height uncompressed insulation over the wall top plate at the eaves, and requiring that access be provided to all equipment in attics that prevents damaging or compressing the insulation beneath.

However, Section 3 also requires that a strategy be selected to reduce thermal bridging in above-grade walls, which is not required by code. For this analysis, the cost and energy savings associated with the advanced framing option in this Section were estimated using a reduced framing fraction of 19%, rather than the default of 23%, in each home.

Code requires that all headers be insulated, which generally aligns with the Rater-F TES requirement to insulate all headers above windows and doors ≥ R-3 for 2x4 framing or equivalent cavity width, and ≥ R-5 for all other assemblies (e.g., with 2x6 framing). The remaining advanced framing details are not required by code, including that corners use modified framing or high-density insulation to achieve ≥ R-6, that framing be limited at all windows & doors, that all interior / exterior wall intersections be insulated to the same R-value as the rest of the exterior wall, and that extraneous use of framing be minimized. These details are achieved by reducing the amount of lumber used in the walls, resulting in a reduced framing fraction.

To estimate the impact on framing fraction from these details, a 30'x8' wall was modeled with and without these details. The wall below was modeled without these features and has a framing fraction of 23%.

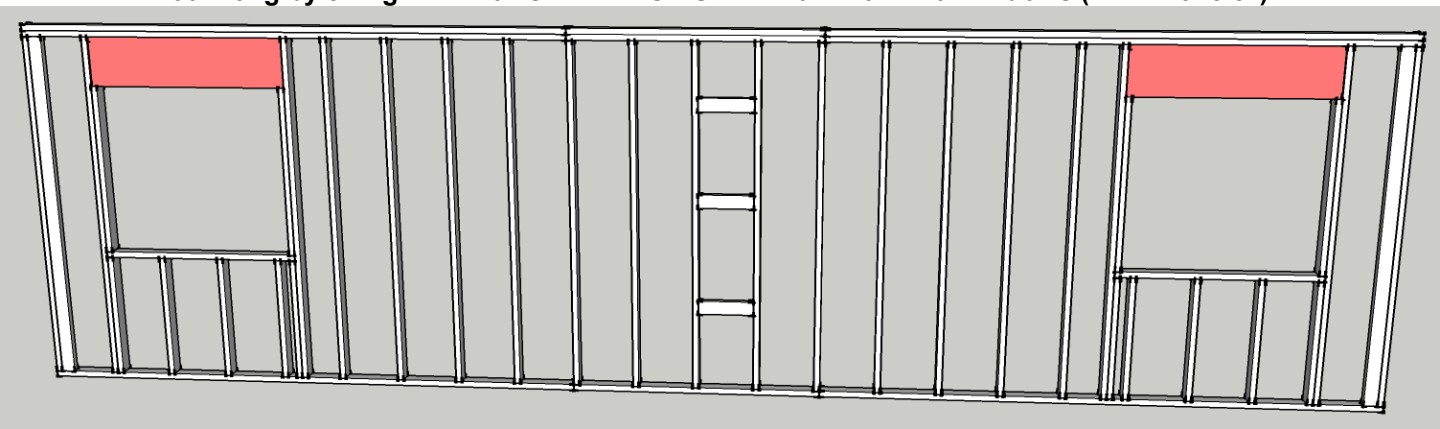
30' Long by 8' High 2x4 16" OC Standard Wall with Two Windows (4'-1" x 3'-8.5")



Top & Bottom Plates:	3 *30' * 1.5"	= 11.3 sqft
King Studs:	23 * 7'-7.5" * 1.5"	= 21.9 sqft
Int. / Ext. Wall Intersection:	7'-7.5" * 3.5"	= 2.2 sqft
Exterior Wall Corner:	4 * 7'-7.5" * 1.5"	= 3.8 sqft
Window Header:	2 * 4'-4" * 11.5"	= 8.3 sqft
Jacks / Trimmers:	4 * 6'-8" * 1.5"	= 6.0 sqft
Window Sills:	2 * 4'-1" * 1.5"	= 1.0 sqft
Cripples:	8 * 2'-8.5" * 1.5"	= 2.7 sqft
Total Wood Area		= 54.6 sqft
Total Wall Area		= 240 sqft
Framing Fraction	= 54.6 / 240	= 23%

The wall below was modeled with these features and has a framing fraction of 18%.

30’ Long by 8’ High 2x4 16” OC ENERGY STAR Wall with Two Windows (4’-1” x 3’-8.5”)



Top & Bottom Plates:	3 *30’ * 1.5”	= 11.3 sqft
King Studs:	19 * 7’-7.5” * 1.5”	= 18.1 sqft
Int. / Ext. Wall Intersection:	(Insulated Ladder Wall)	= 0 sqft
Exterior Wall Corner:	(Insulated 3-Stud Corner)	= 0 sqft
Window Header:	2 * 4’-4” * 11.5”	= 8.3 sqft
Jacks / Trimmers:	4 * 3’-10” * 1.5”	= 1.9 sqft
Window Sills:	2 * 4’-4” * 1.5”	= 1.1 sqft
Cripples:	10 * 2’-8.5” * 1.5”	= 3.4 sqft
Total Wood Area		= 44.1 sqft
Total Wall Area		= 240 sqft
Framing Fraction	= 44.1 / 240	= 18%

Recognizing that not all walls will achieve the exact same reduction in framing fraction, for this analysis the baseline and improved framing fraction values were aligned with the default framing fractions in ANSI / RESNET / ICC 301-2014, January 2016. Table 4.2.2(6) of this Standard defines a default framing fraction of 23% for 16 inch on-center Standard walls and 19% for 16 inch on-center Advanced walls. Energy savings from this reduction in framing were estimated within REM/Rate. In addition to saving energy, the lower framing fraction will reduce material costs. To estimate the material cost savings, the net wall area of each home modeled in Exhibits 4 through 16 was multiplied by 23% for the baseline home and by 19% for the ENERGY STAR certified home. The resulting lumber area was converted to thousand board-feet and multiplied by the material cost for 2x4 8.5 ft. high studs in Climate Zones 1 and 2 and 2x6 8.5 ft. high studs in Climate Zones 3 through 8. This resulted in material savings of $120 per home in Climate Zones 1 and 2 and $188 in Climate Zones 3 through 8.

Section 4 requires air sealing of penetrations, cracks, and other openings in the home’s thermal enclosure system. These details largely overlap with the 2012 IECC, which requires that all joints, seams, and penetrations; other sources of infiltration; and utility penetrations be caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film or solid material. Code specifically requires that the junction of the foundation and sill plate be sealed (but does not require a gasket); that the space between window/door jambs and framing be sealed; and that duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space be sealed. For recessed luminaires, code requires that they be IC-rated and labeled as meeting ASTM E283 and be sealed with a gasket or with caulk between the housing and the interior wall or ceiling covering. Finally, code requires that access doors from conditioned spaces to unconditioned spaces be weather-stripped and insulated to a level equivalent to the insulation on the surrounding surfaces.

As a result of these code requirements, no incremental costs were estimated for the air sealing measures in Section 4. Instead, it was assumed that these requirements will largely be met to achieve the code-required infiltration limit of 7 ACH50. Also note that no incremental cost was estimated for the blower door test, as it was assumed that a blower door test will be used to demonstrate compliance with the code-required infiltration limit of 3 or 5 ACH50. However, an incremental cost was estimated in Exhibits 4 through 16 to account for additional air sealing required to reduce the infiltration rate in Climate Zones 1 and 2 from 5 ACH50 to the level included in the ENERGY STAR Version 3.1 Reference

Design. Included in this cost was the one air sealing detail from the Rater-F TES that is not required by code – the inclusion of a gasket between the sill plate and foundation.

Finally, despite the fact that many of the requirements in the Rater-F TES are also required by code, the 2012 IECC does not require third-party verification of these details by a Home Energy Rater. It is estimated that this will require two inspections plus transportation time. Combined, this was estimated to take an average of 1.5 hours per home. At a labor rate of $55 per hour for a Home Energy Rater, this was estimated to cost $82.

In summary, the costs for the measures that impact the HERS Index are itemized in Exhibits 4 through 16. The additional costs for the reduced thermal bridging requirements and Rater verification of the Rater-F TES sum to -$38 in Climate Zones 1 and 2 and -$106 in Climate Zones 3 through 8, and were rounded to the nearest $25, for a final estimated cost of -$50 and -$100 respectively.

Section 4: Incremental Cost & Savings of the Rater Field Checklist: HVAC System

Average Estimated Incremental Cost

The requirements of the HVAC System sections of the Rater Field Checklist (Rater-F HVAC) were grouped into two categories – those that impact the HERS Index and those that do not. This is an important distinction, because partners have expressed an interest in knowing what the cost of the checklist is, yet several of the requirements are efficiency measures that might also be included as part of a standard HERS rating.

As can be seen in Exhibits 4 through 16, the net cost for complying with the Rater-F HVAC was estimated to be between -$366 and -$648, depending on Climate Zone and house configuration, and encompasses both requirements that improve the HERS Index and those that do not.

Excluding the requirements that impact the HERS Index, the remaining checklist requirements address Rater verification of the equipment model numbers, static pressure, bedroom pressure balancing, ventilation system, and filter, which are estimated to cost $250 for Climate Zones 1 and 2 as well as electric homes in Climate Zones 3-8, and $150 for gas homes in Climate Zones 3-8.

The Rationale section, below, discusses the costs for all measures in more detail.

Average Estimated Incremental Savings

Because the requirements of the HVAC System section of the Rater-F simply help ensure that the heating, cooling, ventilation, and duct system requirements contained in the HVAC Design Report have been met, no additional energy savings were associated with HVAC System section of the Rater-F.

Rationale

Section 5 of the Rater-F requires Raters to check the manufacturer and model number of installed equipment against the HVAC Design Report. It was estimated that the review will take 5 minutes per home. At a labor rate of $55 per hour for a Home Energy Rater, this was estimated to cost $5. Raters are also required to duplicate the static pressure test conducted by the contractor. It is estimated that the Rater can conduct this test while on-site for their final inspection and can complete the test in approximately 10 minutes. Therefore, this was estimated to cost $9 at a labor rate of $55 per hour.

Section 6 requires, in part, that the duct system be visually inspected for proper installation. It is expected that this visual inspection will occur concurrent with the visual inspections conducted for the Thermal Enclosure System section of Rater-F and therefore no incremental cost was estimated for this task.

Next, Section 6 requires that the bedrooms in the home be pressure-balanced. Assuming that pressure relief is provided by a transfer grille, at a cost of $31 per grille (including two interior registers, a galvanized frame, and a sound baffle), the total cost for this feature was estimated to be $124 for a four bedroom home, plus 40 minutes of installation by an HVAC Assistant at a labor rate of $55 per hour, equal to $37. In addition, the Rater must verify that the pressure balancing requirements have been met. Estimating 5 minutes per bedroom, at a labor rate of $55 per hour, the cost for verification was $18. These three costs add to a total of $179.

Section 6 also requires that duct insulation levels be visually verified. It is expected that this visual inspection will occur concurrent with the visual inspections conducted for the Thermal Enclosure System section of the Rater-F and therefore no incremental cost was estimated for this task.

Finally, Section 6 requires that ducts be tested and verified to meet air leakage limits. The 2012 IECC also requires this for the home configurations analyzed. Therefore no incremental cost was assumed for testing. However, the duct leakage limits in the 2012 IECC are less stringent than those in the Rater-F. Therefore, the increased effort and cost to achieve the lower leakage limits were accounted for in Exhibits 4 through 16.

Section 7 requires the whole-house mechanical ventilation rate to be measured. Verifying that the Rater-measured ventilation rate is within ±15 CFM or ±15% of the design value on the HVAC Design Report was estimated to take between 5 and 20 minutes. At a labor rate of $55 per hour, the test will cost between $5 and $18. By averaging the two values, a cost of $11 was estimated. Note that the incremental cost of the whole-house mechanical ventilation system itself is accounted for with the HVAC Design Report.

Section 7 also defines whole-house mechanical ventilation control, fan efficiency, inlet location, and sound requirements, which are not addressed in the 2012 IRC. Not all of the requirements will apply to all homes. Therefore, these quick visual inspections were estimated to take 5 minutes per home. At a labor rate of $55 per hour, the cost for verification was $5.

Section 8 primarily defines airflow requirements for kitchen and bath exhaust fans. While the 2012 IRC requires bath and kitchen exhaust fan airflow rates that are consistent with the requirements of the Rater-F, it does not require a third-party to verify the airflow rates. Because airflow must be verified by the Rater for ENERGY STAR certified homes, an incremental cost was estimated to purchase a bath fan with 70 CFM of rated airflow rather than 50 CFM, to help ensure compliance. This incremental cost was estimated to be $11 per fan. While two bathroom fans are assumed to be present in the home, only one is upgraded to meet this requirement. The other is upgraded as part of the whole-house mechanical ventilation system, as accounted for with the HVAC Design Report. Estimating that it takes 5 minutes to measure each bath fan, 10 minutes are required to complete this test. Due to the complexity of some kitchen exhaust fan inlets, it was estimated that it will take 10 minutes to verify the kitchen exhaust requirements. In total, this equals 20 minutes. At a labor rate of $55 per hour, this equates to $18. Because sound limits are now recommended, rather than required, for all but continuously-running bath fans, no incremental cost was assumed to achieve these limits.

Section 9 defines filtration requirements. The 2012 IRC does not explicitly require the installation of a filter, that all return air and mechanically supplied outdoor air pass through filter prior to conditioning, or that the filter access panel include a gasket or comparable sealing mechanism and fit snugly against the exposed edge of the filter when closed to prevent bypass. However, a filter is routinely included with new equipment and can be installed to meet these requirements with little to no added effort or cost. Therefore, only an incremental cost of $5 was estimated to upgrade the filter from MERV 2 to MERV 6. In addition, visual verification of these requirements by the Rater was estimated to take 5 minutes. At a labor rate of $55 per hour, this equates to $5.

Section 10 defines combustion safety requirements. Unlike the Rater-F, the 2012 IRC does not explicitly require power-vented or direct-vented combustion appliances, nor does it explicitly require combustion safety testing. However, for homes in Climate Zones 1 through 3, it was assumed that the most common compliance path would be to move the combustion appliances outside the pressure boundary, either into the unconditioned attic or the garage, or to use electric space and water heating equipment. In Climate Zones 4 through 8, the most common compliance path would be to use power-vented or direct-vented combustion appliances or electric space and water heating equipment. The cost associated with upgrading to a direct-vented furnace and power-vented water heater was accounted for in Exhibits 9 through 16 for the gas fueled homes in Climate Zones 3 through 7. For these home configurations, it was assumed that a “B-vent” metal combustion vent was replaced with a PVC side-wall combustion inlet and vent system, resulting in savings of $100.

The remainder of Section 10 defines requirements for fireplaces that are not mechanically-drafted or direct-vented and for unvented combustion appliances other than cooking ranges or ovens. On average, it is not expected that homes will have combustion appliances of these types and, therefore, no incremental cost was assumed for compliance.

In summary, the costs for the measures that impact the HERS Index are itemized in Exhibits 4 through 16. The remaining checklist requirements address Rater verification of the equipment model numbers, static pressure, bedroom pressure balancing, ventilation system, and filter. These sum to $247 for Climate Zones 1 and 2 as well as electric homes in Climate Zones 3-8, and to $147 for gas homes in Climate Zones 3-8. These were rounded to the nearest $25, for a final estimated cost of $250 and $150, respectively.

Section 5: Incremental Cost & Savings of the HVAC Design Report

Average Estimated Incremental Cost

The requirements of the HVAC Design Report (HVAC-D) were grouped into two categories – those that impact the HERS Index and those that do not. This is an important distinction, because partners have expressed an interest in knowing what the cost of the checklist is, yet several of the requirements are efficiency measures that might also be included as part of a standard HERS rating.

As can be seen in Exhibits 4 through 16, the net cost for complying with the HVAC-D was estimated to range between savings of $463 and $259, depending on Climate Zone and house configuration, and encompasses both requirements that improve the HERS Index and those that do not.

Excluding the requirements that impact the HERS Index, the only remaining requirement is the completion of the HVAC-D by the designer, which is estimated to cost $5 based upon current labor rates.

The Rationale section, below, discusses the costs for all measures in more detail.

Average Estimated Incremental Savings

Because code requires that heating and cooling design loads be properly calculated, that equipment capacity be properly selected, and that ducts be properly designed, no energy savings were associated with these requirements.

In addition, no energy impacts were associated with meeting the filter requirements of ASHRAE 62.2-2010. However, additional energy use required to meet the ventilation requirements of ASHRAE 62.2-2010 was captured within REM/Rate.

The Rationale section, below, discusses all measures in more detail.

Rationale

Section 1 of the HVAC-D requires the designer to provide a basic overview of their design. While not explicitly required by the 2012 IECC, providing this information does not add any incremental cost other than the time required to complete the paperwork.

Section 2 of the HVAC-D requires that a whole-house mechanical ventilation system be designed and installed, which is not required by the 2012 IRC.

In Climate Zones 1 through 3, costs were estimated for a ventilation system comprising a ventilation controller for 62.2 compliance, a 6” round motorized fresh air damper to provide ventilation air to the return-side of the HVAC system, a switch that allows the bathroom fan to ventilate when the HVAC fan is not in heating or cooling mode, and an ENERGY STAR certified bathroom exhaust fan. Homes with this system use the supply ventilation system when the HVAC air handler is running in heating or cooling mode, and the bathroom exhaust fan system when the HVAC air handler is not running. The run time of both the HVAC fan and the bathroom exhaust fan is managed by the 62.2 controller, which communicates with the bath fan using the switch. For this system, the added costs were the motorized damper, the controller for the motorized damper and bathroom exhaust fan, the ENERGY STAR certified bathroom exhaust fan, and a half hour of installation.

For Climate Zones 4 through 7, the costs were estimated for a ventilation system comprising an ENERGY STAR certified bathroom exhaust fan and bath fan controller. Homes with this system use the bathroom exhaust fan to provide all required ventilation. For this system, the added costs were the incremental cost to upgrade from a non-certified to an ENERGY STAR certified fan and the controller for the bathroom exhaust fan. No incremental labor cost was assumed.

The incremental costs for all of these ventilation systems are included in Exhibits 4 through 16. The energy impact from the ventilation load and the fan power were captured within REM/Rate.

Sections 3 through 5 of the HVAC-D require that designers properly calculate heating and cooling design loads (generally per ACCA Manual J), select right-sized equipment capacities (generally per ACCA Manual S), and design the duct system (generally per ACCA Manual D). No incremental costs or savings were estimated specifically for these tasks, as they are required by the 2012 IRC. However, while both the baseline home and the ENERGY STAR certified home were assumed to be right-sized per code requirements, the cooling equipment capacity of the ENERGY STAR certified home was assumed to be one half ton smaller. This occurs because of the reduced load resulting from measures such as the insulation installation, infiltration, and fenestration requirements of the program. The cost savings from this half ton reduction in equipment size is included in Exhibits 4 through 16.

In summary, the costs for the measures that impact the HERS Index are itemized in Exhibits 4 through 16. The additional cost for the completion of the HVAC-D by the designer is estimated to be $5. EPA is working to automate this task, such that it will require negligible time or money to complete. Currently, however, many designers complete this task manually. Filling out one report manually is estimated to take 20 minutes. This might be done multiple times for one plan, if multiple designs are needed to accommodate options. On the other hand, one HVAC design might be used multiple times in a production environment where the same house plan and HVAC design is built repeatedly. Assuming that the average HVAC design is used 5 times, the average cost per house is 4 minutes. At a labor rate of $88 per hour, the total labor cost equates to $6, which was rounded to the nearest $5, for a final estimated cost of $5.

Section 6: Incremental Cost & Savings of the Rater Design Review Checklist

Average Estimated Incremental Cost

The requirements of the Rater Design Review Checklist (Rater-D) do not directly affect the HERS Index. As can be seen in Exhibits 4 through 16, the net cost for complying with the Rater-D was estimated to be $25.

The Rationale section, below, discusses the costs for all measures in more detail.

Average Estimated Incremental Savings

While the tasks required on the Rater-D add value, there are no estimated savings directly associated with them.

Rationale

The Rater-D requires the Rater to verify that the builder is an ENERGY STAR partner and the HVAC contractor is credentialed, to verify that the fenestration and insulation specified in the home energy rating file complies with the program's requirements, to collect the HVAC Design Report, and to review the report to ensure that the documented HVAC design falls within the tolerances of the program.

Therefore, the incremental costs of this checklist are all related to the labor of the Rater. The estimated time required to verify that the builder is an ENERGY STAR partner is 1 minute and the estimated time required to verify that the HVAC contractor is credentialed is 5 minutes. Verification that the fenestration and insulation meets program requirements automatically occurs within the home energy rating software program, so no time is estimated for compliance. Assuming that the same HVAC design is built five times, and that the time required to collect each one-page HVAC Design Report is one hour, the average time per house to complete this task is estimated to be 12 minutes. Lastly, by again assuming that one report is needed per five homes constructed, and estimating that 30 minutes are required to review each report, the estimated time to review the HVAC Design Report is 6 minutes per home.

In summary, the tasks on the Rater-D require 24 minutes per home. At a labor rate of $55 per hour, the total labor cost equates to $22. This was rounded to nearest the $25, for a final estimated cost of $25.

Section 7: Incremental Cost & Savings of the HVAC Commissioning Checklist

Average Estimated Incremental Cost

The requirements of the HVAC Commissioning Checklist (HVAC-C) do not affect the HERS Index. In total, the average incremental cost of the HVAC-C was estimated to be $75.

The Rationale section, below, discusses the costs for all measures in more detail.

Average Estimated Incremental Savings

The only energy savings of the HVAC-C were estimated outside of REM/Rate and account for complying with the commissioning requirements for heating and cooling systems (i.e., refrigerant charge test and air handler airflow test). These savings were estimated to be 6.9% of heating consumption for air-source heat pumps and 6.9% of cooling consumption for heat pumps and air conditioners.

The Rationale section, below, discusses the approach to estimating savings for all measures in more detail.

Rationale

Prior to installation of HVAC systems in ENERGY STAR certified homes and completion of the HVAC-C, contractors are required to be credentialed by an HVAC Quality Installation Oversight Organization (HQUITO). Two HQUITO's are available, each with its own fee structure and an overall cost per home that is dependent on the annual number of homes that the contractor installs systems in. Costs per home can range from less than $10 to greater than $100. For a contractor installing systems in 25 homes per year, the costs per home after the first year is approximately $24, assuming no significant quality assurance issues.

Section 1 of the HVAC-C requires the contractor to provide a basic overview of the system they're commissioning. While not explicitly required by the 2012 IECC, providing this information does not add any incremental cost other than the time required to complete the paperwork.

The remainder of the HVAC-C requires two HVAC commissioning tests to be completed, which are not explicitly required by the 2012 IRC. In Section 2, the contractor is required to verify the refrigerant charge. Using a digital manifold, this is estimated to take 20 minutes. In Section 3, the contractor is required to assess the air handler airflow using the measured static pressure and fan-speed setting. This was estimated to take 15 minutes. Section 4 recommends, but does not require, that the contractor measure and balance the register airflow. Because this is only a recommendation, no incremental cost was assumed. Lastly, it was estimated to take 5 minutes to fill out the checklist with the information gathered in the field. The total time for commissioning (i.e., measuring refrigerant charge, using static pressure and the fan-speed setting to approximate air handler airflow, and completing the checklist) was estimated to take 44 minutes. At a labor rate of $88 per hour for an HVAC Contractor, this translates to $59. With the addition of the $24 per home credential fee, this sums to a total cost of $83. This was rounded to the nearest $25, which is $75.

Energy savings from the HVAC commissioning were based upon the following paper: Pigg, S. (2008). Central Air Conditioning in Wisconsin: A Compilation of Recent Field Research (Report Number 241-1). Energy Center of Wisconsin.

Specifically, a savings factor of 4.0% was estimated for the commissioning of the refrigerant charge. This was derived from the average savings cited on page 34, which states: "If one combines this charge error distribution with the performance curves in Figure 32—together with an assumption that the majority of new units are TXV systems—aggregate savings from tuning refrigerant charge appears to be on the order of 3 to 5 percent."

In addition, a savings factor of 2.9% was estimated for the commissioning of system airflow. This was derived in part from the average savings cited on page 37, which states: "The average EER improvement from these airflow adjustments was +5.6 percent." Because this savings amount represents only the subset of systems for which airflow had to be adjusted, and not the overall population of systems, it was reduced to account for this subset. Table 9 of the paper indicates that 52% of the new systems required airflow adjustments, as summarized below:

Description	All Homes	%With Improper Airflow
New, SEER 10-13	10	20%
New, SEER 14+	30	63%
Total	40	52%

Therefore, the savings factor of 2.9% was derived by multiplying 5.6% savings by 52% of systems requiring airflow adjustment.

Combined, this results in a savings factor of 4.0% + 2.9% = 6.9%. This factor was applied to both the heating consumption of air-source heat pumps and the cooling consumption of both air-source heat pumps and air conditioners.

Section 8: Incremental Cost & Savings of the Water Management System Bldr. Req.'s

Average Estimated Incremental Cost

The requirements of the Water Management System Builder Requirements (Builder-W) do not impact the HERS Index. Furthermore, because they are also required by the 2012 IECC, there is estimated to be no net cost for meeting these requirements.

The Rationale section, below, discusses the measures in more detail.

Average Estimated Incremental Savings

Energy savings were not anticipated as a result of implementing the Builder-W, as the measures implemented are focused on water management details.

Rationale

Section 1 defines water management details applicable to the site and to the home's foundation, Section 2 defines details applicable to the wall assembly, Section 3 defines details applicable to the roof assembly, and Section 4 defines requirements that help manage water in building materials. These requirements are aligned with the requirements of the 2012 IRC. Therefore, no incremental cost was estimated for meeting these code-required checklist items. Furthermore, since the Builder-W is simply a list of requirements and not a formal checklist that must be completed, there is no cost associated with documenting compliance with the requirements.

Section 9: Cost References

A. Thermal Enclosure System

Air Sealing

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction.

Doors

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Costs linearly interpolated by U-factor using the following entries: o Swinging Entry, Opaque, Steel Frame, U-Value: 0.55 o Swinging Entry, Opaque, Fiberglass Frame, U-Value: 0.21

Framing

Reference	RS Means Construction Cost Data 2010
Accessed	June 2016
Notes	• Framing costs based upon RS Means Line Number 06 11 10.40 6145, representing 2x4 8.5 ft. high studs in Climate Zones 1 and 2, and RS Means Line Number 06 11 10.40 6165,representing 2x6 8.5 ft. high studs in Climate Zones 3 through 8. • All costs prorated by 12.9% to adjust for inflation between 2010 and 2016 using RS Means 2016 Cost Construction Index.

Insulation Installation

Source	RS Means Construction Cost Data 2010
Accessed	June 2016
Notes	• Incremental cost for going from Grade III to Grade I wall insulation: o In Climate Zones 1-2: Assumed to cost 35% more than labor rate for RS Means Line Number 07 21 16.20 0080, representing batt insulation, o In Climate Zones 3-7: Assumed to cost 25% more than labor rate for RS Means Line Number 07 21 26.10 0020, representing blown insulation. • Incremental cost for going from Grade II to Grade I ceiling insulation assumed to cost 10% more than labor rate for RS Means Line Number 07 21 16.10 2210, representing blown insulation. • Incremental cost for going from Grade II to Grade I floor insulation assumed to cost 25% more than labor rate for RS Means Line Number 07 21 16.10 2215, representing blown insulation. • All labor rates prorated by 12.9% to adjust for inflation between 2010 and 2016 using RS Means 2016 Cost Construction Index.

Windows

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/

	Market data from ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights
Accessed	June 2016
Notes	• A two-step process was used to estimate the incremental costs for windows, reflecting a dearth of data for this measure. • In the first step, data from the NREL National Residential Energy Efficiency Measures Database was used to create two multivariate regression equations. Because the database represents retrofit costs, the low-end of the cost range was used as inputs into the regression. Each equation represented the cost per square foot of window, using the U-factor and SHGC as inputs. The first equation was created using the NREL data for insulated frames, representing windows with a U-factor ≤ 0.32, and is as follows: y = [SHGC] x (-0.688) + [U-value] x (-96.33) + 54.5. The second equation was created using the NREL data for non-metal frames, representing windows with a U-factor > 0.32, and is as follows: y = [SHGC] x (-1.32) + [U-value] x (-8.36) + 25.8. • Even using the low-end of the retrofit cost data from the NREL database, the resulting regression equations over-predicted the cost of windows relative to incremental cost data collected during the development of Version 5 of the ENERGY STAR Program Requirements for Residential Windows, Doors, & Skylights. The incremental cost data reported for upgrading from the 2009 IECC window requirements to Version 5 of the ENERGY STAR Program Requirements for Residential Windows, Doors, & Skylights ranged from zero to $0.66 per square foot. In contrast, the highest incremental cost predicted by the unmodified regression equations was $3.06 per square foot in Climate Zones 5 through 7. Therefore, the second step discounted the costs predicted by the unmodified regression equations by applying a factor to align with the reported costs. That is to say, the $3.06 per square foot predicted cost was reduced to $0.66 per square foot by applying a factor of 21.5%. This factor was then applied to both regression equations. • Using these modified regression equations, the cost of each baseline and ENERGY STAR window was calculated using the U-factor and SHGC, with the difference between the two representing the incremental cost.

B. Space Conditioning Equipment & Filter

Air-source Heat Pump

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Costs were linearly interpolated by SEER and HSPF.

Central Air Conditioner

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Costs were linearly interpolated by SEER.

Filter

Reference	True Blue 12 in. x 24 in. x 1 in. Fiberglass FPR 1 Air Filter (MERV 2) Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # 112241 Honeywell 12 in. X 24 in. X 1 in. Allergen Plus Pleated FPR 7 Air Filter (~MERV 6) Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # 205164337

Accessed	September 2016
Notes	• N/A.

Gas Furnace

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Costs were linearly interpolated by AFUE.

C. Ventilation Equipment

Exhaust Ventilation System

Reference	SmartExhaust Toggle Controller http://www.aircycler.com/products/smartexhaust Air King 50 CFM Bath Exhaust Fan Without Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # AS54 Air King 50 CFM Bath Exhaust Fan With Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # ASLC50 Air King 80 CFM ENERGY STAR Certified Bath Exhaust Fan Without Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # AK80 Air King 100 CFM ENERGY STAR Certified Bath Exhaust Fan Without Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # AK100L
Accessed	September 2016
Notes	• Included in homes in Climate Zones 4-7. • The average incremental cost between the two non-ENERGY STAR certified and two ENERGY STAR certified bath exhaust fans was first calculated. Next, the cost of the SmartExhaust Toggle Controller was added to this incremental cost.

Supply Ventilation System

Reference	AirCycler g2 http://www.aircycler.com/products/aircycler-g2 Honeywell EARD6TZ 6" Round Motorized Fresh Air Damper http://www.supplyhouse.com/Honeywell-EARD6TZ-6-Round-TrueZONE-Motorized-Fresh-Air-Damper AirCycler FanConnect http://www.aircycler.com/products/fanconnect Air King 50 CFM Bath Exhaust Fan Without Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # AS54 Air King 50 CFM Bath Exhaust Fan With Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # ASLC50 Air King 80 CFM ENERGY STAR Certified Bath Exhaust Fan Without Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # AK80

	Air King 100 CFM ENERGY STAR Certified Bath Exhaust Fan Without Light Homedepot.com, Gulfgate Mall Store #6509 (Houston), Model # AK100L
Accessed	September 2016
Notes	• Included in homes in Climate Zones 1-3. • The ventilation system costs are comprised of an AirCycler g2 controller for 62.2 compliance, a 6" round motorized fresh air damper to provide ventilation air to the return-side of the HVAC system, a FanConnect switch that allows the bathroom fan to ventilate when the HVAC fan is not in heating or cooling mode, and the incremental cost between a non-ENERGY STAR certified and ENERGY STAR certified bath exhaust fan.

D. Ductwork

Duct sealing

Reference	NREL National Residential Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Full costs from database were first normalized to the cost per 1% reduction in leakage relative to fan airflow. Then, because the requirements in code and the ENERGY STAR program are defined as a leakage limit per 100 sq. ft. of conditioned floor area, rather than as a % of fan airflow, the units were converted using the average cooling equipment capacity (3 tons in CZ 1-4 and 2.25 tons in CZ 5-7) and average fan airflow (375 CFM per ton in CZ 1-4 and 400 CFM per ton in CZ 5-7). Finally, the normalized cost was multiplied by the change in leakage to arrive at the incremental cost. • A duct surface area of 576 ft^2 was assumed using the default area reported in REM/Rate v15.1 for a 2,400 sq. ft. 2-story home with one return register.

Transfer Grille

Reference	Tamarack Return Air Pathway 12x6" New Construction http://www.tamtech.com/home-featured-1/tamarack-perfect-balance-interior-door-air-transfer-grille-with-sound-and-light-mitigation Model # TTi-RAP-Di
Accessed	June 2016
Notes	• Contents include 2-white interior grilles, 1-galvanized frame, and 1-interior baffle.

E. Domestic Hot Water Equipment

Electric Water Heater

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Costs linearly interpolated by Energy Factor (EF).

Gas Water Heater

Reference	NREL National Residential Energy Efficiency Measures Database v3.0.0 http://www.nrel.gov/ap/retrofits/
Accessed	June 2016
Notes	• Because the database represents retrofit costs, the low-end of the cost range was used to approximate the costs for new construction. • Costs were linearly interpolated by Energy Factor (EF).

	• Additional incremental cost for power venting capability in CZ 3-8 was estimated to be $150.

F. Appliances & Lighting

Dishwasher

Reference	Savings Calculator for ENERGY STAR Qualified Appliances https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
Accessed	June 2016
Notes	• Incremental cost between standard-sized average new non-qualified and ENERGY STAR qualified dishwasher.

Lighting

Reference	Savings Calculator for ENERGY STAR Qualified Light Bulbs http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/light_bulb_calculator.xlsx
Accessed	June 2016
Notes	• Incremental cost between 40, 60, 75, 100, and 150 watt average new incandescent bulbs and corresponding 11, 13, 15, 23, and 40 watt ENERGY STAR qualified compact fluorescent bulbs.

Refrigerator

Reference	Savings Calculator for ENERGY STAR Qualified Appliances https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
Accessed	June 2016
Notes	• Incremental cost between 22.7 cubic ft. side-by-side average new non-qualified and ENERGY STAR qualified refrigerator, with automatic defrost.

G. Labor

Source	RS Means Construction Cost Data 2010
Accessed	June 2016
Notes	• Hourly rate listed by position:

Cost & Savings Role	RS Means Trade	Hourly Rate with Overhead and Profit
Home Energy Rater	'Helpers' Average	$55
HVAC Assistant	'Helpers' Average	$55
HVAC Contractor	Plumber	$88
Foreman	Foreman Average, Outside	$77

• All labor rates prorated by 12.9% to adjust for inflation between 2010 and 2016 using RS Means 2016 Cost Construction Index.

Eligibility Requirements

The following homes are eligible to earn the ENERGY STAR:

- Detached dwelling units [1] (e.g. single family homes); OR
- Dwelling units [1] in any multifamily building with 4 units or fewer; OR
- Dwelling units [1] in multifamily buildings with 3 stories or fewer above-grade [2,3]; OR
- Dwelling units [1] in multifamily buildings with 4 or 5 stories above-grade [2,3] that have their own heating, cooling, and hot water systems [4], separate from other units, and where dwelling units occupy 80% or more of the occupiable [3] square footage of the building [5]. When evaluating mixed–use buildings for eligibility, exclude commercial / retail space when assessing whether the 80% threshold has been met.

Dwelling units [1] in multifamily buildings that are not eligible to earn the ENERGY STAR through the Certified Homes Program may be eligible through the Multifamily High Rise Program. For more information, visit: www.energystar.gov/mfhr/eligibility

Note that compliance with these requirements is not intended to imply compliance with all local code requirements that may be applicable to the home to be built. [6]

Partnership, Training, and Credentialing Requirements

Builders, Raters, and HVAC contractors must meet the following requirements prior to certifying homes:

- Builders are required to sign an ENERGY STAR Partnership Agreement and complete the online Version 3 Builder Orientation, which can be found at www.energystar.gov/homesPA.
- HVAC installing contractors are required to be credentialed by an EPA-recognized HVAC Quality Installation Training and Oversight Organization (H-QUITO). An explanation of this process can be found at www.energystar.gov/newhomesHVAC.
- Raters and Field Inspectors are required to complete training, which can be found at www.energystar.gov/newhomestraining.

ENERGY STAR Certification Process [7]

1. The certification process provides flexibility to select a custom combination of measures for each home that is equivalent in performance to the minimum requirements of the ENERGY STAR Reference Design Home, Exhibit 1, as assessed through energy modeling. Use a RESNET-accredited Home Energy Rating software program to determine the ENERGY STAR HERS Index Target, which is the highest numerical HERS Index value that each rated home may achieve to earn the ENERGY STAR. [8]
2. Using the same software program, configure the preferred set of efficiency measures for the home to be certified and verify that the resulting HERS Index meets or exceeds the ENERGY STAR HERS Index Target, as determined in Step 1.

   Note that, regardless of the measures selected, the Mandatory Requirements for All Certified Homes in Exhibit 2 are also required and impose certain constraints on the efficiency measures selected (e.g., insulation levels, insulation installation quality, window performance, duct leakage). Furthermore, on-site power generation may only be used to meet the ENERGY STAR HERS Index Target for homes that are larger than the Benchmark Home and only for the incremental change in the ENERGY STAR HERS Index Target caused by the Size Adjustment Factor. [9]
3. Construct the home using the measures selected in Step 2 and the Mandatory Requirements for All Certified Homes, Exhibit 2.
4. Using a Rater, verify that all requirements have been met in accordance with the Mandatory Requirements for All Certified Homes and with RESNET's On-Site Inspection Procedures for Minimum Rated Features. [10] The Rater is required to keep electronic or hard copies of the completed and signed Rater checklists and the HVAC Design Report.

   The Rater must review all items on the Rater checklists. Raters are expected to use their experience and discretion to verify that the overall intent of each inspection checklist item has been met (i.e., identifying major defects that undermine the intent of the checklist item versus identifying minor defects that the Rater may deem acceptable).

   In the event that a Rater finds an item that is inconsistent with the intent of the checklists, the home cannot earn the ENERGY STAR until the item is corrected. If correction of the item is not possible, the home cannot earn the ENERGY STAR. In the event that an item on a Rater checklist cannot be inspected by the Rater, the home also cannot earn the ENERGY STAR. The only exceptions to this rule are in the Thermal Enclosure System Section of the Rater Field Checklist, where the builder may assume responsibility for verifying a maximum of eight items. This option shall only be used at the discretion of the Rater. When exercised, the builder's responsibility will be formally acknowledged by the builder signing the checklist for the item(s) that they verified.

   In the event that a Rater is not able to determine whether an item is consistent with the intent (e.g., an alternative method of meeting a checklist requirement has been proposed), then the Rater shall consult their Provider. If the Provider also cannot make this determination, then the Rater or Provider shall report the issue to EPA prior to project completion at: energystarhomes@energystar.gov and will typically receive an initial response within 5 business days. If EPA believes the current program requirements are sufficiently clear to determine whether the intent has been met, then this guidance will be provided to the partner and enforced beginning with the house in question. In contrast, if EPA believes the program requirements require revisions to make the intent clear, then this guidance will be provided to the partner but only enforced for homes permitted after a specified transition period after the release of the revised program requirements, typically 60 days in length.

   This process will allow EPA to make formal policy decisions as partner questions arise and to disseminate these policy decisions through the periodic release of revised program documents to ensure consistent application of the program requirements.

Exhibit 1: ENERGY STAR Reference Design Home

The ENERGY STAR Reference Design Home is the set of efficiency features modeled to determine the ENERGY STAR HERS Index Target for each home pursuing certification. Therefore, while the features below are not mandatory, if they are not used then other measures will be needed to achieve the ENERGY STAR HERS Index Target. In addition, note that the Mandatory Requirements for All Certified Homes, Exhibit 2, contain additional requirements such as total duct leakage limits, minimum allowed insulation levels, and minimum allowed fenestration performance. Therefore, EPA recommends that partners review the documents in Exhibit 2 prior to selecting measures.

Hot Climates (2009 IECC Zones 1,2,3) [12]	**Mixed and Cold Climates** (2009 IECC Zones 4,5,6,7,8) [12]
Cooling Equipment (Where Provided)	
• Cooling equipment modeled at the applicable efficiency levels below:	
• 15 SEER / 12 EER AC, • Heat pump (See Heating Equipment)	• 13 SEER AC, • Heat pump (See Heating Equipment)
Heating Equipment	
• Heating equipment modeled at the applicable efficiency levels below, dependent on fuel and system type:	

• Gas furnace, efficiency as follows:
  • *CZ 1 & 2:* 80 AFUE,
  • *CZ 3:* 90 AFUE, ENERGY STAR certified,
• 80 AFUE oil furnace,
• 80 AFUE boiler,
• 8.2 HSPF / 15 SEER / 12 EER air-source heat pump with electric or dual-fuel backup
	• 95 AFUE ENERGY STAR gas furnace,
	• 85 AFUE ENERGY STAR oil furnace,
	• 90 AFUE ENERGY STAR gas boiler,
	• 86 AFUE ENERGY STAR oil boiler,
	• Heat pump, with efficiency as follows:
	  • *CZ 4:* 8.5 HSPF / 15 SEER / 12 EER air-source w/ electric or dual-fuel backup,
	  • *CZ 5:* 9.25 HSPF / 15 SEER / 12 EER air-source w/ electric or dual-fuel backup,
	  • *CZ 6:* 9.5 HSPF / 15 SEER / 12 EER air-source w/ electric or dual-fuel backup,
	  • CZ 7-8: 3.6 COP / 17.1 EER ground-source w/ electric or dual-fuel backup

Envelope, Windows, & Doors

- Insulation levels modeled to 2012 IECC levels and Grade I installation per RESNET standards.
- Infiltration rates modeled as follows:

4 ACH50 in CZs 1,2	3 ACH50 in CZs 3,4,5,6,7,8

- ENERGY STAR windows and doors modeled, as illustrated below:

Window U-Value:	0.40 in CZs 1,2	0.30 in CZ 3	0.30 in CZ 4	0.27 in CZs 5,6,7,8
Window SHGC:	0.25 in CZs 1,2	0.25 in CZ 3	0.40 in CZ 4	Any in CZs 5,6,7,8

Door U-Value:	Opaque: 0.17	≤½ lite: 0.25	>½ lite: 0.30
Door SHGC:	Opaque: Any	≤½ lite: 0.25	>½ lite: 0.25 in CZs 1,2,3; 0.40 in CZs 4,5,6,7,8

Water Heater

- DHW equipment modeled with the following efficiency levels as applicable:

Gas:	30 Gal = 0.63 EF	40 Gal = 0.61 EF	50 Gal = 0.59 EF	60 Gal = 0.57 EF	70 Gal = 0.55 EF	80 Gal = 0.53 EF
Electric:	30 Gal = 0.94 EF	40 Gal = 0.93 EF	50 Gal = 0.92 EF	60 Gal = 0.91 EF	70 Gal = 0.90 EF	80 Gal = 0.89 EF
Oil:	30 Gal = 0.55 EF	40 Gal = 0.53 EF	50 Gal = 0.51 EF	60 Gal = 0.49 EF	70 Gal = 0.47 EF	80 Gal = 0.45 EF

Thermostat & Ductwork

- Programmable thermostat modeled.
- All ducts and air handlers modeled within conditioned space.

Lighting & Appliances

- ENERGY STAR refrigerators, dishwashers, and ceiling fans modeled.
- ENERGY STAR light bulbs modeled in 90% of RESNET-defined Qualifying Light Fixture Locations.

Exhibit 2: Mandatory Requirements for All Certified Homes

Party Responsible	Mandatory Requirements
Rater	• Completion of Rater Design Review Checklist • Completion of Rater Field Checklist
HVAC System Designer	• Completion of HVAC Design Report
HVAC Installing Contractor	• Completion of HVAC Commissioning Checklist
Builder	• Completion of Water Management System Builder Requirements

Exhibit 3: Benchmark Home [9]

Bedrooms in Home to be Built	0	1	2	3	4	5	6	7	8
Conditioned Floor Area Benchmark Home	1,000	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Effective Date

EPA intends to implement the Version 3.1 program requirements for homes permitted starting one year after state-level implementation of the 2012 IECC or an equivalent code. However, EPA will make a final determination of the implementation timeline on a state-by-state basis. Exhibit 4 defines the Version 3.1 implementation timeline for states where EPA has made this determination. Homes permitted prior to the implementation timeline are eligible to earn the ENERGY STAR under Version 3 of the program requirements.

Note that regional program requirements and associated implementation schedules have been developed for homes in CA, FL, GU, HI, the Northern Mariana Islands, and PR.

Exhibit 4: ENERGY STAR Certified Homes Version 3.1 Implementation Timeline

State	Applicable to Homes with the Following Permit Date
MA	On or after 01/01/2015
DC, IL, MD, RI	On or after 04/01/2015 (except for Calvert County and St. Mary's County in MD, for which the applicable permit date is on or after 07/01/2015)
IA	On or after 06/01/2015
DE	On or after 12/01/2015
MT,OR, WA	On or after 01/01/2016
MN, VT	On or after 04/01/2016
NV	On or after 07/01/2016
NJ	On or after 04/01/2017
TX	On or after 10/01/2017

Notes:

1. A dwelling unit, as defined by the 2012 IECC, is a single unit that provides complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.
2. Any above-grade story with 20% or more occupiable space, including commercial space, shall be counted towards the total number of stories for the purpose of determining eligibility to participate in the program. The definition of an 'above-grade story' is one for which more than half of the gross surface area of the exterior walls is above-grade. All below-grade stories, regardless of type, shall not be included when evaluating eligibility.
3. Per ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities or continual human occupancy, including, but not limited to, areas used for living, sleeping, dining, and cooking, toilets, closets, halls, storage and utility areas, and laundry areas.
4. Central domestic hot water systems are allowed if solar energy provides ≥ 50% of the domestic hot water for the residential units.
5. Units in multifamily buildings with 4 or 5 stories above-grade, including mixed–use buildings, that have their own heating, cooling, & hot water systems, separate from other units, *but where dwelling units occupy < 80%* of the residential (i.e., excluding commercial / retail space for mixed-use buildings) occupiable square footage of the building may earn the ENERGY STAR through either the

Certified Homes Program or the Multifamily High Rise (MFHR) Program if permitted prior to July 1, 2012. Units in buildings of this type that are permitted after this date shall only be eligible to earn the ENERGY STAR through the MFHR Program.

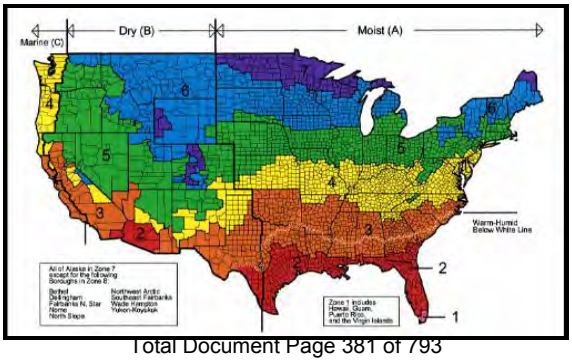
6. Where requirements of the local codes, manufacturers' installation instructions, engineering documents, or regional ENERGY STAR programs overlap with the requirements of these guidelines, EPA offers the following guidance:
   a. Where the overlapping requirements exceed the ENERGY STAR guidelines, these overlapping requirements shall be met;
   b. Where overlapping requirements conflict with a requirement of the ENERGY STAR program (e.g., slab insulation is prohibited to allow visual access for termite inspections), then the conflicting requirement within these program requirements shall not be met. Certification shall only be allowed if the Rater has determined that no equivalent option is available that could meet the intent of the conflicting requirement (e.g., switching from exterior to interior slab edge insulation). Note that a home must still meet its ENERGY STAR HERS Index Target. Therefore, other efficiency measures may be needed to compensate for the omission of the conflicting requirement.
7. Prior to Rev. 06, homes were permitted to be certified using either a Prescriptive Path or a Performance Path. Homes with a permit date on or after 09/01/2015 shall only use the Performance Path, which has been renamed the ENERGY STAR Certification Process. To minimize disruption to projects that are in process, homes with a permit date before 09/01/2015 are permitted to use a modified version of the Prescriptive Path in lieu of the Performance Path. For more information about this compliance option, visit: www.energystar.gov/v31prescriptivepath.
8. The software program shall automatically determine (i.e., without relying on a user-configured ENERGY STAR Reference Design) this target for each rated home by following the ENERGY STAR HERS Index Target Procedure, Version 3.1, available on EPA's website.
9. The average-size home with a specific number of bedrooms is termed the "Benchmark Home". The conditioned floor area of a Benchmark Home ($CFA_{Benchmark\ Home}$) is determined by selecting the appropriate value from Exhibit 3. For homes with more than 8 bedrooms, the $CFA_{Benchmark\ Home}$ shall be determined by multiplying 600 sq. ft. by the total number of bedrooms & adding 400 sq. ft.

   A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

   An egress window, as defined in 2012 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

   - have a sill height of not more than 44 in. above the floor; AND
   - have a minimum net clear opening of 5.7 sq. ft.; AND
   - have a minimum net clear opening height of 24 in.; AND
   - have a minimum net clear opening width of 20 in.; AND
   - be operational from the inside of the room without the use of keys, tools or special knowledge.
10. The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall: a) be a certified Home Energy Rater, Rating Field Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET; and, b) have attended and successfully completed an EPA-recognized training class. See www.energystar.gov/newhomestraining.

    Raters who operate under a Sampling Provider are permitted to verify the Minimum Rated Features of the home and to verify any Checklist Item designated "Rater Verified" using the RESNET-approved sampling protocol for homes outside California, and the CEC-approved sampling protocol for homes in CA. No parties other than Raters are permitted to use sampling. All other items shall be verified for each certified home. For example, no items on the HVAC Commissioning Checklist are permitted to be verified using a sampling protocol.
11. In States that have a v3.1 implementation timeline, per Exhibit 4, this Revision of the National Program Requirements is required to certify all homes permitted after 07/01/2016, but is allowed to be used for any home permitted or completed prior to this date. The Rater may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors. These assumptions should be both defensible and documented.
12. The following map illustrates the Climate Zone boundaries as defined by the 2012 IECC Figure R301.1.



HVAC Commissioning Contractor Responsibilities:

- The commissioning contractor must be credentialed by an HVAC oversight organization to complete this checklist. One checklist must be completed and signed by the commissioning contractor for each HVAC system that is commissioned.
- The completed checklist for each commissioned system, along with the corresponding HVAC Design Report, shall be retained by the contractor for quality assurance purposes. Furthermore, the contractor shall provide the completed checklist to the builder, the Home Energy Rater responsible for certifying the home, and the HVAC oversight organization upon request.
- Visit www.energystar.gov/newhomeshvac for information about the credential requirement and this checklist.

1. Commissioning Overview			
1.1 Contractor name_____ Contractor company_____ Date_____			
1.2 Organization that your company is credentialed with: ☐ ACCA ☐ Advanced Energy ☐ NYSERDA			
1.3 Builder client name: _____			
1.4 Home address: _____ City: _____ State: _____ Zip code: _____			
1.5 HVAC Design Report corresponding to this system has been collected from designer or builder. ☐ Contractor-verified			
1.6 Area that system serves, per Item 1.4 of HVAC Design Report: ☐ Whole-house ☐ Upper-level ☐ Lower-level ☐ Other _____			
1.7 House plan, per Item 1.6 of HVAC Design Report:_____ ☐ Site-specific design ☐ Group design #: _____			
2. Refrigerant Charge - Run system for 15 minutes before testing. If outdoor ambient temperature at the condenser is ≤ 55°F or, if known, below the manufacturer-recommended minimum operating temperature for the cooling cycle, then the system shall include a TXV, the outdoor temperature shall be recorded in Item 2.1, and the contractor shall check "N/A" in this Section. [3]		**Contractor Verified**	**N/A**
2.1 Outdoor ambient temperature at condenser: _____ °F DB		-	-
2.2 Return-side air temperature inside duct near evaporator, during cooling mode: _____ °F WB		-	☐
2.3 Liquid line pressure: _____ psig		-	☐
2.4 Liquid line temperature: _____ °F DB		-	☐
2.5 Suction line pressure: _____ psig		-	☐
2.6 Suction line temperature: _____°F DB		-	☐
For System with Thermal Expansion Valve (TXV):			
2.7 Condenser saturation temperature: _____ °F DB (Using Item 2.3)		-	☐
2.8 Subcooling value: _____ °F DB (Item 2.7 - Item 2.4)		-	☐
2.9 OEM subcooling goal: _____ °F DB		-	☐
2.10 Subcooling deviation: _____ °F DB (Item 2.8 – Item 2.9)		-	☐
For System with Fixed Orifice:			
2.11 Evaporator saturation temperature: ____ °F DB (Using Item 2.5)		-	☐
2.12 Superheat value: ____ °F DB (Item 2.6 – Item 2.11)		-	☐
2.13 OEM superheat goal: ____ °F DB (Using superheat tables and Items 2.1 & 2.2)		-	☐
2.14 Superheat deviation: ____ °F DB (Item 2.12 – Item 2.13)		-	☐
2.15 Item 2.10 is ± 3°F or Item 2.14 is ± 5°F		☐	☐
2.16 An OEM test procedure (e.g., as defined for a ground-source heat pump) has been used in place of the sub-cooling or super-heat process and documentation has been attached that defines this procedure		☐	☐
3. Indoor HVAC Fan Airflow			
3.1 The mode with the higher design HVAC fan airflow used, per Item 5.2 of HVAC Design Report: ☐ Heating ☐ Cooling		☐	-
3.2 Static pressure test holes have been created, and test hole locations are well-marked and accessible.		☐	-
Test hole location for **return** external static pressure: ☐ Plenum ☐ Cabinet ☐ Transition ☐ Other: _____		-	-
Test hole location for **supply** external static pressure: ☐ Plenum ☐ Cabinet ☐ Transition ☐ Other: _____		-	-
3.3 Measured **return** external static pressure (Enter value only, without negative sign): _____ IWC		-	-
3.4 Measured **supply** external static pressure (Enter value only, without positive sign): _____ IWC		-	-
3.5 Measured **total** external static pressure = Value-only from Item 3.3 + Value-only from Item 3.4 = _____ IWC		-	-
3.6 **Measured** (Item 3.5) - **Design** (Item 5.4 on HVAC Design Report) total external static pressure = _____ IWC		-	-
3.7 Measured HVAC fan airflow, using Item 3.5 and fan speed setting: _____ CFM		-	-
3.8 Measured HVAC fan airflow (Item 3.7) is ± 15% of design HVAC fan airflow (Item 5.2 on HVAC Design Report)		☐	-
4. Air Balancing of Supply Registers & Return Grilles (Recommended, but not Required) [4]			
4.1 Balancing report attached with room-by-room design airflows from Item 5.5 on HVAC Design Report, and contractor-measured airflow using ANSI / ACCA 5 QI-2015 protocol		☐	☐
4.2 Room-by-room airflows verified by contractor to be within the greater of ± 20% or 25 CFM of design airflow		☐	☐

Footnotes

1. This Checklist is designed to align with the requirements of ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems (e.g., those caused by a lack of maintenance by occupants). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

   This Checklist applies to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source (i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air distribution systems (i.e., ducts). All other permutations of equipment (e.g., boilers, mini-split / multi-split systems) and distribution systems are exempt.

2. For a home certified in the State of ID, MT, OR, or WA, the following alternatives and exemptions apply:
   a. For a home with an air-source heat pump up to 65 kBtuh with a forced-air distribution system (i.e., ducts), the contractor is permitted to complete the 2011 PTCS® Commissioned Heat Pump Certificate and Startup Form in lieu of this Checklist.
   b. For a home with a split air conditioner or unitary air conditioner up to 65 kBtuh with a forced-air distribution system (i.e., ducts), the contractor is permitted to complete the Northwest Central AC Commissioning & Startup Form in lieu of this Checklist.
   c. For a home in a location with < 600 CDD, the completion of this Checklist is recommended, but not required.

3. Either factory-installed or field-installed TXV's may be used. For field-installed TXV's, ensure that sensing bulbs are insulated and tightly clamped to the vapor line with good linear thermal contact at the recommended orientation, usually 4 or 8 o'clock.

4. Air balancing of supply registers and return grilles is highly recommended to improve the performance of the HVAC system and comfort of the occupants, but is not required at this time for certification. When air balancing is completed, balancing dampers or proper duct sizing shall be used instead of looped or coiled ductwork to limit flow to diffusers. When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, Opposable Blade Dampers (OBD) or dampers located in the duct boot are permitted to be used.

5. This Revision of the HVAC Commissioning Checklist is required to certify all homes permitted after 07/01/2016, but is allowed to be used for any home permitted or completed prior to this date. The Home Energy Rater certifying the home may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors.

HVAC Design Report [1]
ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

HVAC Designer Responsibilities:

- Complete one HVAC Design Report for each system design for a house plan, created for either the specific plan configuration (i.e., elevation, option, orientation, & county) of the home to be certified or for a plan that is intended to be built with potentially different configurations (i.e., different elevations, options, and/or orientations). Visit www.energystar.gov/newhomeshvacdesign and see Footnote 2 for more information. [2]
- Obtain efficiency features (e.g., window performance, insulation levels, and infiltration rate) from the builder or Home Energy Rater.
- Provide the completed HVAC Design Report to the builder or credentialed HVAC contractor and to the Home Energy Rater.

1. Design Overview

1.1 Designer name: _____ Designer company: _____ Date: _____

1.2 Select which party you are providing these design services to: ☐ Builder or ☐ Credentialed HVAC contractor

1.3 Name of company you are providing these design services to (if different than Item 1.1): _____

1.4 Area that system serves: ☐ Whole-house ☐ Upper-level ☐ Lower-level ☐ Other _____

1.5 Is cooling system for a temporary occupant load? [3] ☐ Yes ☐ No

1.6 House plan: _____ Check box to indicate whether the system design is site-specific or part of a group: [2]

☐ Site-specific design. Option(s) & elevation(s) modeled: _____

☐ Group design. Group #: _____ out of _____ total groups for this house plan. Configuration modeled: _____

2. Whole-House Mechanical Ventilation Design [4, 5]		Designer Verified
Airflow:		
	2.1 Ventilation airflow design rate & run-time meet the requirements of ASHRAE 62.2-2010 or 2013 [6]	☐
	2.2 Ventilation airflow rate required by 62.2 for a continuous system _____ CFM	-
	2.3 Design for this system: Vent. airflow rate: _____ CFM Run-time per cycle: _____ minutes Cycle time: _____ minutes	-
System Type & Controls:		
	2.4 Specified system type: ☐ Supply ☐ Exhaust ☐ Balanced	-
	2.5 Specified control location: _____ (e.g., Master bath, utility room)	-
	2.6 Specified controls allow the system to operate automatically, without occupant intervention	☐
	2.7 Specified controls include a readily-accessible ventilation override and a label has also been specified if its function is not obvious (e.g., a label is required for a standalone wall switch, but not for a switch that's on the ventilation equipment)	☐
	2.8 No outdoor air intakes designed to connect to the return side of the HVAC system, unless specified controls operate intermittently and automatically based on a timer and restrict intake when not in use (e.g., motorized damper) [7]	☐
Sound:	2.9 The fan of the specified system is rated ≤ 3 sones if intermittent and ≤ 1 sone if continuous, or exempted [8]	☐
Efficiency:		
	2.10 If system utilizes the HVAC fan, then the specified fan type in Item 4.7 is ECM / ICM, or the specified controls will reduce the standalone ventilation run-time by accounting for hours when the HVAC system is heating or cooling	☐
	2.11 If bathroom fans are specified as part of the system, then they are ENERGY STAR certified [9]	☐
Air Inlet Location: (Complete this section if system has a specified air inlet location; otherwise check "N/A") [10]		☐ N/A
	2.12 Inlet pulls ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit	☐
	2.13 Inlet is ≥ 2 ft. above grade or roof deck; ≥ 10 ft. of stretched-string distance from known contamination sources (e.g., stack, vent, exhaust, vehicles) not exiting the roof, and ≥ 3 ft. from known sources exiting the roof	☐

3. Room-by-Room Heating & Cooling Loads

3.1 Room-by-room loads calculated using: ☐ Unabridged ACCA Manual J v8 ☐ 2013 ASHRAE Fundamentals ☐ Other per AHJ [11]									-
3.2 Indoor design temperatures used in loads are 70°F for heating and 75°F for cooling									☐
3.3 Outdoor design temperatures used in loads: (See Footnote 12 and energystar.gov/hvacdesigntemps) [12] County & State selected: _____ Cooling season: _____°F Heating season: _____°F									-
3.4 Number of occupants used in loads: [13] _____									-
3.5 Conditioned floor area used in loads: _____ Sq. Ft.									-
3.6 Window area used in loads: _____ Sq. Ft.									-
3.7 Predominant window SHGC used in loads: [14] _____									-
3.8 Infiltration rate used in loads: [15] Summer: _____ Winter: _____									-
3.9 Mechanical ventilation rate used in loads: _____ CFM									-
Loads At Design Conditions (kBtuh)	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**	-
Cooling 3.10 Sensible heat gain (By orientation [16])									-
Cooling 3.11 Latent heat gain (Not by orientation)									-
Cooling 3.12 Total heat gain (By orientation [16])									-
Cooling 3.13 Maximum – minimum total heat gain (Item 3.12) across orientations = _____ kBtuh						Variation is ≤ 6 kBtuh [16, 17]			☐
Heating 3.14 Total heat loss (Not by orientation)									-

HVAC Design Report [1]
ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

4. Heating & Cooling Equipment Selection	**Designer Verified**
4.1 Equipment selected per ACCA Manual S (see Footnote 19 & 20) [19, 20]	☐
Air Conditioner / Heat Pump (Complete if air conditioner or heat pump will be installed; otherwise check "N/A")	☐ N/A
4.2 Equipment type: ☐ Cooling-only air conditioner or ☐ Cooling & heating heat pump	-
4.3 Condenser manufacturer & model: _____	-
4.4 Evaporator / fan coil manufacturer & model: _____	-
4.5 AHRI reference #: [21] _____	-
4.6 AHRI listed efficiency: _____ / _____ EER / SEER Air-source heat pump: ____ HSPF Ground-source heat pump: _____COP	-
4.7 Evaporator fan type: ☐ PSC ☐ ECM / ICM ☐ Other: _____	-
4.8 Compressor type: ☐ Single-speed ☐ Two-speed ☐ Variable-speed	-
4.9 Latent capacity at design conditions, from OEM expanded performance data: _____ kBtuh	-
4.10 Sensible capacity at design conditions, from OEM expanded performance data: _____ kBtuh	-
4.11 Total capacity at design conditions, from OEM expanded performance data: _____ kBtuh	-
4.12 Air-source heat pump capacity: At 17°F: _____ kBtuh At 47°F: _____ kBtuh ☐ N/A	-
4.13 Cooling sizing % = Total capacity (Item 4.11) divided by maximum total heat gain (Item 3.12): _____ %	-
4.14 Complete this Item if Condition B Climate will be used to select sizing limit in Item 4.15. Otherwise, check "N/A": [22] ☐ N/A	
4.14.1 Load sensible heat ratio = Max. sensible heat gain (Item 3.10) / Max. total heat gain (Item 3.12) = _____ %	-
4.14.2 HDD / CDD ratio (Visit energystar.gov/hvacdesigntemps to determine this value for the design location) = _____	
4.15 Check box of applicable cooling sizing limit from chart below: [19, 20]	-

Equipment Type (Per Item 4.2) & Climate Condition (Per Item 4.14)	Compressor Type (Per Item 4.8)		
	Single-Speed	Two-Speed	Variable-Speed
For Cooling-Only Equipment or For Cooling Mode of Heat Pump in Condition A Climate	☐ Recommended: 90 – 115% Allowed: 90 – 130%	☐ Recommended: 90 – 120% Allowed: 90 – 140%	☐ Recommended: 90 – 130% Allowed: 90 – 160%
For Cooling Mode of Heat Pump in Condition B Climate	☐ 90% - 100%, plus 15 kBtuh	☐ 90% - 100%, plus 15 kBtuh	☐ 90% - 100%, plus 15 kBtuh

4.16 Cooling sizing % (4.13) is within cooling sizing limit (4.15)	☐
Furnace (Complete if furnace will be installed; otherwise check "N/A")	☐ N/A
4.17 Furnace manufacturer & model: _____	-
4.18 Listed efficiency: _____ AFUE	-
4.19 Total capacity: _____ kBtuh	-
4.20 Heating sizing % = Total capacity (Item 4.19) divided by total heat loss (Item 3.14): _____ %	-
4.21 Check box of applicable heating sizing limit from chart below:	-

When Used for Heating Only	When Paired With Cooling
☐ 100 – 140%	☐ Recommended: 100 – 140% Allowed: 100 – 200%

4.22 Heating sizing % (4.20) is within heating sizing limit (4.21)	☐
5. Duct Design (Complete if heating or cooling equipment will be installed with ducts; otherwise check "N/A")	☐ N/A
5.1 Duct system designed for the equipment selected in Section 4, per ACCA Manual D	☐
5.2 Design HVAC fan airflow: [23] Cooling mode _____ CFM Heating mode _____ CFM	-
5.3 Design HVAC fan speed setting (e.g., low, medium, high): [24] Cooling mode _____ Heating mode _____	-
5.4 Design total external static pressure (corresponding to the mode with the higher airflow in Item 5.2): [25] _____ IWC	-
5.5 Room-by-room design airflows documented below (which must sum to the mode with the higher airflow in Item 5.2) [26, 27]	-

	Room Name	Design Airflow (CFM)		Room Name	Design Airflow (CFM)
1			13		
2			14		
3			15		
4			16		
5			17		
6			18		
7			19		
8			20		
9			21		
10			22		
11			23		
12		Total for all rooms			

HVAC Design Report [1]
ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

Footnotes

1. This report is designed to meet ASHRAE 62.2-2010 / 2013 and ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems (e.g., those caused by a lack of maintenance by occupants). Therefore, system designs documented through the use of this report are not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
2. The report shall represent a single system design for a house plan. Check the box for "site-specific design" if the design was created for the specific plan configuration (i.e., elevation, option, orientation, and county) of the home to be certified. Check the box for "group design" if the design was created for a plan that is intended to be built with potentially different configurations (i.e., different elevations, options, and/or orientations). Regardless of the box checked, the system design as documented on this HVAC Design Report must fall within the following tolerances for the home to be certified:
   - Item 3.3: The outdoor design temperature used in loads are within the limits defined at energystar.gov/hvacdesigntemps.
   - Item 3.4: The number of occupants used in loads is within ± 2 of the home to be certified.
   - Item 3.5: The conditioned floor area used in loads is between zero and 300 sq. ft. larger than the home to be certified.
   - Item 3.6: The window area used in loads is between zero and 60 sq. ft. larger than the home to be certified.
   - Item 3.7: The predominant window SHGC is within 0.1 of the predominant value in the home to be certified.
   - Items 3.10 - 3.12: The sensible, latent, & total heat gain are documented for the orientation of the home to be certified.
   - Item 3.13: The variation in total heat gain across orientations is ≤ 6 kBtuh.
   - Item 4.16: The cooling sizing % is within the cooling sizing limit selected.

   Provide the HVAC Design Report to the party you are providing these design services to (i.e., a builder or credentialed HVAC contractor) and to the Home Energy Rater. The report is only required to be provided once per system design, even if multiple homes are built using this design (e.g., in a production environment where the same plan is built multiple times, only one report is required). As long as a report has been provided that falls within these tolerances for the home to be certified, no additional work is required. However, if no report falls within these tolerances or if any aspect of the system design changes, then an additional report will need to be generated prior to certification.

   Visit energystar.gov/newhomeshvacdesign for a tool to assist with group designs and for more information.
3. Check "Yes" if this system is to handle temporary occupant loads. Such a system may be required to accommodate a significant number of guests on a regular or sporadic basis and shall be handled by a supplemental cooling system (e.g., a small, single-package unit or split-coil unit) or by a system that can shift capacity from zone to zone (e.g., a variable volume system).
4. The system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of a whole-house ventilation system. Designers may provide supplemental documentation as needed to document the system design.
5. In "Warm-Humid" climates as defined by 2009 IECC Figure 301.1 (i.e., CZ 1 and portions of CZ 2 and 3A below the white line), it is recommended, but not required, that equipment be specified with sufficient latent capacity to maintain indoor relative humidity at ≤ 60%.
6. Airflow design rates and run-times shall be determined using ASHRAE 62.2-2010 or later. Designers are permitted, but not required, to use published addenda and/or the 2013 version of the standard to assess compliance.
7. In addition, consult manufacturer requirements to ensure return air temperature requirements are met.
8. Whole-house mechanical ventilation fans shall be rated for sound at no less than the airflow rate in Item 2.3. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400 CFM. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.
9. Bathroom fans with a rated flow rate ≥ 500 CFM are exempted from the requirement to be ENERGY STAR certified.
10. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the owner.
11. Select "2013 ASHRAE Fundamentals" if using Chapter 17 of the 2013 ASHRAE Handbook of Fundamentals. Select "Other per AHJ" if the Authority Having Jurisdiction where the home will be certified mandates the use of a load calculation methodology other than Unabridged ACCA Manual J v8 or 2013 ASHRAE Fundamentals.
12. Visit energystar.gov/hvacdesigntemps for the maximum cooling season design temperature and minimum heating season design temperature permitted for ENERGY STAR certified homes. For "County & State selected", select the County and State where the home is to be certified. The same design report is permitted to be used in other counties, as long as the design temperature limits in those other counties meet or exceed the cooling and heating season temperature limits for the county selected. For example, if Fauquier County, VA, is used for the load calculations, with a 1% cooling temperature limit of 93 F, then the same report could be used in Fairfax County (which has a higher limit of 94 F) but not in Arlington County (which has a lower limit of 92 F).
13. To determine the number of occupants among all HVAC systems in the home, calculate the number of bedrooms, as defined below, and add one. This number of occupants must be within ± 2 of the home to be certified, unless Item 1.5 indicates that the system is a cooling system for temporary occupant loads.

    A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

    An egress window, as defined in 2009 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

- have a sill height of not more than 44 inches above the floor; AND
- have a minimum net clear opening of 5.7 sq. ft.; AND
- have a minimum net clear opening height of 24 in.; AND
- have a minimum net clear opening width of 20 in.; AND
- be operational from the inside of the room without the use of keys, tools or special knowledge.

14. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.
15. Infiltration rate shall reflect the value used in the confirmed or projected HERS rating for home to be certified. Alternatively, use "Average" or "Semi-loose" values for the cooling season infiltration rate and "Semi-tight" or "Average" values for the heating season infiltration rate, as defined by ACCA Manual J, Eighth Edition, Version Two.
16. Orientation represents the direction that the front door of the house is facing. The designer is only required to document the loads for the orientation(s) that the house might be built in. For example, if a house plan will only be built one time in a specific orientation (e.g., a site-specific design), then the designer only needs to document the loads for this one orientation.
17. Determine the orientation with the largest and smallest Total Heat Gain. Verify that the difference in Total Heat Gain between the orientation with the largest and smallest value is ≤ 6 kBtuh. If not, then assign the orientations into one or more groups until the difference is ≤ 6 kBtuh and then complete a separate HVAC Design Report for each group.
18. This Revision of the HVAC Design Report is required to certify all homes permitted after 07/01/2016, but is allowed to be used for any home permitted or completed prior to this date. The Home Energy Rater certifying the home may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors.
19. Equipment shall be selected using the maximum total heat gain in Item 3.12 and the total heat loss in Item 3.14 per ACCA Manual S, Second Edition, except that cooling ranges above ACCA Manual S limits are temporarily allowed, per Item 4.15.
20. As an alternative for low-load spaces, a system match-up including a single-speed compressor with a total capacity ≤ 20 kBtuh is permitted to be used in spaces with a total cooling load ≤ 15 kBtuh. A system match-up including a two-speed or variable-speed compressor with a total capacity ≤ 25 kBtuh is permitted to be used in spaces with a total cooling load ≤ 18 kBtuh.
21. Evaporators and condensing units shall be properly matched as demonstrated by an AHRI Reference #. If an AHRI Reference # is not available, a copy of OEM-provided catalog data indicating acceptable combination selection and performance data shall be attached.
22. Per ACCA Manual S, Second Edition, if the load sensible heat ratio is ≥ 95% and the HDD/CDD ratio is ≥ 2.0, then the Climate is Condition B, otherwise it is Condition A.
23. Design HVAC fan airflow is the design airflow for the blower in CFM, as determined using the manufacturer's expanded performance data.
24. Design HVAC fan speed setting is the fan speed setting on the control board (e.g., low, medium, high) that corresponds with the Design HVAC fan airflow.
25. Design total external static pressure is the pressure corresponding to the Design HVAC fan airflow, inclusive of external components (e.g., evaporator coil, whole-house humidifier, or ≥ MERV 6 filter).
26. Designers may provide supplemental documentation with room-by-room and total design airflows in lieu of completing Item 5.5.
27. Orientation-specific room-by-room design airflows are recommended, but not required, to distribute airflow proportional to load, thereby improving comfort and efficiency.

Home Address: _____ City: _____ State: _____ Permit Date: _____

1. Partnership Status	Must Correct	Rater [1] Verified
1.1 Rater has verified that builder is an ENERGY STAR partner using energystar.gov/partnerlocator	☐	☐
1.2 Rater has verified that HVAC contractor holds credential required to complete the HVAC Commissioning Checklist, unless all equipment to be installed in home to be certified is an exempted type, in which case check "N/A" [2] ☐ N/A HVAC Contractor Company Name: _____	☐	☐
2. High-Performance Fenestration		
2.1 Specified fenestration meets or exceeds 2009 IECC requirements [3]	☐	☐
3. High-Performance Insulation		
3.1 Specified ceiling, wall, floor, and slab insulation levels comply with one of the following options:	☐	☐
3.1.1 Meets or exceeds 2009 IECC levels [4, 5, 6] **OR**;	-	-
3.1.2 Achieves ≤ 133% of the total UA resulting from the U-factors in 2009 IECC Table 402.1.3, per guidance in Footnote 4d, AND specified home infiltration does not exceed the following: [5, 6] 3 ACH50 in CZs 1, 2 2.5 ACH50 in CZs 3, 4 2 ACH50 in CZs 5, 6, 7 1.5 ACH50 in CZ 8	-	-
4. Review of HVAC Design Report [7]		
4.1 HVAC Design Report collected for records, with no Items left blank	☐	☐
4.2 HVAC Design Report reviewed by Rater for the following parameters (HVAC Design Report Item # indicated in parenthesis):		
4.2.1 Cooling season and heating season outdoor design temperatures used in loads (3.3) are within the limits defined at energystar.gov/hvacdesigntemps for the State and County where the home will be built, or the designer has provided an allowance from EPA to use alternative values [8]	☐	☐
4.2.2 Number of occupants used in loads (3.4) is within ± 2 of the home to be certified [9]	☐	☐
4.2.3 Conditioned floor area used in loads (3.5) is between zero and 300 sq. ft. larger than the home to be certified	☐	☐
4.2.4 Window area used in loads (3.6) is between zero and 60 sq. ft. larger than the home to be certified	☐	☐
4.2.5 Predominant window SHGC used in loads (3.7) is within 0.1 of predominant value in the home to be certified [10]	☐	☐
4.2.6 Sensible, latent, & total heat gain are documented (3.10 - 3.12) for the orientation of the home to be certified [11]	☐	☐
4.2.7 The variation in total heat gain across orientations (3.13) is ≤ 6 kBtuh [11]	☐	☐
4.2.8 Cooling sizing % (4.13) is within the cooling sizing limit (4.15) selected by the HVAC designer	☐	☐

Rater Name: _____ Date of Review: _____

Rater Signature: _____ Rater Company Name:_____

(Intentionally Left Blank)

Home Address: _____ City: _____ State: _____ Permit Date: _____

Thermal Enclosure System	Must Correct	Builder Verified [1]	Rater Verified [2]	N/A [3]
1. High-Performance Fenestration & Insulation				
1.1 Fenestration meets or exceeds levels specified in Item 2.1 of the Rater Design Review Checklist	☐	☐	☐	-
1.2 Insulation meets or exceeds levels specified in Item 3.1 of the Rater Design Review Checklist	☐	☐	☐	-
1.3 All insulation achieves RESNET-defined Grade I installation. See Footnote 4 for alternatives. [4]	☐	☐	☐	-
2. Fully-Aligned Air Barriers [5] At each insulated location below, a complete air barrier is provided that is fully aligned as follows:				
Ceilings: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays).[6]				
2.1 Dropped ceilings / soffits below unconditioned attics, and all other ceilings	☐	☐	☐	☐
Walls: At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8 [7]				
2.2 Walls behind showers, tubs, staircases, and fireplaces	☐	☐	☐	☐
2.3 Attic knee walls and skylight shaft walls [8]	☐	☐	☐	☐
2.4 Walls adjoining porch roofs or garages	☐	☐	☐	☐
2.5 Double-walls and all other exterior walls	☐	☐	☐	-
Floors: At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment. See Footnotes 10 & 11 for alternatives. [9, 10, 11]				
2.6 Floors above garages, floors above unconditioned basements or crawlspaces, and cantilevered floors	☐	☐	☐	☐
2.7 All other floors adjoining unconditioned space (e.g., rim / band joists at exterior wall or at porch roof)	☐	☐	☐	☐
3. Reduced Thermal Bridging				
3.1 For insulated ceilings with attic space above (i.e., non-cathedralized), Grade I insulation extends to the inside face of the exterior wall below and is ≥ R-21 in CZ 1-5; ≥ R-30 in CZ 6-8 [12]	☐	☐	☐	☐
3.2 For slabs on grade in CZ 4-8, 100% of slab edge insulated to ≥ R-5 at the depth specified by the 2009 IECC and aligned with the thermal boundary of the walls [13, 14]	☐	☐	☐	☐
3.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) ≥ R-21 in CZ 1-5; ≥ R-30 in CZ 6-8	☐	☐	☐	☐
3.4 At above-grade walls separating conditioned from unconditioned space, one of the following options used (rim / band joists exempted): [15]				
3.4.1 Continuous rigid insulation, insulated siding, or combination of the two is: ≥ R-3 in CZ 1-4; ≥ R-5 in CZ 5-8 [16, 17, 18], **OR**;	☐	☐	☐	☐
3.4.2 Structural Insulated Panels **OR**; Insulated Concrete Forms **OR**; Double-wall framing **OR**; [16,19]	☐	☐	☐	☐
3.4.3 Advanced framing, including all of the Items below: [20]				
3.4.3a Corners insulated ≥ R-6 to edge [21], **AND**;	☐	☐	☐	☐
3.4.3b Headers above windows & doors insulated ≥ R-3 for 2x4 framing or equivalent cavity width, and ≥ R-5 for all other assemblies (e.g., with 2x6 framing) [22], **AND**;	☐	☐	☐	☐
3.4.3c Framing limited at all windows & doors to one pair of king studs, plus one pair of jack studs per window opening to support the header and sill, **AND**;	☐	☐	☐	☐
3.4.3d Interior / exterior wall intersections insulated to same R-value as rest of exterior wall, [23] **AND**;	☐	☐	☐	☐
3.4.3e Minimum stud spacing of 16 in. o.c. for 2x4 framing in all Climate Zones and, in CZ 6-8, 24 in. o.c. for 2x6 framing [24]	☐	☐	☐	☐
4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material)				
4.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed	☐	☐	☐	-
4.2 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4-8.	☐	☐	☐	☐
4.3 Above-grade sill plates adjacent to conditioned space sealed to foundation or sub-floor. Gasket also placed beneath above-grade sill plate if resting atop concrete / masonry & adjacent to cond. space [25,26]	☐	☐	☐	☐
4.4 Continuous top plate or blocking is at top of walls adjoining unconditioned space, and sealed	☐	☐	☐	☐
4.5 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above.	☐	☐	☐	☐
4.6 Rough opening around windows & exterior doors sealed [27]	☐	☐	☐	-
4.7 Walls that separate attached garages from occupiable space sealed and, also, an air barrier installed and sealed at floor cavities aligned with these walls	☐	☐	☐	☐
4.8 In multifamily buildings, the gap between the common wall (e.g. the drywall shaft wall) and the structural framing between units sealed at all exterior boundaries	☐	☐	☐	☐
4.9 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions made substantially air-tight with weatherstripping or equivalent gasket	☐	☐	☐	☐
4.10 Attic access panels, drop-down stairs, & whole-house fans equipped with durable ≥ R-10 cover that is gasketed (i.e., not caulked). Fan covers either installed on house-side or mechanically operated. [28]	☐	☐	☐	☐

HVAC System [30] (HVAC Design Report Item # indicated in parenthesis)	Must Correct	Rater Verified [2]	N/A [3]
5. Heating & Cooling Equipment			
5.1 HVAC manufacturer & model number on installed equipment matches either of the following (check box): [31] ☐ HVAC Design Report (4.3, 4.4, & 4.17) ☐ Written approval received from designer	☐	☐	-
5.2 External static pressure measured by Rater at contractor-provided test locations and documented below: [32] Return-Side External Static Pressure: _____IWC Supply-Side External Static Pressure: _____IWC	☐	☐	☐
5.3 Permitted, but not required: HVAC Commissioning Checklist collected, with no items left blank	☐	☐	☐
6. Duct Quality Installation - *Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote*			
6.1 Ductwork installed without kinks, sharp bends, compressions, or excessive coiled flexible ductwork [33]	☐	☐	☐
6.2 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and / or undercut doors to achieve a Rater-measured pressure differential ≤ 3 Pa with respect to the main body of the house when all bedroom doors are closed and all air handlers are operating. See Footnote 34 for alternative.[34]	☐	☐	-
6.3 All supply and return ducts in unconditioned space, including connections to trunk ducts, are insulated to ≥ R-6 [35]	☐	☐	☐
6.4 Rater-measured total duct leakage meets one of the following two options. See Footnote 37 for alternative: [36, 37, 38]			
6.4.1 Rough-in: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, all duct boots sealed to finished surface, Rater-verified at final. [39]	☐	☐	☐
6.4.2 Final: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed [40]	☐	☐	☐
6.5 Rater-measured duct leakage to outdoors the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25 [36, 38, 41]	☐	☐	☐
7. Whole-House Mechanical Ventilation System			
7.1 Rater-measured ventilation rate is within either ± 15 CFM or ±15% of design value (2.3) [42]	☐	☐	-
7.2 A readily-accessible ventilation override control installed and also labeled if its function is not obvious (e.g., a label is required for a standalone wall switch, but not for a switch that's on the ventilation equipment)	☐	☐	-
7.3 No outdoor air intakes connected to return side of the HVAC system, unless controls are installed to operate intermittently & automatically based on a timer and to restrict intake when not in use (e.g., motorized damper)	☐	☐	-
7.4 System fan rated ≤ 3 sones if intermittent and ≤ 1 sone if continuous, or exempted [43]	☐	☐	-
7.5 If system utilizes the HVAC fan, then the specified fan type is ECM / ICM (4.7), or the controls will reduce the standalone ventilation run-time by accounting for hours when the HVAC system is heating or cooling	☐	☐	☐
7.6 Bathroom fans are ENERGY STAR certified if used as part of the whole-house system [44]	☐	☐	☐
7.7 Air inlet location (Complete if ventilation air inlet location was specified (2.12, 2.13); otherwise check "N/A"): [45, 46]	-	-	☐
7.7.1 Inlet pulls ventilation air directly from outdoors and not from attic, crawlspace, garage, or adjacent dwelling unit	☐	☐	-
7.7.2 Inlet is ≥ 2 ft. above grade or roof deck; ≥ 10 ft. of stretched-string distance from known contamination sources (e.g., stack, vent, exhaust, vehicles) not exiting the roof, and ≥ 3 ft. distance from sources exiting the roof	☐	☐	-
7.7.3 Inlet is provided with rodent / insect screen with ≤ 0.5 inch mesh	☐	☐	-

8. Local Mechanical Exhaust - In each kitchen and bathroom, a system is installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow and manufacturer-rated sound level standards: [42, 47]

Location		Continuous Rate	Intermittent Rate [48]	Must Correct	Rater Verified [2]	N/A [3]
8.1 Kitchen	Airflow	≥ 5 ACH, based on kitchen volume [49, 50]	≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume [49, 50, 51]	☐	☐	-
	Sound	Recommended: ≤ 1 sone	Recommended: ≤ 3 sones			
8.2 Bathroom	Airflow	≥ 20 CFM	≥ 50 CFM	☐	☐	-
	Sound	Required: ≤ 1 sone	Recommended: ≤ 3 sones			

9. Filtration			
9.1 At least one MERV 6 or higher filter installed in each ducted mechanical system in a location that facilitates access and regular service by the owner [52]	☐	☐	☐
9.2 Filter access panel includes gasket or comparable sealing mechanism and fits snugly against the exposed edge of filter when closed to prevent bypass [53]	☐	☐	☐
9.3 All return air and mechanically supplied outdoor air passes through filter prior to conditioning	☐	☐	☐
10. Combustion Appliances			
10.1 Furnaces, boilers, and water heaters located within the home's pressure boundary are mechanically drafted or direct-vented. See Footnote 56 for alternatives. [54, 55, 56]	☐	☐	☐
10.2 Fireplaces located within the home's pressure boundary are mechanically drafted or direct-vented. See Footnote 57 for alternatives.[54, 55, 57]	☐	☐	☐
10.3 If unvented combustion appliances other than cooking ranges or ovens are located inside the home's pressure boundary, the Rater has followed Section 805 of RESNET's Standards, encompassing ANSI/ACCA 12 QH-2014, Appendix A, Section A3 (Carbon Monoxide Test), and verified the equipment meets the limits defined within [54, 58]	☐	☐	☐

Rater Name: _____ Rater Pre-Drywall Inspection Date: _____ Rater Initials: _____

Rater Name: _____ Rater Final Inspection Date: _____ Rater Initials: _____

Builder Employee: _____ Builder Inspection Date: _____ Builder Initials: _____

Rater Design Review Checklist Footnotes

1. The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall: a) be a certified Home Energy Rater, Rating Field Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET; and, b) have attended and successfully completed an EPA-recognized training class. See energystar.gov/newhomestraining.
2. HVAC contractors must be credentialed by an EPA-recognized HVAC Quality Installation Training and Oversight Organization (H-QUITO) if a split air conditioner, unitary air conditioner, air-source heat pump, or water-source (i.e., geothermal) heat pump up to 65 kBtuh with a forced-air distribution system (i.e., ducts) or a furnace up to 225 kBtuh with a forced-air distribution system (i.e., ducts) will be installed in the home to be certified. For all other permutations of equipment (e.g., boilers, mini-split / multi-split systems) and distribution systems, a credential is not required. An explanation of this credentialing process and links to H-QUITOs, which maintain lists of credentialed contractors, can be found at energystar.gov/newhomeshvac.
3. All windows, doors and skylights shall meet or exceed the component U-factor and SHGC requirements specified in 2009 IECC Table 402.1.1. If no NFRC rating is noted on the window or in product literature (e.g., for site-built fenestration), select the U-factor and SHGC value from Tables 4 and 10, respectively, in 2013 ASHRAE Fundamentals, Chapter 15. Select the highest U-factor and SHGC value among the values listed for the known window characteristics (e.g., frame type, number of panes, glass color, and presence of low-e coating). Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion. The following exceptions apply:
   a. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements;
   b. An area-weighted average of fenestration products ≥ 50% glazed shall be permitted to satisfy the SHGC requirements;
   c. 15 square feet of glazed fenestration per dwelling unit shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above;
   d. One side-hinged opaque door assembly up to 24 square feet in area shall be exempt from the U-factor requirements and shall be excluded from area-weighted averages calculated using a) and b), above;
   e. Fenestration utilized as part of a passive solar design shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above. Exempt windows shall be facing within 45 degrees of true South and directly coupled to thermal storage mass that has a heat capacity > 20 btu / $ft^3 x^oF$ and provided in a ratio of at least 3 sq. ft. per sq. ft. of South facing fenestration. Generally, thermal mass materials will be at least 2 in. thick.

   In Passive House (PHIUS+) certified homes, where triple-glazed window assemblies with thermal breaks / spacers between the panes are used, such windows meet the intent of Item 2.1 and shall be excluded when assessing compliance of a) through e), above.
4. Specified levels shall meet or exceed the component insulation levels in 2009 IECC Table 402.1.1. The following exceptions apply:
   a. Steel-frame ceilings, walls, and floors shall meet the insulation levels of 2009 IECC Table 402.2.5. In CZ 1 and 2, the continuous insulation requirements in this table shall be permitted to be reduced to R-3 for steel-frame wall assemblies with studs spaced at 24 in. on center. This exception shall not apply if the alternative calculations in d) are used;
   b. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in d) are used;
   c. For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof / ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 sq. ft. or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in d) are used;
   d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows:

      An assembly with a U-factor equal or less than specified in 2009 IECC Table 402.1.3 complies.

      A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 also complies. The performance of all components (i.e., ceilings, walls, floors, slabs, and fenestration) can be traded off using the UA approach. Note that Items 3.1 through 3.3 of the Rater Field Checklist shall be met regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.
5. Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 12 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall. Alternatively, the thermal break is permitted to be created using ≥ R-3 rigid insulation on top of an existing slab (e.g., in a home undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).
6. Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the home's certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: energystar.gov/slabedge.
7. The Rater shall collect one HVAC Design Report per system design per plan. Regardless of whether the "site-specific design" or "group design" box has been checked in Item 1.6 of the HVAC Design Report, the system design as documented on the HVAC Design Report must fall within the tolerances in Item 4.2 for the home to be certified. The report is only required to be collected once per system design, even if multiple homes are built using this design (e.g., in a production environment where the same plan is built multiple times, only one report is required as long as no aspect of the system design changes between homes). The Rater is only responsible for verifying that the designer has not left any items blank on the HVAC Design Report and for verifying the discrete objective parameters in Item 4.2 of this Checklist, not for verifying the accuracy of every input on the HVAC Design Report.
8. Visit energystar.gov/hvacdesigntemps for the maximum cooling season design temperature and minimum heating season design temperature permitted for ENERGY STAR certified homes, and the process for a designer to obtain an allowance from EPA. The same

design report is permitted to be used in other counties, as long as the design temperature limits in those other counties meet or exceed the cooling and heating season temperature limits for the county selected. For example, if Fauquier County, VA, is used for the load calculations, with a 1% cooling temperature limit of 93 F, then the same report could be used in Fairfax County (which has a higher limit of 94 F) but not in Arlington County (which has a lower limit of 92 F).

9. To determine the number of occupants among all HVAC systems in the home, calculate the number of bedrooms, as defined below, and add one. The number of occupants used in loads must be within ± 2 of the home to be certified, unless Item 1.5 of the HVAC Design Report indicates that the system is a cooling system for temporary occupant loads.

   A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

   An egress window, as defined in 2009 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

   - have a sill height of not more than 44 inches above the floor; AND
   - have a minimum net clear opening of 5.7 sq. ft.; AND
   - have a minimum net clear opening height of 24 in.; AND
   - have a minimum net clear opening width of 20 in.; AND
   - be operational from the inside of the room without the use of keys, tools or special knowledge.

10. "Predominant" is defined as the SHGC value used in the greatest amount of window area in the home.
11. Orientation represents the direction that the front door of the house is facing. The designer is only required to document the loads for the orientation(s) that the house might be built in. For example, if a house plan will only be built one time in a specific orientation (e.g., a site-specific design), then the designer only needs to document the loads for this one orientation.
12. This Revision of the Rater Design Review Checklist is required to certify all homes permitted after 07/01/2016, but is allowed to be used for any home permitted or completed prior to this date. The Rater may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors. These assumptions should be both defensible and documented.

Rater Field Checklist Footnotes

1. At the discretion of the Rater, the builder may verify up to eight items in Sections 1-4 of this Checklist. When exercised, the builder's responsibility will be formally acknowledged by the builder signing off on the checklist for the item(s) that they verified. However, if a quality assurance review indicates that Items have not been successfully completed, the Rater will be responsible for facilitating corrective action.
2. The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall: a) be a certified Home Energy Rater, Rating Field Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET; and, b) have attended and successfully completed an EPA-recognized training class. See energystar.gov/newhomestraining.
3. The column titled "N/A," which denotes items that are "not applicable," should be used when the checklist Item is not present in the home or conflicts with local requirements.
4. Two alternatives are provided: a) Grade II cavity insulation is permitted to be used for assemblies that contain a layer of continuous, air impermeable insulation ≥ R-3 in Climate Zones 1 to 4, ≥ R-5 in Climate Zones 5 to 8; b) Grade II batts are permitted to be used in floors if they fill the full depth of the floor cavity, even when compression occurs due to excess insulation, as long as the R-value of the batts has been appropriately assessed based on manufacturer guidance and the only defect preventing the insulation from achieving Grade I is the compression caused by the excess insulation.
5. For purposes of this Checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers.

   Open-cell or closed-cell foam shall have a finished thickness ≥ 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise.

   If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads ≥ 1 in. diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft paper, paper-based products, or other materials that are easily torn. If polyethylene is used, its thickness shall be ≥ 6 mil.
6. All insulated ceiling surfaces, regardless of slope (e.g., cathedral ceilings, tray ceilings, conditioned attic roof decks, flat ceilings, sloped ceilings), must meet the requirements for ceilings.
7. All insulated vertical surfaces are considered walls (e.g., above and below grade exterior walls, knee walls) and must meet the air barrier requirements for walls. The following exceptions apply: air barriers recommended, but not required, in adiabatic walls in multifamily dwellings; and, in Climate Zones 4 through 8, an air barrier at the interior vertical surface of insulation is recommended but not required in basement walls or crawlspace walls. For the purpose of these exceptions, a basement or crawlspace is a space for which ≥ 40% of the total gross wall area is below-grade.
8. Exterior air barriers are not required for attic knee walls that are ≤ 24 in. in height if an interior air barrier is provided and insulation extends in all directions from the top of this interior air barrier into unconditioned space at the following levels: CZ 1-5: ≥ R-21; CZ 6-8: ≥ R-30.
9. EPA highly recommends, but does not require, an air barrier at the interior vertical surface of floor insulation in Climate Zones 4-8.
10. Examples of supports necessary for permanent contact include staves for batt insulation or netting for blown-in insulation. Alternatively, supports are not required if batts fill the full depth of the floor cavity, even when compression occurs due to excess insulation, as long as the R-value of the batts has been appropriately assessed based on manufacturer guidance and the only defect preventing the insulation from achieving the required installation grade is the compression caused by the excess insulation.

11. Alternatively, an air barrier is permitted to be installed at the exterior horizontal surface of the floor insulation if the insulation is installed in contact with this air barrier, the exterior vertical surfaces of the floor cavity are also insulated, and air barriers are included at the exterior vertical surfaces of this insulation.
12. The minimum designated R-values must be achieved regardless of the trade-offs determined using an equivalent U-factor or UA alternative calculation, with the following exception:

    For homes permitted through 12/31/2012: CZ 1-5: For spaces that provide less than 5.5 in. of clearance, R-15 Grade I insulation is permitted. CZ 6-8: For spaces that provide less than 7.0 in. of clearance, R-21 Grade I insulation is permitted.

    For homes permitted on or after 01/01/2013: Homes shall achieve Item 3.1 without exception.

    Note that if the minimum designated values are used, then higher insulation values may be needed elsewhere to meet Item 1.2. Also, note that these requirements can be met by using any available strategy, such as a raised-heel truss, alternate framing that provides adequate space, and / or high-density insulation.
13. Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 12 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall. Alternatively, the thermal break is permitted to be created using ≥ R-3 rigid insulation on top of an existing slab (e.g., in a home undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).
14. Where an insulated wall separates a garage, patio, porch, or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the home's certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: energystar.gov/slabedge.
15. Mass walls utilized as the thermal mass component of a passive solar design (e.g., a Trombe wall) are exempt from this Item. To be eligible for this exemption, the passive solar design shall be comprised of the following five components: an aperture or collector, an absorber, thermal mass, a distribution system, and a control system. For more information, see: energy.gov/sites/prod/files/guide_to_passive_solar_home_design.pdf.

    Mass walls that are not part of a passive solar design (e.g., CMU block or log home enclosure) shall either utilize the strategies outlined in Item 3.4 or the pathway in the assembly with the least thermal resistance, as determined using a method consistent with the 2013 ASHRAE Handbook of Fundamentals, shall provide ≥ 50% of the applicable assembly resistance, defined as the reciprocal of the mass wall equivalent U-factor in the 2009 IECC Table 402.1.3. Documentation identifying the pathway with the least thermal resistance and its resistance value shall be collected by the Rater and any Builder Verified or Rater Verified box under Item 3.4 shall be checked.
16. Up to 10% of the total exterior wall surface area is exempted from the reduced thermal bridging requirements to accommodate intentional designed details (e.g., architectural details such as thermal fins, wing walls, or masonry fireplaces; structural details, such as steel columns). It shall be apparent to the Rater that the exempted areas are intentional designed details or the exempted area shall be documented in a plan provided by the builder, architect, or engineer. The Rater need not evaluate the necessity of the designed detail to certify the home.
17. If used, insulated siding shall be attached directly over a water-resistive barrier and sheathing. In addition, it shall provide the required R-value as demonstrated through either testing in accordance with ASTM C 1363 or by attaining the required R-value at its minimum thickness. Insulated sheathing rated for water protection can be used as a water resistant barrier if all seams are taped and sealed. If non-insulated structural sheathing is used at corners, the advanced framing details listed in Item 3.4.3 shall be met for those wall sections.
18. Steel framing shall meet the reduced thermal bridging requirements by complying with Item 3.4.1 of the Checklist.
19. Double-wall framing is defined as any framing method that ensures a continuous layer of insulation covering the studs to at least the R-value required in Item 3.4.1 of the Checklist, such as offset double-stud walls, aligned double-stud walls with continuous insulation between the adjacent stud faces, or single-stud walls with 2x2 or 2x3 cross-framing. In all cases, insulation shall fill the entire wall cavity from the interior to exterior sheathing except at windows, doors and other penetrations.
20. All advanced framing details shall be met except where the builder, architect, or engineer provides a framing plan that encompasses the details in question, indicating that structural members are required at these locations and including the rationale for these members (e.g., full-depth solid framing is required at wall corners or interior / exterior wall intersections for shear strength, a full-depth solid header is required above a window to transfer load to jacks studs, additional jack studs are required to support transferred loads, additional cripple studs are required to maintain on-center spacing, or stud spacing must be reduced to support multiple stories in a multifamily building). The Rater shall retain a copy of the detail and rationale for their records, but need not evaluate the rationale to certify the home.
21. All exterior corners shall be constructed to allow access for the installation of ≥ R-6 insulation that extends to the exterior wall sheathing. Examples of compliance options include standard-density insulation with alternative framing techniques, such as using three studs per corner, or high-density insulation (e.g., spray foam) with standard framing techniques.
22. Compliance options include continuous rigid insulation sheathing, SIP headers, other prefabricated insulated headers, single-member or two-member headers with insulation either in between or on one side, or an equivalent assembly. R-value requirement refers to manufacturer's nominal insulation value.
23. Insulation shall run behind interior / exterior wall intersections using ladder blocking, full length 2x6 or 1x6 furring behind the first partition stud, drywall clips, or other equivalent alternative.
24. In Climate Zones 6 - 8, a minimum stud spacing of 16 in. o.c. is permitted to be used with 2x6 framing if ≥ R-20.0 wall cavity insulation is achieved. However, all 2x6 framing with stud spacing of 16 in. o.c. in Climate Zones 6 - 8 shall have ≥ R-20.0 wall cavity insulation installed regardless of any framing plan or alternative equivalent total UA calculation.
25. Existing sill plates (e.g., in a home undergoing a gut rehabilitation) on the interior side of structural masonry or monolithic walls are exempt from this Item. In addition, other existing sill plates resting atop concrete or masonry and adjacent to conditioned space are permitted, in lieu of using a gasket, to be sealed with caulk, foam, or equivalent material at both the interior seam between the sill plate and the subfloor and the seam between the top of the sill plate and the sheathing.

26. In Climate Zones 1 through 3, a continuous stucco cladding system adjacent to sill and bottom plates is permitted to be used in lieu of sealing plates to foundation or sub-floor with caulk, foam, or equivalent material.
27. In Climate Zones 1 through 3, a continuous stucco cladding system sealed to windows and doors is permitted to be used in lieu of sealing rough openings with caulk or foam.
28. Examples of durable covers include, but are not limited to, pre-fabricated covers with integral insulation, rigid foam adhered to cover with adhesive, or batt insulation mechanically fastened to the cover (e.g., using bolts, metal wire, or metal strapping).
29. This Revision of the Rater Field Checklist is required to certify all homes permitted after 07/01/2016, but is allowed to be used for any home permitted or completed prior to this date. The Rater may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors. These assumptions should be both defensible and documented.
30. This Checklist is designed to meet the requirements of ASHRAE 62.2-2010 / 2013, and ANSI / ACCA's 5 QI-2015 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, (e.g., those caused by a lack of maintenance by occupants). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
31. If installed equipment does not match the HVAC Design Report, then prior to certification the Rater shall obtain written approval from the designer (e.g., email, updated HVAC Design Report) confirming that the installed equipment meets the requirements of the HVAC Design Report. In cases where the condenser unit is installed after the time of inspection by the Rater, the HVAC manufacturer and model numbers on installed equipment can be documented through the use of photographs provided by the HVAC Contractor after installation is complete.
32. The Rater shall measure and record the external static pressure in the return-side and supply-side of the system using the contractor-provided test locations. However, at this time, the Rater need not assess whether these values are within a specific range to certify the home.
33. Kinks are to be avoided and are caused when ducts are bent across sharp corners such as framing members. Sharp bends are to be avoided and occur when the radius of the turn in the duct is less than one duct diameter. Compression is to be avoided and occurs when flexible ducts in unconditioned space are installed in cavities smaller than the outer duct diameter and ducts in conditioned space are installed in cavities smaller than inner duct diameter. Ducts shall not include coils or loops except to the extent needed for acoustical control.
34. Item 6.2 does not apply to ventilation or exhaust ducts. For an HVAC system with a multi-speed fan, the highest design fan speed shall be used when verifying this requirement. As an alternative to the 3 Pa limit, a Rater-measured pressure differential ≤ 5 Pa is permitted to be used for bedrooms with a design airflow ≥ 150 CFM. The Rater-measured pressure shall be rounded to the nearest whole number to assess compliance.
35. Item 6.3 does not apply to ducts that are a part of local mechanical exhaust and exhaust-only whole-house ventilation systems. EPA recommends, but does not require, that all metal ductwork not encompassed by Section 6 (e.g., exhaust ducts, duct boots, ducts in conditioned space) also be insulated and that insulation be sealed to duct boots to prevent condensation.
36. Items 6.4 and 6.5 only apply to heating, cooling, and balanced ventilation ducts. Duct leakage shall be determined and documented by a Rater using a RESNET-approved testing protocol. Leakage limits shall be assessed on a per-system, rather than per-home, basis. For *balanced ventilation ducts* that are not connected to space heating or cooling systems, a Rater is permitted to visually verify, in lieu of duct leakage testing, that all seams and connections are sealed with mastic or metal tape and all duct boots are sealed to floor, wall, or ceiling using caulk, foam, or mastic tape.
37. For a duct system with three or more returns, the total Rater-measured duct leakage is permitted to be the greater of ≤ 6CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM25 at 'rough-in' or the greater of ≤ 12 CFM25 per 100 sq. ft. of CFA or ≤ 120 CFM25 at 'final'.
38. For a home certified in the State of ID, MT, OR, or WA that is permitted before 01/01/2016, as an alternate to Rater-verified duct leakage, a PTCS® Duct Sealing Certification Form is permitted to be collected by the Home Energy Rater.
39. Cabinets (e.g., kitchen, bath, multimedia) or ducts that connect duct boots to toe-kick registers are not required to be in place during the 'rough-in' test. For homes permitted through 12/31/2013: Homes are permitted to be certified if rough-in leakage is ≤ 6 CFM25 per 100 sq. ft. of CFA or ≤ 60 CFM25, with air handler & all ducts, building cavities used as ductwork, & duct boots installed.
40. Registers atop carpets are permitted to be removed and the face of the duct boot temporarily sealed during testing. In such cases, the Rater shall visually verify that the boot has been durably sealed to the subfloor (e.g., using duct mastic or caulk) to prevent leakage during normal operation.
41. Testing of duct leakage to the outside can be waived if all ducts & air handling equipment are located within the home's air and thermal barriers AND infiltration does not exceed the following: CZ 1-2: 3 ACH50; CZ 3-4: 2.5 ACH50; CZ 5-7: 2 ACH50; CZ 8: 1.5 ACH50. Alternatively, testing of duct leakage to the outside can be waived if total duct leakage is ≤ 4 CFM25 per 100 sq. ft. of conditioned floor area or 40 CFM, whichever is larger.
42. The whole-house ventilation air flow and local exhaust air flows shall be measured by the Rater using RESNET Standard 380 upon publication and, in the interim, a flow hood, flow grid, anemometer, or substantially equivalent method.
43. Whole-house mechanical ventilation fans shall be rated for sound at no less than the airflow rate in Item 2.3 of the HVAC Design Report. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400 CFM. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms, toilets, hallways, storage areas, closets, or utility rooms.
44. Bathroom fans with a rated flow rate ≥ 500 CFM are exempted from the requirement to be ENERGY STAR certified.
45. Ventilation air inlets that are only visible via rooftop access are exempted from Item 7.7 and the Rater shall mark "n/a". The outlet and inlet of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be used. However, if this occurs the manufacturer's instructions shall be collected for documentation purposes.
46. Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require, that these ventilation air inlets be located so as to facilitate access and regular service by the owner.

47. Continuous bathroom local mechanical exhaust fans shall be rated for sound at no less than the airflow rate in Item 8.2. Intermittent bathroom and both intermittent and continuous kitchen local mechanical exhaust fans are recommended, but not required, to be rated for sound at no less than the airflow rate in Items 8.1 and 8.2. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range hoods, clothes dryers). Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.
48. An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.
49. Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries, islands, and peninsulas and multiplying by the average ceiling height for this area. Cabinet volume shall be included in the kitchen volume.
50. *For homes permitted through 01/01/2014:* Homes are permitted to be certified without enforcement of this Item to provide partners with additional time to integrate this feature into their homes.

    For homes permitted on or after 01/01/2014: Homes shall meet this Item. Alternatively, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 are permitted to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC. If the rated airflow is unknown, ≥ 6 in. smooth duct shall be used, with a rectangular to round duct transition as needed. Guidance to assist partners with these alternatives is available at energystar.gov/newhomesresources. As an alternative to Item 8.1, homes that are PHIUS+ certified are permitted to use a continuous kitchen exhaust rate of 25 CFM per 2009 IRC Table M1507.3.
51. All intermittent kitchen exhaust fans must be capable of exhausting at least 100 CFM. In addition, if the fan is not part of a vented range hood or appliance-range hood combination (i.e., if the fan is not integrated with the range), then it must also be capable of exhausting ≥ 5 ACH, based on the kitchen volume.
52. Per ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space through ductwork exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet this definition are exempt from this requirement. Also, mini-split systems typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the requirements. HVAC filters located in the attic shall be considered accessible to the owner if drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filter.
53. The filter media box (i.e., the component in the HVAC system that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the return grill.
54. The pressure boundary is the primary enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to outside than to conditioned space would be outside the pressure boundary.
55. Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.
56. Naturally drafted equipment is allowed within the home's pressure boundary in Climate Zones 1-3 if the Rater has followed Section 805 of RESNET's Standards, encompassing ANSI/ACCA 12 QH-2014, Appendix A, Sections A3 (Carbon Monoxide Test) and A4 (Depressurization Test for the Combustion Appliance Zone), and verified that the equipment meets the limits defined within.
57. Naturally drafted fireplaces are allowed within the home's pressure boundary if the Rater has verified that the total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is ≤ 15 CFM per 100 sq. ft. of occupiable space when at full capacity. If the net exhaust flow exceeds the allowable limit, it shall be reduced or compensating outdoor airflow provided. Per ASHRAE 62.2-2010, the term "net rated exhaust flow" is defined as flow through an exhaust fan minus the compensating outdoor airflow through any supply fan that is interlocked to the exhaust fan. Per ASHRAE 62.2-2010, the term "occupiable space" is defined as any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas. See Footnote 43 for the definition of "habitable spaces".
58. The minimum volume of combustion air required for safe operation by the manufacturer and / or code shall be met or exceeded. Also, in accordance with the National Fuel Gas Code, ANSI Z223.l / NFPA54, unvented room heaters shall not be installed in bathrooms or bedrooms.

Builder Responsibilities:

- It is the exclusive responsibility of builders to ensure that each certified home is constructed to meet these requirements.
- While builders are not required to maintain documentation demonstrating compliance for each individual certified home, builders are required to develop a process to ensure compliance for each certified home (e.g., incorporate these requirements into the Scope of Work for relevant sub-contractors, require the site supervisor to inspect each home for these requirements, and / or sub-contract the verification of these requirements to a Rater).
- In the event that the EPA determines that a certified home was constructed without meeting these requirements, the home may be decertified.

1. Water-Managed Site and Foundation
1.1 Patio slabs, porch slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less. [2]
1.2 Back-fill has been tamped and final grade sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. See Footnote for alternatives. [2]
1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either: ≥ 6 mil polyethylene sheeting, lapped 6-12 in., or ≥ 1 in. extruded polystyrene insulation with taped joints. [3, 4, 5]
1.4 Capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6-12 in., & installed using one of the following: [3, 4, 5]
1.4.1 Placed beneath a concrete slab; OR,
1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR,
1.4.3 Secured in the ground at the perimeter using stakes.
1.5 Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows: a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. [6] b) For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.
1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in exterior below-grade walls. [7]
1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.
1.8 Drain tile installed at basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with ≥ 6 in. of ½ to ¾ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. If drain tile is on interior side of footing, then channel provided through footing to exterior side. [8]
2. Water-Managed Wall Assembly
2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems, or equivalent drainage system. [9]
2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. [9, 10]
2.3 Window and door openings fully flashed. [11]
3. Water-Managed Roof Assembly
3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated shingle-style with drainage plane above; boot / collar flashing at all roof penetrations. [12]
3.2 For homes that don't have a slab-on-grade foundation and do have expansive or collapsible soils, gutters & downspouts provided that empty to lateral piping that discharges water on sloping final grade ≥ 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation. See Footnote for alternatives & exemptions. [3, 13, 14]
3.3 Self-adhering polymer-modified bituminous membrane at all valleys & roof deck penetrations. [3, 15]
3.4 In 2009 IECC Climate Zones 5 & higher, self-adhering polymer-modified bituminous membrane over sheathing at eaves from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall. [3, 15]
4. Water-Managed Building Materials
4.1 Wall-to-wall carpet *not* installed within 2.5 ft. of toilets, tubs, and showers.
4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used. [16]
4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls. [7]
4.4 Building materials with visible signs of water damage or mold *not* installed or allowed to remain. [17]
4.5 Framing members & insulation products having high moisture content *not* enclosed (e.g., with drywall). [18]
4.6 For each condensate-producing HVAC component, corrosion-resistant drain pan (e.g., galvanized steel, plastic) included that drains to a conspicuous point of disposal in case of blockage. Backflow prevention valve included if connected to a shared drainage system.

Footnotes:

1. These requirements are designed to improve moisture control in homes. However, these features alone cannot prevent all moisture problems. For example, leaky pipes or overflowing baths can lead to moisture issues and negatively impact the performance of the home.
2. Swales or drains designed to carry water from foundation are permitted to be provided as an alternative to the slope requirements for any home, and shall be provided for a home where setbacks limit space to less than 10 ft. Also, tamping of back-fill is not required if either: proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer; OR, the builder has scheduled a site visit to provide in-fill and final grading after settling has occurred (e.g., after the first rainy season).

3. Not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1.
4. Not required for raised pier foundations with no walls. To earn the ENERGY STAR, EPA recommends, but does not require, that radon-resistant features be included in homes built in EPA Radon Zones 1, 2 & 3. For more information, see www.epa.gov/indoorairplus.
5. For an existing slab (e.g., in a home undergoing a gut rehabilitation), in lieu of a capillary break beneath the slab, a continuous and sealed Class I or Class II Vapor Retarder (per Footnote 7) is permitted to be installed on top of the entire slab. In such cases, up to 10% of the slab surface is permitted to be exempted from this requirement (e.g., for sill plates). In addition, for existing slabs in occupiable space, the Vapor Retarder shall be, or shall be protected by, a durable floor surface. If Class I Vapor Retarders are installed, they shall not be installed on the interior side of air permeable insulation or materials prone to moisture damage.
6. Interior surface of an existing below-grade wall (e.g., in a home undergoing a gut rehab.) listed in Item 1.5a is permitted to be finished by:
   - Installing a continuous and sealed drainage plane, capillary break, Class I Vapor Retarder (per Footnote 7) and air barrier that terminates into a foundation drainage system as specified in Item 1.8; OR
   - If a drain tile is not required as specified in Footnote 8, adhering a capillary break and Class I Vapor Retarder (per Footnote 7) directly to the wall with the edges taped/sealed to make it continuous.

   Note that no alternative compliance option is provided for existing below-grade wood-framed walls in Item 1.5b.
7. The 2009 IRC defines Class I vapor retarders as a material or assembly with a rating of ≤ 0.1 perm, using the desiccant method with Proc. A of ASTM E 96. The following materials are typically ≤ 0.1 perm and shall not be used on the interior side of air permeable insulation in above-grade exterior walls in warm-humid climates or below-grade exterior walls in any climate: rubber membranes, polyethylene film, glass, aluminum foil, sheet metal, and foil-faced insulating / non-insulating sheathings. These materials can be used on the interior side of walls if air permeable insulation is not present (e.g., foil-faced rigid foam board adjacent to a below-grade concrete foundation wall is permitted).

   Note that this list is not comprehensive and other materials with a perm rating ≤ 0.1 also shall not be used. Also, if mfr. spec.'s for a product indicate a perm rating ≥ 0.1, then it may be used, even if it is in this list. Also note that open-cell and closed-cell foam generally have ratings above this limit and may be used unless mfr. spec.'s indicate a perm rating ≤ 0.1. Several exemptions to these requirements apply:
   - Class I vapor retarders, such as ceramic tile, may be used at shower and tub walls;
   - Class I vapor retarders, such as mirrors, may be used if mounted with clips or other spacers that allow air to circulate behind them.
8. Alternatively, either a drain tile that is pre-wrapped with a fabric filter or a Composite Foundation Drainage System (CFDS) that has been evaluated by ICC-ES per AC 243 are permitted to be used. Note that the CFDS must include a soil strip drain or another ICC-ES evaluated perimeter drainage system to be eligible for use. In an existing home (e.g, in a home undergoing a gut rehab.) a drain tile installed only on the interior side of the footing without a channel is permitted. Additionally, a drain tile is not required when a certified hydrologist, soil scientist, or engineer has determined that a crawlspace foundation, or an existing basement foundation (e.g., in a home undergoing a gut rehab.), is installed in Group I Soils (i.e. well-drained ground or sand-gravel mixtures), as defined by 2009 IRC Table R405.1.
9. These Items not required for existing structural masonry walls (e.g., in a home undergoing a gut rehabilitation). Note this exemption does not extend to existing wall assemblies with masonry veneers.
10. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) shingled at horizontal joints and sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints; lapped shingle-style building paper or felts; or other water-resistive barrier recognized by ICC-ES or other accredited agency.
11. Apply pan flashing over the rough sill framing, inclusive of the corners of the sill framing; side flashing that extends over pan flashing; and top flashing that extends over side flashing or equivalent details for structural masonry walls.
12. Intersecting wall siding shall terminate 1 in. above the roof or higher, per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.
13. The assessment of whether the soil is expansive or collapsible shall be completed by a certified hydrologist, soil scientist, or engineer.
14. Any of the following are permitted to be used as alternatives to Item 3.2: a) a roof design that deposits rainwater to a grade-level rock bed with a waterproof liner and a lateral drain pipe that meets discharge requirements per Item 3.2; b) a rainwater harvesting system that drains overflow to meet discharge requirements per Item 3.2; or c) a continuous rubber membrane (e.g. EPDM) that is aligned with the foundation wall from final grade to ≥ 8 in. below grade and then slopes ≥ 0.5 in. per ft. away from the home for at least 5 ft., with Group I Soils (as defined in Footnote 8) covering the membrane to within 3 in. of final grade.
15. As an alternative, any applicable option in 2009 IRC Section R905.2.8.2 is permitted to be used to meet Item 3.3 and any option in 2009 IRC Section R905.2.7.1 is permitted to be used to meet Item 3.4. EPA recommends, but does not require, that products meet ASTM D1970.
16. In addition to cement board, materials that have been evaluated by ICC-ES per AC 115 may also be used to meet this requirement. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures or waterproof membranes that have been evaluated by ICC-ES per AC 115, and then only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.
17. If mold is present, effort should be made to remove all visible signs of mold (e.g., by damp wipe with water and detergent). If removal methods are not effective, then the material shall be replaced. However, stains that remain after damp wipe are acceptable. Lumber with "sap stain fungi" is exempt from this Item as long as the lumber is structurally intact.
18. For wet-applied insulation, follow manufacturer's drying recommendations. EPA recommends that lumber moisture content be ≤ 18%.
19. This Revision is required to certify all homes permitted after 07/01/2016, but can be used to certify any home permitted or completed prior to this date. The Rater may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases where permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors. These assumptions should be both defensible and documented.

This document provides instructions for determining the ENERGY STAR HERS Index Target, the highest numerical HERS Index value that each rated home may achieve to earn the ENERGY STAR. Note that, in addition to meeting the ENERGY STAR HERS Index Target, homes shall also meet all Mandatory Requirements for All Certified Homes in Exhibit 2 of the ENERGY STAR Certified Homes Version 3.1 National Program Requirements.

A RESNET-accredited Home Energy Rating software program shall automatically determine (i.e., without relying on a user-configured ENERGY STAR Reference Design) this target for each rated home using the following procedure:

1. The software shall configure the ENERGY STAR Reference Design Home in accordance with Exhibit 2, the Expanded ENERGY STAR Reference Design Definition, and calculate its associated HERS Index value.

2. For all single-family detached homes, townhomes, rowhomes, duplexes, triplexes, and quadplexes, the software shall calculate the Size Adjustment Factor (SAF) using the following equation:

   $$SAF = [CFA_{Benchmark\ Home} / CFA_{Home\ To\ Be\ Built}]^{0.083}, \text{ not to exceed } 1.0$$

   Where:

   $CFA_{Benchmark\ Home}$ = Conditioned Floor Area of the Benchmark Home, using Exhibit 1 below

   $CFA_{Home\ to\ be\ Built}$ = Conditioned Floor Area of the Home to be Built

   For the purposes of this step, the software shall calculate the number of bedrooms and the CFA of the home to be built using RESNET standards with the following exception: floor area in basements with at least half of the gross surface area of the basement's exterior walls below grade shall not be counted. [1] Because the SAF cannot exceed 1.0, it only modifies the HERS Index Target for homes with conditioned floor area greater than the Benchmark Home. For condos and apartments in multi-family buildings the SAF shall always equal 1.0.

3. The software shall calculate the ENERGY STAR HERS Index Target, rounded to the nearest whole number:

   ENERGY STAR HERS Index Target = HERS Index of ENERGY STAR Reference Design Home x SAF

Exhibit 1: Benchmark Home Size [2,3]

Bedrooms in Home to be Built	0	1	2	3	4	5	6	7	8
Conditioned Floor Area $_{Benchmark\ Home}$	1,000	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Exhibit 2: Expanded ENERGY STAR Reference Design Definition

Building Component	Expanded ENERGY STAR Reference Design Definition [4]							
Foundations:	Construction Type & Structural Mass: Same as Rated Home, except: • For masonry floor slabs, modeled with 80% of floor area covered by carpet and 20% of floor directly exposed to room air							
	Conditioning Type: Same as Rated Home, except: • Crawlspaces shall be modeled as vented with net free vent aperture = 1sq. ft. per 150 sq. ft. of crawlspace floor area							
	Gross Area: Same as Rated Home [5]							
	Insulation: [6, 7] Choose appropriate insulation level below: • Basement Wall Assembly U-factor only applies to conditioned bsmt.'s; if applicable, insulation shall be located on interior side of walls • Floor assemblies above crawlspace foundations shall be configured to meet the applicable floor assembly U-factor listed in the building component section for Floors Over Unconditioned Spaces • Slab floors with a floor surface less than 12" below grade shall be insulated to the Slab Insulation R-value. The insulation shall extend downward from the top of the slab on the outside of the foundation wall and then vertically below-grade to the Slab Insulation Depth							
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Slab Insulation R-Value:	0	0	0	10	10	10	10	10
	Slab Insulation Depth (ft):	0	0	0	2	2	4	4	4
	Basement Wall Assembly U-Factor:	0.360	0.360	0.091	0.059	0.050	0.050	0.050	0.050
Floors Over Unconditioned Spaces:	Construction Type: Wood frame							
	Gross Area: Same as Rated Home							
	Insulation: [6, 7]							
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Floor Assembly U-Factor:	0.064	0.064	0.047	0.047	0.033	0.033	0.028	0.028
Above-Grade Walls:	Interior and Exterior Construction Type: Wood frame							
	Gross Area: Same as Rated Home							
	Solar Absorptance = 0.75							
	Emittance = 0.90							
	Insulation: [6]							
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Wall Assembly U-Factor:	0.082	0.082	0.057	0.057	0.057	0.048	0.048	0.048
Thermally Isolated Sunrooms:	None							
Doors:	Area: Same as Rated Home							
	Orientation: Same as Rated Home							
	U-Values and SHGCs, based on ENERGY STAR doors: [8]							
	Door Type:	**Opaque**		**≤ 1/2-Lite**		**> 1/2-Lite CZ 1-3**		**> 1/2-Lite CZ 4-8**
	U-Value:	0.17		0.25		0.30		0.30
	SHGC:	N/A		0.25		0.25		0.40
Glazing:	Total Area: (except in homes with conditioned basements and attached homes [9]) • Same as Rated Home, where Rated Home glazing area is less than 15% of conditioned floor area; OR • 15% of the conditioned floor area, where the Rated Home glazing area is 15% or more of the conditioned floor area							
	Orientation: Equally distributed to North, East, South, and West							
	+ Interior Shade Coefficient: Same as HERS Reference Home, as defined by RESNET's standard [10]							
	External Shading: None							
	U-Values and SHGCs, based on ENERGY STAR Windows: [8]							
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	U-Value:	0.40	0.40	0.30	0.30	0.27	0.27	0.27	0.27
	SHGC:	0.25	0.25	0.25	0.40	0.40	0.40	0.40	0.40
Skylights:	None							
Ceilings:	Construction Type: Wood frame							
	Gross Area: Same as Rated Home							
	Insulation: [6]							
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Ceiling Assembly U-Factor:	0.035	0.030	0.030	0.026	0.026	0.026	0.026	0.026
Attics:	Construction Type: Vented with aperture = 1sq. ft. per 300 sq. ft. ceiling area							
	Radiant Barrier: None							
Roofs:	Construction Type: Composition shingle on wood sheathing							
	Gross Area: Same as Rated Home							
	Solar Absorptance = 0.92							
	Emittance = 0.90							

Exhibit 2: Expanded ENERGY STAR Reference Design Definition (Continued)

Heating Systems:	Heating loads may be calculated and equipment capacity selected according to the latest edition of ACCA Manual J, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure; otherwise, same as Rated Home.								
	Fuel Type: Same as Rated Home [11]								
	System Type: Same as Rated Home, except Reference Design shall be configured with air-source heat pump in CZ 1-6 where Rated Home is modeled with ground-source heat pump, electric strip or baseboard heat, and Reference Design shall be configured with ground-source heat pump in CZ 7 & 8 where Rated Home is modeled with air-source or ground-source heat pump, electric strip or baseboard heat; applicable efficiency selected from below [12]								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Gas Furn. AFUE:	80	80	90	95	95	95	95	95
	Oil Furn. AFUE:	80	80	80	85	85	85	85	85
	Gas Boiler AFUE:	80	80	80	90	90	90	90	90
	Oil Boiler AFUE:	80	80	80	86	86	86	86	86
	Air-Source Heat Pump HSPF:	8.2	8.2	8.2	8.5	9.25	9.5	n/a	n/a
	Air-Source Heat Pump Backup:	Electric	Electric	Electric	Electric	Electric	Electric	n/a	n/a
	Ground-Source Heat Pump COP:	n/a	n/a	n/a	n/a	n/a	n/a	3.6	3.6
Cooling Systems:	Cooling loads may be calculated and equipment capacity selected according to the latest edition of ACCA Manual J, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure; otherwise, same as Rated Home.								
	Fuel Type: Same as Rated Home [11]								
	System Type: Same as Rated Home, except Reference Design shall be configured with air-source heat pump in CZ 1-6 where Rated Home is modeled with ground-source heat pump and Reference Design shall be configured with ground-source heat pump in CZ 7 & 8 where Rated Home is modeled with air-source or ground-source heat pump; applicable efficiency selected from below.[13]								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	AC SEER:	15	15	15	13	13	13	13	13
	Air-Source Heat Pump SEER:	15	15	15	15	15	15	n/a	n/a
	Ground-Source Heat Pump EER:	n/a	n/a	n/a	n/a	n/a	n/a	17.1	17.1
Service Water Heating Systems:	+ Use (Gallons per Day): Same as HERS Reference Home, as defined by RESNET's standard. [10]								
	+ Tank Temperature: Same as HERS Reference Home, as defined by RESNET's standard. [10]								
	Fuel Type: Same as Rated Home [11]								
	System Type: Conventional storage water heater with tank size equal to that of Rated Home, unless Rated Home uses instantaneous water heater in which case select 40 gallon tank for gas systems and 60 gallon tank for electric systems. Select applicable efficiency from below using tank size of Reference Home.								
	Gas Storage Tank Capacity: [14]	**30 Gallon**	**40 Gallon**	**50 Gallon**	**60 Gallon**	**70 Gallon**	**80 Gallon**		
	Gas DHW EF:	0.63	0.61	0.59	0.57	0.55	0.53		
	Electric Storage Tank Capacity: [14]	**30 Gallon**	**40 Gallon**	**50 Gallon**	**60 Gallon**	**70 Gallon**	**80 Gallon**		
	Electric DHW EF:	0.94	0.93	0.92	0.91	0.90	0.89		
	Oil Storage Tank Capacity: [14]	**30 Gallon**	**40 Gallon**	**50 Gallon**	**60 Gallon**	**70 Gallon**	**80 Gallon**		
	Oil DHW EF:	0.55	0.53	0.51	0.49	0.47	0.45		
Thermal Distribution Systems:	Duct Leakage to Outside: 0 CFM25 per 100 sq. ft. of conditioned floor area								
	Duct Insulation: None, because 100% of ducts are in conditioned space.								
	Duct Surface Area: Same as Rated Home								
	Supply and Return Duct Locations shall be configured according to the table below or, if Rated home does not meet any of the conditions below (e.g. multifamily dwelling unit with conditioned unit below), then duct locations shall be configured to be 100% in conditioned space.								
	Foundation Type:	**Slab**		**Crawlspace**		**Basement**			
	One Story Above Grade:	100% Conditioned		100% Conditioned		100% Conditioned			
	Two Story Above Grade:	100% Conditioned		100% Conditioned		100% Conditioned			
Thermostat:	Type: Programmable								
	+ Temperature Setpoints: Same as HERS Reference Home, with offsets defined by RESNET's standard, [10] Section 303.5.1.2								
Infiltration & Mechanical Ventilation:	Infiltration Rates:								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	ACH50:	4	4	3	3	3	3	3	3
	Mechanical ventilation system without heat recovery								
	Rate: CFM = 0.01 * CFA + 7.5 * (Nbr + 1), where CFA = Conditioned Floor Area and Nbr = Number of Bedrooms								
	Hours per Day: 24								
	Fan Watts: Watts = CFM Rate / 2.8 CFM per Watt, where CFM Rate is determined above								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Ventilation Type:	Supply	Supply	Supply	Supply	Exhaust	Exhaust	Exhaust	Exhaust
Lighting, Appliances, & Internal Gains:	Fluorescent Lighting: 90%								
	Refrigerator: 423 kWh per year								
	Dishwasher: 0.66 EF								
	Ceiling Fan: 122 CFM per Watt; Quantity = Number of bedrooms + 1 when ceiling fans present in the Rated Home; otherwise Quantity = 0								
	+ Internal Gains: Defined by Section 303.5.1.1 of RESNET's standard [10] and adjusted for internal gains from the high-efficiency lighting and appliances listed above, as provided by Section 303.4.1.7.								
Internal Mass:	+ Same as HERS Reference Home, as defined by RESNET's standard. [10]								
	Additional mass specifically designed as a Thermal Storage Element for the Rated Home shall be excluded.								

Notes:

1. To determine whether at least half of the basement wall area is below grade, use the gross surface area of the walls that are in contact with either the ground or ambient outdoor air, measured from the basement floor to the bottom of the basement ceiling framing (e.g., the bottom of the joists for the floor above). Note that the exception regarding the floor area in basements is only for the purpose of determining a home's Benchmark Home Size and Size Adjustment Factor. The full conditioned floor area, per RESNET's standards, should be used when rating the home (e.g., determining compliance with duct leakage requirements).
2. The average-size home with a specific number of bedrooms is termed the "Benchmark Home". A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

   An egress window, as defined in 2012 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

   - have a sill height of not more than 44 in. above the floor; AND
   - have a minimum net clear opening of 5.7 sq. ft.; AND
   - have a minimum net clear opening height of 24 in.; AND
   - have a minimum net clear opening width of 20 in.; AND
   - be operational from the inside of the room without the use of keys, tools or special knowledge.
3. The conditioned floor area of a Benchmark Home (CFA Benchmark Home) is determined by selecting the appropriate value from Exhibit 1. For homes with more than 8 bedrooms, the CFA Benchmark Home shall be determined by multiplying 600 sq. ft. by the total number of bedrooms and adding 400 sq. ft.

   Example: CFA Benchmark Home for a 10 bedroom home = (600 sq. ft. x 10) + 400 sq. ft. = 6,400 sq. ft.
4. Any parameter not specified in this exhibit shall be identical to the value entered for the Rated Home.
5. "Same as Rated Home" indicates that the parameter shall be identical to the value entered for the Rated Home.
6. Slab insulation R-values represent nominal insulation levels; and assembly U-factors for foundations, floors, walls, and ceilings represent the overall assembly, inclusive of sheathing materials, cavity insulation, installation quality, framing, and interior finishes.
7. If software allows the user to specify the thermal boundary location independent of the conditioned space boundary in the basement of the rated home, then the thermal boundary of the ENERGY STAR Reference Design shall be aligned with this boundary. For example, if the thermal boundary is located at the walls, then the wall insulation shall be configured as if it was a conditioned basement. If the thermal boundary is located at the floor above the basement, then the floor insulation shall be configured as if it was a floor over an unconditioned space.
8. All Reference Design window and door U-value and SHGC requirements are based on the ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights – Version 6.0 as outlined at www.energystar.gov/windows, except that SHGC values have been assumed for CZ 4C & 5-8. Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion.
9. When determining the ENERGY STAR HERS Index Target for homes with conditioned basements and for attached homes, the following formula shall be used to determine total window area of the ENERGY STAR Reference Design:

   $$AF = 0.15 \times AFL \times FA \times F$$

   Where:

   - AF = Total fenestration area
   - AFL = Total floor area of directly conditioned space
   - FA = (Above-grade thermal boundary gross wall area) / (Above-grade boundary wall area + 0.5 x Below-grade boundary wall area)
   - F = 1- 0.44 x (Common wall area) / (Above-grade thermal boundary wall area + Common wall area)

   And where:

   - Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions;
   - Above-grade thermal boundary wall is any portion of a thermal boundary wall not in contact with soil;
   - Below-grade boundary wall is any portion of a thermal boundary wall in soil contact; and
   - Common wall is the total wall area of walls adjacent to another conditioned living unit, not including foundation walls.
10. RESNET's 2006 Mortgage Industry National Home Energy Rating Systems Standard requires that all RESNET-accredited Home Energy Rating software programs automatically configure this parameter when calculating a HERS index value.
11. Fuel type(s) shall be same as Rated Home, including any dual-fuel equipment where applicable. For a Rated Home with multiple heating, cooling, or water heating systems using different fuel types, the applicable system capacities and fuel types shall be

weighted in accordance with the loads distribution (as calculated by accepted engineering practice for that equipment and fuel type) of the multiple systems.

12. For a Rated Home without a heating system, the ENERGY STAR Reference Design Home shall be configured with a 78% AFUE gas furnace system, unless the Rated home has no access to natural gas or fossil fuel delivery. In such cases, the ENERGY STAR Reference Design Home shall be configured with a 7.7 HSPF air-source heat pump.
13. For a Rated Home without a cooling system, the ENERGY STAR Reference Design Home shall be configured with a 13 SEER electric air conditioner.
14. To determine domestic hot water (DHW) EF requirements for additional tank sizes, use the following equations: Gas DHW EF ≥ 0.69 - (0.002 x Tank Gallon Capacity); Electric DHW EF ≥ 0.97 - (0.001 x Tank Gallon Capacity); Oil DHW EF ≥ 0.61 - (0.002 x Tank Gallon Capacity).

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Slabs-on-grade.

1.02 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. Product Data for Low VOC Content: For curing and sealing compounds, documentation including printed statement of VOC content.
   2. Design Mixtures for Recycled Content Credit: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Samples: For vapor retarder.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.

4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Curing compounds.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Semirigid joint filler.
11. Joint-filler strips.
12. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.
   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-retarder installation, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.02 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.

D. Deformed-Steel Wire: ASTM A 496/A 496M.

E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

F. Anchor Bolts: Conform to ASTM F1554 Grade 36 unless otherwise indicated on drawings. Nuts shall conform to ASTM A563, hex nuts.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

C. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

2.05 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.06 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A (10 MIL minimum thickness) Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
      b. Fortifiber Building Systems Group; Moistop Ultra 10.
      c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
      d. Insulation Solutions, Inc.; Viper VaporCheck 10.
      e. Meadows, W. R., Inc.; Perminator 10 mil.
      f. Raven Industries Inc.; Vapor Block 10.
      g. Reef Industries, Inc.; Griffolyn 10 mil Green.
      h. Stego Industries, LLC; Stego Wrap 10 mil Class A.

2.07 CURING MATERIALS

A. Evaporation Retarder for areas scheduled to receive floor covering: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
      b. BASF Construction Chemicals - Building Systems; Confilm.
      c. ChemMasters; SprayFilm.
      d. Conspec by Dayton Superior; Aquafilm.
      e. Dayton Superior Corporation; Sure Film (J-74).
      f. Edoco by Dayton Superior; BurkeFilm.
      g. Euclid Chemical Company (The), an RPM company; Eucobar.
      h. Kaufman Products, Inc.; Vapor-Aid.
      i. Lambert Corporation; LAMBCO Skin.
      j. L&M Construction Chemicals, Inc.; E-CON.
      k. Meadows, W. R., Inc.; EVAPRE.
      l. Metalcrete Industries; Waterhold.
      m. Nox-Crete Products Group; MONOFILM.
      n. Sika Corporation; SikaFilm.
      o. SpecChem, LLC; Spec Film.
      p. Symons by Dayton Superior; Finishing Aid.
      q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
      r. Unitex; PRO-FILM.
      s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Clear, Waterborne, Membrane-Forming Dissipating Curing Compound: ASTM C309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements. Available products that may be incorporated into the work include, but are not limited to, the following:
      a. Euclid Chemical Company: Kurex DR VOX
      b. L & M Construction Materials, Inc.: L & M Cure R
      c. Nox-Crete Products Group: Bro-Cure
      d. Spec Chem - SpecRez

C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A. – Only seal concrete where no flooring materials will be applied or where specifically required on construction documents.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Construction Chemicals - Building Systems; Kure 1315.
   b. ChemMasters; Polyseal WB.
   c. Conspec by Dayton Superior; Sealcure 1315 WB.
   d. Edoco by Dayton Superior; Cureseal 1315 WB.
   e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
   f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
   g. Lambert Corporation; UV Safe Seal.
   h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
   i. Meadows, W. R., Inc.; Vocomp-30.
   j. Metalcrete Industries; Metcure 30.
   k. Right Pointe; Right Sheen WB30.
   l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
   m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
   n. SpecChem E-Cure – Compatible with most Flooring compounds
2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.08 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
   1. Granular fill below slab-on-grade (slab sub-base) shall consist of a densely graded, compactable “crusher run” material per ASTM D1241. This material should have a uniform distribution of particle sizes ranging from 100 percent passing a 1-1/2” sieve down to 0 – 10% passing a No. 100 sieve. If crusher run material is not available, compact open graded granular fill (#57) and choke off with ½” – 1” of Fine-Graded Granular Material (#10 aggregate per ASTM D448) as listed below for slab sub-base.

D. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.09 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 5 inches, plus or minus 1.5 inches.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Minimum Cementitious Materials Content: 470 lb/CY for interior slabs
4. Minimum Cementitious Materials Content: 520 LB/CY for exterior slabs
5. Maximum Aggregate Size: 1 ½"
6. If Fly-Ash is added into slabs-on-grade mix, the addition shall not be less than 15% nor more than 20% of cementitious materials.
7. Slump Limit: 4, plus or minus 1 inch.
8. Air Content for Exterior Slabs-on-Grade: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
9. Air Content for Interior Slabs-on-Grade: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
3. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
4. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for slabs and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended tape.
   2. Install under all interior slab areas indicated to receive any type of floor covering.
   3. Seal all joints and penetrations per manufacturer’s instructions.
   4. Terminate the vapor retarder per manufacturer's instructions.
   5. Extend Vapor Barrier to outside edge of thickened slab edge and turn up 6”, min.

3.05 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
   1. For slabs-on-grade, provide 2” chairs on a 3’-0” x 3’-0” grid to fully support welded wire fabric at all locations.

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for slabs in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls at underside of floors and slabs and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Install slab-on-grade construction joints in a similar pattern to contraction joints as designated on construction documents.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
3. Install contraction joints as designated on construction documents.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of

reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.08 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces to receive a rubbed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where exposed to view:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until

producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.09 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
   2. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture

and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.

4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31/C 31M.
      a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
   7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
   8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
   9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
   10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
   11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of

concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 03 54 13 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes gypsum-cement-based, self-leveling underlayment over existing wood floors for application below interior floor coverings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. For priming and sealing coatings, documentation including printed statement of VOC content.
   2. For priming and sealing coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of underlayment and floor-covering systems certify in writing that products are compatible.

C. Preinstallation Conference: Conduct conference at Project site.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
   1. Place gypsum-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

1.06 COORDINATION

A. Coordinate application of underlayment with requirements of floor-covering products and adhesives, to ensure compatibility of products.

PART 2 - PRODUCTS

2.01 GYPSUM-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Gypsum-cement-based, self-leveling product that can be applied in minimum uniform thickness of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Allied Custom Gypsum; AccuCrete.
      b. Ardex; GS-4 Self-Leveling Repair Underlayment
      c. Bonsal American, an Oldcastle company; ProSpec Level Set G.
      d. CMP Specialty Products, Inc.; Level Finish G-SL.
      e. Conspec by Dayton Superior; Conflow Supreme.
      f. Euclid Chemical Company (The); Flo-Top.
      g. Maxxon Corporation; Gyp-Crete.
      h. USG Corporation; Levelrock 2500.
   2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
   3. Compressive Strength: Not less than 2000 psi at 28 days when tested according to ASTM C 109/C 109M.
   4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Water: Potable and at a temperature of not more than 70 deg F.

C. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

D. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
   1. Primer shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D.
   2. Primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.
   1. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.
   1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
   2. Fill substrate voids to prevent underlayment from leaking.

B. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
   1. Install underlayment reinforcement recommended in writing by manufacturer.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.03 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.
   1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
   2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
   3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply underlayment to produce uniform, level surface.
   1. Feather edges to match adjacent floor elevations.

C. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

D. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

E. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.04 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 13

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Face brick.
   2. Building (common) brick.
   3. Mortar and grout.
   4. Steel reinforcing bars.
   5. Masonry joint reinforcement.
   6. Ties and anchors.
   7. Embedded flashing.
   8. Miscellaneous masonry accessories.

1.02 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Samples for Initial Selection:
   1. Face brick, in the form of straps of five or more bricks.
   2. Colored mortar.
   3. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
   1. Face brick.
   2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   3. Weep holes and vents.
   4. Accessories embedded in masonry.

1.04 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch

numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C 67.
      d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing per ASTM C 67 or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.
      e. For masonry units, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
   2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Sample Panels: Build not less than three sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
   1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 inches long by 36 inches high by full thickness.
   2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
   3. Clean exposed faces of panels with masonry cleaner indicated.
   4. Protect approved sample panels from the elements with weather-resistant membrane.
   5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
      a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Build mockups for typical exterior wall in sizes approximately 96 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.
      a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
      b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
      c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
      d. Include wood studs, sheathing, building wrap, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
   3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
   4. Clean exposed faces of mockups with masonry cleaner as indicated.
   5. Protect accepted mockups from the elements with weather-resistant membrane.
   6. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.07 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills 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 down both sides of walls and hold cover securely in place.
2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.02 BRICK

A. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
1. Products: Subject to compliance with requirements, provide one of the following as directed by the Architect. Provide all brick from the same manufacturer as directed by the Architect.
a. Face Brick: As selected by Architect.
2. Grade: SW.

3. Type: FBS.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
6. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
7. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
8. Application: Use where brick is exposed unless otherwise indicated.
9. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
10. Provide solid units match face brick where cores would be exposed.
11. Color and Texture: As selected by Architect.

D. Building (Common) Brick: ASTM C 62, Grade SW.
1. Size: Match size of face brick.
2. Application: Use where brick is indicated for concealed locations.

2.03 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Masonry Cement: ASTM C 91.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Capital Materials Corporation; Flamingo Color Masonry Cement.
b. Cemex S.A.B. de C.V.; Brikset Type N.
c. Essroc, Italcementi Group; Brixment.
d. Holcim (US) Inc.; Rainbow Mortamix.
e. Lafarge North America Inc.; Magnolia Masonry Cement.
f. Lehigh Cement Company; Lehigh Masonry Cement.
g. National Cement Company, Inc.; Coosa Masonry Cement.

F. Colored Cement Product: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Colored Portland Cement-Lime Mix:

1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond Portland & Lime.
4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.

b. Colored Masonry Cement:
1) Capital Materials Corporation; Flamingo Color Masonry Cement.
2) Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
3) Essroc, Italcementi Group; Brixment-in-Color.
4) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
5) Lafarge North America Inc.; U.S. Cement Custom Color Masonry Cement.
6) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
7) National Cement Company, Inc.; Coosa Masonry Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent of masonry cement by weight.

G. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Euclid Chemical Company (The); Accelguard 80.
b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ACM Chemistries; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

J. Water: Potable.

2.04 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Hot-dip galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods: 0.187-inch diameter.
   4. Wire Size for Cross Rods: 0.187-inch diameter.
   5. Wire Size for Veneer Ties: 0.187-inch diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
   7. Provide in lengths of not less than 10 feet , with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Multi-wythe Masonry:
   1. Adjustable (two-piece) type, ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2.05 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
   2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
   3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication.
   2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch-diameter, hot-dip galvanized steel wire.
   3. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M

C. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
      a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05-inch.
   2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
   3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section long enough to accommodate continuous insulation.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Dayton Superior Corporation, Dur-O-Wal Division; D/A 213.
         2) Hohmann & Barnard, Inc.; 2-Seal Thermal Wing Nut Anchor.
         3) Wire-Bond; RJ-711.

b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- thick, steel sheet, galvanized after fabrication.
c. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch-diameter, hot-dip galvanized steel wire.
d. Provide manufacturer's recommended fasteners for wood framing.

2.06 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B. Flexible Flashing: Use one of the following unless otherwise indicated:
1. Copper-Laminated Flashing: 3-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
a. Products: Subject to compliance with requirements, provide one of the following:
1) Advanced Building Products Inc.; Copper Fabric Flashing.
2) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
5) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
6) York Manufacturing, Inc.; Multi-Flash 300.

C. Application: Unless otherwise indicated, use the following:
1. Where flashing is partly exposed and is indicated to terminate at the wall face, flexible flashing with a metal drip edge.
2. Where flashing is fully concealed, use flexible flashing.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars: 26-gauge by 1-1/2-inches by 8 feet long type 304 stainless steel with 1/4 inch diameter holes spaced 8 inches on center.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use one of the following unless otherwise indicated:
   1. Wicking Material for window sills: Absorbent rope, made from cotton, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.
   2. Cellular Plastic Weep/Vent for all other locations: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Advanced Building Products Inc.; Mortar Maze weep vent.
         2) Blok-Lok Limited; Cell-Vent.
         3) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
         4) Heckmann Building Products Inc.; No. 85 Cell Vent.
         5) Hohmann & Barnard, Inc.; Quadro-Vent.
         6) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Advanced Building Products Inc.; Mortar Break II.
      b. Archovations, Inc.; CavClear Masonry Mat.
      c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
      d. Mortar Net USA, Ltd.; Mortar Net.
   2. Provide one of the following configurations:
      a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
      b. Strips, not less than 1-1/2 inches thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
      c. Sheets or strips full depth of cavity and installed to full height of cavity.
      d. Sheets or strips not less than 1 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

2.08 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

2.09 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Pigmented Mortar: Use colored cement product.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Pigments shall not exceed 5 percent of masonry cement by weight.
   3. Mix to match Architect's sample.
   4. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Face brick.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
      a. Face brick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or ½-inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or ½-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or ½-inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or ½-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or ½-inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or ½-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or ½-inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to ½-inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMU as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.06 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.07 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.08 ANCHORING MASONRY TO CONCRETE

A. Anchor masonry to concrete where masonry abuts or faces concrete to comply with the following:

1. Provide an open space not less than ½-inch wide between masonry and concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.09 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24-inches o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install

vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and attach to inner wythe with a termination bar and fasteners spaced 8 inches on center.
   3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; and attach to sheathing with metal termination bar and fasteners spaced 8 inches on center.
   4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products or open head joints to form weep holes.
   2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
   3. Space weep holes 24 inches o.c. unless otherwise indicated.
   4. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
   5. Trim wicking material flush with outside face of wall after mortar has set.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.15 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Steel pipe columns for supporting wood frame construction.
   3. Lintels.
   4. Metal bollards.

B. Products furnished, but not installed, under this Section:
   1. Loose steel lintels.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Paint products.
   2. Grout.

B. Sustainable Design Submittals:
   1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.03 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.06 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.02 FERROUS METALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

F. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 by 1-5/8 inches.
   2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

2.03 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

B. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

C. Eyebolts: ASTM A 489.

D. Machine Screws: ASME B18.6.3.

E. Lag Screws: ASME B18.2.1.

F. Wood Screws: Flat head, ASME B18.6.1.

G. Plain Washers: Round, ASME B18.22.1.

H. Lock Washers: Helical, spring type, ASME B18.21.1.

I. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

J. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

K. Post-Installed Anchors: Torque-controlled expansion anchors, chemical anchors, or screw anchors per construction documents.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.04 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
   1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
   2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

D. Galvanize miscellaneous framing and supports where indicated.

2.07 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime interior miscellaneous steel trim with primer specified in Division 09 Section "Painting."

2.08 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

B. Fabricate bollards with 3/8-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

D. Prime bollards with primer specified in Division 09 Section "Painting."

2.09 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete or masonry, or unless otherwise indicated.
1. Shop prime with universal shop primer indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
   1. Embed anchor bolts at least 4 inches in concrete.

C. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

D. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

E. Fill bollards solidly with concrete, mounding top surface to shed water.

3.04 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
   1. Use nonshrink grout, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Steel pipe and tube railings.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
      b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Railing brackets.
   3. Grout, anchoring cement, and paint products.

B. Sustainable Design Submittals:
   1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. For primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Initial Selection: For products involving selection of color, texture, or design.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.07 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.02 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 513.

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.03 FASTENERS

A. General: Provide the following:
   1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
   2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining loads as designed by the railing engineer
   1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

E. Wall Rail Brackets: No. 306, manufactured by Julius Blum.

1. Galvanized for exterior exposure.

2.04 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
   1. For railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

F. Shop Primer for Galvanized Steel: Water based galvanized metal primer complying with MPI#134.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

J. Form changes in direction as follows:
   1. By bending, unless otherwise indicated.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.07 STEEL AND IRON FINISHES

A. Galvanized Railings:
   1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
   2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
   3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
   4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
   5. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Other Railings: SSPC-SP 3, "Power Tool Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Shop prime uncoated railings with universal shop primer indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.04 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. For interior railings, cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. For exterior railings, leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.05 ATTACHING RAILINGS

A. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

B. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
   1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
   2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets and railing end flanges to building construction as follows:
   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

3.06 ADJUSTING AND CLEANING

A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.07 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 52 13

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for wood-preservative treated wood, fire-retardant treated wood, engineered wood products, shear wall panels, and metal framing anchors.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
   1. Allowable Design Stresses: Engineered wood products shall have allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.02 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Use treatment containing no arsenic or chromium.
   2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
   3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

B. Provide preservative-treated materials for items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing members that are less than 18 inches above the ground.
   4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FRAMING

A. Dimension Lumber:
   1. Maximum Moisture Content: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness.
   2. Non-Load-Bearing Interior Partitions: No. 1/No. 2 Spruce Pine Fir. : SPIB.
   3. Load Bearing Interior and Exterior Stud Framing No. 1/No. 2 Spruce Pine Fir.

4. Elevated Beams and Headers: No. 1 Southern Yellow Pine
5. Dimensional Posts (4x4) No. 1 Southern Yellow Pine
6. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
    a. Species: As specified for framing other than non-load-bearing interior partitions.
    b. Grade: No. 1.

B. Timbers 5-Inch Nominal Size and Thicker: No. 1: Southern pine: SPIB.
    1. Maximum Moisture Content: 20 percent.

C. Laminated-Veneer Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Georgia-Pacific Gypsum LLC.
        b. Louisiana-Pacific Corporation.
        c. Stark Truss Company, Inc.
        d. Weyerhaeuser
    2. Extreme Fiber Stress in Bending, Edgewise: As noted on construction documents
    3. Modulus of Elasticity, Edgewise: 1,900,000 psi.

D. Wood I-Joists: Prefabricated units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Anthony-Domtar Inc.
        b. Georgia-Pacific Gypsum LLC.
        c. International Paper Corporation.
        d. J. M. Huber Corporation.
        e. Louisiana-Pacific Corporation.
        f. Stark Truss Company, Inc.
        g. Weyerhaeuser, Inc.
    2. Web Material: Either oriented strand board or plywood, Exposure 1.
    3. Structural Properties: Provide units with depths and design values not less than those indicated.
    4. Provide units complying with APA PRI-400, factory marked with nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.

E. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
    1. Manufacturer: Provide products by same manufacturer as I-joists.
    2. Material: All-veneer product, glued-laminated wood, or product made from any combination solid lumber, wood strands, and veneers.
    3. Thickness: 1-1/4 inches.

2.04 MISCELLANEOUS LUMBER

A. Miscellaneous Dimension Lumber: Construction, or No. 2 grade with 15 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

B. Utility Shelving: Mixed southern pine, No. 1: SPIB; with 15 percent maximum moisture content.

C. Concealed Boards: Mixed southern pine, No. 2: SPIB; 15 percent maximum moisture content.

2.05 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, Exterior, AC, fire-retardant treated, not less than 1/2-inch nominal thickness.

2.06 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
   1. Power-Driven Fasteners: CABO NER-272.
   2. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Structural capacity, type, and size indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cleveland Steel Specialty Co.
      b. KC Metals Products, Inc.
      c. Phoenix Metal Products, Inc.
      d. Simpson Strong-Tie Co., Inc.
      e. USP Structural Connectors.
   2. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 coating designation for interior locations where stainless steel is not indicated.
   3. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

C. Sill Sealer: Closed-cell neoprene foam, 1/4 inch thick.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports unless otherwise indicated.

D. Securely attach rough carpentry to substrates, complying with the following:
   1. CABO NER-272 for power-driven fasteners.
   2. Published requirements of metal framing anchor manufacturer.
   3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

END OF SECTION 06 10 00

SECTION 06 15 23 - COMPOSITE WOOD

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Wood plastic composite made from 60% wood-like cellulose fiber and 40% reclaimed plastics, not use for framing or structural members.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
   2. ASTM D648 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   3. ASTM D1037 Standard Test Method for Evaluating Properties of Wood-Base Fiber and Particle Panel Material.
   4. ASTM D1413 Standard Test Method for Wood Preservatives by Laboratory Soil-Block Cultures.
   5. ASTM D143 Standard Test Methods for Small Clear Specimens of Timber.
   6. ASTM D1525 Standard Test Method for Vicat Softening Temperature of Plastics.
   7. ASTM D1761 Standard Test Method for Mechanical Fasteners in Wood.
   8. ASTM D1929 Standard Test Method for Determining Ignition Temperature of Plastics.
   9. ASTM D2017 Standard Test Method for Accelerated Laboratory Test or Natural Decay Resistance of Wood.
   10. ASTM D2240 Standard Test Method for Rubber Property – Durometer Hardness.
   11. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
   12. ASTM D2394 Standard Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring.
   13. ASTM D256 Standard Test Method for Determining the Pendulum Impact of Notched Specimens of Plastics.
   14. ASTM D2565 Standard Practice for Xenon Arc Exposure of Plastics Intended for Outdoor Applications.
   15. ASTM D3345 Standard Test Method for Laboratory Evaluation of Wood and Other Cellulosic Materials for Resistance to Termites.
   16. ASTM D4060: Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
   17. ASTM D4761 Standard Test Method for Mechanical Properties of Lumber and Wood-Base Structural Material.
   18. ASTM D6109 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber.
   19. ASTM D6117 Standard Test Methods for Mechanical Fasteners In Plastic Lumber and Shapes.

20. ASTM D6341 Standard Test Method for Determination of the Linear Coefficient of Thermal Expansion of Plastic Lumber and Plastic Lumber Shapes Between -30 and 140°F (-34.4 and 60°C).
21. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
22. ASTM D638 Standard Test Method for Tensile Properties of Plastic.
23. ASTM D6662 Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards.
24. ASTM D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer.
25. ASTM D790 Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
26. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
27. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

B. International Code Council (ICC):
1. International Building Code, 2006.

C. Nexwood Industries Limited:
1. Nexwood Contractor's Handbook and Instruction Guide.

D. Additional Test Results:
1. Full Scale Load Test as per BOCA NBC 1710.3.1.
2. Uniform Load and Creep Relaxation as per ICC AC-174.
3. Full Scale Railing System Test as per BOCA NBC 1606.4 and section 4.4 ASCE 7.
4. Full Scale Railing System Test as per 1997 Ontario Building Code and 1995 National Building Code of Canada Section 1.1.10.1 (1) © and (2).
5. Stair Tread Concentrated Load Test as ICBO AC174 section 4.1.3.

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Ultimate strength values are not meant for design analysis. Testing performed on a 2x6 cross section. Design values are for temperatures up to 1300 F (540C).
1. Structural properties: Ultimate Value/Design Value:
a. Compression Parallel to Length (ASTM D6108): 1,970 psi.
b. Tensile Strength of Beam (ASTM D638): 2,230 psi.
c. Tensile Strength of Material (ASTM D638): 2,840 psi.
d. Modulus of Rupture (ASTM D6109): 2,923 psi/1,144 psi.
e. Modulus of Elasticity (ASTM D6109): 403,068 psi/230,749 psi.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with conditions of the contract and submittal procedure.

B. Product Data: Submit manufacturer's product data, maintenance recommendations and installation manual including joints' details.

C. Samples: Submit selected and verified samples of composite lumber and or railing in color as selected by Architect. Some color variation in boards exposed to weathering is normal and should be expected. All colors will fade when exposed to sunlight and natural weathering.

D. Warranty documents specified herein.

1.05 DELIVERY, STORAGE AND HANDLING

A. General: Comply with product requirement section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged conditions, fitted with a protective Nexwood plastic wrap with stringers and straps; identification labels remain intact. These units should be off loaded using forklift and must be lifted from the center, between the crossers, to prevent the unit from dropping.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions.
   1. Immediately upon delivery to jobsite, place materials in area protected from weathering. Keep the units covered with protective Nexwood wrap, including any exposed ends.
   2. Units from the same shipment should be stored together or the wrap dated to reduce mixedproduction lots.
   3. Store Nexwood products on a flat surface.
   4. When stacking bundled units, line up supports vertically. The distance between the stringers at least 38.5" to prevent sagging.

1.06 WARRANTY

A. Manufacturer's Limited Warranty: No warranty claim shall be honored without presentation of the Limited Warranty Form, proof of purchase, and submission of "certificate of installation" (if one should apply).
   1. Provide manufacturer's non-transferable limited warranty against splitting, rot, and/or termite attack.
   2. Warranty Period: 20 years beginning with proof of dated purchase receipt for 2x6 Nexwood board and 10 years for 5/4 Tongue and Groove Nexwood board and 5/4 REB.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Composite Wood Lumber and Materials:
   1. Nexwood Industries Limited, 1327 Clark Boulevard, Brampton, Ontario, Canada L6T 5R5; Telephone: 1-888-763-9966; Fax: 905-799-3663; E-mail: inquiry@nexwood.com; website: www.nexwood.com.
   2. Trex Company, Inc.

2.02 PROPRIETARY PRODUCTS/SYSTEMS

A. Nexwood is manufactured by an extrusion process per manufacturer's quality control manual.
   1. Nexwood Composite Lumber:
      a. Material Description: Hollow composite material consists of approximately 60 pph wood-like cellulose fiber by weight with 40 pph reclaimed plastics and 1 pph additives.
      b. Nexwood profiles manufactured in specified length: 8, 12, 16, 20 ft.
      c. Color: Natural, Driftwood Grey, Sierra Brown, Sequoia Red.
      d. Self-Ignition Temperature (ASTM D1929): > 8420 F (4500C).
      e. Flammability (ASTM E84): Flame spread index 65, smoke developed index 340; Class B (Class II).
      f. Rate of Burning (ASTM D635): 0.68"/min.
      g. Solubility in Water: Negligible.
      h. Toxicity: no harmful material.
      i. Water Absorption (ASTM D1037): < 0.8%.
      j. Relative Density (ASTM D792): 1.167 g/cm3.
      k. Specific Gravity (ASTM D792): 1.170.
      l. Bulk Density (ASTM D6111): 0.510 g/cm3.
      m. Specific Gravity (ASTM D6111): 0.511.
      n. Coefficient of linear thermal expansion (ASTM D696): 2.60X10-5 in/in/10F (5.79X10-5 in/in/10C).
      o. Resistance to Termite Block Evaluation rating (ASTM D3345): 10 (no damage).
      p. Fungus Resistance Rating (ASTM D2017): < 3% (highly resistant).
      q. Static Coefficient of Friction (ASTM C1028): 0.58 when dry, and 0.64 when wet.
      r. Hygrothermal Cycles (ASTM D6662): average flexural strength change = minus 0.4%.
      s. Weathering test (ASTM D2565-2000 hours & D2244): noticeable change.
      t. Screw Uplift (ASTM D2047): 312 lb.
      u. Lateral Withdrawal (ASTM D6117): 392 lb.
      v. VICAT Softening Temperature (ASTM D1525): 99.3 0C (210.7 0F).
      w. Heat Deflection temperature (ASTM D648): 71.2 0C (160.2 0F).
      x. Abrasion (ASTM D4060): 0.0738g/1000 cycles.
      y. Hardness (ASTM D2240): Shore D-68.

2.03 ACCESSORIES

A. End caps, C-channel, E-channel, post cap, fastening screws.

B. Bolts, Exterior Use:
   1. Material Standard: Comply with ASTM A307, with standard washers.
   2. Finished: Galvanized, ASTM A123.
   3. Size: Diameter less than or equal to ½" (12.7 mm).

C. Screws:
   1. 2x6 Nexwood board: #7x3" Trim Head Swan Secure Stainless Steel.

2. 5/4 Tongue and Groove: TrapEase 2½" Fasten Master Composite Deck Screw (do not apply to the deck surface!).
3. 5/4x6 REB Nexwood board: #7x2-1/4" Trim Head Swan Secure Stainless Steel.

D. Adhesive:
1. OSI/LePage PL-400 Sub-Floor & Decking Adhesive.
2. Devcon, Plastic Welder-II.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with the methods detailed in Nexwood Contractor's Handbook and Installation Guide.

3.02 EXAMINATION

A. Site Verification of Conditions:
1. Verify that site conditions are acceptable for installation of Nexwood products.
2. Do not proceed with installation of Nexwood products until unacceptable conditions are corrected.

3.03 INSTALLATION

A. Install in accordance with most recent version Contractor's Handbook and Installation Guide.

B. Ensure boards are gapped end to end and width to width as described in the Nexwood Contractor's Handbook and Installation Guide.

C. Avoid butting boards of 20 feet in length end to end (≤16 ft); use other alternative design of your deck with different levels (elevations) or Herringbone pattern.

D. Use manufacturer's gapping guidelines to calculate end spacing due to temperature change.

E. Always use double joists for each butt joint.

F. Avoid building less than 12 ft from the ground without ventilation.

G. Do not attach lumber to any solid surface or watertight system.

H. Ensure lumber spans do not exceed the specifications of Nexwood Span Chart.

3.04 CLEANING

A. Comply with cleaning instructions as described in Nexwood Contractor's Handbook and Installation Guide.

B. At completion of work, remove debris caused by installation from project site and wash the entire deck with pressure washer. Periodic cleaning is necessary to keep the deck looking great.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 06 15 23

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Roof sheathing.
   3. Subflooring.
   4. Underlayment.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Sustainable Design Submittals:
   1. For adhesives, documentation including printed statement of VOC content.
   2. For composite wood products, documentation indicating that product contains no urea formaldehyde.
   3. For adhesives and composite wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:
   1. Preservative-treated plywood.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having

jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
   1. Plywood.
   2. Underlayment.

C. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

E. Factory mark panels to indicate compliance with applicable standard.

2.02 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.03 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1 Sheathing
   1. Span Rating: Not less than 32/16
   2. Nominal Thickness: Not less than 15/32 inch.

2.04 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
   1. Span Rating: Not less than 40/20.
   2. Nominal Thickness: Not less than 19/32 inch.

2.05 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1 Sheathing, , C-D single-floor panels.
   1. Span Rating: Not less than 24 o.c.
   2. Nominal Thickness: Not less than 23/32 inch.
   3. Edge Detail: Tongue and groove.
   4. Surface Finish: Fully sanded face.

B. Sound Deadening and Fire-Retardant Underlayment: Extremegreen Flooring.
   1. Thickness: ¾-inch.

2.06 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

2.07 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Combination Subfloor-Underlayment:
      a. Glue and nail to wood framing.
      b. Space panels 1/8 inch apart at edges and ends.
      c. Provide nailing pattern as dictated in structural documents.
   2. Wall and Roof Sheathing:
      a. Nail to wood framing.
      b. Space panels 1/8 inch apart at edges and ends.
      c. Provide nailing patterns according to shear wall schedules and typical structural details
   3. Underlayment:
      a. Nail to subflooring.
      b. Space panels 1/32 inch apart at edges and ends.
      c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

C. Install sound deadening and fire-retardant flooring in accordance with the manufacturer’s written instructions.

END OF SECTION 06 16 00

SECTION 06 16 70 – COMPOSITE WOOD PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sound Barrier Board.

1.02 REFERENCES

A. APA The Engineered Wood Association (APA): APA AFG-01 – Specification for field gluing subfloors.

B. American Society for Testing and Materials (ASTM):
   1. ASTM C 209 - Test Methods for Cellulosic Fiber Insulating Board.
   2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   3. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

C. UL listed, File R16381.

D. Forest Stewardship Certification (FSC): CoC Cert no. 5682.

E. ICC-ES Report ESR-1374.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10-years experience in producing sound-deadening boards.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging with labels intact until ready for installation.

B. Inspect the materials upon delivery to assure that specified products have been received. Report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.

C. Store materials in a dry place, indoors, on raised platform protected from weather damage.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Climatize panels to existing moisture conditions and for not less than 24 hours before installation. Comply with manufacturer’s recommendations for acclimatization.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:
   1. Homasote Company; 932 Lower Ferry Road, West Trenton, NJ 08628. Tel: (800) 257-9491. Tel: (609) 883-3300. Fax: (609) 883-3497. Email: sales@homasote.com Website: www.homasote.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

C. Substitutions: Not permitted.

D. Provide all acoustical wall panels from a single manufacturer.

2.02 MATERIALS

A. 440 SoundBarrier: Class C fire-rated. Molded, recycled post-consumer paper, cellulose fiber structural panel. Physical properties as follows:
   1. Thickness: 1/2 inch (13 mm).
   2. Density: 26-28 pcf (416-448 kg/cu. m) tested in accordance with ASTM C 209.
   3. Tensile Strength: When tested in accordance with ASTM C 209:
      a. Parallel: 450-700 psi (3,100-4,830 kPa).
      b. Transverse: 750-1000 psi (5.1171-6.894 kPa).
   4. Hardness (Janka Ball): 230 lbs (104 kg) tested in accordance withASTM D 1037.
   5. Water Absorption by Volume: When tested in accordance with ASTM C 209:
      a. 2 hour immersion: 7 percent maximum.

6. Expansion: 50 to 90 percent relative humidity, 0.25 percent in accordance with ASTM C 209.
7. Thermal Resistance: When tested in accordance with ASTM C 209 per ASTM C 518:
   a. R-value: 1.2 for 1/2 inch (13 mm) thick board.
   b. K-value: .512 Btu-in/ (h ft² °F).
8. Noise reduction coefficient (NRC): 0.20
9. Flame Spread: 76 to 200 tested in accordance with ASTM E 84, Class III or C.

2.03 ACCESSORIES

A. Adhesive: APA AFG-01 specification sub-floor adhesive.

B. Panel Fasteners:
   1. Nails, Wood Framing: annular thread type (ring shank) of length required to penetrate not less than 3/4 inch (19 mm) into subfloor.
   2. Screws: Coarse thread drywall type wood screw of length required to penetrate not less than 3/4 inch (19 mm) into sub-floor.
   3. Metal Framing: 22-25 gauge, drywall type steel screw.

C. Drywall fastener for decoupled wall installation.
   1. #10 drywall screw or laminating screw.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed.

B. Verify framing member spacing complies with manufacturer’s requirements depending on substrates and installation methods.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Verify what environmental conditions are, and will continue to be maintained in accordance with manufacturer’s recommendations.

E. Starting work by installer is acceptance of substrate and environmental conditions.

3.02 PREPARATION

A. Follow manufacturer’s instructions by separating and allowing panels to be exposed to environmental temperature and humidity conditions for not less than 24 hours before start of installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install only clean dry panels. Do not install wet panels.

C. Floor Panel Installation: Space panel joints 3/16 inch (5 mm) apart; 3/8 inch (10 mm) space at walls and partitions. Stagger joints.

D. Wall Panel Installation: Space panel joints 1/8 inch (3 mm) apart; 1/4 inch (6 mm) space at floors, ceilings, and window and door frames. Install gypsum wallboard or other wall finish panels so that finish panel joints are staggered and do not coincide with sound barrier panel joints. Install in accordance with finish panel manufacturer’s installation recommendations.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.05 CLEANING

A. Comply with manufacturer's recommendations for repairing damaged panels.

B. Replace panels that cannot be repaired.

END OF SECTION 06 16 70

SECTION 06 17 33 - WOOD I-JOISTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wood I-joists for roof and floor framing.

B. Bridging, bracing, and anchorage.

C. Framing for openings.

1.02 REFERENCE STANDARDS

A. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a.

B. ASTM D5055 - Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists; 2016.

C. PS 1 - Structural Plywood; 2009.

D. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

1.03 DESIGN REQUIREMENTS

A. Design Floor Live Load: 40 lbs/sq ft (25.5 kPa) with live load deflection limited to 1/480 of span.

B. Design Floor Dead Load: 25.5 lbs/sq ft with total deflection limited to 1/240 of span

1.04 SUBMITTALS

A. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.

C. Shop Drawings: Indicate sizes and spacing of joists, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between joists.

D. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.

B. Protect products from damage due to weather and breakage.

C. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks.

D. Handle individual joists in the upright position.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood I-Joists:
   1. Georgia-Pacific Corporation; www.buildgp.com.
   2. LP Building Products: www.lpcorp.com.
   3. Weyerhaeuser; www.woodbywy.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Wood I-Joists: Solid lumber top and bottom flanges and oriented strand board (OSB) webs bonded together with structural adhesive, with published span rating to meet project requirements.
   1. Span Rating: Established and monitored in accordance with ASTM D5055 by independent inspection agency.
   2. Oriented Strand Board: Comply with PS 2.
   3. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.
   4. Depth: As indicated on drawings.
   5. Fabrication Tolerances:
      a. Flange Width: Plus/minus 1/32 inch (0.8 mm).
      b. Flange Thickness: Minus 1/16 inch (1.6 mm).
      c. Joist Depth: Plus 0, minus 1/8 inch (3.2 mm).
   6. Marking: Mark each piece with depth, joist spacing, and allowable span for joist spacing.
   7. Provide bearing stiffeners if required by span rating or joist hanger manufacturer.

B. Joist Hangers: Per Structural Documents.

C. Joist Bridging: Type, size and spacing recommended by joist manufacturer.

D. Wood Blocking, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, maximum moisture content of 19 percent.

E. Wood Blocking, Plates, and Miscellaneous Framing: As specified in Section 06 1000.

F. Fasteners: Electrogalvanized steel, type to suit application.

G. Bearing Plates: Electrogalvanized steel, unfinished.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports and openings are ready to receive joists.

B. Verify that field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Install joists in accordance with manufacturer's instructions.

B. Set structural members level and plumb, in correct position.

C. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect.

E. Install permanent bridging and bracing.

F. Install headers and supports to frame openings required.

G. Frame openings between joists with lumber in accordance with Section 06 1000.

H. Coordinate installation of sheathing/decking with work of this section.

3.04 TOLERANCES

A. Framing Members: 1/2 inch (12 mm) maximum, from true position.

END OF SECTION 06 17 33

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wood roof trusses.
   2. Wood truss bracing.
   3. Metal truss accessories.

1.02 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.
   1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
   2. Indicate sizes, stress grades, and species of lumber.
   3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
   4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
   5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
   6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Roof truss design shall comply with all loading requirements listed on the structural construction documents.

1.04 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
   1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
   2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses 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."
   1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
   2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
   3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
   1. Design Loads: As indicated.
   2. Maximum Deflection Under Design Loads:
      a. Roof Trusses: Vertical deflection of 1/240 of span.

C. Comply with applicable requirements and recommendations of the following publications:
   1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
   2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
   3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.02 DIMENSION LUMBER

A. Certified Wood: For metal-plate-connected wood trusses and permanent bracing, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Provide dressed lumber, S4S.
3. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

C. Minimum Chord Size for Roof Trusses: 2 by 4 inches nominal for both top and bottom chords.

D. Minimum Specific Gravity for Top Chords: 0.50.

E. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 06 Section "Rough Carpentry."

2.03 METAL CONNECTOR PLATES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpine Engineered Products, Inc.; an ITW company.
2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
3. CompuTrus, Inc.
4. Eagle Metal Products.
5. Jager Building Systems, Inc.; a Tembec/SGF Rexfor company.
6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
7. Robbins Engineering, Inc.
8. Truswal Systems Corporation; an ITW company.

B. Source Limitations: Obtain metal connector plates from single manufacturer.

C. General: Fabricate connector plates to comply with TPI 1.

D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
1. Use for interior locations unless otherwise indicated.

2.04 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
   2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

2.05 METAL FRAMING ANCHORS AND ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cleveland Steel Specialty Co.
   2. KC Metals Products, Inc.
   3. Phoenix Metal Products, Inc.
   4. Simpson Strong-Tie Co., Inc.
   5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
   1. Use for interior locations unless otherwise indicated.

D. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050-inch thick.

E. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.

F. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

G. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040-inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.06 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.07 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
   1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.08 SOURCE QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform special inspections.
   1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
   2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses 24 inches o.c.; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
   1. Anchor trusses to girder trusses as indicated.

H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
   1. Install bracing to comply with Division 06 Section "Rough Carpentry."
   2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

I. Install wood trusses within installation tolerances in TPI 1.

J. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

K. Replace wood trusses that are damaged or do not meet requirements.
   1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.02 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
   1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 06 17 53

SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior wood trim.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
   1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
   2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
   4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Sustainable Design Submittals:
   1. For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
   2. Chain-of-custody certificates indicating that products specified to be made from certified wood comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.

C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

D. Samples for Verification:
   1. For each species and cut of lumber and panel products, with 1/2 of exposed surface finished; 50 sq. in. for lumber.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having

jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.05 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
   1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Regional Materials: The following wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
   1. Exterior trim.

B. Lumber: DOC PS 20 and the following grading rules:
   1. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
   2. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."

C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b.
   1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.

2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. Do not use material that is warped or does not comply with requirements for untreated material.
4. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
5. Application: Where indicated.

2.03 EXTERIOR TRIM

A. Lumber Trim for Painted Finish:
1. Species and Grade: Hem-fir, Prime or D finish; NLGA.
2. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; D Select (Quality); NLGA.
3. Maximum Moisture Content: 19 percent.
4. Finger Jointing: Allowed if made with wet-use adhesive complying with ASTM D 5572.
5. Face Surface: Surfaced (smooth).
6. Factory Priming: Factory coated on faces and edges with exterior primer compatible with topcoats specified.

B. Moldings for Painted Finish: WMMPA WM 4, P-grade wood moldings. Made from kiln-dried stock to patterns included in WMMPA WM 12.
1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Finger Jointing: Allowed if made with wet-use adhesive complying with ASTM D 5572.
3. Factory Priming: Factory coated on faces and edges with exterior primer compatible with topcoats specified.
4. Profiles: As indicated on the Drawing or to match existing on Building E.

2.04 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
1. For pressure-preservative-treated wood, provide stainless-steel fasteners.
2. For applications not otherwise indicated, provide stainless-steel or aluminum fasteners.

B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

C. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and with applicable requirements in Section 07 92 00 "Joint Sealants," recommended by sealant manufacturer and manufacturer of substrates for intended application.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. May National Associates, Inc.; Bondaflex 600.
d. Pecora Corporation; AC-20+.
e. Schnee-Morehead, Inc., an ITW company; SM 8200.
f. Tremco Incorporated; Tremflex 834.

2.05 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 09 91 13 "Exterior Painting."

3.03 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
   1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
   3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.04 STANDING AND RUNNING TRIM INSTALLATION

A. Install flat-grain lumber with bark side exposed to weather.

B. Install foam plastic moldings to comply with manufacturer's written instructions.

C. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary.
   1. Use scarf joints for end-to-end joints.
   2. Stagger end joints in adjacent and related members.

D. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

E. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.05 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.06 CLEANING

A. Clean exterior finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.07 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 13

SECTION 06 20 23 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior trim.
   2. Shelving and Closet Rods.
   3. Interior stairs and railings.

1.02 DEFINITIONS

A. MDF: Medium-density fiberboard.

B. MDO: Plywood with a medium-density overlay on the face.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
   1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
   2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
   4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Sustainable Design Submittals:
   1. Product Certificates: For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
   2. Product Data: For adhesives and glues used at Project site, documentation including printed statement of VOC content.
   3. Product Data: For composite wood products, documentation indicating that product contains no urea formaldehyde.
   4. Laboratory Test Reports for Credit IEQ 4: For adhesives and composite wood products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

1.04 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

B. Sample Warranty: For manufacturer's warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Regional Materials: The following wood products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
   1. Interior trim.
   2. Fire-rated interior door frames.
   3. Shelving and clothes rods.
   4. Interior stairs and railings.

B. Low-Emitting Materials: Composite wood products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Lumber: DOC PS 20 and the following grading rules:
   1. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
   2. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
   3. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."

D. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

E. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
   1. Color: As selected by Architect from manufacturer's full range.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent respectively.
   2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
   3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
   4. Do not use material that is warped or does not comply with requirements for untreated material.
   5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
      a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
   6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
      a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
   7. Application: Where indicated.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.

C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.

D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.

E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
   2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

F. Application: All interior lumber and plywood used in fire-rated assemblies.

2.04 INTERIOR TRIM

A. Lumber Trim for Opaque Finish (Painted Finish):
   1. Species and Grade: Alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; A Finish; NHLA.
   2. Maximum Moisture Content: 19 percent.
   3. Finger Jointing: Allowed.
   4. Face Surface: Surfaced (smooth).
   5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

B. Moldings for Opaque Finish (Painted Finish): Made to patterns included in WMMPA WM 12.
   1. Hardwood Moldings: WMMPA HWM 2, P-grade.
      a. Species: Aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar.
      b. Maximum Moisture Content: 9 percent.
   2. Optional Material: Primed MDF.
   3. Finger Jointing: Allowed.
   4. Profiles: As indicated on the Drawings.

2.05 WOOD SHELVING AND CLOTHES RODS

A. Closet Shelving: Made from the following material, 3/4 inch thick:
   1. MDF with solid-wood front edge.
   2. MDO softwood plywood with solid-wood edge.
   3. Wood boards as specified above for lumber trim for opaque finish.

B. Shelf Cleats: 3/4-by-3-1/2-inch boards with hole and notch to receive clothes rods, as specified above for lumber trim for opaque finish.

C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.

D. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.

E. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.

F. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

G. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; powder-coat-finished steel.

H. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; powder-coat-finished steel.

I. Clothes Rods: 1-5/16-inch-diameter, aluminum tubes.

J. Rod Flanges: Aluminum.

2.06 STAIRS AND RAILINGS

A. Treads: 1-1/16-inch, clear, kiln-dried, edge-glued, poplar stepping with half-round nosing.

B. Risers: 13/16-inch, clear, kiln-dried, edge-glued poplar stock.

C. Finished Stringers: 3/4-inch finish boards as specified above for interior lumber trim for opaque finish.

D. Interior Railings: Clear, kiln-dried yellow poplar, of pattern indicated, either solid or laminated.

2.07 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Low-Emitting Materials: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
   1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
   1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.08 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:
   1. Interior standing and running trim except shoe and crown molds.
   2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.03 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
   3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.04 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
   1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
   2. Install trim after gypsum-board joint finishing operations are completed.
   3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.05 SHELVING AND CLOTHES ROD INSTALLATION

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
   1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
   2. Space fasteners not more than 16 inches o.c. Use two fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.
   3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
   4. Remove adhesive that is squeezed out after fastening shelf cleats in place.

B. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.
   1. Install shelves, fully seated on cleats, brackets, and supports.

2. Fasten shelves to cleats with finish nails or trim screws, set flush.
3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

F. Install rod flanges for rods as indicated.
1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
2. Install rods in rod flanges.

3.06 STAIR AND RAILING INSTALLATION

A. Treads and Risers at Interior Stairs: Secure treads and risers by gluing and nailing to rough carriages.
1. Closed Stringers: Cope wall stringers to fit tightly over treads and risers.

B. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts, and glue. Assemble railings at goosenecks, easements, and splices with rail bolts and glue.

3.07 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.08 CLEANING

A. Clean interior finish carpentry on exposed and semi-exposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.09 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 23

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Surface-Burning Characteristics: According to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

PART 2 - PRODUCTS

2.01 INSULATION PRODUCTS

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, with flame-spread and smoke-developed indexes of 75 and 450, respectively.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. DiversiFoam Products.
      b. Dow Chemical Company (The).
      c. Kingspan Insulation Limited.
      d. Owens Corning.
   2. Thickness: 2 inches.
   3. Provide where perimeter insulation under slab-on-grade is noted.

B. Glass-Fiber-Blanket Insulation: ASTM C 665, Type II, kraft-faced.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Thickness: Match stud depth.

C. Mineral-Fiber-Blanket Insulation: ASTM C 665, Type I, unfaced with flame-spread index of 25 or less.
   1. Thickness: 3 inches.
   2. Provide where sound attenuation is noted.

2.02 ACCESSORIES

A. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed to fit between roof framing members and to provide cross-ventilation between insulated attic spaces and vented eaves.

B. Insulation for Miscellaneous Voids:
   1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.

B. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

C. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

D. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape. Seal joints caused by pipes, conduits, electrical boxes, and similar items with tape.

END OF SECTION 07 21 00

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Building wrap/air barrier.
   2. Flexible flashing.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.01 WATER-RESISTIVE BARRIER

A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap
      b. Reemay, Inc.; Typar MetroWrap.
   2. Water-Vapor Permeance: Not less than 150 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).
   3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
   4. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.02 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.020 inch.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
      b. Reemay, Inc.; Typar Flashing RA.

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

C. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.01 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:
   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions.
   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

3.02 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where required to comply with manufacturer's written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over water-resistive barrier at bottom and sides of openings.
   4. Lap water-resistive barrier over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 07 25 00

SECTION 07 31 12 – ASPHALT SHINGLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Asphalt roofing shingles.

B. Leak barrier and roof deck protection.

C. Metal flashing associated with shingle roofing.

D. Attic ventilation.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) - Annual Book of ASTM Standards
   1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction.
   4. ASTM D 3018 - Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.
   5. ASTM D 3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
   6. ASTM D 3462 – Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules.
   7. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
   8. ASTM D 7158 - Standard Test Method for Wind-Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method).
   9. AC438-1011-R1 – New Acceptance Criteria for Alternative Asphalt Roofing Shingles.

B. Underwriters Laboratories (UL) - Roofing Systems and Materials Guide (TFWZ.R21)
   1. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
   2. UL 997 - Wind Resistance of Prepared Roof Covering Materials.
   3. UL 2218 – Impact Resistance of Prepared Roof Covering Materials.

C. Asphalt Roofing Manufacturers Association (ARMA)

D. Sheet Metal and Air Conditioning Contractors National Association, 1nc. (SMACNA) - Architectural Sheet Metal Manual.

E. National Roofing Contractors Association (NRCA)

F. American Society of Civil Engineers (ASCE).
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

1.03 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.04 SUBMITTALS

A. Submit copies of product data sheets, detail drawings and samples for each type of roofing product.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all primary roofing products, including shingles, underlayment, leak barrier, and ventilation, by a single manufacturer.

B. Installer Qualifications: Installer must be approved for installation of all roofing products to be installed under this section.

1.06 REGULATORY REQUIREMENTS

A. Provide a roofing system achieving an Underwriters Laboratories (UL) Class A fire classification.

B. Install all roofing products in accordance with all federal, state and local building codes.

C. All work shall be performed in a manner consistent with current OSHA guidelines.

1.07 PREINSTALLATION MEETING

A. Timing: The meeting shall take place at the start of the roofing installation, no more than 2 weeks into the roofing project.

B. Attendees: Meeting to be called for by manufacturer’s certified contractor. Meeting’s mandatory attendees shall include the certified contractor and the manufacturer’s representative. Non-mandatory attendees shall include the owner’s representative, architect or engineer’s representative, and the general contractor’s representative.

C. Topics: Certified contractor and manufacturer’s representative shall review all pertinent requirements for the project, including but not limited to, scheduling, weather considerations, project duration, and requirements for the specified warranty.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store all products in manufacturer's unopened, labeled packaging until they are ready for installation.

B. Store products in a covered, ventilated area, at temperature not more than 110 degrees F (43 degrees C); do not store near steam pipes, radiators, or in direct sunlight.

C. Store bundles on a flat, properly drained surface. Maximum stacking height shall not exceed Manufacturer's recommendations. Store all rolls on end.

D. Store and dispose of solvent-based materials in accordance with all federal, state and local regulations.

1.09 WEATHER CONDITIONS

A. Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with Manufacturer's recommendations.

1.10 WARRANTY

A. Provide to the owner a GAF WeatherStopper Golden Pledge Ltd Warranty covering:
   1. Roofs installed by a Certified GAF Master Elite Contractor only.
   2. Manufacturing defects: 100% coverage for materials and labor for:
      a. 40 years with the first 20 years non- prorated.
   3. Workmanship errors: 100% coverage for workmanship errors for:
      a. 20 years.
   4. Warranted against algae discoloration for 10 years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Asphalt Shingles: Subject to compliance with the Contract Documents, provide products by one of the following:
   1. GAF,1 Campus Drive, Parsippany, NJ 07054. Tel: 1-973-628-3000.
   2. Certainteed.
   3. Owens-Corning.
   4. Tamko.

2.02 SHINGLES

A. Granule surfaced, high reflectance, self-sealing asphalt shingle with a strong fiberglass reinforced Micro Weave core and a mineral granule surfacing. Architectural laminate styling provides a wood shake appearance with a 5-5/8in. exposure. UL 790 Class A rated with UL 997 Wind Resistance Label; ASTM D 7158, Class H; ASTM D 3161, Type 1; ASTM D 3018, Type 1; ASTM D 3462; AC438 compliant; CSA 123.5-98; Dade County Approved, Florida Building Code Approved, Texas Dept of Insurance Approved, ICC Report Approval. Timberline Cool Series Energy-Saving Architectural Shingles, by GAF.
   1. Color: As selected from manufacturers' full range.

2.03 HIP AND RIDGE SHINGLES

A. High profile self-sealing hip and ridge cap shingle matching the color of selected roof shingle. Each bundle covers approx. 20 lineal feet (6.10m). Timbertex Premium Ridge Cap Shingles, by GAF.

2.04 STARTER STRIP

A. Self-sealing starter shingle designed for premium roof shingles. Each bundle covers approx. 100 lineal feet (30.48m) for English and metric shingles or 50 lineal feet (15.24m) for oversized shingles. WeatherBlocker Eave/Rake Starter Strip by GAF.

2.05 LEAK BARRIER

A. Self-adhering, self-sealing, bituminous leak barrier surfaced with fine, skid-resistant granules. Approved by UL, Dade County, ICC, State of Florida and Texas Department of Insurance. Each roll contains approx. 150 sq ft (13.9 sq.m.), 36" X 50' (0.9m x 20.3m) or 200 sq ft (18.6 sq.m.), 36" X 66.7' (0.9m x 20.3m). WeatherWatch Leak Barrier, by GAF.

2.06 SHINGLE UNDERLAYMENT

A. Premium, water repellant, breather type non-asphaltic underlayment. UV stabilized polypropylene construction. Meets or exceeds ASTM D226 and D4869. Approved by Dade Country, Florida Building Code, and ICC. Each roll contains approximately 10 squares (1003 sq. ft.) of material and is 54 in. x 223 ft. Deck-Armor Premium Breathable Roof Deck Protection, by GAF.

2.07 ROOFING CEMENT

A. Asphalt Plastic Roofing Cement meeting the requirements of ASTM D 4586, Type I or II.

2.08 ROOF ACCESSORIES

A. UV stable solid molded PVC compression collar, Kynar PVDF coated 24 gauge galvanized flange, Ultimate Pipe Flashing by Lifetime Tool.

2.09 ATTIC VENTILATION

A. Ridge Vents:
   1. Flexible rigid plastic ridge ventilator designed to allow the passage of hot air from attics, while resisting snow infiltration. For use in conjunction with eave/soffit ventilation products. Provides 12.5 sq inches Net Free Ventilation Area per lineal foot (26460 sq.mm/m). Each package contains 20 lineal feet (6.10m) of vent. Cobra Ridge Runner Ridge Vent by GAF.

B. Fascia and Soffit/Under Eave Vents
   1. Flexible rigid plastic ridge ventilator designed to allow the passage of hot air out of attics at the roof top along the eaves. For use in conjunction with ridge ventilation products. Provides 9.0 sq inches (11613 sq.mm/m) in NFVA per lineal foot. Each package contains 40 lineal feet (12.19m) of vent, Cobra IntakePro Rooftop Intake Vent (includes 1-3/4" (44.5 mm) coil nails), by GAF.

C. Hip Vents
   1. Flexible low profile rigid plastic ridge ventilator designed to allow the passage of hot air from attics, while resisting rain and snow infiltration. For use in conjunction with eave/soffit ventilation products. Provides 9 sq inches Net Free Ventilation Area per lineal foot (19,046 sq.m/m). Each package contains 40 lineal feet (12.19m) of vent. Cobra Hip Vent Exhuast Vent by GAF.

2.10 NAILS

A. Standard round wire, zinc-coated steel or aluminum; 10 to 12-gauge, smooth, barbed or deformed shank, with heads 3/8 inch (9mm) to 7/16 inch (11mm) in diameter. Length must be sufficient to penetrate into solid wood at least 3/4 inch (19mm) or through plywood or oriented strand board by at least 1/8 inch (3.18mm).

2.11 METAL FLASHING

A. Metal Flashing: 16-oz/sq ft (0.56mm) copper sheet, complying with ASTM B 370.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until the roof deck has been properly prepared.

B. If roof deck preparation is the responsibility of another installer, notify the architect or building owner of unsatisfactory preparation before proceeding.

3.02 PREPARATION OF SUBSTRATE

A. Clean deck surfaces thoroughly prior to installation of eaves protection membrane and underlayment.

B. At areas that receive eaves protection membrane, fill knotholes and cracks with latex filler.

C. Install crickets on the upslope side of all chimneys in the north, any chimney wider than 24” (610mm), and on all roofs steeper than 6/12.

3.03 INSTALLATION OF UNDERLAYMENTS

A. General:
1. Install using methods recommended by GAF, in accordance with local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.

B. Eaves:
1. Install eaves edge metal flashing tight with fascia boards; lap joints 2 inches (51mm) and seal with plastic cement or high-quality urethane sealant; nail at the top of the flange.
2. In the north, and on all roofs between 2/12 and 4/12 (low slopes) install GAF leak barrier up the slope from eaves edge a full 36 inches (914mm) or to at least 24 inches (610 mm) beyond the interior “warm wall”. Lap ends 6 inches (152mm) and bond.

C. Closed-Cut Valleys: Extend asphalt-shingle strips from one side of valley **12 inches** beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten

with extra nail in upper end of shingle. Install asphalt-shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.

1. Do not nail asphalt shingles within 6 inches of valley center.
2. Set trimmed, concealed-corner asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.

D. Hips and Ridges:

1. Install GAF leak barrier along entire lengths. If ridge vents are to be installed, position the GAF leak barrier so that the ridge slots will not be covered.

E. Deck-Armor Application:

1. Deck-Armor shall be installed over a clean, dry deck.
2. Install Weather Watch or StormGuard Leak Barrier at eaves, valleys, rakes, skylights, dormers and other vulnerable leak areas.
3. Lay Deck-Armor over deck and overlap 3” (76mm) at side laps and 6” (152mm) at end laps.
4. For exposure to rain or snow, overlap 12” (305mm) at end laps.
5. For side and end laps: fasten Deck-Armor 12” (305mm) o.c. (6” (152mm)o.c. for high wind areas).
6. For middle of the roll: fasten Deck-Armor 24” (610mm) o.c. (12” (305mm) o.c. for high wind areas).
7. For exposure to rail or snow, completely cover all side laps, end laps and fasteners with tape.
8. For long term exposure see complete Deck-Armor installation instructions for side lap detail.
9. If roof may be exposed to high winds, apply tape over all fasteners at the center of the roll to prevent rain or snow from entering at the fasteners.
10. For slopes less that 2:12, a double application of Deck-Armor is required. See complete Deck-Armor installation instructions for more information.

F. Penetrations:

1. Vent pipes: Install a 24 inch (610 mm) square piece of eaves protection membrane lapping over roof deck underlayment; seal tightly to pipe.
2. Vertical walls: Install eaves protection membrane extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.
3. Skylights and roof hatches: Install eaves protection membrane from under the built-in counterflashing and 12 inches (305mm) on to the roof surface lapping over roof deck underlayment.
4. Chimneys: Install eaves protection membrane around entire chimney extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.
5. Rake Edges: Install metal edge flashing over eaves protection membrane and roof deck underlayment; set tight to rake boards; lap joints at least 2 inches (51mm) and seal with plastic cement; secure with nails.

3.04 INSTALLATION OF STARTER SHINGLES

A. General:

1. Install in accordance with Manufacturer's instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
2. Refer to application instructions for the selected starter strip shingles.

B. Placement and Nailing:
1. For maximum wind resistance along rakes & eaves, install any GAF starter strip containing sealant or cement shingles to underlayment and each other in a 4" (102mm) width of asphalt plastic roof cement.
2. Place starter strip shingles 1/4" – 3/4" (6 – 19mm) over eave and rake edges to provide drip edge.
3. Nail approximately 1-1/2" – 3" (38 – 76mm) above the butt edge of the shingle.
4. Rake starter course should overlap eave edge starter strip at least 3" (76mm).

3.05 INSTALLATION OF SHINGLES

A. General:
1. Install in accordance with Manufacturer's instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.
2. Minimize breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F (4 degrees C).
3. Handle carefully in hot weather to avoid scuffing the surface, or damaging the shingle edges.

B. Placement and Nailing:
1. Secure with 4, 5, or 6 nails per shingle per Manufacturer's application instructions or local codes.
2. Placement of nails varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.
3. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.
4. Shingle offset varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.

C. Valleys:
1. Install valleys using the "closed cut valley" method:
    a. Run the first course of shingles from the higher roof slope across the valley at least 12 inches (305mm).
    b. Run succeeding courses of shingles from the lower roof slope across the valley at least 12 inches (305mm) and nail not closer than 6 inches (152mm) to center of valley.
    c. Run shingles from the upper roof slope into the valley and trim 2 inches (51mm) from the center line.

D. Penetrations
1. All Penetrations are to be flashed according to GAF, ARMA and NRCA application instructions and construction details.

3.06 INSTALLATION OF ATTIC VENTILATION

A. General:
   1. Ventilation must meet or exceed current F.H.A., H.U.D. and local code requirements.

B. Ridge / Soffit ventilation:
   1. Install ridge vent along the entire length of ridges:
   2. Cut continuous vent slots through the sheathing, stopping 6 inches (152mm) from each end of the ridge.
   3. On roofs without ridge board, make a slot 1 inch (25mm) wide, on either side of the peak (2 inch (51mm) overall).
   4. On roofs with ridge board, make two slots 1-3/4 inches (44.5mm) wide, one on each side of the peak (3 ½ inch (89mm) overall).
   5. Install ridge vent material along the full length of the ridge, including uncut areas.
   6. Butt ends of ridge vent material and join using roofing cement.
   7. Install eaves vents in sufficient quantity to equal or exceed the ridge vent area.

3.07 PROTECTION

A. Protect installed products from foot traffic until completion of the project.

B. Any roof areas that are not completed by the end of the workday are to be protected from moisture and contaminants.

END OF SECTION 07 31 12

SECTION 07 46 00 - SIDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

1.02 SUMMARY

A. Section Includes:
   1. Fiber-cement siding.
   2. Fiber-cement soffit.
   3. Extruded aluminum trim and vents.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For siding and soffit including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.
   1. 12-inch- long-by-actual-width Sample of siding.
   2. 12-inch- long-by-actual-width Sample of soffit.
   3. 12-inch- long-by-actual-width Samples of trim and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of siding and soffit, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of siding required, from the ICC.

D. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of siding and soffit and related accessories to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish full lengths of siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.07 QUALITY ASSURANCE

A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain siding and soffit, including related accessories, from single source from single manufacturer.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockups for siding and soffit including accessories.
      a. Size: 48 inches long by 60 inches high.
      b. Include outside corner on one end of mockup and inside corner on other end.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.09 COORDINATION

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.10 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and soffit that fail(s) in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including cracking, deforming.
   2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. GAF.
      c. James Hardie Building Products, Inc.
      d. Nichiha Fiber Cement.
      e. Norandex Building Materials Distribution, Inc.

2. Horizontal Pattern: Boards 6.25 inches and 8.25 inches, as indicated on the Drawings, wide in plain style.
    a. Texture: Wood-grain.
3. Factory Priming: Manufacturer's standard acrylic primer.

B. Provide 5/4-inch thick smooth trim where indicated.

2.02 FIBER-CEMENT SOFFIT

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Cemplank.
    b. CertainTeed Corp.
    c. James Hardie.

B. Pattern: 24-inch wide bead board sheets with smooth texture.

C. Ventilation: Provide perforated soffit unless otherwise indicated.

D. Factory Priming: Manufacturer's standard acrylic primer.

2.03 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
1. Door and window casings.
2. Entrance and window head pediments.
3. Fasciae.
4. Moldings and trim.

C. Colors for Decorative Accessories: Match adjacent siding.

D. Flashing: Provide stainless-steel flashing complying with Division 07 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

E. Fasteners:
1. For fastening to wood, use siding nails of sufficient length to penetrate a minimum of 1 inch into substrate.
2. For fastening fiber cement, use stainless-steel fasteners.

F. Insect Screening for Soffit Vents: Stainless steel, 18-by-18 mesh.

G. Continuous Soffit Vents: Aluminum, hat-channel shape, with perforations; 2 inches wide and not less than 96 inches long.
   1. Net-Free Area: 6 sq. in./linear ft.
   2. Finish: Mill finish

H. Aluminum Trim and Reveals: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Clear anodized, Class II.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and soffit and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION

A. General: Comply with siding and soffit manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Do not install damaged components.
   2. Install fasteners no more than 16 inches o.c.

B. Install fiber-cement siding and soffit and related accessories.
   1. Install fasteners no more than 16 inches o.c.

C. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.

3.04 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color samples.

B. Coordinate installation of sheet metal flashing and trim with adjoining roofing and wall materials, joints, and seams to provide a leakproof, secure, and noncorrosive installation.

C. Warranty on Finishes: Manufacturer agrees to repair or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless otherwise indicated. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

2.02 SHEET METAL

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, not less than 0.032 inch thick; finished as follows:
   1. Finish: Manufacturer's standard two-coat fluoropolymer system with color coat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
   2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

2.03 ACCESSORIES

A. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, High-Temperature Sheet Underlayment: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970.

C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

D. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.
   1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
   2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

E. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.04 FABRICATION

A. Fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to the design, dimensions, geometry, metal thickness, and other characteristics of item indicated.

B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that are capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with cited sheet metal standards. Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.

B. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

C. Seams: Fabricate nonmoving seams with flat-lock seams. For aluminum, form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

D. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating.
   1. Coat concealed side of aluminum with bituminous coating where it contacts wood, ferrous metal, or cementitious construction.

END OF SECTION 07 62 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. For penetration firestopping sealants and sealant primers, documentation including printed statement of VOC content.
   2. For penetration firestopping sealants and sealant primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping

products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
      b. Classification markings on penetration firestopping correspond to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
         3) FM Global in its "Building Materials Approval Guide."

C. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.06 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A/D Fire Protection Systems Inc.
   2. Grace Construction Products.
   3. Hilti, Inc.
   4. Johns Manville.

5. Nelson Firestop Products.
6. NUCO Inc.
7. Passive Fire Protection Partners.
8. RectorSeal Corporation.
9. Specified Technologies Inc.
10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

H. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

I. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Slag-wool-fiber or rock-wool-fiber insulation.
      b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      c. Fire-rated form board.
      d. Fillers for sealants.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

2.03 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.04 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.03 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 46 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.
   2. Joints in smoke barriers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. For fire-resistive joint system sealants, documentation including printed statement of VOC content.
   2. For fire-resistive joint system sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.
   1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
   1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
      a. Fire-resistive joint system products bear classification marking of qualified testing agency.
      b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

C. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.06 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.01 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
   1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. A/D Fire Protection Systems Inc.
    b. CEMCO.
    c. Fire Trak Corp.
    d. Grace Construction Products.
    e. Hilti, Inc.
    f. Johns Manville.
    g. Nelson Firestop Products.
    h. NUCO Inc.
    i. Passive Fire Protection Partners.
    j. RectorSeal Corporation.
    k. Specified Technologies Inc.
    l. 3M Fire Protection Products.
    m. Tremco, Inc.; Tremco Fire Protection Systems Group.
    n. USG Corporation.

C. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. A/D Fire Protection Systems Inc.
    b. Grace Construction Products.
    c. Hilti, Inc.
    d. Johns Manville.
    e. Nelson Firestop Products.
    f. NUCO Inc.
    g. Passive Fire Protection Partners.
    h. RectorSeal Corporation.
    i. Specified Technologies Inc.
    j. 3M Fire Protection Products.
    k. Tremco, Inc.; Tremco Fire Protection Systems Group.
    l. USG Corporation.

D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 84 46

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Urethane joint sealants.
   2. Latex joint sealants.
   3. Acoustical joint sealants.

1.02 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Sustainable Design Submittals:
   1. For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.
   2. For sealants and sealant primers used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
   2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Preinstallation Conference: Conduct conference at Project site.

1.04 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 URETHANE JOINT SEALANTS

A. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corporation; Dynatrol II.
      b. Polymeric Systems, Inc.; PSI-270.

c. Tremco Incorporated; Dymeric 240.

B. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolastic NP 2.
b. LymTal International, Inc.; Iso-Flex 885 SG.
c. May National Associates, Inc.; Bondaflex PUR 2 NS.
d. Pacific Polymers International, Inc.; Elasto-Thane 227 High Shore Type II.
e. Pecora Corporation; Dynatred.
f. Sika Corporation, Construction Products Division; Sikaflex - 2c NS.
g. Tremco Incorporated; Vulkem 227.

2.03 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Building Systems; Sonolac.
b. Bostik, Inc.; Chem-Calk 600.
c. May National Associates, Inc.; Bondaflex 600.
d. Pecora Corporation; AC-20+.
e. Schnee-Morehead, Inc.; SM 8200.
f. Tremco Incorporated; Tremflex 834.

2.04 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Pecora Corporation; AC-20 FTR.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2.05 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin).

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine

primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.

1.02 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:
   1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.
   1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Mesker Door Inc.
6. Metal Products, Incorporated.
7. Steelcraft; an Ingersoll-Rand company.
8. Windsor Republic Doors.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Division 08 Section "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Panel Embossed.
2. Core Construction: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, or mineral-board core.
    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
        1) Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. (2.16 W/K x sq. m) when tested according to ASTM C 518.
        2) Locations: Exterior doors and unit entry doors.
3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.
1. Fabricate frames with knocked down, slip-on frame corners .
2. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
3. Frames for Wood Doors: 0.053-inch-thick steel sheet.
4. Frames for Borrowed Lights: 0.053-inch- thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:
   1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.06 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032-inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032-inch thick, fabricated from same material as frames in which they are installed.

2.07 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.08 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   6. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
         1) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
         5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
      c. Compression Type: Not less than two anchors in each jamb.
      d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
   7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.09 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. At fire-protection-rated openings, install frames according to NFPA 80.
   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   c. Install frames with removable glazing stops located on secure side of opening.
   d. Install door silencers in frames before grouting.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide

flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
      d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
   3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 16 00 – COMPOSITE DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Passage Doors for inside living units.

1.02 REFERENCES

A. National Fire Protection Association (NFPA): NFPA 252: Standard Methods of Fire Tests of Door Assemblies.

B. Underwriters Laboratories, Inc. (UL): UL 10C: Standard for Positive Pressure Fire Tests of Door Assemblies.

1.03 DESIGN REQUIREMENTS

A. Fire-Rated Door Assemblies: Fire door assemblies shall meet or exceed fire-protection ratings indicated when tested in accordance with UL 10C.

1.04 SUBMITTALS

A. Product Data: Submit door manufacturer current product literature, including installation instruction.
   1. Samples: Provide finish samples for all products.
   2. Quality Assurance Submittals:
   3. Manufacturer Instructions: Provide manufacturer's written installation instructions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver doors, materials and components in manufacturer's original, unopened, damaged containers with identification labels intact.

B. Store doors as recommended by manufacturer.

1.06 WARRANTY

A. Manufacturer standard warranty indicating that the door will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:
   1. Door Unit: 5 years.

PART 2 - PRODUCTS

2.01 ACCEPTALBE MANUFACTURERS

A. Flush Composite Doors:

1. JELD-WEN Interior Doors; 3305 Lakeport Blvd; Klamath Falls, OR 97601, USA; Phone 877.535.3462, fax 541.882.3455; website www.jeld-wen.com.
2. Tru-Stile Doors, LLC.
3. Masonite Corporation.

2.02 COMPOSITE DOORS

A. Basis of Design: Doors are based on JELD-WEN's Molded Interior Doors.

B. Core and Frame: Hollow core with wood frame.
1. Thickness: 1-3/8 inch.

C. Hardware Finish: Brushed chrome.

D. Finish: Preprimed.

E. Provide bi-fold doors matching swinging doors.

PART 3 - EXECUTION

3.01 GENERAL

A. Install doors in accordance with manufacturer's installation guidelines and recommendations.

3.02 EXAMINATION

A. Inspect door prior to installation.

B. Inspect rough opening for compliance with door manufacturer recommendations. Verify rough opening conditions are within recommended tolerances.

3.03 PREPARATION

A. Prepare door for installation in accordance with manufacturer's recommendations.

B. Trim bottom of jamb sides to achieve desired distance between door bottom and finished floor height.

3.04 INSTALLATION

A. Place door unit into opening and level hinge side of jamb. Use shims fastened through jamb and stop to level and temporarily secure in place.

B. Level latch side of jamb. Use shims fastened through jamb and stop to level and temporarily secure in place.

C. Verify spacing between jamb and door is uniform on all sides. Adjust as necessary.

D. Shim top of jamb in center of opening and fasten with nail.

E. Re-check for square, level and even spacing around door. Nail securely in place through stop, jamb, shims and into studs every 12 inches.

F. Set nails.

G. Install trim on both sides using nails every 12 to 16 inches.

END OF SECTION 08 16 00

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Access doors and frames for walls and ceilings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
   2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.02 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Access Panel Solutions.
   2. Acudor Products, Inc.
   3. Alfab, Inc.
   4. Babcock-Davis.
   5. Cendrex Inc.
   6. Elmdor/Stoneman Manufacturing Co.; Div. of Acorn Engineering Co.
   7. Jensen Industries; Div. of Broan-Nutone, LLC.
   8. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   9. Karp Associates, Inc.
   10. Larsen's Manufacturing Company.

11. Maxam Metal Products Limited.
12. Metropolitan Door Industries Corp.
13. MIFAB, Inc.
14. Milcor Inc.
15. Nystrom, Inc.
16. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Wall Access Doors:
1. Fire Rated Doors: Fire Rated Access Door, manufactured by Inryco/Milcor.
   a. UL "B" (1-1/2 hour) Label.
   b. Steel, prime finish.
   c. Size as required to access equipment.
   d. Provide key-operated cylinder lock.
   e. Provide masonry anchors, where applicable.
2. Non-Fire Rated Doors, for gypsum board walls and partitions: Style DW, manufactured by Inryco/Milcor.
   a. Steel, prime finish.
   b. Size: 24" x 48".
   c. Provide key-operated cylinder lock.

D. Ceiling Access Doors:
1. Doors: Style ATR, manufactured by Inryco/Milcor.
2. Size: 24" x 30".

E. Fire-Rated Attic Access Doors:
1. Doors: KRP-150FR, manufactured by Karp Associates, Inc.
2. Size: 36 by 22 inches.

2.03 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.04 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
   2. Provide mounting holes in frames for attachment of units to wood framing.
   3. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
   1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder locks, furnish two keys per lock and key all locks alike.
   2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:
   1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
   2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.03 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 53 13 - VINYL WINDOWS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CertainTeed Corporation.
   2. Jeld-Wen, Inc.
   3. Kolbe & Kolbe Millwork Co., Inc.
   4. Pella Corporation.
   5. Weather Shield Mfg., Inc.
   6. YKK AP America Inc.

2.02 PERFORMANCE REQUIREMENTS

A. Product Standard: AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Window Certification: WDMA certified with label attached to each window.
   2. Performance Class: LC.
   3. Performance Grade: 30.

B. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.31 Btu/sq. ft. x h x deg F.

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

2.03 VINYL WINDOWS

A. Window Types: As indicated on Drawings.

B. Window Color: As selected by Architect from manufacturer’s full range.

C. Equip units with grilles located within the insulating glass units as indicated.

D. Trim: Provide indicated trim, matching material and finish of frame members.

E. Provide stainless-steel, ball-bearing sash rollers with nylon tires for sliding windows.

F. Equip units with vinyl-coated, glass-fiber mesh insect screens at operable sashes.

G. Equip units with UL Listed breakaway devices for emergency egress at all second floor windows.

H. Equip units with charcoal-gray, coated-aluminum mesh insect screens at operable sashes.

I. Glaze units with clear low-E-coated, argon-filled, sealed insulating glass, complying with Section 08 80 00 "Glazing."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels. Provide proper support and anchor securely in place.

B. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.

D. Adjust operating panels, screens, and hardware to provide a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

E. Clean glass and vinyl surfaces immediately after installing windows. Remove nonpermanent labels from glass surfaces.

END OF SECTION 08 53 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
      b. Folding doors.
   2. Cylinders for door hardware specified in other Sections.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Other Action Submittals:
   1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
      b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
      c. Content: Include the following information:
         1) Identification number, location, hand, fire rating, size, and material of each door and frame.
         2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
         3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
         4) Fastenings and other pertinent information.
         5) Explanation of abbreviations, symbols, and codes contained in schedule.
         6) Mounting locations for door hardware.
         7) List of related door devices specified in other Sections for each door and frame.
   2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Door Hardware:
      a. Provide one of each type of lock and latchset.
      b. Provide one of each deadbolt.
      c. Provide 200 key blanks.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Warehousing Facilities: In Project's vicinity.
   2. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

F. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines, ICC/ANSI A117.1, and HUD's "Fair Housing Accessibility Guidelines".
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
   2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

H. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

I. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Review required testing, inspecting, and certifying procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
      a. Manual Closers: 10 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA designations referenced.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
   2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.02 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.]
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bommer Industries, Inc.

b. Hager Companies.
c. McKinney Products Company; an ASSA ABLOY Group company.
d. PBB, Inc.
e. Stanley Commercial Hardware; Div. of The Stanley Works.

2.03 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: BHMA A156.17.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Baldwin Hardware Corporation.
b. Bommer Industries, Inc.
c. Hager Companies.
d. McKinney Products Company; an ASSA ABLOY Group company.
e. PBB, Inc.
f. Stanley Commercial Hardware; Div. of The Stanley Works.

2.04 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:
1. Description: Levers matching Omega design as manufactured by Schlage.
2. Levers: Cast.
3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lever lock trim and escutcheons.
5. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

F. Bored Locks: BHMA A156.2; Grade 1 and 2 as scheduled; Series 4000.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Allegion plc.
b. Best Access Systems; Stanley Security Solutions, Inc.
c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
d. SARGENT Manufacturing Company; ASSA ABLOY.
e. Yale Security Inc; an ASSA ABLOY Group company.
f. Stanley Commercial Hardware; Div. of The Stanley Works.

G. Roller Latches: BHMA A156.16; Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Builders Hardware Mfg., Inc.
      b. Baldwin Hardware Corporation.
      c. Don-Jo Mfg., Inc.
      d. Door Controls International, Inc.
      e. IVES Hardware; an Ingersoll-Rand company.
      f. Rockwood Manufacturing Company.
      g. Stanley Commercial Hardware; Div. of The Stanley Works.

2.05 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.5: Grade 2; with strike that suits frame.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allegion plc.
      b. Best Access Systems; Stanley Security Solutions, Inc.
      c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
      d. SARGENT Manufacturing Company; ASSA ABLOY.
      e. Yale Security Inc; an ASSA ABLOY Group company.
      f. Stanley Commercial Hardware; Div. of The Stanley Works.

2.06 LOCK CYLINDERS

A. Lock Cylinders: Interchangeable type, constructed from brass or bronze, stainless steel, or nickel silver.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Best Access Systems; Stanley Security Solutions, Inc.
      b. Stanley Commercial Hardware; Div. of The Stanley Works.

B. Standard Lock Cylinders: BHMA A156.5; Grade 2 permanent cores; face finished to match lockset.
   1. Core Type: Interchangeable.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.07 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
   2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."
2. Quantity: In addition to one extra key blank for each lock, provide the following:
a. Master Keys: Five.
b. Grand Master Keys: Five.

2.08 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Key Boxes and Cabinets.
b. GE Security, Inc.
c. HPC, Inc.
d. Lund Equipment Co., Inc.
e. MMF Industries.
f. Tri Palm International.
2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.09 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. LCN Closers; an Ingersoll-Rand company.
b. Norton Door Controls; an ASSA ABLOY Group company.
c. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
e. Yale Security Inc.; an ASSA ABLOY Group company.

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Architectural Builders Hardware Mfg., Inc.
b. Baldwin Hardware Corporation.
c. Burns Manufacturing Incorporated.
d. Cal-Royal Products, Inc.
e. Don-Jo Mfg., Inc.
f. Door Controls International, Inc.
g. Hager Companies.
h. Hiawatha, Inc.

i. IVES Hardware; an Ingersoll-Rand company.
j. Rockwood Manufacturing Company.
k. Stanley Commercial Hardware; Div. of The Stanley Works.
l. Trimco.

2.11 DOOR GASKETING

A. General: Provide continuous gasketing on exterior doors, provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
1. Perimeter Gasketing: Apply to head and jambs, forming a seal between door and frame.
2. Door Sweeps and Door Shoes: Apply to bottom of door, forming a sea l with threshold when door is close
3. Door Corner Pads: Apply to door jambs at threshold,

B. Air Leakage: None at jambs and head. Not to exceed 0.50 cfm per foot of crack length for gasketing as tested according to AT SM E 283 at sweep.

C. Aluminum Seal Retainers and Replaceable Seal Inserts.
1. Provide only aluminum seal retainers that mechanically accept barbed, foam inserts for easy replacement.
a. Seal Retainers shall be 11/4" X38", T 3 aluminum. Tolerance +/- .001”. Seal Retainers shall be designed to not allow ' oil-canning" during installation.
2. Provide only open-celled, passive, Replaceable Seal Foam Inserts with polyethylene liner and are readily available from stocks maintained by manufacturer.
a. Foam Inserts shall be 11/4" deep when in un-retracted shape.
b. Foam Inserts sha ll have a U/ L Fire Rating rated at 90 minutes.
c. Foam Inserts polyethylene liner shall conta in chemical additives making them UL and paint resistant.
d. Foam Inserts shall be CFC free.
e. Foam Inserts shall exceed 702.

D. Corner Pads:
1. Provide only non-wicking open celled wedges with polyethylene liner. {Required.) Door Sweeps and Door Shoes.

E. Door Sweeps:
1. Provide Type 6 nylon brushes that are locked in to a steel channel and retained in an aluminum extrusion.

F. Testing:
1. Water infiltration: Passed water penetration tests at 25 mph {40 km/ h) and 34 mph {55 km/ h) ASTM E331 standard test method.
2. Water Absorption: No visible effects in degradation; water absorption negligible after being submerged in water 24 hours t hen frozen for 1 week. Compressed 50% upon removal from freezer.
3. Performance Testing: Tested in accordance with ASTM E 273 on " real life" test. Results reduced total cfm 17% on one door. Results will vary according to door condition.

G. Adjustment:
1. Adjust and check the operating system of the door to ensure proper fu nction of hardware. Due to the passive nature of the Seal Inserts, hardware adjustment is not required if installed according to directions.

H. Warranty:
1. Insert Seals are Lif etime Warranted to function, This war ranty applies to function, not to wear.

I. ACCEPTABLE MANUFACTURERS
1. Storm Strips Corp., 224 Diamond Valley Pass, Canton, GA 30114.
2. Green Seal USA, Inc., Marietta, GA.

2.12 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hager Companies.
b. National Guard Products.
c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
d. Reese Enterprises, Inc.
e. Zero International.

2.13 FOLDING DOOR HARDWARE

A. Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Cox, Arthur, & Sons, Inc.
b. Hager Companies.
c. Henderson, PC Inc.
d. Johnson, L. E., Products, Inc.
e. Stanley Commercial Hardware; Div. of The Stanley Works.

2.14 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Baldwin Hardware Corporation.
b. Cal-Royal Products, Inc.
c. Don-Jo Mfg., Inc.
d. Hager Companies.
e. Rockwood Manufacturing Company.
f. Stanley Commercial Hardware; Div. of The Stanley Works.
g. Trimco.

2.15 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
         2) Strike plates to frames.
         3) Closers to doors and frames.
   3. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
   4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.16 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

H. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
   2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

D. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.06 DOOR HARDWARE SCHEDULE

A. For each opening where scheduled, provide the following:

Hardware Set No. 1
Each to have:

3	Hinges	Hager BB1279, 4.5” X 4.5”, US26D
1	Passage Set	Schlage ND10S – Sparta, US26D
1	Door Closer	LCN 4011/4111 X Sprayed Aluminum
1	Door Stop	Hager 236W OR 241F, US26D
1	Threshold	NGP 884V
1	Weatherstripp	Stormstrips

Hardware Set No. 2
Each to have:

6	Hinges	Hager BB1263 – 4.5” x 4.5”, US26D
2	Auto Flush Bolts	Hager 296W US26D
1	Dust Proof Strike	Hager 280X US26D
1	Storeroom Set	Schlage ND80PM – Sparta, US26D
1	Interchangeable Core	
1	Latch Protector	Don-Jo LP-111, US32D
2	Silencers	Ives SR64

Hardware Set No. 3:
Each to have:

2	Spring Hinges	Hager 1250, 4.5.x 4.5, US26D
1	Hinge	Hager BB1279, 4.5 x 4.5, US26D
1	Passage Set	Schlage AL10S, Sparta, US26D
1	Deadbolt	Schalge BC160P,US26D
1	Interchangeabe Core	
1	Viewer	Rockwood 622, US26D
1	Threshold	NGP 425, Mill.
1	Door Sweep	Stormstrips
1 set	Weatherstripping	Stormstrips
1	Door Stop	

Hardware Set No. 4
Each to have:

3	Hinges	Coordinate with door supplier
1	Passage Set	Schlage AL10S, Sparta, US26D
1	Door Stop	Rockwood 525

Hardware Set No. 5
Each to have:

1 set	Folding Door Hardware	L.E. Johnson FS100 Series, Length as required.

Hardware Set No. 6
Each to have:

3	Hinges	Coordinate with door supplier
1	Privacy Set	Schalge AL40S, Sparta, US26D
1	Door Stop	Rockwood 525

Hardware Set No. 7
Each to have:

3	Hinges	Coordinate with door supplier
1	Lockset	Schalge AL53PD, Sparta US26D
1	Door Stop	Rockwood 525

Hardware Set No. 8
Each to have:

6	Hinges	Coordinate with door supplier
2	Dummy Trim	Schlage AL170, Sparta, US26D
2	Roller Latches	Rockwood 594
2	Door Stops	

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.
   1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

PART 2 - PRODUCTS

2.01 GLASS, GENERAL

A. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated.

B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201. Provide safety glazing labeling where safety glass is indicated.

2.02 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3.

C. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials.

D. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

2.03 MONOLITHIC-GLASS TYPES

A. Glass: Clear float glass.
   1. Provide fully tempered float glass where indicated or required by Authorities Having Jurisdiction.
   2. Thickness: 6.0 mm.

2.04 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated, clear insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Each Glass Lite: 6.0 mm.
   3. Outdoor Lite: Float glass.
   4. Interspace Content: Argon.
   5. Indoor Lite: Float glass.
   6. Visible Light Transmittance: 70% percent minimum.
   7. Winter Nighttime U-Factor: 0.29 maximum.
   8. Summer Daytime U-Factor: 0.28 maximum.
   9. Solar Heat Gain Coefficient: 0.38. maximum.

2.05 GLAZING SEALANTS

A. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: One of the following:
      a. Dow Corning Corporation; 799.
      b. GE Advanced Materials - Silicones; UltraGlaze SSG4000.
      c. May National Associates, Inc.; Bondaflex Sil 200 GPN.
      d. Polymeric Systems, Inc.; PSI-631.
      e. Schnee-Morehead, Inc., an ITW company; SM5731 Poly-Glaze Plus.
      f. Tremco Incorporated; Proglaze SSG.

B. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

C. Low-Emitting Materials: Sealants shall have a VOC content of not more than 250 g/L.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."

B. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

C. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 08 80 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and Samples.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide louvers complying with performance requirements indicated as demonstrated by testing according to AMCA 500-L.

2.02 FORMED-ALUMINUM LOUVERS

A. Horizontal, Nondrainable-Blade Louvers.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Louver and Vent Company.
      b. American Warming and Ventilating; a Mestek Architectural Group company.
      c. Greenheck Fan Corporation.
      d. Ruskin Company.
   2. Louver Depth: ¾” inch.
   3. Frame and Blade Nominal Thickness: Not less than 0.019 inch.
   4. Louver Spacing: 1-3/4 inches.

2.03 LOUVER SCREENS

A. Provide screen at interior face of each exterior louver. Fabricate screen frames from same kind and form of metal as indicated for louver to which screens are attached.
   1. Screening: Fiberglass.

2.04 MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005.

B. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.

2.05 LOUVER FINISHES

A. Aluminum Louvers: Conversion-coated and factory-primed finish, AA-C12C42R1x.

B. Aluminum Louvers: Baked-enamel or powder-coat finish, AAMA 2603 except with a minimum dry film thickness of 1.5 mils.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install louvers level, plumb, and at indicated alignment with adjacent work.

B. Provide perimeter reveals of uniform width for sealants and joint fillers, as indicated.

C. Use concealed anchorages where possible.

D. Protect metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION 08 91 19

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior gypsum board.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. For products and materials required to comply with requirements for regional materials, certificates indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating distance to Project, cost for each regional material, and fraction by weight that is considered regional.
   3. For adhesives used to laminate gypsum board panels to substrates, documentation including printed statement of VOC content.
   4. For adhesives used to laminate gypsum board panels to substrates, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.03 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 GYPSUM BOARD, GENERAL

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site.

C. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. American Gypsum.
   2. CertainTeed Corp.
   3. Georgia-Pacific Gypsum LLC.
   4. Lafarge North America Inc.
   5. National Gypsum Company.
   6. PABCO Gypsum.
   7. Temple-Inland.
   8. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

D. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch.
   2. Long Edges: Tapered.

E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
   4. Provide moisture and mold resistant gypsum board in all kitchens, bathrooms, laundry rooms and utility closets.

G. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistive capability.
   1. Thickness: ½ inch.
   2. Long Edges: Tapered.

2.04 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.

c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
4. Provide factory-formed corner and tee sections.

2.05 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

2.06 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical.
2. Minimum Base-Metal Thickness: 0.018 inch.

C. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112-inch thick, or wood members.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.

F. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
      b. Grabber Construction Products; Acoustical Sealant GSC.
      c. Pecora Corporation; AC-20 FTR.
      d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
      e. USG Corporation; SHEETROCK Acoustical Sealant.
   2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

H. Vapor Retarder: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840 and ASTM C 754.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install

acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Wallboard Type: As indicated on Drawings.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Curved Surfaces:
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
   2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints [at locations indicated on Drawings] [according to ASTM C 840 and in specific locations approved by Architect for visual effect].

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.
6. Cornerbead: Use at outside corners.
7. LC-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.05 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated
   a. Primer and its application to surfaces are specified in other Section 09 91 00 "Interior Painting." Level 5 is suitable for surfaces receiving gloss and semigloss enamels and other surfaces subject to severe lighting. It is considered a high-quality gypsum board finish.
3. Level 5: Ceilings.
   a. Primer and its application to surfaces are specified in other Section 09 91 00 "Interior Painting."

3.06 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product data and Samples.

B. Obtain tile of each type and color or finish from same production run for each contiguous area.

C. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling ceramic tile packages.

PART 2 - PRODUCTS

2.01 CERAMIC TILE

A. Ceramic tile that complies with ANSI A137.1.

B. Ceramic Tile: As selected by Architect.

2.02 INSTALLATION MATERIALS

A. Setting and Grouting Materials: Comply with material standards in ANSI's "Specifications for the Installation of Ceramic Tile" that apply to materials and methods indicated.
   1. Thinset Mortar Type: Modified dry-set, ANSI A118.4 mortar; white, unless otherwise indicated.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Boiardi Products Corporation; a QEP company.
         2) Bonsal American, an Oldcastle company.
         3) Bostik, Inc.
         4) C-Cure.
         5) Custom Building Products.
         6) H.B. Fuller Construction Products Inc. / TEC.
         7) Jamo Inc.
         8) LATICRETE SUPERCAP, LLC.
         9) MAPEI Corporation.
         10) Southern Grouts & Mortars, Inc.
         11) Summitville Tiles, Inc.
   2. Grout Type: High-performance tile grout, ANSI A118.7.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ARDEX Americas.
         2) Boiardi Products Corporation; a QEP company.
         3) Bonsal American, an Oldcastle company.
         4) Bostik, Inc.
         5) C-Cure.

6) Custom Building Products.
7) H.B. Fuller Construction Products Inc. / TEC.
8) Jamo Inc.
9) LATICRETE SUPERCAP, LLC.
10) MAPEI Corporation.
11) Southern Grouts & Mortars, Inc.
12) Summitville Tiles, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, are specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

C. Lay tile in grid pattern unless otherwise indicated. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.

D. Interior Floor Tile Installation Method(s):
1. Over Concrete Subfloors: TCNA F113; thinset mortar.

END OF SECTION 09 30 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient stair accessories.
   3. Resilient molding accessories.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design Submittals:
   1. For adhesives, documentation including printed statement of VOC content.
   2. For adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

E. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.03 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.06 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allstate Rubber Corp.; Stoler Industries.
      b. Armstrong World Industries, Inc.
      c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      d. Endura Rubber Flooring; Division of Burke Industries, Inc.
      e. Flexco, Inc.
      f. Johnsonite.
      g. Musson, R. C. Rubber Co.
      h. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TS (rubber, vulcanized thermoset).
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected by Architect from manufacturer’s full range of colors.

2.02 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allstate Rubber Corp.; Stoler Industries.
      b. Armstrong World Industries, Inc.
      c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      d. Endura Rubber Flooring; Division of Burke Industries, Inc.
      e. Flexco, Inc.
      f. Johnsonite.
      g. Musson, R. C. Rubber Co.
      h. Roppe Corporation, USA.

B. Resilient Stair Treads Standard: ASTM F 2169.
   1. Material Requirement: Type TS (rubber, vulcanized thermoset).
   2. Surface Design:
      a. Class 1, Smooth (flat).
      b. Class 2, Pattern: Raised-square design.
   3. Manufacturing Method: Group 1, tread with embedded abrasive strips.

C. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.

D. Nosing Height: 1-1/2 inches.

E. Thickness: 1/4 inch and tapered to back edge.

F. Size: Lengths and depths to fit each stair tread in one piece.

G. Risers: Smooth, flat, coved-toe, 7 inches high by length matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
   1. Thickness: 0.080 inch.

H. Colors and Patterns: As selected by Architect from manufacturer’s full range of colors.

2.03 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      b. Flexco, Inc.
      c. Johnsonite.
      d. R.C.A. Rubber Company (The).
      e. Roppe Corporation, USA.

B. Description:
   1. Nosing for resilient floor covering.
   2. Reducer strip for resilient floor covering.
   3. Transition strips.

C. Material: Rubber.

D. Profile and Dimensions: As indicated.

E. Colors and Patterns: As selected by Architect from manufacturer’s full range of colors.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.
   2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.04 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:
   1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
   2. Tightly adhere to substrates throughout length of each piece.
   3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of resilient floor covering that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
   1. Apply three coat(s).

E. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples for Verification: Full-size units of each color and pattern of floor tile required.
   1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.03 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for floor tile including resilient base and accessories.
      a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

C. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.02 SOLID VINYL FLOOR TILE

A. Product: Patcraft, Timber Grove 1323V, Color: Thicket 00729, 12 mil wear layer, 5.96" X 48",

B. Tile Standard: ASTM F 1700.

C. Seamless-Installation Method: Chemically bonded.

D. Colors and Patterns: As indicated by manufacturer's designations.

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
   1. Adhesives shall comply with the following limits for VOC content:
      a. Vinyl Composition Tile Adhesives: 50 g/L or less.
      b. Rubber Floor Adhesives: 60 g/L or less.

C. Seamless-Installation Accessories:
   1. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
      a. Bonding compound shall have a VOC content of 350 g/L or less.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

E. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
    1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.03 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
    1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
    1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and

pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:
   1. Chemically Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless flooring. Prepare seams and apply compound to produce tightly fitted seams without gaps, overlays, or excess bonding compound on flooring surfaces.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates.

1.02 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
   3. VOC content.

1.04 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 1 gallon of each material and color applied.

1.06 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture’s label with the following information:
   1. Product name and type (description).
   2. Batch date.
   3. Color number.
   4. VOC content.
   5. Environmental handling requirements.
   6. Surface preparation requirements.
   7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

D. Hazardous Materials: Hazardous materials including lead paint [are] [may be] present in buildings and structures to be painted. A report on the presence of known hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
   1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified.
   2. Perform preparation for painting of substrates known to include lead paint in accordance with EPA Renovation, Repair and Painting Rule and additional requirements of authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
   1. Benjamin Moore & Co.
   2. Glidden Professional, Division of PPG Architectural Finishes, Inc.
   3. PPG Paints .

B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
   1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: As indicated in a color schedule.
   1. A maximum of 5 exterior colors, of which 2 may be deep-tone colors, will be used.
   2. 30 percent of surface area will be painted with deep tones.

2.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Wood: 15 percent.
      d. Portland Cement Plaster: 12 percent.
      e. Gypsum Board: 12 percent.
   2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
   3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
   1. SSPC-SP 3, "Power Tool Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
   3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed to view:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINTING SCHEDULE

A. Concrete, and Cementitious Siding:
   1. Latex System:
      a. Prime Coat: Primer sealer, latex, exterior: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4): S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

B. Concrete Substrates, Pedestrian Traffic Surfaces:
   1. Latex Floor Paint System:
      a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
      b. Topcoat: Floor paint, latex, slip-resistant, low gloss: S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils dry per coat.
   2. Concrete Stain System (Water-based) for Vertical Surfaces:
      a. First Coat: Low-luster opaque finish matching top coat.
      b. Topcoat: Low-luster opaque finish: S-W H&C Concrete Stain Solid Color Water Based, at 50 to 250 sq. ft. per gal.

C. CMU Substrates:
   1. Latex System:
      a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal (1.8 to 3.1 sq. m per l).
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
   2. CMU Stain System (Water-based):
      a. First Coat: Low-luster opaque finish matching topcoat.
      b. Topcoat: Low-luster opaque finish: S-W H&C Concrete Stain Solid Color Water Based, at 50 to 250 sq. ft. per gal.

D. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
   1. Water-Based Light Industrial Coating System:
      a. Prime Coat: Primer, water-based, anti-corrosive for metal: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
      b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.

c. Topcoat: Light industrial coating, exterior, water based, semi-gloss: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

E. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
   1. Latex System:
      a. Prime Coat: Primer, latex for exterior wood, MPI #6.
      a. Intermediate Coat: Latex, exterior, matching topcoat.
      b. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
   2. Stain System:
      a. 1st Coat: S-W WoodScapes Exterior Polyurethane Semi-Transparent Stain, A15T00005.
      b. 2nd Coat: S-W WoodScapes Exterior Polyurethane Semi-Transparent Stain, A15T00005 (100-350 sq ft/gal).

F. Plastic Trim Fabrication Substrates: Including architectural PVC, plastic, and fiberglass items.
   1. Latex System:
      a. Prime Coat: Primer, bonding, water-based: S-W PrepRite ProBlock Latex Primer/Sealer.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

G. Exterior Gypsum Board Substrates:
   1. Latex System:
      a. Prime Coat: Primer, bonding, water-based: S-W PrepRite ProBlock Latex Primer/Sealer.
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4): S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.02 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
   3. VOC content.

1.04 CLOSEOUT SUBMITTALS

A. Coating Maintenance Manual: Upon completion of the project, the Contractor or Paint Manufacturer / Supplier shall provide a coating maintenance manual, such as the Sherwin-Williams “Custodian Project Color and Product Information” report or equal. This manual shall include area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 1 gallon of each material and color applied.

1.06 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer’s label with the following information:
   1. Product name and type (description).
   2. Batch date.
   3. Color number.
   4. VOC content.
   5. Environmental handling requirements.
   6. Surface preparation requirements.
   7. Application instructions.

B. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
   1. Benjamin Moore & Co.
   2. Glidden Professional, Division of PPG Architectural Finishes, Inc.
   3. PPG Paints

B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
   1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.02 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Dry-Fog Coatings: 400 g/L.
   4. Primers, Sealers, and Undercoaters: 200 g/L.
   5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings: 100 g/L.
   9. Shellacs, Clear: 730 g/L.
   10. Shellacs, Pigmented: 550 g/L.

2.03 COLORS

A. Colors as selected by Architect.

B. A maximum of 12 interior colors, of which 3 may be deep-tone colors, will be used.
   1. Deep-tone colors will be used for 50 percent, maximum, of the surface area.
   2. Up to 8 colors may be used in spaces exceeding 2,000 square feet.

C. A maximum of 4 colors will be used in each room or space.

D. Architect will furnish a Color Schedule showing colors to be used and locations of use.

2.04 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:
   1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
      a. Concrete: 12 percent.
      b. Masonry (Clay and CMU): 12 percent.
      c. Wood: 15 percent.
      d. Gypsum Board: 12 percent.
      e. Plaster: 12 percent.
   2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
   3. Plaster Substrates: Verify that plaster is fully cured.
   4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
   1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
   1. SSPC-SP 3, "Power Tool Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   3. Prime edges, ends, faces, undersides, and backsides of wood.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.03 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
   1. Paint the following work where exposed in equipment rooms:
      a. Equipment, including panelboards and switch gear.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Tanks that do not have factory-applied final finishes.
      h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   2. Paint the following work where exposed in occupied spaces:
      a. Equipment, including panelboards.
      b. Uninsulated metal piping.
      c. Uninsulated plastic piping.
      d. Pipe hangers and supports.
      e. Metal conduit.
      f. Plastic conduit.
      g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      h. Other items as directed by Architect.
   3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates::
   1. Latex System:
      a. Prime Coat: Primer sealer, latex, interior: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, eggshell: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

B. CMU Substrates:
   1. Latex System:
      a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, eggshell: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

C. Metal Substrates (Aluminum, Steel, Galvanized Steel):
   1. Latex System:
      a. Prime Coat: Primer, rust-inhibitive, water based: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
      b. Intermediate Coat: Water-based acrylic, interior, matching topcoat.
      c. Topcoat: Water-based acrylic, semi-gloss: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

D. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
   1. Latex System:
      a. Prime Coat: Primer sealer, latex, interior: S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, semi-gloss: S-W ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
   2. Stain System:
      a. 1st Coat: S-W WoodClassics 250 Stains.
      b. 2nd Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series.
      c. 3rd Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series (4 mils wet, 1.0 mil dry per coat).

E. Gypsum Board Substrates:
   1. Latex System:
      a. Prime Coat: Primer, latex, interior: S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Latex, interior, eggshell: S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
   2. Epoxy System:
      a. Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (4 mils wet, 1.5 mils dry).
      b. Intermediate Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series.
      c. Topcoat: S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45- Series (4 mils wet, 1.5 mils dry per coat).

END OF SECTION 09 91 23

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Private-use bathroom accessories.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
   1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.06 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.02 PRIVATE-USE BATHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Basco, Inc.
   2. Bobrick Washroom Equipment, Inc.
   3. Franklin Brass by Liberty Hardware Manufacturing Corporation; a Masco company.
   4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
   5. Ginger; a Masco company.
   6. Seachrome Corporation.
   7. Tubular Specialties Manufacturing, Inc.

B. Toilet Tissue Dispenser:
   1. Basis-of-Design Product: B-7685, manufactured by Bobrick Washroom Equipment, Inc.
   2. Description: Single-roll dispenser.
   3. Mounting: Surface mounted.
   4. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Shower Curtain Rod:
   1. Basis-of-Design Product: B-6047, manufactured by Bobrick Washroom Equipment, Inc.
   2. Rod Material and Finish: Stainless steel, No. 4 finish (satin).
   3. Flange Material and Finish: Stainless steel, No. 4 finish (satin).

D. Towel Bar:
   1. Basis-of-Design Product: B-7674, manufactured by Bobrick Washroom Equipment, Inc.
   2. Mounting: Flanges with concealed fasteners.
   3. Length: 24 inches.
   4. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Folding Shower Seat:

1. Basis-of-Design Product: B-5191, manufactured by Bobrick Washroom Equipment, Inc.
2. Configuration: Rectangular seat.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

F. Grab Bar:
1. Basis-of-Design Product: B-6806.99, manufactured by Bobrick Washroom Equipment, Inc.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

G. Mirror:
1. Basis-of-Design Product: Mirror: B-290, 24 x 36, manufactured by Bobrick Washroom Equipment, Inc.

H. Robe Hook:
1. Basis-of-Design Product: B-672, manufactured by Bobrick Washroom Equipment, Inc.

2.03 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire Extinguishers

B. Cabinets

C. Accessories

1.02 REGULATORY REQUIREMENTS

A. Comply with National Fire Protection Association (NFPA) Standard No. 10, Portable Fire Extinguishers, for extinguishers and operation and maintenance data.

B. Provide Underwriter's Laboratories (UL) listed fire extinguishers bearing mark for type, rating, and classification indicated.

1.03 SUBMITTALS

A. Submit product data for the following:
   1. Extinguishers.
   2. Cabinets.

B. Submit manufacturer's installation instructions.

C. Submit under provisions of Section 01 33 00.

1.04 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's operation and maintenance data.

B. Include test, refill or recharge schedules, procedures, re-certification requirements.

C. Submit under provisions of Section 01 77 00.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. One of the following:
   1. JL Industries, Inc.
   2. Amerex Corporation.
   3. Ansul Incorporated.
   4. Badger Fire Protection.
   5. Buckeye Fire Equipment Company.
   6. Fire End & Croker Corporation.

7. General Fire Extinguisher Corporation.
8. Kidde Fyrnetics.
9. Larsen's Manufacturing Company.
10. Modern Metal Products; Div. of Technico.
11. Moon American.
12. Potter Roemer; Div. of Smith Industries, Inc.
13. Watrous; Div. of American Specialties, Inc.

B. Substitutions: No substitutions, except under provisions of Section 01 60 0.

2.02 FIRE EXTINGUISHERS

A. Model Cosmic 10E, manufactured by J.L. Industries, or equivalent by other acceptable manufacturer.

B. U.L. ratings:
1. Public Spaces: 3A-40BC.
2. Units: 1A-10BC.

C. Provide one 3A-10BC extinguisher in each cabinet and where indicated as wall mounted.

D. Provide one 1A-10BC extinguisher in each unit kitchen.

2.03 CABINETS

A. Ambassador model 1012 manufactured by J.L. Industries, or equivalent by other acceptable manufacturer.
1. Trim Style: 4 RT.
2. Door Style: S21, Solid with Flush Pull Handle that is ADA Compliant.
3. Provide fire-rated cabinets where mounted in fire-rated partitions.

B. Finish:
1. Exterior door and trim: Manufacturer’s Standard White.
2. Interior: Manufacturer's Standard White.

2.04 ACCESSORIES

A. Identification: Decal, vertical red lettering, FIRE EXTINGUISHER, approximately 1" high letters.

B. Fire Extinguisher Brackets: For wall mounted extinguishers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinets are correctly sized and located.

3.02 INSTALLATION

A. Install cabinets plumb and level in wall openings. Secure rigidly in place.

B. Securely fasten mounting brackets to structure.

C. Distribute extinguishers and place in service.

D. Apply decal to cabinet door after finish painting.

END OF SECTION 10 44 00

SECTION 10 57 23.13 - ADJUSTABLE WIRE SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adjustable mount wire shelving.

1.02 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including: Preparation instructions and recommendations, Storage and handling requirements and recommendations, and Installation methods.

B. Shop Drawings: Prepared specifically for this project; show dimensions of shelving and interface with other products.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

A. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.04 WARRANTY

A. At project closeout, provide to Owner or Owner's Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: ClosetMaid Corp., which is located at: 650 S.W. 27th Ave.; Ocala, FL 34471; Toll Free Tel: 800-221-0641; Tel: 352-401-6338; Fax: 352-732-2140; Email: request info (lou.cuomo@emerson.com); Web: www.closetmaid.com

B. Provide all storage shelving and accessories from a single manufacturer.

2.02 MATERIALS

A. Steel Wire: Basic cold drawn, Grade C-1006; average tensile strength over 100,000 psi (690 MPa); coated.

B. Wire Coating: Proprietary heavy-duty polyvinyl chloride (PVC) formula resin, plasticizers, stabilizers, pigments, and other additives.
   1. Thickness: 7 to 17 mil (0.178 to 0.432 mm).
   2. Classification: No ingredients listed as hazardous per OSHA 29CFR1910.0017.

C. Hang Track: Hot-rolled sheet metal, Grade C-1008/C-1010; epoxy-coated.

D. Standards: Sheet metal, Grade C-1006; epoxy coated

E. Ventilated Shelf Bracket: Sheet metal, High strength steel; epoxy coated

2.03 ADJUSTABLE SHELFTRACK HARDWARE SYSTEM

A. HangTrack, Standards and Brackets: Can be used with SuperSlide, Heavy Duty, Linen, Shelf & Rod and Close Mesh 12 inch, 16 inch, or 20 inch Decking.
   1. Hang Track: Use to hang standards. Creates one step leveling and eliminates the need to install each standard separately
      a. Part # 2826 40 inch length
      b. Part # 2836 80 inch length
   2. Standard: Attaches to hang track. Provides adjustable height options for hanging shelving. Space standards no more than 24 inches apart and no more than 4 inches from each end of shelf.
      a. Part # 2800 12 inch length.
      b. Part # 2801 30 inch length.
      c. Part # 2008 48 inch length.
      d. Part # 2804 60 inch length.
      e. Part # 2012 84 inch length.
   3. Bracket: Attaches to standard to support shelving. Use a bracket that is the same depth as your shelving. Exception: 16 inch Shelf & Rod or 16 inch TotalSlide installation requires a 12 inch bracket.
      a. Part # 2853 12 inch length.
      b. Part # 2854 16 inch length.
      c. Part # 2855 20 inch length.
   4. Shoe Shelf Support: Attaches to standard to support shelf at an angle for shoes.
   5. Color: Epoxy coated.
      a. White

B. SuperSlide/Linen Wire Shelving:
   1. Size:
      a. Part # 30600: 12 foot long Linen 6 inches deep.
      b. Part # 31021: 12 foot long Linen 9 inches deep.
      c. Part # 32521: 12 foot long Linen 20 inches deep.
      d. Part # 564021: 12 foot long Low Profile Linen SuperSlide/All-Purpose 12 inch.
      e. Part # 564221: 12 foot long Low Profile Linen SuperSlide/All-Purpose 16 inch.

2. Cross Deck Spacing: 1 inch (25 mm) 12-3/4 GA wire.
3. Color:
    a. White PVC Coated Wire.
4. Mounting System: Provide ShelfTrack adjustable system mounting hardware as required using hardware components recommended by the manufacturer.
5. Hardware Accessories: Provide the following hardware accessories as required.
    a. Provide ShelfTrack adjustable system hardware as required using hardware components recommended by the manufacturer.
    b. Continuous-Slide Closet Rod Attachments:
        1) TotalSlide Pro: 3/32 inch diameter closet rod hardware
            (a) Color:
                (1) White
                (2) Satin Chrome
            (b) Corner Closet Rod: Part # 794900
            (c) Corner Support Bracket: Part # 793100
        2) SuperSlide 3/4 inch (19 mm) diameter closet rod and support hardware:
            (a) Color:
                (1) White
                (2) Chrome
                (3) Satin Chrome
            (b) Corner Closet Rod: Part # 564900/574800
            (c) Closet Rod Support Bracket: Part # 92500
    c. Shoe Shelf Support: Attaches to standard and shelf at an angle for shoes. Shelf would be installed lip up to keep shoes in place.

C. TotalSlide Shelving
1. Size:
    a. Part # 591401: 12 foot long TotalSlide 12 inch.
    b. Part # 591801: 12 foot long TotalSlide 16 inch.
2. Cross Deck Spacing: 1 inch (25 mm) 12-3/4 GA wire.
3. Color:
    a. White PVC Coated Wire.
4. Mounting System: Provide ShelfTrack adjustable system mounting hardware as required using hardware components recommended by the manufacturer.
5. Hardware Accessories: Provide the following hardware accessories as required.
    a. Provide the ShelfTrack adjustable system hardware as required using hardware components recommended by the manufacturer.

D. Shelf & Rod Wire Shelving
1. Size:
    a. Part # 30000: 12 foot long Shelf & Rod 12 inches deep.
    b. Part # 30500: 12 foot long Shelf & Rod 16 inches deep.
    c. Part # 31600: 12 foot long Shelf & Rod 10 inches deep.
    d. Part # 3730400: 12 foot long Shelf & Rod 16 inches deep with 10 inch Hang
2. Cross Deck Spacing: 1 inch (25 mm) 12-3/4 GA wire.
3. Color: White PVC Coated Wire.

4. Mounting System: Provide ShelfTrack adjustable system mounting hardware as required using hardware components recommended by the manufacturer.

E. Heavy Duty Shelving
   1. Size:
      a. Part # 73100: 12 foot long Heavy Duty 12 inch.
      b. Part # 73300: 12 foot long Heavy Duty 16 inch.
   2. Cross Deck Spacing: 1 inch (25 mm) 12-3/4 GA wire.
   3. Color: White PVC Coated Wire.
   4. Mounting System: Provide ShelfTrack adjustable system mounting hardware as required using hardware components recommended by the manufacturer.
   5. Hardware Accessories: Provide the following hardware accessories as required.
      a. Provide ShelfTrack adjustablet system hardware as required using hardware components recommended by the manufacturer.
      b. Continuous-Slide Closet Rod Attachments:
         1) TotalSlide Pro: 3/32 inch diameter closet rod support hardware
            (a) Color:
               (1) White
            (b) Corner Closet Rod: Part # 794900
            (c) Corner Support Bracket: Part # 793100
         2) SuperSlide 3/4 inch (19 mm) diameter closet rod and support hardware:
            (a) Color:
               (1) White
            (b) Corner Closet Rod: Part # 564900/574800
            (c) Closet Rod Support Bracket: Part # 92500

F. Close Mesh Shelving
   1. Size:
      a. Part # 31800: 12 foot long Close Mesh 16 inches deep.
      b. Part # 40200: 12 foot long Close Mesh 12 inches deep.
      c. Part # 40300: 12 foot long Close Mesh 20 inches deep.
      d. Part # 3740400: 12 foot long Close Mesh 9 inch.
   2. Cross Deck Spacing: 5/8 inch (16 mm) 13-1/2 GA wire.
   3. Color:
      a. White PVC Coated Wire.
   4. Mounting System: Provide the fixed mount system mounting hardware as required using hardware components recommended by the manufacturer.
   5. Hardware Accessories: Provide the following hardware accessories as required.
      a. Provide the fixed mount system hardware as required using hardware components recommended by the manufacturer.

G. Linen Shelving
   1. Size:
      a. Part # 30600: 12 foot long Linen 6 inches deep.
      b. Part # 3731021: 12 foot long Linen 9 inches deep.
      c. Part # 32521: 12 foot long Linen 20 inches deep.
      d. Part # 564021: 12 foot long Low Profile Linen SuperSlide/All-Purpose 12 inch.

e. Part # 564221: 12 foot long Low Profile Linen SuperSlide/All-Purpose 16 inch.

2. Cross Deck Spacing: 1 inch (25 mm) 12-3/4 GA wire.
3. Color:
   a. White PVC Coated Wire.
4. Mounting System: Provide ShelfTrack adjustable system mounting hardware as required using hardware components recommended by the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verification of Conditions:
1. Prepared spaces are sized and located in accordance with shop drawings.
2. Framing, reinforcement, and anchoring devices are correct type and are located in accordance with shop drawings.

D. Installer's Examination:
1. Examine conditions under which installation is to be performed; submit written notification if such conditions are unacceptable.
2. Installation activities started before unacceptable conditions have been corrected is prohibited.
3. Installation indicates installer's acceptance of conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's printed instructions.

B. Cut shelves 1/2 inch to 1-3/8 inches (12.7 to 35 mm) shorter than actual wall measurements; cap all exposed ends.

C. Install shelving plumb and level at heights indicated in accordance with shop drawings and manufacturer's printed installation instructions.

D. Drill holes where required using sharp bit; do not punch.

3.04 CLEANING

A. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.

B. Upon completion of installation, clean all surfaces that have become soiled during installation.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 10 57 23.13

SECTION 11 31 00 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cooking appliances.
   2. Kitchen exhaust ventilation.
   3. Refrigeration appliances.
   4. Cleaning appliances.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

B. Sustainable Design Submittals:
   1. For appliances indicated, documentation that products are ENERGY STAR rated.
   2. For water-efficient clothes washer, documentation indicating modified energy factor and water factor.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

D. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of appliance, from manufacturer.

B. Warranties: Sample of special warranties.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.

B. Regulatory Requirements: Comply with the following:
   1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.06 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period:
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 RANGES

A. Electric Range: Owner furnished, Owner installed. Contractor to coordinate power and space requirements with the Owner.

2.02 KITCHEN EXHAUST VENTILATION

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by the following:
   1. Air King Ventilation Products

B. Overhead Exhaust Hood:
   1. Basis-of-Design Product: ESDQ1306, as manufactured by Air King Ventilation Products.
   2. Energy Star certified.
   3. Type: Wall-mounted, exhaust-hood system.
   4. Sones Levels: 1.5, 2.5, and 4.
   5. Dimensions:
      a. Width: 30 inches.
      b. Depth: 19-1/2 inches.
   6. Exhaust Fan: Three-speed, thermally protected, permanently lubricated motor.
      a. Venting: Vented type with grease filter.
      b. Fan Control: Hood-mounted fan switch, with separate hood-light control switch.
   7. Finish: Baked enamel.
      a. Color: Black.
   8. Features:
      a. Permanent, washable aluminum mesh.
      b. Built-in LED lighting.

2.03 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer: Owner furnished, Contractor installed. Contractor to coordinate power and space requirements with the Owner.

2.04 DISHWASHERS

A. Dishwashers: Owner furnished, Contractor installed. Contractor to coordinate power, plumbing and space requirements with the Owner.

2.05 CLOTHES WASHERS AND DRYERS

A. Clothes Washer: Owner furnished, Contractor installed. Contractor to coordinate power, plumbing, and space requirements with the Owner.

B. Clothes Dryer: Owner furnished, Contractor installed. Contractor to coordinate power, plumbing, and space requirements with the Owner.

2.06 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

END OF SECTION 11 31 00

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product data and Samples.

PART 2 - PRODUCTS

2.01 HORIZONTAL LOUVER BLINDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Comfortex Window Fashions.
   2. Hunter Douglas Contract.
   3. Levolor Contract; a Newell Rubbermaid company.
   4. Springs Window Fashions; SWFcontract.

B. Provide blinds passing flame-resistance testing according to NFPA 701.

C. Fabrication: Comply with WCMA A 100.1 unless otherwise indicated.
   1. Provide color-coated finish on exposed metal parts unless otherwise indicated.
   2. Fabricate concealed components from noncorrodible or corrosion-resistant-coated materials.
   3. Provide permanently lubricated moving parts.

D. Slats: Extruded PVC (vinyl), UV stabilized and integrally colored.

E. Slat Width: 1-inch dimension.

F. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.

G. Tilt Operation: Manual with wand.

H. Valance: Manufacturer's standard.

I. Mounting: End brackets.

J. Colors, Textures, Patterns, and Gloss: As selected from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install blinds level, plumb, and located not closer than 1 inch to interior face of glass.
   1. Jamb Mounted: Install headrail flush with face of opening jamb and head.
   2. Head Mounted: Install headrail on face of opening head.

B. Adjust window blinds to operate smoothly and easily throughout entire operational range.

END OF SECTION 12 21 13

SECTION 12 35 30 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Kitchen cabinets.
   2. Vanity cabinets.
   3. Plastic-laminate countertops and backsplashes.

B. Related Sections:
   1. Section 113100 "Residential Appliances" for appliances.

1.02 DEFINITIONS

A. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semiexposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers, and bottoms of wall cabinets.

C. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, ends of cabinets installed directly against and completely concealed by walls or other cabinets, and tops of wall cabinets and utility cabinets.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Cabinets.
   2. Plastic-laminate countertops.
   3. Cabinet hardware.

B. Sustainable Design Submittals:
   1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Chain-of-custody certificates indicating that wood used to produce cabinets and countertops complies with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
   3. For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
   4. For adhesives and composite wood and agrifiber products, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.

D. Samples for Initial Selection: For each type of material exposed to view.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified manufacturer.

B. Product Certificates: For casework, from manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain cabinets from a manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations for Cabinets: Obtain cabinets from single source from single manufacturer.

C. Product Options: Drawings indicate size, configurations, and finish material of cabinets by referencing designated manufacturer's catalog numbers. Other manufacturers' cabinets of similar sizes and door and drawer configurations, same finish material, and complying with the Specifications may be considered. See Section 01 60 00 "Product Requirements."

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Field Measurements for Countertops: Verify actual dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.07 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

B. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.01 CABINETS

A. Basis of Design Product: The design for cabinets is based on Norwich, manufactured by Echelon Cabinetry.
   1. Style: Shaker.
   2. Stain: Storm

B. Quality Standard: Provide cabinets that comply with KCMA A161.1.
   1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.

C. Exposed Cabinet End Finish: Match face finish.

D. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.

2.02 CABINET MATERIALS

A. General:
   1. Certified Wood Materials: Fabricate cabinets with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
   2. Adhesives and Composite Wood and Agrifiber Products: Do not use products that contain urea formaldehyde.
   3. Adhesives: Use adhesives that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
   4. Composite Wood and Agrifiber Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
   5. Hardwood Lumber: Kiln dried to 7 percent moisture content.
   6. Softwood Lumber: Kiln dried to 10 percent moisture content.
   7. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.
   8. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
      a. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.

9. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
10. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
    a. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.
11. Hardboard: ANSI A135.4, Class 1 Tempered.
    a. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.

B. Exposed Materials:
1. Exposed Wood Species: Maple
    a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
    b. Staining and Finish: As selected by Architect from manufacturer's full range.
2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
    a. Edge band exposed edges with veneer edging of same species as face veneer.

C. Semiexposed Materials: Unless otherwise indicated, provide the following:
1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.
2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces[or stained to be compatible with exposed surfaces].
3. Vinyl-Faced Particleboard: Medium-density particleboard with embossed, wood-grain-patterned vinyl film adhesively bonded to particleboard.
    a. Provide vinyl film on both sides of shelves, dividers, drawer bodies, and other components with two semiexposed surfaces and on semiexposed edges.
    b. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.03 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Wire pulls.

C. Hinges: Concealed butt hinges.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.

2.04 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: KCMA A161.2.

B. Configuration: Provide countertops with the following front, cove (intersection of top with backsplash), backsplash, and endsplash style:
1. Front: No drip (raised marine edge with rolled front).
2. Cove: Cove molding (one-piece postformed laminate supported at junction of top and backsplash by wood cove molding).
3. Backsplash: Curved or waterfall shape with scribe.
4. Endsplash: None.

C. Plastic-Laminate Substrate: Particleboard not less than 3/4 inch thick.
1. For countertops at sinks and lavatories, use Grade M-2-Exterior-Glue particleboard or exterior-grade plywood.
2. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of particleboard laminated to top.

D. Paper Backing: Provide paper backing on underside of countertop substrate.

2.05 COUNTERTOP MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following as indicated on the finish legend:
a. Formica.
b. Nevamar.
c. Wilsonart International.
2. Grade: HGS.
3. Provide through-color plastic laminate.
4. Grade for Backer Sheet: BKL.
5. Colors, Textures, and Patterns: As indicated by manufacturer's designations.

B. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

C. Composite Wood and Agrifiber Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
1. Recycled Content: Not less than 25 percent preconsumer or postconsumer recycled content.

E. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

F. Adhesives: Do not use adhesives that contain urea formaldehyde.

G. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install cabinets and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing.
   1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
   2. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c., with toggle bolts through metal backing behind gypsum board.

E. Fasten plastic-laminate countertops by screwing through corner blocks of base units into underside of countertop. Form seams using splines to align adjacent surfaces, and secure with glue and concealed clamping devices designed for this purpose.
   1. Provide cutouts for sinks and lavatories, including holes for faucets and accessories.
   2. Seal edges of cutouts by saturating with varnish.

3.02 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 12 35 30

SECTION 21 10 00 - FIRE PROTECTION

PART 1 – GENERAL

1.01 PROJECT SUMMARY

A. Work in this Section includes, but is not necessarily limited to providing all engineering and associated costs, calculations, labor, materials, supervision, testing, permits and approvals required to design, install and obtain final acceptance of the automatic fire protection sprinkler system complete in all respects.

B. The fire protection system shall provide full and complete coverage of all areas, and shall be compatible with the contract document layouts and avoid interference with work of all other trades in the building. Contractor shall provide offsets as needed to avoid other trades, including but not limited to mechanical ductwork, hydronic piping, structural elements and lighting. Contractor shall provide any additional heads, piping and appurtenances required in order to satisfy complete coverage of the building in accordance with NFPA.

C. Provide fire protection system complete with all component equipment and material items. Install and test in full conformity with the requirements of all applicable codes, National Fire Protection Association (NFPA) 13 Edition.

1.02 RELATED SECTIONS – NOT USED

1.03 DEFINITIONS

A. Working Plans: Documents, including shop drawings, calculations, and material specifications prepared according to NFPA 13 for obtaining approval from authorities having jurisdiction.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. Sprinkler systems shall not be calculated to less than 5 psi or 10% below the actual water supply available, which ever is greater. Sprinkler plans and calculations must take into account and show elevation loss from the flow test location to the flowing sprinklers. Flow test information must be recent to within one (1) year previous to submittal of sprinkler drawings.

B. NFPA standards require that the spray defector of the sprinkler heads be installed eighteen (18") inches minimum above the top of the merchandise stored in piles, racks, shelves or displays.

C. Sprinkler deflectors shall be positioned to avoid obstruction to both activation and discharge. Obstructions are (but are not limited to) lights, diffusers, duct-work, structural members (false or real), displayed signage or any object capable of impeding the proper activation and discharge of the fire sprinklers. Installation shall comply to the referenced NFPA 13 document (Chapter 4) and the manufacturers listing. The sprinkler contractor shall be responsible for final coordination.

D. All obstructions exceeding four (4') feet wide or which cannot be spaced around (to comply with 1.4.F) shall have sprinklers installed beneath the obstruction. If sprinklers are installed at or below 7'.6" they shall be equipped with a listed head guard.

E. All sprinkler heads in finished ceilings shall be symmetrically spaced to provide proper coverage, and to avoid interference with lights, diffusers, grilles, or other ceiling mounted equipment. The head layout shall conform to the typical pattern.

F. All overhead piping located in areas containing ceilings shall run concealed above the ceiling, without exception.

G. Consult the bid specification drawings for acceptable locations for all piping to be run exposed (areas without ceilings).

H. Inspector's tests to be provided with half-inch orifice, discharging at three (3") inches above a hard paved surface. Provide pressure relief valves at inspectors test locations on all "grid" type systems. Al inspector's test shall not be located behind racking or other obstructions, and shall be located within eighteen (18") inches of an exterior door opening.

I. Provide flushing and drainage as per required in NFPA 13.

J. Provide fire department connection. The exact placement and model of the fire department connection shall be verified with the local jurisdiction. Refer to the provided fire sprinkler drawings for location and arrangement.

K. System control valves accessed from the interior of the riser area and shall be tampered butterfly valves.

L. Provide sprinkler protection at electrical rooms per the requirements of the local jurisdiction.

M. The calculations shall include all sprinklers within the most hydraulically demanding area along each branch line within the distance determined using a 1.2 multiplier (times the square roof of the area).

N. The contractor shall provide a valve connection discharging onto a paved (outside) surface, to allow full system demand to flow forward of the backflow preventor for testing. The test connection shall be capable of full system flow and shall not require system drainage or alteration. Note, the two (2") inch main drain and FDC are not acceptable.

1.05 SUBMITTALS

A. The contractor shall submit complete shop (working) plans in all aspects in accordance with NFPA 13 (Chapter 6). Include complete calculations and all material data and engineering sheets including but not limited to:
   1. Underground materials (pipe, fittings, valve, rod, etc.).
   2. Pipe and fitting.
   3. Hangers and supports.
   4. Seismic restraints.

5. Valve(s) – any type.
6. Alarm devices including electric.
7. Fire department connections.
8. Hose valves (if applicable).
9. Sprinklers.
10. Gauges.
11. Flow Switches.
12. Air Compressors.

B. Fire Sprinkler shop drawings (2 sets of working plans, product data and hydraulic calculations) are to be submitted for review after the Engineer of record is satisfied that the shop drawings satisfy the requirements of the NFPA 13 and the project documents. The Engineer of record shall cite such approval on the shop drawings.

C. Coordinate the sprinkler system to avoid interference with work of all other trades in the building. Examine the contract documents and make any modifications needed for a complete shop drawing.

D. Submit shop drawings. Permit ample time for review and potential correction prior to start of work. No fabrication is permitted until approval is obtained.

E. Submit revised drawings and calculations for review and approval as required to accommodate changes to the architectural plan and other contract documents during construction.

F. Actual loss through any backflow devices must be accounted for in calculations. Sprinkler contractor shall submit, with their calculations and shop drawings a manufacturer's flow chart indicating pressure loss through the device(s) at the required flows.

PART 2 – PRODUCTS

2.01 GENERAL PARAMETERS

A. All materials submitted and installed shall be UL listed, individually or as any assembly to be installed in a fire protection system.

B. All materials shall be acceptable to all national and local applicable codes and standards.

2.02 SPRINKLER HEADS

A. No sprinklers to be installed are permitted to have a rubber O-ring seal. Only metallic "spring seal" or equivalent seals are allowed.

B. All sprinkler types and temperature ratings shall be as indicated on the drawings.

2.03 BRACKETS

A. Brackets for attaching pipe hangers to building structure shall be the size and type for the intended use, and acceptable to the structural engineer in accordance with NFPA

13.

2.04 SWITCHES

A. Provide all tamper and flow switches for indicating control valves and systems and as required by local ordinances.

2.05 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those indicated on drawings.

2.06 PIPE AND FITTINGS

A. Ductile-Iron Pipe: AWWA C151, push-on-joint type, with cement-mortar lining and seal coat according to AWWA C104. Include rubber gasket according to AWWA C111.

B. Ductile-Iron Pipe: AWWA C151, mechanical-joint type; with cement-mortar lining and seal coat according to AWWA C104. Include glad, rubber according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass, lugged caps, gaskets, and brass chains; brass, lugged swivel connection and drop clapper for each hose-connection inlet; eighteen (18") inch (460-mm) high brass sleeve; and round, floor, brass, escutcheon plate with marking "AUTO SPKR."
   1. Finish Including Sleeve: Polished chrome-plated.
   2. Finish Including Sleeve: Rough chrome-plated.
   3. Finish Including Sleeve: Polished brass.

C. Steel Pipe: ERW or CW schedule 10 or 40. All fittings shall comply with NFPA 13.

D. CPVC: ASTM 437-439, Blazemaster or approved equal.

2.07 FIRE DEPARTMENT CONNECTIONS

A. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250 psig (1725-kPa) pressure rating; and designed for horizontal or vertical installation. Include two (2) single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts 7A, 125-V ac and 0.25A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that send signal if removed.

B. Pressure Switches: UL 753; electrical-supervision type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

C. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

D. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw, with normally closed contacts, Include design that signals controlled indicator-post valve is

in other than fully open position.

2.08 PRESSURE GAUGES

A. Pressure Gauges: UL 393, 3 ½ to 4 ½ inch -)90 to 115 mm) diameter dial with dial range of 0 to 300 psig (0 to 1725 kPa).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Furnish and install under this Section all hangers and steel fabrications, other than building structure, required for proper support of piping and equipment.

3.02 HANGER ATTACHMENTS

A. Support of pipes with diameter larger than 2 ½ inches may require modification of structural members to support increased loads. Suspend piping and equipment supported by building structure only by those methods, and only at those locations acceptable to the structural engineer.

B. Provide supplementary supporting steel fabrication to bridge between structural steel fabrication to bridge between structural members to receive the hanger. Attach supplementary members to building structure only by those methods, and at those locations acceptable to the structural engineer.

3.03 INSPECTION, TESTING, AND CLEANING

A. Arrange for all inspections, examinations and tests in full conformity with the requirements of all applicable codes, National Fire Protection Association (NFPA) standards and authority having jurisdiction necessary to obtain complete and final acceptance of the fire sprinkler system.

B. Flush underground piping and pressure test at 200 psi for two (2) hours prior to connection to overhead piping. Flushing and testing shall be witnessed by the Fire Department.

C. Leave entire sprinkler system clean in every respect at the conclusion of the work.

D. Testing will occur after installation of all systems has been completed (approximately two (2) to three (3) weeks prior to opening). The contractor shall be required to provide a lift, air, and water pumps for system pressurization, and any necessary hand tools and apparatus for complete testing and draining of the systems. One (1) test of all systems should be completed within one (1) day. If all or any systems fail, the contractor shall be responsible to be present and furnish all items listed above until such time that systems are found to be acceptable or in accordance with NFPA 13, 25, and the bid documents. The contractor is responsible for notifying the Owner when installation is complete and testing may begin. Please allow five (5) to ten (10) working days for scheduling.

E. The contractor shall furnish to the owner a complete set of signed and witnessed test

certificates for the following:

1. Underground flushing.
2. Underground hydrostatic test.
3. Interior system hydrostatic test(s).
4. All system trip tests.

F. The Contractor shall train owner on use of all equipment and furnish two (2) copies to be left on site, of NFPA 25 the latest edition, and all apparatus manuals, please allow seven (7) days for scheduling.

3.04 WARRANTY

A. Provide warranty in accordance with the General Conditions for a period of at least one (1) year.

END OF SECTION 21 10 00

SECTION 22 07 19 - PIPING INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

C. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

D. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

E. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation.

F. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

G. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density, and

thickness.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 – PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84.

2.02 GLASS FIBER

A. Insulation: ASTM C 547; rigid molded, noncombustible.
1. 'K' ('Ksi') value: ASTM C 177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
2. Maximum service temperature: 850 degrees F (454 degrees C).
3. Maximum moisture absorption: 0.2 percent by volume.

B. Insulation: ASTM C 547; semi-rigid, noncombustible, end grain adhered to jacket.
1. 'K' ('Ksi') value: ASTM C 177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
2. Maximum service temperature: 650 degrees F (343 degrees C).
3. Maximum moisture absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm-inches (0.029 ng/Pa s m).

D. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

E. Vapor Barrier Lap Adhesive:
1. Compatible with insulation.

F. Insulating Cement/Mastic:
1. ASTM C 195; hydraulic setting on mineral wool.

G. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

H. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

I. Insulating Cement:
1. ASTM C 449/C 449M.

2.03 CLOSED CELL MOLDED

A. Insulation: ASTM C 578; rigid closed cell.
   1. 'K' ('Ksi') value: 0.23 at 75 degrees F (0.033 at 24 degrees C).
   2. Maximum service temperature: 165 degrees F (74 degrees C).
   3. Maximum water vapor permeance: 5.0 perms (287 ng/Pa s sq m)

2.04 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (-18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.00029 ng/Pa s sq m), maximum, when tested in accordance with ASTM E 96.
      d. Thickness: 15 mil (0.38 mm).
      e. Connections: Brush on welding adhesive.
   2. Covering Adhesive Mastic:
      a. Compatible with insulation.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to drawings.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Water Supply:
      a. Closed Cell Insulation:
         1) Pipe Size Range: All sizes.
         2) Thickness: 1/2 inch Cold Water except for Pex piping, 3/4" Hot Water.

B. Cooling and Heating Systems:
   1. Cold Condensate Drains and drains accepting condensate: All sizes, Glass Fiber 1 1/2 ".
   2. Refrigerant Suction: Closed Cell in accordance with Manufacturer's instructions.
   3. Refrigerant Hot Gas: Closed Cell in accordance with Manufacturer's instructions.

END OF SECTION 22 07 19

SECTION 22 10 05 – PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Natural Gas.

1.02 REFERENCES

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers (ANSI B16.18).

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.

C. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers (ANSI/ASME B31.1).

D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

E. ASTM B 32 - Standard Specification for Solder Metal.

F. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

G. ASTM B 88 - Standard Specification for Seamless Copper Water Tube.

H. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

I. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

J. ASTM D 2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

K. ASTM D 2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

L. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

M. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society.

N. AWWA C651 - Disinfecting Water Mains; American Water Works Association; (ANSI/AWWA C651).

O. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

Q. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

R. ASTM D 1784 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

1.03 SUBMITTALS

A. See Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with local standards.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.05 REGULATORY REQUIREMENTS

A. Perform Work in accordance with plumbing code.

B. Conform to local requirements for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.08 EXTRA MATERIALS

A. Provide two repacking kits for each size valve.

PART 2 - PRODUCTS

2.01 SANITARY AND STORM SEWER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. PVC Pipe: ASTM D 2665 or ASTM D 3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D 2564 solvent cement.

2.02 SANITARY AND STORM SEWER PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D 1785 Schedule 40, or ASTM D 2241 SDR 26 for not less than 150 psi (1 034 kPa) pressure rating.
   1. Fittings: ASTM D 2466, PVC.
   2. Joints: Solvent welded, with ASTM D 2564 Solvent cement. Mechanical joint restraints on bottom 20' of vertical stacks and to 20' once turned horizontal (except buried).

2.03 WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

A. Copper Pipe: ASTM B 42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

2.04 WATER PIPING, ABOVE GRADE

A. CPVC Pipe: ASTM D 1784 Schedule 80.

   1. Fittings: ASTM D 1784, CPVC.
   2. Joints: Solvent welded, with ASTM D 2564 Solvent cement.

B. Polyethylene (PEX) Tubing: ASTM F876/F877.
   1. Fittings: ASTM F1281 Expansion Fittings
   2. Joints: Expansion.

2.05 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
   2. Joints: NFPA 54, threaded or welded to ASME B31.1.

2.06 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch (25 mm):
1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Grooved and Shouldered Pipe End Couplings:
1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.07 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - Drain, Waste, and Vent:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

B. Plumbing Piping - Water:
1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches (50 mm) to 4 Inches (100 mm): Carbon steel, adjustable, clevis.
5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Wall Support for Pipe Sizes to 3 Inches (80 mm): Cast iron hook.
8. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
9. Vertical Support: Steel riser clamp.

10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
11. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.

2.08 GATE VALVES

A. Up To and Including 3 Inches (80 mm): MSS SP-80, Class 125, bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge disc, threaded ends.

2.09 BALL VALVES

A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union.

2.10 BUTTERFLY VALVES

A. Construction 1-1/2 Inches (40 mm) and Larger: MSS SP-67, 150 psi CWP, cast or ductile iron body, aluminum bronze disc, resilient replaceable EPDM seat, grooved ends, extended neck, infinite position lever handle with memory stop.

2.11 FLOW CONTROLS

A. Construction: Class 125, Brass or bronze body with union on inlet, temperature and pressure test plug on inlet.

B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi psi (24 kPa kPa).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular

to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide support for utility meters in accordance with requirements of utility companies.

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

M. Install bell and spigot pipe with bell end upstream.

N. Install valves with stems upright or horizontal, not inverted.

O. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

P. Install water piping to ASME B31.9.

Q. PVC Pipe: Make solvent-welded joints in accordance with ASTM D 2855.

R. Sleeve pipes passing through partitions, walls and floors.

S. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

T. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.

3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished

covering and adjacent work.

4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Refer to Section 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install gate, ball, or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install butterfly valves for throttling, bypass, or manual flow control services.

F. Provide flow controls in water recirculating systems where indicated.

G. Provide spring loaded check valves on discharge of water pumps.

H. Provide plug valves in natural gas systems for shut-off service.

3.05 ERECTION TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system

to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1) Maximum hanger spacing: 6.5 ft (2 m).
         2) Hanger rod diameter: 3/8 inches (9 mm).
      b. Pipe size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1) Maximum hanger spacing: 10 ft (3 m).
         2) Hanger rod diameter: 3/8 inch (9 mm).
      c. Pipe size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
         1) Maximum hanger spacing: 10 ft (3 m).
         2) Hanger rod diameter: 1/2 inch (13 mm).
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum hanger spacing: 4 ft (1.2 m).
         2) Hanger rod diameter: 3/8 inch (9 mm).

END OF SECTION 22 10 05

SECTION 23 00 01 - MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 REFER TO DIVISION 1 FOR FULL PROJECT SCOPE OF WORK

1.02 MECHANICAL SCOPE OF WORK

A. Heating, ventilating, air conditioning systems, plumbing, and other piping systems modifications as specified; complete and in operating order.

B. Maintenance of heating and air conditioning equipment used for temporary heating, cooling, and for testing.

C. Installation of all mechanical control components which require mechanical connections only, both mechanical and electrical connections, penetrations of air plenums and ducts, or installations into piping systems.

D. All low voltage and line voltage control wiring, conduit, and devices for systems furnished under this division.

E. Counterflashing of penetrations of roof or exterior walls by pipes, ducts, or other Work under this Division.

F. Cutting and patching required due to omissions in the installation of Work under this Division, or due to failure to properly coordinate Work with other Divisions.

G. Painting and labeling of pipe, ductwork, equipment, and devices furnished under this Division.

H. Furnish access panels required for equipment furnished and installed under this Division.

1.03 RELATED ELECTRICAL WORK

A. Wiring and conduit for electrical power shall be furnished and installed under Division 26.

1.04 OTHER RELATED WORK UNDER OTHER DIVISIONS

A. Flashing of ducts and pipes into roofs and outside walls.

B. Holes, chases, and recesses required for mechanical work.

C. Miscellaneous steel including equipment supports.

1.05 CONFLICTS

A. Designer shall be notified in writing at least ten (10) days prior to the Bid Date of any conflicts or items requiring clarification. Resolution shall be only by written notice from the Designer. Oral clarifications shall be confirmed in writing.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements listed below are given as a supplement to those in Division 1 and do not relieve the Contractor of complying with any and all applicable regulatory requirements set forth in this Specification.

B. Obtain and pay for the required permits, inspection fees, tapping fees, connection charges, and utility company service charges.

C. The mechanical work installation shall comply with State and local Health Departments and Building Codes, applicable Life Safety Code, State and local ordinances, and with NFPA Standard 90A and 90B.

D. Equipment shall be U.L. listed. All installations shall comply with U.L. standards, where applicable.

E. Equipment and Work shall comply with existing noise and safety standards.

F. Certificates of compliance from authorities having jurisdiction shall be transmitted to the Engineer and the Owner. Complete all work, pay all fees, and arrange for tests to obtain certificates of compliance.

1.07 SUBMITTALS

A. Submit to the Designer for review certified shop drawings on material furnished under this division as listed below. Submittal data shall be checked and stamped approved by the Contractor prior to his transmitting to the Designer. Refer to Division 1 for additional requirements.

B. Submittals shall be bound in three-ring binders and indexed with a table of contents for each indexed section. Table of contents shall list item, manufacturer, and model number. Large drawings shall be attached to binder or inserted in pockets of binder.

C. Submittal books shall be complete with all information required for this project prior to submittal. Submittals will be reviewed two (2) times only. The first review will include all items submitted. The second review will verify that comments noted on the first review have been resolved. Additional reviews required due to failure of Contractor to comply with Contract documents shall be at the Contractor's expense.

D. Submittals shall contain rating data, accessories and features, the same as listed in specifications and capacities, shall be stated in the terms specified. Deviations from specifications and drawings shall be noted on the submittal. If none are noted, it shall be assumed the material meets the specified requirements fully.

E. Where preprinted manufacturer's data describes more than one (1) product, mark submittals to indicate the specific product to be provided for this Project. Delete or mark out significant portions of pre-printed data which is not applicable. Where operating curves, graphs, etc. are required, mark the operating point or range for the Project.

F. Requests for substitution of products not specifically named shall be submitted in writing a minimum of fourteen (14) calendar days prior to the bid date. Requests shall include

section number, items, name of manufacturer to be substituted, and catalog data. Requests shall be reviewed only to approve or reject submission of detailed submittals as noted in other paragraphs of this Section.

G. Acceptable manufacturers are noted in each section. Do not substitute materials, equipment, or methods unless such substitution has been approved in writing. Where the phase "approved equal" appears, do not assume that materials, equipment, or methods will be approved until specific written approval has been given. The burden of proof for requested substitutions rests with the Contractor.

H. Approved substitution requiring variations in quantity or arrangement of materials, or equipment from that specified, or indicated on drawings shall be furnished and installed by the Contractor at no additional cost to the Owner.

I. Work shall not proceed until submittals for equipment and shop drawings have been approved. Work installed using unapproved substitutions shall be replaced at no additional cost to the Owner.

1.08 GUARANTEE, MAINTENANCE, AND OPERATING INSTRUCTIONS

A. Guarantee

Refer to Division 1 for additional requirements for guarantees.

1. Equipment shall be turned over to Owner clean and in complete working order with full one (1) year warranty by the manufacturer. Use of equipment for temporary heating or cooling shall not be included as part of the warranty period.

B. Maintenance

1. Work furnished and installed under this Division shall be maintained including inspection, lubrication, etc., in accordance with manufacturer's recommendations until acceptance of system by Owner.

C. Operating Instructions:

1. Refer to Division 1 for O & M Requirements.

1.09 RECORD DRAWINGS

A. At completion of Work, prepare mechanical record drawings to accurate scale. Drawings shall indicate piping connections, other service connections, and interfaces with other Work including structural supports.

B. Indicate portions of mechanical Work shown on record drawings which deviate from Work as indicated in the contract drawings and note the reasons for such deviations.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 23 00 01

SECTION 23 05 01 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 WORK DESCRIPTION

A. Provide all labor, equipment, materials, etc. required to complete installation as specified herein and/or shown or scheduled on the drawings.

PART 2 - PRODUCTS

2.01 ELECTRICAL EQUIPMENT

A. Motor controllers, protective devices, etc. for control and protection of equipment shall be furnished with the equipment; but installed and electrically connected to power source under "Electrical Division".

B. NEMA Standards shall be taken as a minimum requirement for electrical equipment.

C. Equipment shall operate properly under a 10% plus or minus frequency variation.

D. Unless noted otherwise, motors shall be squirrel-cage induction type with ball bearings. Motors 1/2HP and smaller shall be 120 volts, single phase with permanently lubricated bearings; 3/4 HP and larger shall be 3 phase, general purpose, Design "B" or "C", drip proof type. Verify characteristics of available current at the building before equipment is ordered.

E. Motors shall be in accordance with IEE, UL and NEMA Standards, non-radio interfering type, rated for continuous, full-load duty and capable of withstanding momentary overloads of 50%. Select motors so actual loads does not exceed nameplate rating, and does not use motor "service factor". "Open" motors shall be rated 40 degrees C.; "totally enclosed" type shall be 50-degrees C. rated. Motors over 5 HP shall be "high efficiency" type and so labeled.

F. Provide both overload and under-voltage protection in all phases.

G. Except where interlock or automatic control is required, single speed motors, and smaller than 1/2 HP have manual switch with pilot light and thermal overload protection.
H. For manual operation of 3/4 HP and larger motors, furnish magnetic starter with:
   1. Maintained contact PB and pilot light or momentary contact pushbutton station and pilot when directed.
   2. Trip free, thermal overload relays.
   3. Capable of accepting electrical interlocks.

H. Where interlock or automatic operation is specified, regardless of HP, provide magnetic starter complete with RUN/OFF/AUTO switch so connected that in "RUN" or "AUTO" all safety controls shall stop the motor.

I. All magnetic starters shall have control circuits individually fused from line side of starter, or load side of breaker. All starters on service 200 volts and above shall have 120 volt, built-in control circuit transformer fused on line and load side.

J. Provide dual element fused disconnect for all hermetic motors above 3/4 HP.

K. Heating Equipment: Phase and voltage as noted or unless noted otherwise.

L. Contactors shall be UL listed for 100,000 cycles of operation.

M. Normal operation pilot lights shall be green; emergency condition signal lights shall be red.

2.02 EQUIPMENT ACCESSORIES

A. AS NOTED UNDER SPECIFIC EQUIPMENT SCHEDULES AND SPECIFICATIONS.

2.03 ACCESS PANELS

A. Provide access panels, or doors, at concealed dampers, valves, shock absorbers, vents, trap primers, inspection points, etc. and where noted. Panels shall be galvanized steel, 16 gauge frame, 14 gauge door with mounting accessories, spring hinges, screwdriver operated lock, and prime coat paint. Milcor "A" for acoustic tile, "M" for exposed masonry, "K" for plaster finishes, stainless steel for ceramic, or glazed structural tile. Where ceiling is "lift out" construction, ceiling access panels are not required. Panels shall be 18" x 18" or larger, as required for service intended.

B. Access doors giving access to "live" electrical gear shall have switch to cut off power when opened.

C. Access panels in fire rated construction shall have a UL label, Class B rating.

2.04 CONCRETE: Where required for thrust blocks, pipe system encasement, equipment bases, etc. for Division 21, 22, and 23, provide 3,000 PSI concrete.

PART 3 - EXECUTION

3.01 ELECTRICAL WORK

A. All electrical work shall be provided under "Electrical Division 26", except: (1) motor controls (2) interlock circuits, (3) control circuits, (4) temperature-humidity controls. For these excepted items, this division shall provide conduit, wiring, connections, etc. as required for a complete control installation according to the appropriate sections of Specifications.

B. The work under this Division shall be of the same type and quality as specified under "Electrical Division".

3.02 EXCAVATION, SHORING AND BACKFILL

A. Provide any excavation required for this Division below that needed for general construction. Unless specifically noted, no extra shall be paid if rock or excavation difficulties are encountered.

B. Provide separate trench for each utility.

C. Provide: (1) bracing, shoring, etc. to protect sides of excavation, (2) staging, suitable ladders, barricades, etc. Comply with local regulations, or absence thereof with Division of the Manual of Accident Prevention provided for in Construction of the AGC.

D. Remove all timber before backfilling. Backfill simultaneously on both sides of tanks, piping, etc. Backfill material shall be approved clay or chert, free of debris, rock larger than 1%" or other harmful material.

E. All backfilling shall be compacted to 90% under sidewalks, or grass areas, and to 95% when under paved areas, structures, building slabs, steps, etc. These percentages refer to "Percent of Maximum Density" per ASTM #D-1557. If more stringent, compact backfill to a dry density equal to that required by G.C.

F. Restore existing pavement, curbs, sidewalks, sodding, etc. removed or damaged in connection with work.

3.03 CUTTING AND PATCHING

A. Provide all cutting, patching, etc. incidental to this work.

B. Do not cut into any structural element without written approval of Structural Engineer.

C. Patching shall be: (1) of quality equal to, and of appearance matching existing construction, and (2) shall restore all services and construction which remains in use to its condition prior to this contract, unless otherwise noted.

3.04 PIPING THRU RATED WALLS AND FLOORS

A. Insulation on pipe passing thru fire rated walls must stop at pipe sleeve unless 3M fire barrier fire stopping is used. Space between pipe and sleeve shall be protected with 3M Fire Barrier Penetration Sealing System or approved substitute. Installation shall be in accordance with the manufacturers recommendations for the hourly fire rating of the partition. The system shall be U.L. listed. Maintain vapor barrier on insulated chilled water and refrigerant suction piping.

B. PVC pipe passing through rated walls or floors shall have 3M UL Modified Fire Stop System, Pro-Set System or Hilti.

C. Refer to details on drawing for pipe and duct penetration thru rated walls and floors.

3.05 FLASHING

A. Where pipes, ducts, etc. pass through roof, flash per manufacturers recommendations.

B. Locate pipes, ducts, etc. through roof to clear parapets, etc. by at least 18".

C. Provide flashing or caulking as required at each opening through outside walls or roof. Flashing through roof of same materials and methods as under "Moisture Protection Division"; through walls shall be aluminum unless noted otherwise.

3.06 PROTECTION

A. Work shall be protected at all times. Pipe openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered if necessary, to protect against dirt, water, chemical or mechanical damage or defacement.

B. All piping indicated to be installed above ceilings in walls or crawl spaces, shall be placed on the heated space side of the building insulation to prevent freezing. Piping indicated to be installed in areas outside heated envelope to be protected by the application of electric heat tape under pipe insulation. The Contractor shall be responsible in contacting the Architect/Engineer before installing and subjecting any piping to freezing conditions.

3.07 TEMPORARY WORK:

A. Water and electricity consumed during construction shall be paid for by General Contractor.

END OF SECTION 23 05 01

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

1.02 REFERENCES

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association.

1.03 SUBMITTALS

A. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit to the Engineer within two weeks after completion of testing, adjusting, and balancing.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   3. Provide reports in 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   6. Units of Measure: Report data in I-P (inch-pound) units only.
   7. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.
      b. Address of Testing, Adjusting, and Balancing Agency.
      c. Telephone number of Testing, Adjusting, and Balancing Agency.
      d. Project name.
      e. Project location.
      f. Project Architect.

g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

C. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

1.04 QUALITY ASSURANCE (moved to PART 3)

1.05 PRE-BALANCING MEETING (moved to PART 3)

1.06 SEQUENCING AND SCHEDULING (moved to PART 3)

1.07 WARRANTY (moved to PART 3)

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC MN-1, AABC National Standards for Total System Balance.
2. ASHRAE STD 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of 5 years documented experience.
3. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

E. TAB Supervisor Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure.

3.07 SCOPE

A. Test, adjust, and balance the following:
   1. All new systems
   2. Recirculation of Potable Hot Water Systems
   3. Heating/Cooling Units
   4. Air Handling Units
   5. Fans
   6. Air Filters
   7. Air Terminal Units
   8. Air Inlets and Outlets

3.08 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and actual

C. Air Moving Equipment:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Arrangement/Class/Discharge
   6. Air flow, specified and actual
   7. Return air flow, specified and actual
   8. Outside air flow, specified and actual
   9. Total static pressure (total external), specified and actual
   10. Inlet pressure
   11. Discharge pressure
   12. Sheave Make/Size/Bore
   13. Number of Belts/Make/Size
   14. Fan RPM

15. Total HW and CHW flow, specified and actual

D. Return Air/Outside Air:
   1. Identification/location
   2. Design air flow
   3. Actual air flow
   4. Design return air flow
   5. Actual return air flow
   6. Design outside air flow
   7. Actual outside air flow
   8. Return air temperature
   9. Outside air temperature

E. Exhaust Fans:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Air flow, specified and actual
   6. Total static pressure (total external), specified and actual
   7. Inlet pressure
   8. Discharge pressure
   9. Sheave Make/Size/Bore
   10. Number of Belts/Make/Size
   11. Fan RPM

F. Air Distribution Tests:
   1. Air terminal number
   2. Room number/location
   3. Terminal type
   4. Terminal size
   5. Area factor
   6. Design velocity
   7. Design air flow
   8. Test (final) velocity
   9. Test (final) air flow
   10. Percent of design air flow

G. Potable Water:
   1. Location of circuit setter
   2. Design Flow
   3. Actual Flow

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCT INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

1.02 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

C. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

D. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 – PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C 553; flexible, noncombustible blanket.
   1. 'K' ('Ksi') value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C 518.
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s sq m), when tested in accordance with ASTM E 96.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

E. Tie Wire: Annealed steel, 16 gage (1.5 mm).

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C 612; rigid, noncombustible blanket.
   1. 'K' ('Ksi') value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C 518.
   2. Maximum service temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Sorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s sq m), when tested

in accordance with ASTM E 96.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.04 JACKETS

A. Aluminum Jacket: ASTM B 209 (ASTM B 209M).
1. Thickness: 0.016 inch (0.40 mm) sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms: Finish with aluminum jacket.

F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with calked

aluminum jacket with seams located on bottom side of horizontal duct section.

G. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. Supply and Fresh Air Ducts: Glass Fiber 2" Thick.

B. Return and Relief Ducts in Mechanical Rooms: Glass Fiber, 1-1/2" Thick.

C. Ducts Exposed to Outdoors: Glass Fiber 2-1/2" Thick.

END OF SECTION 23 07 13

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Ductwork Cleaning.

1.02 REFERENCES

A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.

D. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association.

F. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association.

G. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

1.03 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.04 SUBMITTALS

A. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 standards.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Steel Ducts: ASTM A 1008/A 1008M, Designation CS, cold-rolled commercial steel.

B. Aluminum Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. VOC Content: Not more than 250 g/L, excluding water.
3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
4. For Use with Flexible Ducts: UL labeled.

D. Hanger Rod: ASTM A 36/A 36M; steel; threaded both ends, threaded one end, or continuously threaded.

2.02 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.03 MANUFACTURED METAL DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

2.04 KITCHEN HOOD DUCTWORK AND FITTINGS

A. Provide in accordance with IMC 2012, NFPA 96 and details on design drawings. Maintain required slope and avoid cavities where grease can collect. Provide access doors for maintenance.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

C. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

G. Use double nuts and lock washers on threaded rod supports.

H. Connect terminal units to supply ducts with one foot (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.

I. Connect diffusers or light troffer boots to low pressure ducts with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

J. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

K. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

END OF SECTION 23 31 00

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connections.

H. Smoke dampers.

I. Volume control dampers.

1.02 REFERENCES

A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.

B. NFPA 92A - Standard on Smoke-Control Systems; National Fire Protection Association.

C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

D. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.

E. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.

F. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.

1.03 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

1.04 PROJECT RECORD DOCUMENTS

A. Record actual locations of access doors, test holes, and all dampers.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

1.07 EXTRA MATERIALS

A. Provide two of each size and type of fusible link.

PART 2 – PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS

A. Gravity Backdraft Dampers, Size 18 x 18 inches (450 x 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.03 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

B. Provide factory sleeve and collar for each damper.

C. Multiple Blade Dampers: Fabricate with 16 gage (1.5 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

D. Operators: UL listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. Locate damper operator on exterior of duct and link to damper operating shaft.

E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices.

F. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.04 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.05 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.06 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Ceiling Dampers: Galvanized steel, 22 gage (0.76 mm) frame and 16 gage (1.5 mm) flap, two layers 0.125 inch (3.2 mm) ceramic fiber on top side with locking clip.

C. Horizontal Dampers: Galvanized steel, 22 gage (0.76 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

D. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

2.07 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
      a. Net Fabric Width: Approximately 2 inches (50 mm).
   2. Metal: 3 inches (75 mm) wide, 24 gage (0.6 mm) thick galvanized steel.

C. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

2.08 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 curtain type fire damper, normally open automatically operated by electric actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.09 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and

Flexible, and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch (150 x 760 mm).

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 233100 for duct construction and pressure class.

B. Provide back draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as indicated. Provide 4 x 4 inch (100 x 100 mm) for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 33 00

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers.

1.02 REFERENCES

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.

B. ASHRAE Std 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

PART 2 – PRODUCTS

2.01 ROUND CEILING DIFFUSERS – See Drawings

2.02 RECTANGULAR CEILING DIFFUSERS – See Drawings

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES – See Drawings

2.04 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES – See Drawings

2.05 LOUVERS

A. Type: 4 inch (100 mm) deep with blades on 45 degree slope, heavy channel frame, 1/2 inch (13 mm) square mesh screen over exhaust and 1/2 inch (13 mm) square mesh screen over intake.

B. Fabrication: 16 gage (1.50 mm) thick galvanized steel welded assembly, with factory baked enamel finish, color to be selected.

C. Mounting: Furnish with screw holes in jambs for installation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION 23 37 00

SECTION 23 76 55 - SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps and cooling units.

B. Air cooled condensing units.

C. Indoor air handler (fan & coil) units for non-ducted and ducted connections.

1.02 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute.

B. ARI 520 - Positive Displacement Condensing Units; Air-Conditioning and Refrigeration Institute.

C. ASHRAE Std 23 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

D. ASHRAE Std 90.1 - Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

E. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

F. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association.

1.03 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Design Data: Indicate refrigerant pipe sizing.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Project Record Documents: Record actual locations of components and connections.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

PART 2 - PRODUCTS

2.01 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.
   1. Efficiency: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1 as indicated on drawings; seasonal efficiency to ASHRAE Std 103.

C. Electrical Characteristics:
   1. Disconnect Switch: Provided under Division 26.

2.02 INDOOR UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.

C. Air Filters: 1 inch (25 mm) thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with ARI 210/240 and UL listed.
   2. Manufacturers: System manufacturer.

E. Furnaces: UL listed and manufactured integral to air handling unit at listed capacities on schedules.

2.03 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Ceiling Cassette Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer. Four-way 2'x2' ceiling-cassette indoor unit with

built-in drain pump mechanism for condensate removal. Low Ambient cooling capability to 0 degrees F and reverse cycle heating capability as specified. Wide air-flow pattern with ventilation air intake knockout. Air filter included with unit. Indoor unit powered from outdoor unit with control transformer. Automatic fan speed control; auto restart following a power outage. Auto wave airflow in heating mode—unit independently cycles through horizontal and vertical positions for more even heat distribution.

B. Indoor Wall Mounted Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer. Wall mounted indoor unit with built-in drain pump mechanism for condensate removal. Low Ambient cooling capability to 0 degrees F and reverse cycle heating capability where specified in heat pump configuration. Air filter included with unit. Indoor unit powered from outdoor unit with control transformer. Auto restart following a power outage.

C. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with ARI 210/240 and UL listed.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   2. Construction and Ratings: In accordance with ARI 210/240 with testing in accordance with ASHRAE Std 23 and UL listed.

B. Compressor: ARI 520; hermetic, two speed 1800 and 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion and reversing valves for heat pump operation.

D. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting. Thermostat shall allow occupied and unoccupied settings from BAS and have an occupied mode override. Provide outdoor coil defrost control. Unit shall be capable of operating with automatic changeover in cooling or reverse cycle heating, and auxiliary heating modes.

E. Unit shall be capable of operating to 0 degrees F.

2.05 AUXILIARY HEAT/ELECTRIC FURNACE COMPONENTS

A. Electric Heater: Helix wound bare nichrome wire heating elements arranged in incremental stages of 5 kW each, with porcelain insulators.

B. Operating Controls:
   1. Heater stages energized in sequence with pre-determined delay between heating stages.
   2. High limit temperature control to de-energize heating elements, with automatic reset.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION 23 76 55

SECTION 26 05 00 - ELECTRICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide all materials, labor, and equipment required to furnish and install a complete electrical system as indicated on the Drawings and as specified herein.

B. Electrical work includes, but is not limited to, the following:
   1. Electrical distribution system for lighting and power including the electrical service and necessary feeders, panelboards, branch circuits, conduit, lighting fixtures, control switches, and receptacles.
   2. Excavation, trenching, and backfilling for conduit and/or cable.
   3. Grounding.
   4. Power wiring for equipment furnished under Division 21, 22, and 23

1.02 RELATED WORK

A. The following work shall be furnished under other Divisions of these Specifications, but shall be coordinated with said Divisions by Division 26 tradesman prior to bid.
   1. Painting.
   2. Cutting and patching.
   3. Heating, ventilating, air conditioning, and plumbing equipment.

1.03 DEFINITIONS

A. Provide: Shall mean "furnish, install, connect, and put in good working order."

B. Wiring: Shall mean "wire and cable, installed in raceway with all required boxes, fittings, connectors, etc. completely installed."

C. Engineer: Shall mean "Engineer of Record" whose seal is affixed to the contract specifications and drawings of Division 26.

1.04 CODES AND STANDARDS

A. Comply with applicable local, state, and federal codes.

B. Electrical work shall be installed in accordance with the Drawings and Specifications, the 2012 IBC/IRC, 2011 NEC, ANSI, and NFPA.

C. In event of conflict between Drawings, Specifications and such codes, Engineer shall be notified in writing prior to bid. A ruling will then be made by the Engineer in writing. All work shall be installed in strict accordance with applicable codes without additional cost to Owner.

D. Contractor shall submit and/or file all necessary specifications and drawings as required by governing authorities.

1.05 SUBMITTALS

A. Provide submittals on materials and equipment identified in the Specifications and Drawings prior to manufacturer, order, or installation in accordance with Shop Drawings, Product Data, and Samples.

B. Submittals shall include but not be limited to the following:

Lighting fixtures Panelboards Safety switches Meter Centers Sprinkler Monitoring

1.06 OPERATING AND MAINTENANCE MANUALS

A. Furnish, to the Owner, an electronic copy of the product data for operation and maintenance on the electrical equipment. Instructions shall also include recommended spare parts lists.

B. A minimum of 4 hours of training on the operation and maintenance of the electrical equipment shall be provided for the Owner's representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment and materials to job site in original, unopened, labeled containers.

B. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring.

PART 2 – PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 SITE VISIT

A. Visit job site prior to bid date to determine actual conditions under which work shall be done, to become familiar with project, and to verify total scope of work required. Failure to do so shall not constitute a reason for an extra charge.

END OF SECTION 26 05 00

SECTION 26 05 01 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Qualifications of Manufacturer: All materials and equipment used in work of Division 26 shall be produced by manufacturers regularly engaged in manufacturer of similar items and with history of successful production acceptable to the Engineer. They shall be new and be UL listed and labeled or listed and labeled by other recognized testing laboratory where such label is available.

B. Qualifications of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of work of this Section.

PART 2 – PRODUCTS

2.01 SUBSTITUTIONS

A. Reference in Specifications to any article, device, product, material, fixture, form and type of construction, by name, make, or catalog number shall be interpreted as established standard of quality and shall not be construed as limiting competition unless noted otherwise. Any article, device, product, material, fixture, form and type of construction which in the judgment of Engineer, expressed in writing, is equal to that specified, may be used.

B. Substitution shall be approved by Engineer before purchase and/or installation. If unapproved materials are installed, work required to remove and replace unapproved items shall be done at the Contractor's expense.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Electrical drawings are diagrammatic and shall not be scaled for exact sizes or locations. They are not intended to disclose absolute or unconditional knowledge of actual field conditions. This Division shall be prepared to relocate any outlet or device 6' in any direction without additional charge to the Owner.

B. Equipment shall be installed according to manufacturer's recommendations.

C. Protect work and materials from damage by weather, entrance of water, and dirt. Cap conduit during installation. Avoid damage to materials and equipment in place.

D. Satisfactorily repair or remove and replace damaged work with new materials.

E. Failure to route conduit through building without interfering with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit and fixtures shall fit into available space in building and shall not be introduced into building

at such times and manner as to cause damage to structure. Equipment requiring services shall be readily accessible.

F. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate electrical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
   8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, whether exposed or concealed.
   9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
   10. Install access panels or doors where units are concealed behind finished surfaces.
   11. Insulate dissimilar metals so they are not installed in direct contact.

H. Conduits which pass through floor slabs (except ground floor) shall be sealed with Fire Stop Sealant. Seal around conduits or other wiring materials passing through partitions, floors, and fire rated walls. Use UL approved Fire Stop Sealant as detailed on the drawings.

I. Coordinate electrical power connection requirements with all equipment suppliers. Where power requirements differ from drawing design requirements, Engineer shall be notified for clarification and installation requirements prior to installing that portion of work. Cost for equipment and labor for improperly installed electrical connections not coordinated and approved by other trades and the Engineer shall be incurred by the Electrical Contractor and shall not constitute a reason for an extra charge because of rework.

3.02 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.03 TESTING AND EQUIPMENT SERVICING

A. Entire installation shall be free from improper grounds and short or open circuits. Conductors shall be tested before energizing circuit. Test to insure that entire system is in proper operating condition, and that adjustments and setting of circuit breakers, fuses, control equipment, and apparatus have been made. Correct defects discovered during tests.

B. Equipment shall be turned over to Owner in lubricated condition with instructions on further lubrication included in operating instructions.

3.04 REMOVAL OF DEBRIS

A. Remove surplus materials and debris caused by, or incidental to electrical work. Remove such debris at frequent intervals. Keep job site clean during construction.

3.05 IDENTIFICATION OF EQUIPMENT

A. Equipment shall be identified in accordance with Section 260553, “Electrical Identification.”

3.06 AS-BUILT DRAWINGS

A. Maintain one set of blue line electrical prints on site, marked to show as-built conditions and installations, prints to be turned over to Owner after job is complete.

3.07 TEMPORARY LIGHTING AND POWER

A. Provide, maintain and remove after construction is completed, temporary lighting adequate for workman safety and temporary power for all trades.

3.08 OTHER MATERIALS

A. Work of this Division shall also include those items not specifically mentioned or described, but which are obviously necessary to conform to the design intent, applicable codes and to produce complete electrical system that functions properly. These materials shall be as selected by Contractor but subject to approval of the Engineer.

3.09 OTHER COORDINATION

A. Contractor shall obtain and pay for all necessary permits and inspection fees required for the electrical installation.

B. All utility company (KUB) aid to construction fees shall be included in the bid.

3.10 GUARANTEE-WARRANTY

A. Guarantee work to be free of material and workmanship defects for a period of one year, from date of final acceptance for the project. Repair and replace defective work and other work damaged thereby which becomes defective during term of Guarantee-Warranty. Furnish Owner with three written copies of Guarantee-Warranty.

END OF SECTION 26 05 01

SECTION 26 05 19 - WIRE AND CABLE

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Wire and cable for all service, feeders, branch circuits, and instrument and control wiring rated 600 volts and below.

1.02 QUALITY ASSURANCE

A. Listing and Labeling: Provide wire and cable that is listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Wire and cable and its installation shall comply with requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Wires and cables shall meet applicable requirements of the National Electrical Code and UL for the type of insulation, jacket, and conductor specified or indicated.

B. All conductors shall be copper with 600 volt insulation unless otherwise indicated.

C. Wire and cable shall be manufactured by Belden, General Cable, Essex, Encore, Rome Cable, Southwire, or approved equal.

D. Use solid copper type THHN/THWN for branch circuit wiring #10 AWG and smaller. No conductor for branch circuit wiring shall be smaller than #12 AWG.

E. Use stranded copper, type THHN/THWN for feeder and power circuits #8 AWG and larger.

F. Provide color coded wire and with a different color for each phase and neutral and ground as follows: 240/120 volt circuits - phases A and B: black and red, respectively; neutral: white; ground: green. Approved color tape is acceptable for feeders. The neutral shall have a stripe to match the corresponding phase conductor color. Also provide color coded wire for control circuits.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Complete conduit system before pulling any wire or cable. Use cable lubricants recommended by cable manufacturer as necessary.

B. Conductors shall be continuous from outlet to outlet or to branch circuit over-current

devices. Make splices only in junction boxes. Splices shall not be made in panelboards. Control wiring shall be continuous between components and/or terminal boards.

C. A minimum of eight (8") inches of slack conductor shall be left in every outlet or junction box. There should also be enough slack so three (3") inches extends outside the outlet or junction box.

D. Make splices in conductors #10 AWG and smaller diameter with insulated, pressure-type connector. Use Scotchlok, Ideal, or equal wire connectors.

E. Make splices in conductors #8 AWG and larger diameter with solderless connectors and cover with insulation material equivalent to conductor insulation. Use Burndy compression connectors with crimpit cover, type CC, or equal.

F. Where branch circuits homeruns exceed 70' in length for 120 volt and 150' in length for 240 volt circuits, #10 AWG wire shall be the minimum size used to the first outlet.

G. Type NM cable shall be routed parallel or perpendicular to the structure and supported at intervals specified in the NEC. Nail plates shall be provided where cabling is less than the NEC specified minimum depth.

3.02 TESTING

A. After completion of the installation and splicing and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified.

B. Test wiring to verify that no short circuits, open circuits, or accidental grounds exist. Continuity tests shall be conducted using a dc device with bell or buzzer.

C. All conductors number 4 and larger shall be Megger tested.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.02 PERFORMANCE REQUIREMENTS

A. The grounding system to earth resistance shall be less than 25 ohms.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide grounding and bonding materials that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Components and installation shall comply with the requirements of the National Electrical Code (NEC).

C. Materials shall comply with UL 467, “Grounding and Bonding Equipment.”

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers shall be Burndy, T&B, or approved equal.

2.02 GROUNDING ELECTRODES

A. Ground rods shall be copper clad steel with minimum dimensions of ¾ inch diameter by 10 feet long.

2.03 CONNECTORS

A. Exothermic welded connections shall be provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

B. Pressure connectors shall be high-conductivity-plated units.

C. Bolted clamps shall be heavy-duty units listed for the application.

2.04 WIRE AND CABLE

A. All grounding conductors shall be copper.

B. The grounding electrode conductor shall be stranded.

C. Equipment grounding conductors shall have green insulation.

D. Bare copper conductors shall conform to the following:
   1. Solid conductors: ASTM B-3
   2. Assembly of stranded conductors: ASTM B-8
   3. Tinned Conductors: ASTM B-33

2.05 MISCELLANEOUS CONDUCTORS

A. Ground bus shall be bare annealed copper bars.

B. Braided bonding jumpers shall be copper tape, braided number 30 gauge bare copper wire, and terminated with copper ferrules.

C. Bonding strap conductor/connectors shall be soft copper, 0.05 inch thick and two (2") inches wide, unless otherwise noted.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grounding system shall be in accordance with Article 250 of the NEC except where the Drawings or Specifications exceed NEC requirements.

B. A code sized green grounding conductor shall be provided in all feeder and branch circuits. Bond conductors to chassis or fixed equipment.

C. All grounding conductors shall be bonded to multi-terminal ground bus at panelboard or other distribution equipment. Grouping of grounding conductors under a single lug is not acceptable.

D. Bond interior metal piping systems.

E. Bond reinforcing steel in foundation footing to grounding electrode conductor. Bond steel together.

F. Install a single ground rod at each building and connect to the grounding electrode system.

G. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.

3.02 CONNECTIONS

A. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

2. Make connections with clean bare metal at points of contact.
3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.
4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Use exothermic welded connections for connections to structural steel and for underground connections. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. For compression-type connections, use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

D. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

E. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

F. Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

G. Do not use flexible metal conduit and fittings as a grounding means. Pull a green wire in each piece of flexible conduit, and screw to conduit system with lugs at both ends.

3.03 FIELD QUALITY CONTROL

A. Use the fall-of-potential method as described in IEEE Standard 81 to measure the resistance of the following. Record the measurements and provide to the Engineer.
The resistance between earth and each ground rod prior to interconnection with other ground rods.
1. The resistance between earth and the counterpoise.
2. The resistance of the grounding system at the grounding electrode connection to earth.

Measure the ground resistance when there has been no precipitation for 5 days, without the soil being moistened by any means other than natural precipitation or natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance.

3. Resistance shall be less than 25 ohms.

B. Perform continuity tests at all power receptacles to ensure the ground terminals are properly grounded to the facility ground network.

END OF SECTION 26 05 26

SECTION 26 05 29 - SUPPORTING DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fasteners.

1.02 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with the National Electrical Code.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, Slotted Metal Angle and U-Channel Systems shall be provided by Allied Tube & Conduit, American Electric, B-Line Systems, Inc., Unistrut Diversified Products, or approved equal.

B. Subject to compliance with requirements, Conduit Sealing Bushings shall be provided by Bridgeport Fittings, Inc., Cooper Industries, Inc., Killark Electric Mfg. Co., O-Z/Gedney, Raco, Inc., Spring City Electrical Mgf. Co., Thomas & Betts Corp., or approved equal.

2.02 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be aluminum or hot-dip galvanized.

2.03 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Raceways shall be supported with clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features as follows:
   1. Expansion Anchors: Carbon steel wedge or sleeve type.
   2. Toggle Bolts: All steel springhead type.
   3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
      a. 3-inch and smaller: 20-gauge.
      b. 4-inch to 6-inch: 16-gauge.
      c. over 6-inch: 14-gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
   3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Coordinate with the building structural system and with other electrical installation.

C. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer's recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.

   3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
   5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways

serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

6. Space supports for raceway types not covered by the above in accordance with NEC.
7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

D. Vertical Conductor Supports: Install simultaneously with installation of conductors.

E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

F. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

G. Sleeves: Install in concrete slabs and walls and all other fire rated floors and walls for raceways and cable installations. For sleeves through fire rated wall or floor construction, apply UL listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with manufacturer's recommendations.

H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

END OF SECTION 26 05 29

SECTION 26 05 34 - CONDUIT

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide a conduit system for building wire/conductors where specifically noted on the plans. Conduit system includes conduit, couplers, connectors, fittings, boxes, covers and supports.

1.02 QUALITY ASSURANCE

A. Listing and Labeling: Provide conduit that is listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Conduit and its installation shall comply with requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 CONDUIT

A. Electric Metallic Tubing (EMT): Allied, Wheatland, LTV Copperweld, or approved equal.

B. Rigid Metal Conduit (RMC): Allied, Wheatland, Republic, or approved equal.

C. Flexible Steel Conduit (Greenfield): Alflex, Electroflex, or approved equal.

D. Rigid Non-Metallic Conduit (PVC): Carlon Schedule 40, Cantex, Southern Pipe, Schedule 80 or approved equal.

E. Liquidtight Flexible Nonmetallic Conduit (LFNC): Aflex, Electroflex, or approved equal.

2.02 CONDUIT FITTINGS

A. Couplings and connectors: Appleton, T&B, Arlington, or 0.Z. Gedney.

B. Bushings: Appleton, T&B, O.Z., or Gedney

C. Straps and Hangers: Appleton, T&B, Steel City, or Minerallac.

D. Group Pipe supports: Unistrut, Kindorf, B-Line, or approved equal.

E. Expansion Fittings: O.Z. Gedney Type AX, or equal by Appleton, or approved equal.

F. Exposed Conduit Fittings: Appleton, Crouse-Hinds, or O.Z. Gedney.

PART 3 – EXECUTION

3.01 CONDUIT

A. In general, conduit installation shall follow layout shown on drawings. However, this layout is diagrammatic only and where changes are necessary due to structural conditions, other apparatus or other causes, such changes shall be made without cost to Owner. Offsets in conduits are not indicated and must be furnished as required.

B. Conduit shall be installed in accordance with the National Electrical Code.

C. Provide bushings on the open ends of conduit containing conductors. Insulated bushings shall be provided for conduits containing conductors #4 AWG or larger with an insulating ring an integral part of the bushing.

D. Use EMT where Drawings call for conduit to be concealed in walls or above ceilings. Do not use EMT in wet locations or in exterior applications.

E. Use Schedule 40 PVC encased in concrete or when run underground. Use Schedule 80 PVC when exposed.

F. When conduit is turned up, penetration of the slab shall be vertical. The entire radius of the conduit shall be below slab.

G. Support conduit and secure to forms when cast in concrete so that conduit will not be displaced during pouring of concrete. Stuff boxes and cork fittings to prevent entrance of water during concrete pouring and at other times during construction, prior to completion of conduit installation.

H. Route all conduit at right angles or parallel to walls of building.

I. Use proper sized tools for bending. Do not heat metal conduit. Dents and flat spots will be rejected. Cut and thread conduit so ends will butt in couplings. Make threads no longer than necessary and ream pipe free of burrs.

J. Leave one #10 AWG or equivalent nylon pull wire in empty conduits.

K. Use short pieces, approximately five (5') feet of flexible conduit to connect motors and other devices subject to motion and vibration. Use liquidtight flexible conduit where outside or subject to water spray.

3.02 CONDUIT FITTINGS

A. When EMT is installed concealed in walls or above ceilings, for sizes one (1") inch and smaller use set screw connectors and steel couplings with two set screws. For sizes larger than one (1") use steel double set screw connectors and steel couplings with four set screws. All connectors shall have throated insulating bushing.

B. Support conduit vertically and horizontally by straps or hangers. Do not exceed intervals as described in the National Electrical Code.

C. Use expansion fittings, properly bonded to assure ground continuity, across expansion joints in floors and ceilings. Use double lock nuts and bushings on panel feeders at panel cans.

END OF SECTION 26 05 34

SECTION 26 05 37 - OUTLET AND JUNCTION BOXES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.02 QUALITY ASSURANCE

A. Listing and Labeling: Provide outlet and junction boxes that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Outlet and junction boxes and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 OUTLET AND JUNCTION BOXES

A. Outlet and junction boxes shall be plastic, 1-1/2” deep minimum by Raco, T&B/Steel City, Crouse Hinds or approved equal. Use 2 hour rated plastic boxes in rated walls.

PART 3 – EXECUTION

3.01 GENERAL

A. Outlet and junction boxes in inaccessible ceiling areas shall be located no more than 6 inches from ceiling access panel or from removable recessed luminaire.

B. Install boxes to preserve fire resistance rating of partitions and other elements, using UL listed fire stop materials and methods.

C. Do not install flush mounted boxes back-to-back in walls; provide minimum six (6") inches separation. Provide minimum twenty-four (24") inches separation in fire rated walls.

D. Bonding jumpers shall be used around concentric knockouts.

3.02 OUTLET BOXES

A. Outlet boxes shall be securely anchored, set true, and plumb and no part of box shall extend beyond finished wall or ceiling. Flush mounted boxes shall be set to within 1/8" of finished wall and a plaster ring used to make cover flush with wall.

B. Select boxes according to intended use and type of outlet. Ceiling outlet boxes shall be

four (4") inches octagon and 2-1/2" deep. Use four (4") inches square boxes where required. All ceiling outlet boxes shall have a fixture stud of the no bolt, self-locking type if required to hang the fixture specified at the outlet.

C. Install blank device plates on outlet boxes left for future use.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Confirm accessibility code compliance.

3.03 JUNCTION BOXES

A. Pull and junction boxes shall be sized in accordance with the National Electrical Code according to number of conductors in box or type of service to be provided. Minimum size is 4-11/16” square and 2-1/2” deep.

B. Pull boxes shall be provided where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with bends exceeding 270 degrees shall have a pull box installed at a convenient intermediate location.

C. Install in locations as shown on Drawings and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.

D. Install pull and junction boxes above accessible ceilings and in unfinished areas only.

3.04 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.05 CLEANING

A. Clean interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 37

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Extent and types of electrical identification are indicated herein and as follows:
   1. Operational instructions and warnings.
   2. Danger signs.
   3. Equipment/system identification signs.
   4. Conduit identification.
   5. Power and control wiring identification.
   6. Terminal marking.
   7. Arc-flash warning.
   8. Panelboard Legends.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, identification products shall be provided by W.H. Brady Co., Ideal Industries, Inc., Panduit, T&B, or approved equal.

2.02 MATERIALS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

B. Cable/Conductor Identification Bands: Provide manufacturer's standard wrap-around type, vinyl-cloth, self-adhesive cable/conductor markers with either pre-numbered plastic coated type or write-on type with clear plastic self-adhesive cover flap, numbered to show circuit identification. Provide markers for all field control wiring.

C. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings. Signs shall be of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: 208V, EXHAUST FAN or DANGER – HIGH VOLTAGE).
   1. Colors: Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.

D. Engraved Plastic-Laminate Signs: Provide three-layer engraving stock in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
   1. Thickness: 1/16", for units up to 20 sq. in. or eight (8") length; 1/8" for larger units.
   2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

E. Underground Warning Tape: Provide four (4") inch wide detectable type, plastic, yellow warning tape with suitable warning describing type of cable/circuit over buried electrical lines.

2.03 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 – EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:
   1. Coordination: Where identification is to be applied to surfaces, which require finish, install identification after completion of painting.
   2. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
   3. Equipment/System Identifications: Install engraved plastic-laminate sign on each disconnect and enclosure. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide identification and warning signs for each unit of the following categories of electrical work.
      a. Panelboards
      b. Disconnect switches.

B. Install signs at locations indicated or, where not otherwise indicated, at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with stainless steel tamperproof fasteners.

C. Install magnetic/traceable underground warning tape in accordance with the National Electrical Code.

END OF SECTION 26 05 53

SECTION 26 05 73 - OVERCURRENT PROTECTIVE DEVICES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. This section includes circuit breakers and fuses.

1.02 SUBMITTALS

A. Provide manufacturer's product data for the following:
   1. Circuit breakers
   2. Enclosures
   3. Fuses (Provide complete list of all fuses and the equipment where they are used.)
   4. Shunt trips

B. Provide maintenance data for products for inclusion in the Operating and Maintenance Manual.
   1. Include a load current and overload relay heater list complied by Contractor after motors have been installed. Arrange list to demonstrate selection of heaters to suit actual motor nameplate full load currents.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide overcurrent protective devices that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Overcurrent protective devices and their installation shall comply with the requirements of the National Electrical Code.

C. Circuit breakers shall comply with UL 489, NEMA AB 1, and NEMA AB 3.

D. Fuses shall conform to NEMA FU 1.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Circuit Breakers: Subject to compliance with requirements, provide products by Cutler-Hammer; General Electric Co.; Siemens Energy & Automation, Inc.; Square D Co.; or approved equal.

B. Fuses: Subject to compliance with requirements, provide products by Bussmann Mfg. Co., Littlefuse Co, Ferraz Shawmut, or approved equal.

2.02 FUSES

A. A complete set of fuses for all switches shall be provided. Fuses shall have a voltage rating

not less than the circuit voltage.

B. Provide Class RK1 fuses for motor branch circuits.

C. Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable.

D. Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.

2.03 EQUIPMENT ENCLOSURES

A. Enclosures for equipment shall be in accordance with NEMA 250.

B. Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures.

C. Equipment installed in wet locations shall be contained in NEMA Type 3R, rainproof, sheet-steel enclosures, constructed for outdoor use to protect against falling rain, sleet, and ice.

D. Ferrous-metal surfaces of electrical enclosures shall be cleaned and painted with the manufacturer’s standard finish.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install overcurrent protective devices as indicated or required, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements.

B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices.

C. Install enclosed circuit breakers plumb with operating handle at five (5') feet above finished elevation.

D. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.

E. Provide engraved plastic-laminate nameplates under the provisions of Section 260553, "Electrical Identification" for enclosed circuit breakers and motor controllers.

3.02 ADJUSTING

A. Inspect circuit breaker operating mechanisms for malfunctioning and where necessary, adjust units for free mechanical movement.

3.03 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry

and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 26 05 73

SECTION 26 24 16 - PANELBOARDS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance panelboards (loadcenters). All 240/120Volt, 1 Phase panels.

1.02 REFERENCES

A. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association.

B. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association.

C. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association.

D. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association.

E. NFPA 70 - National Electrical Code; National Fire Protection Association;

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.05 MAINTENANCE MATERIALS

A. Furnish two of each panelboard key.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Eaton Electrical/Cutler-Hammer

B. GE Industrial

C. Square D

D. GE

2.02 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard. Unit shall be similar to Square D. Co. NQOB Series.

B. Panelboard Bus: Copper, ratings as indicated. Provide aluminum ground bus in each panelboard; provide insulated ground bus where scheduled.

C. Minimum Integrated Short Circuit Rating: As indicated.

D. Cabinet Box: 4 inches (153 mm) deep, 14 inches (508 mm) wide.

E. Cabinet Front: Flush cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6 feet (1800 mm) to top of panelboard; install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed or circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide engraved plastic nameplates under the provisions of Section 260553.

G. Ground and bond panelboard enclosure according to Section 260526.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES AND PLATES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Switches

B. Receptacles

C. Plates

1.02 QUALITY ASSURANCE

A. Listing and Labeling: Provide wiring devices and plates that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Wiring devices and plates and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 SWITCHES

A. Switches shall be toggle, quiet-type with totally enclosed with bodies of thermoplastic and mounting strap.

B. Switches shall be rated for 20 amps, 277 volts AC. Switches shall be specification grade Hubbell, P&S, Leviton, Cooper Wiring Devices, or approved equal.

2.02 RECEPTACLES

A. Receptacles shall be general purpose, heavy duty, duplex receptacles of thermoplastic supported on a metal mounting strap in accordance with NEMA WD 1. Receptacles shall be 20 amp, 125 volt, specification grade Cooper Wiring Devices, Hubbell, Leviton, P&S.

B. Ground fault circuit interrupter receptacles shall be the “feed-through” type rated to protect 20 amps. Receptacles shall be specification grade duplex receptacles with impact-resistant nylon face with test and reset buttons.
   1. 20 Amp, 125 Volt: Cooper Wiring Devices, Hubbell, Leviton, P&S, or approved equal.

C. All devices shall be tamper and/or weather resistance where required by the NEC.

2.03 PLATES

A. Provide UL listed, one-piece device plates to suit the devices installed.

B. Plates on finished walls shall be mid-size, nylon.

C. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate.

D. Plates installed in wet locations shall be gasketed and UL listed for “wet locations” as per 2005 NEC 406.8 (B).

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide proper size outlet boxes for all wiring devices in accordance with Section 260537, “Outlet and Junction Boxes.”

B. Install switches forty-eight (48") inches above finished floor on lock side and clear of door frame a minimum of three (3") inches unless otherwise noted. Prior to rough-in, coordinate with architectural drawings to determine lockside of door.

C. All switches shall be made by the same manufacturer.

D. Where two or more snap switches are to be installed at the same location, they shall be mounted in one-piece ganged switch boxes, with at gang cover plate.

E. Combination snap switch and single or duplex receptacles shall be mounted in two-gang switch box with one-piece device plate.

F. Receptacles shall be mounted 18" above finished floor unless otherwise noted.

G. All wiring devices shall be mounted in accordance with accessibility code requirements.

H. Verify the finish color of all devices and cover plates with architect/owner.

END OF SECTION 26 27 26

SECTION 26 28 18 - DISCONNECT SWITCHES

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Fused Disconnect Switches

1.02 SUBMITTALS

A. Provide product data showing switch's ratings and enclosure type.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide disconnect switches that are listed and labeled.
   1. The term "listed and labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

B. Disconnect switches and their installation shall comply with the requirements of the National Electrical Code.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Switches shall be Square D, Cutler-Hammer/Eaton, General Electric, Siemens Energy & Automation, or approved equal.

2.02 MATERIALS

A. Use standard duty, pull-out type switches.

C. Provide equipment ground lug in each switch.

D. Provide NEMA 1 enclosures for interior installations, unless otherwise noted.

E. Provide NEMA 3R enclosures for exterior installations or in wet locations, unless otherwise noted.

F. Provide fuses as per equipment manufacturer recommendation.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Provide safety switches sized as indicated on the Drawings.

B. Mount individually enclosed switches plumb and level with top four (4') feet above floor for interior and three (3') feet above grade on the exterior, unless otherwise noted.

C. Provide a set of fuses in fusible disconnect switches, as per equipment manufacturer recommendations.

3.02 IDENTIFICATION

A. Identify disconnect switches in accordance with Section 260553, "Electrical Identification."

END OF SECTION 26 28 18

SECTION 312219-FINISH GRADING

PART 1 - GENERAL

1.1 The work called for by this section shall include, but not necessarily be limited to, finish grading and the spreading and shaping of topsoil to the finished contour elevations indicated by the drawings.

1.2 Refer to other sections for work related to that specified under this heading. Coordinate this work with that specified by other sections for timely execution.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Premium Mix Soil. Soil pH. 6.6-7.0. Ready to use screened mixture of sandy loam and compost, high organic matter and essential nutrients included are as follows: phosphorus, potassium, calcium and magnesium.

PART 3 - EXECUTION

3.1 Do not begin work until the earth is dry enough to be tillable.

3.2 Inspect subgrades to see that they generally conform to the standards called for elsewhere in these specifications, particularly with regard to the approximate depths required for the work. After work is completed, inspect it to ensure that all finish grading complies with design requirements.

3.3 Place finished grade stakes wherever necessary to bring the work accurately to the elevations required by the drawings.

3.4 Finish grade all areas outside the building line to the depths Required for the work as follows:

3.5 Grade uniformly with rounded surfaces at the tops and bottom of abrupt changes of plans.

A. Hand grade steep slopes and areas that are inaccessible for machine work.

B. Protect graded areas from undue erosion, and repair and re-grade areas where erosion does occur.

C. Refill areas where noticeable settlement has occurred.

D. Finish grade areas that are to receive topsoil up to 4 inches below the finished contour elevations called for by the drawings or, over rock, to 12 inches below these elevations.

3.6 Place topsoil uniformly over disturbed areas that do not receive other work as follows.

A. Obtain approval of the finish grading from the A/E before starting to place topsoil.

B. Scarify subgrade to a depth of 6 inches.

C. Place the topsoil to a depth of 4 inches when lightly rolled or, on rock, to a depth of 12 inches.

D. Level the topsoil so that it slopes uniformly and has no water pockets.

E. Carefully rake the topsoil by hand to remove all clods, roots, sticks, stones over 1 inch in diameter, and other foreign materials from the surface.

3.7 Dispose of excess excavated materials and debris away from the site in a legal manner.

END OF SECTION

SECTION 312300-EXCAVATION AND FILL

PART 1 - PART 1- GENERAL

1.1 SECTION INCLUDES

A. Excavation to line, grade, and configuration as shown on Construction Drawings for proposed structures and future expansion areas.

B. Fill to line, grade, and configuration as shown on Construction Drawings for proposed structures and future expansion areas.

C. Compacting for materials in acceptable manner as specified herein.

1.2 RELATED SECTIONS

A. Section 311123 – Aggregate Material

B. The “Foundation Subsurface Preparation” as shown on the Construction Drawings and/or the Architectural-structural drawings and/or the “Report of Subsurface Exploration”, whichever is more stringent.

C. Construction drawings and Report of Subsurface Exploration.

1.3 REFERENCE STANDARDS

A. See Section 310000

1.4 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid for by Contractor, shall be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 310000 and as specified herein.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to excavating and filling for structures are not required unless otherwise shown on Construction Drawings or if contrary procedures to Contract Documents are proposed.

B. Submit 100-pound sample of each type of off-site fill material that is to be used in backfilling in air-tight container(s) to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the independent testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 310000 and approved by Geotechnical Engineer.

B. Fill material from off-site as specified in Section 310000 and approved by Geotechnical Engineer.

C. Aggregate material as specified in Section 321123.

2.2 EQUIPMENT

A. Transport off-site materials to the project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify lines, elevations, and grades necessary to construct building subgrades as shown on Construction Drawings.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Overexcavate and properly prepare areas of subgrade that are not capable of supporting proposed structures. Stabilize these areas by using acceptable geotextile fabrics or aggregate materials placed and compacted.

3.2 EXCAVATION

A. Excavate building areas to line and grade as shown on Construction Drawings being careful not to overexcavate beyond elevations needed for building subgrades.

B. Place suitable excavated material into project fill areas as specified in Section 312300.

C. Unsuitable excavated material is to be disposed of in a legal manner.

D. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.3 FILLING AND SUBGRADE PREPARATION

A. Building area subgrade pad shall be that portion of site directly beneath and 10-feet beyond building and appurtenances, including limits of future building expansion areas as shown on Construction Drawings.

B. Prepare building area subgrade pad in strict accordance with “Foundation Subsurface Preparation” as shown on the Construction Drawings and/or the architectural-structural

drawings, whichever is more stringent. Rock larger than 6-in. shall not be part of building subgrade fill.

C. Areas exposed by excavation or stripping and on which building subgrade preparations are to be performed shall be scarified to a minimum depth of 8-inches and compacted as per the geotechnical report included herein.

D. Place fill materials used in preparation of subgrade as per the geotechnical report included herein.

3.4 COMPACTION

A. Maintain optimum moisture content as specified above of fill materials to attain required compaction density.

B. Test materials in accordance with Section 310000.

C. Corrective measures for non-compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.5 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of materials equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 310000 and as more specifically specified herein.

B. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Tolerances of 0.10-feet, more or less, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION

SECTION 312313-EXCAVATION, BACKFILL AND COMPACTION FOR PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation to line, grade, and configuration as shown on Construction Drawings for proposed and future pavement areas.

B. Fill to line, grade, and configuration as shown on Construction Drawings for proposed and future pavement areas.

C. Compacting fill materials in acceptable manner as specified herein.

1.2 RELATED SECTIONS

A. Section 310000 – EarthworK

B. Section 321123 – Aggregate Materials

C. Construction Drawings and Report of Subsurface Exploration.

1.3 REFERENCE STANDARDS

A. See Section 310000.

1.4 QUALITY ASSURANCE

A. Independent Testing Laboratory, selected and paid by Contractor, shall be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 310000 and as specified herein.

1.5 SUBMITTALS

A. Shop drawings or details pertaining to excavating and filling for pavements are not required unless otherwise shown on Construction Drawings or if contrary procedures to Construction Documents are proposed.

B. Submit 100-pound sample of each type of off-site fill material that is to be used in backfilling in air-tight container to independent testing laboratory or submit gradation and certification of aggregate material that is to be used to independent testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 310000 and approved by Geotechnical Engineer.

B. Fill material from off-site as specified in Section 310000 and approved by Geotechnical Engineer.

C. Aggregate material as specified in Section 321123.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify lines, elevations, and grades necessary to construct pavements, curb, curb and gutter, bases, sidewalk, and roadways as shown on Construction Drawings.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify site utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Overexcavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted as described in Soils Report.

3.2 EXCAVATION

A. Excavate roadway and pavement areas to line and grade as shown on Construction Drawings.

B. Place suitable material into project fill areas as specified in Section 310000.

C. Unsuitable excavated material is to be disposed of in a legal manner.

D. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

3.3 FILLING AND SUBGRADE PREPARATION

A. Areas exposed by excavation or stripping and on which subgrade preparations for paving are to be performed, including future pavement areas, shall be scarified to minimum depth of 8-inches and compacted and proof roll as per the geotechnical report included herein. Excavate and recompact areas of failure as specified herein. Continual failure areas shall be stabilized in accordance with Section 312300 at no additional cost to Owner.

B. Place fill materials used in preparation of the subgrade in lifts or layers not to exceed 6-inches loose measure and compact as per the geotechnical report included herein.

C. Fill Material imported from off-site or fill material removed from onsite cut areas shall have CBR value equal to or greater than pavement design subgrade CBR value indicated in geotechnical report.

3.4 COMPACTION

A. Maintain optimum moisture content of fill materials as specified herein to attain required compaction density.

B. Test materials in accordance with Section 310000.

C. Corrective measures for non-complying compaction: Remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.5 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Section 312219 and as specified herein.

B. Check grading of paving areas by string line from grade stakes (blue tops) set at not more than 50-foot centers. Tolerances of 0.10-foot, more or less, will be permitted. Contractor is to provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION

SECTION 31 23 16 - FACILITY UTILITIES EXCAVATING AND BACKFILLING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Excavate and backfill trenches for all piping except irrigation system.

1.2 RELATED WORK

A. Section 014000 - Quality Control
   1. Testing Laboratory Services.

B. Section 310000 - Earthwork.

C. Section 334000 - Storm Drainage.

D. Section 334900 - Storm Drainage Structures

1.3 QUALITY ASSURANCE

A. Comply with requirements of local Department of Public Works.

B. Obtain required permits and notices.

1.4 PROTECTION

A. Shore and brace excavations to prevent caving as required.

B. Provide surface drainage to keep excavations clear of water. Pump if required.

C. Protect all existing on-site utilities, and City utilities at project site property lines.

1.5 COORDINATION

A. Coordinate with other trades affected by this work.

B. Schedule trench excavations so that pipes passing under foundations are in place and trenches are properly backfilled before foundations are placed.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. Crushed stone or clean natural gravel: ASTM D448, No. 6

B. Sand: ASTM C144.

2.2 EARTH FILL

A. Earth: Clean selected clay, silty clay, or sandy clay.

2.3 POLYETHYLENE LINER

A. Black polyethylene, 6 mils thick, minimum, or approved equal.

2.4 MULCH

A. Clean coarse hay.

PART 3 - EXECUTION

3.1 EXCAVATING ROCK

A. When rock is encountered which cannot be removed with backhoe and powered shovel, obtain instructions from Geotechnical Engineer before proceeding.

B. In excavated areas, backfill with aggregate and thoroughly compact.

3.2 EXCAVATING TRENCHES

A. Trenches may be excavated with trenching machines and backhoes, except as otherwise specified below.

B. Unless otherwise indicated, excavate trenches outside of building to a depth which will allow placement of pipes below frost line, but in no case less than 2'-0" cover.

C. Trenches which cross foundations inside of building, excavate to a depth which will allow placement of top pipes to hold pitch and meet connection points.

D. Service lines inside of building serving as distribution lines to individual fixtures may be placed in aggregate fill below concrete slab-on-grade, as specified below. Electric conduit below slabs-on-grade may be similarly placed.

E. Excavate trenches for bell hubbed pipe wide enough to allow for proper jointing, bedding, and visual inspection of at least the top half of pipe.
1. Excavate the bottom 6 inches of trenches with hand tools and make uniformly smooth. Scoop out bell holes so that the barrel of each length of pipe is uniformly supported.
2. Excavate trenches in rock 6 inches and backfill with sand to allow pipe to lay on sand bed.
3. Provide the following slopes on sewer and drain lines unless shown otherwise:
   a. Inside of building: 1/4" to 1'-0".
   b. Outside of building: 1/8" to 1'-0".

F. Earth Trenches for Copper, PVC, and Galvanized Pipe, and Electrical Conduit shall be excavated to a depth of 6 inches below bottoms of pipes in final position and backfill with sand. Tamp sand to settle it and provide smooth surface to uniformly support pipe.

Trenches may be narrow provided pipes can be properly bedded, connected, and inspected.

G. Sewer and Water Line Trenches:
1. Provide separate trenches. Allow at least 10 feet of undisturbed earth or controlled fill between sewer and waterlines.
2. Where sewer and waterlines are within 10 feet of each other, and where they cross, place sewer lines at least 18 inches below water lines.

3.3 PLACING PIPES IN FILL AGGREGATE

A. Cast iron, vitreous clay, and concrete pipe may be placed directly into trenches furrowed out in fill aggregate, but tops of piping shall be below bottoms of concrete slabs.

B. Where copper, PVC, corrugated metal pipe, or black pipe and electrical conduit are placed in fill, furrow out trenches to a depth which will allow tops of pipes to be below bottoms of concrete slabs after the following bedding is done. Line trenches in fill with a double layer of polyethylene sheeting; place at least 3" of sand on top of felt and tamp it smooth. After pipe is installed, back-fill over top of pipe with sand at least 3" deep, backfill to level of tip of fill.

3.4 BACKFILLING TRENCHES

A. Do not backfill utility trenches until pipes are installed, tested and approved.

3.5 PIPING OUTSIDE OF BUILDING

A. Cast iron, vitreous clay, corrugated pipe, and concrete pipe: Backfill with aggregate to 6” below adjacent grades in areas designated as lawns or plantings and place a thin dense layer of hay and finish backfilling with earth fill. Areas paved or covered by there construction shall be back-filled with aggregate to level of adjacent grades. In placing aggregate fills, work along sides and under bottom half to fully support pipes; then place fill on top of pipes in 8" lifts and tamp each lift for compaction.

B. Copper, PVC or black pipe and electrical conduit: Backfill with sand over tops of pipes. Use hand tools to backfill and compact sand along sides and bottoms of pipes to ensure their support. After sand has been tamped, backfill with aggregate and earth (as specified above for cast iron pipe) in areas designated as lawns or planted. In paved areas backfill as specified above for cast iron pipe.

3.6 BACKFILLING PITS

A. Do not backfill pits until installed items have been completed and tested.

B. Concrete masonry and cast iron items: Backfill with coarse aggregate. Place aggregate in one foot layers and compact each layer after placing. Where items are placed in lawn areas, fill with aggregate to one foot below adjacent grades, cover with straw or paper, and finish backfilling to grade with fill earth. Tamp and compact earth fill to the same density as adjacent grade materials. Where items are placed in areas

covered by paving or other hard surfaced construction, fill with coarse aggregate to existing grades.

3.7 CLEAN-UP

A. After other work of this Section is completed, leave area clean and free of debris.

B. Remove excess earth and rock remaining after backfill is completed from job site.

END OF SECTION

SECTION 31 25 13 - SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of temporary and permanent erosion control systems.

B. Installation of temporary and permanent slope protection systems.

1.2 RELATED SECTIONS

A. Section 310000 – Earthwork

B. Construction Drawings

C. Subsection 209 TDOT, standard specifications

D. Tennessee Department of Environment and Conservation Erosion and Sediment Control Handbook

1.3 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties and water resources from erosion and sediment damage throughout life of contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses as specified in Construction Drawings.

B. Hay or straw bales as specified in Construction Drawings.

C. Fencing for siltation control as specified on Construction Drawings.

D. Curlex blankets by American Excelsior Company or approved equal.

E. Bale stakes as specified in Construction Drawings.

F. Temporary mulches such as loose hay, straw, netting, wood cellulose, or agricultural silage.

G. Fence stakes shall be as specified in Construction Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review Construction Drawings and Storm Water Pollution Prevention Plan.

B. Deficiencies or changes on Construction Drawings or Storm Water Pollution Prevention Plan as it is applied to current conditions shall be brought to the attention of Engineer for remedial action.

3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion control systems in accordance with Construction Drawings and Storm Water Pollution Prevention Plan (SWPPP) or as may be dictated by site conditions in order to maintain the intent of the specifications and permits at no additional cost to Owner.

B. Engineer has authority to limit surface area of erodible earth material exposed by cleaning and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures. Contractor will be required to incorporate permanent erosion control features into project at earliest practical time to minimize need for temporary controls. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.

C. Maintain temporary erosion control systems as directed by Engineer or governing authorities to control siltation during life of contract. Contractor shall respond to maintenance or additional work ordered by Engineer or governing authorities within 48 hours or sooner if required.

D. Slopes that erode easily or that will not be graded for a period of 14 days or more shall be temporarily seeded as work progresses with Kentucky 31 Fescue application unless otherwise specified on the Construction Drawings.

E. In the event that sitework on this project will disturb one or more acres; the Contractor shall not begin construction without submitting a “Notice of Intent” as required by the Tennessee General Permit No TNR 10-0000, Construction General Permit (TNCGP) for Storm Water Discharges from Construction Activities. No construction activity shall begin until a “Notice of Coverage” (NOC) is received from the Tennessee Department of Environment and Conservation.

F. The contractor shall be totally responsible for conducting storm water management practices in accordance with the TNCGP, the Tennessee Erosion & Sediment Control Handbook, and the WWPPP and for enforcement action taken by or imposed by Federal or State agencies, including the cost of fines, construction delays, and remedial action resulting from the Contractor’s failure to comply with the provisions of the TNCGP.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Soil treatment with termiticide.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of termite control product.
   1. Include the EPA-Registered Label for termiticide products.

1.03 INFORMATIONAL SUBMITTALS

A. Product Certificates: For termite control products, from manufacturer.

B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Termiticide brand name and manufacturer.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes used, and rates of application.
   6. Areas of application.
   7. Water source for application.

C. Warranties: Sample of special warranties.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.

B. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

C. Source Limitations: Obtain termite control products from single source.

D. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.06 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Corporation, Agricultural Products; Termidor.
      b. Bayer Environmental Science; Premise 75.
      c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar or Prevail.
      d. Syngenta; Demon TC, Prelude or Probuild TC.
   2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
   1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.03 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.04 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
   1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
   3. Masonry: Treat voids.
   4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 31 16

SECTION 321100-PAVING BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction of granular base for asphaltic concrete and portland cement concrete paving.

B. Construction of sand/shell base for asphaltic concrete and portland cement concrete paving.

C. Construction of full depth asphalt base for asphaltic concrete paving

D. Construction hot-mix sand asphalt base for asphaltic concrete paving.

E. Construction of soil cement stabilized base for asphaltic concrete and portland cement concrete paving.

1.2 RELATED SECTIONS,

A. Section 310000 – Earthwork

B. Section 312313 – Excavation, Backfill, and Compaction for Pavement

C. Section 321123 – Aggregate Materials

D. Section 321600 – Curbs and Sidewalks

E. State Highway Department Standard Specifications

F. Construction Drawings

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) latest edition.
1. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft2) (600 kN.m/m2)
2. D 1556 Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. D 1557Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft2) (2,700 kN.m/m2)
4. D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
6. D 2487 Classification of Soils for Engineering Purposes.
7. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
8. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
9. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. American Association of State Highway and Transportation Official (AASHTO) latest edition
1. T88 Particle Size Analysis of Soils

1.4 QUALITY ASSURANCE

A. An independent testing laboratory selected and paid by Contractor, will be retained to perform construction testing of in-place base course for compliance with requirements for thickness,

compaction, density, and tolerances. Paving base course tolerances shall be verified by rod and level readings on not more than 50-foot centers to be not more than 0.05 feet above design elevation which will allow for paving thickness as shown on Construction Drawings. Contractor shall provide instruments and suitable benchmark.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Submit materials certificate to the independent testing laboratory which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

2.2 SOURCE QUALITY CONTROL

A. Following test will be performed on each type of material used as base course material:
1. Moisture and Density Relationship: ASTM D 698 (or ASTM D 1557).
2. Mechanical Analysis: AASHTO T 88.
3. Plasticity Index: ASTM D 4318.
4. Base material thickness: Perform 1 test for each 20,000 sq. ft. of in-place base material area.
5. Base material compaction: Perform 1 test in each lift for each 20,000 sq. ft. of in-place base material area.
6. Test each source of base material for compliance with state highway department specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with the requirements of applicable state highway department specifications section(s) referred to or noted on the Construction Drawings.

3.2 CONSTRUCTION

A. Construction shall meet or exceed requirements of this Section and applicable state highway department specifications section(s) referred to or noted on the Construction Drawings which pertain to aggregate base course design, materials, preparation, and execution. Materials shall be as indicated on Construction Drawings and shall comply with state highway department specifications regarding source, quality, gradation, liquid limit, plasticity index, and mix proportioning.

3.3 FIELD QUALITY CONTROL

A. Field density tests for in-place materials shall be performed in accordance with one of following standards:
1. Sand-Cone Method: ASTM D 1556.
2. Balloon Method: ASTM D 2167.
3. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission).

B. The independent testing laboratory will prepare reports that indicate test location, elevation data, and test results. Owner and Contractor shall be provided with copies of the reports within 96 hours of the time the test was performed. In the event that the test results show failure to meet any of the Specifications; Owner and Contractor will be notified immediately by the independent testing laboratory.

C. Costs related to retesting due to failures shall be paid for by Contractor at no additional expense to Owner. Contractor shall provide free access to the site for testing activities.

END OF SECTION

SECTION 32 11 23 - AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate materials for use as specified in other sections.

1.2 RELATED SECTIONS

A. Section 310000 – Earthwork

B. Section 312300 – Excavation, Backfill, and Compaction for Structures

C. Section 312313 – Excavation, Backfill, and Compaction for Pavement

D. Section 312513 – Slope Protection and Erosion Control

E. Construction Drawings and Report of Subsurface Exploration

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition.
1. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft2)(600 kN.m/m2)
2. D 1556 Density and Unit Weight of Soil In Place by the Sand-Cone Method.
3. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft2) (2,700 kN.m/m2)
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6. D 2487 Classification of Soils for Engineering Purposes.
7. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
8. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
9. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
1. TT 88 Particle Size Analysis of Soils

1.4 QUALITY ASSURANCE

A. Tests and analysis of aggregate materials will be performed in accordance with ASTM and AASHTO procedures specified herein.

1.5 SUBMITTALS

A. Submit 100-pound sample of each aggregate or mixture that is to be incorporated into project in air-tight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be incorporated into project to the Engineer for review.

B. Submit name of each material supplier and specific type and source of each material. Any change in source requires approval of Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Construction and materials shall meet or exceed requirements of this Section and applicable state highway department specifications section(s) referred to or noted on the Construction Drawings which pertain to paving base course design, materials, preparation, and execution. Materials shall be as indicated on Construction Drawings and shall comply with state highway department specifications regarding source, quality, gradation, liquid limit, plasticity index, and mix proportioning.

2.2 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger any improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile on-site at locations indicated by Owner in such manner that there will be no standing water or mixing with other materials.

3.2 BORROW AND SPOIL SITES

A. Upon completion of borrow and/or soil operations, clean up borrow and/or soil areas as indicated on Construction Drawings in neat and reasonable manner to satisfaction of property owner and Owner.

END OF SECTION

SECTION 321600-CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation and placement of combination portland cement concrete curb and gutter.

B. Preparation and placement of portland cement concrete curb.

C. Preparation and placement of portland cement concrete sidewalk.

1.2 RELATED SECTIONS

A. Section 310000 – Earthwork

B. Section 321123 – Aggregate Material.

C. Cast-in-place Concrete (See Architectural/Building Specifications).

D. State Highway Department Standard Specifications.

E. Construction Drawings.

1.3 REFERENCE STANDARDS

A. American Concrete Institute (ACI) latest edition.
1. 304R Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
2. 308 Standard Practice for Curing Concrete.

B. American Society for Testing and Materials (ASTM) latest edition.
1. A615 Deformed and Plan Billet-Steel for Concrete Reinforcement.
2. C33 Concrete Aggregates.
3. C94 Ready-Mixed Concrete.
4. C150 Portland Cement
5. C260 Air-Entraining Admixtures for Concrete
6. C309 Liquid Membrane-Forming Compounds for Curing Concrete
7. C494 Chemical Admixtures for Concrete
8. D1751 Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

C. FS TT-C-800 – Curing Compound, Concrete, for New and Existing Surfaces.

1.4 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations.

B. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

1.5 SUBMITTALS

A. Submit materials certificate to the independent testing laboratory which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

1.6 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to from radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

B. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.

C. Concrete Materials: Comply with requirements of Section 033000 for concrete materials, admixtures, bonding materials, curing materials, and others as required.

D. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751, FS HH-F-341, Type II, Class A.

E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn “Sonolastic Paving Joint Sealant, Sonneborn “Sonomeric CT 1 Sealant”, Sonneborn “Sonomeric CT 2 Sealant, Mameco “Vulken 245”, or Woodmont Products “Chem-Caulk”.

2.2 MIX DESIGN AND TESTING

A. Concrete mix design and testing shall comply with requirements of Section 03300.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:

C. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on Construction Drawings.

D. Slump Range: 2 to 5 inches at time of placement.

E. Air Entrainment: 5 to 8 percent.

PART 3 - EXECUTION.

3.1 PREPARATION

A. Proofroll prepared base material surface to check for unstable areas. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction:
1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:
4. Top of forms not more than 1/8-inch in 10'-0".
5. Vertical face of longitudinal axis, not more than ¼-inch in 10'-0".
6. Clean forms after each use and coat with from release agent as often as required to ensure separation from concrete without damage.

B. Concrete Placement:
1. Place concrete in accordance with requirements of Section 033000.
2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.
3. Place Concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowel, and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible, If interrupted for more than ½ hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.

C. Joint Construction:

1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/8-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with ¾-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold its shape, but shall be removed while forms are still in place.
2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with ½-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement

D. Joint Filler: Extend joint fillers full-width and depth of joint, and not less than ½-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

E. Joints Sealants: Seal joints with approved exterior pavement joint sealants. Install in accordance with manufacturer's recommendations.

3.3 INSTALLATION PROCEDURES

A. The area to receive imprinted concrete shall have the sup-grade prepared as required as for any concrete slab on grade.

B. The formwork shall be installed in accordance with the drawings. The slab thickness shall be consistent with that of ordinary concrete slabs under the same conditions.

C. Provide reinforcement as specified.

D. Control joints and/or expansion joints shall be provided in accordance with the drawings and the guidelines established by the American Concrete Institute. As with any concrete slab, imprinted concrete usually contains construction joints, control joints and expansion joints. The contractor shall advise and work with the architect/engineer to determine the best location for these joints to minimize the visibility of the joints and to minimize unsightly cracking.

E. The concrete shall be placed and screeded to finished grade, and floated to a uniform surface using standard finishing techniques.

F. While the concrete is still in its plastic stage of set, the imprinting tools shall be applied to the surface.

G. Cure and Seal, or approved equal shall be applies in accordance with the manufacturer's recommendations immediately after the completing the imprinting process for.

H. After the initial curing period the surface of the slab shall be sealed.

3.4 BACKFILL

A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with geotechnical report.

3.5 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION

SECTION 32 80 00 – IRRIGATION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Design of an irrigation system on a design build basis and preparation of shop drawings of proposed layout for submission to, and approval by, the Owner's Representative.

B. Complete, operable irrigation system.

1.02 RELATED WORK

A. Division 1: Submittals

B. Division 1: Product Data, and Samples

C. Division 1: Project Close Out

D. Section 31 22 13: Site Excavation

E. Section 32 92 19: Seeding

F. Section 32 92 23: Sodding

G. Section 32 93 10: Trees, Plants, and Groundcovers

H. Division 16: Electrical work other than 24V wiring.

1.03 QUALITY ASSURANCE

A. Comply with requirements of local Codes Department jurisdiction.

B. Obtain required permits and notices.

C. Contractor to be a Hunter, Toro or Rainbird certified installer.

1.04 PROTECTION

A. Protect existing on-site construction. Existing plants and trees, and miscellaneous landscape to remain.

1.05 COORDINATION

A. Coordinate this work with other trades whose work is affected, so that work is performed in a systematic sequence.

1.06 SUBMITTALS

A. Submit items to Owner's Representative in accordance with Division 1.

B. Submit six copies of manufacturer's product data describing piping and components of system.

C. Prepare a shop drawing illustrating proposed irrigation head layout and fixture specifications, piping diagram with sizes and controller information.

DELIVERY AND HANDLING

A. Deliver mechanical and electrical components in manufacturer's unopened packaging.

B. Store materials in accordance with manufacturer's recommendations.

1.07 PROJECT RECORD DRAWING

A. Neatly mark a clean blue line print to indicate actual locations of underground pipes, valves, sprinkler heads, and control items. Identify locations by dimensioning from building walls or other fixed points, and depth below surface.

B. Upon final inspection, deliver marked drawing to Owner's Representative.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Irrigation components to be manufactured by Hunter, Rainbird, Toro, Inc. or approved equivalent.

B. Provide a system where all components are compatible.

2.02 PIPING

A. Pipe 3/4" through 1-1/2" diameter: PVC, Class 200, Type 1120 or 1220,meeting requirements of CS-256-63.

B. Pipe 2" through 4" diameter: PVC, Schedule 40, with bell and spigot joints.

C. Provide pipe continuously marked its entire length with identity of manufacturer, type, class, and size.

2.03 FITTINGS

A. Fittings for pipe 3/4" through 1-1/2" diameter: PVC, Schedule 40, Type 1, domestic manufacturer, and marked to identify pressure rating or schedule number.

B. Fittings for bell and spigot pipe: PVC, un-plasticized, or asbestos-cement with brass inserts for threaded outlets. Provide fittings by manufacturer of pipe supplied.

C. Make connections between plastic pipe and metal valves and piping with threaded fittings, using male plastic adapters.

2.04 PIPE SLEEVES (CONDUITS)

A. PVC pipe, Schedule 40 of sizes to fit conditions.

2.05 ELECTRICAL CONDUIT

A. Rigid conduit: Hot-dip galvanized, or electrogalvanized with matching couplings and connections. Size to suit conditions.

2.06 RISER AND SWING JOINT NIPPLES

A. Poly Pipe, with insert fittings:

1. For sprinklers with 6.5 gpm demand: 3/8" inside diameter pipe.
2. For sprinklers with 12 gpm demand: 3/4" inside diameter pipe.

2.06 SOLVENT CEMENT

A. Make joints in PVC pipe and fitting with solvent cement recommended by pipe manufacturer.

2.07 CONTROL WIRING

A. Wire: Time conductor, UL approved, 14 gauge, 24 volt, direct burial wire with insulation color different to 115V service to equipment.

B. Ground: Single strand, UL approved, 14 gauge, direct burial wire with insulation color different to 24 volt and 115V wiring.

C. Splicing Kits: Waterproof Scotchlok or Pen-Tite kits.

2.08 CONTROL EQUIPMENT

A. Automatic Controller: Rainbird, Toro Vision II, or approved equal, with program features for operation sequences specified herein. Size and type is indicated on the plans. Features required:

1. Field adjustable for minor timing adjustments.
2. No time lag in sprinkling operations where controller switches between sections or stations.
3. Continued manual operation if timing mechanism is removed.
4. Water conservation programming capability.

Provide surge protection with the controller unit.

B. Controller Enclosure: A sturdy, lockable, mounting box, easily accessible for maintenance.

C. Automatic Control Valves: Toro Co., or approved equal, compatible with the automatic controller (as noted below).

2.09 RAIN GAUGE SENSOR

A. Toro, Rainbird, or approved equal moisture sensor.

2.10 SPRINKLER HEADS:

A. Hunter, Rainbird, Toro, or approved equal.

2.11 GATE VALVES AND BOXES

A. Valves for main irrigation line: Brass with screwed connections, non-rising valve stem, cross handle, minimum rated working pressure of 150 psi.

B. Boxes: Amatex valve boxes with covers. Types and sizes are indicated.

2.12 SERVICE SADDLES

A. Smith - Blair, double strap, all bronze.

2.13 BACKFILL MATERIAL

B. Topsoil: Natural, fertile, friable, productive soil, neither excessively acid nor alkaline, and free from toxic substances, stones, weeds, clay, clods, roots, cinders and debris.

C. Aggregate: Crushed stone or clean natural gravel, ASTM D448, Size 16-6.

PART 3 - EXECUTION

3.01 PREPARATION

A. Stake out sprinkler locations before starting excavation work. Obtain approval of Owner's Representative before proceeding.

3.02 TRENCHING AND BACKFILLING

A. Trenching: Provide smooth bottoms to allow pipe to be uniformly supported over its entire length. All pipe shall be below the freeze depth and at least 18 inches below finish grade as determined by Owner's Representative.

1. Trench sizes:
   a. For pipe 2" diameter and over: 2" wider than pipe with 12" minimum earth cover over top of pipe.
   b. For pipe up to 2" diameter: 2" wider than pipe with 8" minimum earth cover over pipe.
2. Trenches under paved areas:
   a. Wherever possible install pipes in PVC sleeves before pavements are placed.
   b. Trench depth of pavement subgrade plus depth required to place aggregate below pipe, and so top of pipe is even with or below sub-grade level.
   c. If necessary to cut through existing pavements, cut pavements to width of trench and excavate to subgrade plus depth required. See b. above. When pipe is installed and tested, neatly replace base material and pavements.
3. Trenching in sodded areas; remove and preserve sod. Perform trenching when pipe has been installed and tested, backfill trenches and restore sod.
4. Do not trench closer than 5'-0" to any tree.

B. Backfilling:

1. Material removed in trenching operations may be reused provided it meets requirements for specified topsoil.
2. Backfill trenches with specified topsoil. Place topsoil by hand in 6" lifts and tamp for compaction. Compact to a minimum density of 90% maximum dry density, ASTM D-698. Finish surface with a slight crown to allow for settlement.

C. Backfill only when pipe is cool. Pipes may be cooled by circulating water in pipe.

D. Where trenches run under pavement, place specified aggregate in trenches below pipe, and over pipe to depth matching aggregate base under pavement.

3.03 INSTALLING PIPES

A. Install piping in accordance with manufacturer's printed instructions.

B. Where pipes run under pavements install pipe in PVC pipe conduit (sleeve) and extend conduit 12" beyond each edge of payment.

C. Pipe 3" diameter and larger: Install concrete thrust blocks at changes in direction.

D. Before installing lateral lines, flush main system and pressure test for 24 hours. Repair leads and retest until leaks are topped.

3.04 INSTALLING VALVE BOXES

A. Install valves to allow for isolating sections of system, and for draining system. System must drain in such a manner to preclude pipe breakage due to freezing.

B. Excavate for valve and drain boxes and allow 2" below bottom of pipe for aggregate fill.

C. Install valve boxes and aggregate fill.

D. Backfill around boxes with topsoil and compact.

3.05 INSTALLING SPRINKLER HEADS

A. Install sprinkler heads on swing joints in accordance with manufacturer's printed instructions.

B. Install so that top of each head is slightly above finished grade. Do not install sprinkler heads until finished grading is complete.

C. Backfill around swing joints and sprinkler heads with specified topsoil.

3.06 INSTALLING CONTROL WIRING

A. Install wire without kinks or bends. Tape together at two foot intervals and then this bundle shall be taped to the side of the main line at five foot intervals with at leas two wraps of electrical tape.

B. Where wires run under paving, install wires in PVC pipe conduit (sleeve) and extend conduit 12" beyond each edge of pavement.

C. Install wiring in accordance with manufacturer's printed instructions and applicable codes.

3.07 INSTALLING CONTROL EQUIPMENT

A. Install control equipment where indicated and in accordance with manufacturer's written instructions.

3.08 TESTING

A. Upon completion, test entire system for proper operation.

B. Flush air from the entire system.

C. Apply a continuous, static water pressure of 60-40 psi with the risers capped. Apply pressure to:

1. Main lines and submain lines for 12 hours.
2. Lateral lines for 2 hours.

D. Repair leaks and retest until leaks are stopped.

3.09 BALANCING AND ADJUSTING

A. Balance and adjust components of sprinkler system so that overall operation is efficient.

1. Synchronize controllers.
2. Adjust pressure regulators and pressure relief valves.
3. Adjust sprinkler heads; if required.
4. Adjust individual station control if required.

3.10 WINTERIZATION OF SYSTEM

A. Turn-off and winterize entire systems to prevent freezing damage at the end of watering season during the first year.

B. Turn on in Spring and check to ensure proper operation for the coming season in first year.

C. Repair damage resulting from freezing water in lines and improper winterizing of system during first year.

3.11 TRAINING OWNER'S DESIGNATED EMPLOYEES

A. Train Owner's designated personnel in operation, care and maintenance of the system and provide data as required.

B. Have a trained, qualified person, thoroughly familiar with individual system, conduct training session.

C. Allot one full day for training.

3.12 CLEAN-UP

A. Clean up grounds and sprinkler system.

B. Remove excess material, excess earth, rock, and equipment from project site.

END OF SECTION

SECTION 32 92 19 - SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Preparation of lawn area including loosening, pulverizing and fertilizing.

B. Placement of seed, including mulch, where required.

C. Watering of lawn areas.

1.02 RELATED WORK

A. Section 31 11 00: Clearing and Grubbing

B. Section 31 23 40: Backfilling and Finish Grading

1.03 SUBMITTALS

A. Submit certification of seed species and purity.

B. Submit 12 x 12 inch samples of establishment blanket. If erosion control fabric is proposed for use, also submit catalog data for fabric.

1.04 DEFINITIONS

A. Weeds: Includes Bent Grass, Bermuda Grass, Bindweed, Blackberry, Brome Grass, Canadian Thistle, Chickweed, Crabgrass, Cress, Dandelion, Horsetail, Jimsonweed, Johnson Grass, Lambsquarter, Morning Glory, Mustard, Nimble Will, Nutgrass, Nut Sedge, Perennial Sorrel, Poison Ivy, Poison Oak, Quackgrass, Rush Grass, Tansy Ragwort, and Wild Garlic.

1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies having jurisdiction for fertilizer and herbicide composition.

1.06 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver products under provisions of Division 1 of the Specifications.

1. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

2. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of the manufacturer.

B. Store and protect products under provisions of Division 1 of the specifications.

1.08 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 - PRODUCTS

2.01 LAWN SEED

A. Fresh, clean, and new crop italicized seed mixture.

B. Seed to be composed of the following varieties, mixed to the specified proportions by weight and tested to minimum percentages of purity and germination. Poa annua, bent grass and noxious weed seed free.

Coordinate turf-grass blends with Sod Blends.
Approved varieties include but are not limited to:

RATE: 8 lbs. per 1,000 S.F.

		Parts	Purity	Minimum Germination
'Bonanza'	Tall Fescue	40%	97%	90%
'Arid'	Tall Fescue	30%	97%	90%
'Trident"	Tall Fescue	30%	97%	90%

Grass seed blend for planting from April 1 through October 1. Seeding performed after October 1st (with Owner's permission) shall have 20% of the mix in Pennfine Perennial Ryegrass.

C. Provide final seed blend and tag to Landscape Architect as a shop drawing submittal For review

2.02 SOIL AMENDMENT MATERIALS

A. Commercial fertilizer: Commercial grade fertilizer recommended for grass, grade 6/12/12, with 50% of the elements derived from organic sources.

B. Agricultural limestone: Finely pulverized limestone (calcium carbonate) containing at least 45% calcium oxide. Pulverize so that residue on #30 and #200 sieves is not more than 0.5% and 15%, respectively.

2.03 ACCESSORIES

A. Mulching material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Establishment blanket: "HoldGro" erosion control fabric by Gulf States Paper Corporation, or a uniform open weave jute matting.

C. Herbicide: Treflan herbicide.

D. Water: Clean, fresh and free from substances or matter which could inhibit vigorous growth of grass.

E. Substitutions: Materials of the same function and performance are acceptable under provisions of Division 1 of Specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that prepared soil base is ready to receive work of this Section.

B. Cultivate topsoil to a depth of 4 inches with a mechanical tiller. Cultivate inaccessible areas by hand. Rake until surface is smooth.

C. Remove foreign materials collected during cultivation and raking operations from the Project site.

D. Eliminate rough spots and low areas where ponding may occur. Maintain smooth uniform grade.

E. Finish ground level, firm and sufficient to prevent sinkage pockets from irrigation.

3.02 APPLYING SOIL AMENDMENT MATERIALS

A. Apply at the rate of 18 lbs per 1,000 sq. ft. for commercial fertilizer, and a rate of 100 lbs per 1,000 sq. ft. for agricultural limestone. Commercial fertilizer and agricultural limestone may be applied in one operation.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at the same time or with the same machines as will be used to apply seed.

D. Mix thoroughly in the upper 2 inches of topsoil.

E. Lightly water to aid breakdown of fertilizer, and to provide moist soil for seed.

3.03 SEEDING

A. Perform seeding only during appropriate planting conditions. Approximate planting season dates range from April 1 to October 1.

B. Apply seed at a rate of (8) lbs per 1,000 sq. ft. evenly in two intersecting directions. Rake in lightly. Do not seed area in excess of that which can be mulched on the same day.

C. Do not sow immediately following rain, when ground is too dry, or during windy periods.

D. Roll seeded area with roller not exceeding 112 lbs.

E. Immediately following seeding and compacting, apply mulch at the rate of one bale per 1,000 sq. ft. Maintain clear of trees and shrubs.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to a depth of 4 inches

3.6 SEEDING / HYDROSEEDING

A. Sow seed during the periods indicated below unless otherwise approved by the D/B Contractor. Do not sow seed when weather conditions are unfavorable, such as during drought or high winds.

1. Warm season grasses: Between April 15 and September 1, or when the ground temperature is consistently above 65 degrees Fahrenheit (F).

2. Cool season grasses: Between September 1 and April 15, when temperatures consistently are above 40° F.

3. If seeding of warm season grasses cannot occur within the specified period, seed with perennial ryegrass at the specified rate. The following spring, the Landscape Subcontractor shall apply herbicide, till, fine grade and sow specified warm season grass at the specified rate.

B. Hydroseeding: Mix specified seed, fertilizer, tackifier, and fiber mulch in water, using equipment specifically designed for hydroseed application.

1. Mix water and tackifier in accordance with manufacturer's recommendations.

2. Add mulch to mixture. For slopes less than 5%, apply mulch at a minimum rate of one thousand (1,000) pounds per acre dry weight, but not less than the rate required to obtain specified seed-sowing rate. For slopes greater than 5% but less than 25%, increase mulch to one thousand, five hundred (1,500) pounds per acre, For slopes greater than 25%, but less than 33%, increase mulch to two thousand (2,000) pounds per acre.

3. Add seed and fertilizer at specified rates.

4. Perform two-step hydroseeding / hydromulching for seed mixtures indicated on the drawings, and perform as directed or noted.

C. Seed Drilling - Perform drill seeding using approved equipment such as cultipacker seeders, grass seed drill, or wildflower seeder. Apply seed parallel to the slope of the ground, perpendicular to the flow of surface water where possible.

A. Water all seeded areas thoroughly and immediately with a fine mist until soil is soaked to a depth of three (3) inches. Maintain soil in a moist condition until seeds have sprouted and reached a height of one inch. Water thereafter at least once every seven (7) days, or as required to promote vigorous growth without overwatering, unless natural rainfall has provided sufficient watering.

3.04 SEED PROTECTION

A. Cover seeded slopes where grade is 4 inches/foot or greater with establishment. Roll blanket down slopes without stretching or pulling.

B. If erosion control fabric is used, install in accordance with the manufacturer's printed instructions. If jute matting is used, install as follows:

1. Lay matting smooth on soil surface, burying top end of each section in narrow 6 inch deep trench. Maintain 12 endlaps (top over bottom) and 4 inch sidelaps. Backfill trench and rake smooth and level with adjacent soil.
2. Secure outside edges and overlaps at 36 inches oc.
3. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
4. In ditches, lay fabric laps in direction of water flow. Overlap ends and edges 6 inches with upstream section on top.

3.05 MAINTENANCE

A. Mow grass at regular intervals to maintain a height of between 2 and 3 inches. Do not cut more than one-third of the grass blade at any one mowing.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming if clippings are not bagged during mowing operation.

D. Water to prevent grass and soil from drying out.

E. Control growth of weeds. Apply herbicides in accordance with the manufacturer's printed instructions. Remedy damage resulting from improper use of herbicides.

F. Immediately reseed areas which show bare spots.

G. Protect seeded areas with warning signs during maintenance period.

H. Maintenance period shall remain in effect until final acceptance of the project.

END OF SECTION

SECTION 32 92 23 - SODDING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all of the labor, materials, equipment, and services required to furnish and install the sodding. The work shall include, but not be limited to, the following:

1. Soil preparation.
2. Sodding lawns, and other indicated areas.

1.02 RELATED WORK

A. Section 32 92 19: Seeding
B. Section 32 93 10: Trees, Plants, and Groundcovers

1.03 QUALITY ASSURANCE

A. Comply with Division 1 requirements.

B. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

C. Provide and pay for materials testing. Testing agency shall be acceptable to the Architect. Provide the following data:

1. Test representative material samples proposed for use.
2. Topsoil: pH factor Mechanical analysis Percentage of organic content Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.04 SUBMITTALS

A. Submit sod growers certification of grass species. Identify source location.

1.05 DELIVERY, STORAGE AND HANDLING

A. Cut, deliver and install sod within a 24-hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind, and dehydration prior to installation.
3. Do not tear, stretch, or drop sod during handling and installation.

1.06 PROJECT CONDITIONS

A. Work notification: Notify Architect at least 7 working days prior to start of sodding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.

C. Perform sodding work only after planting and other work affecting ground surface has been completed.

D. Provide hose and lawn watering equipment as required to establish sod.

E. Where applicable, the irrigation system will be installed prior to sodding. Locate, protect, and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations at the Contractor's expense.

1.07 WARRANTY

A. Provide a uniform stand of grass by watering, mowing, and maintaining lawn areas until final acceptance. Resod areas, with specified materials, which fail to provide a uniform stand of grass until all affected areas are accepted by the Architect.

PART 2 - PRODUCTS

2.01 SOD

A. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; viable and capable of growth and development when planted.

B. An "approved" nursery grown blend of Select Turf-Type Tall Fescue Blend, for areas to be sodded lawn. Landscape Contractor shall submit proposed turf blend, sod farm/source data, and tags as a shop drawing submittal for review and approval. Final turf-grass selections shall be coordinated with and approved by landscape architect.

1. Sod containing Common Bermudagrass, Quackgrass, Johnsongrass, Poison Ivy, Nutsedge, Nimblewill, Canada Thistle, Timothy, Bentgrass, Wild Garlic, Ground Ivy, Perennial Sorrel, or Bromegrass weeds will not be acceptable.
2. Furnish sod machine stripped in square pads or strips not more than 3'-0" long; uniformly 1" to 1" thick with clean cut edges. Mow sod before stripping.

2.02 SOIL AMENDMENT MATERIALS

A. Commercial Fertilizer: Granular, non-burning product compound of not less than 50% organic slow acting, guaranteed analysis professional fertilizer. Grade 6-12-12.

B. Lime: Ground limestone, dolomite type, with minimum of 95% carbonates.

2.03 WATER

A. Free of substance harmful to sod growth. Hoses or other methods of transportation furnished by Contractor.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine finish surfaces, grades, topsoil quality and depth. Do not start sodding work until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Limit preparation to areas which will be immediately sodded.

B. Loosen topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.

C. Grade lawn areas to a smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions as required to drain.

D. Apply fertilizer at a rate of 18 lbs per 1,000 sq. ft. Adjust proportions based upon recommendations resulting from soil test. Mix thoroughly into upper 2 inches of topsoil.

E. Dampen dry soil prior to sodding

F. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.03 INSTALLATION

A. Sodding:

1. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
2. Do not lay dormant sod or install sod on saturated or frozen soil.
3. Install initial row of sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
4. Water sod thoroughly with a fine spray immediately after laying.
5. Roll with light lawn roller to ensure contact with sub-grade.
6. Sod indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.
7. On slopes of two to one or steeper, pinning or pegging may be required to hold the sod in place.

3.04 MAINTENANCE

A. Maintain sodded lawns until completion and acceptance of the entire project.

B. Maintain sodded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Architect.

1. Water sod thoroughly every 2 to 3 days, as required to establish proper rooting.

2. Repair, rework, and resod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.
3. Mow lawn areas as soon as lawn top growth reaches a (3") height. Cut back to (2") height. Repeat mowing as required to maintain specified height. Not more than 40% of grass leaf shall be removed at any single mowing.

C. Apply herbicides as required to control weed growth or undesirable grass species.

D. Apply fungicides and insecticides as required to control diseases and insects.

3.05 ACCEPTANCE

A. Inspection to determine acceptance of sodded lawns will be made by the Architect, upon Contractor's request. Provide notification at least 7 working days before requested inspection date.

1. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even colored Viable lawn is established, free of weeds, undesirable grass species, disease, and insects.

B. Upon acceptance, the Owner will assume lawn maintenance.

3.06 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from sodding operations.

END OF SECTION

SECTION 32 93 10 - TREES, PLANTS AND GROUNDCOVER

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all labor, equipment, materials and services necessary to complete the Work of this Section including:

1. Providing and installing trees, shrubs, groundcovers, sod and seed for landscape planting.
2. Fine grading of topsoil for all exterior areas to receive planting, mulch, or seed as specified.
3. Specified Maintenance Period and One-Year Guarantee Period.
4. Irrigation Work shall be provided as a subcontract to the Work of this Section.

1.01 RELATED WORK

A. Section 31 23 40: Backfilling and Finish Grading

B. Section 32 80 00: Irrigation System

1.02 QUALITY ASSURANCE

A. Codes and Standards:

1. All plant materials to comply with State and Federal laws relating to inspection for disease and insect control.
2. Plant material size and grades to conform to "American Standard for Nursery Stock."
3. American Association of Nurserymen, Inc. Latest approved revision, ANSI Z-60-1.
4. Plant material nomenclature to conform to:
   a. "Standardized Plant Names" as adopted by the Joint Committee of Horticulture Nomenclature, latest revision.
   b. Names not listed in the above standard to comply with those most commonly used in the trade.
   c. In all cases, botanical names take precedence over common names.

B. Qualification of Personnel: Use adequate numbers of skilled workmen trained and experienced in the Work and familiar with requirements and methods needed for performance of the Work. At all times during planting operations, have on the site in a supervisory role a man knowledgeable in horticultural practices as defined in 3.08 Maintenance D.1 a-c herein.

C. Inspection and Approval:

1. All plant material is subject to inspection and approval in the field or nursery before digging, by the Landscape Architect.
2. All plant materials and other materials are subject to inspection and approval at the site before planting or placing or at any other time.
3. Attach secure, durable, legible waterproof labels, stating correct botanical and common names as specified, to at least one plant, bundle or container of each plant variety.
4. Immediately remove from the site plant materials or other materials not complying with specified requirements.
5. Approval is for visual qualities only and does not relieve the Contractor of his obligation to provide materials and workmanship in full compliance with all specifications.

1.03 SUBMITTALS

A. Materials Lists:

1. On the bid date, bidder shall be prepared to submit a complete list of materials demonstrating source, availability, and conformance with requirements specified.
2. For trees not specified as pre-selected and tagged, submit color photographs of representative plants with materials unit price list to the satisfaction of the Landscape Architect.
3. Substitutions not permitted unless proof is submitted to Landscape Architect's satisfaction that the material is unavailable as specified.

B. Maintenance Manual: In 3-ring binder, typewritten schedule and procedures for annual landscape maintenance, by Contractor to Owner and Landscape Designer.

1.04 PRECAUTIONS

A. Examine conditions under which Work is to be performed and notify the Landscape Architect of unsatisfactory conditions.

B. Determine locations of underground utilities and perform Work in a manner, which will avoid all possible damage. Hand excavate as required.

1.05 COORDINATION

A. Coordinate the Work of this Section with that of other trades.

B. Do not perform the Work until conditions are satisfactory and acceptable.

C. Maintain stakes set by others until all parties mutually agree upon removal.

D. Inform Landscape Architect in writing, prior to planting, of conditions existing which could be considered detrimental to the successful planting and growth of any plant material, including but not limited to subsurface drainage conditions, utility locations, subgrade compaction, percolation, rate and elevations.

1.06 HANDLING, DELIVERY AND STORAGE

A. Deliver packaged material in manufacturer's original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the site.

B. Deliver all non-packaged or non-containerized materials to site in a manner that will prevent loss, damage, deterioration or contamination.

C. Store all materials in approved locations and to prevent loss, damage, deterioration or contamination.

D. Delivery, storage and handling of all plant materials shall conform to the following:

1. Deliver freshly dug plants, which have not been in cold storage or healed-in.
2. Do not prune prior to delivery.
3. Do not bend or bind trees or shrubs on such a manner as to damage bark, break branches or destroy natural shape.

4. Provide protective covering during delivery.
5. Deliver plants after preparations for planting have been completed and approved. Plant immediately.

1.07 SITE MAINTENANCE

A. Keep roads, paving and structures adjacent to planting operations clean and free of obstructions, mud and debris at all times.

B. Do not permit flushing of roads or disposal of dirt or debris into sewers or drainage ditches.

C. Control dust from planting operations.

D. Remove trash, debris and rejected materials from the site daily as the work progresses.

1.08 PLANTING SEASON

A. A period of acceptable weather conditions, during seasons in which satisfactory results can be expected as determined by acceptable practice in the locality or approved by the Landscape Architect.

B. Commence planting operations as soon as portions of the site are available, as approved by the Landscape Architect.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS

A. Plant Material:

1. Definition: trees, shrubs and groundcover listed in the Plant Schedule in the Drawing.
2. General:
   a. Species, size, manner in which to be planted, and approximate quantities to complete planting as indicated are included in the Plant Schedule. It is the Contractor's responsibility to check these quantities to allow for the correct quantity of plants based on the plan. Any discrepancies should be pointed out to the Landscape Architect prior to bid.
   b. Plants shall remain the property of the Contractor until Substantial Completion.
   c. Scientific and common plant names conform to those given in Standardized Plant Names or are those generally accepted in the nursery trade.
3. Quality:
   a. Standard quality and first-class representative of their species or variety and true to name and type. Plants, which are not of the highest quality, will be rejected.
   b. Nursery-grown, unless specified otherwise.
   c. In compliance with State and Federal laws relating to disease.
   d. Having normal, well-developed branches and vigorous root systems.
   e. Healthy, vigorous, free from defects, decay and disfigurements, sunscald injuries, abrasions of the bark, plant disease, insect pests or eggs, borers, and all forms of infestations or objectionable disfigurements.
   f. Reject plants lacking compactness or proper proportions, plants that are weak or thin or are injured by too close planting in nursery rows.
   g. Plants which have been cut beck from larger grades to meet certain specified requirements will be rejected.

h. Plants with undersized, dry, cracked or broken balls, or which are loose in their balls will be rejected.
i. B & B material: Root-pruned within the last two years.
j. Container-grown material: Grown for one growing season in the container in which it is delivered; free from weeds and grasses. Root bound material will be rejected.

4. Size:
   a. Sizes and proportions shall be equal to those recommended by the "American Standard for Nursery Stock" for specified grades.
   b. Measure plants before pruning and with branches in normal position.
   c. Equal or exceed measurements specified in Plant Schedule, which are the minimum acceptable; provide at least 50% of the plant material at the maximum size specified.
   d. Height and spread dimensions: General body mass of plant, not from branch tip to tip.
   e. Well-proportioned as to height; reject plants which meet specified measurements but do not possess an overall balance.
   f. Take caliper measurements on trunk 6 inches above natural ground level up to and including 4-inch caliper size; 12 inches above natural ground level for larger sizes.
   g. B & B plants shall generally follow the code of standards in the "American Standard for Nursery Stock" pertaining to measurements, branching, grading, quality and balling and burlapping of plants.
   h. Container-grown plants: conform to standards set forth in "American Standard for Nursery Stock for container-grown plants.
5. Quantity: Furnish plants in sufficient quantity to satisfy the intent of Drawings and Specifications. Locate in sufficient quantity so that time is not lost if some plants are rejected.

2.02 TOPSOIL MATERIALS AND AMENDMENTS

A. Topsoil: stockpiled by others on site for use in planting operation.

1. Characteristics of approved topsoil:
   a. Fertile, friable, naturally occurring topsoil, free of stones, subsoil, clay lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth.
   b. PH: 5.0 to 7.0
   c. Organic Matter: 5% to 10%
   d. Sand: 50% to 70%
   e. Silt: less than 30%
   f. Clay: 10% to 25%
   g. Permeability Rate of 5 x 10 (-3) centimeters or greater at 85% compaction.

B. Testing for topsoil:

1. Sample and test minimum of three samples of stockpiled topsoil for compliance with specified characteristics. Tests to be performed by soil testing lab approved in advance by Landscape Architect, by Contractor at Owner's expense. Amend per recommendations of Soil Test Report and as approved to meet specified characteristics.

C. Commercial Fertilizer:

1. Characteristics:
   a. Uniform in composition, dry and free flowing.

b. Delivered in original, unopened containers each bearing the manufacturer's guaranteed analysis.
2. Or the formulation recommended in the Soil Test Report as specified.
3. Acceptable manufacturers:
   a. Sta-Green Plant Food Co.; Sta-Green
   b. O.M.Scott & Sons, Inc.; Scott's
   c. Approved equal

D. Lime:

1. Ground or crushed agricultural lime.
2. Containing not less than 85% of total carbonates.
3. 90% passing 20-mesh screen.
4. Not less than 50% passing a 60-mesh screen.
5. Dry and free flowing.
6. **Apply at rate specified in Soil Test Report.**

E. Topsoil Mix:

1. Prepare all topsoil used in tree and shrub pits and groundcover beds and planters in the following proportions:
   a. 50% approved material excavated from the pits (0% if excavation is in rock)
   b. 50% prepared soil in the following proportions (100% if excavation is in rock):
      i. 2 parts by volume topsoil as specified in 2.02 A herein.
      ii. 1 part by volume organic matter (peat moss and/or soil conditioner).
      iii. 1 part by volume sand
2. Add 3 lbs. of 6-12-12 fertilizer to each cubic yard of topsoil mix

F. Pine Bark: (IF SPECIFIED)

1. 100% Shredded Pine Bark Fines:
   a. Free from wood, wood shaving, cambium, sawdust, leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substance harmful to plant growth.
   b. Acceptable Manufacturers:
      i. Soil Products, Inc.
      ii. Approved equal

G. Soil Conditioner:

1. Well-rotted organic matter of uniform composition.
2. Containing no weeds, grasses, plants or their seeds nor any substance harmful to plant growth.
3. Acceptable manufactuerers:
   a. Klumb Company, "Soil conditioner'" Tuscaloosa, AL
   b. Soil Products, "Metro-Nitro Humas Compost," Hermitage, TN
   c. Approved equal

I. Polymer Crystals (to be added to plant backfill in non-irrigated areas):

1. Non-degradable water-storing polymers 1.0 to 3.0 millimeters in size.
   Acceptable Product:
   a. Terrasorb AG as manufacturer by Industrial Services International, Inc., Bradenton, FL., or approved equivalent.

2.03 MULCH

A. 100% Pine Needle Mulch (tree, plant and groundcover pits and beds):

1. Free from wood, wood shavings, cambium, sawdust, leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any other substance harmful to plant growth.
2. Annual planting beds to receive Pine Bark Mulch

B. Hay or Straw Mulch (seeding): Shall be clean hay or straw mulch.

2.04 GUYING, STAKING AND WRAPPING **(ONLY IF SPECIFIED/NOTED OR REQUIRED)**

A. Wood Stakes:

1. Pressure-treated Southern Yellow Pine, or other approved wood, 2" x 4" x length specified in the Drawings, pointed at one end.
2. Above-ground portion painted black.
3. Free from insects and fungi.

B. Wire: Pliable #10 or #12 gauge galvanized steel wire, double and twisted.

C. Turnbuckles: Galvanized turnbuckles, as detailed and approved by Landscape Architect.

D. Tree Strap:

1. Polypropylene web straps with 2 brass eyelets.
2. 2" minimum width.
3. Olive in color.

2.05 WATER

A. Fresh water, free of impurities or any substance harmful to plant growth.

B. Provided by Owner.

C. Provide all hose, attachments and accessories necessary to complete the Work as specified.

PART 3 - EXECUTION

3.01 GRADING

A. Topsoil shall be spread and rough graded by others in all areas indicated in the Drawings to receive planting, mulch, or seed.

B. Fine grade topsoil to form smooth grades, eliminating irregularities and ponding.

C. Remove extraneous matter measuring 1" or larger in any dimension from top four inches (4") of placed topsoil.

D. Eliminate all unwanted vegetative growth from topsoil by approved means before planting is commenced.

E. Obtain approval of finished grades before proceeding with planting operations; eliminate irregularities and ponding.

3.02 TOPSOIL MIXES

A. Prepare topsoil mixes as specified in 2.02 (E & F) herein.

B. Obtain approval of topsoil mix before commencing planting operations. Do not mix in place with placed topsoil.

C. Remove extraneous matter measuring 1" or larger in any dimension within topsoil mix.

D. Place topsoil mix as backfill for tree and shrub pits and ground cover beds as drawn.

E. Protect topsoil mix from erosion by force of wind or water, or damage by traffic.

3.03 PLANT LAYOUT

A. Stake plant locations and areas for approval prior to planting.

B. Do not dig plant pits prior to obtaining Landscape Architect's approval of plant locations.

C. Make adjustments in plant locations as directed.

D. If underground obstructions are encountered in planting areas, alternate locations may be selected by the Landscape Architect at no additional cost to the Owner.

3.04 PLANTING

A. Place plants which comprise a planting composition in approved staked locations for final approval by Landscape Architect.

B. Plant Pits and Beds:

1. Drainage:
    a. Landscape contractor is responsible for achieving and maintaining adequate drainage from all plant pits and beds. Use specified or other approved means.
    b. 48 hours prior to planting, test each plant pit for adequate drainage.
    c. Drainage is considered inadequate if pit or bed holds water for 24 hours or more.
    d. Owner reserves the right to test tree or plant pits at any time for adequate drainage. Correct immediately any inadequate drainage encountered.
    e. Submit proposal for Contractor's preferred tree pit drainage method(s) with Bid Proposal.
2. Pits are generally circular in outline with vertical sides.
3. Tree pits 2' greater in diameter than ball or root spread.
4. Shrub pits 1' greater in diameter than ball or root spread.
5. Prepare as specified in detail Drawings.

C. Setting Plants:

1. Set plants uniformly 2" to 4" height than surrounding grade or as necessary to provide adequate positive drainage away from roots. Slope soil gradually from saucer.
2. Cut rope, wire or string from top of ball after plant has been set; turn down and bury burlap.

D. Backfilling Plants:

1. Backfill to 2/3 full with specified topsoil mix.
2. Water thoroughly to eliminate air pockets and settling before filling to grade.
3. Form shallow saucer at plant pit edge to hold water.
4. Water in thoroughly.

E. Staking and Wrapping:

1. Inspect tree trunks for injury, improper pruning and insect infestation; take corrective measure before wrapping.
2. Immediately after planting, stake and wrap trees as detailed.
3. Wind wrapping material spirally from the ground line of the trunk to the second branch, allowing 50% overlap. Tie at no less than five places, including bottom, middle and top.
4. Secure trees in rooftop planters via guys and turnbuckles to eyebolts provided with planters.

F. Pruning:

1. Do not prune plants without approval of the Landscape Architect.
2. Prune after plants are in place and ONLY at the direction of the Landscape Architect.
3. Main leaders of trees to remain intact.
4. Paint all cuts over 1/2" in diameter with approved tree wound dressing.

G. Finished Grading: Hand grade and rake planting areas so that grades conform to surrounding areas and surface water drains freely.

H. Mulching:

1. Mulch all plant pits and beds with 3" deep specified mulch, uniform throughout.
2. Spread mulch solid in planting beds.

3.05 SITE ANNUAL PLANTING

A. Plant annuals as indicated in the Drawings and in Site Annual Chart in theDrawings, one time within the month before anticipated Substantial Completion or as directed by the Landscape Architect.

B. Plant within the month preceding anticipated Substantial Completion. Blooming plants shall be in bloom at the time of planting.

C. Base bid includes single installation of appropriate annuals for the month of initial installation as specified in the site Annual Chart.

3.06 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Continue maintenance for thirty calendar days following Substantial Completion.

C. Provide labor, materials, equipment and means for proper maintenance of all plant materials and workmanship.

D. Supervision:

1. Maintenance program, schedule and operations shall be supervised by a person(s) having one or more of the following qualifications:
    a. Is a Certified Nurseryman.
    b. Is a Licensed Horticulturist.
    c. Has a State Setting and Maintenance License.
2. Submit a written report and conduct joint inspection, with the Landscape Architect, of the maintenance program and procedures, at inspection for Substantial Completion and at end of Maintenance Period.

E. Maintenance of trees, shrubs and groundcovers:

1. Maintain all plants in a growing, well-formed, healthy condition by watering, fertilizing, pruning, weeding, spraying, wrapping, straightening, and replacement or by any other necessary maintenance operations.
2. Watering:
    a. Schedule for proper watering of all plant material.
    b. Advise Landscape Architect immediately of recommended alterations due to weather or other conditions.
    c. Water landscaped areas as frequently as necessary to maintain proper moisture level, using the following schedule as a guide:
        i. Twice a month during March, April, May.
        ii. Once a week during June, July, August, September.
        iii. No watering from October through February, except in drought conditions.
        iv. Arrange for activation in mid-March, unless otherwise directed.
3. Fertilizing:
    a. Mid-March application of 23-3-3 (slow release nitrogen).
    b. April 1 application of iron chelate.
    c. Mid-April application of 6-12-12.
    d. August 1 application of 15-0-15.
4. Site Annual Planting: Replace annual plantings according to the Schedule in the Drawings. Blooming plants shall be replaced as necessary throughout designated maintenance period.
5. Pruning:
    a. Remove dead wood as it becomes evident.
    b. Remove living portions of plants only at the direction of the Landscape Architect.
6. Spraying:
    a. For each spraying, combine approved insecticide and fungicide to provide maximum protection for all plant materials.
    b. Three sprayings annually: in March, May and August.
7. Weeding:
    a. Two applications (spring and fall) of approved insecticide and fungicide to provide maximum protection for all plant materials.
    b. Two applications (during growing season) of chemical contact spray (Round-up by Monsanto, or approved equal).
    c. Two days per month (every two weeks) manual weeding (by hand) during the period from March 1 through September 30; remove all visible weeks.
8. Mulching:
    a. Keep planting areas neat and uniformly mulched as specified.
    b. In addition to replacing and respreading mulch as necessary during the maintenance period, completely replenish mulch in all planting areas one time (*during the last month of the One-Year Guarantee Period or as directed by the Landscape Architect).
9. Straightening:

a. Maintain plants in their stable upright position and at the proper grade by straightening and tightening staking and guying apparatus, and by other necessary means.
b. Remove staking and guying apparatus during the last month of the one-year guarantee period or earlier if guying begins to girdle tree.

F. Install and maintain temporary flags, signs, barricades, protection fences, and other precautions necessary to protect the Work and the general public, and as approved by the Landscape Architect.

G. Clean-Up:

1. Keep all planting areas neat, weeded and uniformly mulched on a continuous basis.
2. Clean-up adjacent walks, drives and other areas where littered as a result of landscape maintenance operations, on a continuous basis.

H. Submit request for payment monthly at end of month maintained.

3.07 SUBSTANTIAL COMPLETION, PAYMENT AND GUARANTEE

A. Substantial Completion and Payment:

1. Submit request for inspection of Substantial Completion in writing to the Landscape Architect at least one week prior to anticipated date of inspection.
2. Submit Maintenance Manual as specified in 1.04 (C) for Owner's information and Landscape Architect's approval, containing full details for care and maintenance of landscape work, personnel and procedures, and weekly schedule for maintenance.
3. Review the Work jointly with the Landscape Architect for Substantial Completion.
4. Upon completion of repairs and replacements found necessary at time of review, the Landscape Architect will confirm the date of Substantial completion of the Work.
5. Upon receipt of confirmation of Substantial Completion, Contractor will be paid amount of money then due, less the value of the Maintenance Period, amounts already paid, and other deductions allowed to be made,
6. Substantial Completion constitutes the beginning date of the Maintenance Period and One-Year Guarantee Period.

B. Basis of Acceptance:

1. Planted trees, shrubs and groundcovers will be counted as individual units, complete, in place and planted in accordance with the plans and specifications. Each unit will include the installed plant, topsoil mix, mulch and staking apparatus.
2. Maintenance Period will be counted as a lump sum item.
3. Plant pit excavation in shot-rock (if required) will be counted as individual units. Necessity will be determined by Landscape Architect.
4. The cost of mobilization (including all provisions of General Requirements and General and Supplementary Conditions), clean-up, guarantee and maintenance will Substantial Completion as specified herein are considered incidental to the Work and will not be counted as separate items for payment.

C. Guarantee:

1. Guarantee all materials and workmanship for a period of one (1) year beyond the Date of Substantial Completion.

2. When Work is substantially completed in parts, the Guarantee Period extends from each Substantial Completion date to the terminal date of the last Guarantee Period. Thus, all Guarantee Periods terminate at the same time.
3. During the period of the Guarantee, replace with no additional compensation, and as soon as weather permits, all dead plant materials and all plant materials not in a thriving condition; replace all other materials which are unsatisfactory in the opinion of the Landscape Architect; make good any other damage, loss destruction, or failure to flourish sufficiently as the result of inferior or defective materials or workmanship, including, but not limited to inadequate drainage.
4. Repair grades and other Work necessitated due to planting replacements.
5. If the replacement plant is not acceptable during or at the end of the Guarantee Period, the Owner may elect either subsequent replacement or credit.
6. Guarantee applies to losses other than those due to Act of God, vandalism, or Owner neglect, as determined by the Landscape Architect. Contractor agrees to replace such plant material at original contract price when directed by Landscape Architect or Owner.

3.08 FINAL INSPECTION AND FINAL ACCEPTANCE

A. At the end of the Guarantee Period submit request for inspection for Final Acceptance to the Landscape Architect at least one week prior to anticipated date of inspection. Include list of Work substantially completed list of Work replaced during Guarantee Period.

B. Upon request for Inspection, jointly review with Landscape Architect all guaranteed Work for Final Acceptance.

C. Upon completion by the Contractor of all required repairs and replacements, the Landscape Architect will confirm the date of Final Acceptance of the Work.

END OF SECTION

SECTION 33 40 00 - STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division –1 Specification sections, apply to work of this section.

B. These specifications cover all required equipment and the complete installation of the systems shown on the attached drawings and related items.

C. Scope of the work includes furnishing and complete installation of the equipment and materials for the storm drainage system, with all auxiliaries, ready for owner's use. Storm drain piping from connection at gutter downspouts and/or connection with underground piping at a point five feet outside of the building, to the termination at manholes or catch basins are included in the scope of this section.

D. Storm drainage piping shall comply with the 2006 International Plumbing Code.

E. The Contractor shall pay for all permits and fees.

F. The drawings indicate generally the locations of plumbing fixtures, apparatus, piping, etc., but if, before installation, it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner and as directed by the Owner.

1.2 REFERENCES

A. Section 221400 – Storm Drainage (inside building)

B. Section 077100 – Manufactured Roof Specialties (for gutters and downspouts)

C. International Plumbing Code – 2006 Edition

1.3 SUBMITTALS

A. Provide submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedure Section.

B. Submittals are required for fixtures and equipment scheduled on the drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Furnish the Owner 3 sets of as-built drawings upon completion of work.

1.5 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for additional project warranty provisions.

B. Furnish one (1) year service and guarantee on all labor and material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Storm drainage piping shall be HDPE gravity sewer pipe – "ADS N-12 ST in accordance with ASTM F2648.

2.2 EQUIPMENT

A. Cleanouts shall be as indicated on drawings. Backfill shall be 100% compacted around vertical cleanout extension prior to pouring concrete.

PART 3 - EXECUTION

3.1 TRENCHING AND BACKFILLING

A. Protect all private roads and walks and maintain them during course of the work. Repair all damage at Contractor's expense.

B. Erect construction fencing around all excavations before starting work.

C. Provide and maintain guard lights at all barricades, railing, obstructions, in streets, roads, or sidewalks, and all trenches or adjacent to public walks or roads.

D. Remove and replace at Contractor's expense all work damaged by failure to provide protection.

E. Excavate trenches of sufficient width for proper installation of work. When depth of backfill over piping exceeds 10 feet, keep trench below level of top of pipe as narrow as practical.

F. Perform trenching in accordance with OSHA and local safety regulations.

G. Excavate all trenches to at least six inches below bottom elevation of pipe at all points. Grade trench bottom evenly. Lay piping in trenches on 6" bed of crushed stone with stone backfilled to 12" above top of pipe by hand.

H. Trenches shall provide uniform bearing. Where rock is encountered, excavate 2' below the pipe and refill to pipe grade with gravel.

I. Backfill trenches to grade only after piping has been inspected, tested, approved and location of pipe and appurtenances has been recorded. Tamp to 95% compaction. Under pavement, walks, and other surfacing, backfill shall be tamped solidly in layers not thicker than 6". Exclude all cinders and rubbish from trenches in which pipes are laid.

J. If unstable soil conditions are encountered, erect adequate supports needed in an approved manner to adequately support the underground piping.

3.2 INSTALLATION

A. The location of existing underground utilities are approximate locations only. Before beginning work determine the exact location of all existing utilities. The contractor shall pay for and repair all damages caused by failure to exactly locate and preserve any

and all underground utilities. Connect to the public storm sewer system at a catch basin or other standard connection provided.

B. Elevations shown on the drawings are to the invert of all gravity piping.

C. Adjust inverts to keep tops of pipe inline where pipe size changes.

D. Confirm elevation of existing storm drain connection point and grade storm drain at least 1/4” per foot unless otherwise indicated on drawings.

E. All piping is shown diagrammatically on the drawing. Determine exact locations in the field. Coordinate exact locations with all trades before installation.

F. Lay storm drainage piping to uniform grade. Make changes in directions of drain piping with long bends. No screwed joints are permitted in drainpipes, except as described herein.

G. Provide and install cleanouts where shown on the drawings, at 100 feet intervals, and as required by local codes. Extend cleanouts through and terminate flush with the finished grade. Terminate with C.I. plugs.

3.3 FIELD QUALITY CONTROL

A. Flush with water in sufficient volume to obtain free flow through each line. Remove all obstruction and correct all defects discovered. Remove all silt and trash from structures prior to final acceptance of work.

END OF SECTION

SECTION 33 46 00 - SUBDRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes subdrainage systems for the following:
   1. Foundations.

1.02 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

C. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.03 SUBMITTALS

A. Product Data: For the following:
   1. Perforated-wall pipe and fittings.
   2. Solid-wall pipe and fittings.
   3. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.03 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:
   1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
   2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
   3. Couplings: Manufacturer's standard, band type.

2.04 SOLID-WALL PIPES AND FITTINGS

A. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
   1. Gaskets: ASTM F 477, elastomeric seal.

2.05 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.
   1. Sleeve Materials:
      a. For Concrete Pipes: ASTM C 443, rubber.
      b. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      c. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      d. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
   2. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.
   3. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant metal tension band and tightening mechanism on each end.

2.06 CLEANOUTS

A. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded plug and threaded pipe hub.

2.07 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Section 31 20 00 - Earthwork.

2.08 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
   1. Structure Type: Nonwoven, needle-punched continuous filament.
   2. Style(s): Flat and sock.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 02300 - Earthwork.

3.03 PIPING APPLICATIONS

A. Underground Subdrainage Piping:
   1. Perforated PE pipe and fittings, couplings, and coupled joints.
   2. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Header Piping:
   1. PVC sewer pipe and fittings, couplings, and coupled joints.

3.04 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:
   1. At Grade in Earth: PVC cleanouts.
   2. At Grade in Paved Areas: Cast-iron cleanouts.

3.05 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Place impervious fill on subgrade adjacent to bottom of footing and compact to dimensions indicated, but not less than 6 inches deep and 12 inches wide after concrete footing forms have been removed.

C. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

D. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

E. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

F. Install drainage piping as indicated in Part 3 "Piping Installation" Article for foundation subdrainage.

G. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

H. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

I. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.

J. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

3.06 RETAINING-WALL DRAINAGE INSTALLATION

A. Lay flat-style geotextile filter fabric in trench and overlap trench sides.

B. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

C. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with tape.

D. Install drainage piping as indicated in Part 3 "Piping Installation" Article for retaining-wall subdrainage.

E. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

F. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

G. Place drainage course in layers not exceeding 3 inches in loose depth; compact each layer placed and wrap top of drainage course with flat-style geotextile filter fabric.

H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches.

I. Fill to Grade: Place satisfactory soil fill material over compacted drainage course . Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.07 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
   1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 30 inches unless otherwise indicated.
   2. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 30 inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
   3. Lay perforated pipe with perforations down.
   4. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

D. Install PVC piping according to ASTM D 2321.

E. Connect all subdrainage piping to drain to storm sewer system.

3.08 PIPE JOINT CONSTRUCTION

A. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."

B. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.

C. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

D. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

E. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.09 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00

SECTION 33 49 00 - STORM DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This work shall consist of constructing the following drainage structures: manholes, catch basins, inlets and junction boxes. Construction shall be in reasonable close conformity to the lines, grades, dimension and sizes shown on the drawings or as directed by the Engineer.

B. The height or depth of these drainage structures will vary with location, but unless otherwise shown on the drawings, shall be such that the frames will match the line and grades of the parking area, roadway surface or grasses areas and the invert will be at the designated elevations.

C. Cast iron frames, grates, and covers shall be provided as specified on the drawings.

D. Manholes, inlets, catch basins, and junction boxes shall conform to the Standard Detail Drawings of the Tennessee Department of Transportation unless otherwise noted on the drawings. Deviations from these drawings may be approved, by submitting a detailed drawing to the Engineer before construction begins.

E. All materials used in this construction, in addition to the general requirements of these Specifications, unless other wise stipulated, shall conform to the following:

F. Drainage structures shall conform to Subsection 611 of the Tennessee Department of Transportation, Standard Specifications for Road and Bridge Construction, 1981 or latest revisions.

END OF SECTION

Construction of an Affordable Housing Development at Five Points Phase 4 C19013
Solicitation Document A General Information and Cost

General Information about the Supplier	
Sign Your Name to the Right of the Arrow → By signing, you indicate you read and agree to "KCDC's General Instructions to Suppliers" on **www.kcdc.org**.	
Printed Name and Title →	
Company Name →	
Street Address →	
City/State/Zip →	
Contact Person (Please Print Clearly) →	
Telephone Number →	
Cell Number →	
Supplier's E-Mail Address (Please Print Clearly) →	

Addenda					
Addenda are at www.kcdc.org. Click on "Procurement" and then on "Open Solicitations" to find addenda. Please check for addenda prior to submitting a proposal.					
Acknowledge addenda have been issued by checking below as appropriate:					
None ☐	**Addendum 1 ☐**	**Addendum 2 ☐**	**Addendum 3 ☐**	**Addendum 4 ☐**	**Addendum 5 ☐**

Statistical Information (Check all the apply)	
This business is at least 51% owned and operated by a woman	**Yes ☐ No ☐**
This business qualifies as a small business by the State of Tennessee (Gross receipts of $10,000,000 or less and employing less than 100 full time persons)	**Yes ☐ No ☐**
This business qualifies as a Section 3 business by defined herein	**Yes ☐ No ☐**

This business is owned & operated by persons at least 51% of the following ethnic background:					
Asian/Pacific ☐	**Black ☐**	**Hasidic Jew ☐**	**Hispanic ☐**	**Native Americans ☐**	**White ☐**

Prompt Payment Discount
A prompt payment discount of _____% is offered for payment within ____ days of submission of an accurate and proper invoice.

MasterCard Acceptance
Mastercard is accepted for payment without additional fees. Yes ☐ No ☐
Mastercard is accepted for payment with a fee of _____. Yes ☐ No ☐

Cost Offered	
Infrastructure Construction Total Development Cost:	**$**
Housing Construction Total Development Cost:	**$**
Options and Deducts	
Alternate No. 1: Plastic-Laminate-Clad Residential Casework. Base Bid: Provide wood cabinets specified in Section 12 35 30 – Residential Casework. Alternate: Provide Plastic-Laminate-Clad Residential Casework specified in Section 12 35 30.13 – Plastic-Laminate-Clad Residential Casework.	-$
Alternate No. 2: Plastic Siding. Base Bid: Provide fiber-cement siding, soffits and trim specified in Section 07 46 00 – Siding. Alternate: Provide plastic siding, soffits and trim as specified in Section 07 46 33 – Plastic Siding.	-$
Alternate No. 3: Vinyl Composition Tile in lieu of Luxury Vinyl Tile. Base Bid: Provide Luxury Vinyl Tile (LVT) where noted on the Finish Plans. Alternate: Provide Vinyl Composition Tile (VCT) in lieu of Luxury Vinyl Tile (LVT) where noted on the Finish Plans.	-$
Alternate No. 4: Sheet Vinyl in lieu of Ceramic Tile. Base Bid: Provide Ceramic Tile where noted on the Finish Plans. Alternate: Provide Sheet Vinyl in lieu of Ceramic Tile where noted on the Finish Plans.	-$

Supplier: _____

Conflict of Interest:

1. No commissioner or officer of owners or other person whose duty it is to vote for, let out, overlook or in any manner superintend any of the work for owners has a direct interest in the award or the supplier providing goods or services.

2. No employee, officer or agent of the grantee or sub-grantee will participate in selection, or in the award or administration of an award supported by Federal funds if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when the employee, officer or agent, any member of his immediate family, his or her partner, or an organization, which employs, or is about to employ, any of the above, has a financial or other interest in the supplier selected for award.

3. The grantee's or sub-grantee's officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from suppliers, potential suppliers, or parties to sub-agreements.

4. By submission of this form, the supplier is certifying that no conflicts of interest exist.

Drug Free Workplace Requirements:

5. Private employers with five or more employees desiring to contract for construction services attest that they have a drug free workplace program in effect in accordance with TCA 50-9-112.

Eligibility:

6. The supplier is eligible for employment on public contracts because no convictions or guilty pleas or pleas of nolo contender to violations of the Sherman Anti-Trust Act, mail fraud or state criminal violations with an award from the State of Tennessee or any political subdivision thereof have occurred.

General:

7. Supplier fully understands the preparation and contents of the attached offer and of all pertinent circumstances respecting such offer.

8. Such offer is genuine and is not a sham offer.

Iran Divestment Act:

9. Concerning the Iran Divestment Act (TCA 12-12-101 et seq.), by submission of this bid/quote/quotes, each supplier and each person signing on behalf of any supplier certifies, and in the case of a joint bid/quote/quotes, each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each supplier is not on the list created pursuant to § 12-12-106.

Non-Collusion:

10. Neither the said supplier nor any of its officers, partners, owners, agents, representatives, employees or parties interest, including this affiant, has in any way colluded conspired, connived or agreed, directly or indirectly, with any other responder, supplier, or person to submit a collusive or sham offer in connection with the award or agreement for which the attached offer has been submitted or to refrain from making an offer in connection with such award or agreement, or collusion or communication or conference with any other supplier, or, to fix any overhead, profit, or cost element of the offer price or the offer price of any other supplier, or to secure through any collusion, conspiracy, connivance, or unlawful agreement any advantage against owners or any person interested in the proposed award or agreement.

11. The price or prices quoted in the attached offer are fair, proper and not tainted by any collusion, conspiracy, connivance, or unlawful agreement on the part of the supplier or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

Accuracy of Electronic Copies:

12. If the supplier provides electronic copies of the bid/proposal/quote to owners, the supplier certifies that the information provided on paper and in the electronic format is identical unless specifically noted otherwise.

No Contact/No Advocacy Affidavit

13. After this solicitation is issued, any contact initiated by any supplier or proposer with any owner's representative concerning this proposal is strictly prohibited-except for communication with the Procurement Division. My signature signifies that no unauthorized contact occurred.

14. To ensure the integrity of the review and evaluation process, respondents to this solicitation nor any firm representing them, may not lobby or advocate to owner's staff or Board members. My signature signifies that no unauthorized advocacy occurred.

The undersigned hereby acknowledges receipt of these affidavits and certifies that the submittal in response to this solicitation is in full compliance with the listed requirements.

Signed by	
Printed Name	
Title	
Subscribed and sworn to before me this date	
By (Notary Public)	
My Commission Expires on	
Notary Stamp	

Representations, Certifications, and Other Statements of Bidders

Public and Indian Housing Programs

Table of Contents

1. Certificate of Independent Price Determination

(a) The bidder certifies that--

(1) The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to (i) those prices, (ii) the intention to submit a bid, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a competitive proposal solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit a bid for the purpose of restricting competition.

(b) Each signature on the bid is considered to be a certification by the signatory that the signatory--

(1) Is the person in the bidder's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above.

_____ *[insert full name of person(s) in the bidder's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the bidder's organization];*

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the bidder deletes or modifies subparagraph (a)2 above, the bidder must furnish with its bid a signed statement setting forth in detail the circumstances of the disclosure.

☒ [Contracting Officer check if following paragraph is applicable]

(d) Non-collusive affidavit. (applicable to contracts for construction and equipment exceeding $50,000) ● in Solicitation Document B attached

(1) Each bidder shall execute, in the form provided by the PHA/IHA, an affidavit to the effect that he/she has not colluded with any other person, firm or corporation in regard to any bid submitted in response to this solicitation. If the successful bidder did not submit the affidavit with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the affidavit by that date may render the bid nonresponsive. No contract award will be made without a properly executed affidavit.

(2) A fully executed "Non-collusive Affidavit" [ ] is, [ ] is not included with the bid.

2. Contingent Fee Representation and Agreement

(a) Definitions. As used in this provision:

"Bona fide employee" means a person, employed by a bidder and subject to the bidder's supervision and control as to time, place, and manner of performance, who neither exerts, nor proposes to exert improper influence to solicit or obtain contracts nor holds out as being able to obtain any contract(s) through improper influence.

"Improper influence" means any influence that induces or tends to induce a PHA/IHA employee or officer to give consideration or to act regarding a PHA/IHA contract on any basis other than the merits of the matter.

(b) The bidder represents and certifies as part of its bid that, except for full-time bona fide employees working solely for the bidder, the bidder:

(1) [ ] has, [ ] has not employed or retained any person or company to solicit or obtain this contract; and

(2) [ ] has, [ ] has not paid or agreed to pay to any person or compan employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(c) If the answer to either (a)(1) or (a)(2) above is affirmative, the bidder shall make an immediate and full written disclosure to the PHA/IHA Contracting Officer.

(d) Any misrepresentation by the bidder shall give the PHA/IHA the right to (1) terminate the contract; (2) at its discretion, deduct from contract payments the amount of any commission, percentage, brokerage, or other contingent fee; or (3) take other remedy pursuant to the contract.

3. Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions (applicable to contracts exceeding $100,000)

(a) The definitions and prohibitions contained in Section 1352 of title 31, United States Code, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The bidder, by signing its bid, hereby certifies to the best of his or her knowledge and belief as of December 23, 1989 that:

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of a contract resulting from this solicitation;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the bidder shall complete and submit, with its bid, OMB standard form LLL, "Disclosure of Lobbying Activities;" and

(3) He or she will include the language of this certification in all subcontracts at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(d) Indian tribes (except those chartered by States) and Indian organizations as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) are exempt from the requirements of this provision.

4. Organizational Conflicts of Interest Certification

The bidder certifies that to the best of its knowledge and belief and except as otherwise disclosed, he or she does not have any organizational conflict of interest which is defined as a situation in which the nature of work to be performed under this proposed contract and the bidder's organizational, financial, contractual, or other interests may, without some restriction on future activities:

(a) Result in an unfair competitive advantage to the bidder; or,

(b) Impair the bidder's objectivity in performing the contract work.

[ ] In the absence of any actual or apparent conflict, I hereby certify that to the best of my knowledge and belief, no actual or apparent conflict of interest exists with regard to my possible performance of this procurement.

5. Bidder's Certification of Eligibility

(a) By the submission of this bid, the bidder certifies that to the best of its knowledge and belief, neither it, nor any person or firm which has an interest in the bidder's firm, nor any of the bidder's subcontractors, is ineligible to:

(1) Be awarded contracts by any agency of the United States Government, HUD, or the State in which this contract is to be performed; or,

(2) Participate in HUD programs pursuant to 24 CFR Part 24.

(b) The certification in paragraph (a) above is a material representation of fact upon which reliance was placed when making award. If it is later determined that the bidder knowingly rendered an erroneous certification, the contract may be terminated for default, and the bidder may be debarred or suspended from participation in HUD programs and other Federal contract programs.

6. Minimum Bid Acceptance Period

(a) "Acceptance period," as used in this provision, means the number of calendar days available to the PHA/IHA for awarding a contract from the date specified in this solicitation for receipt of bids.

(b) This provision supersedes any language pertaining to the acceptance period that may appear elsewhere in this solicitation.

(c) The PHA/IHA requires a minimum acceptance period of 90 calendar days.

(d) In the space provided immediately below, bidders may specify a longer acceptance period than the PHA's/IHA's minimum requirement. The bidder allows the following acceptance period: calendar days.

(e) A bid allowing less than the PHA's/IHA's minimum acceptance period will be rejected.

(f) The bidder agrees to execute all that it has undertaken to do, in compliance with its bid, if that bid is accepted in writing within (1) the acceptance period stated in paragraph (c) above or (2) any longer acceptance period stated in paragraph (d) above.

7. Small, Minority, Women-Owned Business Concern Representation

The bidder represents and certifies as part of its bid/ offer that it --

(a) [ ] is, [ ] is not a small business concern. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR 121.

(b) [ ] is, [ ] is not a women-owned business enterprise. "Women-owned business enterprise," as used in this provision, means a business that is at least 51 percent owned by a woman or women who are U.S. citizens and who also control and operate the business.

(c) [ ] is, [ ] is not a minority business enterprise. "Minority business enterprise," as used in this provision, means a business which is at least 51 percent owned or controlled by one or more minority group members or, in the case of a publicly owned business, at least 51 percent of its voting stock is owned by one or more minority group members, and whose management and daily operations are controlled by one or more such individuals. For the purpose of this definition, minority group members are:

(Check the block applicable to you)

[ ] Black Americans	[ ] Asian Pacific Americans
[ ] Hispanic Americans	[ ] Asian Indian Americans
[ ] Native Americans	[ ] Hasidic Jewish Americans

9. Certification of Eligibility Under the Davis-Bacon Act (applicable to construction contracts exceeding $2,000)

(a) By the submission of this bid, the bidder certifies that neither it nor any person or firm who has an interest in the bidder's firm is a person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of the contract resulting from this solicitation shall be subcontracted to any person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U.S.C. 1001.

10. Certification of Nonsegregated Facilities (applicable to contracts exceeding $10,000)

(a) The bidder's attention is called to the clause entitled **Equal Employment Opportunity** of the General Conditions of the Contract for Construction.

(b) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(c) By the submission of this bid, the bidder certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The bidder agrees that a breach of this certification is a violation of the Equal Employment Opportunity clause in the contract.

(d) The bidder further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) prior to entering into subcontracts which exceed $10,000 and are not exempt from the requirements of the Equal Employment Opportunity clause, it will:

(1) Obtain identical certifications from the proposed subcontractors;

(2) Retain the certifications in its files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

Notice to Prospective Subcontractors of Requirement for Certifications of Nonsegregated Facilities

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Employment Opportunity clause of the prime contract. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

Note: The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

11. Clean Air and Water Certification (applicable to contracts exceeding $100,000)

The bidder certifies that:

(a) Any facility to be used in the performance of this contract [ ] is, [ ] is not listed on the Environmental Protection Agency List of Violating Facilities:

(b) The bidder will immediately notify the PHA/IHA Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the Environmental Protection Agency, indicating that any facility that the bidder proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and,

(c) The bidder will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

12. Bidder's Signature

The bidder hereby certifies that the information contained in these certifications and representations is accurate, complete, and current.

(Signature and Date) _____

(Typed or Printed Name) _____

(Title) _____

(Company Name) _____

(Company Address)

Previous edition is obsolete

form **HUD-5369-A** (11/92)

Construction of an Affordable Housing Development at Five Points Phase 4 C19013
Solicitation Document D Good Faith Compliance Affidavit

The supplier must demonstrate a good faith effort to utilize Minority Owned Businesses (MOB) and Woman Owned Businesses (WOB). To assist in this effort, owners posts the web links of organizations, which can provide suppliers with a list of minority and women owned businesses on its web site. These lists can be useful to the supplier in preparing a response to this solicitation.

Place a checkmark in either Section One or Section Two of this form. Provide the information in Section One if you check that box.

Section One ☐ The following companies were asked for pricing for the attached bid. Provided the listed companies meet bid document requirements and their pricing is competitive, it is our intent to use the companies listed. Attached hereto or to be provided to owners within five calendar days of solicitation opening is our Form of Commitment/Statement of Effort (**failure to submit Form of Commitment/Statement of Effort timely will be cause to reject the bid**.)

Company Name	Person	Product/Service	MOB	WOB

Section Two ☐ MOB/WOB's were not contacted because sub-suppliers suppliers will not be needed to complete the contract and all work will be completed by the supplier. Other MOB/WOB's not shown above, will be considered during the duration of the contract in the event the supplier decides additional subcontractors or supplier will be used (to complete all or part of the contract).

Signed by	
Print Name and Title	
Subscribed and Sworn to before me on this date	
By	
Notary Public (stamp/signature)	
My Commission Expires on	

Construction of an Affordable Housing Development at Five Points Phase 4 C19013
Solicitation Document E Form of Commitment: Minority Owned Business/Woman Owned Business

Place a checkmark in either Section One or Section Two of this form.

Section One Does not apply - MOB/WOB subcontractors will not be used. ☐ (Stop Here)
Section Two MOB/WOB Subcontractors will be used. ☐ (Complete this page)

I, _____ do certify the supplier has or will enter into a formal agreement with the MOB/WOB enterprise for work listed in this schedule.

Supplier Name	MOB	WOB	Contact Person	Type of Supplies to be Provided	Type of Work to be Performed	Dollar Value of Supplies or Service

COMPLETE THE FOLLOWING BOXES IF BOX ABOVE WAS NOT COMPLETED

The following companies were listed on the Good Faith Compliance Affidavit submitted with my bid.

Company Name	Person	Product/Service	MOB	WOB

Explain why each of the above companies could not be used to provide the needed products or services.

Company Name	Reason

Above information submitted by _____

Printed/Typed Name and Title:_____

Part One: Infrastructure Insurance Requirements

1. INSURANCE (Five Points 4 Infrastructure)

The Contractor shall maintain, at Contractor's sole expense, on a primary and non-contributory basis, at all times during the life of the contract insurance coverages, limits, and endorsements described herein. All insurance must be underwritten by insurers with an A.M. Best rating of A :VIII or better. Upon award, the Contractor shall provide Certificate(s) of Insurance and amendatory endorsements to KCDC evidencing said insurance coverages.

The Contractor agrees the insurance requirements herein as well as KCDC's review or acknowledgement, is not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the Contractor under this contract. KCDC's failure to require a certificate of insurance, acceptance of a non-conforming certificate, or allowing the contractor to commence work shall not operate as a waiver of these minimum insurance requirements or the liabilities and obligations assumed by the Contractor under this contract.

a. **Commercial General Liability and Umbrella/Excess Liability Insurance:** with a minimum combined single limit of $1,000,000 per occurrence with $2,000,000 in the aggregate with the minimum of $5,000,000 per occurrence umbrella covering the following perils: products/completed operations ($2,000,000) for one year after completion of the Project; broad form property damage including completed operations for one year after completion of the Project. Limits must apply separately to the work/location in this contract.

Such insurance shall contain or be endorsed to contain a provision that includes KCDC, its officials, officers, employees, and volunteers as additional insureds providing coverage at least as broad as CG 20 10 07 04 and 20 37 07 04 endorsements. The coverage shall contain no special limitations on the scope of its protection afforded to the listed insureds.

Unless the Umbrella/Excess liability insurance provides coverage on a pure/true follow-form basis, or KCDC is automatically defined as an additional insured, the contractor shall add by endorsement, KCDC its officials, officers, employees, and volunteers as an additional insured.

See paragraph "g.1." for exact naming of certificate holder and additional insured.

b. **Commercial Automobile Liability Insurance:** in an amount not less than $1,000,000 (combined single limit) for all owned, hired, and non-owned vehicles utilized by contactor in connection with the Project. Coverage is to include coverage for loading and unloading hazards.

Such insurance shall contain or be endorsed to contain a provision that includes KCDC, its officials, officers, employees, and volunteers as additional insureds.

See paragraph "g.1." for exact naming of certificate holder and additional insured.

c. **Workers' Compensation Insurance and Employers Liability Insurance:** Workers' Compensation Insurance with statutory limits as required by the State of Tennessee or other applicable laws and Employers Liability with a minimum limit of $1,000,000 each employee/accident/policy.

d. **Environmental Impairment Liability:** with limits of not less than $1,000,000 per occurrence.

e. **Pollution Liability Insurance:** coverage, providing defense and indemnity coverage for bodily injury, property damage, and environmental investigation and clean-up costs for pollution conditions arising from the Contractor's operations. Limit of liability not less than $1,000,000 each occurrence and $2,000,000 annual aggregate. The policy shall include a minimum three (3) year Discovery (tail) reporting period, and a Retroactive Date that equals or precedes the effective date of this contract or the performance of work hereunder. Coverage may be provided on a per project basis.

f. **Builder's Risk:** coverage shall be written on an All-Risk, Replacement Cost, and Completed Value Form basis in an amount at least equal to one-hundred percent (100%) of the projected completed value of the Work, as well as subsequent modifications of that sum due to Change Order(s). Contractor agrees to be responsible for reporting increases in the projected completed value of the work due to Change Order(s).

Coverage shall insure *without limitation* against the perils of fire (with extended coverage) and physical loss or damage including, but not limited to and without duplication of coverage, theft, vandalism, malicious mischief, collapse, windstorm, testing and startup, temporary buildings, portions of the work stored off site, all portions of the work in transit, debris removal including demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

Coverage shall insure without limitation slab on grade, excavations, foundations, caissons, tenant finish work, and retainage walls around the perimeter of the project. Any exclusion of so-called underground damage to pipes, collapse of structure, or damage resulting from explosion or blasting shall be deleted.

Insurance is to cover all property of Contractor (and its subcontractors), Owners and all certificate holders as their interest may appear.

Coverage shall include soft costs resulting from damage or destruction to insured property on-site and while in transit including flood, earthquake and earth movement when such perils are required. Such insurance shall cover continuing expenses not directly involved in the direct cost of construction/renovation, including expense incurred upon money borrowed to finance construction or repair, continuing interest on mortgage loans, advertising, promotion, realty taxes and other assessments, the cost to the insured of additional commissions incurred upon re-negotiating leases, and other expenses incurred as a result of property loss or destruction by an insured peril.

See paragraph "g.1." for exact naming of certificate holder and additional insured.

g. **Other Insurance Requirements:**

1. Upon award, Contractor shall furnish Owner with original Certificate(s) of Insurance and amendatory endorsements effecting coverage required by this section.

   The certificate holder and additional insured:

   Knoxville's Community Development Corporation (KCDC), its officials, officers, employees, and volunteers"
   901 N Broadway
   Knoxville, TN 37917

2. Provide a waiver of subrogation **for each required policy herein**. When required by the insurer, or should a policy condition not permit contractor to enter into a pre-loss agreement to waive subrogation without an endorsement, the policy should be endorsed with a Waiver of Transfer of Rights of Recovery Against Others, or its equivalent. This waiver of subrogation requirement shall not apply to any policy which includes a condition specifically prohibiting such an endorsement, or voids coverage should contractor enter into such an agreement on a pre-loss basis.

3. A minimum 30-day cancellation notice for all insurances (by endorsement if necessary) is required.

4. Provide certified copies of endorsements and policies if requested by KCDC in lieu of or in addition to Certificates of Insurance.

5. Replace certificates, policies, and endorsements for any such insurance expiring prior to completion of services.

6. Maintain such insurance from the time services commence until services are completed or through such extended discovery/reporting/tail period as required. Failure to maintain or renew coverage or to provide evidence of renewal may be treated by KCDC as a material breach of contract.

7. Any deductibles and/or self-insured retentions greater than $50,000 must be disclosed to and approved by KCDC prior to the commencement of services. Use of large deductibles and/or self-insured retentions will require proof of financial ability as determined by KCDC.

8. All policies must be written on an occurrence basis.

9. **Require all subcontractors** to maintain during the term of the resulting contract commercial general liability insurance, automobile liability insurance, and workers' compensation/employers liability insurance (unless subcontractor's employees are covered by contractor's insurance) in the same manor and limits as specified for the Contractor with the exception of:

   Umbrella: $5,000,000 per occurrence umbrella is preferred, but not required

   ***Workers' Compensation Insurance and Employers Liability Insurance*:** with statutory limits as required by the State of Tennessee or other applicable laws.

Contractor shall furnish subcontractor(s)' Certificates of Insurance to KCDC without expense prior to subcontractor(s) commencing work.

h. **Right to Revise or Reject:** KCDC reserves the right, but not the obligation, to review or revise any insurance requirement, not limited to limits, coverages and endorsements based on insurance market conditions affecting the availability or affordability of coverage; or changes in the scope of work / specifications affecting the applicability of coverage.

i. **No Representation of Coverage Adequac**y: The coverages, limits or endorsements required herein protect the primary interests of KCDC, and the Contractor agrees in no way should these coverages, limits or endorsements required be relied upon when assessing the extent or determining appropriate types and limits of coverage to protect the contractor against any loss exposures, whether as a result of the project or otherwise

Part Two: Five Points 4 Construciton Insurance

2. INSURANCE (Five Points 4 Construction)

The Contractor shall maintain, at Contractor's sole expense, on a primary and non-contributory basis, at all times during the life of the contract insurance coverages, limits, and endorsements described herein. All insurance must be underwritten by insurers with an A.M. Best rating of A :VIII or better. Upon award, the Contractor shall provide Certificate(s) of Insurance and amendatory endorsements to Owner for all Owner Entities evidencing said insurance coverages.

The Contractor agrees the insurance requirements herein as well as Owner's review or acknowledgement, is not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the Contractor under this contract. Owner's failure to require a certificate of insurance, acceptance of a non-conforming certificate, or allowing the contractor to commence work shall not operate as a waiver of these minimum insurance requirements or the liabilities and obligations assumed by the Contractor under this contract.

a. **Commercial General Liability and Umbrella/Excess Liability Insurance:** with a minimum combined single limit of $1,000,000 per occurrence with $2,000,000 in the aggregate with the minimum of $5,000,000 per occurrence umbrella covering the following perils: products/completed operations ($2,000,000) for one year after completion of the Project; broad form property damage including completed operations for one year after completion of the Project. Limits must apply separately to the work/location in this contract.

Such insurance shall contain or be endorsed to contain a provision that includes Owner and Owner Entities listed in paragraph "g" as additional insureds providing coverage at least as broad as CG 20 10 07 04 and 20 37 07 04 endorsements. The coverage shall contain no special limitations on the scope of its protection afforded to the listed insureds.

Unless the Umbrella/Excess liability insurance provides coverage on a pure/true follow-form basis, or the Owner Entities listed in paragraph "g.1.", are automatically defined as additional insureds, the Contractor shall add them by endorsement.

See paragraph "g.1." for exact naming of certificate holders and additional insureds.

b. Commercial Automobile Liability Insurance: in an amount not less than $1,000,000 (combined single limit) for all owned, hired, and non-owned vehicles utilized by contactor in connection with the Project. Coverage is to include coverage for loading and unloading hazards.

Such insurance shall contain or be endorsed to contain a provision that includes the Owner Entities listed in paragraph "g.1." as additional insureds.

See paragraph "g.1." for exact naming of certificate holders and additional insureds.

c. Workers' Compensation Insurance and Employers Liability Insurance: Workers' Compensation Insurance with statutory limits as required by the State of Tennessee or other applicable laws and Employers Liability with a minimum limit of $1,000,000 each employee/accident/policy.

d. Environmental Impairment Liability: with limits of not less than $1,000,000 per occurrence.

e. Pollution Liability Insurance: coverage, providing defense and indemnity coverage for bodily injury, property damage, and environmental investigation and clean-up costs for pollution conditions arising from the Contractor's operations. Limit of liability not less than $1,000,000 each occurrence and $2,000,000 annual aggregate. The policy shall include a minimum three (3) year Discovery (tail) reporting period, and a Retroactive Date that equals or precedes the effective date of this contract or the performance of work hereunder. Coverage may be provided on a per project basis.

f. Builder's Risk: coverage shall be written on an All-Risk, Replacement Cost, and Completed Value Form basis in an amount at least equal to one-hundred percent (100%) of the projected completed value of the Work, as well as subsequent modifications of that sum due to Change Order(s). Contractor agree to be responsible for reporting increases in the projected completed value of the work due to Change Order(s).

Coverage shall insure *without limitation* against the perils of fire(with extended coverage) and physical loss or damage including, but not limited to and without duplication of coverage, theft, vandalism, malicious mischief, collapse, windstorm, testing and startup, temporary buildings, portions of the work stored off site, all portions of the work in transit, debris removal including demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

Coverage shall insure without limitation slab on grade, excavations, foundations, caissons, tenant finish work, and retainage walls around the perimeter of the project. Any exclusion of so-called underground damage to pipes, collapse of structure, or damage resulting from explosion or blasting shall be deleted.

Insurance is to cover all property of Contractor (and its subcontractors), Owner and all certificate holders as their interest may appear.

Coverage shall include soft costs resulting from damage or destruction to insured property on-site and while in transit including flood, earthquake and earth movement when such perils are required. Such insurance shall cover continuing expenses not directly involved in the direct cost of construction/renovation, including expense incurred upon money borrowed to finance construction or repair, continuing interest on mortgage loans, advertising, promotion, realty taxes and other assessments, the cost to the insured of additional commissions incurred upon re-negotiating leases, and other expenses incurred as a result of property loss or destruction by an insured peril.

See paragraph "g.1." for exact naming of certificate holders and additional insureds.

g. Other Insurance Requirements:

1. Upon award, Contractor shall furnish Owner with original Certificate(s) of Insurance and amendatory endorsements effecting coverage required by this section.

   The certificate holders and additional insureds:

   Five Points 4 LP
   901 N Broadway
   Knoxville, TN 37917

   Five Points 4 Corporation
   901 N Broadway
   Knoxville, TN 37917

   Knoxville's Community Development Corporation (KCDC), its officials, officers, employees, and volunteers"
   901 N Broadway
   Knoxville, TN 37917

   RSEP Holding, LLC, its successors and/or assigns
   1100 Superior Avenue, Suite 1640
   Cleveland, OH 44114

   Red Stone Equity Manager, its successors and/or assigns
   1100 Superior Avenue, Suite 1640
   Cleveland, OH 44114

   Home Federal Bank of Tennessee
   Attn: Jonathan W. Mayfield, Vice President 515 Market Street
   Knoxville TN 37902

2. Provide a waiver of subrogation **for each required policy herein**. When required by the insurer, or should a policy condition not permit contractor to enter into a pre-loss agreement to waive subrogation without an endorsement, the policy should be endorsed with a Waiver of Transfer of Rights of Recovery Against Others, or its equivalent.

This waiver of subrogation requirement shall not apply to any policy which includes a condition specifically prohibiting such an endorsement, or voids coverage should contractor enter into such an agreement on a pre-loss basis.

3. A minimum 30-day cancellation notice for all insurances (by endorsement if necessary) is required.

4. Provide certified copies of endorsements and policies if requested by Owner in lieu of or in addition to Certificates of Insurance.

5. Replace certificates, policies, and endorsements for any such insurance expiring prior to completion of services.

6. Maintain such insurance from the time services commence until services are completed or through such extended discovery/reporting/tail period as required. Failure to maintain or renew coverage or to provide evidence of renewal may be treated by KCDC as a material breach of contract.

7. Any deductibles and/or self-insured retentions greater than $50,000 must be disclosed to and approved by Owner prior to the commencement of services. Use of large deductibles and/or self-insured retentions will require proof of financial ability as determined by Owner.

8. All policies must be written on an occurrence basis.

9. **Require all subcontractors** to maintain during the term of the resulting contract commercial general liability insurance, automobile liability insurance, and workers' compensation/employers liability insurance (unless subcontractor's employees are covered by contractor's insurance) in the same manor and limits as specified for the Contractor.

   Umbrella: $5,000,000 per occurrence umbrella is preferred, but not required

   ***Workers' Compensation Insurance and Employers Liability Insurance*:** with statutory limits as required by the State of Tennessee or other applicable laws.

   Contractor shall furnish subcontractor(s)' Certificates of Insurance to Owner without expense prior to subcontractor(s) commencing work.

h. Right to Revise or Reject: Owner reserves the right, but not the obligation, to review or revise any insurance requirement, not limited to limits, coverages and endorsements based on insurance market conditions affecting the availability or affordability of coverage; or changes in the scope of work / specifications affecting the applicability of coverage.

i. No Representation of Coverage Adequacy: The coverages, limits or endorsements required herein protect the primary interests of Owner, and the Contractor agrees in no way should these coverages, limits or endorsements required be relied upon when assessing the extent or determining appropriate types and limits of coverage to protect the contractor against any loss exposures, whether as a result of the project or otherwise.

Part Three: Term Sheet - Insurance Requirements

	Infrastructure **Owner - KCDC**	**Construction** **Owner – Five Points 4 LP**
Certificate Holder & Additional Insureds	KCDC	Five Points 4 LP Five Points 4 Corporation KCDC RSEP Holding, LLC Red Stone Equity Manager Home Federal Bank of Tennessee
GL ***(Contractor & Subcontractors)***	$1M / $2M	$1M / $2M
Umbrella *(Contractor only)*	$5M	$5M
Auto ***(Contractor & Subcontractors)***	$1M (owned, hired, & non-owned)	$1M (owned, hired, & non-owned)
WC ***(Contractor & Subcontractors)***	Statutory limits	Statutory limits
Employers Liability ***(Contractor)***	$1M	$1M
Employers Liability ***(Subcontractors)***	Statutory limits	Statutory limits
Environmental ***(Contractor)***	$1M	$1M
Pollution ***(Contractor)***	$1M / $2M with 3 year Discovery; with Retro Date at least equal to contract date	$1M / $2M with 3 year Discovery; with Retro Date at least equal to contract date
Builder's Risk ***(Contractor)***	100% of projected completed value	100% of projected completed value
30-day cancellation	Required– must indicate on COI	Required– must indicate on COI
Primary non-contributory	Required – must indicate on COI	Required – must indicate on COI
Waiver of Subrogation	Required – must indicate on COI	Required – must indicate on COI

Solicitation Document F Envelope Coversheet

State Law requires certain supplier license information be on the front of your envelope. You are responsible for providing the correct information on the front of your envelope but the owners provided this form as a guide to help you. Failure to supply such required information as invalidates your bid. Attach this completed page to the front of your bid envelope. **Do not put it inside the envelope.**

Bid Due Date/Time		01-15-19 at 2:00 p.m..	
Supplier's Name			
State of Tennessee Supplier's License Holder Name			
State of Tennessee Supplier's License Number			
Pertinent State of Tennessee Supplier's License Classification			
State of Tennessee Supplier's License Expiration Date			
Subcontractors to be used on this project (If subcontract work is not required, write "none required")			
Electrical Subcontractor Name on the State of Tennessee's Supplier's License		**State of Tennessee Supplier License Number**	
State of Tennessee Supplier License Classification(s)		**Expiration Date of State Supplier's**	
HVAC Subcontractor Name on the State of Tennessee's Supplier's License		**State of Tennessee Supplier License Number**	
State of Tennessee Supplier License Classification(s)		**Expiration Date of State Supplier's**	
Masonry Subcontractor Name on the State of Tennessee's Supplier's License		**State of Tennessee Supplier License Number**	
State of Tennessee Supplier License Classification(s)		**Expiration Date of State Supplier's**	
Plumbing Subcontractor Name on the State of Tennessee's Supplier's License		**State of Tennessee Supplier License Number**	
State of Tennessee Supplier License Classification(s)		**Expiration Date of State Supplier's**	

Advisements:

1. Owners will not consider notes changing the bid written on the bid envelope. Such notes must be inside the envelope.

2. For the listed subcontractor types above, you may only list one firm.