

# PROJECT MANUAL

## Point Breeze Scattered Site Rehabs Philadelphia, PA

1159 S. Cleveland Street  
1628 Manton Street  
1633 S. Taylor Street  
1637 S. 24<sup>th</sup> Street  
1734 S. 24<sup>th</sup> Street  
2325 Watkins Street

07-28-14



**CICADA**  
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## **DIVISION 01 – GENERAL REQUIREMENTS**

### ***SECTION 01 10 00- GENERAL REQUIREMENTS***

#### A. Permits

1. The contractor shall secure and pay for the building permit. The contractor, and/or his subcontractors, shall secure and pay for all other permits and governmental fees, licenses, and inspections necessary for proper execution and completion of the work.
  - a. The developer may secure the necessary permits as directed by OHCD/PHDC/PRA.

#### B. Codes and Regulations

1. The contractor and his subcontractors to comply with all laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction on the performance of the work.
2. The contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance of the work.

#### C. Taxes

1. The contractor shall pay sales, consumer, use and similar taxes for the work or portions thereof provided by the contractor which are legally enacted when bids are received or negotiations concluded.

#### D. Labor and Material

1. Unless otherwise provided in the Contract Documents, the contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the work, whether temporary or permanent and whether or not incorporated or to be incorporated in the work.
2. The contractor shall enforce strict discipline and good order among the contractor's employees and other persons carrying out the Contract. The contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.
3. Substitutions: Product names, if and where noted, are given as a standard for type and quality.
  - a. Contractor or developer may propose substitution for any named product by submitting sufficient information (catalog cuts, technical data, performance data, samples, etc.) to prove that the proposed substitute is of equal or greater quality and will perform as well as or better than the named product to OHCD/PHDC/PRA. Substitutes are not to be installed unless approved in writing by OHCD/PHDC/PRA

#### E. Warranty

1. The contractor warrants that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted, that the work will be free from defects not inherent in the quality required or permitted, and that the work will conform with

the requirements of the Contract Documents.

- a. The contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

F. Shop Drawings, Product Data, and Samples

1. The contractor shall perform no portion of the work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Inspector and/or Architect. Such work shall be in accordance with approved submittals.
2. Shop Drawings showing all essential construction, finishes, materials, field dimensions, views and other details shall be provided for approval as required by the Specifications and/or drawings.
  - a. Contractor to submit four (4) copies of each material; one for OHCD/PHDC/PRA, one for the Inspector, one for the Architect, and one to be returned to the contractor.
2. Samples and Product Data to establish standards of acceptable quality shall be submitted to OHCD/PHDC/PRA.
  - a. Contractor to submit four (4) copies of each material; one for OHCD/PHDC/PRA, one for the Inspector, one for the Architect, and one to be returned to the contractor.

G. Review of Contract Documents and Field Conditions

1. The contractor to carefully study and compare the Contract Documents with each other and with information furnished by OHCD/PHDC/PRA and shall report any errors, inconsistencies, or omissions discovered to the Architect, developer, and OHCD/PHDC/PRA.
2. The contractor to take field measurements and verify field conditions and to compare such field measurements and information with the Contract Documents before commencing activities. Immediately report any errors, inconsistencies, or omissions discovered to the Architect, developer, and OHCD/PHDC/PRA.

H. Use of Site

1. The contractor to confine operations at the site to areas permitted by law, ordinances, permits, and the Contract Documents. Contractor shall not encumber the site with materials or equipment.

I. Cutting and Patching

1. The contractor is responsible for cutting, fitting or patching required to complete the work or to make its parts fit together properly.

J. Cleaning Up

1. The contractor to keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by construction operations.

- a. The contractor to provide daily clean up of the site.
2. At completion of the work the contractor to remove from and about the Project waste materials, rubbish, the contractor's tools, construction equipment, machinery, and surplus materials.

K. Indemnification

1. Upon completion of the Project, and prior to final payment, the contractor to provide a complete waiver of liens, including a waiver of liens from each subcontractor and material supplier, stating that each has received payment for all labor and materials relating to the Project and disclaiming any right to file a lien against the property.

L. Insurance

1. Certificates of Insurance, on a form acceptable to OHCD/PHDC/PRA shall be submitted, prior to the start of the work, to OHCD/PHDC/PRA.
  - a. Submit one copy to the Architect and developer.

M. Execution of the Work

1. The contractor to install and maintain dust barriers, temporary covers and temporary doors as required to maintain security, safety, weather tightness, and cleanliness.
2. The contractor to provide secure temporary supports as required and maintain same until permanent supports are fully in place.
3. At Project completion, the contractor to provide a "Clean" building and site, vacuum carpet and mop hard surface floors, wipe down walls, ceilings, and fixtures. Remove all stains and paints from glass, flooring, plastic laminate, metal, and similar finishes. The interior of the building is to be dust free, ready for the Lead Risk Assessors to perform their final assessment.

**END OF SECTION**

July 2014

**SECTION 01 20 00 - PROJECT SUMMARY**

A. Project Description

1. Project Name and Location:

Name: Point Breeze Scattered Site Rehabs  
Owner: Philadelphia Redevelopment Authority  
Locations: 1159 S. Cleveland Street (Market-rate unit)  
1628 Manton Street (Market-rate unit)  
1633 S. Taylor Street  
1637 S. 24<sup>th</sup> Street  
1734 S. 24<sup>th</sup> Street  
2325 Watkins Street  
Architect: CICADA Architecture/Planning, Inc.

2. Project Summary: The project consists of the complete renovation of (6) two-story single-family homes in the Point Breeze neighborhood of Philadelphia.
3. Projected Date of Occupancy: Spring 2015
4. Scope of Work: Unless otherwise specifically noted, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution and completion of the Work.
5. Bid Submission Documents: The following documents must be provided by the General Contractor as part of the bid submission:
- a. Bid Form with completed Redevelopment Authority of Philadelphia Construction Cost Estimate form attached
  - b. Non-Collusion Affidavit
  - c. Bid Bond
  - d. Contractor's Qualification Statement
  - e. Timeline for Construction Activity Subcontracting: The GC/bidder must specify anticipated dates for advertising bids or soliciting services, selecting subcontractors, forwarding executed contracts, and submitting monthly summary reports.
  - f. Contractor's Certificate of Compliance: The GC/bidder must sign and return a certification (form attached) indicating their commitment to making good faith efforts to utilize disadvantaged and/or local low-income residents and businesses in the project.
  - g. Contractor's Workforce Needs/Manpower Utilization: The GC/Bidder must indicate the anticipated number of employment and training positions to be filled during the course of the project.
  - h. Contractor's Affirmative Action Plan for Business Utilization: The GC/Bidder must specify the anticipated number and dollar amounts of subcontracts to be let during the course of the project.
  - i. Bid Solicitation and Commitment: The GC/Bidder must list all contractors solicited for each bid opportunity and indicate the dollar amount of contracts committed, if any.
  - j. Certification of Training, Employment, and Contracting Opportunities for Business and

Lower Income Persons: The GC/bidder must sign and return the attached certification.

6. Special Requirements:
  - a. Prior or Concurrent Work by Owner or Others: None.
  - b. Existing Site Conditions and Restrictions: None.
  - c. Contractor's Use of Premises and Adjacent Facilities: Contractor shall have full access to the sites.
  - d. Owner-Furnished and Owner-Installed Items: None.

B. Contract Forms

1. Owner Contractor Agreement: AIA Document A101-1997, Stipulated Sum Edition.
2. Bid Bond: AIA Document A310-1970.
3. Non-Collusion Affidavit of Bidder: See Specification Section 00 08 00.
4. Material and Payment Bond: AIA Document 312-1984, Performance Bond and Labor and Material Payment Bond: for 100% of the contract amount.
5. General Conditions of the Contract for Construction: AIA Document A201-1997 (copy attached).
6. Waiver of Liens: See Specification Section 00 08 10.
7. Contractor's Affidavit of Release of Liens: AIA Document G706A-1994.
8. Contractor's Application and Certificate for Payment: AIA Document G702-1992.
9. Economic Opportunity Plan:
  - a. Contractor's Certification of Compliance
  - b. Contractor's Workforce Needs/Manpower Utilization
  - c. Contractor's Affirmative Action Plan for Business Utilization
  - d. Bid Solicitation and Commitment
  - e. Certification of Training, Employment, and Contracting Opportunities for Business and Lower Income Persons
10. Contractor's Request for Information: Contractor's standard form.
11. Change Order: AIA Document G701-2000.
12. Supplementary General Conditions:
  - a. Preconstruction requirements:
  - b. The Contractor shall examine the site and verify all dimensions and conditions before start of construction. Any discrepancies shall be reported immediately to the Architect.

C. Testing



1. Testing Agency: Independent testing agency engaged and paid for by Owner.

D. Coordination

1. Coordination: Coordination of site work, utilities, and building construction.
2. Schedule: Bar-chart type project schedule indicating the estimated time duration and sequence requirements for each major activity or trade identified on the PRA Construction Cost Estimate form. An updated schedule is to be submitted by the Contractor with each Application and Certificate for Payment.

E. Field Engineering

1. Underground Utilities: Verification and location of underground utilities, facilities, and equipment.

F. Project Meetings

1. Pre-Construction Conference: Attendance by Owner, Architect, Engineers, Contractor and Owner's Representative, if applicable.
2. Progress Meetings: Biweekly; attendance by Owner, Architect, Engineers, Contractor and Owner's Representative, if applicable. Contractor is responsible for tracking and reviewing the status of outstanding Requests for Information (RFI's). Architect is responsible for production and distribution of meeting minutes.

G. Submittals

1. Project Submittals: Reproducible plus three copies of shop drawings, three copies for product data and warranties, two representative units for samples. The PRA
2. will require their Energy Consultant to review and approve submittals for windows and mechanical systems before installation proceeds.
3. Record Documents: Record drawings, record specifications and maintenance manuals.
4. Substitutions and "Or Equal": Product names are given as a standard of type and quality. The Architect and Owner will approve other products that, in their opinion, are of equal quality and performance. For any proposed substitution, the Contractor shall provide sufficient catalog sheets, technical information, and/or samples to the Architect for approval. Use of substitutions is subject to such approval; substitutions shall not be installed until approval is granted.

H. Quality Control

1. Codes and Regulations: The Contractor and his subcontractors shall comply with all laws, ordinances, rules, regulations, and orders of any public authority bearing on the performance of the Work.
2. Standards: Quality of materials and workmanship shall generally be in accordance with the best standards and practices of the trades involved.
3. Any discrepancy in the Drawings or Specifications shall be brought to the attention of the Architect.

I. Temporary Facilities

1. Temporary Utility Service: All new temporary utility services including temporary heating systems

during cold weather.

2. Temporary Facilities: Temporary construction, support facilities, and security measures. One of the properties will be designated as the Contractor's field office; the Contractor is responsible for supplying drinking water, sanitary facilities, a telephone/fax line, plan table and meeting facilities.
3. Security, Safety, and Cleanliness: The Contractor shall install and maintain dust barriers, temporary covers and temporary doors as required to maintain security, safety and cleanliness. The Contractor shall provide daily cleanup of construction areas.

J. Contract Closeout

1. Waiver of Liens: Upon completion of the project, and prior to final payment, the contractor shall provide a complete release of all liens with all subcontractors and suppliers, stating that each has received payment for all labor and materials related to the project and disclaiming any right to file a lien against the property.
2. At job completion, the Contractor shall provide a "broom clean" work area and shall, in addition, remove and clean all stains and paints from glass, flooring, laminate, metal, and similar finishes.
3. Extra Materials: General Contractor is to provide each property with a minimum of one (1) gallon of each paint used and 10% of the floor area of each floor finish and base used.
4. At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey".
5. At Substantial Completion, reduction of retainage from 10% to 5% will be approved provided that the Contractor submits, at a minimum, the following closing documents:
  - a. Certificate of Occupancy and/or all Permits signed off by Philadelphia L&I.
  - b. Electrical Certificate from the Underwriter.
  - c. Plumbing Certificate from L&I.
  - d. Roof Warranty/Guarantee must be provided by the General Contractor (not the roofing subcontractor).
  - e. Complete set of As-built Drawings (incorporating field changes) for all trades.
  - f. Copies of the Change Order Log, Shop Drawing/Submittal Log, all sketches and Product Data.
  - g. Final Construction Schedule.
  - h. All Engineering Reports, if applicable.
  - i. All Manufacturer's Certifications.
  - j. All Guarantees and/or Warranties.
  - k. All Testing and Balancing approvals (including Blower Door Test results).
  - l. Operation and Maintenance data/manuals.
  - m. Subcontractor's and Material Suppliers final "Release of Liens."

**END OF SECTION**

**DIVISION 1- GENERAL REQUIREMENTS**

***SECTION 01 21 00- BASIS OF DESIGN***

A. Product/Finish Schedule:

<p>04 MASONRY Unit Masonry Assemblies - 04 20 00</p>	<p>Brick Type: Where required, new brick is to match existing, unless drawings indicate that wall is to be covered with stucco. Submit sample(s) of brick for approval.</p> <p>Provide reinforced precast concrete lintels for window and door openings where indicated for stucco finished masonry walls.</p>
<p>04 MASONRY Cast Stone - 04 30 00</p>	<p>Provide Reinforced Cast Stone Lintels for door and window openings, where indicated for exposed brick walls. Provide cast stone sills for window openings where indicated for exposed brick walls and for stucco faced masonry walls. Submit samples for approval from Continental Cast Stone or approved equal.</p>
<p>05 METALS Decorative Metals - 05 70 00</p>	<p>Steel handrail for new painted steel railings to be Julius Blum #4428, or approved equal.</p>
<p>06 WOODS, PLASTICS &amp; COMPOSITE Finish Carpentry – 06 20 00</p>	<p>Wood rail for railing at bottom of stairs to second floor and for wall-mounted railing to be oak railing in natural clear finish with railing profile as indicated on detail D1/A4.1</p> <p>Exterior trim to be painted fiber-cement trim or painted Azek Cellular PVC.</p>
<p>07 THERMAL &amp; MOISTURE PROTECTION Drainage Plane – 07 28 00</p>	<p>Provide layer of Benjamin Obdyke "Home Slicker" drainage mat, vented at top and bottom, over Water Resistive Barrier (WRB) beneath all installations of fiber cement siding and trim.</p>
<p>07 THERMAL &amp; MOISTURE PROTECTION Siding – 07 46 00</p>	<p>Fiber Cement Siding: Smooth Lap Siding, without wood grain, width 7.25" for 6" exposure.</p> <p>Fiber Cement Trim: Boards Smooth, ¾" thick by 3 ½" wide for corner boards and for trim between bottom of siding and exposed soffit.</p> <p>Soffit and Porch Ceilings: For soffits of overhanging bays and for porch ceiling provided Fiber-cement, beaded porch panels</p>
<p>07 THERMAL &amp; MOISTURE PROTECTION Modified Bituminous Roofing – 07 52 00</p>	<p>Roof Warranty: minimum 5 year installation warranty to be provided for all roofing, in addition to manufacturers' warranties.</p>

<p>07 THERMAL &amp; MOISTURE PROTECTION</p> <p>Roofing Accessories or Plumbing</p>	<p>Provide cast iron combination downspout boot with area drain.</p>
<p>08 OPENINGS</p> <p>Doors and Frames - 08 11 00</p>	<p>Interior Door Profile: Masonite Two panel, smooth finish (wood grain texture not permitted).</p> <p>Exterior Door Profile: Fiberglass smooth finish (wood grain texture not permitted) with two panel square top, no glazing.</p>
<p>08 OPENINGS</p> <p>Storm Doors and Windows – 08 20 00</p>	<p>Combination Storm door: Self-Storing Storm Door, White finish</p>
<p>08 OPENINGS</p> <p>Windows - 08 50 00</p>	<p>Double Hung windows, or casement windows where indicated on drawings with matching brick moulding and jambs and head and extended subsill.</p> <p>Window Color: White</p>
<p>08 OPENINGS</p> <p>Security Screens and Doors – 08 56 00</p>	<p>Security Storm Door: Divided Lite security storm door, White finish.</p>
<p>08 OPENINGS</p> <p>Door Hardware - 08 71 00</p>	<p>Door Hardware: Lever Set: Passage function &amp; Privacy lock for bathrooms and bedrooms; Satin nickel finish.</p> <p>Door Hardware: Entrance Handleset: Entrance Lock with profiled exterior handleset and interior lever set; satin nickel finish.</p> <p>Provide hinges, stops, thresholds and weatherstripping as indicated in specifications. Standard finish for hinges and stops to be satin nickel finish. Threshold to have satin nickel or satin stainless steel finish.</p>
<p>09 FINISHES</p> <p>Portland Cement Plastering - 09 24 00</p>	<p>Three-coat stucco over metal lath.</p> <p>Stucco Finish: Medium Sand Float</p> <p>Stucco Color: As selected by Owner from manufacturer's standard colors</p>
<p>09 FINISHES</p> <p>Tiling - 09 30 00</p>	<p>Kitchen Backsplash tile: White, 3"x6" subway tile, full height with accent tiles where indicated on drawings.</p> <p>Kitchen Floor Tile: 12" x12" nominal Porcelain Floor Tiles, with matching bullnose wall base tile, to be selected.</p> <p>Powder Room Floor Tile: Porcelain Floor Tiles, to be selected.</p> <p>Bathroom Tile: Porcelain Floor Tiles, with matching bullnose base tile, except for bathrooms scheduled to receive wainscot wall tile, to be selected.</p>

Bathroom Wall Tile (where indicated in interior elevations)

Wainscot Tile: White, 3"x6" subway tile, with bullnose edge tile at top, with row of Accent Glass Mosaic tiles, to be selected.

Tub Surround: White 6"x6" tiles with 3"x6" bullnose tope edge tile and with accent glass mosaic tile to be selected.

Grout: to be selected

Thresholds: Marble to be selected

Provide recessed shelf in shower where indicated in the interior elevations.

Setting Methods:

Floors: Latex Thin-set, TCA F144-14

Walls: Latex Thin-set, TCA W244-14

Shower and Bath Surrounds: Latex Thin-Set with waterproof membrane; TCA B412-14

09 FINISHES

Wood Flooring - 09 64 00

Wood Flooring: Nominal 3 1/4" Oak plank flooring, finish to be selected

09 FINISHES

Carpeting – 09 60 00

Carpet: To be selected

09 FINISHES

Painting and Coating  
- 09 64 00

Interior Ceiling Paint: Flat White

Interior Trim Paint: Gloss White

Interior Wall Paint: Eggshell, color(s) to be selected

Interior Basement walls: 2 coats UGL Drylok Latex Base Masonry Waterproofer

Exterior Trim

Door: Semi-gloss, color to be selected

Cornice Trim: Semi-gloss, color to be selected

10 SPECIALTIES

Toilet and Bath Accessories –  
10 28 00

Medicine Cabinet: 24"W x 30"H recessed mounted with satin nickel or satin stainless steel finish.

Alternative is 24"w x 30" h frameless recessed mounted cabinet with beveled edge mirror.

Powder room Medicine Cabinet: Recessed Cabinet to fit in 16" stud space and to be 24" high, satin nickel or satin stainless steel finish frame.

Bath Accessories: Satin nickel Finish, Provide the following as indicated on the drawings:

Towel Bars

Towel Rings

Robe Hooks

	Toilet Paper Holder
	Curved Shower Rod
	No soap dish or tooth brush holder at sink
10 SPECIALTIES	Mail Box: Locking, wall-mounted, brushed stainless steel finish
Mailboxes – 10 28 00	House Numbers: 5" cast brass, satin nickel finish
11 EQUIPMENT	Stainless Steel Finished Appliances (Market-Rate Units):
Residential Appliances – 11 31 00	Refrigerator: 18 Cu. Ft., Stainless Steel finish; Top-mount Freezer w/Ice maker; Energy Star
	Dishwasher: 24" built-in, Energy Star; stainless steel finish
	Range: 5-burner 30" gas range, self-cleaning, gas, stainless steel finish
	Microwave/Range Hood: 30" over range microwave/hood; stainless steel finish
	Silver-Mist Finish Appliances
	Refrigerator: 18 Cu. Ft.; Top-mount Freezer w/Ice maker; Energy Star, Silver Mist Finish
	Dishwasher: 24" built-in, Energy Star; Silver Mist finish
	Range: 30" freestanding, self-cleaning, gas, Silver Mist finish
	Microwave/Range Hood: 30" over range microwave/hood; Silver Mist finish
	Garbage Disposal: Insinkerator Badger 5, 1/2 HP
12 FURNISHINGS	Window Treatments: 1" Premium Vinyl horizontal blinds, to be provided/installed at all windows.
Window Treatments - 12 20 00	For Market-rate units upgrade to 2" Premium Faux Wood Blinds
12 FURNISHINGS	Kitchen & Vanity Casework: Full overlay with Shaker doors and slab drawer fronts, all-plywood construction. Finish: To be selected.
Residential Casework – 12 35 30	Kitchen & Vanity Pulls: Stainless steel bar pulls with 3" center-to-center mounting.
	Kitchen Countertops: Plastic laminate to be selected. For market-rate units upgrade to granite counters, to be selected
22 PLUMBING	Also provide downspout boot with area drain.
Plumbing and Drainage – 22 00 00	

<p>22 PLUMBING Domestic Water Heaters – 22 36 00</p>	<p>Hot Water Heater: Bradford-White PDX4-40S6FBN; 40 gal.; Natural Gas, Power Direct Vent High EF Energy Saver Gas Water Heater, Energy Star Qualified, or approved equal.</p>
<p>22 PLUMBING Plumbing Fixtures - 22 40 00</p>	<p>Water Closet: Toto Eco Drake EL 1.28 gpf, White.</p> <p>Bathtub: 60” Cast Iron White, white 3-piece fiberglass surround where indicated on drawings.</p> <p>Tub/Shower Trim: Delta T17430; stainless finish.</p> <p>Vanity Sink: Cultural marble vanity top with integral oval bowl.</p> <p>Vanity Faucet: Delta 520-MPU-DST; stainless finish.</p> <p>Drop-in Kitchen Sink: Moen 2200 Series G221943, 7 3/4” depth.</p> <p>Kitchen Faucet: Delta 4353-DST stainless finish</p> <p>Washer Box: Oatey Quadtro, single lever ball valve</p> <p>Laundry Sink: Florestone Model 20FM Utility Sink, 20”x24”. Provide with Chicago faucet and hole punching to accommodate faucet</p>
<p>23 HVAC Exhaust System - 23 35 00</p>	<p>Exhaust fans:</p> <p>Bathrooms: Panasonic Whisper Green Lite, ENERGY STAR certified combination recessed exhaust fan with compact fluorescent light. Size to suit conditions.</p> <p>Powder Room: Panasonic Whisper Green, ENERGY STAR certified recessed exhaust fan. Size to suit conditions.</p>
<p>23 HVAC Gas Vents – 23 51 23</p>	<p>Furnace: Condensing Unit, direct vent using plastic pipe in accordance with specifications</p> <p>Hot Water Heater: Power direct vent with 2" or 3" PVC</p>
<p>23 HVAC Central Heating System Requirements – 23 52 22</p>	<p>HVAC to be air system. Provide supply in basement to temper space.</p>
<p>23 HVAC Furnaces – 23 54 00</p>	<p>High-Efficiency, gas fired condensing furnace, ENERGY STAR certified and direct-vent with exterior fresh-air intakes.</p> <p>Thermostat: Programmable</p>
<p>26 ELECTRICAL Electrical - 26 00 00</p>	<p>Recessed Light Fixture: Halo H471CAT 5” Insulated</p> <p>Ceiling Fan: Hampton Bay Windward IV 52”, Brushed nickel</p> <p>Ceiling Surface-mounted lights: AFX Capri Flush Mount CFF Series 12" diameter (2) Compact Fluorescent lamps, satin nickel finish, CFF-12-2-18W-GU- 27-SN</p> <p>Under-cabinet Light Fixture: Progress Hide-a-Lite3, P7021 (20, 22, or</p>

23), fixture w/ built-in switch, direct wire, white finish. Coordinate length with wall cabinet layout.

Vanity Light Fixture: Progress P7114-60EB with (2) F17T8 lamps

Exterior Light Fixture at Front: Eglo Ascoli Model #90121A, Up and Down light cylinder, stainless steel finish, with (2) compact fluorescent lamps.

Exterior Light Fixture at Rear: Progress Lighting P5881-30WB, white finish, with 1 GU-24 18w lamp.

Exterior Porch Light: Progress P5616-16 satin aluminum w/ white glass globe, supply with compact fluorescent lamp

Basement Light Fixture: T8 wrap-around fluorescent

31 EARTHWORK  
Termite Control – 31 31 16

Provide termite control treatment at each residence.

32 EXTERIOR  
IMPROVEMENTS  
Paving – 32 00 00

Provide asphalt paving repair as required by news work to make all utility connections to street.

32 EXTERIOR  
IMPROVEMENTS  
Landscaping – 32 92 00

All Landscaping beds in rear yards to receive sod.

**END OF SECTION**



**DIVISION 01 – GENERAL REQUIREMENTS*****SECTION 01 77 00- CLOSEOUT PROCEDURES***

## A. Summary

1. Section includes, but is not limited to, the following:
  - a. Inspection procedures.
  - b. Warranties.
  - c. Final cleaning.

## B. Substantial Completion

1. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. Certificate of Substantial Completion will not be issued until all of these items are complete:
  - a. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - b. Advise OHCD/PHDC/PRA of pending insurance changeover requirements.
  - c. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - d. Obtain and submit releases permitting OHCD/PHDC/PRA unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - e. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
  - f. Deliver tools, spare parts, extra materials, and similar items to location designated by OHDC/PHDC/PRA. Label with manufacturer's name and model number where applicable.
  - g. Make final changeover of permanent locks and deliver keys to ODDC/PHDC/PRA. Advise OHDC/PHDC/PRA personnel of changeover in security provisions.
    - 1) Remove all temporary locks installed by Contractor, sub-contractors, or other contractor related personnel.
  - h. Complete startup testing of systems.
  - i. Submit test/adjust/balance records.
  - j. Required submittals to regulatory agencies.
  - k. Terminate and remove temporary facilities from Project site, along with mockups, excess materials, construction tools, and similar elements.
  - l. Advise OHDC/PHDC/PRA of changeover in heat and other utilities.
  - m. Submit changeover information related to occupancy, use, operation, and maintenance.
  - n. Complete final cleaning requirements, including touchup painting.
  - o. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
2. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect or Developer and Inspector will either proceed with inspection or notify Contractor of unfulfilled requirements. OHDC/PHDC/PRA 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 or developer, that must be completed or corrected before certificate will be issued.

- a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  - 1) The Architect or developer will perform one re-inspection when requested and only when assured that the Work has been substantially completed.
- b. Results of completed inspection will form the basis of requirements for Final Completion.

#### C. Final Completion

1. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
  - a. Submit a final Application for Payment according to provisions in the Contract.
  - b. Submit certified copy of Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect or developer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  - c. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  - d. Submit Hazardous Material final inspection report.
  - e. Instruct OHDC/PHDC/PRA personnel in operation, adjustment, and maintenance of products, equipment, and systems.
2. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect or developer and Inspector will either proceed with inspection or notify Contractor of unfulfilled requirements. OHCD/PHDC/PRA 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.
  - a. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
    - 1) The Architect or his consultants will perform one re-inspection when requested and only when assured that the remaining corrective Work has been completed.

#### D. List of Incomplete Items (Punch List)

1. Preparation: Submit three copies 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.
  - a. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

- b. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
- c. Include the following information at the top of each page:
  - 1) Project name.
  - 2) Date.
  - 3) Name of Architect or developer.
  - 4) Name of Contractor.
  - 5) Page number.

E. Warranties

1. Submittal Time: Submit written warranties on request of Architect or developer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
2. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - a. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11 - inch paper.
  - b. 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.
  - c. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
3. Provide additional copies of each warranty to include in operation and maintenance manuals.

F. Materials

1. 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.

G. Final Cleaning

1. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
2. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition acceptable for testing by hazardous material risk assessor. Comply with manufacturer's written instructions.

- a. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
  - 1) 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.
  - 2) Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - 3) Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - 4) Remove tools, construction equipment, machinery, and surplus material from Project site.
  - 5) Remove snow and ice to provide safe access to building.
  - 6) Clean exposed exterior and interior hard-surfaced finishes to a dirt/dust-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - 7) Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - 8) Sweep and mop concrete floors in unoccupied spaces.
  - 9) Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - 10) Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - 11) Remove labels that are not permanent.
  - 12) Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - a) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - 13) Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - 14) Replace parts subject to unusual operating conditions.
  - 15) Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

- 16) Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - 17) Clean ducts, blowers, and coils if units were operated without filters during construction.
  - 18) Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
  - 19) Leave Project clean and ready for risk assessment and occupancy.
3. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
  4. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

**END OF SECTION**

July 2014

## **DIVISION 01 – GENERAL REQUIREMENTS**

### ***SECTION 01 81 20- SUSTAINABLE DESIGN REQUIREMENTS***

#### A. Summary

1. The OHCD/PHDC/PRA has determined that all projects will follow a best practices approach of environmentally responsible design and construction. This Section outlines this approach. Attention will be given to: materials and products, energy and resource efficiency, durability, and indoor environmental quality both during construction and for future homeowners. These requirements are in addition to minimum efficiencies, methods, and other aspects specified in other divisions of this specification manual.
  - a. ENERGY STAR Certification: If the project will meet ENERGY STAR for New Homes certification, also refer to Part G of this Section.
  - b. LEED Certification: If the project is pursuing LEED for Homes Certification, also refer to Part H of this Section.
  
2. Section Includes:
  - a. General requirements and procedures for the following:
    - 1) Indoor Water Use.
    - 2) Heating and Cooling Distribution System.
    - 3) Space Heating and Cooling Equipment.
    - 4) Water Heating.
    - 5) Lighting.
    - 6) Appliances.
    - 7) Residential Refrigerant Management.
    - 8) Environmentally Preferable Products.
    - 9) Waste Management.
    - 10) Indoor Air Quality During Construction.

#### B. Definitions

1. Absorptive Materials: Materials which can absorb moisture and air-borne particulates leading to mold growth or other damage. Materials include but are not limited to: carpet, gypsum wallboard, and wood flooring, trim, and doors.
2. Environmentally Preferable Products: Products which contain no formaldehydes, contain no added urea-formaldehyde, and meet VOC content levels listed in other parts of this Section.
3. Green Guard: The Green Guard Environmental Institute certifies products and materials for low chemical emissions.
4. IAQ: Indoor Air Quality.
5. Urea-formaldehyde: Thermosetting resin or plastic made from urea and formaldehyde, heated in the presence of a mild base such as ammonia. Urea-formaldehyde may have short- or long-term health effects.
6. VOC: Volatile Organic Compound. Gases which are emitted from certain solids or liquids which may contain VOC's and may have short- or long-term health effects.

C. Administrative Requirements

1. Respond to questions and requests from the OHCD/PHDC/PRA.
2. Track the total amount of waste generated on the project and amount diverted from landfill. Report monthly waste totals and amount diverted totals to OHCD/PHDC/PRA with each Application for Payment. Separate diverted totals into categories listed in other parts of this Section.
3. Maintain minimum IAQ standards during construction as required by other Articles of this Section.
4. Provide Manual J calculations in accordance with most current version of the ACCA Manual J Residential Load Calculation Manual prior to purchase and/or installation of new heating or cooling equipment, unless written authorization is received from OHCD/PHDC/PRA to exclude the calculations.

D. Systems and Products

1. Systems and Products, General: Provide systems, materials and products meeting the following requirements.
2. Indoor Water Use: Comply with Division 224000 Plumbing Fixtures.
3. Heating and Cooling Distribution System: Comply with 230000 HVAC Air Distribution.



4. Space Heating and Cooling Equipment: Comply with Division 23 Sections specific to system or systems being installed.
5. Water Heating. Comply with Section 223600 Domestic Water Heaters.
6. Lighting. Comply with Section 260000 Electrical.
7. Appliances. Comply with Section 113100 Residential Appliances.
8. Residential Refrigerant Management. Comply with Section 238126 Split System Air Conditioners.
9. Environmentally Preferable Materials:
  - a. Formaldehyde Free: Select insulation products which contain no formaldehyde or are Green Guard certified.
  - b. No Added Urea-Formaldehyde: To the fullest extent possible, select engineered wood products which contain no added urea-formaldehydes in resins.
    - 1) If products containing urea-formaldehyde resins need to be used either due to inability to obtain product or cost issues, obtain written permission from OHCD/PHDC/PRA prior to purchase and installation. Clearly explain why material containing added urea-formaldehyde resin must be used in request to OHCD/PHDC/PRA. If permission is granted, follow requirements for handling and installing outlined in other Sections of the OHCD/PHDC/PRA Small Building Specifications.
  - c. Flooring: Select flooring products with the following attributes:
    - 1) Carpet and carpet pad complying with the Carpet & Rug Institute Green Label and Green Label Plus program unless approved in writing by OHCD/PHDC/PRA to install non-complying carpet and carpet pad.
  - d. Interior Paints & Finishes: Paints and coatings with low to no VOC's, complying with the following VOC content limits:
    - 1) Architectural paints and coatings applied to interior walls and ceilings must not exceed the VOC content limits established in Green Seal Standard CS11, Paints, the most current addition, available at this link:  
[http://www.greenseal.org/Portals/0/Documents/Standards/GS-11%20Stn20Dev/paints GS 11.pdf](http://www.greenseal.org/Portals/0/Documents/Standards/GS-11%20Stn20Dev/paints%20GS%2011.pdf)
    - 2) Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 *g/L*.

- 3) Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed the current VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings, available at the following link: <http://www.agmd.gov/rules/reg/reg11/r1113.pdf>.
- e. Adhesives and Sealants: Adhesives and sealants with low to no VOC's, complying with current VOC content limits as outlined in the South Coast Air Quality Management District (SCAQMD) Rule #1168 available at the following link: <http://www.agmd.gov/rules/reg/reg11/r1168.pdf>.

E. Waste Management

1. Performance Requirements: The OHCD/PHDC/PRA has determined that projects shall divert as much non-hazardous construction and demolition waste as possible from landfills. Amount will be measured as a percentage of the total and percent totals will be measured by weight in tons.
2. Waste Management Plan: The Contractor will develop a waste management plan. This plan will be submitted to OHCD/PHDC/PRA for review prior to starting construction. The plan will identify anticipated types of waste and a plan for diverting waste from landfills, including names of organizations and facilities which will accept the diverted waste. The following waste to be diverted will be indentified at minimum, (as applicable to each project):
  - a. Recycling Waste: Recycle paper and beverage containers used by on-site workers.
    - 1) Packaging:
      - a) Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
      - b) Polystyrene Packaging: Separate and bag materials.
      - c) Pallets: As much as possible, require deliveries using pa/lets to remove pa/lets from Project site. For pa/lets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
      - d) Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
    - 2) Site-Clearing Wastes: Chip brush, branches, and trees off site.
    - 3) Concrete and Masonry: Place unusable excess/waste in designated area/container. Remove reinforcement and other metals from concrete and sort with other metals.
    - 4) Wood Materials: Place unusable excess/waste in designated area/container.
    - 5) Metals: Place unusable excess/waste in designated area/container.

- 6) 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.
- 7) Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and place with other metals.

F. Indoor Air Quality During Construction

1. General: The OHCD/PHDC/PRA has determined that all projects will institute minimum IAQ standards during construction. Standards are as follows:
  - a. Smoking is prohibited inside buildings during construction and within 10 feet of any window and door openings.
  - b. Storage Area: The Contractor must designate a secure and clean area to store all absorptive materials and products.
    - 1) Designate and review this area with OHCD/PHDC/PRA prior to taking delivery of and starting to store absorptive materials.
    - 2) Keep the designated area dry, clean, and orderly; prevent contamination of products from moisture and construction debris/dirt. Cover products with tarps that are weighted down.
    - 3) Monitor the storage areas for contamination; correct problems and implement preventative measures.
  - c. Protection:
    - 1) Do not install dry materials until wet materials have been installed and allowed to dry to greatest extent practical.
    - 2) Immediately remove products exhibiting stains, mold, mildew, or other evidence of water or moisture damage from site.
    - 3) Protect fabricated ductwork stored on site, wrapped and protected from dust and debris. Elevate ductwork off of floor level.
    - 4) Completely seal exposed duct ends and exposed return air and supply air grilles with plastic film and tape, or other suitable material, until after final cleaning of unit.

G. Energy Star for New Homes Certification

1. General: This part of the Section applies only to projects pursuing ENERGY STAR for New Homes Certification, as directed by the OHCD/PHDC/PRA. This Part is in addition to all requirements in preceding parts of this Section.
2. References
  - a. ENERGY STAR National Program Requirements:

- 1) Information on current program requirements is available here:  
[www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.homes\\_guidelns](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.homes_guidelns).

### 3. Administrative Requirements

- a. HERS Rater will inform the designers of ENERGY STAR requirements.
- b. HERS Rater will provide energy modeling of proposed construction to demonstrate that construction meets or exceeds ENERGY STAR for New Homes standards
- c. HERS Rater will perform inspections and tests to confirm performance in accordance with ENERGY STAR National Program Requirements.
- d. Contractor will respond to questions and requests from the OHCD/PHDC/PRA, and HERS Rater.

### H. LEED for Homes Certification

1. General: This part of the Section applies only to projects pursuing LEED for Homes Certification, as directed or approved by the PHCD/OHDC/PRA. This Part is in addition to all requirements in preceding parts of this Section References
  - a. LEED for Homes Reference Guide, current edition per USGBC and GBCI.
  - b. LEED for Homes Providers: Providers do not need to be in the state where the project is located. Refer to the USGBC website for a full listing of LEED for Homes Providers: [http://www.usgbc.org/DisplayPage.aspx?CMS\\_PageID=1\\_554](http://www.usgbc.org/DisplayPage.aspx?CMS_PageID=1_554)

### 2. Definitions

- a. In supplement and/or addition to definitions listed in Part B of this Section, the following:
  - 1) Environmentally Preferable Products: Products which contain recycled content, and are extracted, processed and manufactured locally, i.e.: within 500 miles of the home and that generally have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, product, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product or service.
  - 2) Green Rater: Individuals who work with the LEED for Homes Provider overseeing all verification services on a project.
  - 3) LEED for Homes Provider: Providers are responsible for working with eligible LEED for Homes projects, Green Raters, and verifying that homes are built to meet the requirements of the LEED for Homes Rating System.
  - 4) MERV: Minimum efficiency reporting value, a standard for mechanical air filters.
  - 5) USGBC: Unites States Green Building Council, a non-profit organization dedicated to promoting sustainable design and developers of the LEED for Homes Rating System.

3. Administrative Requirements

- a. In supplement and/or addition to requirements outlined in Part C of this Section:
  - 1) With approval to proceed with LEED certification by OHCD/PHDS/PRA, a qualified architect with LEED Accreditation shall be engaged.
  - 2) The developer and architect shall select a LEED for Homes Provider to monitor the project and perform inspections as required under LEED practices. A LEED for Homes Provider is required on LEED for Homes projects.
  - 3) Respond to questions and requests from the OHCD/PHDC/PRA, Architect, LEED for Homes Provider and Green Rater.
  - 4) Submit information to document compliance with LEED as directed by the Architect, LEED for Homes Provider and Green Rater.

4. Environmentally Preferable Materials

- a. Recycled Content: To the fullest extent possible, select products and materials which contain recycled content as defined in Part C of this Section. Materials containing recycled content include but are not limited to the following:
  - 1) Concrete
  - 2) Flooring products (carpet, vinyl, linoleum)
  - 3) Doors
  - 4) Roofing
  - 5) Drywall
- b. Extracted, Processed and Manufactured Locally: To the fullest extent possible, select products and materials which have raw materials which were extracted and processed within 500 miles of project site and which were manufactured within 500 miles of project site. Local materials are generally -but not limited to, the following:
  - 1) Concrete
  - 2) Flooring products (carpet, vinyl, linoleum)
  - 3) Doors
  - 4) Roofing
  - 5) Drywall

5. Waste Management

- a. In supplement to Part E of this Section, the following

- 1) Performance Requirements: Divert as much non-hazardous construction and demolition waste at minimum from landfills. Amount will be measured by weight in tons.

**END OF SECTION**

## DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

### ***SECTION 23 - QUALITY STANDARDS & CONSTRUCTION PROCEDURES***

- A. Quality Standards: Conform to the following standard material/product attributes and installation and workmanship requirements for all Sections within this Division.
1. References:
    - a. Reference: Builder’s Guide to Mixed-Humid Climates, Joseph Lstiburek, Ph.D., PE, Building Science Corporation, c. 2005; Chapter 12 “HVAC.”
    - b. Duct Manual and Sheet Metal Construction for Ventilation and Air Conditioning, Sheet Metal and Air Conditioning Contractors of America (SMACNA).
    - c. Manual D, Residential Duct Systems, Air Conditioning Contractors of America (ACCA, most current edition).
    - d. Manual J, Residential Load Calculation, Air Conditioning Contractors of America (ACCA), most current edition.
    - e. “Specifications of Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems,” Consortium for Energy Efficiency, July 2000, available at <http://www.ceel.org/resid/rs-ac/reshvacspec.pdf>.
  2. All work shall conform to current applicable code standards. Contractor is responsible for having a working knowledge of all codes.
  3. All equipment and ductwork shall be sized in accordance with ACCA Manual J and to maintain an interior temperature of 70 degrees F when exterior temperature is 10 degrees F and an interior temperature of 75 degrees F when exterior temperature is 95 degrees F.
  4. The heating capacity (output) rating of furnaces and boilers and cooling capacity of air conditioning systems shall not exceed the calculated design heat load and cooling load by the percentages specified in other Sections of this Division. Submit documentation of design heat and cooling load to OHCD/PHDC/PRA before beginning installation of equipment.
  5. Dryer venting shall be as specified in other Sections of this Division. No other type of venting is permitted.
  6. Equipment venting shall be as specified in other Sections of this Division and meet UL and NFPA requirements where required.
  7. Exhaust systems and ductwork for heating and cooling systems shall be designed and installed as specified in other Sections of this Division.
  8. The Annual Fuel Utilization Efficiency (AFUE) rating of heating equipment shall not be less than that specified in other Sections of this Division.
  9. The Seasonal Energy Efficiency Rating (SEER) of cooling equipment shall not be less than that specified in other Sections of this Division.

10. Locate all ductwork within the thermal boundary. Do not locate ductwork in attics unless within the thermal boundary.
  11. Properly seal all joints and seams in ductwork against air leakage as specified in other Sections of this Division.
  12. Alternate space heating methods, for example, electric resistance heat, are not permitted unless approved in writing by the OHCD/PHDC/PRA. In such cases where approval is sought, follow protocol for submitting required information to OHCD/PHDC/PRA as specified in other Sections of this Division.
  13. All systems shall be tested and balanced to verify proper operation in accordance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- B. Construction Procedures: Conform to the following standard construction procedures. Procedures apply to all Sections within this Division.
1. Verify all existing site conditions prior to commencing work.
  2. Provide required clearances around equipment as specified in other Sections of this Division.
  3. Install all equipment to be level and plumb.
  4. Seal off unused chimneys. Demolish and cap or repair and make sound deteriorated portions.
  5. Clean heating and cooling systems equipment and distribution system in accordance with requirements specified in other Sections of this Division.

**END OF DOCUMENT**



**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 05 93- TESTING, ADJUSTING AND BALANCING FOR HVAC***

A. Summary

1. Section Includes:

- a. Testing and adjusting ducted air system.
- b. Testing and verification of air conditioning system airflow and refrigerant charge.
- c. Testing and adjusting hydronic systems.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements.

3. Applicability:

- a. All furnaces, air conditioners, and ducted air distribution systems.
- b. All boilers and hydronic piping distribution systems.

4. Qualified testers - testing contractor shall be a company experienced in adjusting air distribution systems, commissioning air conditioning equipment, and adjusting hydronic systems to suit installed systems.

B. Related Requirements

1. Section 07 97 00 - Blower Door Air Leakage Testing
2. Section 23 30 00 - HVAC Air Distribution.
3. Section 23 2113 - Hydronic Piping.
4. Section 23 50 00 - Central Heating System Requirements.
5. Section 23 52 16 - Heating Boilers.
6. Section 23 54 00 - Furnaces.
7. Section 23 81 26 Split System Air Conditioners

C. Submittals

1. Required information:

- a. Upon completion of work, testing and adjusting reports shall be submitted to OHCD/PHDC/PRA in specified format, with identifying label on cover. Each report shall be signed by the technician(s) who performed the test. The reports are (1) certified proof that the systems have been tested and adjusted in accordance with the referenced standards; (2) an accurate representation of how the systems have been installed and are operating; and (3) an accurate record of all final quantities measured to establish normal operating values of the systems.
- b. Include set of reduced drawings with supply air outlets, return air inlets, and equipment identified to correspond with data sheets, and indicating thermostat locations. If information is incomplete or further testing and adjusting is deemed necessary, submit final complete report after those further steps have been taken.

2. Format:

- a. Bind report forms in letter sized folder, or three-ring binder, or portfolio binders. Label on front cover shall include the title HVAC Testing and Adjusting Report and the name and address of the property.
- b. Title Page:
  - 1) Testing company name, address and telephone number, Name, signature, and registration number of each technician performing test, Property name and location, Project Architect, Project Contact, or OHCD/PHDC/PRA Inspector, Date of report, and testing methods used for each test. Identify Airflow test method (Static Pressure or Temperature Split), and refrigerant charge adjustment method (Sub-cooling test or Weigh-in).
- c. Instrument List:
  - 1) Type of instrument
  - 2) Manufacturer
  - 3) Model
  - 4) Range
- d. Fully completed City of Philadelphia "Air Conditioning Commissioning Report" form (if applicable), including:
  - 1) System Description showing manufacturer, model number, serial number and installation dates for Air Handler/Evaporator and for outside condensing units.
  - 2) System Airflow Requirements, including Manufacturer, Model Number of AC and Air Handler/Furnace unit, Rated Capacity, Load calculations as specified in Section 23 52 16 and Section 23 54 00, Targeted System

Airflow at 450 cfm per ton (as determined by load calculations), Estimated System Airflow per manufacturer's data in cooling and heating modes, difference between targeted and estimated airflow.

- 3) Verification of proper airflow, using Static Pressure method or Temperature Split method.
- 4) System Charging Verification Test, using Sub-cooling method (if ambient temperature is above manufacturer-specified minimum), otherwise Weigh-in method.
- 5) The following required information:
  - a) Name and address of development
  - b) Name of General Contractor
  - c) Name and phone number of company employing the technician(s) who commissioned the system
  - d) Name(s) of technician(s) commissioning the system (on each form) and certification of results by same.

D. Testing and Adjusting Ducted Air System

1. Examination:

- a. Before commencing work, verify that systems are complete and operable. Ensure the following:
  - 1) Equipment is operable and 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) Fan rotation is correct.
  - 7) Fire and volume dampers are in place and open.

- 8) Coil fins have been 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 has been minimized.
- b. Report any defects or deficiencies noted during performance of services to Architect/Engineer and to OHCD/PH DC/PRA.
  - c. Promptly report abnormal conditions in mechanical systems or conditions which prevent system balance.
  - d. If, for design reasons, system cannot be properly balanced, report as soon as observed. Beginning of work means acceptance of existing conditions.
2. Preparation: Provide instruments required for testing and adjusting operations. Make instruments available to Architect/Engineer and to OHCD/PHDC/PRA to facilitate spot checks during testing.
  3. Air system testing procedure:
    - a. Test system with blower in Cooling or "Fan ON" mode.
    - b. Measure air quantities at furnace supply and return duct. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. Adjust furnace and duct system to operate with supply and return air volumes required by system design.
    - c. Adjust air handling and distribution systems to provide uniform space temperatures free from objectionable drafts and noise.
    - d. 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. Adjust furnace and duct system to operate with pressure drop required by system design.
  4. Recording:
    - a. Recorded data shall represent actually measured or observed condition.
    - b. Record results on Report form approved by OHCD/PHDC/PRA.
    - c. Provide system schematic with required and actual air quantities recorded at furnace.

5. Final Steps:
  - a. Permanently mark settings of dampers and other adjustment devices, allowing settings to be restored. Set and lock stops.
  - b. Leave systems in proper working order, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
  - c. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by OHCD/PHDC/PRA.
  
- E. Air Conditioning System Commissioning Step 1 – Verification of Airflow through Indoor Coil
  1. General:
    - a. Measured airflow over the indoor coil should be (a) as indicated in the manufacturer’s installation literature, or (b) the equivalent of 400 to 450 cfm per ton for a wet coil (condensation on coil) or 425 to 475 cfm per ton for a dry coil. “Targeted Airflow” on the Commissioning Report form is defined as 450 cfm per ton. Indoor coil airflow must always be measured after any duct and plenum sealing has been completed.
    - b. Examination: Same as ducted air system above.
    - c. Preparation: Same as ducted air system above.
    - d. Test Methods:
      - 1) Static Pressure.
      - 2) Temperature Split.
    - e. Choice of Method:
      - 1) The Air Conditioner Commissioning Report form assumes use of the Static Pressure method. This default test is unreliable, however, unless ducts near the air handler are fairly straight. If there are sharp bends or dead ends in the duct work, it is recommended that the Temperature Split method be used to verify that the system is producing proper airflow across the coil. A supplemental form is available for recording Temperature Split method results.
    - f. Static Pressure method:
      - 1) Required equipment:
        - a) Digital or analog manometer
        - b) Static pressure probe or pitot tube

- c) Drill and bits
- d) Screw or nut drivers

2) Procedure:

- a) Using drill, make hole to gain access to both sides of the coil and air handler. Attach static pressure probes to tubes leading to the ports on the manometer. For analog manometers, attach the high side port to the probe inserted downstream of the coil or air handler. Consult manufacturer's literature for a table relating static pressure difference to airflow. Find airflow for the static pressure measured above.
- b) If estimated airflow is less than the minimum flow specified in the manufacturer's installation literature (or 400 cfm per ton wet coil / 425 cfm per ton dry coil), installer must increase flow by eliminating restrictions in the duct system, increasing blower speed, or opening registers. After adjustment, re-measure.
- c) On Air Conditioning Commissioning Report form, record adjustments made, final results, and if target airflow could not be achieved, document reason.

3) Background:

- a) With this method, the air temperature drop across the cooling coil is compared to a reference value read from a table. This drop is called the "temperature split." The Actual Temperature Split is the difference between the dry bulb temperature in the return (entering the evaporator) and the dry bulb temperature in the supply (leaving the evaporator).
- b) The Target Temperature Split depends on return air wet-bulb temperature and return air dry-bulb temperature.

g. Instrumentation:

- 1) Digital thermometer with thermocouple compatibility (type K and J) and Celsius or Fahrenheit readout;
  - a) Accuracy:  $\pm(0.1\% \text{ of reading} + 1.30 \text{ F})$ ,
  - b) Resolution:  $0.2^\circ \text{ F}$  to  $1.0^\circ \text{ F}$ .

- 2) Thermocouples: five heavy-duty beaded low-mass wire thermocouples and one cotton wick for measuring web-bulb temperatures.
- 3) Standard multipoint refrigerant manifold gauge set.

h. Procedure:

- 1) This procedure may be used only when the outdoor temperature is 55° F or higher. The HVAC system must first be installed and charged in accordance with the manufacturer's specifications.
  - a) Calculate the Actual Temperature Split as the return air dry-bulb temperature minus the supply air dry-bulb temperature. Actual Temperature Split =  $(T_{\text{return, db}}) - (T_{\text{supply, db}})$
  - b) Determine the Target Temperature Split from the table on the back of the supplemental form, using the return air wet-bulb temperature ( $T_{\text{return, wb}}$ ) and return air dry-bulb temperature ( $T_{\text{return, db}}$ ).
  - c) Calculate the difference between target and actual temperature split (Actual Temperature Split minus Target Temperature Split).
    - (1) If the difference is within plus 3 degrees F and minus 3 degrees F, then airflow is adequate.
    - (2) If the difference is greater than plus 3 degrees F, then airflow is insufficient; installer must increase flow by eliminating restrictions in the duct system, increasing blower speed, or opening registers. After corrective measures are taken, repeat measurement procedure as often as necessary to establish adequate airflow range. Allow system to stabilize for 15 minutes before repeating measurement procedure.
    - (3) If the difference is between minus 3 degrees F and minus 25 degrees F, repeat the measurement procedure - making sure that temperatures are measured at the center of the airflow.
    - (4) If the re-measured difference is between plus 3 degrees F and minus 3 degrees F, system airflow is acceptable. If the re-measured difference is between minus 3 degrees F and minus 25 degrees F, the system passes but it is likely that capacity is low (it is also possible, though unlikely, that airflow is higher than average).

- d) On Air Conditioning Commissioning Report form, record adjustments made, final results, and - if target airflow could not be achieved - why not.

F. Air Conditioning System Commissioning Step 2- Verification of Refrigerant Charge

1. Examination: Same as ducted air system above.
2. Preparation: Same as ducted air system above.
3. Test methods:
  - a. Sub-cooling method
  - b. Weigh-in method
4. Choice of method:
  - a. Although the Sub-cooling method provides the most accurate verification of refrigerant charge in a TXV-equipped system, at ambient temperatures below a manufacturer-specified minimum (typically 75° - 80° F) it requires calibrated partial blocking of the condenser's airflow to simulate design temperatures. Accordingly, the Weigh-in method is approved for use in cooler weather. The Weigh-in method assumes that the compressor unit has been delivered with the correct factory charge and adjusts refrigerant quantity by formula to account for variations in the line length between the compressor unit and indoor coil.
5. Sub-cooling method:
  - a. Background:
    - 1) Sub-cooling is the heat removed from the refrigerant after it has changed to a liquid. Modern condensing units are designed to obtain their capacities and efficiencies at a given sub-cooling value. Any variance from the design sub-cooling will reduce capacity and efficiency. Note that the "evaporator superheat" method is accurate only for capillary coils and those having a fixed orifice; it may not be used with PHDC/PRA approved systems.
  - b. Instrumentation and equipment:
    - 1) Refrigerant manifold gauge set Contact digital thermometer, accurate to tolerances specified for Verification of Airflow Through Indoor Coil, with auxiliary devices as needed to establish good contact for the thermometer probe DOT-approved recovery cylinder.
  - c. Setup:



- 1) Before the test is performed, proper airflow across the coil must be verified by static-pressure or temperature-split method.
- 2) Air conditioner should be running for 10 minutes prior to the test.

d. Procedure:

- 1) Test must be performed when outside temperature is above minimum set by manufacturer (or, absent such guidelines, 80° F).
- 2) Follow the manufacturer's guidelines for the test. If they are not available, follow the instructions below.
- 3) Measure the compressor discharge pressure. Convert this pressure to the condensing temperature, using temperature-pressure table for the system's refrigerant. Or, simply measure the surface temperature of a protruding loop of tubing in the center of the condenser between that section's inlet and outlet.
- 4) Measure the temperature of the liquid refrigerant leaving the condenser.
- 5) Subtract the liquid-refrigerant temperature from the condensing temperature. This is the sub-cooling temperature.
- 6) Find the correct sub-cooling temperature from the permanent sticker inside the condenser unit, from manufacturer's literature or from a manufacturer's slide rule.
- 7) Add refrigerant if the measured sub-cooling temperature is lower than recommended. Subtract refrigerant if the sub-cooling temperature is higher than recommended. Refrigerant must be removed into an empty DOT-approved recovery cylinder or one containing the same refrigerant being removed.
- 8) Allow the system to run for 10 minutes to adjust to the new operating conditions. Repeat the test until the results match the manufacturer's recommendations.

e. Recording:

- 1) Record the results of this test on Furnace/Air Conditioning Commissioning Report – Sub-cooling Attachment form. Each unit must be tested and reported.

6. Weigh-in Method:

a. Instrumentation and equipment:

- 1) Electronic scale for accurate measurement of refrigerant added or removed.
- 2) Tape measure
- 3) Vernier caliper
- 4) Refrigerant of the type used in the system to be adjusted.
- 5) DOT-approved recovery cylinder.

b. Procedure:

- 1) All lengths and quantities mentioned below are to be recorded on Furnace/Air Conditioning Commissioning Report form.
- 2) Measure and record total feet of line set at site (one way) between compressor unit and indoor coil.
- 3) Record length of line set included with factory charge.
- 4) Subtract record length of line from the measured total fee of line installed. Record difference. This is the Line Set Adjustment.
- 5) Measure the outside diameters of suction and liquid lines. Circle the appropriate row in Charging Data table on reverse of form. Record the Rated Line Set Charge in ounces per foot.
- 6) Multiply the line set adjustment by the rated line set charge. Record the resulting Charge Adjustment.
- 7) If the charge adjustment is negative, remove the indicated quantity of refrigerant to the recovery cylinder. If it is positive, add the indicated quantity of refrigerant to the unit.

G. Testing and Adjusting Hydronic Systems

1. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
2. Prepare schematic diagrams of systems' "as-built" piping layouts.

3. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - a. Open all manual valves for maximum flow.
  - b. Check liquid level in expansion tank.
  - c. Check makeup water-station pressure gage for adequate pressure for highest vent.
  - d. Check flow-control valves for specified sequence of operation, and set at indicated flow.
  - e. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - f. Set system controls so automatic valves are wide open to heat exchangers.
  - g. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  - h. Check air vents for a forceful liquid flow exiting from vents when manually operated.
  
4. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
  - a. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
    - 1) If impeller sizes must be adjusted to achieve pump performance, obtain approval from Owner and comply with requirements in Section 232123 "Hydronic Pumps."
  - b. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved. Monitor motor performance during procedures and do not operate motors in overload conditions.
  - c. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - d. Report flow rates that are not within plus or minus 10 percent of design.
  
5. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

6. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
7. Set calibrated balancing valves, if installed, at calculated pre-settings.
8. Measure flow at all stations and adjust, where necessary, to obtain first balance. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
9. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
10. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - a. Determine the balancing station with the highest percentage over indicated flow.
  - b. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  - c. Record settings and mark balancing devices.
11. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
12. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
13. Check settings and operation of each safety valve. Record settings.

**END OF SECTION**

**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 11 23- FACILITY NATURAL-GAS PIPING***

A. Summary

1. Section Includes:

- a. Natural gas piping and accessories.

B. Quality Assurance

1. Materials and installation shall comply with the International Fuel Gas Code.
2. Minimum Operating-Pressure Ratings: Piping and Valves: 150 psig.

C. Materials

1. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40.
2. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, as approved by Philadelphia Gas Works.
3. Appliance Flexible Connectors: Comply with ANSI Z21 .24, as approved by Philadelphia Gas Works. Maximum Length: 72 inches.
  - a. Flexible connectors are not permitted for connection to furnaces, boilers, and water heaters.
4. Gas shutoff valves: Comply with ASME B 16.33, threaded ends.
5. Corrugated stainless steel tubing and fittings as approved by Philadelphia Gas Works.

D. Execution:

1. Arrange for gas service and meter with Philadelphia Gas Works.
2. Size new service in accordance with Philadelphia Gas Works recommendations for gas equipment consumption and length of run.
3. Install drip leg, union, and shutoff valve near each appliance.
4. Provide shut-off valve at meter.

5. Extend relief vent connection for service regulator and terminate with weatherproof vent cap.
6. Support piping at intervals used in standard engineering practice.
7. Test piping and appliance connections for leaks in accordance with Philadelphia Gas Works requirements.

**END OF SECTION**

**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 30 00- HVAC AIR DISTRIBUTION***

A. Summary

1. Section Includes:

- a. Metal ductwork.
- b. Flexible ductwork.
- c. Supply air outlets.
- d. Return air inlets.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements.

B. Related Requirements

1. “Duct Manual and Sheet Metal Construction for Ventilation and Air Conditioning” - Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
2. “Manual D, Residential Duct Systems” - Air Conditioning Contractors of America (ACCA).

C. Performance Requirements

1. Duct Sealing: Seal installed ductwork in accordance with IECC to minimize air leakage within duct system.

D. Submittals

1. Submit ductwork layout drawing showing duct routing, duct sizes, and air flow at each outlet and inlet, and outlet and inlet sizes.

E. Products

1. All ductwork, plenums, casings, construction and erection methods, including metal gauges, reinforcing, fittings, connections, access doors, and all other accessories shall be in accordance with Section 1 and 2 of the SMACNA Duct Manual.
2. Metal Ductwork: Galvanized steel of gauges noted in SMACNA manual.
3. Flexible Ductwork. Flex duct may be permitted for branch runs of less 8 feet serving a single register when approved in writing by OHCD/PHDC/PRA.
4. Supply Air Outlets: Formed metal with volume adjustment damper, factory finish painted.

5. Return Air Inlets: Formed metal, factory finish painted.
6. Insulation: Free of asbestos, lead, mercury, or mercury compounds
  - a. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin and factory-applied ASJ or FSK facing. Comply with ASTM C 553, Type II and ASTM C 1290.
  - b. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin and factory-applied ASJ or FSK facing. Comply with ASTM C 612, Type IA or Type IB.
  - c. Adhesives, Tapes, Sealants and Mastics: Manufacturer's recommended type, compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated.

F. Supply System

1. Ductwork: Arrange trunks and branch runs as short and compact as possible. Arrange ductwork so all ductwork is installed on inside the building thermal boundary.
2. Supply Air Outlets:
  - a. Ground Floor: Locate low on the wall.
  - b. Upper Floors: Locate high on the wall.
  - c. Locate at exterior wall below windows.
    - 1) When windows conform to thermal performance requirements of Section 08 50 00, supply air outlets may be located high on the interior wall opposite windows, arranged to direct airflow across ceiling and down the exterior wall.
3. System Pressure Drop: Maximum 0.2 inch w.c. per 100 equivalent feet of run.
4. Maximum Velocity: 600 feet per minute.
5. Ductwork Sizing: Size branch runs for airflow required by the heating and cooling load calculated for each room as specified in Section 23 52 00 and Section 23 81 26. As an alternative to duct system engineered in accordance with ACCA Manual 0, ducts may be sized according to the following table.

G. Return System

1. Return Air Inlets: Locate return air inlets in a central area communicating directly with all closable rooms



- a. One- and two-story units. Install a single non-closing inlet low on the walls.
  - 1) In a two-story unit, locate inlet on the lower floor.
- b. Three- and four-story units. Install two non-closing inlets, one low on a ground floor wall and one high on a top-floor wall.

2. Ductwork:

- a. Provide ducted return system, except as noted below.
- b. Seal ducted return system joints with mastic.

Air Flow (cfm)	Round Duct (inches)	Rectangular Duct (inches)
0-65	5	6x3.5
66-110	6	0x3.5,8x4,6x5
111-160	7	4x3.5,12x4,8x6
161-230	8	18x3.5,16x4,10x6,8x8
231-410	10	26x4,16x6,12x8,10x10
411 -650	12	24x6, x16, x8, 12 x 10
651 -1000	14	32x6,22x8,16x10,14x12
1001-1400	16	30x8,22x10,18x12,16x14

- c. Cavity Returns - General: Joist panning is permitted where the joist cavity is exposed (e.g. unfinished basement). Seal throughout, including all joints, corners and penetrations.
  - 1) Cavity returns are permitted only when approved in writing by OHCD/PHDC/PRA, and only when LEED compliance is not required.
  - 2) Cavities must be fully metal panned, sealed and functional for inspection before drywall is installed.

- 3) After drywall is installed, pressure test when required by OHCD/PHDC/PRA to prove seal. Perform test with air handler fan running. Pressure shall not be more than 1 Pascal or 3 inches w.c. greater than atmospheric pressure in framing cavities adjacent to the ducted section and in the mechanical room itself.
  - d. Wood Framed Return Plenums: May be used with return air inlets to permit air egress from closed rooms to central return. Subject to the same sealing and testing requirements specified for special case cavity returns, other return plenums may also be wood-framed.
    - a) Wood framed plenum returns are permitted only when approved in writing by OHCD/PHDC/PRA.
  - e. Filter retainer: Provide with hinged galvanized closure or install inside fan compartment.
3. Duct Cross-Section:
- a. The net free area of each return grille and the cross sectional area of each return duct shall not be less than either (a) 90% of the cumulative cross-sectional areas of the supply ducts, or (b) 24 sq. inches for each 100 cfm of supply air.

#### H. Return Air Egress from Rooms

1. Provide room supplied with conditioned air with a non-closable means for air egress. Comply with one of the following:
  - a. Prescribed Area Method: Provide transfer grilles or ducts which - in combination with an optional door undercut not more than 3/4" - have a minimum total cross-section at least twice the supply duct area. (Example: for a bedroom served by one 5-inch round supply duct, the Air Egress Area shall be at least 39.3 sq. inches. Maximum allowable door undercut provides 22 sq. inches.) For bathrooms only, when approved in writing by OHCD/PHDC/PRA, a door grille or 1-5/8" door undercut may be used instead of the through-wall or ducted transfer grille described below.
  - b. Performance Test: With doors closed, air handler shall not pressurize the room more than 3 Pascals (0.01 inches w.c.) relative to the area containing the main return register; air flow measured at the supply register shall not decrease by more than 10 percent. Total airflow may not be less than the cfm calculated for the room and shown on the duct plan.
2. Configuration of transfer duct/grilles (required except for bathrooms):
  - a. Through wall (preferred method):

- 1) Prefabricated Unit: Through-wall pressure relief vent with sound-absorbent baffle. Use 4 X 12-inch size for rooms with a single 5-inch round or 3.5 X 6-inch rectangular duct. Use 4 X 24-inch size for rooms with duct cross-sectional area up to 48 sq. inches.
  - 2) Site-Built Unit: Offset grilles connected through wall. Utilize wood stud cavity, or box in steel framing with wood 2x lumber. Use sealed 2x blocking or ball-in- plastic bag pillow to block off remainder of stud cavity within 6 inches of grille openings. Offset room- and hallway-side grilles by 2 to 3 feet between openings and seal to drywall. Sealant must be visible to inspector upon removal of grille. Where wall configuration does not permit offset as described, place grilles above door with fixed uni-directional vanes oriented upward to minimize light transmission.
- b. Ducted: For other than through-wall above, use galvanized steel. Do not run in exterior walls or outside thermal boundary.

I. Installation - General

1. Install ductwork in accordance with NFPA 90-B.
  - a. Install ductwork within thermal boundary of each residential unit.
  - b. Install ductwork to avoid branch runs within exterior walls.
    - 1) When unavoidable, provide clearance to permit continuous un-compressed building thermal insulation on the cold side of the duct as specified in Section 07 20 00.
2. Install balancing dampers near takeoff in all accessible supply runs. Dampers are not required in engineered systems.
3. Return damper in air-conditioned, three- and four-story units - Provide (labeled) damper to switch between upper and lower return. Label shall indicate "Position for air conditioning" (lower return closed) and "Position for heating" (upper return closed).
4. Install ductwork concealed from view in completed construction.
  - a. Exposed ducts are permitted in basements and furnace rooms only.
5. Secure tight filling joints in ductwork with two screws spaced 120 degrees apart. Provide additional screws to eliminate possibility of damage to seal by joint movement before close-in.
6. Sealing of ductwork:

- a. Seal supply and return ductwork with mastic at all joints and gaps, including joist panning, plenum connections, and register boots.
- b. Embed fiberglass mesh tape in mastic if joint rotation is possible or joint opening exceeds 1/8 inch.

7. Install combustion air transfer grilles as required by National Fuel Gas Code.

8. Install supply air outlets and return air inlets at duct openings.

J. Leakage Testing

1. Verify leakage performance when ductwork is installed outside the thermal boundary of the conditioned space with duct blaster or other OHCD/PHDC/PRA approved method. Ductwork installed inside the thermal boundary need not be tested.
2. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual" before ducts are concealed by other construction. Submit a test report for each test as specified in Section 23 05 93.
3. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.

K. Cleaning

1. Comply with NADCA ACR 2006.
2. Remove visible surface contaminants and deposits from within the HVAC system.
3. Systems and Components to Be Cleaned: All air devices for supply and return air, air-terminal units, ductwork, air-handling units, filters and filter housings.
4. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
  - a. Use HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger where the particulate collection equipment is exhausting inside the building,
  - b. Control odors and mist vapors during the cleaning and restoration process. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

5. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components after cleaning is completed.
- L. Insulation Installation
1. Install insulation materials in accordance with manufacturer's installation instructions.
  2. Insulate ductwork with minimum R-6 insulation in unheated basements and minimum R12 insulation in attics.
  3. Insulate ductwork for air conditioning systems with 1-1/2 inch thick insulation.
  4. Tape and seal joints in vapor retarder facings and jackets to prevent condensation within insulation and on ductwork.
- M. Commissioning
1. After construction, HVAC installer or third-party air balancer must balance the system and verify that air flow at each supply air outlet equals the planned flow plus or minus no more than 10 percent.
    - a. Balance system in heating mode.
    - b. Balance system in cooling mode when air conditioning is provided as part of the Work.
  2. Balance each unit and submit balancing report to OHCD/PHDC/PRA on approved form in accordance with the instructions in Section 23 05 93.

**END OF SECTION**



**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 35 00- EXHAUST SYSTEMS***

A. Summary

1. Section Includes:

- a. Ducted kitchen range hood.
- b. Duct for owner-installed clothes dryer.
- ~~c. Whole-house ventilation system.~~
- d. Bath exhaust fan.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements.

B. Related Requirements

1. Section 23 30 00 - HVAC Air Distribution.

C. Kitchen Range Hood

- 1. Ratings: 180 cfm minimum; 4.5 sones maximum sound rating.
- 2. Housing Construction: Steel, primed and finish painted in color selected by Owner.
- 3. Fan/Motor Assembly; Two speed; resiliently mounted to housing.
- 4. Air Inlet: Protect with removable, washable aluminum filters.
- 5. Work Area Light: Protected with removable lens.
- 6. Controls: Separate built-in switches for fan and light.
- 7. Vent Cap: Weatherproof, painted galvanized steel roof or wall cap.

D. Microwave Oven Over the Range

- 1. Vent Cap: Weatherproof, painted galvanized steel roof or wall cap.

E. Clothes Dryer Vent

- 1. Vent: 4 inch diameter, UL Listed, rigid steel type.
- 2. Vent Cap: Weatherproof, painted galvanized steel roof or wall cap with integral backdraft damper.

F. ~~Whole House Ventilation System~~

1. ~~Ratings: Continuous duty, single speed fan, with a permanent split capacitor motor, maximum 1.5 sones as rated by the Home Ventilating Institute.~~
2. ~~Fan Capacity: Determined by number of bedrooms in unit:~~
  - a. ~~Up to 3 bedrooms: 50 cfm.~~
  - b. ~~4 bedrooms: 90 cfm.~~
  - c. ~~5 or more bedrooms: 110 cfm.~~
3. ~~Fan Assembly:~~
  - a. ~~Housing: Steel, lined with acoustical insulation.~~
  - b. ~~Fan: Centrifugal type, steel construction mounted directly on and secured to motor shaft using steel set screw. Connect fan shroud, motor and wheel assembly to housing using rubber in-shear isolators, removable for service. V~~
  - c. ~~Discharge: Include integral backdraft damper.~~
  - d. ~~Grille: Manufacturer's standard with flange attachment to housing; factory painted finish.~~
4. ~~Controls: Control fan by (1) by the bathroom light switch (or adjacent crank timer) and (2) by a clearly labeled switch mounted in basement or furnace room, near furnace safety switch.~~
  - a. ~~Mark "Off" position of basement switch "SUMMER ONLY."~~
  - b. ~~When basement switch is on, fan runs continuously.~~
  - c. ~~When basement switch is off, fan runs only when bathroom light (or crank timer) is on.~~
5. ~~Vent Cap: Weatherproof, painted galvanized steel roof or wall cap.~~

G. Bath Exhaust Fan

1. Ratings: Continuous duty, single speed fan, with a permanent split capacitor motor, maximum 1.5 sones as rated by the Home Ventilating Institute.
2. Fan Capacity: 50 cfm, minimum.
3. Fan Assembly:
  - a. Housing: Steel, lined with acoustical insulation.
  - b. Fan: Centrifugal type, steel construction mounted directly on and secured to motor shaft using steel set screw. Connect fan shroud, motor and wheel assembly to housing using rubber-in-shear isolators, removable for service.
  - c. Discharge: Include integral backdraft damper for connection to duct to exterior, unless re-circulating type is approved in writing by OHCD/PHDC/PRA.



- d. Grille: Manufacturer's standard with flange attachment to housing; factory painted finish.
- 4. Controls: Control fan by (1) by the bathroom light switch (or adjacent crank timer).
- 5. Vent Cap: Weatherproof, painted galvanized steel roof or wall cap.

#### H. Installation

- 1. Install exhaust systems in accordance with NFPA 90-B, duct requirements specified in section 23 30 00 and manufacturer's instructions.
  - a. Install exhaust systems using shortest path to exterior with minimum number of elbows.
  - b. Connect exhaust systems to vent cap on roof or exterior wall. Seal vent cap to prevent air infiltration and water intrusion to building interior.
- 2. Kitchen Range Hood:
  - a. Install kitchen range hood ducted to exterior using Schedule 40 PVC or metal ductwork.
- 3. Clothes Dryer Vent:
  - a. Install clothes dryer vent from dryer location near required 20-amp receptacle in basement or laundry area as indicated or as directed by Inspector.
- ~~4. Whole House Ventilation System:
  - ~~a. Install whole house ventilation system, unless Building Performance Institute (BPI) auditor determines it is not necessary.~~
  - ~~b. Install fan in bathroom ceiling ducted to exterior using Schedule 40 PVC or metal ductwork sized to match fan discharge diameter.~~
  - ~~c. Seal ductwork joints air tight.~~
  - ~~d. Slope horizontal runs in unheated spaces toward discharge and seal to wall cap forming air tight and watertight joint.~~~~
- 5. Bath Exhaust Fan:
  - a. Install bath exhaust fan in each bathroom when whole house ventilation system is not installed.
  - b. Install fan in bathroom ceiling ducted to exterior using Schedule 40 PVC or metal ductwork sized to match fan discharge diameter unless re-circulating type is approved in writing by OHCD/PHDC/PRA.
  - c. Seal ductwork joints air tight.
  - d. Slope horizontal runs in unheated spaces toward discharge and seal to wall cap forming air tight and watertight joint.

**END OF SECTION**

**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 51 23- GAS VENTS***

A. Summary

1. Section Includes:

- a. Gas vents for domestic water heaters.
- b. Gas vents for heating boilers.
- c. Gas vents for furnaces.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements”.

B. Related Requirements

1. Section 22 36 00 - Domestic Water Heaters.

2. Section 23 52 16 - Heating Boilers.

3. Section 23 54 00 - Furnaces.

C. Products

1. Listed Chimney Liners to be used on existing chimneys.

- a. Description: Single-wall chimney liner tested according to UL 1777 and rated for 1000 deg F continuously and 2100 deg F for 10 minutes; with negative or positive flue pressure complying with NFPA 211.
- b. Accessories: Fittings: Tees, elbows, increasers, draft-hood connectors, metal caps with bird barriers, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar or compatible materials and designs.
- c. Sealant: Manufacturer’s standard high-temperature sealant.
- d. Fill: Manufacturer’s standard high-temperature insulation fill material in annular space surrounding chimney liner including high-temperature, ceramic-fiber insulation required to seal chimney at top and bottom.

2. Listed Type B Vents to be used with gas fired units.

- a. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, with neutral or negative flue pressure complying with NFPA 211.

- b. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.
  - c. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - d. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.
3. Listed Type L Vents to be used with oil fired units.
- a. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously and 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.
  - b. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace filled with high-temperature insulation.
  - c. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - d. Termination: Stack cap designed to exclude 90 percent of rainfall.
4. Barometric Dampers.
- a. Construction: High-temperature-enamel-painted steel damper and housing with galvanized-steel breeching connection and adjustable counterweight with lock.
  - b. Include knife-edge bearings that do not require lubrication.
5. Vent Dampers, when approved in writing by OHCDIPHDC/PRA.
- a. Construction: Stainless-steel damper blade, shaft, and vent pipe with metal, pre-lubricated bearings.
  - b. Electric Motor: Sized to power damper open and closed in approximately 15 seconds in each direction. Power is off when damper is at rest. Comply with ANSI Z21 .66.
  - c. Controls: Control transformer. Keyed wiring harness. Damper end-switch to prove damper is open. Interlock with boiler to permit burner operation when damper is open. Hold-open switch for troubleshooting

D. Installation

- 1. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

2. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
  3. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding unit loading.
  4. Slope breechings down in direction of unit, with condensate drain connection at lowest point piped to nearest drain.
  5. Lap joints in direction of flow.
  6. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
  7. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
  8. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.
- E. Application
1. Condensing Units: Vent using plastic pipe in accordance with the National Fuel Gas Code and the manufacturer's instructions.
  2. Non-Condensing Units Vented Horizontally: Vent through a side or rear wall using Listed B-Vent or Listed L-Vent in accordance with the National Fuel Gas Code and the manufacturer's instructions.
    - a. Water heaters shall be vented horizontally.
    - b. Furnaces and boilers may be vented horizontally.
  3. Non-Condensing Units Vented Vertically:
    - a. When approved in writing by OHCD/PHDC/PRA, the use of an approved furnace common-vented with an atmospheric water heater may be permitted only where the chimney has been sized appropriately for this combined venting and has been lined with a stainless steel or galvanized steel vent approved for this application. Under no circumstances may an unlined masonry chimney be used for venting gas fired- appliances. Approval will be granted only for single-family rehab units (not new construction); the units may not be centrally air conditioned. Any such installation must comply with manufacturers' instructions for common-venting fan-assisted and atmospherically-vented units and with all applicable requirements of the National Fuel Gas Code (Part 7, Venting of Equipment and Part 11, Sizing of Category I Venting Systems). In addition,

- 1) The combustion equipment must be in a basement;
  - 2) the B-vent must be inside the thermal envelope;
  - 3) the water heater vent connector must be no larger than 3" in diameter;
  - 4) the final as-tested infiltration rate must be not less than 1400 CFM50;
- b. In other special situations when approved in writing by OHCD/PHDC/PRA, the use of an approved power-vented or passive direct-vented water heater and approved furnace vented vertically may be permitted. Neither may be common-vented with any other unit; each must have a dedicated code-approved vent.
- F. Units Located in an Equipment Room in the Living Space:
1. Approved direct-vent units may be located in the living space.
  2. Approved power-vented, non-direct-vent units (each with its own dedicated vent) may be located in the living space. The equipment room shall then have permanently open ventilation registers to admit combustion air from the living space. Size ventilation registers to provide the required net free area per 1,000 BTU of gas input in accordance with the National Fuel Gas Code. Combustion air shall not be drawn from a bedroom or bathroom.
  3. Under no circumstances may atmospherically vented non-direct-vent units be installed in the living space.
- G. Chimneys:
1. Unused chimneys shall be sealed off at top and bottom.
  2. Deteriorated Chimneys: Repair to make sound or demolish and cap to make building air tight and watertight.

**END OF SECTION**

**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 52 00- CENTRAL HEATING SYSTEM REQUIREMENTS***

A. Summary

1. Section Includes

- a. Complete new heating system consisting of one of the following:
  - 1) Hydronic System: Boiler, water supply connection, hydronic distribution system, fuel system, temperature control system, and all required accessories.
  - 2) Air System: Furnace, air distribution system, fuel system, temperature control system, and all required accessories.
- b. Housekeeping pad for furnace and boiler.
- c. Cutting and patching to connect new Work to existing systems.
- d. Cleaning, testing, balancing, adjusting, and performance tests for all equipment and materials furnished or installed under this section.
- e. New electrical wiring on dedicated circuit, including switch at top of basement stairs for oil burner and switch near heater for gas system.
- f. Low voltage control wiring and electrical equipment necessary for the proper operation of the systems.
- g. Final fuel connections to equipment installed under this section.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements.

B. Related Requirements

1. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
2. Section 23 30 00 - HVAC Air Distribution.
3. Section 23 52 16 - Heating Boilers.
4. Section 23 54 00 - Furnaces.

C. References

1. “HVAC Quality Installation Specification, Standard Number: ANSI/ACCA 5 QI-2007”, Air Conditioning Contractors of America Available for The Consortium for Energy Efficiency (CEE) as a free download from their website at [www.ceel.org](http://www.ceel.org).

2. "Manual J, Residential Load Calculation" - Air Conditioning Contractors of America (ACCA), most recent edition.
- D. Design Data
1. Exterior Design Temperature: 10 degrees F.
  2. Interior Design Temperature: 70 degrees F.
  3. Load calculations: Comply with ACCA Manual J or approved alternate method.
  4. Heating Equipment Sizing: Select equipment with least rated output meeting the maximum design load.
    - a. Maximum Heating Capacity (Output) Rating: 130% of calculated design heat load.
- E. Submittals
1. System Design Calculation: Submit heat loss calculations showing environmental design conditions and required heating equipment and distribution system sizes.
    - a. Indicate thermal resistance properties for each building envelope assembly used for calculations.
  2. Energy Cost Analysis: Submit estimated system operation cost when developer proposes alternative heating system.
    - a. Indicate annual operating costs based on calculated heating loss and proposed equipment heating output using manufacturer's rated efficiency.
- F. Project Conditions
1. Normal Space Heating System Requirement:
    - a. Where a sound hydronic heat distribution system does not exist, forced warm air (FWA) is the required means of heating a living unit unless an alternative system is permitted when approved in writing by OHCD/PHDC/PRA.
    - b. A new hot-water boiler may be installed (1) when there is a sound hot water heat distribution system; (2) when there is a sound two-pipe steam heat distribution system, which shall then be changed from steam to hydronic; or (3) in other special circumstances when approved in writing by OHCD/PHDC/PRA.
    - c. Steam boilers may be permitted in repair and partial rehab applications when approved in writing by OHCD/PHDC/PRA.
    - d. When gas service is available, provide gas fired equipment.



2. Alternative Space Heating System Requirements:
  - a. OHCD/PHDC/PRA recognizes that there may be unusual situations in which it is appropriate to use heating equipment other than equipment specified in Sections 23 52 16 and 23 54 00. For example, electric resistance heat may be cost-effective for zoned backup in a super-insulated solar dwelling.
  - b. Developers who propose an alternative heating system must demonstrate that operating costs of the proposed system will be affordable. Accordingly, the developer must submit results of a building energy analysis simulation (using eQUEST 3.64 available at [www.doe2.com](http://www.doe2.com), or similar approved software) to show the predicted cost, at current Philadelphia energy prices, of maintaining specified interior design temperature throughout the heating season in a standard Philadelphia weather year.
  - c. When approved in writing by OHCD/PHDC/PRA, an alternative system for the proposed development if and only if predicted heating cost is no greater than the Standard Heating Cost of a dwelling, or multi-unit building, of the same size may be permitted. Standard Heating Cost, the estimated average cost to heat a dwelling, or multi-unit building, rehabilitated to OHCD/PHDC/PRA energy efficiency requirements calculated based on current energy costs for loads determined in accordance with Manual J.
  
- G. Installation - General
  1. Comply with manufacturer's installation instructions and the following:
    - a. City of Philadelphia Fire Code
    - b. Oil Fired Equipment: NFPA 31 Installation of Oil Burning Equipment,
    - c. Gas Fired Equipment: NFPA 54, National Fuel Gas Code,
    - d. Electrical Service: NFPA 70 National Electrical Code,
    - e. Air Distribution System: NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems.
  
- H. Equipment Installation
  1. Floor Mounted Equipment: Install equipment on 4 inch thick continuous solid masonry housekeeping pad placed on floor slab.
  2. Suspended Equipment: Install equipment hung from joists above.
  3. Clearance for Service Access: Install equipment positioned to permit operational clearances and maintenance and servicing access. Provide the following minimum clearances between equipment and adjacent walls, structures, other objects:
    - a. 36 inches on the side containing the service panel.
    - b. 12 inches on all other sides.

- c. 48 inches above vertical discharge unit.
- d. As specified by manufacturer or required by PGW, if greater than above.

I. Thermostatic Control:

- 1. Hydronic System: As specified in Section 23 52 16.
- 2. Air System: As specified in Section 23 54 00.

J. Commissioning: Test adjust and balance entire system as specified in Section 23 05 93.

- 1. Verify correct operation of space heating equipment and distribution system.

**END OF SECTION**

**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 54 00- FURNACES***

A. Summary

1. Section Includes:

- a. Gas fired condensing furnaces.
- b. Gas fired non-condensing furnaces.
- c. Oil fired condensing and non-condensing furnaces.
- d. Thermostats.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements.

B. References

1. Air Conditioning Contractors of America:

- a. ACCA Manual J - “Manual J Residential Load Calculation.”

C. Design Data

1. Exterior Design Temperature: 10 degrees F.
2. Interior Design Temperature: 70 degrees F.
3. Load calculations: Comply with ACCA Manual J or approved alternate method.
4. Furnace Sizing: Select furnace with least rated output meeting the maximum design load.

D. Submittals

1. Product Data: Submit data indicating furnace capacities and efficiency ratings.
2. Equipment Design Calculation: Submit heat loss calculations showing environmental design conditions and required furnace size.
3. Operation and Maintenance Data: Submit one manufacturer’s standard owner’s manual for maintenance and troubleshooting furnaces and controls to Owner for distribution to residents of each residential unit.

E. Gas-Fired Furnaces, Condensing

1. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21 .47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
2. Furnace shall be housed in galvanized steel, painted cabinet. Fan: Centrifugal, factory balanced, resilient mounted, direct drive, multi-tapped, multi-speed. Heat Exchangers: Primary and secondary: Stainless steel. Burner: Gas Valve: two-stage or modulating main gas valve, main shutoff valve, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board. Ignition: Electric pilot. Combustion-Air Inducer: Centrifugal fan with thermally protected motor. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds.
3. Capacities and Characteristics: output heating requirement: Air flow to provide 50 deg F maximum temperature rise. 120/1/60 power. 95% AFUE minimum, ENERGY STAR labeled.
4. When equipped for air conditioning as specified in Section 23 81 26 size furnace blower rated capacity to meet cooling requirements but no larger. Furnaces with oversized blowers will not be accepted.

F. Gas-Fired Furnaces, Non-Condensing

1. General Requirements for Gas-Fired, Non-condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
2. Furnace shall be housed in painted, galvanized steel, cabinet. Fan shall be centrifugal, factory balanced, resilient mounted, direct drive, multi-tapped, multi-speed with internal thermal protection and permanent lubrication. Heat Exchanger: Stainless steel. Burner Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board. Ignition: Electric pilot. Gas-Burner Safety Controls: Electronic Flame Sensor. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings. Furnace Controls: Solid-state board integrating ignition, heat, cooling, and fan speeds.
3. Capacities and Characteristics: Output heating requirement: Air flow to provide 50 deg F maximum temperature rise. 120/1/60 power. 80% AFUE.
4. When equipped for air conditioning as specified in Section 23 81 26 size furnace blower rated capacity to meet cooling requirements but no larger. Furnaces with oversized blowers will not be accepted.
  - a. Non-condensing gas fired furnaces are permitted only when approved in writing by OHCD/PHDC/PRA.

G. Oil-Fired Furnaces, Condensing and Non-Condensing

1. General for Oil-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with UL 727 "Oil Fired Central Furnaces" and with NFPA 31, Standard for the Installation of Oil Burning Equipment.
2. Furnace shall be housed in galvanized steel, painted cabinet. Fan: Centrifugal, factory balanced, resilient mounted, direct drive, multi-tapped, multi-speed. Heat Exchangers: Primary and secondary: Stainless steel. Burner: Flame retention, pressure-atomizing, forced-draft, gun type; with integral fuel pump and electronic spark ignition, flame safety, oil-pressure switch safety device, limit control, transformer, and combination ignition/fan timer control board. Ignition: Electric pilot. Centrifugal fan with thermally protected motor. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds.
3. Capacities and Characteristics: output heating requirement: Air flow to provide 50 deg F maximum temperature rise. 120/1/60 power. 85% AFUE minimum, ENERGY STAR labeled.
4. When equipped for air conditioning as specified in Section 23 81 26 size furnace blower rated capacity to meet cooling requirements but no larger. Furnaces with oversized blowers will not be accepted.
  - a. Oil fired furnaces are permitted only when approved in writing by OHCD/PHDC/PRA.

H. Thermostats

1. Programmable Thermostat: Controls shall comply with requirements in ASHRAE/IESNA 90.1, "Controls." Solid-State Thermostat: Wall-mounting, digital, programmable, microprocessor-based, with automatic heat/cool switching, 7-day programmability, four temperature presets per day, battery backup.
2. Non-Programmable Thermostat: Solid-State Thermostat: Wall-mounting, digital, with manual heat/cool switching.
  - a. Non-programmable thermostats are permitted only when approved in writing by OHCD/PHDC/PRA.

I. Air Filters

1. Disposable Filters: 1-inch thick, fiberglass media with MERV 6 rating in sheet metal frame.

J. Installation

1. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
2. Install oil-fired furnaces and associated fuel and vent piping according to NFPA 31.

3. Install thermostats at mounting height of 60 inches above floor.
4. Install gas piping in accordance with 23 11 23.
5. Comply with ASME B31 .9, "Building Services Piping," for fuel-oil piping materials, installation, testing, and inspecting.
6. Connect ducts to furnace with flexible connector.
7. Adjust airflow and initial temperature set points. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.
8. Install new filters in each furnace within 14 days after Substantial Completion.

**END OF SECTION**

**DIVISION 23– HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**

***SECTION 23 81 26- SPLIT-SYSTEM AIR-CONDITIONERS***

A. Summary

1. Section Includes:

- a. Indoor cooling coil.
- b. Outdoor condensing unit.
- c. Thermostats.
- d. Refrigerant piping.
- e. Condensate pump.
- f. Condensate piping.
- g. Condenser pad.

2. Sustainable Design: Comply with Division 01 Section “Sustainable Design Requirements.

B. Related Requirements

- 1. Section 23 30 00 - HVAC Air Distribution.
- 2. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

C. References

1. Air Conditioning Contractors of America:

- a. ACCA Manual J - “Manual J Residential Load Calculation.”
- b. ACCA HVAC Quality Installation Specification Residential and Commercial Heating, Ventilating, and Air Conditioning (HVAC) Applications. Available as a free download from their website at [www.acca.org](http://www.acca.org).

2. The Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

- a. Directory of Certified Product Performance.

3. Reference: Builder’s Guide to Mixed and Humid Climates, Joseph Lstiburek, Ph.D., PE, Building Science Corporation, c. 2005

D. Design Data

- 1. Exterior Design Temperature: 90 degrees F dry bulb and 74 degrees F wet bulb.

2. Interior Design Temperature: 75 degrees F.
  3. Load calculations: Comply with ACCA Manual J or approved alternate method.
  4. Air Conditioner Sizing: Select air conditioner with rated capacity not greater than 115% of the maximum design load rounded up to the next 1/2 ton increment. Oversized systems are not permitted.
- E. Submittals
1. Product Data: Submit data indicating air conditioning system capacities and efficiency ratings.
  2. Equipment Design Calculation: Submit cooling load calculations showing environmental design conditions and required air conditioning equipment size.
  3. Operation and Maintenance Data: Submit one manufacturer's standard owner's manual for maintenance and troubleshooting air conditioning equipment and controls to Owner for distribution to residents of each residential unit.
- F. Indoor Cooling (5 Tons or Less)
1. Casing: Galvanized steel with finished paint, designed to mate with matching gas furnace. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve to comply with ARI 210/240. Condensate Drain Pan: Single- wall, galvanized steel with 1/2" drain connection.
- G. Outdoor Air-Cooled Condensing Units (5 Tons or Less)
1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device, with thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
  3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler to comply with ARI 210/240. Fan: Aluminum-propeller type, directly connected to permanently lubricated, motor with integral thermal-overload protection.
- H. Capacities and Characteristics
1. Cooling Capacity: Minimum 16.0 SEER with evaporator coil rated to match condenser coil, as listed in ARI Directory; ENERGY STAR labeled.



2. Outdoor Unit: Electrical Characteristics: 208/240-volt, 1-phase, 60 hertz.
- I. Thermostats
1. Thermostats: As specified in Section 23 52 16 for use with boilers.
  2. Thermostats: As specified in Section 23 54 00 for use with furnaces.
- J. Accessories
1. Refrigerant Line Kits: ACR soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends; sized to suit system capacity.
  2. Refrigerant Suction Line Insulation: 3/8-inch minimum wall thickness of closed-cell elastomeric material.
  3. Low ambient kits: to permit operation down to 45 deg F.
  4. Condensate Pump: Rated for use with the condensate of high efficiency gas furnaces and air conditioning units, and of sufficient head capacity for application.
  5. Condensate Piping: PVC solvent-weld type.
  6. Condenser Pad: Plastic, with adjustable legs, made for this application, sized per manufacturer's instructions, minimum 2 inches high. In no case shall its depth or width be less than that of the condensing unit.
- K. Execution
1. Install ground-mounted, condensing unit on 4-inch- thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Bolt condensing unit to concrete base. Install seismic restraints.
    - a. Allow sufficient space around outdoor units for proper operation and servicing in accordance with manufacturer's instructions. Minimum clearances between equipment and adjacent structures, walls or other objects shall be 36 inches on the service panel side, 12 inches on all other sides, 48 inches above vertical discharge.
    - b. Keep area surrounding condenser free of shrubs, trees and other plantings for a distance of three feet.
    - c. Install code-compliant electric service and disconnect for each condensing unit.
  2. Install cooling coils over gas furnaces.
    - a. Install coil on supply side of furnace with air-tight connection.
    - b. Provide means for gravity removal of condensate to wastewater plumbing, using traps where required. Provide condensate pump and piping to nearest drain where gravity drainage is not possible.
    - c. Remove identifying label from coil and attach label to ductwork nearby in clearly visible location.

- d. Provide access door for inspecting thermostatic expansion valve.
3. Install refrigerant line kit.
- a. Insulate suction lines. Do not insulate liquid lines. Protect insulation exposed to weather with waterproof, UV light resistant covering.
  - b. Install refrigerant lines with maximum 50 feet horizontal run and 20 feet vertical run. When it is necessary to exceed these limits, comply with manufacturer's instructions.
  - c. When installing air condition within an existing system, perform cutting and patching required to install new equipment.
4. Cleaning and Testing:
- a. Clean, evacuate, charge, balance and test equipment to confirm proper operation.
  - b. Certify sub-cooling test and amount of refrigerant added or subtracted from system for each unit.

**END OF SECTION**