GUAM HOUSING AUTHORITY | REQUEST FOR PROPOSAL

Schematic Design Submittal: 1000 sqft Residence

OUTLINE SPECIFICATIONS

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BASIS OF DESIGN

ARCHITECTURAL BASIS OF DESIGN FOR

INVITATION FOR DESIGN SUBMISSIONS FOR THE CREATION OF
AFFORDABLE MODEL HOMES
SAGAN LINAHYAN, DEDEDO, GUAM

1. REFERENCES

1.1 GHC (Guam Housing Corporation) Invitation for Design Submissions for the Creation of Affordable Model Homes in Sagan Linahyan, Dededo, Guam.

1.2 IBC (International Building Code), 2012 edition

1.3 NFPA 101 (National Fire Protection Association), Life Safety Code, 2012 edition

1.4 NFPA 10 (Standard for the Portable Fire Extinguisher), latest edition.

1.5 ADA-ABA, Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, 2010

2. PROJECT DESCRIPTION

This project will provide for the design of an affordable model home in Sagan Linahyan, Dededo, Guam.

The model home shall be designed to a minimum area of 1,000 square feet and shall include a living room, a dining room, a kitchen, two bedrooms and one full bath.

The project will also include the development of individual lots to include site development, all the necessary utilities, and all design provisions to ensure completely operational, safe, energy-efficient and affordable housing units.

3. DESIGN REQUIREMENTS AND ACTUAL PROVISIONS

The design of the model home shall include the spaces and net areas listed below.

A. Living Room: 165 SF
B. Dining Room: 115 SF
C. Kitchen: 126 SF
F. Bedroom: 135 SF
G. Linen: 2 SF
H. A/C closet (in attic): 25SF
I. Entry: 80SF
J. T & B (toilet and bath): 35 SF
K. Storage closets: 17 SF
L. Bedroom 2: 135 SF

Total net area: 835 SF
Actual gross area (enclosed living spaces including wall thicknesses): 1,004 SF

4. MATERIALS AND FINISHES

The selection of all materials, finishes and architectural systems for the model home shall be based on initial cost-effectiveness, durability, energy efficiency and ease of maintenance.

A. Floors
1) The living room, dining room, kitchen, bedrooms, utility, laundry, hallway, closets and storage rooms shall be polished stained concrete.
2) Floor for the toilet shall be unglazed, non-slip, ceramic tiles. B.

Wall base trims
Interior partitions shall be provided with rubber bases. Ceramic tile flooring shall be provided with ceramic tile base.

C. Exterior walls
Exterior walls shall be ISI's patented Energy Mass™ wall system on reinforced concrete foundations. The exterior walls surface shall be nozzle finish and the interior surface will be hard troweled or floated with paint finish on the exterior and interior sides.

D. Interior partitions
Interior partitions shall be light gage steel studs with gypsum board (1/2-inch thick) and paint finish. The toilet and bath shall be provided with a ceramic wall tile finish.

E. Roof System
The roof system shall consist of a galvanized metal roof system approved in Guam sloped at approximately 6 inches to the foot.

F. Ceilings

Gypsum board (1/2-inch thick) ceilings with a metal framing system shall be provided on the underside of the roof metal decking. Thermal insulation (batt, sprayed-on or rigid type) shall be provided inside the cavity of the gypsum board ceilings to ensure a comfortable environment for the occupants and energy-efficiency. The roof insulation shall be provided with an r-value of R-38.

G. Windows

Exterior windows shall be sliding and fixed type windows with double-paned tinted glass units and anodized aluminum frames. Typhoon shutters shall be

provided for all exterior windows. Exterior windows shall be designed and manufactured per applicable criteria to resist Guam's typhoon wind velocities.

H. Doors
Exterior doors shall solid core wood with wood frames and shall include aluminum screen doors. Exterior doors shall be designed and manufactured per applicable criteria to resist Guam's typhoon wind velocities. Interior doors shall be hollow core doors with wood frames.

I. Door hardware
All door hardware shall be stainless steel, heavy-duty type and ADA compliant. Exterior doors shall be provided with appropriate weatherstripping.

J. Paints and coatings
Exterior and interior paints shall be mildewcide and semi-gloss types to provide for ease of cleaning and mold resistance.

K. Kitchen casework
Kitchen counters, drawers and cabinets shall be provided with a plastic laminate finish. Appropriate cabinet hardware shall be specified. Kitchen sink shall be stainless.

L. Toilet accessories
Bathroom toilets shall be porcelain and bath accessories shall be stainless steel type and shall comply with ADA requirements. The following toilet accessories shall be provided.

1) Mirror glass with stainless steel frames to span the full length of the lavatory counter
2) Vanity counter with built-in lavatory. Vanity counter shall be provided with plastic laminate finish and backsplash
3) Towel bars
4) Toilet tissue dispensers
5) Recessed ceramic type soap holder
6) Shower curtain and stainless steel curtain rod

5. DESIGN EXPANDIBILITY

A. The floor plan scheme is configured such that another bedroom (with its own toilet) can be added adjacent to the living room, dining, kitchen area. The addition would be accessed by removing the tall window in the dining area to access a master bedroom suite.

B. A future carport is also considered in the design of the model home. It may be added adjacent to the entry porch and living room. This will provide a convenient access from the carport to the living room via the entry porch, or to the dining and kitchen exterior doors.

6. LIFE SAFETY AND FIRE PROTECTION

The proposed model home shall include all provisions for life safety and fire protection as required by IBC 2012 and NFPA 101, 2012.
Adequate emergency exits shall be provided. Wall and roof construction shall be as required by the IBC.
Smoke detectors shall be provided.
A portable fire extinguisher shall be provided per requirements of NFPA 10.

7. PROVISIONS FOR THE PHYSICALLY HANDICAPPED

The model home shall be designed to provide accessibility for the physically handicapped as required by the ADA-ABA.
Provisions for the physically handicapped include accessible entrance doors, required clearances from walls to doors and circulation clearances.
All accessories and countertops shall be ADA compliant.
Each model home site shall be designed to be handicapped accessible from each driveway to the interior of the building.

Section 01 10 00

SUMMARY

1.1 PROJECT INFORMATION

A Project Identification: Low cost housing

1. Project Location: Guam

B Owner: Guam Housing Authority

C. Architect and Structural Engineers: Integrated Structures Inc, 1250 Addison Street, Berkeley California.

D. Architects Consultants: The architect has retained the following consultants

1. Mechanical: Raymond Cole President , Axiom Engineers, 22 Lower Ragsdale Drive, Monterey California.

2. Mechanical and Plumbing: Mike Pritchard Sr Project Manager, Coffman Engineers, Inc, 1939 Harrison, Street, Suite 215 Oakland California; Hagatna, Guam 414 West Soledad Avenue, Suite 903 Hagatna, Guam.

3. Structural Engineering: Nemencio “Nemy” Macario, Principal and President MC Macario and Associates, 1296 N Marine Drive, Suite 4, Tamuning, Guam.

4. Architecture: Terry Puccini 1483 Red Cliff Way, Castle Rock, CO

E. Other Owner Consultants:

F. Contractor: Paul Perez, Hardwire Electrical and Construction, P.O.Box 915 Hagatna, Guam

1.2 WORK COVERED BY ENCLOSED DOCUMENTS

A. The Work of the Project: The project is a two bedroom single family residence with a total plan area of 1003 Square feet. The walls are constructed using a patented and patent pending Energy Mass™ wall system, fabricated from Quadlock, ICF forms, and reinforced concrete (shotcrete) combined with Tropical PCM (phase change materials). This combination provides an innovative new energy reduction product designed for equatorial installations, providing superior energy, wind and

earthquake performance. Coupled with the wall system, an innovative mechanical system which uses off the shelf equipment employs radiant cooling coupled with a fan coil for de-humidification. The roof system, based upon the Navy Base and Andersen AFB, Guam approved standard developed by MCR Guam, uses a proven engineered, Cool Roof, aluminum metal panel roof system which is designed and certified for 170 MPH wind speeds, providing superior performance and corrosion resistance and is coated with a specially formulated for Guam, warranted, long lasting paint system.

With the above combinations (insulated exterior walls, phase change materials, radiant mechanical system, and insulated roof) cooling loads will be reduced approximately 75% over the standard construction methods employed for the residential market.

The following outline specs address information required by the invitation in addition to unfamiliar aspects of the construction and mechanical systems.

SECTION 03130

INSULATING CONCRETE FORMS (ICFs)

PART 1 – GENERAL

1.01 OVERVIEW

- Compliance with Division 1 – General Requirement.
- Supply and installation of Quad-Lock Insulating Concrete forms for structural cast-in-place concrete walls, installation of reinforcing steel bars and placement of concrete within the insulating concrete forms.
- Adequate bracing and scaffolding shall be provided by the installing contractor and shall comply with all applicable codes.

1.02 SCOPE OF WORK

- Furnish all labor, materials, tools and equipment to perform the installation of **Quad-Lock** insulating concrete forms as manufactured by **Quad-Lock Building Systems Ltd.** 7398 - 132nd Street Surrey, B.C. V3W 4M7 – Canada; Tel.: (604) 590-3111 Fax: (604) 590-8412 in its plants in the USA and Canada.
- Furnish all labor to install the steel reinforcing bars, placement of concrete into the insulating concrete forms and final cleanup.

1.03 MATERIALS/PRODUCTS INSTALLED BUT NOT SPECIFIED OR SUPPLIED UNDER THIS SECTION

- Reinforcing steel or steel fiber reinforcement
- Concrete
- Hold-downs and anchors
- Bolts, sleeves, inserts, and hangers
- Window and door rough openings
- Utility penetrations and sleeves

1.04 ALTERNATES

- Unless otherwise approved by engineer or architect, alternate materials shall not be accepted. Alternate materials are materials not specified within this document.

1.05 RELATED SECTIONS

- Section 01 50 00 – Temporary Facility and Controls
- Section 03 05 00 – Basic Concrete Materials and Methods
- Section 03 10 00 – Concrete Forming and Accessories
- Section 03 20 00 – Concrete Reinforcement
- Section 03 30 00 – Cast-in-Place Concrete

- Section 03 40 00 – Pre-Cast Concrete
- Section 04 00 00 – Masonry
- Section 05 50 00 – Metals
- Section 06 00 00 – Woods and Plastics
- Section 07 10 00 – Damp-proofing and Waterproofing
- Section 07 11 00 – Damp-proofing
- Section 07 13 00 – Modified Bituminous Sheet Waterproofing
- Section 07 24 00 – Exterior Insulation and Finish System
- Section 07 46 00 – Siding
- Section 07 60 00 – Flashing and Sheet Metal
- Section 08 00 00 – Doors and Windows
- Section 09 20 00–09 30 00 – Portland Cement Plaster (Stucco) and Gypsum Board
- Section 09 70 00 – Wall Finishes / Acoustical Treatments

1.06 REFERENCES

- 2006 International Building Code (IBC) and International Residential Code (IRC), 1995 Uniform Building Code (UBC), UBC, 2004 Florida Building Code (FBC)
- Acceptance Criteria for Stay-In-Place, Foam Plastic Insulating Concrete Form
- (ICF) Systems For Solid Concrete Walls - AC353-07
- PCA 100-2007 (Prescriptive Design of Exterior Concrete Walls for One- and Two-Family Dwellings)
- ASTM C578-01 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
- ASTM C203 - Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
- ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
- ASTM C303 - Standard Test Method for Dimensions and Density of Preformed Block-Type Thermal Insulation
- ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
- ASTM D1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
- ASTM D1929 Standard Test Method for Determining Ignition Temperature of Plastics
- ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- ASTM D1761-88 Standard Test Method for Mechanical Fasteners in Wood
- ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials
- UBC 26-3 Standard Room Fire Test
- ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials

- ASTM E119 - Standard test Methods for Fire Tests of Building Construction and Materials
- CSA A23.1 – Concrete Materials and Methods of Concrete Construction
- CSA A23.2 – Methods of Test for Concrete
- CSA A23.3 – Design of Concrete Structures
- CSA S269.3 – Concrete Formwork
- ICC/ICBO #ER-5188
- CCMC #12914-R
- Ontario Building Approval #06-09-153
- City of Los Angeles - General Approval #RR 25527
- City Of New York – MEA 71-05-M
- Florida Product Approval - FL10431
- Miami-Dade County: NOA #06-0407.06
- CE European Technical Approval ETA-06/0189
- British Board of Agrement – Evaluation Report Number # 06/4347
- Germany: Zulassung Z-15.2.205 vom Deutschen Institut für Bautechnik, Berlin (Anlagen)
- Romania: Aviz Tehnic 1-44/15.07.2004 of CTPC-1; Agrement Tehnic 008-01/049-2004
- Bahamas: MOW&U/BC/24/14
- South Africa: SABS Report No. 2538/1357/07
- Analysis of Thermal Properties of Quad-Lock by Ecotope
- ACI 301– Standard Specification for Structural Concrete
- ACI 318 – Building Code Requirements for Reinforced Concrete
- ACI 332 – Guide to Residential Cast-in-Place Concrete Construction
- ACI 347 – Guide to formwork for Concrete
- ISO 9001:2000 Certification

1.07 SYSTEM DESCRIPTION

- Quad-Lock ICFs consist of two EPS foam plastic boards with slots for injection molded high density polyethylene or polypropylene ties. The ties are not fixed into foam and can be spaced at 12" [305mm] O.C. vertically and at any 2" [51mm] increment horizontally.
- For the ease of siding attachment Quad-Lock also carries the FS Panel which has vertical plastic strips embedded into foam every 12" [305mm] O.C.
- The ties are sized to maintain concrete cavity thicknesses of 3.75" [96mm], 5.75" [146mm], 7.75" [197mm], 9.75" [248mm] or 11.75" [299mm]. Thicker concrete cavities are possible by using a 12" [300mm] Quad-Lock Tie Extender.
- The EPS panels are 12" [305mm] high by 48" [1220mm] long and either 2.25" [57mm] for Regular Panels or 4.25" [108mm] thick for Plus Panels. Three R-values are possible: R-22, R-30 and R-38 [U-0.28, U-0.20 and U-0.15].
- Quad-Lock Panels are molded from EPS bead from BASF, NOVA, HUNTSMAN or STAREX SAMSUNG. The panel has a nominal density of 1.9 lb/ft^3 [30 g/l] ± 7% for Regular Panels and 1.5 lb/ft^3 [24 g/l] ± 7% for Plus Panels, maximum smoke deviation rating of 450 and maximum flame spread rating of 25 in accordance with ASTM E84.

- The rigid cellular EPS insulation complies with ASTM C 578-95 as follows:
  - Regular Panels are Type III in Canada and Type IX in US.
  - Plus Panels are Type II Canada and US.
- The polyethylene or polypropylene ties consist of four flanges (1½"W x 4¾"H [38mm x 121mm]) which, when inserted, provide attachment for exterior and interior wall finishes. On each Tie, the flanges are spaced 4" [102mm] O.C. on each side of the tie and are covered with 1/8" [3mm] of foam.

1.08 QUALITY ASSURANCE

- Qualifications
  - Installer Qualifications: Installers shall have a minimum of 1 years experience in the installation of ICF products and demonstrated experience with work of scope and scale equivalent to the project.
- Pre-installation Meetings
  - Prior to starting ICF work, convene meeting at project site. Include trades responsible for installing forms, concrete, reinforcement and trades responsible for installing work that requires form modification.
- Certifications
  - Manufacturer's signed certification that product meets the requirement of this section.
- Approvals and Requirements
  - ICC Report, CCMC Report, City of Los Angeles Approval, Miami-Dade County Approval, New York City: MEA Approval, Ontario Building Approval, CE European Technical Approval, Germany: Zulassung Report, Romania: Aviz Tehnic Report, United Kingdom: BBA Certificate, Bahamas Approval, South Africa: SABS Report.
  - ISO 9001:2000 certified company.

1.09 DELIVERY, STORAGE AND HANDLING

- Deliver the product in original factory packaging with product listing label and manufacturing label.
- Store materials in manufacturer provided bundles, to prevent damage. Protect unwrapped panels from extended exposure to direct sunlight.
- Handle and store product in a location to prevent physical damage and soiling.

1.10 WARRANTY

- Contact Quad-Lock for a written copy of product warranty, OR
- Refer to requirements of the project contract for warranty provisions.

1.11 SUBMITTALS

- Conform to requirements of Section 01 33 00 Submittal Procedures and Section 01 78 00 Closeout Submittals.
- Product Data: Submit manufacturer's literature describing products and installation procedures.
- Shop Drawings: Submit drawings with dimensions, layout and form types and details.

- Test and Legacy Reports: When requested, submit test reports to support performance requirements specified and Legacy reports or approvals from ICC, CCMC, Miami-Dade County, City of Los Angeles, Germany: Zulassung Report, Romania: Aviz Tehnic Report, New York City: MEA Approval, Ontario Building Approval, CE European Technical Approval, United Kingdom: BBA Certificate, Bahamas Approval or South Africa: SABS Report as required.
- Steel Reinforcement: Submit schedule of reinforcing. Steel fiber reinforcement may be included when verified by the project engineer and used within the limitations set out by the manufacturer or evaluation report
- Concrete: Submit proposed concrete mix design.
- Engineering Calculations: Provide structural calculations sealed by a Professional Engineer.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

1. 7398 - 132nd Street
   Surrey, BC V3W 4M7
   Canada
   (888) 711-5625 - Toll Free
   (604) 590-3111
   (604) 590-8412 - Fax

2. 65 Grady Knight Industrial Court
   Villa Rica, GA 30180

2.02 MATERIALS

- Expanded Polystyrene (for Regular Panels Type III in Canada and Type IX in US; for Plus Panels Type II in Canada and US) Requirements as per ASTM C578-95 Standard Specification for Rigid Cellular Polystyrene Thermal Insulation, DIN 54836 and MIL-P-19644.
  - Density (ASTM C 1622-98)
  - Compressive Strength (ASTM D 1621-94)
  - Shear Strength (ASTM C-273)
  - Tensile Strength (MIL-P-19644)
  - Flexural Strength (ASTM C 203-99)
  - Water Vapor Permeance (ASTM E-96-94)
  - Water Absorption (96 hr) (ASTM C 272-91)
  - Dimensional Stability (ASTM D 2126-94)
  - Coefficient of Expansion (ASTM D-696)
  - Allowable Dimension Tolerances
  - STC Rating 6in (ASTM)
  - Flammability (ASTM E-84)

- Flash Ignition Temperature (DIN 54836, Styropor, BASF)
- Self Ignition Temperature (ASTM D1929)
- UL/ULC Fire Resistance Rating for Load Bearing Walls

- Fastener Withdrawal and Lateral Shear Resistance in accordance with ICC-ES AC 353-07, Acceptance criteria for Stay-in-Place, Foam Plastic Insulating Concrete Form (ICF) Systems for Solid Concrete Walls and ASTM D 1761-06, Standard Test Methods/or Mechanical Fasteners in Wood.

Lateral (Shear) Strength Evaluation

Summary of Results			
Sample Designation		Average Ultimate Load (lb_f)	Allowable Lateral Strength (lb_f)
Substrate	Fastener Type		
Flange Ties	#9 Cement Board Fasteners	157.32	48.24
FS Fastening Strips	#9 Cement Board Fasteners	196.09	61.28
	#8 Drywall Screws	209.81	65.57

Withdrawal Strength Evaluation

Summary of Results			
Sample Designation		Average Ultimate Load (lb_f)	Allowable Withdrawal Strength (lb_f)
Substrate	Fastener Type		
Flange Ties	#9 Cement Board Fasteners	183.80	36.76
FS Fastening Strips	#9 Cement Board Fasteners	195.20	39.04
	#8 Drywall Screws	178.98	35.80

- Fire Rating in accordance with ASTM E119 / UL/ULC S101 Fire Resistance Rating Test for walls with 2.25" [57mm] of EPS foam on both sides under load bearing conditions and Sound Transmission Class Rating in accordance with ASTM E-90.
  - 3.75" concrete wall [96mm] has a fire rating of 2 hours;
  - 5.75" concrete wall [146mm] has a fire rating of 3 hours; STC of 50.
  - 7.75" concrete wall [197mm] has a fire rating of 4 hours; STC of 50+.
  - 9.75" concrete wall [248mm] has a fire rating of 4 hours; STC of 50+.
  - 11.75" concrete wall [299mm] has a fire rating of 4 hours; STC of 50+.
- Calculated R-Value of R-22 or R-30 or R-38 h*ft²*°F/BTU [U-0.26, U-0.19 or U-0.15 W/(m²·K)]. The R-Values and U-Values (direct conversion intended for North American use only) are based on wall assembly including exterior + interior foam panels, concrete core, stucco exterior and drywall interior finish.

2.03 CONCRETE

- Concrete supplied under section 03300 shall be normal weight with 3/8" to max. 3/4" [9.5mm to 19mm] aggregate size having a minimum compressive strength of 2500 psi [17.2 MPa] at 28 days or as specified by the design engineer.
- Slump shall be from 5" to 6" [127 to 152mm] max. with a water/cement ratio less than 0.55.

2.04 STEEL

- Reinforcing steel grade, size, placement and spacing under section 03210 shall be as specified by the design engineer or prescriptive tables applicable to the specific project,
- Use of steel fiber reinforcement is permitted providing it complies with the applicable building codes, ASTM A-820 (Standard steel fiber specification) and is installed to manufacturer's recommendation.

2.05 MANUFACTURED COMPONENTS

- Regular Panel – 12" [305mm] x 2.25" [57mm] x 48" [1219mm] with interlocking knobs and slots for plastic ties on top and bottom.
- FS Panel – 12" [305mm] x 2.25" [57mm] x 48" [1219mm] with interlocking knobs and slots for plastic ties on top and bottom. Has vertical plastic strips embedded for ease of siding attachment.
- Plus Panel – 12" [305mm] x 4.25" [108mm] x 48" [1219mm] with interlocking knobs and slots for plastic ties on top and bottom.
- FS Plus Panel – 12" [305mm] x 4.25" [57mm] x 48" [1219mm] with interlocking knobs and slots for plastic ties on top and bottom. Has vertical plastic strips embedded for ease of siding attachment.
- Plastic Ties
  - Color coded Full Ties which range in length to accommodate concrete cavity widths ranging in 2" [51mm] increments from 3.75" [95mm] to 11.75" [298mm]
  - Extender Ties which add exactly 12" [305mm] to a concrete cavity formed with Full Ties, &
  - Brick Ledge Ties that form a 3.75" [95mm] concrete ledge by transitioning 11.75" [298mm] to 5.75" [146mm] concrete cavity

	Panel Types and Actual Concrete Cavity Widths		
	Regular & Regular	Regular & Plus	Plus & Plus
4" [100mm] Black Tie	3.75" [96mm]	N/A	N/A
6" [150mm] Blue Tie	5.75" [146mm]	3.75" [96mm]	N/A
8" [200mm] Yellow Tie	7.75" [197mm]	5.75" [146mm]	3.75" [96mm]

10" [250mm] Green Tie	9.75" [248mm]	7.75" [197mm]	5.75" [146mm]
12" [300mm] Red Tie	11.75" [298mm]	9.75" [248mm]	7.75" [197mm]
12" [300mm] Orange Extender Tie	Add 12" [305mm] to actual cavity above	Add 12" [305mm] to actual cavity above	Add 12" [305mm] to actual cavity above

- Corner and Angle Brackets – Galvanized steel, sit on top of interlocking knobs. Corner Brackets hold together outside and inside 90° corners. Adjustable Angle Brackets can form angles of almost any degree. Straight brackets span 4-way wall intersections.
- Metal Track – Securely attached to footing or slab (with drilled-in or powder driven pins) and are used to secure panels in place to start off the first layer and on top to secure wire top ties.
- Wire Top Ties – Keep the top panels together and are to be spaced at maximum 24" [610mm] O.C.

2.06 ACCESSORIES

- Bracing, wall alignment and scaffolding
- Anchor Bolts
- Door and Window rough openings, plastic or wood
- Water proofing or Damp proofing for below grade walls
- Sleeves for penetrations
- Exterior and interior finishes

PART 3 – EXECUTION / INSTALLATION

EXAMINATION

- Site Verification of Conditions: Verify lines, levels and centers before proceeding with formwork. Ensure dimension agree with drawings.

3.01 SURFACE PREPARATION

- Clean top of footings and slabs prior to starting installation of ICF. Use methods and materials approved by ICF manufacturer.
- Cast anchor dowels into concrete footing as per design engineer requirements and in co-ordination with ICF manufacturer recommended spacing and location related to the form size.

3.02 INSTALLATION – GENERAL

- Install the system in accordance with Quad-Lock's installation methods. Protect forms from damage.

- Install formwork, shoring and bracing to achieve design requirements and in accordance with ACI 301.
- Provide bracing to ensure stability and alignment of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
- Align joints and install forms in a running bond pattern.
- Assure alignment of furring strips to facilitate siding attachment.
- Install reinforcing, as indicated in engineered shop drawings, over opening to provided for integral lintels with the wall.
- Achieve wall width transition by combining Plus Panels with Regular Panels.
- Achieve brick ledges with Quad-Lock Brick Ledge Tie or other methods recommended by the manufacturer.
- Ties and/or tie flanges placed in accordance with manufacturer's specifications at all horizontal and vertical joints.

3.03 INSTALLATION - FORMS

- Secure Metal Track into footing or slab with drilled-in or powder driven pins at approximately 24" [610mm] O.C. Secure outside tracks first and align the inside ones to the outside tracks so that they are parallel.
- Door bucks should be installed before any panels are laid in place.
- Always start any project by assembling corners, angles, T-Walls and other special elements and then work to a common point at mid-wall.
- Stagger the panels from one course to the next with an offset of 24" [610mm] so that vertical joints are not aligned. This means that odd courses will replicate (i.e. 1st, 3rd, 5th…). Never leave more than 8" [203mm] between any two ties (12" [305mm] O.C.) in straight walls.
- Insert corner brackets on every row.
- Insert corner flanges into Outside Corner Brackets.
- Insert horizontal steel as specified.
- Install window bucks and secure them in place with window fasteners.
- Use cut panel pieces of minimum 12" [305mm] length on the second to last course and full panels on the top course to lock smaller pieces into place.
- Make sure all plastic ties are aligned vertically.
- Cut away interlock knobs from the last layer of panels all around the building and secure the top panels with Wire Top Ties. Where metal ties cannot be used, provide adequate means to space and secure top of wall.
- Finish off by placing Metal Tracks on top of the panels.
- Complete bracing; check for plumb, straight, square and level.
- Panels ripped in height and used to achieve fractional vertical dimensions can be installed at bottom or top row.

3.04 CONSTRUCTION

- Interface with Other Work

- Provide formed openings where required for items to be embedded in or to pass through concrete work.
- Locate and set items to be cast directly into concrete.
- Coordinate with work of other trades in forming and placing openings, sleeves, bolts, anchors, other inserts.
- Install accessories in accordance with manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement.
- Install floors and/or floor connections, such as Quad-Deck and Deck Forming System, precast panels, Open Web Steel Joist etc.

- Site Tolerances
  - Construct formwork to maintain tolerances as indicated per ACI 301 or CSA S269.3

3.05 FIELD QUALITY CONTROL

- Conformance to design drawings or pertinent Building Codes
- Plumbness of wall
- Rebar placement and proper mixing and disbursement of steel fibers in concrete mix
- Inspect stability of erected formwork, shoring and bracing to ensure that work is in accordance with design and that elements are secure
- Site Tests: To be specified as required

3.06 CLEANUP

- Clean forms as installation proceeds, to remove foreign matter within forms.
- Clean formed cavities of debris prior to placing concrete.
- Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- Do not use water to clean out forms in freezing conditions, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 PROTECTION

- Provide temporary cover for insulating forms to reduce exposure to UV light in case the final finish is delayed longer than 8 weeks.
- Prior to concrete placement, interlocking knobs along the top of the ICF wall shall be protected with steel track or tape or other means to ensure no concrete debris sets on and between the interlocking knobs.

06 41 00 Cabinets

BATH VANITY

The Glacier Bay Chelsea 24 in. Vanity in Nutmeg with Porcelain Vanity Top in White with White Basin will instantly upgrade your bath or powder room decor. The vanity is built-to-last with solid wood and laminated engineered wood construction in a warm nutmeg finish that complements many decor styles. Providing ample storage space behind double doors, the doors have brushed nickel hardware for a decorative accent that complements the finish. The porcelain vanity top has an integral sink and a 1 in. H backsplash and is pre-drilled for a 4 in. centerset faucet. Ideal for smaller spaces, this vanity coordinates with other Chelsea Collection pieces for a pull-together, polished look that is simple to achieve and easy to enjoy. Limited Lifetime Warranty.

- Classic style and nutmeg finish will complement many Decor styles
- Porcelain vanity top included with integral sink and 0.75 in. H backsplash
- Included vanity top is pre-drilled for 4 in. centerset faucet
- Brushed nickel cabinet hardware adds elegnat touch
- Durably constructed of solid wood and laminated engineered wood
- Doors feature 6-way adjustable European concealed hinges for a clean, seamless look
- Furniture-style toe kick adds a decorative accent
- Interior cabinet provides ample storage space
- Faucet not included
- Note: Product may vary by store

SPECIFICATIONS

Assembled Depth (in.)	17.66 in	Assembled Height (in.)	35.36 in
Assembled Width (in.)	26.5 in	Assembly Required	No
Backsplash height (in.)	1	Basin Depth (in.)	4.5
Basin Length (in.)	10.375	Basin Width (in.)	17.5
Basin color	White	Basin material	Porcelain
Basin primary color	White	Color Family	Brown

Assembled Depth (in.)	17.66 in	Assembled Height (in.)	35.36 in
Faucet Hole Spacing (in.)	4 In. Centerset	Fixture type	Vanity cabinet and top with basin
Hardware Color/Finish Family	Nickel	Installation Type	Free Standing
Manufacturer Warranty	Limited Lifetime Warranty	Material	Porcelain
Number of Doors	2	Number of concealed shelves	0
Product Width (in.)	26.5	Returnable	90-Day
Sink Mount Type	Farmhouse/apron front	Style	Basic
Top depth (in.)	17.66	Top edge thickness (cm.)	2.22
Top edge type	Straight	Top material	Porcelain
Top weight (lb.)	21	Top width (in.)	26.5
Vanity Features	Adjustable Hinges,Concealed Hinges,Predrilled	Vanity Included Components	Basin,Vanity Top
Vanity Top Color	White	Vanity Type	Single Basin
Vanity Width (in.)	24	Vanity top accommodations	Single center set basin

Assembled Depth (in.)	17.66 in	Assembled Height (in.)	35.36 in
Wall mounted	No		

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BASE CABINETS

- Composite box is sturdy
- Solid oak doors create a stylish appearance
- Recessed-panel door design for a classic look
- Solid wood door frame with an oak-veneer flat insert panel
- Wood drawer boxes store lots of kitchen and bathroom items
- Unfinished surface is ready for paint or stain
- Natural maple-laminated interior for easy cleaning
- Pre-configured and fully assembled for your convenience
- Great choice for the kitchen, laundry room, garage, office or bathroom
- CARB compliant
- Concealed hinges

SPECIFICATIONS: verify dimensions in field with plans

Adjustable Shelves	No	Assembled Depth (in.)	24 in
Assembled Height (in.)	34.5 in	Assembled Width (in.)	60 in
CA (CARB) Compliant	CARB Compliant	Cabinet Collection	Unfinished
Cabinet Construction	Framed	Color Family	Unfinished Wood
Color/Finish	Unfinished	Door Design	Recessed panel
Door Material	Oak	Finish Family	Unfinished
HUD Approved	No	Interior Cabinet Depth (in.)	22.625 in
Manufacturer Warranty	One Year Limited Warranty	Overlay Type	Partial
Preconfigured	Yes	Product Depth (in.)	24

Adjustable Shelves	No	Assembled Depth (in.)	24 in
Product Height (in.)	34.5	Product Weight (lb.)	101
Product Width (in.)	60	Shelf Thickness (in.)	.625 in
Toe Kicks Included	No	Width x Height x Depth	60 x 34.5 x 24 in.

06 41 50 Countertop

The Tempo 96 in. Laminate Countertop does not require buffing or sealing for use, and its laminate surface is designed to resist staining and scratching for added durability. It comes in a tumbled roca finish that resembles a solid surface and offers a soft, sophisticated look. The countertop is easy to care for and comes ready to install.

- Stain- and scratch-resistant laminate helps ensure strength
- Designed to not need buffing or sealing for added durability
- Postformed waterfall edge adds simple elegance to home decor
- Built-in backsplash for convenience
- Low maintenance and easy to care for
- Tumbled roca finish offers a soft, classic look

SPECIFICATIONS: Verify Dimensions in field with plans

Antimicrobial	No	Assembled Depth (in.)	25 in
Assembled Height (in.)	5.125 in	Assembled Width (in.)	96 in
Built-in backsplash	Yes	Color Family	Beige
Color Family	Beige/bisque	Color/Finish	Tumbled Roca
Edge Type	Tempo Waterfall	High Temperature Resistance	A slight effect is acceptable per the NEMA LD3 2005 test method.
Kitchen Product Type	Countertop	Manufacturer Warranty	One Year Limited Warranty
Material	Laminate	Merchandised Nested Increment (in.)	1 in
Product Length (in.)	96 in	Product Thickness (in.)	5.125 in

Antimicrobial	No	Assembled Depth (in.)	25 in
Product Width (in.)	25	Scratch Resistant	Yes
Stain Resistant	Yes		

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SECTION 07110 – Cementitious Damp-proofing

Moxie Admixture

1800 SUPER-ADMIX

Basic Use:
MOXIE 1800 SUPER-ADMIX is a ready to use liquid admixture formulated for concrete to Waterproof and stop Moisture Vapor Migration and alkali efflorescence above and below grade. Ideal for use in concrete, stucco, shotcrete, mortar and pool plaster applications. A complex process converts the by-products of hydration into a higher density of cementitious materials thereby reducing permeability. The additional cementitious materials, by their very chemical and physical nature, produce concrete with a much greater density and surface hardness. Additionally, a dramatic increase in bond, flexural and compressive strengths are produced with significant reductions of shrinkage cracking and curling while achieving near-zero capillary voids. Adhesion characteristics of the surface are improved by providing the ideal surface dry condition necessary for coatings, paint or floor coverings. The use of MOXIE 1800 SUPER-ADMIX alone, without any other additives, will produce the highest quality, impermeable concrete possible for the given mix design.

Advantages:

- Produces Waterproof Concrete
- Stops moisture migration, above/below grade (0.011 WVT)
- Increases flexural strength up to 200% ±
- Provides a shrinkage compensating thermal barrier
- Plasticizer-like characteristics
- Curing compound sealer
- Dust proofing compound
- Prevents chloride intrusion
- Resists freeze thaw
- Resists spalling and flaking
- Resists acids and sulfates erosion
- Resistant to extreme abrasion
- Ideal for concrete, stucco, plaster, grout and mortar
- Increased compression strength to 175% ±
- Increased surface hardness to 200% ±
- Corrosion inhibitor
- Pumping aid
- Finishing aid
- Reduces internal chloride ion levels
- Resists scaling
- Resistant to acids, oils, fats and solvents
- Resists chlorides and hydrogen sulfides
- Resists lichen, moss and other accretions
- Resists rust and water-borne stains

Description:
MOXIE 1800 SUPER-ADMIX is an in-organic, chemically reactive, complex catalyzed silicate that initially forms an integral colloidal gel membrane prior to initial set. The Colloidal Gels eliminate the formation of capillary pathways for bleed water, restrict the rapid evaporation of surface water, prevent shrinkage cracking and slab curl as well as behaves like an integral curing compound. In addition, the Gels create a corrosion inhibiting barrier around reinforcing steel while serving as a thermal barrier in the concrete (conserves heat generated by hydration during colder conditions and reduces heat absorption in hot weather). The Gels continue to react with the hydration by-products and parallel the curing process by forming additional cementitious bonds for 28 days and beyond resulting in the achievement of exceptional compressive and flexural strengths.

Packaging:
MOXIE 1800 SUPER-ADMIX is available as follows: * 275 gallon tote (US) * 55 gallon drums (US) * 5 gallon pails(US)

Applicable Standards:
ASTM E96 E1745 F710 E1907 Sec 7.9, C156 C157 C567 C666 C805 C494 D4263 D5084 C309 *Performance,* IBC 1911 CARB EPA USDA VOC=0

Limitations: If ambient temperature is below 50^{o} F or an accelerator is needed, use **MOXIE *FASTSET50*** to decrease set time up to 50%. DO NOT USE CHLORIDE ACCELERATORS. If temperatures are above 85^{o} F, a retarder may be used per manufacturer's instructions to extend the working time of the concrete. If a retarder is used, mixing should continue for at least 15 minutes before placing, ASTM C94 - Specifications for Ready Mix Concrete. DO NOT USE SURFACE SEALER/HARDENERS, THEY WILL PREVENT PROPER MECHANICAL BOND OF ADHESIVES. DO NOT USE CURING COMPOUNDS. FOG MIST ONLY WITH WATER IF NECESSARY PER ACI 302 -
- CONCRETE FLOOR AND SLAB CONSTRUCTION.

Dosage:
MOXIE 1800 SUPER-ADMIX is used at a dosage of 11 ounces per CWT (325 ml/100 kg) of cementitious materials in ready mixed concrete. 15 to 20 ounces per CWT (444 to 591 ml/100 kg) for mortar, stucco, shotcrete, or if a higher performance dosage is required. **Include any cementitious materials such as fly ash in the calculation.** Consult the 'Batch Plant Instructions' or a MOXIE International Technical Representative for specific details.

Warranty: 20 year standard warranty. **Optional 10 Year Registered Warranty available directly through Moxie International only and is not available through ready-mix concrete suppliers, dealers or distributors.**

Technical data:

Water Vapor	Moisture Vapor				Permeability	Curing (loss of water)
ASTM E96	**ASTM D4263**				**ASTM D5084**	**ASTM C309 (C156)**
0.011 WVT	96 hr's. @ 70^{0} F	none	48hrs @ 110°F	none	6.56 x 10^{-9} cm/s	24 hrs. - 0.433k²/m²
.3 WVT min	127 hr's. @ 70^{0} F	none	96hrs @ 110°F	none	@ **50psi** cell pres	72 hrs. - 0.541k²/m²

Physical Characteristics:

Dispersion	Liquid	Flammability	None	Freezing	32°F
Appearance	Straw	Flash Point	None	Shelf life	Indefinite
Odor	None	pH	11.3	VOC	0

SECTION 07230 - THERMAL STORAGE AND DISSIPATING PCM PRODUCTS

1 GENERAL

1.1 RELATED DOCUMENTS

A. Division 04 Sections for Masonry Systems

B. Division 06 Sections for Substrates

C. Division 07 Sections for Damproofing Systems

D. Division 07 Sections for Waterproofing Systems

E. Division 07 Sections for Insulated Wall Systems

F. Division 07 Sections for Air Barrier Systems

G. Division 07 Sections for Roofing Systems

H. Division 07 Sections for Expansion Control Systems

I. Division 09 Sections for Finish Systems

J. Division 21 Sections for Fire Suppression Systems

1.2 SUMMARY

A. This Section includes the following:

1. Thermal Storage and Dissipating PCM applications:
   a. Concealed:
      1) Exterior Walls.
      2) Interior Ceilings.
      3) Interior Floors.
      4) Interior Walls
   b. Exposed:
      1) Roof Deck.
      2) Building Plenum.

1.3 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide Thermal Storage and Dissipating Tropical PCM products where indicated in ceiling plenums when test performance is rated as follows for use in plenums as determined by testing identical products per tests that are standard and acceptable to authorities having jurisdiction.

1. Mold Growth and Humidity Test Results: Tropical PCM product shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity after inoculation with Chaetomium Globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.
2. Test for Surface Burning Characteristics of Building Materials (UL 723, UBC 8-1, NFPA 255):
a. ASTM E 84-10b:
1) Flame-spread index of not more than 25.
2) Smoke Developed Index of not more than 50.

B. Test for Surface Burning Characteristic of Building Materials ASTM E84 10b, with maximum flame-spread: 75 and smoke-developed: 450.

C. Standard Guide for Measurement of Gases Present or Generated During Fires:
1. ASTM E 800-07:
a. Smoke Toxicity Limits not exceeding those as specified by SMP 800C.

D. Water Vapor Transmission Rate Test:
1. ASTM E 96 (water filled cup) providing 100% RH and exterior of cup is contained within a 23C, 50% RH test environment.
a. No hole sample:
1) gm/(100in^2 x day): 0.040.
2) Perm grain/ft^2 x hr x inHg: 0.090.

E. Cassette Analysis of Fungal Spores and Other Particulates:
1. Optical Microscopy (EMSL Method M001):
a. Control Sample:
1) Total Fungi - 0/m^3.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed Tropical PCM indicated.

C. LEED Submittals:

1. Product Data for Credit [MR-c6]: For products having rapidly renewable material content, documentation indicating less than 10-year lifecycle.
2. Product Data for Credit [IEQ-c7.1, IEQ-c7.2]: For products enhancing comfort designed to meet requirements of ASHRAE 55-2004.

3. Product Data for Credit [EA-c1]: For products demonstrated to achieve increased levels of energy performance above baseline in prerequisite standard of ASHRAE 90.1-2007.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for Tropical PCM products indicated.

E. Research/Evaluation Reports: For Tropical PCM products indicated.

1.5 QUALITY ASSURANCE

A. Source Limitation: Obtain each type of Tropical PCM through one source from a single manufacturer.

B. Product Test Reports: Retain ASTM test method below based on product and kind of fire-resistance characteristic specified for each product in Part 2. Fire-Test-Response Characteristics:

1. Provide Tropical PCM products and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics, by UL 723 and NFPA 255 or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.6 SUBMITTALS

A. Product Data:

1. Provide data on product characteristics, performance criteria and product limitations for each type of product indicated.

B. Product Test Reports:

1. Based on evaluation of comprehensive tests performed by a qualified testing agency for Tropical PCM products.

C. Manufacturers Installation Instructions:

1. Include information on special environmental conditions required for installation and installation techniques.

D. Manufacturers Certification Requirements:

1. Products meet or exceed specified requirements.
2. Installation per manufacturers written requirements and recommendations.

E. Mock-Up (if required):

1. Construct exterior wall or roof assembly mock-up as indicated, including:

a. Exterior wall finishes with associated materials and relations:

1) Joints.
2) Openings.
3) Sill and head flashings.
4) Anchoring and attachment.
5) Structural framing.
6) Sheathing.
7) Insulation.

8) Thermal Mat.
9) Air and vapor barriers.
10) Interior finishes and trim.
b. Include cut-away views into the assembly for wall evaluation.
2. Mockup quantity: One (1)

1.7 DELIVERY STORAGE AND HANDLING

A. Comply with manufacturer's written instructions for handling, storing, and protecting during the Work.

B. Protect Tropical PCM materials from physical damage and from deterioration by abuse, soiling, and other sources.

C. Protect Tropical PCM as follows:
1. When possible, store in a cool dry place in accordance with NFPA 30.
2. Protect against ignition, sparks or open flames at all times.
3. Complete installation and concealment of Thermal Mat as rapidly as possible in each area of construction.

D. Keep material in original containers and wrapping until installed. Store under protection and above ground to keep materials clean and dry.

E. Attain Tropical PCM MSDS from manufacturer for use during the Work.

F. Materials to be kept in clean dry heated storage within temperature range of 45 deg Fahrenheit to 90 deg Fahrenheit.

2PART - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified as basis of design:
a. [___, ___ and ___ Walls]: (Inside of insulation layer) Phase Change Energy Solutions, BioPCmat [Q__/M__, Class ___ Permeable-Perm Rating.]
b. Roof: (On top of drop ceiling for top floor) BioPCmat [Q__/M__, Class ___ Permeable-Perm Rating.]
c. Roof: (Above Roof Deck) BioPCmat [Q__/M__, Class ___ Permeable-Perm Rating.]

2.2 THERMAL MAT

A. Available Manufacturers:

1. Any manufacturer of bio PCM products meeting or exceeding this specification.
a. ASTM E84 10b, with maximum flame-spread: 0 and smoke-developed: 30.
b. ASTM E 800-07:
1) Smoke Toxicity Limits below SMP 800C specification.
c. ASTM E 96:
1) gm/(100in^2 x day): 0.040.
2) Perm grain/ft^2 x hr x inHg: 0.090.
d. Cassette Analysis of Fungal Spores and Other Particulates:
1) Total Fungi - 0/m^3.

2.3 ACCESSORIES

A. Tape: Bright aluminum pressure-sensitive, self-adhering, fiber-reinforced type as recommended by Tropical PCM product manufacturer for sealing joints and penetrations in Tropical PCM when used as a vapor barrier.

B. Fasteners: Nails, staples or screws: Electroplated or galvanized steel type as recommended by Tropical PCM manufacturer for fastening Tropical PCM to substrate indicated.

C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

3PART - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with Tropical PCM manufacturer's written instructions applicable to products and application indicated.

B. Install Tropical PCM t that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. When used as a vapor barrier, extend Tropical PCM thermal mat in dimensions indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with thermal mat and tape. Remove projections that interfere with placement of Thermal Mat.

D. When not used as a vapor barrier, Tropical PCM Mat coverage does not have to be 100%.

E. Coordination: Penetrate Tropical PCM as required for the Work.

F. Provide Tropical PCM product sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of Tropical PCM units to produce thickness indicated unless indicated otherwise.

G. Comply with jurisdictional requirements for thermal barriers for plastics within buildings.

3.2 EXAMINATION

A. Verify Thermal Mat materials are dry, and that substrates are clean and free of materials that would impede fastening or adherence of Thermal Mat materials.

B. Verify that substrate surfaces are flat, free of irregularities and any solvents, or other substances that would impede installation of Thermal Mat materials.

3.3 INSTALLATION

A. Install Tropical PCM materials in accordance with manufacturer's written instructions.
1. If not otherwise indicated, extend Tropical PCM products flat sheet edges over substrate for fastening.
2. Do not puncture or cut into the Tropical PCM pockets containing thermal materials.

B. Apply directly to interior face of insulated wall or ceiling. Fasten to substrate designed to support Tropical PCM materials.
1. Vertical Installation: Fasten at 12 inches on-center on each vertical edge.

AND/OR

2. Lay-in Ceiling Installation: Lay-in directly above suspended acoustical ceiling panel system.

AND/OR

3. Suspended Gypsum Board Ceilings: Lay-in directly above suspended gypsum board ceiling system.

AND/OR

4. Roof Deck Installation: Fasten at 6 inches on-center on each edge of material.

AND/OR

5. Roof Deck Installation: Lay over roof decking or over rigid board insulation.

3.4 PROTECTION

A. Protect Tropical PCM from damage during the Work.

B. Inspect Tropical PCM for damage prior to concealment. Remove damaged product and replace prior to building-in to the Work.

C. Alterations of Tropical PCM by cutting, puncturing, or other methods shall be reviewed with and follow Manufacturer's written guidelines.

3.5 DISPOSAL

A. Dispose of materials in compliance with all applicable jurisdictional requirements, including but not limited to Federal, State and Local.

SECTION 15181 – HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Radiant floor heating and snow melting systems for various applications and control strategies, using PEX-Aluminum-PEX (PAP) tubing and appropriate fittings.

1.2 RELATED SECTIONS

A. Section 02551 – Underground Hydronic Piping

B. Section 03300 – Concrete

C. Section 06100 – Rough Carpentry

D. Section 07210 – Insulation

E. Section 15093 – Sleeves and Sleeve Seals for HVAC Piping

F. Section 15181 – Hydronic Piping

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International:
   1. ASTM F1281 Standard Specification for Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX/AL/PEX) Pressure Pipe
   2. ASTM F1335 Standard Specification for Pressure-Rated Composite Pipe for Elevated Temperature Service

C. Certified to International Association of Plumbing and Mechanical Officials (IAPMO) by NSF:
   1. Uniform Mechanical Code (UMC)

D. Watts Radiant
   1. RadiantPEX, RadiantPEX+, and RadiantPEX-AL Installation Manual
   2. RadiantWorks Professional Software

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Cross-linked Polyethylene-Aluminum-Cross-linked Polyethylene Composite Pipe (PAP): Standard Grade hydrostatic pressure ratings. The following four standard-grade hydrostatic ratings are required:
      a. 200 degrees F (93 degrees C) at 100 psi (689 kPa).
      b. 180 degrees F (82 degrees C) at 125 psi (862 kPa).
      c. 140 degrees F (60 degrees C) at 160 psi (1102 kPa).
      d. 73.4 degrees F (23 degrees C) at 200 psi (1379 kPa).

B. Performance requirements: Provide Hydronic system that is manufactured, fabricated and installed to comply with regulatory agencies and authorities with jurisdiction, and maintain performance criteria stated by the tubing manufacturer without defects, damage, or failure.
   1. Cross-linked Polyethylene-Aluminum-Cross-linked Polyethylene Composite Tubing (PAP):
      a. Show compliance with ASTM F1281

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.
B. Product Data: Submit manufacturer's product submittal data and installation instructions for each product.

C. Shop Drawings – Hydronic System
   1. Provide engineering analysis using manufacturer's proprietary software.
   2. Provide installation drawings indicating tubing layout, manifold locations, zoning requirements, and manifold schedules with details required for installation of the system.
   3. Provide mechanical schematic indicating heat source, mechanical piping and accessories from heat source to manifolds, circulators, water tempering, and zone controls. Indicate supply water temperatures and flow rates to manifolds.

D. Samples: Submit selection and verification samples of primary materials.

E. Documentation:
   1. Provide manufacturer's detailed instructions for site preparation and product installation.

2. Provide manufacturer's electrical power requirements and heat output in watts delivered to the structure.
3. Provide documentation indicating the installer is trained to install the manufacturer's products, as needed.

F. Quality Assurance and Control Submittals:
   1. Upon request, submit test reports from recognized testing laboratories.

G. Closeout Submittals – Submit the following:
   1. Warranty documents specified
   2. Operation and maintenance data
   3. Manufacturer's field reports as specified in this document
   4. Final as-built tubing layout drawing

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer shall have a minimum of ten years experience in similar systems.
   2. Manufacturer shall provide products of consistent quality in appearance and physical properties.
   3. Manufacturer shall use the highest quality products in the production of systems and components referenced in this document.
   4. Materials shall be from a single manufacturer to ensure consistent quality and compatibility.

B. Installer Qualifications:
   1. Use and installer with demonstrated experience on projects of similar size and complexity and/or documentation proving successful completion of familiarization training hosted/approved in writing by the system manufacturer.
   2. Electrical rough-in and connections shall be done by a licensed electrician.

C. Certifications: Provide letters of certification as follows:
   1. Installer employs skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades person.

D. Regulatory Requirements and Approvals – Hydronic Systems: Provide a radiant system that complies with the following requirements:
   1. International Code Council (ICC):
      a. International Mechanical Code (IMC)
      b. International Building Code (IBC)
      c. ICC Evaluation Service (ES) Evaluation Report No. ESR 1155
   2. International Association of Plumbing and Mechanical Officials (IAPMO):
      a. Uniform Mechanical Code (UMC)

E. Pre-installation meetings
   1. Verify project requirements, substrate conditions, excavation conditions, system performance requirements, coverings, manufacturer's installation instructions, and warranty requirements.
   2. Review project construction timeline to ensure compliance or discuss modifications as required.
   3. Coordinate with other trade representatives to verify areas of responsibility.
   4. Establish the frequency (during construction phase of the project) the engineer intends for site visits and inspections by the manufacturer's representative.

F. Mock-up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work

1.7 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirements Section.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer:
   1. Store tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
   2. Do not expose tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing that is exposed to direct sunlight.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Morter-set Systems: Mortar shall cure for 25 days (or time specified by mortar manufacturer) prior to starting heating systems.

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty – Hydronic Systems
   1. Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official.
   2. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.
      a. Warranty covers the repair or replacement of any tubing or fittings proven defective.
      b. Warranty may transfer to subsequent owners.
      c. Warranty Period for Tubing is 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.
      d. Warranty Period for Manifolds and Fittings is 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.
      e. Warranty period for Controls and Electrical components is a 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.

1.10 SYSTEM START-UP

A. Do not start the system for a minimum of 25 days or as specified by mortar, concrete and/or covering manufacturer as applicable.

B. Verify all electrical components are installed per local and National Electrical Code (NEC) prior to start-up.

1.11 OWNER'S INSTRUCTIONS

A. Instruct Owner about operation and maintenance of installed system.

B. Provide Owner with manufacturer's installation instructions for installed components within the system.

C. Provide Owner with all operating instructions/documents for sensors and controls.

D. Provide Owner with copies of any detailed layout drawings and photos of installed product before coverings are installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

Watts Radiant, Inc.

(Subsidiary of Watts Water Technologies, Inc.)

4500 E. Progress Place

Springfield, MO 65803

(800) 276-2419; (417) 864-6108; Fax: (417) 864-8161

Web: http://www.wattsradiant.com

B. Substitutions: not permitted

2.2 PRODUCT CHARACTERISTICS

A. Material:
1. Cross-linked polyethylene with an aluminum middle core.
2. Manufactured by PEX-b or Silane method.

B. Material Standard:
1. Manufactured in accordance with ASTM F1281.
2. Tested for compliance by an independent third-party agency.

C. Temperature/Pressure Ratings: shall be capable of withstanding temperatures of:
1. 73.4°F (23°C) at 160 psi (1.10 MPa)
2. 180°F (82.2°C) at 100 psi (0.69 MPa)
3. 200°F (93.3°C) at 80 psi (0.55 MPa).

D. Minimum Bend Radius (Cold Bending):
   1. No less than five times the outside diameter.
   2. Use the tubing manufacturer's bend supports if radius is less than stated.

E. Barrier Tubing Type: Watts Radiant RadiantPEX-AL:
   1. Oxygen Diffusion Barrier
      a. Tubing has an oxygen diffusion barrier that shall not exceed an oxygen diffusion rate of 0.006 g/cubic meter (0.000000375 lb/cu. ft.) per day at 104 degrees F (40 degrees C) water temperature in accordance with German DIN 4726.
   2. Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated:
      a. ½ inch (12.7 mm) nominal = 0.472 inch (12 mm)
      b. ⅝ inch (16 mm) nominal = 0.630 inch (16 mm)
      c. ¾ inch (20 mm) nominal = 0.787 inch (20 mm)
      d. 1 inch (25.4 mm) nominal = 0.984 inch (25 mm)

2.3 MANIFOLDS AND FITTINGS

A. Manifolds (Residential and light Commercial, Stainless Steel)
   1. For system compatibility, use 1 or 1½" (25 – 38mm) Stainless Stel manifolds offered by the respective tubing manufacturer.
   2. Manifolds shall provide individual flow control for each loop of the manifold through valve actuators available from the manifold supplier.
   3. Manifolds shall feature manual flow balancing capability within the manifold body for balancing unequal loop lengths across the manifold. Balance valves shall not be ball valves.
   4. Manifolds accommodate ½ - ¾" (12.7 – 19 mm)RadiantPEX-AL tubing.
   5. Each manifold location shall have the ability to vent air manually from the system.
   6. Stainless Steel 1" (25 mm) Manifolds
      a. Heavy-duty, DIN Standard, 304 stainless steel
      b. Matching fittings and accessories are made of solid brass and are heavily plated with nickel to match the appearance of the manifold trunk.
      c. Internal balancing valves
      d. 0 - 2½ gpm (0 – 0.16 L/sec)flow meters
      e. Manifold brackets
      f. All connections are BSP (British Standard Pipe) or straight thread and require the use of the included gasket.
      g. 2⅛" (54 mm) OC circuit spacing
      h. 12 gpm (.75 L/sec) maximum flow rate
      i. 194°F (90°C) maximum operating temperature
      j. 87 psi (600 kPa) maximum operating pressure
      k. 2½ gpm (0.16 L/sec) per circuit maximum flow rate
   7. Stainless Steel 1½" (38 mm) Manifolds
      a. Heavy-duty, DIN Standard, 304 stainless steel
      b. Matching fittings and accessories are made of solid brass and are heavily plated with nickel to match the appearance of the manifold trunk.
      c. Internal balancing valves
      d. 0 - 4 gpm (0 – 0.25 L/sec)flow meters
      e. Manifold brackets

f. All connections are BSP (British Standard Pipe) or straight thread and require the use of the included gasket.
g. 2⅛" (54 mm) OC circuit spacing
h. 22 gpm (1.4 L/sec) maximum flow rate
i. 194°F (90°C) maximum operating temperature
j. 87 psi (600 kPa) maximum operating pressure
k. 4 gpm (0.25 L/sec) per circuit maximum flow rate

B. Manifolds (Commercial, Copper)
1. Provide 1" (25 mm) or larger Copper manufactured from L-copper and offered by the respective tubing manufacturer for system compatibility.
a. Install manifolds with optional isolation valves located on both the supply and return manifold.
b. Each manifold location shall have the ability to vent air manually from the system.
2. Provide Copper manifolds approved for use in systems free of ferrous materials, or isolate ferrous material to eliminate corrosion damage due to oxygen diffusion.
3. Balancing:
a. Design individual loop lengths across the manifold with 10% of each other in length.
b. Install supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.
c. Where the supply and return piping is in direct-return configuration, use manifolds with balancing valves or balance flow setters on the return leg of each manifold to the mains.

C. Manifold Mounting Boxes
1. Sizes – Watts Radiant manifold mounting boxes come in 3 sizes:
a. 15¾" by 28½" by 4¼" (400mm by 724 mm by 108 mm)
b. 24½" by 28½" by 4⅜" (622mm by 724 mm by 111 mm)
c. 39½" by 28½" by 4⅜" (1003mm by 724 mm by 111 mm)
2. Each box shall be designed to be recessed into a 4" or 6" (102 mm or 152 mm) stud wall.
3. Included elevators can raise the box from 1½" to 4½" (38 – 114 mm) off of the floor.
4. Each manifold box is constructed of powder-coated sheet metal, providing increased resistance to corrosion and job-site abuse.
5. Inside Manifold Mounting Brackets:
a. Manifold boxes come with 2 fixed horizontal attachment rails and 2 adjustable rails.
b. Each Watts Radiant manifold option will utilize different rail positions, depending on the bracket used.

D. Fittings
1. For system compatibility, use fittings offered by the tubing manufacturer.
a. The fitting assembly shall comply with ASTM F1281.
b. Only Watts Radiant RadiantPEX-AL stainless steel Press Fittings or Compression Fittings are approved.
c. Available connections:
1) Sweat
2) NPT
3) BSP

2.4 SUPPLY AND RETURN PIPING

A. Supply-and-Return Piping to the Manifolds (above ground piping):
   1. Properly size supply and return distribution piping for the given volume and velocities required at system design.
   2. Use compatible distribution pipe material for all supply fluid temperatures and flows in systems with ferrous components.
      a. When using Watts Radiant RadiantPEX-AL tubing, do not exceed 200 degrees F (93 degrees C) at 100 psi (689 kPa).
   3. Do not expose Watts Radiant RadiantPEX-AL tubing to direct sunlight.
      a. Where PEX tubing is exposed, install suitable pipe insulation around the exposed tubing.
   4. Use fittings compatible with piping material. Fittings shall transition from distribution piping to system manifolds.

B. Supply and Return Piping to the Manifolds (below ground piping):
   1. Properly size supply and return distribution piping for the given volume and velocities required at system design.
   2. Use suitable distribution piping material for all supply fluid temperatures and flows in systems with ferrous components.
      a. When using Watts Radiant RadiantPEX-AL tubing, do not exceed 200 degrees F (93 degrees C) at 100 psi (689 kPa).
   3. Use fittings compatible with piping material. Fittings shall transition from distribution piping to system manifolds.

2.5 ROOM TEMPERATURE CONTROLS

A. Room Temperature Controls:
   1. Thermostat: DualTemp, air/floor, digital, 24V
   2. Thermostat: DualTemp, air/floor, digital, battery
   3. Thermostat: DualTemp, air/floor, non-digital, 24V
   4. Thermostat: Digital, programmable, air, 24V
   5. All thermostats shall operate within a one degree differential temperature incorporating pulse-width modulation action.
   6. Install a Watts Radiant Thermostat (heat only) with digital display in each room or zone as required.
      a. The Watts Radiant DualTemp thermostat shall have the ability to sense the temperature of the air, floor, or a combination of air and floor.
      b. Each DualTemp shall be equipped with an internal air sensor.
   7. For multiple-zoning control, install the loop(s) per zone and install the individual valve actuators on the respective loop(s) at the manifold.
      a. Electro-thermal Actuators
         1) Watts Radiant Thermal Actuators are a four-wire actuator designed for use with Watts Radiant Stainless Steel manifolds.
            (a) Actuators are normally closed and will open when power is applied.
            (b) Actuators shall consume no more than 2.5 watts.

(c) Travel time for the actuators is approximately 90 seconds to close the end switch.
(d) Each actuator consists of 4 wires, 2 for poser and 2 for an end switch.

b. Zone Valve Actuator Control Module: Zone valve actuator controls operate zone valves or circuit thermal actuators by supplying 24VAC.
1) No more than three 2.5 VA actuator valves can be connected to any single zone terminal block.
2) The control system shall be designed for use with the following models of thermostats:
(a) Watts Radiant DualTemp (3 or 4 wire)
(b) Watts Radiant Air Only thermostats
(c) Use only Watts Radiant non-programmable thermostat if using Optional Timer
(d) Any 2 wire thermostats with internal battery poser
(e) 2 wire thermostats that consume poser shall not be used, as damage to either the thermostat or controller may occur.
(1) Never connect a power consuming 2 wire thermostat to the control as damage to the thermostat and/or control may occur.
3) External 24/120 VAC transformer (not included) is required to operate these controls.
(a) A 40 VA transformer for a maximum of 12 actuators
(b) A 60 VA transformer for a maximum of 18 actuators
4) Master Controls:
(a) Equipped with valve and thermostat terminals
(b) Incoming 24 volt power connection
(c) Two 8 amp, dry contact terminals for pump and boiler operation
(1) With end-switch capability, the Zone Control Module activates other relays or controls as required by system control strategy.
(2) Control does not use the end-switch wires of a 4 wire actuator
(3) Both 2 wire and 4 wire actuators may be used.
5) Slave Controls:
(a) The use of Slave units allows the control of more zones utilizing the same pump and boiler.
(b) Up to 2 Slave controls can connect to a Master
(1) Allows for a maximum of 18 separate zones or thermostat connections
(2) Both 2 wire and 4 wire actuators may be used.

2.6 HYDRONIC RADIANT SNOW MELTING CONTROLS

A. Use sensors/controls provided by manufacturer:
1. HSC-5 Snow Melting Slab Detector
a. Slab / Pavement mounted
b. Senses actual pavement conditions
c. Microprocessor control eliminates ice-bridging
d. Provides a low-amperage output relay contact
e. Heavy-duty machined brass housing
f. Removable top cover
g. Plug-in electronic assembly
h. 24 VAC
2. LCD-1H Automatic Snow Switch

a. Pole-mounted
b. Senses both temperature and precipitation
c. Isolated 3 Amp resistive/1 Amp inductive relay contact
d. 24 VAC

2.7 ACCESSORIES

A. Provide accessories associated with the installation of the radiant heating system as recommended by or available from the tubing manufacturer.
   1. IsoTherm: The IsoTherm provides mixing control and zone pumping all in a compact, unique package that conveniently connects directly to Watts Radiant Stainless Steel manifolds.
      a. The IsoTherm module includes the following items:
         1) Mix Valve
         2) 3 speed 1/25 hp Circulator
         3) Temperature Guage
         4) Maximum Temperature Sensor
         5) Trunk Isolation Valves
         6) BSP to NPT Transition Nipple
      b. Mounting:
         1) The IsoTherm can be wall mounted with standard cush clamps or other copper pipe mounted brackets.
         2) The IsoTherm can be integrated into a standard Watts Radiant manifold box.
      c. Capacity:
         1) Full heat capacity of 51,000 BTU/h with a minimum boiler temperature of 158°F (70°C).
   2. Pressure Differential By-pass Valve (for use with 1" Stainless Steel Manifolds only):
      a. Use Watts Radiant Pressure Differential By-pass Valve with the manifolds incorporating actuators to avoid noise due to excessive water velocity.
         1) Eliminates water velocity noise and water hammer.
         2) Increases pump life because of minimal pressure surging as actuators open and close.
         3) There is always correct and constant flow regardless of the number of actuators or zone valves open.
         4) Water flow through the DBP valve shall be 25-30 % of the total flow:
            (a) The over-pressure shall not exceed 10-15 % of the system pressure drop.
            (b) If the zones to be by-passed have a maximum pressure drop of 0.5 psi (3.5 kPa), the DBP valve shall be set to accommodate this pressure plus 10-15 %.
            (c) The DBP valve needs to be installed 'downstream' of the main circulator.
            (d) Install before the system zones
            (e) Should connect the supply line with the return line
   3. FlowGuard:
      a. FlowGuards shall be of commercial-quality, non-electronic flow indicator and flow setter.
      b. Cast brass construction
      c. Accurate visual flow indication in GPM
      d. Ability to set fluid flow
      e. FlowGuards shall allow zone-by-zone control and optimization.
      f. No special training or electronic instrumentation required,

g. Sizes:
   1) 1" (25 mm) MNPT ends: 0.5 – 4 gpm (0.03 to 0.25 L/sec) flow meter
   2) 1" (25 mm) FNPT ends: 1 – 13 gpm (0.06 to 0.8 L/sec) flow meter

4. Tempering Valves:
   a. MixTemp 180 Mixing Valve:
      1) The MixTemp 180 is a 3 port, non-electric nix valve for use in Hydronic heating systems.
         (a) Hot, cold, and mix ports are clearly marked "H," "C," and "M."
      2) This mix valve shall be capable of delivering water temperatures ranging from 90° to 160°F (32° to 71°C) +/- 3° F.
      3) The Hydronic mix valve shall have a cast bronze body.
      4) Copper, stainless steel and EPDM internal parts
      5) There are no ferrous components to corrode.
      6) The actuator for the piston shall have lineal expansion characteristics, and shall be completely filled with a temperature-sensitive wax.
      7) Each port on the MixTemp has a union to allow for easy servicing
      8) Available in ¾" (19 mm) and 1" (25 mm) female NPT fittings.
         (a) ¾" Cv = 3.1 gpm (0.195 L/sec)
         (b) 1" Cv = 3.2 gpm (0.20 L/sec)
      9) These mixing valves are not anti-scald valves since they do not have positive shut-off in case of failure of hot or cold water supply. We do not recommend their use for shower service.
      10) Shall have a source of return water cooler than the desired mix temperature to operate properly.
      11) The mix valve shall not be heated in excess of 200°F (93°C) to prevent the liquid-filled actuator from rupture.
         (a) To prevent damage, temporarily remove the mixing valve from the unions before soldering near the mix valve.
   b. AllTemp Mixing Valve:
      1) The AllTemp shall be a non-electric, 3 port mix valve for use in hydronic heating systems.
      2) Valve shall be capable of delivering water temperatures ranging from 100 – 200°F (38 – 93°C).
      3) The hydronic mix valve shall have a cast bronze body.
      4) Chrome-plated bronze piston
      5) The actuator for the piston shall have linear expansion characteristics, and shall be completely filled with a temperature-sensitive liquid communicating with the hydraulically formed NPT fittings.
      6) The AllTemp is available in 1¼" (32 mm), 1½" (38 mm), and 2" (51 mm) female NPT fittings.
         (a) 1¼" Cv = 6.1 gpm (0.38 L/sec)
         (b) 1½" Cv = 6.2 gpm (0.39 L/sec)
         (c) 2" Cv = 9.1 gpm (0.6 L/sec)
      7) Mixing valves are not anti-scald valves since they do not have positive shut-off in case of failure of hot or cold water supply. Do not use for shower service.
      8) Shall have a source of cooler return water to operate properly.
      9) The mix valve shall not be heated in excess of 230°F (110°C), or the liquid-filled actuator may rupture.
         (a) To prevent damage, temporarily remove the actuator assembly from the valve body before soldering near the mix valve.
5. Staples: Watts Radiant Foamboard Staples

6. Terminal 90-degree Exit Bend: Terminal Bend Supports

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   1. Verify that site conditions are acceptable for installation of the system. Refer to manufacturer's installation manual for information.
   2. Do not proceed with installation of the system until unacceptable conditions are corrected.

3.2 INSTALLATION OF FLOOR HEATING SYSTEMS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following:
   1. Installation manuals
   2. Design software engineering and analysis

B. Slab-On-Grade Installation:
   1. Fasten the tubing to the flat mesh or reinforcing bar in accordance with the tubing manufacturer's installation recommendations.
   2. Use closer tubing on-center distances along exterior walls. Increase tubing on-center distances as the installation moves away from the exterior wall as determined by manufacturer analysis.
   3. Staple the tubing to the insulation board.
   4. Install edge insulation where the heated panel directly contacts an exterior wall or panel.
   5. Install tubing at a consistent depth below the surface elevation. Ensure sufficient clearance to avoid control joint saw cutting.
   6. Where tubing crosses metal expansion joints in the concrete, ensure the tubing passes below the joints or is sleeved through the joint.

C. Pre-Cast Plank Construction with a Cap Pour:
   1. Fasten the tubing to the flat mesh or reinforcing bar, or snap into Triple-track or Single-track RailWays in accordance with the tubing manufacturer's installation recommendations.
   2. Use closer tubing on-center distances along exterior walls. Increase tubing on-center distances as the installation moves away from the exterior wall.
   3. Staple the tubing to the insulation board.
   4. Install edge insulation where the heated panel directly contacts an exterior wall or panel.
   5. Install tubing at a consistent depth below the surface elevation. Ensure sufficient clearance to avoid control joint saw cutting.
   6. Where tubing crosses metal expansion joints in the concrete, ensure the tubing passes below the joints or is sleeved through the joint.

D. Wood Floor Construction with a Lightweight Gypsum Topping:
   1. Staple tubing to the wood sub-floor in accordance with the tubing manufacturer's installation recommendations. The attachment method shall not cause abrasions on the tubing.
   2. Use closer tubing on-center distances along exterior walls. Increase tubing on-center distances as the installation moves away from the exterior wall.
   3. Ensure the depth of the lightweight pour is a minimum of ¾" (19 mm) over the outside dimension of the tubing, 1" typical overall thin-slab thickness.
   4. Install reinforcing mesh within the pour for finished flooring of tile or linoleum.
   5. Install wood sleepers along the room perimeter and between the tubing to provide a nailing surface for finished wood floors or carpet tack strips as required. Refer to Section 06100.
   6. Allow lightweight gypsum concrete pour to cure in accordance with the applicator's instructions. Once cured, seal the surface of the floor topping to protect surface from moisture.
   7. Install insulation in the joist cavity below the floor in accordance with the submitted radiant floor design. Refer to Section 07210.
   8. Install edge insulation if the heated panel directly contacts an exterior wall or panel. Refer to Section 07210.

E. Wood Floor Construction with UnderFloor Heating (Onix tubing attached directly to wood sub-floor):
   1. Install tubing attached directly to the underside of the wood sub-floor in accordance with the tubing manufacturer's recommendations. The attachment method shall not puncture or cause abrasions to the tubing.
   2. Do not exceed 8" (203 mm) on center tube spacing. Refer to the submitted radiant floor design.
   3. Comply with the tubing manufacturer's installation procedures on proper joist drilling.
   4. Install foil-faced insulation in the lower portion of the joist cavity. Allow an air gap of 2 – 3" (51 – 76 mm) between the wood sub-floor and the top of the insulation. Refer to Section 07210.
   5. Use the recommended amount of insulation in the joist cavity below the floor in accordance with the submitted radiant floor design. Refer to Section 07210.
   6. Use edge insulation equal to the amount of underfloor insulation if the heated panel directly contacts an exterior wall or panel. Refer to Section 07210.

F. Wood Floor Construction with Joist Heating (tubing suspended in the joist bay):
   1. Install tubing within the joist cavity in accordance with the tubing manufacturer's recommendations. The attachment method shall not cause abrasions to the tubing.
   2. Do not exceed 8" (203 mm) on center. Refer to the submitted radiant floor design.
   3. Do not allow tubing within the joist cavity to contact the wood sub-floor.
   4. Refer to the tubing manufacturer's installation procedures on proper joist drilling.
   5. Install foil-faced insulation in the lower portion of the joist cavity. Allow an air gap of 2 – 3" (51 – 76 mm) between the wood sub-floor and the top of the insulation. Refer to Section 07210.
   6. Use the recommended amount of insulation in the joist cavity below the floor in accordance with the submitted radiant floor design. Refer to Section 07210.
   7. Use edge insulation equal to the amount of underfloor insulation if the heated panel directly contacts an exterior wall or panel. Refer to Section 07210.

G. Wood Floor Construction with SubRay:
   1. Install SubRay on top of the wood sub-floor according to the tubing manufacturer's instructions.
   2. Coordinate the finished floor covering layout direction with the direction of the SubRay layout. Comply with the tubing manufacturer's instructions.
   3. Install insulation in the joist cavity below the floor according to the submitted radiant floor design. Install the insulation tight against the wood sub-floor. Refer to Section 07210.
   4. Use the recommended amount of insulation in the joist cavity below the floor in accordance with the submitted radiant floor design. Refer to Section 07210.
   5. Use edge insulation equal to the amount of underfloor insulation if the heated panel directly contacts an exterior wall or panel. Refer to Section 07210.

H. Glycol and Water Solution:
   1. Provide premixed glycol and water solutions.
   2. Do not use ethylene glycol due to toxicity issues. Provide inhibited propylene glycol for hydronic radiant floor heating systems. Refer to the boiler manufacturer's recommendations.

3.3 INSTALLATION OF HYDRONIC SNOW MELTING SYSTEM

A. Slab-On-Grade Installation:
   1. Fasten the tubing to the rewire or rebar in accordance with the tubing manufacturer's installation recommendations.
   2. Install tubing at a consistent depth below the surface elevation. Ensure sufficient clearance to avoid control joint saw cutting.
   3. Install an extruded polystyrene insulation board at the edge of, and optionally under, the slab, depending on site conditions.
   4. Where tubing crosses metal expansion joints in the concrete, ensure that the tubing passes below the joints or is sleeved through the joints in accordance with manufacturer's instructions.

B. Slab over Steel Deck Installation:
   1. Fasten tubing to either rewire or rebar, or snap tubing into Triple or Single-track RailWays in accordance with manufacturer's installation instructions.
   2. If rewire or rebar is not used, install the tubing perpendicular to the ribbing on the steel deck.
   3. Install either spray-on insulation or insulation board under the steel deck as per the manufacturer's directions.

C. Brick Pavers over Concrete Slab Installation:
   1. Fasten the tubing to the rewire or rebar in accordance with the tubing manufacturer's installation recommendations.
   2. Install tubing at a consistent depth below the surface elevation.
   3. Install the brick pavers on top of the concrete according to proper masonry practice and guidelines for this application.

D. Brick Pavers over Sand or Stone Dust Installation:
   1. Fasten the tubing to the rewire or rebar in accordance with the tubing manufacturer's recommendations for installation in base material.
   2. Install tubing at a consistent depth below the surface elevation.
   3. Place a layer of sand over the tubing to a depth that results in the manufacturer's recommended minimum depth when compacted.
   4. Install the brick pavers on the compacted material according to proper masonry practice and guidelines for this application.

E. Asphalt Installation:
   1. Fasten the tubing to the rewire or rebar in accordance with the tubing manufacturer's recommendations for installation in sub-base material.
   2. Install tubing at a consistent depth below the surface elevation.
   3. Ensure that there is a minimum of 2" (51 mm) of material covering the installed tubing.

3.4 FIELD QUALITY CONTROL AND TESTING

A. Site tests:
   1. To ensure system integrity, pressure test the system before covering tubing in concrete or when other trades are working in the vicinity of the tubing.
   2. Test all electrical controls in accordance with respective installation manuals.
   3. System shall be checked after 3 years of operation and every year thereafter. System shall be checked for pH levels to ensure that it is operating within suggested guidelines.

3.5 SYSTEM ADJUSTING

A. Balancing Across Manifold: Balance all loops across each manifold for equal flow resistance based on actual loop lengths and total manifold flow.

B. Balancing between manifolds is accomplished with a flow control device installed on the return piping leg from each manifold when direct return piping is used for the supply and return mains or the circuits deviate by more than 10%.

3.6 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Remove construction debris from project site and legally dispose of debris.

3.7 DEMONSTRATION

A. Demonstrate operation of system to Owner or Owner's personnel.

B. Instruct the Owner or Owner's personnel about the type, concentration and maintenance of the glycol and water solution.

C. Provide Owner or Owner's personnel with manufacturer's installation, operation, and maintenance instructions for installed components within the system.

3.8 PROTECTION

A. Protect installed work from damage caused by subsequent construction activity on the site. Provide Owner with copy of photos and drawings of product locations to assist.

May 15, 2014

15620 PACKAGED WATER CHILLER

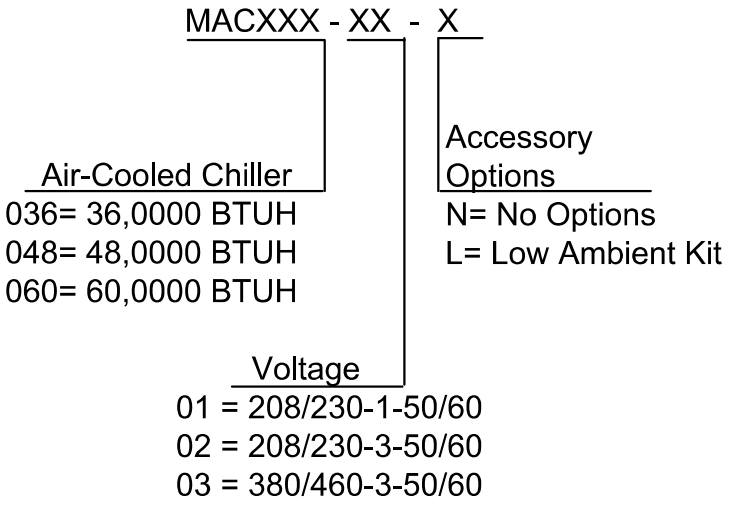
Multiaqua MAC036 Air-cooled Chiller

Multiaqua™

MAC036,048 & 060 Air-Cooled Chiller

Air-Cooled Chillers for Global Residential
and Light Commercial MicroClimates

MAC036,048 & 060 NOMENCLATURE BREAKDOWN



Available Model Numbers		
MAC036-01-N	MAC048-01-N	MAC060-01-N
MAC036-01-L	MAC048-01-L	MAC060-01-L
MAC036-02-N	MAC048-02-N	MAC060-02-N
MAC036-02-L	MAC048-02-L	MAC060-02-L
		MAC060-03-N
		MAC060-03-L

HVAC Guide Specifications

Air-Cooled Liquid Chiller
Nominal Size:
3, 4 & 5 Tons
Multiaqua Model Number:
MAC036-01-N-407, MAC036-01-L-407: MAC036-02-N-407, MAC036-02-L-407,
MAC048-01-N-407, MAC048-01-L-407: MAC048-02-N-407, MAC048-02-L-407,
MAC060-01-N-407, MAC060-01-L-407, MAC060-02-N-407, MAC060-02-L-407,

Part 1-General

1.01 System Description

Multiaqua air-cooled liquid chillers are designed using scroll compressors, low sound condenser fans and high efficiency pumps.

1.02 Quality Assurance

A. Certified in accordance with U.L. Standard 95, latest version (U.S.A.)
B. Construction shall comply with ASHRAE 15 Safety Code, NEC and ASME applicable codes. (U.S.A. Codes)
C. Manufactured in a facility registered to ISO 9002, Manufacturing Quality Standard.
D. ETL Certified
E. Fully load tested at the factory.
F. Damage resistant packaging.

1.03 Delivery, Storage and Handling

A. Packaged and readied for shipment from the factory.
B. Controls shall be capable of withstanding 150°F storage temperatures in the control compartment.
C. Stored and handled per manufacturer's recommendations.

Part 2-Product

2.01 Equipment

A. General:
1. Unit shall be a factory assembled and tested air-cooled liquid chiller.
2. Shall be assembled on heavy gauge steel mounting/lifting rails.
3. Contained within the unit cabinet shall be all factory wiring, piping, controls, refrigerant charge (R407c), POE oil and special accessories required prior to start up.
4. Brass body strainer with 20 mesh screen and blow down shall be supplied in cabinet as a field installable accessory.

B. Unit Cabinet:
1. Composed of heavy gauge galvanized steel casing with a baked polyester powder.
2. Capable of withstanding 500-hour salt spray test in accordance with the ASTM (USA) standard.

C. Condenser Fans:
1. 4-blade, aluminum construction and shall be dynamically balanced and corrosion resistant.
2. Horizontal discharged air.
3. Motors and blades shall be protected by coated steel wire safety guards.

D. Fan Motors:
1. Condenser fan motors shall be single speed, direct drive.
2. Totally enclosed.
3. Permanently lubricated sleeve bearings and Class F insulation.
4. Internal overload protection.

E. Compressors:
1. Unit shall contain one fully hermetic scroll compressors.
2. Direct-drive, 3500 rpm (60Hz)
3. Compressor motor shall be suction gas cooled.
4. Internal motor protection.
5. Externally protected by low and high pressure cutout devices.
6. Individual vibration isolators.

F. Pump:
1. Circulating pump shall be stainless steel with high efficiency enclosed motor.
2. Unit shall have chilled liquid solution piping to the exterior of the cabinet.

G. Evaporator:
1. Evaporator shall have one independent refrigerant circuit and one liquid solution circuit.
2. Rated for a refrigerant side working pressure of 450 psig and a maximum water side working pressure of 150 psig.
3. Single pass, ANSI type 316 stainless steel, brazed plate construction.
4. Externally insulated with closed cell, elastomeric foam. (ASTM518)

H. Condenser:
1. Condenser coil shall be air-cooled with integral subcooler.
2. One independent refrigerant circuit.
3. Constructed of rifled copper tubing mechanically bonded to aluminum fins.
4. Cleaned and dehydrated.
5. Factory leak tested to 450 psig.

I. Refrigerant Circuits:
1. Each circuit shall contain a sight glass, liquid line filter, thermal expansion valve, refrigerant charge of R407c and POE compressor oil.

Part 3-Controls and Safeties

3.01 Controls

A. Chiller shall be completely factory wired and tested.
B. Capacity control shall be based on leaving chilled liquid solution temperature.
1. Temperature accuracy shall be + - 1.0°F.
2. Controls shall be capable of staging the two compressors.
C. Controls shall include the following components.
1. 24vac transformer to serve all controllers relays and control components.
2. Microprocessor based liquid solution temperature controller.
3. Leaving water temperature thermistor.
4. Pump bypass timer.
5. Compressor recycle timer.
6. Optional low pressure bypass timer for low ambient operation.
7. Optional fan cycling control for low ambient operation.
8. Chilled liquid solution flow switch.

3.02 Safeties

A. Unit shall be equipped with thermistors and all necessary components in conjunction with the control system to provide the following protectants.
1. Low refrigerant pressure.
2. High refrigerant pressure.
3. Low chilled liquid solution temperature.
4. Low chilled liquid solution flow.
5. Thermal overload.
6. Short cycling.

Part 4-Operating Characteristics:

4.01 Temperatures

A. Unit shall be capable of starting and running at outdoor temperatures from 55°F to 120°F.
B. Optional Low Ambient Kit shall allow starting and running at outdoor temperatures to -20°F. A field supplied and installed crankcase heater must be used when operating at these temperatures.
C. Unit shall be capable of starting up with a maximum 80°F and a sustained 70°F entering fluid solution temperature to the evaporator.
D. Minimum 10% Glycol solution is required. For outdoor temperatures below 32°F, reference MAC Glycol Solution Data table.

4.02 Electrical Requirements

A. Primary electrical power supply shall enter the unit at a single location.
B. Electrical power supply shall be rated to withstand 120°F operating ambient temperature.
C. Units shall be available in 1 or 3-phase power at the voltages shown in the equipment electrical data.
D. Control points shall be accessed through terminal block.

MAC036, 048 & 060 Product Specifications

Physical Data										
Model Number	Coil				Chiller				Weight (lbs)	
	Height (in)	Length (in)	Copper Diameter (in)	Coil Rows	Height (in)	Length (in)	Width (in)	Refrigerant R407c	Net	Shipping
MAC036	38	48	3/8	1	49.75	39.75	16.25	84.66 oz	280	283
MAC048	38	48	3/8	2	49.75	39.75	16.25	92.95 oz	292	295
MAC060	38	48	3/8	2	49.75	39.75	16.25	92.95 oz	313	316

Electrical Data										
Model Number	Volts/ Phase/ Hertz	Compressor		Condenser Fan Motor (2 qty)		Pump Motor			Fuse or HACR Circuit Breaker Per Circuit	
		(RLA)	(LRA)	(FLA)	(RPM)	(FLA)	(RPM)		Minimum Amps	Maximum Amps
MAC036-01	208/230-1-50/60	18.4	95	1.05	1050	3.70	3450		28.80	45
MAC036-02	208/230-3-50/60	11.4	77	1.05	1050	3.70	3450		20.05	30
MAC048-01	208/230-1-50/60	22.1	137	1.05	1050	3.70	3450		33.43	50
MAC048-02	208/230-3-50/60	16.4	91	1.05	1050	3.70	3450		26.30	40
MAC060-01	208/230-1-50/60	32.1	169	1.05	1050	3.70	3450		45.93	70
MAC060-02	208/230-3-50/60	19.3	137	1.05	1050	3.70	3450		29.93	45
MAC060-03	380/460-3-50/60	10	75	0.60	1050	2.85	3500		16.55	25

	MAC036	MAC048	MAC060
Compressor	Copeland Scroll	Copeland Scroll	Copeland Scroll
Refrigerant	R407c	R407c	R407c
Heat Exchanger	Brazed Plate	Brazed Plate	Brazed Plate
Max. Head Pressure	50 ft.	50 ft.	50 ft.
Max Flow Rate	8.6 gpm	11.5 gpm	14.4 gpm
Min Flow Rate	5.5 gpm	6.5 gpm	9.0 gpm
Supply Water Temp	44°	44°	44°
Return Water Temp	54°	54°	54°
Min. Solution Content	25 Gallons	25 Gallons	25 Gallons
Expansion Tank Size	2 Gallons	2 Gallons	2 Gallons
Pump	0.5 HP	0.5 HP	0.5 HP
Water Connections	1" S & 1.25" R	1" S & 1.25" R	1" S & 1.25" R
Internal Pressure loss	1.77 ft of head	1.68 ft of head	1.85 ft of head

Copper Wire Size (1% Voltage Drop)

Supply Wire Length in Feet	Supply Circuit Ampacity								
200	6	4	4	4	3	3	2	2
150	8	6	6	4	4	4	3	3
100	10	8	8	6	6	6	4	4
50	14	12	10	10	8	8	6	6
	15	20	25	30	35	40	45	50

Multiaqua chillers are designed to operate exclusively with R407c refrigerant in a self-contained, pre-charged refrigerant system. Do not access the closed refrigerant circuit for any reason other than after-sale, after installation component replacement. Routine maintenance and service is to be performed by qualified personnel only.

These specifications are subject to change without notice.

MAC036, 048 & 060 Product Specifications

MAC036, 048 & 060 Capacity / Watts / EER/COP*												
O/A Temp (°F)	MAC036				MAC048				MAC060			
	Tons	KW	EER	COP	Tons	KW	EER	COP	Tons	KW	EER	COP
82	2.9	3.3	10.55	3.09	3.9	4.3	10.88	3.19	5.1	5.3	11.55	3.38
95	2.8	3.6	9.33	2.80	3.7	4.6	9.65	2.83	4.9	5.9	9.97	2.92
100	2.7	3.9	8.31	2.43	3.6	4.8	9.00	2.64	4.8	6.1	9.44	2.76
105	2.7	4.0	8.10	2.37	3.5	5.0	8.40	2.46	4.7	6.4	8.81	2.58
110	2.6	4.3	7.28	2.13	3.4	5.4	7.56	2.21	4.7	6.5	8.68	2.54

* The following equation was used to calculate COP values other than ARI conditions: COP = EER x .2928

Glycol Solution Data				
Propylene Glycol %	Water Flow	Capacity	Min. Ambient Temp	GPM Adjustment= 100% Capacity
10%	x 1.020	x 0.99	26°F	x 1.01
20%	x 1.028	x 0.98	18°F	x 1.03
30%	x 1.036	x 0.98	8°F	x 1.07
40%	x 1.048	x 0.97	-7°F	x 1.11
50%	x 1.057	x 0.96	-29°F	x 1.16

Example: 30% glycol solution.
Maximum Flow Rate = 12gpm x 1.036
System capacity x .98
Use Propylene Glycol Only

Important

If the outside temperature is expected to fall below freezing (32°F) in the area the Multiaqua chiller is to be installed; the installer must take the following precautions. Failure to do so will void the warranty.

To not engage in cold ambient mitigation will result in the failure of components such as the heat exchanger, piping, circulating pump, etc… and or property damage.

• Keep the liquid solution at a minimum of ten percent propylene glycol even in areas where there is no danger of freezing.
• The percentage amount of glycol recommended is dependent on the expected ambient temperatures and the solution makeup recommendation of the glycol manufacturer. Refer to the Glycol Solution Data table above.
• Ensure the system circulating pump is in a constant energized mode to keep a continuous circulation of liquid solution.

The Multiaqua chiller is a self-contained air-cooled condenser, coupled with an insulated brazed plate heat exchanger (evaporator). The system utilizes a scroll compressor to circulate refrigerant between the condenser and heat exchanger. The refrigerant is metered into the heat exchanger with a thermostatic expansion valve. Protecting the system are high and low pressure switches as well as a pump flow switch.
Liquid solution (water and propylene glycol; minimum 10 % is required) is circulated through the heat exchanger by an externally mounted pump. The liquid solution flows through the heat exchanger to the system supply piping and on to the air handlers.
Low ambient kits are available for operating ambient temperatures down to 0 degrees Fahrenheit. The low ambient kits consist of an ICM 325 (+) ICM (175) for single and three phase 208/230 vac chillers. For the three phase 380/460 vac chillers a pressure activated fan control is used.

MAC036 Cooling Performance Data

MAC036 CAPACITIES with 0% Glycol										
LWT (°F)	ENTERING AIR TEMPERATURE (°F)									
	82		95		100		105		110	
	TONS	GPM	TONS	GPM	TONS	GPM	TONS	GPM	TONS	GPM
35	1.70	7.2	1.60	7.2	1.50	7.2	1.40	7.2	1.30	7.2
40	2.30		2.20		2.10		2.10		2.00	
42	2.60		2.50		2.40		2.40		2.30	
44	2.90		2.80		2.70		2.70		2.60	
45	3.10		3.00		2.90		2.80		2.70	
46	3.20		3.10		3.00		3.00		2.90	
48	3.60		3.50		3.20		3.30		3.20	
50	3.90		3.80		3.50		3.60		3.50	
55	4.80		4.70		4.30		4.30		4.20	
60	5.80		5.60		5.20		5.20		5.00	

MAC036 CAPACITIES with 10% Glycol										
LWT (°F)	ENTERING AIR TEMPERATURE (°F)									
	82		95		100		105		110	
	TONS	GPM	TONS	GPM	TONS	GPM	TONS	GPM	TONS	GPM
35	1.68	7.2	1.58	7.2	1.49	7.2	1.39	7.2	1.29	7.2
40	2.28		2.18		2.08		2.08		1.98	
42	2.57		2.48		2.38		2.38		2.28	
44	2.87		2.77		2.67		2.67		2.57	
45	3.07		2.97		2.87		2.77		2.67	
46	3.17		3.07		2.97		2.97		2.87	
48	3.56		3.47		3.17		3.27		3.17	
50	3.86		3.76		3.47		3.56		3.47	
55	4.75		4.65		4.26		4.26		4.16	
60	5.74		5.54		5.15		5.15		4.95	

MAC036 CAPACITIES with 20% Glycol										
LWT (°F)	ENTERING AIR TEMPERATURE (°F)									
	82		95		100		105		110	
	TONS	GPM	TONS	GPM	TONS	GPM	TONS	GPM	TONS	GPM
35	1.67	7.2	1.57	7.2	1.47	7.2	1.37	7.2	1.27	7.2
40	2.25		2.16		2.06		2.06		1.96	
42	2.55		2.45		2.35		2.35		2.25	
44	2.84		2.74		2.65		2.65		2.55	
45	3.04		2.94		2.84		2.74		2.65	
46	3.14		3.04		2.94		2.94		2.84	
48	3.53		3.43		3.14		3.23		3.14	
50	3.82		3.72		3.43		3.53		3.43	
55	4.70		4.61		4.21		4.21		4.12	
60	5.68		5.49		5.10		5.10		4.90	

These specifications are subject to change without notice.

15830 FANS

Multiaqua Hi Wall Fancoil

Ceiling Fans

Multiaqua™

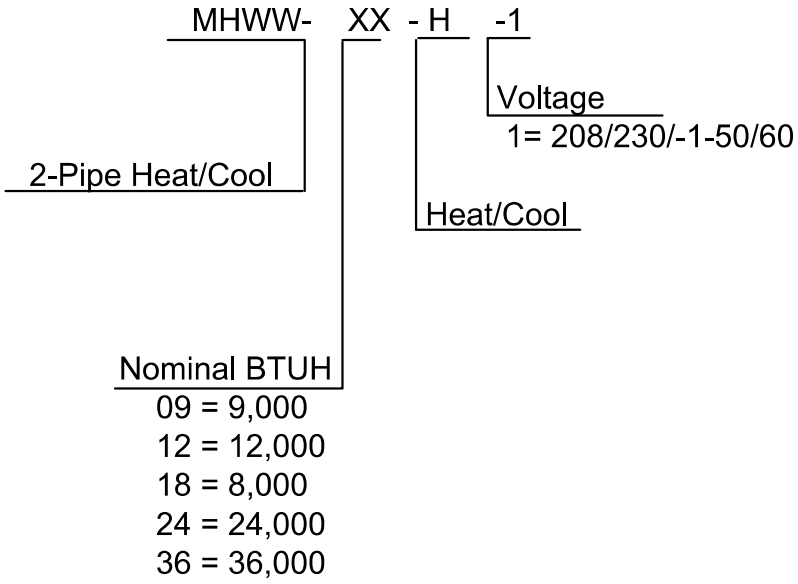
MHWW Chilled/Hot Water

Hi-Wall Fan Coil

2-Pipe Heat / Cool Fan Coil 9,000 - 36,000 BTUH

MHWW NOMENCLATURE BREAKDOWN

2-Pipe Heat/Cool Hi-Wall Fan Coil



Available Model Numbers
MHWW-09-H-1
MHWW-12-H-1
MHWW-18-H-1
MHWW-24-H-1
MHWW-36-H-1

HVAC Guide Specifications

Chilled and Hot Water Hi-Wall Fan Coil
2-Pipe

Nominal Size:
9,000 – 36,000 BTUH

Multiaqua Model Number:
MHWW-09
MHWW-12
MHWW-18
MHWW-24
MHWW-36

Part 1-General
1.01 System Description
Multiaqua Chilled Water Fan Coils are manufactured with high impact molded polymers.

1.02 Quality Assurance
A. Certified in accordance with U.L. Standard 95, latest version (U.S.A.)
B. Manufactured in a facility registered to ISO 9002, Manufacturing Quality Standard.
C. Fully load tested at the factory.
D. Damage resistant packaging.

1.03 Delivery, Storage and Handling
A. Packaged and readied for shipment from the factory.
B. Controls shall be capable of withstanding 150°F storage temperatures in the control compartment.
C. Stored and handled per manufacturer's recommendations.

Part 2-Product
2.01 Equipment
A. General:
1. Unit shall be a factory assembled and tested chilled and hot water fan coil.
2. Shall be assembled with high quality.
3. Contained with the unit shall be all factory wiring, piping, associated controls and special accessories required prior to start up.

B. Unit Cabinet:
1. Composed of high impact polymers.
2. Shall be internally insulated to insure quiet operation.

C. Fan Motors:
1. Shall be available in 208/230-1-50/60 vac.
1. Fan motors shall be three speed, direct drive, and PSC type.
2. Totally enclosed.
3. Internal overload protected.
4. Unit shall contain a swing motor to modulate the discharge air.

D. Blower Wheels:
1. Blower wheels are tangential and dynamically balanced.

E. Water Coil:
1. Manufactured with water coils containing 3/8" copper tubing mechanically bonded to aluminum fins.
2. Coils shall be factory tested to 350 psig.

F. Drain Pan:
1. All drain pans shall be molded with high impact polymers.
2. The exterior of all drain pans shall be insulated with closed cell to prevent condensation.
3. Pans shall contain a flexible drain tubing that is accessible from the back of the unit.

G. Filters:
    1. Unit shall contain 65% washable filters.

Part 3-Controls and Safeties

3.01 Controls

A. Fan coils shall be completely factory wired and tested.
B. Controls shall include a circuit board, room sensor, indoor coil thermistor, transformer and wireless remote.
C. Controls shall be capable of incorporating an optional hard-wired thermostat.

3.02 Safeties:

A. Fan coil shall contain a non reusable fuse on the secondary voltage side of the transformer.
B. Discharge air sensor.

Part 4-Operating Characteristics:

4.01 Electrical Requirements

A. Unit shall incorporate a three prong male primary electrical power cord.
B. Electrical power supply shall be rated to withstand 120°F operating ambient temperatures.

MHWW Product Specifications

Physical Data									
Model Number	Height (in)	Length (in)	Depth (in)	Weight (lbs)	Cooling Rows FPI	Copper Diameter (in)	Water Inlet (in)	Water Outlet (in)	Drain (in)
MHWW-09-H-1	11.70	34.65	6.70	25.70	2-18	3/8	1/2	1/2	1/2
MHWW-12-H-1	12.00	39.00	7.10	27.50	2-18	3/8	1/2	1/2	1/2
MHWW-18-H-1	14.17	46.14	8.10	44.40	2-18	3/8	1/2	1/2	3/4
MHWW-24-H-1	14.17	46.14	8.10	46.20	3-18	3/8	1/2	1/2	3/4
MHWW-36-H-1	14.25	56.50	8.37	50.50	3-18	3/8	3/4	3/4	3/4

Electrical Data						
Model Number	Hi Speed CFM	Volts/ Phase/ Hertz	Motor HP	Full Load Ampacity	Fuse or HACR Circuit Breaker Per Circuit	
					Minimum Amps	Maximum Amps
MHWW-09-H-01	270	208/230-1-50/60	1/60	0.14	.18	1
MHWW-12-H-01	330		1/60	0.17	.18	1
MHWW-18-H-01	480		1/20	0.24	.30	1
MHWW-24-H-01	600		1/20	0.35	.44	1
MHWW-36-H-01	850		1/12	0.42	.53	1

These specifications are subject to change without notice.

MHWW Chilled Water Performance Data

MHWW-09 COOLING CAPACITIES					
CFM	EWT (°F)	GPM	ENTERING AIR TEMPERATURE (°F)		
				80° D.B. / 67° W.B.	75° D.B. / 63° W.B.
270	42	1.8	TC	10.5	8.0
			SC	7.9	7.0
			WPD	3.6	3.6
		2.0	TC	11.8	9.0
			SC	8.4	7.4
			WPD	6.0	6.0
		2.5	TC	12.7	9.7
			SC	8.7	7.6
			WPD	9.0	9.0
		3.0	TC	13.3	10.2
			SC	9.0	7.8
			WPD	12.6	12.6

MHWW-09 COOLING CAPACITIES					
CFM	EWT (°F)	GPM	ENTERING AIR TEMPERATURE (°F)		
				80° D.B. / 67° W.B.	75° D.B. / 63° W.B.
270	45	1.8	TC	9.6	7.3
			SC	7.6	6.7
			WPD	3.6	3.6
		2.0	TC	10.8	8.3
			SC	8.1	7.1
			WPD	6.0	6.0
		2.5	TC	11.6	8.9
			SC	8.3	7.3
			WPD	9.0	9.0
		3.0	TC	12.2	9.3
			SC	8.6	7.5
			WPD	12.6	12.6

These specifications are subject to change without notice.

MHWW Chilled Water Performance Data

MHWW-12 COOLING CAPACITIES					
CFM	EWT (°F)	GPM	ENTERING AIR TEMPERATURE (°F)		
				80° D.B. / 67° W.B.	75° D.B. / 63° W.B.
330	42	3.0	TC	13.7	10.4
			SC	9.2	8.0
			WPD	11.4	11.4
		4.0	TC	14.3	10.9
			SC	9.4	8.2
			WPD	15.9	15.9
		5.0	TC	14.8	11.3
			SC	9.6	8.3
			WPD	17.6	17.6
		6.0	TC	15.1	11.5
			SC	9.8	8.4
			WPD	21.2	21.2

MHWW-12 COOLING CAPACITIES					
CFM	EWT (°F)	GPM	ENTERING AIR TEMPERATURE (°F)		
				80° D.B. / 67° W.B.	75° D.B. / 63° W.B.
330	45	3.0	TC	12.5	9.6
			SC	8.8	7.6
			WPD	11.4	11.4
		4.0	TC	13.1	10.0
			SC	9	7.8
			WPD	15.9	15.9
		5.0	TC	13.5	10.3
			SC	9.1	7.9
			WPD	17.6	17.6
		6.0	TC	13.9	10.6
			SC	9.3	8.0
			WPD	21.2	21.2

These specifications are subject to change without notice.

May 15, 2014

CEILING FAN

Add a traditional touch to your home's decor with the Hampton Bay Brookhurst Brushed Nickel Ceiling Fan. The Brookhurst features 5 reversible maple/walnut blades and a brushed nickel finish that complements a wide range of decor styles. The powerful motor's multi-capacitor delivers quiet operation, while the 3-light kit has a white frosted glass shades to provide attractive illumination in your home. Uses three 13 watt, medium-base CFL bulbs (included).

-
- 5 reversible walnut/maple blades make it easy to change your decor style without purchasing new blades
- 3-light kit with frosted white glass shades
- 3-speed reversible control
- Brushed nickel finish complements a wide variety of decor styles
- For interior use
- Uses three 13 watt, medium-base CFL bulbs, included
- 54 in. lead wires accommodate extended down rod applications (extended down rod not included)
- 160 RPM motor with multi-capacitor offers quiet operation and excellent air movement
- Up to 4,469 CFM airflow
- Large room: room size up to 20 ft. x 20 ft. with blade size of 52 in.
- Cannot be installed without light kit

SPECIFICATIONS

Airflow (CFM)	4469	Assembled Depth (in.)	52 in
Assembled Height (in.)	18.34 in	Assembled Width (in.)	52 in
Blade Color Family	Brown	Bulb Type	CFL
Ceiling Fan Width (in.)	52	Certifications and Listings	1-UL Listed
Color Family	Nickel	Color/Finish	Brushed Nickel
Commercial / Residential	Residential	Compatible with Light Kits	No
Dimmable	No	Distance from Ceiling to Bottom of Fan (In.)	18.34

Airflow (CFM)	4469	Assembled Depth (in.)	52 in
Dual Fan Heads	No	ENERGY STAR Certified	No
Fan Blade Length (In.)	52	Fan Blade Material	MDF
Fan Blade Width (In.)	52	Features	Light Kit Compatible,Reversible Blades,Reversible Motor
Finish	Brushed Nickel	Finish Family	Brushed Nickel
Fixture Color/Finish Family	Nickel	Housing Color Family	Nickel
Included	Bulbs Included,Downrod Included,Light Kit Included	Indoor/Outdoor	Indoor
Installation Features	Can be installed with light kit	Light Bulb Base Code	Medium
Light Bulbs Included	Yes	Light Type	Shades
Manufacturer Warranty	Lifetime Motor Warranty	Motor Speed (RPM)	160
Mount Type	Standard	Number of Blades	5
Number of Speeds	3	Product Weight (lb.)	17.07 lb

Airflow (CFM)	4469	Assembled Depth (in.)	52 in
Pull Chain	Yes	Quick Connect Fan-Blade System	No
Remote Control	No	Returnable	90-Day
Reverse Airflow	Yes	Reversible Two-Sided Blades	Yes
Room Type	Large Room (12ft x 12ft to 18ft x 18ft)	Timer	No

SECTION 15400 - PLUMBING FIXTURES

May 15, 2014

HIGH EFFICIENCY TOILET

The Glacier Bay 2 Piece high efficiency toilet offers top performance with a classic design. The base and tank feature a tapered profile with stylish rounded profile. Featuring a round bowl, the versatile toilet will complement all styles of bathroom. This toilet includes a tank, a bowl and a toilet seat.

- 17.5 in. chair height bowl meets ADA standards
- Toilet and tank are made of Vitreous China and the seat is plastic
- All-in-one packaging includes everything you need: wax ring, plastic elongated seat, floor bolts and caps
- Round Front bowl design
- Ceramic toilet is WaterSense certified by the EPA

SPECIFICATIONS

Assembled Depth (in.)	17.00 in	Assembled Height (in.)	32.25 in
Assembled Width (in.)	28.25 in	Bowl Height	ADA/Comfort
Bowl Shape	Round	Certifications and Listings	ADA Compliant,EPA Approved,IAPMO Certified
Color Family	White	Color/Finish	White
Commercial / Residential	Residential	Flushing System	Gravity Fed
Gallons Per Flush	1.28	Manufacturer Warranty	1 year limited
Material	Vitreous China	Product Depth (in.)	27.30
Product Height (in.)	31.80	Product Weight (lb.)	81.96
Product Width (in.)	27.33	Rough In Size	12
Seat Included	Yes	Toilet Bowl Height (in.)	17.50

Assembled Depth (in.)	17.00 in	Assembled Height (in.)	32.25 in
Toilet Features	Complete Kit	Toilet Type	Two-Piece
Waterless?	No		

May 15, 2014

TUB-SHOWER STALL

The Aquatic 60 in. x 30 in. x 72 in. One Piece Direct-to-Stud Tub Wall in White is constructed from fiberglass-reinforced polyester to help provide long-lasting use and features a smooth, high-gloss finish that resists scratches to help provide easy maintenance. This single-piece tub and shower combination features a slip-resistant, textured bottom to help ensure safety while bathing or showering.

- Features 2 integral soap shelves on the back wall
- Fiberglass-reinforced polyester construction for long-lasting use
- Left-hand drain location
- Single-piece tub and shower combination helps provide a seamless look
- Product may vary in store

SPECIFICATIONS

Assembled Depth (in.)	30 in	Assembled Height (in.)	72 in
Assembled Width (in.)	60 in	Certifications and Listings	No Certifications or Listings
Color Family	White	Color Family	White
Color/Finish	White	Door Swing	Sliding
Exterior bath shape	Rectangle	Faucet mount	Wall
Included	No additional components or accessories are included	Installation type	Wall Mount
Manufacturer Warranty	5-year limited warranty	Material	FRP
Material	Fibre Reinforced Polymer (FRP)	Maximum Number of Occupants	1
Product Weight (lb.)	117	Returnable	90-Day

Assembled Depth (in.)	30 in	Assembled Height (in.)	72 in
Shape	Rectangle	Shower Features	No additional features
Tub depth (in.)	30	Tub height (in.)	72
Tub length (in.)	60	Tub width (in.)	60
Water capacity (gallons)	34		

May 15, 2014

BATHROOM FAUCET

The Glacier Bay Constructor 4 in. 2-Handle Low-Arc Bathroom Faucet in Chrome has a nostalgic look and will complement a wide variety of bathroom decor. WaterSense certified with a 1.5-gallon per minute water flow rate to help reduce water use and washerless cartridges to help prevent dripping, this faucet meets and exceeds the highest standards of efficiency. The 2-handle design, low-arc spout and deck-plate mount make this faucet easy to use and easy to install. Pair with other pieces from the Constructor Collection for a complete and polished look. Limited Lifetime Warranty.

- 2-handle design for easy use
- Low-arc spout has a height of 1-19/32 in.
- Spout has a reach of 4 in.
- Chrome finish is easy to clean
- Contains washerless cartridges to prevent dripping
- WaterSense certified to help reduce water use
- 1.5-Gal. per minute water flow rate helps conserve water
- ADA compliant
- Deck-plate mount for easy installation
- 3 installation holes required
- Pop up assembly included

SPECIFICATIONS

Assembled Depth (in.)	8.79 in	Assembled Height (in.)	3.22 in
Assembled Width (in.)	5.74 in	Bath Faucet Type	4" Centerset
Certifications and Listings	ADA Compliant	Color Family	Chrome
Color/Finish	Chrome	Connection size (in.)	1/2 In.
Faucet Features	No Additional Features	Faucet Included Components	Drain,Handles
Faucet type	Bath Faucet	Flow rate (gallons per minute)	1.5
Handle type	Lever	Manufacturer Warranty	Limited lifetime warranty

Assembled Depth (in.)	8.79 in	Assembled Height (in.)	3.22 in
Number of Faucet Handles	Double Handle	Number of Faucet Holes Required	3
On-center measurement	4 in. center set	Returnable	90-Day
Spout Reach (in.)	4.1 in	Spout Type	Low Arc
Spout height (in.)	1.6		

May 15, 2014

KITCHEN FAUCET

The MOEN Banbury 4 in. 2-Handle High-arc Faucet in Brushed Nickel features a Spot Resist finish that is resistant to fingerprints and water spots for easy cleaning and long-lasting enjoyment. The separate lever handles for hot and cold water meet ADA requirements for easy use, and the faucet is WaterSense certified to help reduce water use without compromising performance.

- 2-handle design features separate handles for hot and cold water for precise adjustment of water flow and temperature
- High-arc rotating spout with a self-centering feature helps provide easy access
- Spot resist brushed nickel finish resists fingerprints and water spots for easy maintenance
- WaterSense certified to help reduce water use without sacrificing performance
- Lever handles are ADA compliant for ease of operation
- 4 in. Centerset design
- Drain included

SPECIFICATIONS

Assembled Depth (in.)	4.75 in	Assembled Height (in.)	7 in
Assembled Width (in.)	9.25 in	Bath Faucet Type	4" Centerset
Certifications and Listings	ADA Compliant	Color Family	Nickel
Color/Finish	Spot Resist Brushed Nickel	Connection size (in.)	1/2 In.
Faucet Features	No Additional Features	Faucet Included Components	Drain,Handles
Faucet type	Bath Faucet	Flow rate (gallons per minute)	1.5
Handle type	Lever	Manufacturer Warranty	Limited Lifetime Warranty
Number of Faucet	Double Handle	Number of Faucet Holes	3

Assembled Depth (in.)	4.75 in	Assembled Height (in.)	7 in
Handles		Required	
Returnable	90-Day	Spout Reach (in.)	4.75 in
Spout Type	High Arc	Spout height (in.)	7

May 15, 2014

TUB-SHOWER FIXTURES

The Banbury collection highlights a timeless nostalgia for traditional versatility and sets a tone that is both classical and sensible. This innovative Spot Resist finish resists fingerprints and water spots to maintain the brilliance of the original finish and easily wipes cleans. All of our new bath faucets feature a 1.5 gallon per minute (GPM) flow rate which uses up to 32% less water, while still maintaining the same great performance you expect from Moen.

- Due to WaterSense regulations in the state of New York, please confirm your shipping zip code is not restricted from use of items which do not meet WaterSense qualifications
- 1-handle lever design for ease of use
- PosiTemp pressure–balancing valve maintains water pressure and controls temperature
- Moenflo xl single function shower head
- Spot Resist brushed nickel resists fingerprints and water spots
- Adjustable temperature limit stop to control maximum hot water temperature
- ADA compliant lever handle for easy operation
- Showerhead maximum flow rate of 2.0 GPM

SPECIFICATIONS

Assembled Depth (in.)	5.00 in	Assembled Height (in.)	7 in
Assembled Width (in.)	7 in	Bath Faucet Type	Combo Tub and Shower
Certifications and Listings	ADA Compliant	Color Family	Nickel
Color/Finish	Spot Resist Brushed Nickel	Connection Size	1/2"
Diverter type	Plunger	Faucet Features	Self-cleaning Nozzles
Faucet Included Components	Handles,Required rough-in valve	Faucet type	Bath Faucet
Flow rate (gallons per minute)	2.0	Handle type	Lever

Assembled Depth (in.)	5.00 in	Assembled Height (in.)	7 in
Manufacturer Warranty	Limited Lifetime Warranty	Number of Faucet Handles	Single Handle
Number of Spray Settings	1	Returnable	90-Day
Showerhead face diameter (in.)	4.5	Showerhead type	Fixed Mount
Spout Reach (in.)	5.81 in	Spout Type	Shower/tub diverter
Spray Pattern	Full	Style	Transitional

May 15, 2014

KITCHEN SINK

Featuring two spacious basins and sound absorption technology, the Southhaven Double-basin sink is perfect for any kitchen. Its stainless steel construction is both durable and easy to clean. It offers Contemporary design lines inspired by handcrafted sinks.

- Self-rimming style with curved deck design
- 8-1/2 in. basin depth; double equal basins
- 3-5/8 in. drain opening
- 4-hole faucet punching
- Made of 18 gauge stainless steel with a durable satin finish
- SilentShield an exclusive sound-deadening system, reduces noise and vibration
- Rolled outer rim for safe handling and increased rim durability

SPECIFICATIONS

Assembled Depth (in.)	22 in	Assembled Height (in.)	8.5 in
Assembled Width (in.)	33 in	Certifications and Listings	CSA Listed
Color Family	Stainless Steel	Color/Finish	Stainless Steel
Cut-Out Below Counter Height (in.)	8.0	Cut-Out Front to Back Depth (in.)	21.5
Cut-Out Left to Right Width (in.)	32.5	Drain Included	No
Faucet Included	No	Finish Type	Satin
Insulated	Yes	Kitchen Product Type	Kitchen Sink
Kitchen Sink Depth (In.)	33	Kitchen Sink Height (In.)	8.5
Kitchen Sink Width (In.)	22	Left Bowl Below Counter Height (in.)	8.0

Assembled Depth (in.)	22 in	Assembled Height (in.)	8.5 in
Left Bowl Left to Right Width (in.)	14	Manufacturer Warranty	Lifetime Limited Warranty
Material	Stainless Steel	Mount type	Top Mount
Product Weight (lb.)	20.0	Returnable	90-Day
Right Bowl Below Counter Height (in.)	8.0	Right Bowl Left to Right Width (in.)	14
Sink Gauge	18	Sound insulation	Yes
Strainer Basket Included	No		

May 15, 2014

SECTION 16500 – LIGHTS & TRIM

The Halo Air-Tite 5 in. Recessed Housing features an Air-Tite design to prevent airflow between the attic and living areas in your home. This housing has a built-in thermal protector that can be covered by insulation and features an adjustable socket bracket to ensure proper and consistent lamp positioning.

- For use as new construction housing
- Can be used with 120-volt incandescent lamps
- Uses a 5 in. aperture designed to accommodate smaller-sized lamps
- Air-Tite design prevents air from flowing between the attic and living areas
- Thermally protected IC housing which can be covered by insulation
- Insulation contact (IC) rated
- UL listed
- Easy installation

SPECIFICATIONS

Airtight	Yes	Aperture width (in.)	5
Assembled Depth (in.)	7.25 in	Assembled Height (in.)	7.5 in
Assembled Width (in.)	10.5 in	Certifications and Listings	1-UL Listed,CSA Listed,IC Rated
ENERGY STAR Certified	No	Housing depth (in.)	7
Insulation contact	Insulation contact	Light Bulb Base Code	Medium
Light Source	Incandescent	Manufacturer Warranty	standard
New Construction or Remodel	New Construction	Number of Housings Included	1
Product Weight (lb.)	3.4 lb	Product Width (in.)	13 in
Recommended bulb	PAR 30	Reflector finish family	Aluminum

Airtight	Yes	Aperture width (in.)	5
type			
Returnable	90-Day	Size	5 in.

The Halo 5 in. Open Trim features a white color and a white splay design to create an attractive, finished look for your decor. This trim is compatible with H5ICAT, H5RICAT and H25ICAT housings and has a dual socket position for use with BR and PAR lamps.

- White open trim with a white splay
- Use as a recessed down light
- Dual socket position for use with BR and PAR lamps
- For use with H5ICAT, H5RICAT and H25ICAT housings
- Insulation Contact (IC) rated

SPECIFICATIONS

Adjustable Lamp Head	No	Aperture width (in.)	5
Assembled Depth (in.)	6.5 in	Assembled Height (in.)	4.75 in
Assembled Width (in.)	6.5 in	Certifications and Listings	1-UL Listed,CSA Listed
Fixture Finish	White	Fixture finish family	White
Fixture\track material	Metal	Light Source	Incandescent
Manufacturer Warranty	standard	Product Weight (lb.)	1

Adjustable Lamp Head	No	Aperture width (in.)	5
Returnable	90-Day	Size	5 in.