

ENJOY : Team New Jersey

U.S. DEPARTMENT OF ENERGY
Solar Decathlon 2011

Project Manual
08/11/2011



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Summary of Changes

Significant changes to the project manual that have occurred between submissions have been outlined below. The Construction Drawings should also be reviewed for relevant revisions.

March 22nd, 2011 Revision

The Project Manual has been updated from the previous issue. Revisions include:

- Revision 1: Addition of Division 06 – Wood, Plastics, and Composites
- Revision 2: Additions to Division 07 – Thermal and Moisture Control
- Revision 3: Additions to Division 08 – Openings
- Revision 4: Additions to Division 26 – Electrical

August 8th, 2011 Revision

The Project Manual has been updated from the previous issue. Revisions include:

- Revision 1: 22 11 13 – Domestic Water Pumps
- Revision 2: 23 72 23 – Energy Recovery Ventilator
- Revision 3: Addition – 23 84 16 – Dehumidifiers, 25 00 00 – Integrated Automation
- Revision 4: Addition of Appendix A, B, and C.



Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 4-2	Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	O-101, O-102, O-103, O-104
Rule 4-2	Construction Equipment	Specifications for heavy machinery	O-601
Rule 4-4	Impact on the Turf	Drawing(s) showing the location, contact area, and soil-bearing pressure of every component resting directly on the turf	C-101, S-101 Project Manual: Structural Calculations Section 6.2
Rule 4-5	Generators	Specifications for generators	Project Manual: 26 32 00
Rule 4-6	Spill Containment	Drawing(s) showing the locations of all equipment, containers, and pipes that will contain liquids at any point during the event	P-101, P-105, P-106, M-102, M-104
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	Project Manual: 22 12 00 22 13 53
Rule 4-7	Lot Conditions	Calculations showing that the structural design remains compliant even if 18 in. (45.7 cm) of vertical elevation change exists	Project Manual: Structural Calculations
Rule 4-7	Lot Conditions	Drawing(s) showing shimming methods and materials to be used if 18 in. (45.7 cm) of vertical elevation change exists on the lot	A-321 - C5 Project Manual: 03 45 00
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	G-201, G-202
Rule 5-2	Solar Envelope Dimensions	List of solar envelope exemption requests accompanied by justifications and drawing references	N/A
Rule 6-1	Structural Design Approval	List of, or marking on, all drawing and project manual sheets that have been or will be stamped by the qualified, licensed design professional in the stamped structural submission; the stamped	Project Manual: Structural Calculations



		submission shall consist entirely of sheets that also appear in the drawings and project manual	
Rule 6-2	Finished Square Footage	Drawing(s) showing all information needed by the rules officials to measure the finished square footage electronically	G-101
Rule 6-2	Finished Square Footage	Drawing(s) showing all movable components that may increase the finished square footage if operated during contest week	N/A
Rule 6-3	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route and the ground surface area that will be covered by organizer-provided walkway material	G-103
Rule 7-1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	L-101
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	N/A
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	Project Manual: 26 31 00
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	N/A
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	N/A
Rule 8-5	Village Grid	Completed interconnection application form.	Project Manual: Page 255
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-102, E-104, E-602
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	Project Manual: 26 31 00
Rule 8-5	Village Grid	One-line electrical diagram	E-602



Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	E-604
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	E-104
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	E-201
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	P-101, M-103
Rule 9-1	Container Locations	Drawing(s) demonstrating that the primary supply water tank(s) is fully shaded from direct solar radiation between 9 a.m. and 5 p.m. EDT or between 8 a.m. and 4 p.m. solar time on October 1	L-501
Rule 9-2	Team-Provided Liquids	Quantity, specifications, and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure testing, and thermodynamic system operation	Project Manual: Team Provided Liquids P-107, P-108
Rule 9-3	Greywater Reuse	Drawing(s) showing the layout and operation of greywater reuse systems	N/A
Rule 9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	N/A
Rule 9-8	Water Delivery	Drawing(s) showing the complete sequence of water delivery and distribution events	P-107, P-108
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	P-107, P-108 Project Manual: 22 12 00
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	P-107, P-108
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	Project Manual: 22 13 53
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	G-103



Design Narrative

Team New Jersey has conceived the ENJOY house as one that integrates passive design strategies, new solar technologies, and contemporary architectural concepts. As a prototype, the house challenges traditional building techniques and suggests a new method of approaching high-performance energy-efficient housing. Modularity coincides with the use of precast insulated concrete sandwich panels for the house's structure - these are seldom considered a conventional residential building material in the United States. Assembly of modular components allows for a faster construction process reducing labor costs and eliminating the need for additional trades on the building site. Additionally, the high thermal mass properties of the precast insulated concrete panels contribute to passive control of a space's climate; and require little to no maintenance while outlasting conventional "stick-building" materials.

The ENJOY house's organization was generated from two main concepts: the core, or "wet module", of the house which contains the integrated systems; and accessibility through universal design strategies. The house strives to create a new image of a highly performative house with an appealing aesthetic. The roof is an *inverted hip* shape that is calibrated for the optimal sun angle and for rainwater collection; concealing the photovoltaic panels and solar-hot water tubes which carry the stigma of being unattractive. The minimal roof overhang on the south-façade shades the interior from intense summer sun while allowing the lower winter sun to enter the house. The roof acts on multiple levels to respond to both visual and passive strategies. The operable windows in the house are placed intentionally low on the west side and high on the east side for cross-ventilation.

The interior highlights the concrete's essence while still creating an atmosphere of relaxation. Panelite is used as an accent; its bright color and translucency gives the interior spaces an air of elegance and refinement. Centering the core makes circulation simple, and decreases the need for traditional hallways while making the compact 950 square foot space seem larger.



STRUCTURAL SYSTEM

The ENJOY house is designed to be built in New Jersey, disassembled, shipped to Washington DC where it will be reassembled in only 24 hours for the purposes of the competition. It will then be disassembled and moved again to a final location on the Jersey Shore. This constraint has played a significant role in the development of the structural systems.

The first of its kind in the Solar Decathlon, the ENJOY house is completely built from precast insulated panels. Typical homes in the United States are built with wooden frames and must be built with wooden frames and finished with various other materials. ENJOY's concrete panels are all in one modular units that eliminate the need for additional trades on the building site. Concrete is low-maintenance and durable, and requires little to no repair or replacement. It can resist weather, chemicals, air infiltration, airborne moisture, abrasion and insects; and because concrete does not require finishes it contains low to negligible levels of VOC's, making it a sustainable alternative to standard construction. Concrete contains natural materials and recycled industrial byproducts such as fly ash that significantly reduce its carbon footprint.

The house deploys a system of reinforced concrete panels in the roof, walls, and floor. The roof is made up of 6 panels and a large beam nicknamed "the boat" that connects them all. The exterior wall enclosure system is comprised of 10 unique panels and the interior walls consist of the core and a coat closet. The floor is made up of 4 panels is designed as a "tray" in order to minimize footing depth.

The construction process of concrete, known as casting, is much different from the common stick frame process. It requires everything that functions in the walls to be built into the walls from the very start. However, it provides the designer with unlimited flexibility in surface treatment, color, and shape, making it a very versatile material to work with. Also because formwork can be reused, the modules can be replicated for mass production making the house more affordable and available to a larger market.

INTEGRATED MEP SYSTEMS

The ENJOY House strives to consolidate all of the electrical, mechanical, and plumbing systems to perform with the goal of net zero energy use and minimal environmental impact. Using the strategies discussed here the ENJOY house will become a self sufficient single family home whose systems will compliment the design of the project and integrate MEP with the house's



formal organization. The main objective is to understand the performative requirements of a winning Solar Decathlon house and tailor a design that will allow the house's aesthetic to integrate with this performance.

The house's roof is its power source for both its heat and electric. The house harvests its power through an 8.8 kWh system of 40 south facing solar panels and a separate system of a 30 tube heat transfer solar collector. This system was designed in accordance to the daily activities, appliances, and competitions that the house will be a part of. Each panel has a micro inverter on it converting its DC power to AC, which benefits the system in terms of efficiencies and goes to the electric panel, then out to the grid. The house's program is planned around a central core that contains all of the mechanical, electrical and plumbing systems (the "wet cell"). These systems come down through the roof into the mechanical closet, along with plumbing for drainage. The evacuated tubing runs into the first coil of a dual heat exchanger, using solar radiation for heating the house's water. This system is five times more efficient means than heating with electric. To cool the house, there is a horizontally mounted 12,000 BTU air handler that distributes 650 CFM to the living areas of the house. There are two supply registers at the ceiling on the east and west side of the wet cell and, one return register feeding from the base of the closet out to the southern hallway. This plan is the most effective for cooling the house, and uses the least amount of ducts and power. The condenser is air to water and sits on the south side of the site. This condenser type allows us to reverse cycles and use the same unit to heat the hydronic flooring, which we are using for heating and cooling the house. This is an efficient way of heating the house and compliments the idea of thermal mass as a passive strategy for a "softer" heating source. Passive design strategies are an integral part of the ENJOY house. The use of these strategies minimizes the load on our active systems, while saving energy.

The house receives its potable water from a 750 gallon tank on the east side of the site. For the plumbing it was important to minimize the length of the piping so all of the appliances, sinks, and shower are located on the perimeter of the wet cell, minimizing length. The plumbing runs along the inside of the mechanical closet. The domestic water is heated by the dual heat exchanger. An instant hot water heater is provided as a backup system for the evacuated tubes in the event that the water is not heated to the desired temperature. After the water is used it is pumped out to a septic tank on the east side of the site.



All of the systems of the house are designed in conjunction with the passive strategies (thermal mass, cross ventilation, etc), material properties, and functions of the house thereby optimizing its performance.

LANDSCAPE PROPOSAL

The landscape of the ENJOY house was designed with a holistic methodology in mind. The decking and planters are composed of individual modules. Each module is designed to be easily constructed using advanced three-dimensional software and three-axis router. The advantage to this modular system is ease of construction and shipping.

A rainwater collection system was designed which will direct water accumulated on the roof to a cistern located underneath the vegetable planters. The collected water can then be dispensed to the planters with the appropriate dosage of fertilizer. This will be a fully automated system that will only need periodical upkeep. The roof storm water collection system, which will not be operational during the competition, will accumulate enough water to disperse and fully supply the vegetable planters when set.



Construction Specifications

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12 35 30.13	RESIDENTIAL KITCHEN CASEWORK	2
12 36 13	CONCRETE SINK AND COUNTERTOPS	3
12 58 13	COUCHES AND LOVESEATS	1
12 58 16	RESIDENTIAL CHAIRS	2
12 58 19	DINING TABLE AND CHAIRS	2
12 58 23	COFFEE TABLES	2
12 58 29	BEDS	1
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23 72 23	ENERGY RECOVERY VENTILATOR	2
23 81 13	PACKAGED TERMINAL AIR-CONDITIONERS	3
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26 24 16	PANELBOARDS	3
26 27 26	WIRING DEVICES	4
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26 32 00	PACKAGED GENERATOR ASSEMBLIES	1
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DIVISION 03 – CONCRETE



SECTION 03 40 00 - PRECAST CONCRETE METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Anchor Bolts
- C. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

1.2 RELATED DOCUMENTS

- A. Construction Documents – S-302, S-501, S-511, S-512, S-531, S-532, S-533
- B. Section 03 45 00 – Architectural Precast Concrete

1.3 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. Reference Keynote: 03 40 00.A1
 - 2. Reference Keynote: 03 40 00.A2
 - 3. Reference Keynote: 03 40 00.A4
- B. Anchor Bolts:
 - 1. Reference Keynote: 03 40 00.A3

2.2 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.



2.3 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

2.4 STEEL AND IRON FINISHES

- A. Hot-dip galvanize steel fabrications at exterior locations.
- B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.
- B. Fit exposed connections accurately together to form hairline joints.
- C. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION 03 40 00



SECTION 03 45 00 - ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Insulated, architectural precast concrete units.
- B. Insulated panel accessories.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.
- B. Project Manual – Structural Calculations
- C. Section 03 40 00 – Precast Concrete Metal Fabrications
- D. Section 07 92 00 - Joint Sealants for elastomeric joint sealants and sealant backings.

1.3 SUMMARY

- A. This section includes the performance criteria, materials, design, production, and erection of architectural precast concrete for the entire project. The work performed under this Section includes all labor, material, equipment, related services, and supervision required for the manufacture and erection of the architectural precast concrete work shown on the Contract Drawings.

1.4 DEFINITION

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.5 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Loads: As indicated in the Project Manual – Structural Calculations.



1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Retain quality control records and certificates of compliance for 5 years after completion of structure.
- B. Shop (Erection) Drawing:
 - 1. Detail fabrication and installation of architectural precast concrete units.
 - 2. Indicate locations, plan views, elevations, dimensions, shapes, and cross-sections of each unit.
 - 3. Indicate aesthetic intent including joints, drips, chamfers, rustications or reveals, and extent and location of each surface finish.
 - 4. Indicate details at building corners.
 - 5. Indicate separate face and backup mixture locations and thicknesses.
 - 6. Indicate welded connections by AWS standard symbols and show size, length, and type of each weld.
 - 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 - 9. Indicate plan views and elevations showing unit location and dimensions, erection sequences, and bracing plan for special conditions.
 - 10. Indicate location of each architectural precast concrete unit by same identification mark placed on unit.
 - 11. Indicate relationship of architectural precast concrete units to adjacent materials.
 - 12. Coordinate and indicate openings and inserts required by other trades.
 - 13. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Architect and submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- C. Comprehensive engineering design signed and sealed by qualified professional engineer responsible for its preparation licensed in the jurisdiction in which the project is located. Show governing panel types, connections, concrete cover and reinforcement types, including special reinforcement such as epoxy coated carbon fiber grid. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame by the architectural precast concrete.
- D. Samples: Design reference samples for initial verification of design intent, approximately 12 x 12 x 2 in. (300 x 300 x 50 mm), representative of finishes, color, and textures of exposed surfaces of architectural precast concrete units.



1. When back face of precast concrete unit is to be exposed, include Samples illustrating workmanship, color, and texture of the backup concrete as well as facing concrete.

1.7 QUALITY ASSURANCE

- A. Erector Qualification: A precast concrete erector with all erecting crews Qualified and designated, prior to beginning work at project site, by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.
- B. Erector Certification: A precast concrete erector with erecting organization and all erecting crews Certified and designated, prior to beginning work at project site, by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.
- C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, PCI Design Handbook - Precast and Prestressed Concrete, applicable to types of architectural precast concrete units indicated.
- D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel"; AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel" and AWS D1.6/D1.6M Structural Welding Code-Stainless".
- F. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 16 ft² (1.5 m²) in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 1. Locate panels where indicated in Contract Document or, if not indicated, as directed by Architect.
- G. Mockups: After sample panel approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Mockups to be representative of the finished work including fiberglass framing, glass, sealants and architectural precast concrete complete with anchors, connections, flashings,



and joint fillers as accepted on the final Shop Drawings. Build mockups to comply with the following requirements, using materials indicated for the completed work:

1. Build mockups in the location and of the size indicated in Contract Documents or, if not indicated, as directed by Architect.
2. Notify Architect in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting fabrication of precast concrete units.
4. Approved mockups may become part of the completed Work if undamaged at the time of Substantial Completion.
5. Approval of mockups does not constitute approval of deviations from the Contact Documents unless such deviations are specifically approved by Architect in writing

H. Preinstallation Conference: Conduct conference at New Jersey Institute of Technology.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to ensure compliance with the agreed upon project schedule and setting sequence and also to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on non-staining shock-absorbing material.
- C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping, or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner to avoid excessive stresses which could cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

1.9 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.



PART 2 - PRODUCTS

2.1 FABRICATORS

- A. NE Precast, LLC Tel: 856-765-9088
92 Reese Road Fax: 856-765-9087
Millvile, NJ 08332
<http://www.northeastprecast.com/index.html>

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
B. Welded Wire Fabric: ASTM A615 – Fy = 70ksi

2.3 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, 7-wire, low-relaxation strand.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150, Type I.
1. For surfaces exposed to view in finished structure, use gray or white, of same type, brand, and mill source throughout the precast concrete production.
2. Standard gray portland cement may be used for non-exposed backup concrete.
- B. High Performance Concrete Mix Type I.
1. Cement
2. NewCem
3. Flyash
4. #67
5. 38
6. Sand
- C. The specimens are tested for the following properties in accordance with the test procedures indicated below:
1. Scaling Resistance: ASTM-C672
2. Abrasion Resistance: ASTM-C944
3. Freeze-Thaw Durability: ASTM-C666, Method-A
4. Chloride Permeability: AASHTO-T277
5. Compressive Strength: AASHTO-T22
6. Water-Cement Ratio: ACI-211 (Max 0.40)



2.5 STEEL CONNECTION MATERIALS

- A. Wall Shoes: PSK Wall Shoes for panel to panel, panel to floor connections: Plates S355J2+N and Metal Sheet S235JR, Grade EN 10025. Ribbed Bars A500HW, Grade SFS1215.
 - 1. Manufacturer: Peikko Group
 - 2. Product: PWS 14 Wall Shoes for 5/8 ASTM Bolt
 - a. Product Website: <http://www.peikko.ca/Default.aspx?id=601022>
 - 3. Capacities: 88 kN
 - 4. Keynote: 03 45 00.B01
- B. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- C. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/ D1.1 M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- D. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496 M or ASTM A 706/A 706M.
- E. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or C (ASTM F 568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A 563/A 563M, Grade A); and flat, unhardened steel washers, ASTM F 844.

2.6 BEARING PADS AND OTHER ACCESSORIES

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast concrete fabricator for application:
 - 1. Shims
 - a. Manufacturer: Crane Works Mats
 - b. Manufacturer Website: <http://craneworksmats.com/>
 - c. Ensinger Nylon Crane Mats
 - d. 15/16-inch Thickness
 - e. 35 lbs.
 - f. Load Capacity: 250,000lbs
- B. Erection Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.
- C. Welding Electrodes: Comply with AWS standards for steel type and/or alloy being welded.

2.7 GROUT MATERIALS



- A. High-Performance, epoxy acrylate, anchoring adhesive: Two-component, mineral-filled epoxy-resin: ASTM C 881/C 881M of type, grade, and class to suit requirements.
 - 1. **Sika AnchorFix - 2**, as manufactured by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071 is considered to conform to the requirements of this specification.
 - 2. Manufacturer Website:
<http://us01.webdms.sika.com/files/show.do?documentID=202>

2.8 INSULATED PANEL ACCESSORIES

- A. Expanded-Polystyrene Board Insulation: ASTM C 578, Type, IX, 1.8 lb/ft³ (15kg/m³); square edges; with thickness of 6 in. R Value: 4.59 per 1 in.
 - 1. Manufacturer: BASF
 - 2. Product: Neopor EPS and XPS
 - 3. Product Website: <http://www.neopor.basf.us/index.html>
 - 4. Keynote: 03 45 00.B02
- B. Wythe Connectors: Fiberglass connectors manufactured to connect wythes of precast concrete panels.
 - 1. Manufacturer: Aslan FRP
 - 2. Product: Aslan 700 Nu-Tie Sandwich Wall Connector
 - 3. Product Website: http://www.hughesbros.com/Aslan700/Aslan700_Nu-Tie_Connector.html
 - 4. Keynote 03 45 00.B03

2.9 CONCRETE MIXTURES

- A. Prepare design mixtures to match Architect's sample or for each type of precast concrete required
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast concrete plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested in accordance with ASTM C 1218/C 1218M.
- D. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 8000 psi minimum.
 - 2. Release Strength: As required by design.



3. Unit Weight: Calculated equilibrium unit weight of 115 lb/ft³ (1842 kg/m³), where variations exceed plus or minus 5 lb/ft³ (80 kg/m³) adjust to plus or minus 3 lb/ft³ (48 kg/m³), according to ASTM C 567.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixtures, add other admixtures to concrete according to manufacturer's written instructions.

2.10 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on Contract Drawings.
- D. Cast in openings larger than 10 in. (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabrication, placing, and supporting reinforcement.
 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete- placement and consolidation operations.



- Completely conceal plastic tipped or corrosion resistant metal or plastic chair support devices to prevent exposure on finished surfaces.
3. Place reinforcing steel and prestressing tendon to maintain at least 3/4 in. (19 mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1 1/2 in. (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation and erection stresses, and specified in-place loads, whichever governs.
- G. Prestress tendons for architectural precast concrete units by pretensioning or post-tensioning methods. Comply with PCI MNL 117.
1. Delay detensioning or post-tensioning of precast, prestressed architectural precast concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under the same conditions as concrete unit.
 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
- H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place face mixture to a minimum thickness after consolidation of the greater of 1 in. (25 mm) or 1.5 times the nominal maximum aggregate size, but not less than the minimum reinforcing cover as indicated on Contract Drawings.
1. Use a single design mixture for those units in which more than one major face (edge) is exposed.
 2. Where only one face of unit is exposed, at the fabricator's option, either of the following mixture design/casting techniques may be used:
 - a. A single design mixture throughout the entire thickness of panel.
 - b. Separate mixtures for face and backup concrete; using cement and aggregates for each type as appropriate, for consecutive



placement in the mold. Use cement and aggregate specified for face mixture. Use cement and aggregate for backup mixture complying with specified criteria or as selected by the fabricator.

- J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete to ensure bond with face-mixture concrete.
 - K. Thoroughly consolidate placed concrete by internal and/or external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
 - 1. Place self-consolidating concrete without vibration in accordance with PCI TR-6 "Interim Guidelines for the Use of Self-Consolidating Concrete." If face and backup concrete is used, ensure adequate bond between concrete mixtures.
 - L. Comply with PCI MNL 117 procedures for hot- and cold-weather concrete placement.
 - M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
 - N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until the compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of final product.
 - O. Repair damaged architectural precast concrete units to meet acceptability requirements in PCI MNL 117 and Architect's approval.
- 2.11 INSULATED PANEL CASTING
- A. Cast, screed and consolidate bottom concrete wythe supported by mold.
 - B. Place insulation boards, abutting edges and ends of adjacent boards. Insert wythe connectors through insulation holes, and consolidate concrete around connectors according to connector manufacturer's written instructions.
 - C. Ensure bottom wythe or insulation layer are not disturbed after bottom wythe reaches initial set.
 - D. Cast and screed top wythe to meet required finish.



- E. Maintain temperature below 150 deg. F (65 deg. C) in bottom concrete wythe.

2.12 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units of shapes, lines and dimensions indicated, so each finished unit complies with the following product tolerances.

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 ft (3 m) or under, Plus or Minus 1/8 in. (± 3 mm).
 - b. 10 to 20 ft (3 to 6 m), Plus 1/8 in. (+3 mm), Minus 3/16 in. (-5 mm).
 - c. 20 to 40 ft (6 to 12 m), Plus or Minus 1/4 in. (± 6 mm).
 - d. Each additional 10 ft (3 m), add Plus or Minus 1/16 in. (± 1.6 mm).
2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 ft (3 m) or under, Plus or Minus 1/4 in. (± 6 mm).
 - b. 10 to 20 ft (3 to 6 m), Plus 1/4 in. (+6 mm), Minus 3/8 in. (-10 mm).
 - c. 20 to 40 ft (6 to 12 m), Plus or Minus 3/8 in. (± 10 mm).
 - d. Each additional 10 ft (3 m), add Plus or Minus 1/8 in. (± 3 mm).
3. Total Thickness or Flange Thickness: Plus 1/4 in. (+6 mm), Minus 1/8 in. (-3 mm).
4. Rib Width: Plus or Minus 1/8 in. (± 3 mm).
5. Rib to Edge of Flange: Plus or Minus 1/8 in. (± 3 mm).
6. Distance between Ribs: Plus or Minus 1/8 in. (± 3 mm).
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or Minus 1/8 in. per 72 in. (± 3 mm per 2 m) or 1/2 in. (13 mm) total, whichever is greater.
8. Length and Width of Blockouts and Openings within One Unit: Plus or Minus 1/4 in. (± 6 mm).
9. Location and Dimensions of Blockouts Hidden from View and Used for HVAC and Utility Penetrations: Plus or Minus 3/4 in. (± 19 mm).
10. Dimensions of Haunches: Plus or Minus 1/4 in. (± 6 mm).
11. Haunch Bearing Surface Deviation from Specified Plane: Plus or Minus 1/8 in. (± 3 mm).
12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or Minus 1/4 in. (± 6 mm).
13. Bowing: Plus or Minus L/360, maximum 1 in. (25 mm).
14. Local Smoothness: 1/4 in. per 10 ft (6 mm per 3 m).
15. Warping: 1/16 in. per 12 in. (1.6 mm per 300 mm) of distance from the nearest adjacent corner.



16. Tipping and Flushness of Plates: Plus or Minus 1/4 in. (± 6 mm).
 17. Dimensions of Architectural Features and Rustications: Plus or Minus 1/8 in. (± 3 mm).
- B. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or Minus 1 in. (± 25 mm).
 2. Inserts: Plus or Minus 1/2 in. (± 13 mm).
 3. Handling Devices: Plus or Minus 3 in. (± 75 mm).
 4. Reinforcing Steel and Welded Wire Reinforcement: Plus or Minus 1/4 in. (± 6 mm) where position has structural implications or affects concrete cover; otherwise, Plus or Minus 1/2 in. (± 13 mm).
 5. Reinforcing Steel Extending out of Member: Plus or Minus 1/2 in. (± 13 mm) of plan dimensions.
 6. Tendons: Plus or Minus 1/4 in. (± 6 mm), perpendicular to panel; Plus or Minus 1 in. (± 25 mm), parallel to panel.
 7. Location of Rustication Joints: Plus or Minus 1/8 in. (± 3 mm).
 8. Location of Opening within Panel: Plus or Minus 1/4 in. (± 6 mm).
 9. Location of Flashing Reglets: Plus or Minus 1/4 in. (± 6 mm).
 10. Location of Flashing Reglets at Edge of Panel: Plus or Minus 1/8 in. (± 3 mm).
 11. Reglets for Glazing Gaskets: Plus or Minus 1/8 in. (± 3 mm).
 12. Electrical Outlets, Hose Bibs: Plus or Minus 1/2 in. (± 13 mm).
 13. Location of Bearing Surface from End of Member: Plus or Minus 1/4 in. (± 6 mm).
 14. Allowable Rotation of Plate, Channel Inserts, Electrical Boxes: 2-degree rotation or 1/4 in. (6mm) maximum measured at perimeter of insert.
 15. Position of Sleeve: Plus or Minus 1/2 in. (± 13 mm).
 16. Location of Window Washer Track or Buttons: Plus or Minus 1/8 in. (± 3 mm).

2.13 FINISHES

- A. Exposed panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform and straight. Finish exposed-face surfaces of architectural precast concrete units to match approved mockups and as follows:
1. As-Cast Surface Finish: Provide surfaces to match accepted sample or mockup units for acceptable surface air voids, sand streaks, and honeycombs.
 2. Textured-Surface Finish: Impart texture by form liners or inserts, to match accepted sample or mockup units for acceptable surface air voids, sand streaks, and honeycombs, with uniform color and texture.
 3. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures to match accepted sample or mockup units.



- B. Finish exposed top back surfaces of architectural precast concrete units to match face-surface finish.
- C. Finish unexposed surfaces of architectural precast concrete units with as-cast finish.

2.14 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete also test and inspect according to PCI TR-6 "Interim Guidelines for the Use of Self-Consolidating Concrete" and ASTM C 1611/C 1611M, ASTM C 1712, ASTM C 1610/1610M, and ASTM C 1621/C 1621M.
- B. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 (ACI 318M) concrete strength requirements.
- C. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, fabricator will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318/ACI 318M.
 - 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 - 2. Cores will be tested in an air-dry condition.
 - 3. Strength of concrete for each series of three cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.
 - 4. Test results will be reported in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- D. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.



- E. Acceptability: Architectural precast concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range are unacceptable. Chipped, spalled, or cracked units may be repaired, if repaired units match the visual mock-up. The Architect reserves the right to reject any unit if it does not match the accepted sample panel or visual mock-up. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Furnish anchorage devices for precast concrete units to be embedded in or attached to the building structural frame or foundation before start of such Work. Provide locations, setting diagrams, templates and instructions for the proper installation of each anchorage device.

3.2 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting precast concrete performance.
- B. Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.
- C. Contractor shall notify precast concrete erector that supporting cast-in-place concrete foundation and building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is structurally ready to receive loads from precast concrete units prior to proceeding with installation.

3.3 ERECTION

- A. Install loose clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Precaster or erector to supply and install miscellaneous steel preweld connection hardware in the field.
- C. Erect architectural precast concrete level, plumb, and square within the specified allowable erection tolerances. Provide temporary supports and



bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Surface weld steel shims to each other to prevent shims from separating.
 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 3. Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
 4. Unless otherwise indicated, provide for uniform joint widths of 3/4 in. (19 mm).
- D. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
1. Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
- E. Welding: Comply with applicable AWS D1.1/D1.1M, AWS D1.4/D1.4M and D1.6/D1.6M requirements for welding, welding electrodes, appearance of welds, quality of welds, and methods used in correcting welding work.
1. Protect architectural precast concrete units and bearing pads from damage during field welding or cutting operations and provide noncombustible shields as required.
 2. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS D 1.1/D 1.1M, D 1.4/D 1.4M or D1.6/D1.6M.
 3. For galvanized metal, clean weld-affected metal surfaces with chipping hammer followed by brushing or power tooling cleaning and then apply a minimum 0.004-in.-thick (4 mil) coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A 780/A 780M.
 4. Visually inspect all welds critical to precast concrete connections. Visually check all welds for completion and remove, reweld or repair all defective welds, if services of AWS-certified welding inspector are not furnished by Owner.
- F. At bolted connections, use upset threads, thread locking compound or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot.



3.4 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.5 REPAIRS

- A. Repairs will be permitted provided structural adequacy of units and appearance are not impaired.
- B. Repair damaged units to meet acceptability requirements of PCI MNL 117.
- C. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 ft (6 m).
- D. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with specified requirements.

3.6 CLEANING

- A. Clean all surfaces of precast concrete to be exposed to view, as necessary, prior to shipping.
- B. Clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, dirt, stains and other markings.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 45 00



DIVISION 05 – METALS



SECTION 05 12 13 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Architecturally Exposed Structural Steel
- B. Accessories

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-531, A-532, A-533, A-534, A-535, A-536, A-537
- B. Section 03 45 00 – Architectural Precast Concrete
- C. Section 08 54 13 – Fiberglass Windows
- D. Section 08 80 00 - Glazing

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data Shop Drawings Welding Procedure Specifications (WPSs).
- B. Comply with applicable provisions of the following:
 - 1. AISC 303.
 - 2. AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 STAINLESS STRUCTURAL STEEL

- A. For shapes, plates, bars and strip (exposed): AISI Type 316, ASTM A 666.
- B. For shapes, plates, bars and strip (concealed): AISI Type 304, ASTM A 666.



2.2 ACCESSORIES

- A. Fasteners: AISI Type 303, 304 or 316 non-magnetic.
 - 1. Bolts and screws: ASTM F 593, Alloy Groups 1 and 4.
 - 2. Nuts: ASTM F 594, Alloy Groups 1 and 4.
 - 3. Button and countersunk head screws: ASTM F 879, Alloy Groups 1 and 4.
 - 4. All stainless steel shall be cleaned and passivated after fabrication per the recommendations of ASTM A 380.

2.3 FABRICATION

- A. Stainless Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

PART 3 - EXECUTION

3.1 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- C. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
- D. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

END OF SECTION 05 12 13



SECTION 05 43 00 - SLOTTED CHANNEL FRAMING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide slotted channel cold-formed metal framing for fiberglass window assembly

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-531, A-532, A-533, A-534, A-535
- B. Section 08 54 13 – Fiberglass Windows

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Standards: AISI, Specification for Design of Cold-Formed Steel Structural Members.
- C. Fabrication Tolerances: 1/8 inch in 10 feet.
- D. Erection Tolerances: 1/16 inch from true position.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Slotted Channel Cold-Formed Metal Framing:
 - 1. Installer:
 - a. Window-Fix
335-347 38th Street
Brooklyn, NY 11232
 - 2. Application: Exterior aluminum-slotted channel for fiberglass window assembly.
 - 3. Framing Accessories:
 - a. Supplementary framing.
 - b. Bracing, bridging, and solid blocking.



- c. Web stiffeners.
- d. Gusset plates.
- e. Deflection track and vertical side clips.
- f. Stud kickers and girts.
- g. Joist hangers and end closures.
- h. Reinforcement plates.
 - 1) Anchors, clips, and fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- B. Comply with requirements of ASTM C 1007 for installation of steel studs and accessories and Metal Lath/Steel Framing Association Lightweight Steel Framing Systems Manual.
- C. Restore damaged components. Protect work from damage.

END OF SECTION 05 43 00



SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.
- B. Section 03 45 00 – Architectural Precast Concrete

1.3 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Fasteners: Except where shown or specified, select fasteners of type, size, style, grade, and class required for secure installation of metal fabrications. For exterior use and where built into exterior walls, fasteners shall be galvanized.
 - 1. Standard Bolts and Nuts: ASTM A 307, Grade A, regular hexagon head.



2. Stainless Steel Fasteners: ASTM A 666; Type 302/304 for interior Work; Type 316 for exterior Work; Phillips flathead (countersunk) screws and bolts for exposed Work unless otherwise specified.

2.2 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.3 FABRICATION

- A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.
- B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

2.4 STEEL FINISHES

- A. Hot-dip galvanize steel fabrications at exterior locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.
- B. Fit exposed connections accurately together to form hairline joints.
- C. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION 05 50 00



SECTION 05 52 00 - METAL RAILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Railing System
- B. Metals

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-331, A-591

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data structural analysis data signed and sealed by a qualified professional engineer registered in the state where Project is located and manufacturer's color charts showing the full range of colors available for factory-applied finishes.

PART 2 - PRODUCTS

2.1 RAILING SYSTEMS

- A. Available Manufacturers:
 - 1. SRS INC.
P.O. Box 4277
Metuchen, NJ 08840
<http://www.srs-metals.com/index.shtml>
- B. Provide railings capable of withstanding a uniform load of **50 lbf/ ft. (0.73 kN/m)** and a concentrated load of **200 lbf (0.89 kN)** applied to handrails and top rails of guards in any direction. Uniform and concentrated loads need not be assumed to act concurrently.
- C. Provide railing infill capable of withstanding a concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**. Infill load and other railing loads need not be assumed to act concurrently.



2.2 METALS

- A. All metals to be 316 Alloy Stainless Steel
- B. 2" x 2" x 7 Gauge end posts
- C. 1" x 2" x 11 Gauge line posts, and top and bottom rails.
- D. 1/8" Stainless-Steel Cable
- E. 3 x 4 1/2" Sleeves for removable posts, quantity: 12.

2.3 FABRICATION

- A. Provide manufacturer's standard floor sleeves to connect railing members to pre-cast concrete ramps.
- B. Fabricate according to manufacturer's specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fit exposed connections accurately together to form tight, hairline joints.
- B. Set railings accurately in location, alignment, and elevation and free of rack.
- C. Anchor posts in concrete by forming or core-drilling holes 5 inches (125 mm) deep and 3/4 inch (20 mm) greater than OD of post. Fill annular space between post and concrete with nonshrink, nonmetallic grout.

END OF SECTION 05 52 00



DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES



SECTION 06 05 23 - WOOD, PLASTIC, AND COMPOSITE FASTENINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Angles
- B. Hangers
- C. Holdown
- D. Post Base and Cap

1.2 RELATED DOCUMENTS

- A. Construction Documents – L-301, S-521, S-522, S-523, S-524
- B. Section 06 10 00 – Rough Carpentry

1.3 SECTION REQUIREMENTS

- A. Compliance with the following codes: 2009 IBC, 2009 IRC
- B. The Simpson Strong-Tie structural angles, clips, and plates described in this report are used as wood-to wood connectors in accordance with Section 2304.9.3 of the IBC. The angles, clips, and plates may also be used in structures regulated under the IRC when an engineered design is submitted in accordance with Section R301.1.3 of the IRC.
- C. The angles, clips, and plates described in this report are used as wood-to-wood connections in structural systems that have been designed to transfer loads from their point of origin to load-resisting elements.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Simpson Strong-Tie Company, Inc.
5956 West Las Positas Boulevard
Pleasanton, CA 94588
www.strongtie.com



2.2 GENERAL

- A. A23 Angle:
 - 1. Reference Keynote: 06 05 23.C13
 - 2. No. 18 gage galvanized steel.

- B. LS50 Angle
 - 1. Reference Keynote: 06 05 23.C14
 - 2. No. 18 gage galvanized steel.
 - 3. Angle is fabricated to assist field adjustment from zero degrees up to a 135-degree bend.

- C. LSU 26 Hanger
 - 1. Reference Keynote: 06 05 23.D29
 - 2. No. 18 gage galvanized steel.

- D. LUS 28 Hanger
 - 1. Reference Keynote: 06 05 23.J81
 - 2. No. 14 gage galvanized steel.
 - 3. One steel, plain (flat), standard plate (W) washer conforming to ASTM F 844 and ASME B18.22.1, Type A, with a 9/16-inch (14.3 mm) inner diameter

- E. DTT2 Z Hold Down
 - 1. Reference Keynote: 06 05 23.L5
 - 2. No. 14 gage galvanized steel.
 - 3. One steel, plain (flat), standard plate (W) washer conforming to ASTM F 844 and ASME B18.22.1, Type A, with a 9/16-inch (14.3 mm) inner diameter

- F. ABA 44 Post Base Standoff
 - 1. Reference Keynote: 06 05 23.N22
 - 2. No. 16 gage galvanized steel.
 - 3. Prepunched holes for 10d or 16d nails driven into the side grain of the wood post.

- G. BCS 2-2/4 Post Caps
 - 1. Reference Keynote: 06 05 23.N23
 - 2. No. 18 gage galvanized steel.
 - 3. Designed for the connection of double 2x's to a nominally 4-inch-wide post.

PART 3 - EXECUTION

3.1 INSTALLATION



- A. Installation of the connectors must be in accordance with each respective evaluation report and the manufacturer's published installation instructions. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.

END OF SECTION 06 05 23



SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wood Products, General
- B. Lumber
- C. Miscellaneous Materials

1.2 RELATED DOCUMENTS

- A. Construction Documents – E-301, E-614, L-301, L-302, L-501, L-502, S-521, S-522, S-523, S-524
- B. Section 06 05 23 – Wood, Plastic, and Composite Fastenings

1.3 SECTION REQUIREMENTS

- A. Detailed drawings indicating dimensioning, configuration, and structural notes for landscaping substructure.
- B. Detailed drawings indicating dimensioning, configuration, and location for recessed lighting.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

2.2 LUMBER

- A. Dimension Lumber:
 - 1. Maximum Moisture Content: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness.



2. Framing Other Than Non-Load-Bearing Interior Partitions: Construction or No. 2:
 - a. Hem-fir (north): NLGA; Southern pine: or WWPA; Spruce-pine-fir: NLGA; Douglas fir south: or WWPA; Hem-fir: WCLIB, or WWPA;.
3. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - a. Species: As specified for framing other than non-load-bearing interior partitions.

2.3 MISCELLANEOUS PRODUCTS

- A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners .
 1. Power-Driven Fasteners: CABO NER-272.
 2. Bolts: Steel bolts complying with **ASTM A 307, Grade A (ASTM F 568, Property Class 4.6)**; with **ASTM A 563 (ASTM A 563M)** hex nuts and, where indicated, flat washers.
- B. Metal Framing Anchors: Structural capacity, type, and size indicated.
 1. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, **G60 (Z180)** coating designation for interior locations where stainless steel is not indicated.
 2. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Securely attach rough carpentry to substrates, complying with the following:
 1. CABO NER-272 for power-driven fasteners.
 2. Published requirements of metal framing anchor manufacturer.

END OF SECTION 06 10 00



SECTION 06 15 00 - WOOD DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Solid Wood Decking

1.2 RELATED DOCUMENTS

- A. Construction Documents – L-101, L-301

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

1.4 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Solid Wood Decking:
 1. Manufacturers: To be determined.
 2. Species: Fabricator's option.
 3. Pattern and Dressing: Solid matched decking, surfaced top and bottom, sanded on exposed surfaces.
 4. Preservative Treatment: AWPAC C31 with inorganic boron (SBX) and redry wood.
 5. Floor Decking Appearance Grade: Custom Clear.
 6. Factory Finish: Penetrating acrylic stain.
 7. Factory Finish: Clear conversion varnish.



8. Fasteners: No. 304 stainless steel.
9. Fasteners: No. 316 stainless steel.
10. Fasteners: Galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- B. Install wood decking complying with recommendations of AITC 112.
- C. Restore damaged components. Clean and protect work from damage.

END OF SECTION 06 15 00



DIVISION 07 - THERMAL AND MOISTURE PROTECTION



SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Thermoplastic membrane roofing

1.2 RELATED DOCUMENTS

- A. Construction documents – A-561, M-203

1.3 SECTION REQUIREMENTS

A. Submittals:

1. Submit product data, including manufacturer's technical data sheet for all specified products
2. Shop Drawings: Submit shop drawings showing roof configuration, sheet layout and details of application.
3. Samples: Submit selection and verification samples of manufacturer's product line.
4. Quality Assurance Submittals: Submit the following:
 - a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
 - b. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
 - c. Manufacturer's Instructions: Manufacturer's Installation Instructions.
 - d. Manufacturer's Field Reports: Manufacturer's field reports specified herein
5. Closeout Submittals: Submit the following:
 - a. Maintenance Data: Maintenance data for installed products. Include methods for maintaining and repairing installed products and precautions against cleaning materials and methods detrimental to finishes and performance
 - b. Warranty: Warranty documents specified herein.

- B. Performance Requirements: Furnish all labor, materials, equipment and supervision to complete the roofing work on the roof areas at the above mentioned facility as shown and specified herein. The installation shall comply with the terms and conditions of these specifications and the membrane manufacturer's written installation instructions for a roof system warranty.



1.4 REFERENCES

- A. Factory Mutual (FM Global) – Approval Guide.
 - 1. Factory Mutual Standard 4470 – Approval Standard for Class 1 Roof Covers.
- B. Underwriters Laboratories (UL) – Roofing Systems and Materials Guide (TGFU R1306).
- C. American Society for Testing and Materials (ASTM) – Annual Book of ASTM Standards.
 - 1. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 2. ASTM C208 – Standard Specification for Cellulosic Fiber Insulating Board.
 - 3. ASTM D6506 – Standard Specification for Asphalt Protection Board.
 - 4. ASTM D41 – Standard Specification for Asphalt used in Roofing.
 - 5. ASTM D1079 – Standard Terminology Relating to Roofing, Waterproofing and Bituminous Material.
 - 6. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete.
 - 7. ASTM D4434 – Standard Specification for Poly (vinyl chloride) Sheet Roofing.

1.5 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have a minimum of five (5) years experience in the application of thermoplastic membrane and shall be currently certified by the manufacturer of the membrane system.
- B. Membrane Qualifications: Membrane shall be factory certified, first run material, seconds will not be permitted. Material and packaging to bear the FM label on the roll.

1.7 WARRANTY

- A. Upon Successful completion of the installed roof by Dumar Services, LLC, Sika Sarnafil can provide a Warranty to the building owner via the Authorized Applicator.



PART 2 - PRODUCTS

2.1 THERMOPLASTIC SARNAFIL G410 ENERGY SMART ROOF MEMBRANE

A. Manufacturer:

1. Sika Saranfil
100 Dan Road
Canton, MA 02021
781-828-5400
<http://ussarnafil.webdms.sika.com/fileshow.do?documentID=95>

B. Membrane:

- Type: Sarnafil G410 Feltback Energy Smart Roof Membrane
Reinforcement: Fiberglass Mat Reinforcement
Color: White
Width: Manufacturer's standard maximum for specified application

C. Physical Properties: Membrane shall have the following minimum physical property values:

<u>Property</u>	<u>Test Method</u>	<u>Specification</u>
Color		White
Thickness	ASTM D638	.048 mil
Tensile Strength	ASTM D638	1500 pso
Elongation	ASTM D751	>250%
Seam Strength	ASTM D751	75% of original
Dimensional	ASTM D751	80%
Stability	ASTM D1204	0.5%
Accel. Weathering (arc)	ASTM 2565	10M hrs. (no change)(xenon)
Solar Reflectivity	ASTM E903	.83 (white)
Emissivity	ASTM E903	.90 (white)
Solar Reflective Index	ASTM E1980	104 (white)

2.2 RELATED MATERIALS

A. Accessories Materials

1. Adhesives: Supplied by the same manufacturer as the membrane and formulated for use with thermoplastic membrane. Each container shall have the shelf life date marked on a label.
 - a. Sarnafil Sarnacol 2121 Adhesive
2. Miscellaneous Materials: Multi purpose caulking, water cut off mastic and like materials compatible with all components of the roofing system to be supplied by the membrane manufacturer.
3. Mechanical Fasteners and Plates: Use Factory Mutual approved corrosion resistant membrane fasteners and plates provided and



approved by Flex for the membrane application and substrate condition as established by pull out tests.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog instructions and product carton instructions for installation.

3.2 EXAMINATION

- A. Site verification of conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions. Verify that all roof openings or penetrations through the roof are solidly set and that required tapered areas have been installed.
- B. Corrections: Do not proceed with installation of roofing material until all defects and preparation work has been corrected and is complete. Installation of the roofing material constitutes that the roofing contractor has inspected and found the deck suitable for installation of the Flex Roof System.

3.3 INSTALLATION

- A. Seam Welding
 1. All Seams must be clean and dry prior to proceeding with the hot air welding procedure. The seams may be cleaned using a clean cotton rag dampened with a mild solvent such as acetone or MEK. Allow the seams to thoroughly dry after cleaning.
 2. All seams greater than 10' in length should be welded with an automatic type welding unit. Hand held welders are used for the remaining seams and all detail welding.
 3. A properly welded seam should be a solid weld approximately 1 1/2" wide.
- B. Inspections
 1. All seams are to be completed by the hot air welding method each day as the installation progresses.
 2. The roofing contractor is to designate a responsible person to inspect the completed installation each day as the installation progresses. The inspection is to include hand probing of all welded seams.



3. Any defects found during these inspections should be immediately corrected.

3.4 FLASHING

- A. Flashing all penetrations, walls, curbs, expansion joints, drains as shown on details and approved shop drawings with Flex Flashing Membrane.
 1. Use Manufacturer's supplied flashing accessories or components such as sealant pockets and prefabricated vent / pipe flashing.
 2. Mechanically fasten flashing at terminations according to approved details.
 - a. Fastening Flashing Membrane through counter-flashing metal is not acceptable. Flashing Membranes are installed adhered to the approved substrate Flex Flashing Adhesive. Flashing Membrane is to be installed flat and wrinkle free. Flashings should be rubbed or rolled onto the substrate for proper adhesion.

3.5 DAILY SEAL

- A. At the end of each working day or at the first sign of inclement weather, install temporary, 100% watertight seal where the completed new roofing adjoins the uncovered deck or existing roof surface.
- B. The roofing contractor shall be responsible for creating and maintaining the temporary seal in such a manner as to prevent moisture from entering into the new and or the existing roof system.
- C. Material for construction of the temporary seal to be from the Membrane Manufacturer's List of approved products and accessories.
- D. Prior to commencing additional roof installation, cut out and remove all contaminated membrane, insulation and temporary sealant and properly dispose in accordance with the Contract Documents.

END OF SECTION 07 54 00



SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

1.2 RELATED DOCUMENTS

- A. Construction Documents - A-531, A-532, A-533, A-534, A-535
- B. Section 08 54 13 – Fiberglass Windows

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and Samples.
- B. Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- C. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METAL

- A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D finish; not less than 0.016 inch (0.4 mm) thick.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, not less than 0.032 inch (0.8 mm) thick; and with mill finish.

2.2 ACCESSORIES

- A. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F (116 deg C) and passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.



- B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 FABRICATION

- A. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with SMACNA's "Architectural Sheet Metal Manual." Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.
- B. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- C. Fabricate nonmoving seams in sheet metal with flat-lock seams.[For aluminum, form seams and seal with epoxy seam sealer. Rivet joints for additional strength.]
- D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pre-tinned surface would show in finished Work.
 - 1. Do not pre-tin zinc-tin alloy-coated stainless steel.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- E. Aluminum Flashing and Trim: Coat back side of aluminum flashing and trim with bituminous coating where it will contact wood, ferrous metal, or cementitious construction.



- F. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

END OF SECTION 07 62 00



SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compatibility
- B. Elastomeric polyurethane sealant.

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-501, A-511, A-531, A-532, A-534, A-535, A-536, A-537, M-203, P-202
- B. Section 03 45 00 – Architectural Precast Concrete
- C. Section 08 11 13 – Hollow Metal Doors and Frames
- D. Section 08 54 13 - Fiberglass Windows

1.3 SECTION REQUIREMENTS

- A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).
- B. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40°F (5°C) and rising.
- C. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified coating.

1.4 QUALITY ASSURANCE

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001:2008 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.



- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.6 WARRANTY

- A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. **Sikaflex-1a**, as manufactured by Sika Corporation, 201 Polito Avenue, Lyndhurst, NJ 07071 is considered to conform to the requirements of this specification.
 - 1. Manufacturer Website:
<http://us01.webdms.sika.com/files/show.do?documentID=259>
- B. Elastomeric polyurethane sealant.

2.2 JOINT SEALANTS

- A. Polyurethane sealant:
 - 1. The joint sealant shall be a one-component, gun grade, polyurethane-base material. It shall be applicable in horizontal, vertical, and overhead joints. The sealant shall cure under the influence of atmospheric moisture to form an elastomeric substance.
- B. Any primers, as required, recommended by the manufacturer of the specified product, approved by the engineer.



- C. Backer rod or bond breaker tape, as approved by the engineer.

2.3 PERFORMANCE CRITERIA

- A. Properties of the uncured polyurethane sealant:
 - 1. Initial Cure (Tack-Free Time): TT-S-00230C - 4 hours
Final Cure 4 – 7 days
 - 2. Consistency: non-sag
 - 3. Color: 7 architectural standard colors

- B. Properties of the cured polyurethane sealant:
 - 1. Tensile Properties (ASTM D-412) at 21 days
 - a. Tensile Stress: 175-psi min.(1.37 MPa)
 - b. Elongation at Break: 550%
 - c. Modulus of Elasticity 25% 35 psi (0.24 MPa) 50% 60 psi (0.41 MPa) 100% 85 psi (0.59 MPa)
 - 2. Shore A Hardness (ASTM D-2240) at 21 days: 40+/- 5
 - 3. Tear Strength (ASTM D-624) at 21 days: 55 lb./in.
 - 4. Adhesion in Peel (TT-S-00230C, ASTM C 794)
 - a. Concrete: 20-lb. min. -0% Adhesion Loss
 - b. Aluminum: 20-lb. min. – 0% Adhesion Loss
 - c. Glass: 20-lb. min. – 0% Adhesion Loss
 - 5. Service Range: -40° to 170°F (-40° to 77 °C)
 - 6. The sealant shall conform to Federal Specification TT-S-00230C, Type II, Class A.
 - 7. The sealant shall conform to ASTM C-920, Type S, Grade NS, Class 35.
 - 8. The sealant must comply with ANSI Standard 61(NSF Approval) for use in contact with potable water.
 - 9. The sealant shall be non-staining.

- C. Note: Tests were performed with material and curing conditions at 71° – 75° F and 45-55% relative humidity.

2.4 MISCELLANEOUS MATERIALS

- A. Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid,



inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

- D. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Joints:

1. Placement Procedure: Prime substrate as required based upon the recommendations of the manufacturer of the specified product, when field testing indicates need, and when the joints will be subject to immersion after cure, as approved by the Engineer.
2. Install approved backer rod or bond breaker tape in all joints subject to thermal movement to prevent three-sided bonding and to set the depth of the sealant at a maximum of 1/2 in., measured at the center point of the joint width. Approval of the backer rod or bond breaker tape shall be made by the engineer.
3. Joints shall be masked to prevent discoloration or application on unwanted areas, as directed by the engineer. If masking tape is used, it shall not be removed before tooling, yet must be removed before the initial cure of the sealant. Do not apply the masking tape until just prior to the sealant application.
4. Install sealant into the prepared joints when the joint is at the mid-point of its expansion and contraction cycle. Place the nozzle of the gun, either hand, air, or electric powered, into the bottom of the joint and fill entire joint. Keep the tip of the nozzle in the sealant; continue with a steady flow of sealant preceding the nozzle to avoid air entrapment. Avoid overlapping the sealant to eliminate the entrapment of air. Tool as required to properly fill the joint.
5. Adhere to all limitations and cautions for the polyurethane sealant as stated in the manufacturer's printed literature.

B. Cracks:

1. For best performance sealant should be gunned into crack to a minimum of a 1/4" in depth. Place the nozzle of the gun, either hand, air or electric powered, into the bottom of the crack and fill entire crack. Keep the tip of the nozzle in the sealant. Continue with a steady flow of sealant preceding the nozzle to avoid air entrapment. Avoid overlapping the sealant to eliminate the entrapment of air. Tool as required to properly fill the crack.
2. Adhere to all limitations and cautions for the polyurethane sealant as stated in the manufacturer's printed literature.



3.2 CLEANING

- A. The uncured polyurethane sealant can be cleaned with an approved solvent. The cured polyurethane sealant can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION 07 92 00



SECTION 07 95 13 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior expansion joint cover assemblies for Fiberglass Window assembly

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-531, A-532, A-533, A-534, A-535

1.3 SECTION REQUIREMENTS

- A. Product Data : For each type of expansion joint cover assembly, provide manufacturer's product specifications.
- B. Shop Drawings: Shop drawing submittal should include Placement drawings which show line diagrams, elevations, sections, details and layout for each joint length. These drawings must include a Joint System Schedule which denotes specific information for each joint system in tabular form. The tables should include the model number for each joint system item, location as cross-referenced in the drawings, nominal joint width and system movement capability, material colors and finishes, fire-resistive ratings, design loading criteria and any other options.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company with not less than 5 years of experience in the design, engineering, and fabrication of expansion joint cover assemblies.
- B. Installer Qualifications: Firm acceptable to manufacturer and with not less than 3 years of successful experience in the installation of systems similar to those required for this project.
- C. Single Source for Products: Architectural joint systems are to be supplied from a single manufacturer. Where fire-rated joint systems are required, both the joint system and fire barrier assembly must be obtained from a single manufacturer. The total system, mechanical joint and fire barrier, must be as shown in the Fire Test Certification Listing Documents.

PART 2 - PRODUCTS



2.1 MANUFACTURERS

- A. Acceptable Manufacturer to be determined and installed by:
 - 1. Window-Fix
335-347 38th Street
Brooklyn, NY 11232

2.2 EXPANSION JOINT COVER ASSEMBLIES

- A. Factory fabricate special transitions and corner fittings as required by project conditions. Miter and weld elastomeric seals as applicable.
- B. Aluminum: Alloy 6063-T6, in accordance with ASTM B 221; mill finish.
- C. Stainless Steel: ASTM A 176, Type 430, 16 gage, satin finish.
- D. EPDM: ASTM D 2000.
- E. Provide appropriate fasteners, adhesives, and accessories as required to properly complete expansion joint cover installation, prepackaged with expansion joint covers in maximum lengths possible.

2.3 EXTERIOR SYSTEMS

- A. Foam Seal Joint Systems:
 - 1. Open cell polyurethane, pre-compressed, foam joint sealant impregnated with manufacturer's weatherproofing agent, with colored silicone face.
 - a. Joint Width - 1/2 inch (13mm) to 4 inch (100mm) in 1/2 inch (6.35mm) increments and 5 inch (127mm) to 8 inch (203mm) in 1 inch (25mm) increments.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are in proper condition to receive installation of expansion joint covers.
 - 1. Confirm that blockout dimensions are appropriate for recessed systems.
 - 2. Confirm that selected expansion joint covers are appropriate for actual joint dimensions.

3.2 PREPARATION



- A. Clean substrate before installation to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install expansion joint covers in strict accordance with manufacturer's instructions. Align work level and flush with adjacent surfaces, and rigidly anchor to substrate. Make allowances for structural gap that varies at time of installation from nominal design gap.
- B. Vapor Barriers: Where required, install in strict accordance with manufacturer's instructions to assure continuous protection. Install drainage fittings where required by project circumstances.

3.4 INSPECTION

- A. Prior to payment by the general contractor, a designated inspector will select a random 10 percent of the joint systems and have the assembly covers removed for inspection. The purpose of this will be to inspect the concrete substrates, filler materials, anchorage of the joint assembly and fire barrier systems that are hidden from view.
- B. Corrective action will be designated as required. Should a majority of the 10 percent scope be deemed as unacceptable, the Inspector will require that additional lengths be opened for inspection. This process will continue until the Inspector and general contractor are satisfied and the Manufacturer's warranties are secured.

3.5 ADJUSTING AND CLEANING

- A. Verify that expansion joint covers are plumb and level and are rigidly secured to substrate; make any adjustments required.
- B. Clean expansion joint covers and immediate areas of installation, using materials and methods recommended by manufacturer. Remove from project site packaging and debris caused by installation.

END OF SECTION 07 95 13



DIVISION 08 – OPENINGS



SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hollow Metal Doors and Frames
- B. Door Hardware

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-522, A-601: Door Schedule, I-201, I-203
- B. Section 07 92 00 - Joint Sealants

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data and Shop Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M, suitable for exposed applications.
- B. Frame Anchors: ASTM A 591/A 591M, 40Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, sheet steel complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

2.2 HOLLOW METAL DOORS AND FRAMES

- A. Available Products:
 - 1. Trio-E Hollow Metal Doors



2. Manufacturer:
 - a. Assa Abloy
100 Sargent Drive
New Haven, CT 06511
<http://www.cecodoor.com/pdf/atdm/D19A.pdf>
- B. Doors: Complying with ANSI 250.8 for level and model and HMMA 867, 1-3/4 inches (44 mm) thick.
 1. Exterior Doors: Model 1 (Full Flush).
 - a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors with thermal-resistance value (R-value) of 3.4 and U-Factor of 0.29 when tested according to ASTM C 1363.
 - b. Trio-E Full-flush doors: Have mechanically interlocked, hemmed, hairline seams on vertical edges and have no visible seams on faces. Face sheets are supported by a steel stiffened, core with polyurethane filler. 22 gage stiffeners are placed no more than 6 in. apart and welded no more than 5 in. along their length. The core fills the entire door cavity and is chemically bonded to all interior surfaces. Density of foam exceeds 1.8 pcf and it has a crush strength of 3600 psf. The top and bottom door edges are closed with 16 gage steel channels welded to both face sheets.
 - c. Hardware Provisions: Hinge Preparations are handed. Hinge edges are mortised for 4-1/2 in. or 5 in. high. 7 gage steel hinge reinforcements are welded inside the door edge and are drilled and tapped for fasteners in accordance with ANSI A156.7. The lock edge has a standard bevel (1:16) and is prepared for Gov. series 86 or 160/161 locks in accordance with ANSI A115
- C. Door Schedule
 1. Door Mark: 221KK
 - a. Location: Exterior North
 - b. Series: Ready Set
 - c. Gauge: 18
 - d. Steel/Species: Trio-E
 - e. Material: Hollow Metal
 - f. Frame: 16 Gauge, 5.75 in jamb/depth
 - g. Notes: Stainless steel, 12 in. full glass sidelight on left of door, welded frame
 2. Door Mark: 221VV
 - a. Location: Exterior East
 - b. Series: Ready Set
 - c. Gauge: 18
 - d. Steel/Species: Trio-E
 - e. Material: Hollow Metal



- f. Frame: 16 Gauge, 5.75 in jamb/depth
- g. Notes: Stainless steel

2.3 DOOR HARDWARE

A. Integrated door hardware assemblies

1. Door Mark: 221KK
 - a. Description: Access control entry with integrated lock which will be connected to the HID Edge controller. Entry by valid card and key override. Free egress at all times.
 - b. Integrated assembly includes:
 - 2 Hinge (heavy weight)
 - 1 Hinge (heavy weight)
 - 1 Integrated Card Reader Lock
 - 1 Cylinder
 - 1 Electromechanical Closer w/Motion Sensor
 - 1 Threshold
 - 1 Gasketing
 - 1 Door Bottom
 - 1 Control Device
 - 1 ElectroLynx Harness
 - 1 ElectroLynx Harness

2. Door Mark: 221VV
 - a. Description: East/Rear Entry
 - b. Integrated assembly includes:
 - 3 Hinge (heavy weight)
 - 1 Mortise Lock (apartment corridor)
 - 1 Cylinder
 - 1 Surface Closer
 - 1 Threshold
 - 1 Gasketing
 - 1 Door Bottom



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install hollow metal frames to comply with ANSI/SDI A250.11.
 - 1. Fire-Rated Frames: Install according to NFPA 80.
- B. Install doors to provide clearances between doors and frames as indicated in ANSI/SDI A250.11.

END OF SECTION 08 11 13



SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Solid-core doors with Low-Pressure Decorative Laminate (herein referred to as "LPDL") Thermal Fused faces.
- B. Integrated Door Hardware

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-522, A-601: Door Schedule, I-201, I-203

1.3 SECTION REQUIREMENTS

- A. Submittals: Samples for plastic-laminate-faced doors.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data.
 - 1. Indicate dimensions and locations of mortises and holes for hardware.
 - 2. Indicate dimensions and locations of cutouts.
- C. Samples for Verification:
 - 1. Hinge corner sections of LPDL Thermal Fused doors, approximately 5 by 11 inches (127 by 279 mm) for each color or wood grain specified.
- D. LEED Submittals:
 - 1. Credit MR 4.1 and 4.2: Interior wood particleboard flush doors to contain a minimum of 70% recycled & recovered content, as certified by SCS (Scientific Certification Systems). Include evidence that door manufacturer is certified with SCS by providing certificates and labeling each crate of doors delivered to the jobsite.
 - 2. Credit EQ 4.4: Adhesive and composite wood materials manufacturers' product data indicating no added urea-formaldehyde content.
 - 3. Credit MR 7.0: Interior particleboard doors to be FSC Mixed 70%, with Chain of Custody number indicated on shipping documents and invoices. Include evidence that door manufacturer is FSC Certified by providing certificates.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified independent third party testing agency, for doors,



showing compliance with specified performance requirements and physical properties.

1.4 Quality Assurance

- A. Source Limitations: Obtain LPDL Thermal Fused Flush Wood Doors through one source from a single manufacturer.
- B. Quality Standard: Comply with **WDMA I.S.1-A, 2004 edition "Industry Standard for Architectural Wood Flush Doors"** and the following minimum values (for particle core doors):
 - 1. NWWDA TM-7 Cycle Slam Test: 1,000,000 cycles.
 - 2. NWWDA TM-8 Hinge Loading Test 1,000 lbs.
 - 3. NWWDA TM-10 Edge Screw Holding Test 850 lbs.
 - 4. NWWDA TM-10 Face Screw Holding Test 650 lbs.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to [UL 10C] [NFPA 252] [UBC Standard 7-2].

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. LPDL Thermal Fused Flush Wood Doors:
 - a. Door Mark: 221YY
 - b. The Maiman Company, Springfield, MO
<http://www.maiman.com/en/site/Maiman1/products/thermal-fused-flush-doors/>

2.2 DOOR CONSTRUCTION, GENERAL

- A. Adhesives: Do not use adhesives containing urea formaldehyde.
- B. LPDL Thermal Fused Wood Flush Doors:
 - 1. WDMA I.S. 1A Performance Duty Level: Extra Heavy Duty
 - 2. WDMA I.S. 1A Aesthetic Grade: Premium



3. LPDL Thermal-Fused Faces: Decorative faces thermally fused to cores under heat and pressure, complying with Laminating Materials Association's Product Standard and Typical Physical Properties of Decorative Overlays. LMA.2003.
 4. Color or Woodgrain Pattern: As indicated
- C. Edgebanding: Impact-resistant polymer edging, minimum .040" thick, applied to all four edges after faces on all particle and mineral core doors. Manufacturer's standard color that is complementary to faces.

2.3 DOOR HARDWARE

- A. Integrated assembly includes:
- 3 Hinge (heavy weight)
 - 1 Mortise Lock (storeroom)
 - 1 Cylinder
 - 1 Surface Closer
 - 1 Gasketing
 - 1 Door Bottom

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors to comply with manufacturer's written instructions and WDMA I.S.1-A, and as indicated.
1. Install fire-rated doors to comply with NFPA 80.
- B. Align[and fit] doors in frames with uniform clearances and bevels.[Machine doors for hardware. Seal cut surfaces after fitting and machining.]
- C. Clearances: As follows unless otherwise indicated:
1. **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors.
 2. **1/8 inch (3.2 mm)** from bottom of door to top of decorative floor finish or covering.
 3. **1/4 inch (6.4 mm)** from bottom of door to top of threshold.
 4. Comply with NFPA 80 for fire-rated doors.



- D. Repair, refinish, or replace factory-finished doors damaged during installation, as directed by Architect.

END OF SECTION 08 14 16



SECTION 08 54 13 - FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass Reinforced Polymer (FRP) windows of the following type (s):
 1. Awning windows
 2. Low Profile Picture Windows

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-501, A-521, A-522, A-523, A-531, A-532, A-533, A-534, A-535, A-602: Window Panel Schedule, I-201, I-202, I-203
- B. Section 05 12 13 – Architecturally Exposed Structural Steel.
- C. Section 07 92 00 - Joint Sealants: Sealants and caulking.

1.3 PERFORMANCE REQUIREMENTS

- A. Air, Water and Structural Performance
 1. Windows shall meet Rating specifications in accordance with ANSI/AAMA/NWDA 101/I.S.2-97, AAMA/WDMA/CSA 101/I.S.2/A440-05, and AAMA/WDMA/CSA 101/I.S.2/A440-08
 2. Window Air Leakage, ASTM E 283: Window air leakage when tested at 1.57 psf (25 mph) shall be 0.05 cfm/ft² of frame or less.
 3. Window Water Penetration, ASTM E 547: No water penetration through window when tested under static pressure of 12.11 psf after 4 cycles of 5 minutes each, with water being applied at a rate of 8 gallons per hour per square foot.
- B. Thermal Performance
 1. Windows shall meet whole-unit U-Value and SHGC Performance determined in accordance with NFRC 100:

1.4 QUALITY ASSURANCE

- A. Overall Standards: Comply with ANSI/AAMA 101.I.S.2, except as otherwise noted herein.

1.5 DELIVERY, STORAGE, AND HANDLING



- A. Delivery:
 - 1. Deliver materials to site undamaged in manufacturer's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage:
 - 1. Protect the windows and accessories from the elements, construction activities, and other hazards until the project is complete.
 - a. Store materials in accordance with manufacturer's instructions.
 - b. Store materials off ground and under cover.
 - c. Protect materials from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.
 - 1. Handle all windows and accessories in accordance with AAMA CW-10.
 - 2. Protect materials and finish during handling and installation to prevent damage.

1.6 WARRANTY

- A. Residential Special Warranty:
 - 1. Provide Manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Serious Materials
 - 1250 Elko Dr. Tel: 408-541-8000
 - Sunnyvale, CA 94089 Fax: 408-715-2560
 - www.seriousmaterials.com

- B. Window and / or Door Series:

- 1. 525 Series Fiberglass Windows and / or Doors

2.2 MATERIALS

- A. Frame and Sash: Pultruded Fiberglass Reinforced Polymer, with color coating.
- B. Hardware: Hardware having component parts which are exposed shall be of brass, aluminum, stainless steel or other non corrosive material(s) compatible with fiberglass and of sufficient strength to perform the functions for which they are used. Cadmium or zinc-plated steel, where used, shall be in



accordance with ASTM A 165 or B 633. Nickel chrome-plated steel, where used, shall be in accordance with ASTM B 456. Inoperable windows will have no exposed hardware.

- C. Weather-stripping: Weather-stripping conforming to AAMA 701 or 702. Weather-stripping shall meet the requirements of the specifications as detailed in the appropriate test report. All weather-stripping shall be installed in specially-extruded ports and secured to prevent movement, shrinkage, or loss when removing sash either for cleaning or repair. Adhered weather-stripping shall not be allowed.
- D. Screens: Full screens supplied separately or delivered applied to windows as requested.

2.3 ASSEMBLY

- A. Fabricate frames and sash with mitered and mechanically joined corners. Mitered seams shall be sealed thoroughly to prevent air or water penetration
- B. Provide metal or composite reinforcement in sash or frame for attaching operating or locking mechanisms
- C. Factory glazed, inside, with snap on PVC or Fiberglass glazing stops. Note: Field glazing is required for large window units (over 40sf (3.72 m²)). Insulating glass units shall be reglazable without dismantling sash framing.
- D. The windows shall be assembled in a secure and professional manner to perform as herein specified and to assure neat and weather tight construction. All main framing joints shall be sealed with sealants meeting the requirement of AAMA 803 or 809.

2.4 INSECT SCREENS

- A. Provide tight-fitting screen for operating sash with hardware to allow easy removal.
 - 1. Screen Cloth: Charcoal fiberglass mesh
 - 2. Frame:
 - a. Rollformed

2.5 GLASS AND GLAZING

- A. Overall IG thickness: nominally 1"
 - 1. Insulated Glass Units: ASTM E774, Class A.,



- B. Construction: Individual components shall comply with criteria specified in following paragraphs. Units shall be hermetically sealed and shall comply with ASTM E 2190, Class CBA.

- C. Components:
 - 1. Exterior layer to be clear float glass of nominal 1/8" (3mm) thickness; per ASTM C 1036: Type 1, Class 1, Quality q3; conforming to ASTM C 1376
 - 2. Exterior glass to be Kind annealed
 - 3. Suspended polymer film : Single Suspended Film
 - 4. Interior layer to be clear float glass of nominal 1/8" (3mm) thickness; per ASTM C 1036: Type 1, Class 1, Quality q3
 - 5. Interior glass to be Kind annealed
 - 6. Gas Fill: Each cavity between glass and SCF shall be filled with an inert gas / air mixture containing a minimum of 90% Argon gas; units shall be equipped with gas-retention device for shipping.
 - 7. Spacers: shall maintain a nominal dimension of 3/8" (9.5mm) between glass and suspended film.
 - 8. Edge Sealants:
 - a. Primary: Polyisobutylene sealant complying with ASTM E 774 for glass-to-spacer seals
 - b. Secondary: Polyurethane sealant for perimeter moisture barrier
 - c. Seal durability: conformance to ASTM E 774; visible ALL certification for CBA rating level. Perimeter seals shall maintain a hermetically-sealed, dehydrated condition for the duration of the product warranty.

2.6 FINISH (Exterior / Interior)

- A. Frame and Sash colors: Custom – custom color requests require Pantone number and matching swatch.

- B. Color match screen frame to window frame and sash color

2.7 SOURCE QUALITY CONTROL

- A. Windows inspected in accordance with manufacturers Quality Control Program.

2.8 WINDOW TYPES

- A. Awning Window (525 Series)
 - 1. Factory assembled and glazed outward opening fiberglass awning
 - 2. Frame:
 - a. Chambered, foam filled, pultruded fiberglass
 - b. Interior Exposed Surfaces: no coating



- c. Overall Frame Depth: 3-1/4 inch (83 mm)
3. Sash:
 - a. Chambered, foam filled, pultruded fiberglass
 - b. Interior Exposed Surfaces: no coating
 - c. Minimum 2-1/4 inch (57 mm) deep, chambered, pultruded fiberglass profile.
4. Sightlines: edge of frame to tip of glazing tower or glass line 2 7/8" (72mm)
5. Weatherstripping:
 - a. Double weatherstripping
 - b. Continuous, flexible PVC type around sash perimeter
 - c. Foam with fabric skin around frames interior perimeter
6. Hardware:
 - a. Operator – steel worm-gear operator, zinc die cast base with painted finish
 - b. Crank Handle – integrated folding handle with painted finish
 - c. Locking System – Single handle multi-point with positive action (reaches out and pulls tight).
 - d. All exposed fasteners- stainless steel
7. Keynote Reference: 08 54 13.A09

B. Picture Window (525 Series) – Low Profile

1. Factory assembled and glazed Fixed (non-operating)
2. Frame:
 - a. Chambered, foam filled, pultruded fiberglass
 - b. Interior Exposed Surfaces: none
 - c. Overall Frame Depth: 3-1/4 inch (83 mm)
3. Sightlines: edge of frame to tip of glazing tower or glass line 1 1/2" (39 mm)
4. Keynote Reference: 08 54 13.A03

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings in which windows will be installed.
1. Field verify that the existing window openings are within tolerance, plumb, level, clean, and provide a solid anchoring surface and substrate. Also confirm that the openings and are in accordance with approved shop drawings.
 2. Verify that framing complies with method of installation
 3. Verify that fasteners in framed walls are fully driven and will not interfere with window installation



- B. Coordinate with responsible entity to correct unsatisfactory conditions. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install windows in framed walls in accordance with AAMA 2400, and manufacturer's instruction
- B. Install windows in accordance with manufacturer's instructions.
- C. Install windows to be weather-tight and freely operating.
- D. Maintain alignment with adjacent work.
- E. Secure assembly to framed openings, plumb and square, without distortion.
- F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.
- G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave windows closed and locked.
- I. Do not remove temporary labels
- J. Install insect screens on operable windows

3.3 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Remove temporary labels and retain for Closeout Submittals.
- C. Clean soiled surfaces and glass using a mild detergent and warm water solution with soft, clean cloths.

3.4 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 54 13



SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Monolithic Glass
- B. Insulating Glass

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-536, A-537. A-601: Dorr Schedule, I-202
- B. Section 05 12 13 – Architecturally Exposed Structural Steel

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data and 12-inch- (300-mm-) square Samples.
- B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.
 - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

PART 2 - PRODUCTS

2.1 MONOLITHIC-GLASS TYPES

- A. Glass Type GL-VE-1-88: Tempered Low-E glass.
 - 1. Thickness: 1"
 - 2. Reference Keynote: 08 80 00.A1
 - 3. Manufacturer: SRS Metals
 - a. Address:
P.O. Box 4277
Metuchen, NJ 08840
 - 4. Product Website:



<http://www.srs-metals.com/index.shtml>

2.2 INSULATING-GLASS TYPES

A. Glass Type: Solera-Nanogel

1. Overall Unit Thickness: **3 inch nominal**
2. U-Value: 0.05 btu/hr. ft²°F
3. Light Transmittance: 0%-33%
4. Light Diffusing Power: 0.95
5. LEED Credits: "Optimized Energy Performance", "Daylight and Views"
6. Manufacturer: Advanced Glazings
7. Product Website:
<http://www.advancedglazings.com/nanogel/>

2.3 GLAZING SEALANTS

- ### A. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."
- B. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- C. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION 08 80 00



SECTION 08 84 00 - PLASTIC GLAZING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Section includes the following:
 - 1. PANELITE™ LAMINATED SERIES Honeycomb Panels in Vertical Applications
 - 2. Closet Doors
 - 3. Doors
 - 4. Partitions
- B. The extent of PANELITE PANELS IS shown on the drawings.

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-601: Door Schedule, I-202,, I-502, I-521, I-561,I-562

1.3 SECTION REQUIREMENTS

- A. Product Data: Indicate PANELITE product description, fabrication information, compliance with specified performance requirements.
- B. Terms and Conditions including Warranty as specified by PANELITE.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Samples for Initial Selection: Submit minimum 2.5 inch by 2.5 inch samples. Indicate full color and honeycomb variation.
- E. Samples for Verification: Submit minimum 5 inch by 5 inch sample for each type, facing, core pattern and color of honeycomb panel.
- F. Maintenance Data: Submit PANELITE's care and maintenance data, including care, repair and cleaning instructions. Include in Project close-out documents.



1.4 PANEL APPLICATIONS

- A. PANELITE™ LAMINATED SERIES and PANELITE™ CAST POLYMER SERIES panels are designated for interior use only and have not been tested or designed for exterior use, live loads, flooring or roofing.
- B. Install as per PANELITE specifications.

1.5 QUALITY ASSURANCE

- A. Response Characteristics - PANELITE LAMINATED SERIES™ Provide Honeycomb Panel(s) that comply with the following requirements:
 - 1. Manufacturer's Warranty on PANELITE LAMINATED SERIES™ and PANELITE CAST POLYMER SERIES™ panels: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.
 - 2. Warranty Period: Refer to Terms and Condition in effect at time of purchase.
 - 3. The warranty shall not deprive the owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.
 - 4. AHC, AHB (aluminum hexagonal honeycomb, fiberglass facing)
 - a. Rate of Burning: ASTM E-84- Class C for Flame Spread for a standard thickness of ¾"
 - b. Short Beam Shear: ASTM C393, stress = 32.2 psi
 - c. Long Beam Flexure: ASTM C393, stress = 1427 psi, deflection # (10lbs loading) =.035"
 - d. Flat wise tensile: ASTM C297, stress = 16.0 psi
 - e. Panel weight: 1.00 psf
 - f. Standard tolerances:
 - 1) Thickness: +/- .010"
 - 2) Warpage: varies per panel dimension
 - 3) Length + Width: +/- .06
- B. Warranty
 - 1. Certain variations may occur in Panelite panels:
 - a. General Appearance: Color, honeycomb cell geometry, and facing texture may vary slightly between the samples provided to customers and the finished Panelite™ product, as well as between individual panels, due to the organic and flexible nature of Panelite™ components and processes.



- b. Honeycomb Core: Cell geometry and alignment may vary slightly within panels and between different panels. Cells may not always run parallel to panel edges.
- c. Custom colors: Slight variations in color may occur between approval samples for custom colors, and the finished Panelite™ panel, as well as between panel lots.
- d. Visible glass fibers in the facing: Fiberglass reinforcement is used in all Panelite™ panels to provide a strong and durable facing material. Glass fibers, which may appear in certain light conditions as scratches, are inherent in the material and are not considered to be defects.

1.6 DELIVERY, HANDLING AND STORAGE

- A. All PANELITETM panels delivered on a wood skid with protective triple-wall cardboard or plywood enclosure and covered with self-adhesive protective film.
- B. Immediately upon delivery examine each crate for evidence of damage
- C. Do not deliver PANELITETM panels, framing systems and/or accessories to Project site until areas are ready for installation.
- D. If delivered early, panels should remain on skids and in crates with other packing material. Store in a dry shaded area. Flat storage recommended. Do not stack other material on top of shipment.
- E. Handle materials to prevent damage to finished surfaces. Do not remove protective film until installation and project construction is complete and site is prepared for occupation.
- F. Do not install PANELITE Honeycomb Panels until spaces are enclosed and weatherproof.
- G. Do not force, warp or torque panels during handling or installation.
- H. Carry panels vertically and lengthwise with support on each end.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: PANELITE LAMINATED SERIES™ and PANELITE CAST POLYMER SERIES™ are trademarks of PANELITE LLC. PANELITE LAMINATED SERIES™ panels are protected by U.S. patent NO. 6,500,516 and PANELITE CAST POLYMER SERIES™ panels are patent pending. The design of Translucent Honeycomb panels is based



ON PANELITE LAMINATED SERIES™ and PANELITE CAST POLYMER SERIES™ as provided by PANELITE LLC. Products from other manufacturers must be approved by the Architect or Designer prior to bidding in accordance with the Instructions to Bidders and Division 1 Section "Product Requirements".

- B. Provide product as specified below under "Materials".
- C. Manufacturer
 - 1. PANELITE NEW YORK
315 W. 39th St., 807 5835 Adams Blvd Tel: 212.947.8292
New York, NY 10018
<http://www.e-panelite.com/>

2.2 MATERIALS

- A. PANELITE LAMINATED SERIES™ panels [formerly "Aluminum Series"]
 - 1. Cores: Aluminum (AH, AO) and tubular polycarbonate (TC) honeycomb core
 - 2. Fiberglass reinforced polyester sheet facings: Clear (C), Blue (B)
 - 3. High pressure Laminate facings: Glass Cloth Laminate (GCL)
- B. PANELITE CAST POLYMER SERIES™ panels
 - 1. High density polymer honeycomb core (PE and P8)
 - 2. Aluminum over-expanded honeycomb core (AO)
 - 3. Fiberglass-reinforced Polyester resin facings in gloss or matte (-mos) finish:
 - 4. G (light green)

2.3 FABRICATION

- A. Cutting – PANELITE LAMINATED SERIES™ and PANELITE CAST POLYMER SERIES™ panels
 - 1. Factory cut panels are available. Rectangular dimensions only.
 - 2. For on-site cutting use of a triple-chip tooth grind, 60 tooth, carbide-tipped, thin kerf blade for cutting non-ferrous materials (eg. for cutting aluminum and plastics).
 - 3. Table saw and use of dust collection system is recommended. Eye protection should be worn when cutting or drilling panels.
 - 4. It is recommended that saw blade should be raised such that only 1/8" to 1/4" of the blade is above surface of panel. Minimum 1" clearance from edge of panel is recommended while cutting. For PANELITE LAMINATED SERIES™, cut pieces narrower than 6" wide are subject to delamination and are not recommended. For PANELITE CAST POLYMER SERIES™, cut pieces narrower than 1" are not recommended.



5. Factory applied protective film should remain on panel during cutting and drilling and should be removed only after installation.

B. Drilling and Attachments

1. On site drilling: PANELITE LAMINATED SERIES™ panels should be secured between a wood substrate and drilling template to avoid damage or delaminating of facing. A template is not necessary for PANELITE CAST POLYMER SERIES™ panels.
2. For panels in vertical applications, a minimum of ½" clearance from edge of panel to outside edge of hole is recommended for drilling and attachments.
3. For horizontal or angled hung installations, the recommended bolting clearance will vary per application. Please inquire with a Panelite Product Specialist.
4. For bolted or screwed attachments through the panel, use of a washer is recommended.
5. Do not over-tighten when screwing or bolting through panels to avoid dimpling or damage of facing.
6. Factory applied protective film should remain on panel during cutting and drilling and should be removed only after installation.

C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.

1. Sawing: Select equipment and blades suitable for type of cut required. Use of a jig saw is NOT recommended. Refer to cutting specifications above.
2. Drilling: Select Drills and drill bits specifically designed for use with plastic products.
3. Milling: PANELITE CAST POLYMER SERIES™ only, climb cut where possible.
4. Routing: Caution should be used while routing panels. Core is extremely vulnerable to damage during routing. Due to potential core damage, routed panels should be framed to hide exposed edge. Use two flute, straight carbide tipped router bit.

D. Fasteners: Appropriate fasteners vary per panel and per design. Please inquire further with PANELITE for specific requirements.

E. Safety and Preparation

1. Eye protection should be worn when cutting or drilling panels. In high volume cutting operations face masks or respirators are recommended.
2. Wearing work gloves is recommended. Allergic reactions to glass fibers can be avoided by the use of barrier creams on exposed skin areas.
3. Fire safety precautions must be employed in storage and during application.



PART 3 - EXECUTION

3.1 APPLIED FRAMING FOR PANELITE LAMINATED SERIES™ AND PANELITE CAST POLYMER SERIES™ PANELS

- A. It is recommended that all edges of panels be protected, either by being built-in, or if freestanding, with the use of edge treatment. For PANELITE LAMINATED SERIES™ panels, applied channels or an aluminum installation system are recommended. For PANELITE CAST POLYMER SERIES™ panels, either applied c-channels, an aluminum framing system, or integral resin edges are recommended. Consult PANELITE for edge treatment recommendations for specific applications.
- B. High quality heavy-duty epoxy or silicone adhesive is recommended for applied framing of PANELITE™ panels. The adhesive should be applied to the inside face of the framing that will be in contact with the facing and then pressed firmly onto the panel. To avoid squeeze-out onto the face of the panel, the amount of adhesive should be sufficient but not excessive, approximately a 1/8" bead. Allow for curing – 48 hours minimum. For full performance, allow 7-10 days for curing.
- C. An initial test of adhesive is recommended to determine the appropriate amount. Remove excess adhesive or sealant before it cures. Installer shall test for most appropriate method of adhesion. This may vary according to facing material and specific application.
- D. If panels will be exposed to moisture or water, ensure a continuous seal between edge of panel and framing by applying a bead of clear silicone where the framing and panel facing meet after the framing is applied.
- E. The use of glazing suction cups should be avoided. Framing detail should be a precise fit to avoid the need for unnecessary force.
- F. PANELITE CAST POLYMER SERIES™ panels have a slightly higher thickness tolerance than PANELITE LAMINATED SERIES™ panels; this should be taken into account when framing CAST POLYMER SERIES panels.

3.2 CLEANING AND MAINTENANCE

- A. PANELITE LAMINATED SERIES™ PANELS:
 - 1. Non-abrasive glass and all-purpose surface cleaners may be used (i.e. Windex, etc.)
 - 2. DO NOT USE ABRASIVE CLEANERS (such as Ajax, Comet, etc.) or cleaners containing phosphates.



3. General-purpose adhesive solvent can be used to rid fiberglass and resin panels of any adhesive residue or other surface marks. Testing on an inconspicuous area of panel is recommended.
4. Handle panels with care. Avoid direct impact to panel faces or edges.
5. Keep panels away from permanent or excessive heat sources.

END OF SECTION 08 84 00



DIVISION 10 – SPECIALTIES



SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Toilet Tissue Dispenser
- B. Grab Bar
- C. Shower Bench
- D. Mirror
- E. Glass Shower Doors
- F. Towel Bar
- G. Hand Towel Bar

1.2 RELATED DOCUMENTS

- A. Construction Document – I-202, I-501

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- B. Tempered Glass: ASTM C 1048, Kind FT (fully tempered).
- C. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.



- E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.2 TOILET AND BATH ACCESSORIES

A. Toilet Tissue Dispenser:

1. Basis-of-Design Product: Kohler Margaux vertical tissue holder
2. Product Number: K-16255
3. Product Price: \$117.55
4. Type: Single-roll dispenser.
5. Mounting: Surface mounted with concealed anchorage.
6. Material: Chrome-plated zinc alloy (zamac)
7. Capacity: Designed for 5-inch- (127-mm) diameter-core tissue rolls.
8. Product Website:
<http://www.us.kohler.com/onlinecatalog/detail.jsp?item=12810002§ion=2&category=19>

A. Grab Bar:

1. Basis-of-Design Product: Kohler Purist 9" Grab Bar (18", 36", 48")
2. Product Number:
 - a. K-11897-S (48 in (1219 mm))
 - 1) Quantity: 2
 - 2) Price: \$ 195.00 /ea.
 - 3) Reference Keynote - 10 28 00.C1
 - b. K-11895-S (36 in (914 mm))
 - 1) Quantity: 1
 - 2) Price: \$ 165.00 /ea
 - 3) Reference Keynote - 10 28 00.C2
 - c. K-11892-S (18 in (457.2 mm))
 - 1) Quantity: 1
 - 2) Price: \$ 120.00 /ea
 - 3) Reference Keynote - 10 28 00.C3
3. Price: \$125.00/each
4. Material: Polished Stainless steel, 0.050 inch (1.27 mm) thick.
5. Mounting: Concealed.
6. Gripping Surfaces: Smooth, satin finish.
7. Outside Diameter: 2-3/4" (69 mm) for medium-duty applications.
8. ADA Compliant
9. Product Website:
http://www.us.kohler.com/onlinecatalog/detail.jsp?item=14003502&prod_num=11890



B. Shower Bench:

1. Basis-of-Design Product: Custom Concrete Shower Bench
2. Price: \$500.00
3. Reference Keynote - 10 28 00.C4
4. Product Website:
<http://www.trueformconcrete.com/>

C. Mirror Cabinet:

1. Basis-of-Design Product: Rifletta Four Light 28 inch Lighted Bathroom Mirror
2. Manufacturer: Bellacor
3. Product Number: 589338
4. Reference Keynote - 10 28 00.C5
5. Size: 28 W x 28 H x 2 in Ext (1000 x 600 x 153 mm)
6. Bulb/Watt: 4-55 W 2G11Bulbs
7. UL Listed
8. Product Website:
<http://www.bellacor.com/productdetail/589338.htm>

D. Glass Shower Doors:

1. Basis-of-Design Product: Glass Crafters ½" Tempered Glass
2. Reference Keynote - 10 28 00.C6
3. Glass: Clear, fully tempered.
4. Vinyl tape will be used for temporary installation
5. Size: 7 ft. x 3 ft.

E. Towel Bar:

1. Basis-of-Design Product: Moen 90° Degree 24 inch towel bar
2. Product Number: YB8824CH
3. Price: \$79.00
4. Description: Posts constructed of zinc, bar is constructed of aluminum.
5. Mounting: Flanges with concealed fasteners.
6. Length: 24 inches (609 mm).
7. Material and Finish: Polished Chrome.
8. Product Website:
http://www.moen.com/90-degree/chrome-24-towel-bar/_/R-CONSUMER%3AYB8824CH

F. Hand Towel Bar:

1. Basis-of-Design Product: Moen 90° Degree 8 inch towel bar
2. Product Number: YB8808CH
3. Price: \$66.25
4. Description: Posts constructed of zinc, bar is constructed of aluminum.
5. Mounting: Flanges with concealed fasteners.
6. Material and Finish: Polished Chrome.



7. Product Website:
http://www.moen.com/90-degree/chrome-pivoting-paper-holder/_/R-CONSUMER%3AYB8808CH

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
 1. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.
- B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 10 28 00



SECTION 10 80 00 - OTHER SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. TV Wall Mount

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. TV Wall Mount:

1. Basis-of-Design Product: LG EZ Slim Wall Mount
2. Product Number: LSW200BG
3. Quantity: 2
4. Color: Black
5. Product Website:

<http://www.lg.com/us/tv-audio-video/accessories/LG-tv-accessories-LSW200BG.jsp>

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

END OF SECTION 10 80 00



DIVISION 11 – EQUIPMENT



SECTION 11 31 13 - RESIDENTIAL KITCHEN APPLIANCES

1.1 SECTION INCLUDES

- A. Electric Induction Hybrid Cooktop
- B. Electric Wall Oven
- C. Exhaust Hood
- D. Refrigerator/Freezer
- E. Dishwasher

1.2 RELATED DOCUMENTS

- A. Construction Documents – I-201, I-203, I-501, I-523, I-524, M-101, M-103, M-105, P-101, P-102, P-103, P-501, P-502, P-602, P-901, P-902, P-903
- B. Project Manual: Appendix A – Electrical Appliances Manufacturer's Specifications

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Regulatory Requirements: Comply with provisions of the following product certifications:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
 - 3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
 - 4. NAECA: Provide residential appliances that comply with NAECA standards.
- C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines ICC/ANSI A117.1.



- D. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

- A. Electric Induction Hybrid Cooktop: **30-inch (762-mm)**, built-in cooktop with four burner elements.

1. Basis-of-Design Product: Frigidaire Professional 30" Electric Induction Cooktop
2. Product Number: FPEC3085KS
3. Product Price: \$665.00
4. Reference Keynote – 11 31 13.A2
5. Product Website:
<http://www.frigidaire.com/products/kitchen/cooktops-stovetops/fpcc3085ks>

- B. Electric Wall Oven: Built-in, single, electric, self-cleaning wall oven with broiler unit.

1. Basis-of-Design Product: Frigidaire 27" Single Electric Wall Oven
2. Product Number: FFEW2725LS
3. Product Price: \$824.00
4. Reference Keynote – 11 31 13.A5
5. Product Website:
<http://www.frigidaire.com/products/kitchen/wall-ovens/ffew2725ls>

- C. Exhaust Hood:

1. Basis-of-Design Product: Air King
2. Product Number: ESSEV28
3. Product Description: Energy Star 28" Insert with 300 CFM and 4.5 Sones, Dual 18 watt, 4 pin high efficiency fluorescent lamps.
4. Reference Keynote – 11 31 13.A4
5. Product Website:
<http://www.ventingdirect.com/air-king-essev28-energy-star-qualified-28-energy-star-insert-with-300-cfm-and-4-5-sones/p1131126>

- D. Refrigerator/Freezer: Freestanding, cycle-defrost, two-door refrigerator with top-mounted freezer, baked-enamel-on-steel interior cabinet liners.

1. Basis-of-Design Product: Liebherr
2. Product Number: CS1311
3. Fresh Food Compartment Volume: 9.7 cu. ft.
4. Freezer Compartment Volume: 3.3 cu. ft.



5. Shelf Area: 4 adjustable glass shelves.
 6. Reference Keynote – 11 31 13.A1
 7. Product Website:
<http://site.us-appliance.com/pdfs/CS131users.pdf>
- E. Dishwasher: Built-in, undercounter, automatic dishwasher, sized to replace 24-inch- (610-mm-) base cabinet, stainless-steel tub and door liner.
1. Basis-of-Design Product: Bosch 24" Evolution 500 Series Dishwasher
 2. Product Number: SHE55M15UC
 3. Product Price: \$830.97
 4. Reference Keynote – 11 31 13.A7
 5. Product Website:
<http://www.bosch-home.com/us/SHE55M15UC.html>

2.2 INSTALLATION

- A. Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- B. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Test each item of residential appliances to verify proper operation. Make necessary adjustments.
- D. Verify that accessories required have been furnished and installed.

END OF SECTION 11 31 13



SECTION 11 31 23 - RESIDENTIAL LAUNDRY APPLIANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Clothes Washer
- B. Electric Clothes Dryer

1.2 RELATED DOCUMENTS

- A. Construction Documents – I-501, M-205, P-101, P-102, P-501, P-502, P-602, P-901, P-902, P-903
- B. Project Manual: Appendix A – Electrical Appliances Manufacturer's Specifications

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Regulatory Requirements: Comply with provisions of the following product certifications:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
 - 3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
 - 4. NAECA: Provide residential appliances that comply with NAECA standards.
- C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines ICC/ANSI A117.1.
- D. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.



PART 2 - PRODUCTS

2.1 RESIDENTIAL LAUNDRY APPLIANCES

- A. Clothes Washer: Freestanding, top-loading, automatic clothes washer with 4.0cu. ft. (0.113-cu. m) capacity stainless-steel tub and 10 wash cycles including regular, delicate, and permanent press; reversible motor.
1. Basis-of-Design Product: Whirlpool Stackable Washer
 2. Product Number: WFW915OWW
 3. Product Price: \$528.00
 4. Reference Keynote – 11 31 23.A1
 5. Product Website:
<http://www.whirlpool.com/catalog/product.jsp?src=WASHERS&cat=115&prod=1872>
- B. Electric Clothes Dryer: Freestanding, front-loading clothes dryer, 6.7-cu. ft. (0.190-cu. m) capacity with stainless-steel interior.
1. Basis-of-Design Product: Whirlpool Stackable Dryer
 2. Product Number: WED915OWW
 3. Product Price: \$518.00
 4. Reference Keynote – 11 31 23.A2
 5. Product Website:
http://www.whirlpool.com/catalog/product.jsp?categoryId=119&productid=1871&successful_search=wed915Oww

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- B. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Test each item of residential appliances to verify proper operation. Make necessary adjustments.
- D. Verify that accessories required have been furnished and installed.

END OF SECTION 11 31 23



SECTION 11 52 00 - AUDIO-VISUAL EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Television

1.2 RELATED DOCUMENTS

- A. Construction Documents – I-101, I-201, I-202, I-203, I-522
- B. Section 10 80 00 – Other Specialties

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PRODUCT TYPE

- A. Television

1. Basis-of-Design Product: LG 47 in. LED LCD Television
2. Product Number: 47LE5400
3. Product Price:
4. Reference Keynote – 11 52 00.A2
5. Product Website:
<http://www.lg.com/us/tv-audio-video/televisions/LG-led-tv-47LE5400.jsp>

- B. Blu-ray disc player

1. Basis-of-Design Product: Network Blu-ray Disc Player with Wireless connectivity
2. Product Number: BD570
3. Product Website:
<http://www.lg.com/us/tv-audio-video/video/LG-blu-ray-dvd-player-BD570.jsp>

2.2 PERFORMANCE/DESIGN CRITERIA



- A. Television
 - 1. Wireless 1080p Ready
 - 2. Wi-fi ready
 - 3. High Definition Resolution
 - 4. Voltage, Hz: 100 V ~ 240 V, 50/60Hz

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- B. Test each item of residential appliances to verify proper operation. Make necessary adjustments.
- C. Verify that accessories required have been furnished and installed.

END OF SECTION 11 52 00



DIVISION 12 – FURNISHINGS



SECTION 12 35 30 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Specifications for manufactured closet storage unit.

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-214, I-521

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and material Samples.
- B. Verify dimensions by field measurements; measure for countertops after base cabinets are installed].

PART 2 - PRODUCTS

2.1 CASEWORK

- A. Closet Storage Unit, Reference Keynote – 12 35 30.A1:

- 1. Available Products:

- a. IKEA Komplement Shelf:

- 1) Dimensions: 18 1/8 in x 22 ½ in (46 cm x 57 cm)
- 2) Frame Dimensions: 19 5/8 in x 22 7/8 in (50 cm x 58 cm)
- 3) Max load/shelf: 44 lb 1 oz (20 kg)
- 4) Materials:
 - a) Tempered Safety Glass (4)
 - b) Particleboard (2)
- 5) Price: \$15.00/each

- b. IKEA Komplement Clothes Rail (2):

- 1) Dimensions: 18 1/8 in (46cm)
- 2) Frame Dimensions: 19 5/8 in (50 cm)
- 3) Max load/shelf: 44 lb (20 kg)
- 4) Materials: Steel, anti-corrosive phosphate coating
- 5) Holder: Acetal plastic
- 6) Price: \$5.00/each



- c. IKEA Komplement Drawer (4):
 - 1) Dimensions: 16 7/8 in x 22 ½ in x 6 ¼ in (43 cm x 57 cm x 16 cm)
 - 2) Frame Dimensions: 19 5/8 in x 22 7/8 in (50 cm x 58 cm)
 - 3) Max load/shelf: 33 lb (15kg)
 - 4) Materials: Particleboard, foil, melamine foil
 - 5) Drawer Bottom: Fiberboard, acrylic paint
 - 6) Price: \$30.00/each

- d. IKEA PAX:
 - 1) Dimensions: 39 ¼ in x 13 ¾ in x 79 ¼ in (99.8 cm x 35 cm x 201.2 cm)
 - 2) Frame Dimensions: 14 in (35.5 cm)
 - 3) Materials: Particleboard, foil, melamine foil
 - 4) Drawer Bottom: Fiberboard, acrylic paint
 - 5) Price: \$80.00/each

PART 3 - EXECUTION

3.1 INSTALLATION

1. Install and secure all pieces according to manufacturer guidelines.

END OF SECTION 12 35 30



SECTION 12 35 30.13 - RESIDENTIAL KITCHEN CASEWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Specifications for manufactured built-in kitchen casework.

1.2 RELATED DOCUMENTS

- A. Construction Documents – I-204, I-501, I-523, I-524
- B. Section 12 36 13 Concrete Countertops
- C. Section 22 40 00 Plumbing Fixtures

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and material Samples.
- B. Verify dimensions by field measurements; measure for countertops after base cabinets are installed.

PART 2 - PRODUCTS

2.1 CASEWORK

- A. Cabinets:
 - 1. Manufacturer: IKEA
 - 2. Basis-of-Design Product: Ikea Akurum
 - 3. Product Website:
<http://www.ikea.com/us/en/catalog/categories/departments/kitchen/10470/>
- B. Products:
 - 1. Akurum Wall Cabinet with Two Doors:
 - a. Cabinet Code: R
 - b. Cabinet Size: 2 ft x 3' 2"
 - c. Quantity: 3
 - d. Product Code: 798.270.93
 - e. Price: \$192.00
 - 2. Akurum Fan Cab, top cabinet:
 - a. Cabinet Code: H1



- b. Cabinet Size: 3' ft x 2'
- c. Quantity: 1
- d. Product Code: 798.271.34
- e. Price: \$172.00
- 3. Akurum Base Cabinet with shelf/drawer/door:
 - a. Cabinet Code: B1
 - b. Cabinet Size: 2 ft x 2' 10"
 - c. Quantity: 1
 - d. Product Code: 998.446.09
 - e. Price: \$234.99
- 4. Akurum Base Cabinet frame:
 - a. Cabinet Code: B2
 - b. Cabinet Size: 3 ft x 2' 10"
 - c. Quantity: 1
 - d. Product Code: 343.823.10
 - e. Price: \$45.00
- 5. Perfekt Abstrakt Cover Panel
 - a. Quantity: 4
 - b. Product Code: 800.699.86
 - c. Price: \$145.00
- 6. Perfekt Plinth
 - a. Quantity: 4
 - b. Product Code: 700.385.04
 - c. Price: \$15.00

2.2 ACCESSORIES

- A. Basis-of-Design Product: Ikea Akurum adjustable legs
 - 1. Quantity: 8
 - 2. Product Code: 300.763.19
 - 3. Price: \$12.00

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets per Manufacturer's specifications.

END OF SECTION 12 35 30.13



SECTION 12 36 13 - CONCRETE SINK AND COUNTERTOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Kitchen Concrete Sink and Countertop
- B. Bathroom Concrete Sink

1.2 RELATED DOCUMENTS

- A. Section 12 35 30.13 – Kitchen Casework
- B. Section 22 41 00 - Residential Plumbing Fixtures
- C. Construction Documents – I-501, I-523, I-524, P-101, P-501, P-502, P-901, P-902, P-903

1.3 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings
- B. Verify dimensions of stone countertops by field measurements and indicate on Shop Drawings.

PART 2 - PRODUCTS

2.1 SINKS

- A. Kitchen Sink with integral Countertop.
 - 1. Cast concrete sink with integral countertop and drain.
 - 2. Manufacturer:
TrueForm Concrete
5 Astro Place Tel: 973-983-7500
Denville, NJ 07834 Fax: 973-989-7501
<http://trueformconcrete.com/>
 - 3. Reference Keynote – 12 36 13.A01
- B. Bathroom Sink



1. Cast concrete sink with integral countertop and drain.
2. Manufacturer:
TrueForm Concrete
5 Astro Place Tel: 973-983-7500
Denville, NJ 07834 Fax: 973-989-7501
<http://trueformconcrete.com/>
3. Reference Keynote – 12 36 13.A02

2.2 COUNTERTOP FABRICATION

- A. Comply with recommendations in MIA's "Dimensional Stone - Design Manual IV."
- B. Cutouts and Holes:
 1. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

PART 3 - EXECUTION

3.1 INSTALLING COUNTERTOPS

- A. Install countertops by adhering to supports with water-cleanable epoxy adhesive.
- B. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts while cutting.
- C. Install backsplash and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave **1/16-inch (1.5-mm)** gap between countertop and splash for filling with sealant. Use temporary shims to ensure uniform spacing.
- D. Grout seams to comply with ANSI A108.10. Tool grout uniformly and smoothly with plastic tool.
- E. Apply sealant to seams and to gap between countertops and splashes.



3.2 CLEANING

- A. Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
- B. Clean stone countertops not less than six days after completion of sealant installation, using clean water and soft rags. Do not use materials or methods that could damage stone.
- C. Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 12 36 13



SECTION 12 58 13 – COUCHES AND LOVESEATS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Couch

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Couch : Construction Documents: I-101:

1. Basis-of-Design Product: Cappellini
2. Collection: Elan
3. Material: Fabric
4. Product Website:

http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_EN;is_finder_result:1&lang=en

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's specifications.

END OF SECTION 12 58 13



SECTION 12 58 16 - RESIDENTIAL CHAIRS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Residential Chairs
- B. Residential Chairs
- C. Residential Chairs
- D. Dining Chairs

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Residential Chairs, Reference Keynote – 12 58 16.A01:

- 1. Basis-of-Design Product: Cappellini
- 2. Collection: Stitch Chair
- 3. Material: Red Metal
- 4. Product Website:

http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_STC;is_finder_result:1&lang=en

- B. Residential Chairs, Reference Keynote – 12 58 16.A02:

- 1. Basis-of-Design Product: Cappellini
- 2. Collection: Ribbon Stool
- 3. Product Website:

http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_RI;is_finder_result:1&lang=en



C. Residential Chairs, Reference Keynote – 12 58 16.A03:

1. Basis-of-Design Product: Cappellini
2. Collection: Wanders' Tulip Chair
3. Product Website:
http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_TL;is_finder_result:1&lang=en

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers' specifications.

END OF SECTION 12 58 16



SECTION 12 58 19 – DINING TABLES AND CHAIRS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Dining Room Table
- B. Dining Room Chairs

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Dining Room Table, Reference Keynote – 12 58 19.A01 :

- 1. Basis-of-Design Product: Cappellini
- 2. Collection: Fronzini
- 3. Product Website:

http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_FR_01;is_finder_result:1&lang=en

- B. Dining Room Chairs, Reference Keynote – 12 58 19.A02 :

- 1. Basis-of-Design Product: Cappellini
- 2. Collection: Bac Chair
- 3. Product Website:

http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_BAC_01;is_finder_result:1&lang=en

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's specifications.

END OF SECTION 12 58 13



SECTION 12 58 23 - COFFEE TABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coffee Tables
- B. Desk
- C. Side Table

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Coffee Table, Reference Keynote – 12 58 23.A01 :
 - 1. Basis-of-Design Product: Cappellini
 - 2. Collection: Smoke
 - 3. Product Website:
http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_SM;is_finder_result:1&lang=en
- B. Office Desk, Reference Keynote – 12 58 23.A02 :
 - 1. Basis-of-Design Product: Cappellini
 - 2. Collection: Loop
 - 3. Product Website:
http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_LP;is_finder_result:1&lang=en
- C. Side Table, Reference Keynote – 12 58 23.A03 :
 - 1. Basis-of-Design Product: Cappellini



2. Collection: Bong
3. Product Website:
http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_BG;is_finder_result:1&lang=en

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers' specifications.

END OF SECTION 12 58 23



SECTION 12 58 29 - BEDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Bed

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Cappellini
 1. Collection: Site
 2. Product Website:
<http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/company/home?lang=en>

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 12 58 29



SECTION 12 58 83 - CUSTOM RESIDENTIAL FURNITURE

PART 1 - GENERAL

- A. Floating Cabinet

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Cabinets, Reference Keynote – 12 58 83.A01:

1. Basis-of-Design Product: Cappellini
2. Collection: Revolving Cabinet
3. Product Website:

http://www.cappellini.it/portal/page/portal/UI/webpages/cappellini/catalogue/product?p=code:CP_PC_04;is_finder_result:1&lang=en

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers' specifications.

END OF SECTION 12 58 83



DIVISION 21 - FIRE SUPPRESSION



SECTION 21 10 00 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concealed Pendent Fire Sprinklers
- B. Pipes and Fittings
- C. Sprinklers General
- D. Piping Specialties and Alarm devices

1.2 RELATED DOCUMENTS

- A. Construction Documents – F-102, I-201, I-202, I-521, I-522

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data for valves, sprinklers, specialties, and alarms.
 - 1. Submit sprinkler system drawings identified as "working plans" and calculations according to NFPA 13. Submit required number of sets to authorities having jurisdiction for review, comment, and approval. Include system hydraulic calculations.
 - 2. Submit test reports and certificates as described in NFPA 13.
- B. Design and Installation Approval: Acceptable to authorities having jurisdiction.
- C. UL-listed and -labeled and FM-approved pipe and fittings.

PART 2 - PRODUCTS

2.1 PRODUCT TYPE

- A. Freedom Residential Concealed Horizontal Sidewall Sprinkler VK452
 - 1. Maximum Working Pressure: 175 psi (12 bar)
 - 2. Discharge Coefficient: $K = 5.6 \text{ GPM/psi}^{1/2}$ (80.6 LPM /bar^{1/2})
 - 3. Thread Size: 1/2in (15 mm) NPT
 - 4. Overall Length (Sprinkler Body): 2- 7/16 in. (50 mm)



5. Manufacturer:
Viking Corporation
<http://www.vikinggroupinc.com/databook/sprinklers/residential/121104.pdf>

2.2 PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 442/F 442M, UL 1821, 175-psig (1207-kPa) rating, made in NPS (DN) for sprinkler service. Include "Listed" and "CPVC Sprinkler Pipe" marks on pipe.
- B. CPVC Plastic Pipe Fittings: ASTM F 438 for NPS 3/4 to NPS 1-1/2 (DN 20 to DN 40) and ASTM F 439 for NPS 2 (DN 50), UL listed, 175-psig (1207-kPa) rating, for sprinkler service. Include "Listed" and "CPVC Sprinkler Fitting" marks on fittings.
- C. Provide hangers, supports, and seismic restraints with UL listing and FM approval for fire-protection systems.

2.3 VALVES

- A. Gate Valves: UL 262, cast bronze, solid wedge, outside screw and yoke, rising stem.
- B. Swing Check Valves, NPS 2 (DN50) and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc.
- C. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring.
- D. Alarm Check Valves: UL 193, 175-psig (1200-kPa) working pressure, designed for horizontal or vertical installation, with cast-iron, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, fill-line attachment with strainer, and drip cup assembly.
- E. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN 20), ball check device.

2.4 SPRINKLERS

- A. Automatic Sprinklers: With heat-responsive element complying with the following:
 1. UL 1626, for residential applications.



- B. Sprinkler types include the following:
 - 1. Upright, pendent, and sidewall sprinklers.
 - 2. Extended coverage sprinklers.
 - 3. Quick-response sprinklers.
- C. Sprinkler Finishes: Chrome-plated and bronze.
- D. Sprinkler Guards: Wire-cage type, including fastening device.
- E. Sprinkler Cabinets: Finished steel cabinet and hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and one wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on Project.

2.5 PIPING SPECIALTIES AND ALARM DEVICES

- A. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with **250-psig (1725-kPa)** pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- B. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- C. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- D. Pressure Gages: UL 393, **3-1/2- to 4-1/2-inch- (90- to 115-mm-)** diameter dial with dial range of **0 to 250 psig (0 to 1725 kPa)**.

PART 3 - EXECUTION

3.1 PIPE AND FITTING APPLICATION

- A. Use steel pipe with threaded, press-seal, roll-grooved, or cut-grooved joints; copper tube with wrought-copper fittings and brazed joints; or CPVC plastic pipe and fittings and metal-to-plastic transition fittings with solvent-cemented joints.



1. For steel pipe **NPS 2 (DN 50)** and smaller, joined by press-seal fittings, use Schedule 5 pipe, fabricated with manufacturer's press-seal tools.
- B. Pipe between Fire Department Connections and Check Valves: Use galvanized-steel pipe with flanged or threaded joints.
- C. Install shutoff valve, check valve, pressure gage, drain, and other accessories indicated at connection to water service piping.

3.2 PIPING INSTALLATION

- A. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve.
- B. Install sprinkler zone control valves, test assemblies, and drain headers adjacent to standpipes.
- C. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- D. Install alarm devices in piping systems and connect to fire-alarm system.
- E. Protect piping from earthquake damage as required by NFPA 13.
- F. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Install gages to permit removal, and install where they will not be subject to freezing.
- G. Install check valve in each water supply connection. Install backflow preventers in potable-water supply sources.
- H. Install alarm check valves for proper direction of flow, including bypass check valve and retard chamber drain line connection.

3.3 SPRINKLER APPLICATIONS

- A. Wall Mounting: Sidewall sprinklers.
- B. Sprinklers Subject to Freezing: Upright, pendent, or sidewall, dry sprinklers as indicated.
- C. Special Applications: Extended coverage or quick-response sprinklers as indicated.

3.4 TESTING

- A. Flush, test, and inspect sprinkler piping systems according to NFPA 13.



END OF SECTION 21 10 00



DIVISION 22 – PLUMBING



SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sleeves
- B. Grout
- C. Motors
- D. Hangers and Support
- E. Pressure Gauges and Test Plugs

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-102, M-201

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. PVC Pipe: ASTM D 1785, Schedule 40.

2.2 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.



2.3 HANGERS AND SUPPORTS

- A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.
- B. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.4 PRESSURE GAUGES AND TEST PLUGS

- A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch (63-mm) diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.
- B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating 500 psig at 200 deg F (3450 kPa at 93 deg C).

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
- E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.
- F. Install unions at final connection to each piece of equipment.
- G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.



- H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.2 GENERAL EQUIPMENT INSTALLATIONS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.3 BASES, SUPPORTS, AND ANCHORAGES

- A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

3.4 HANGERS AND SUPPORTS

- A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.
- B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.
- C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.
- D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:



1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

END OF SECTION 22 05 00



SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipes and Fittings
- B. Special Duty Valves
- C. Transition Fittings
- D. Flexible Connectors

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-104, P-102

1.3 SECTION REQUIREMENTS

- A. Comply with NSF 14 for plastic, potable domestic water piping and components.
- B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. PEX Tube and Fittings: ASTM F 877, SDR 9 PEX tubing and ASTM F 1807, metal insert-type fittings with copper or stainless-steel crimp rings.
 - 1. Manifold: ASTM F 877 plastic or corrosion-resistant-metal assembly, with a plastic or corrosion-resistant-metal valve for each outlet.
- B. PVC Pipe: ASTM D 1785, Schedule 40.
 - 1. PVC Fittings: ASTM D 2466, Schedule 40, socket type.
- C. Special-Duty Valves:
 - 1. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.



2. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.
 3. PVC Union Ball Valves: MSS SP-122, with full-port ball, threaded detachable end connectors, and pressure rating not less than 125 psig (860 kPa) at 73 deg F (23 deg C).
 4. PVC Check Valves: Swing or ball-check design and pressure rating not less than 150 psig (1035 kPa) at 73 deg F (23 deg C).
- D. Transition Fittings: Manufactured piping coupling or specified piping system fitting. Same size as pipes to be joined and pressure rating at least equal to pipes to be joined.
- E. Flexible Connectors: Stainless-steel, corrugated-metal tubing with wire-braid covering. Working-pressure rating a minimum of 200 psig (1380 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.
- B. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for wall penetration systems.
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- D. Install domestic water piping with 0.25 percent slope downward toward drain for horizontal piping and plumb for vertical piping.
- E. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- F. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
 1. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.



- G. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.
- H. Support vertical piping at each floor.
- I. Install flexible connectors in suction and discharge piping connections to each domestic water pump.

3.2 INSPECTING AND CLEANING

- A. Inspect and test piping systems as follows:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
- B. Clean and disinfect potable domestic water piping by filling system with water/chlorine solution with at least **50 ppm (50 mg/L)** of chlorine. Isolate with valves and allow to stand for 24 hours. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

3.3 PIPING SCHEDULE

- A. Aboveground Distribution Piping: PEX piping Schedule 40 PVC piping.

3.4 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball or gate valves for piping **NPS 2 (DN 50)** and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
 - 2. Throttling Duty: Use bronze ball or globe valves for piping **NPS 2 (DN 50)** and smaller. Use cast-iron butterfly valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
 - 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Install gate valves close to main on each branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.



- C. Install gate or ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.
- D. PVC ball, butterfly, and check valves may be used in matching piping materials.
- E. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.
- F. Install swing check valve on discharge side of each pump and elsewhere as indicated.
- G. Install ball valves in each hot-water circulating loop and discharge side of each pump.

END OF SECTION 22 11 16



SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Valves
- B. Air Separator
- C. Wall Hydrants

1.2 REALATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 VALVES

- A. Thermostatic Mixing Valves: Manually adjustable, bronze body. Include check stop and union on hot- and cold-water-supply inlets.
 - 1. Basis-of-Design Product: Taco 1 in. NPT Zone Sentry 2 position valve
 - 2. Product Number: IO75T3R
 - 3. Quantity: 2
 - 4. Product Website:
<http://www.taco-hvac.com/uploads/FileLibrary/101-089.pdf>
- B. Zone Sentry Valves for hydronic system:
 - 1. Basis-of-Design Product: Taco 1 in. NPT 2-Way iSeries Mixing Valve
 - 2. Product Number: Z100T2-1
 - 3. Quantity: 2
 - 4. Product Website:
<http://www.taco-hvac.com/uploads/FileLibrary/101-140.pdf>
- C. Modulating Valve:
 - 1. Basis-of-Design Product: Taco iWorx
 - 2. Product Number: MV3W100S2401067
 - 3. Quantity: 1



- D. Balancing Valve:
 - 1. Basis-of-Design Product: Taco Accu-Flo 1 in.
 - 2. Product Number: ACUF-100-AT-2
 - 3. Quantity: 1
 - 4. Product Website:
<http://www.taco-hvac.com/uploads/FileLibrary/401-047.pdf>

2.2 AIR SEPARATOR

- A. Basis-of-Design Product: Taco 4900 Series Air Separator
 - 1. Product Number: 4900
 - 2. Quantity: 1
 - 3. Product Website:
http://flopro.taco-hvac.com/products/Air%20Separators/index.html?action=file_list&category=89&type=3
- B. Air and dirt removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125 psi at 270°F. Manufacturer shall be holder of ASME U stamp. Manufacturer to have optional 250 psi and 150 psi ASME units available.
- C. Units up to three 3-inch in size shall be provided with threaded connections as standard. Units four 4-inch and larger shall be provided with flanged system connections as standard. Inlet and outlet connections to be inline with piping system. Both inlet and outlet to be in the same horizontal and vertical planes.
- D. Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill.
- E. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.
- F. The air and dirt removal device shall remove air down to 18 microns and shall remove dirt/debris down to 35 microns. The unit shall be 100% efficient at removing dirt down to 90 microns in 100 passes or less.



2.3 WALL HYDRANT

- A. Bronze nickel plated quarter turn non-freeze hydrant with hose connection, integral vacuum breaker, "T" handle key, and stainless steel box with full 180 deg. Cover.
 - 1. Basis-of-Design Product: Jay R. Smith Mfg.
 - 2. Product Number: 5509 QT
 - 3. Product Website:
<http://www.jrsmith.com/>

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers at each water-supply connection to mechanical equipment and where required by authorities having jurisdiction.
- B. Install hose bibs with integral or field-installed vacuum breaker.

END OF SECTION 22 11 19



SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Domestic Water Pumps
- B. Motors
- C. Controls

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-603, P-103, P-104, P-105

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data. Include certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PUMPS

- A. In-Line, Sealless Centrifugal Pumps: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps. Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal; rated for 125-psig (860-kPa) minimum working pressure and minimum continuous water temperature of 225 deg F (107 deg C).
 - 1. Circulating Pump for hydronic system, located outside of the manifold:
 - a. Taco Model 006-VVST4
 - 1) Manufacturer Link:
[http://www.taco-hvac.com/uploads/FileLibrary/00-VVCirc\(PA08\).pdf](http://www.taco-hvac.com/uploads/FileLibrary/00-VVCirc(PA08).pdf)
 - 2. Circulating Pump for main header:
 - a. Taco Model 009-SFS Cartridge Circulator



- 1) Manufacturer Link:
<http://www.taco-hvac.com/uploads/FileLibrary/100-2.pdf>
 - b. FlowRange: 0 – 8 GPM
 - c. Head Range: 0 - 34 ft.
 - d. Casing: Bronze, with threaded or companion-flange connections.
 - e. Stator Housing: Aluminum
 - f. Impeller: Non-Metallic
 - g. Bearings: Carbon
 - h. O-Ring and Gaskets: EPDM
3. Circulating Pump for solar thermal system:
 - a. Taco Model 006-ST-4
 - 1) Manufacturer Link:
<http://www.taco-hvac.com/uploads/FileLibrary/101-028.pdf>
 - b. FlowRange: 0 – 10 GPM
 - c. Head Range: 0 - 9 ft.
 - d. Casing: Bronze, with threaded or companion-flange connections.
 - e. Stator Housing: Aluminum
 - f. Impeller: Non-Metallic
 - g. Bearings: Carbon
 - h. O-Ring and Gaskets: EPDM
4. Circulating Pump for solar thermal system:
 - a. Taco Model 006-ST-4
 - 1) Manufacturer Link:
<http://www.taco-hvac.com/uploads/FileLibrary/101-028.pdf>
 - b. FlowRange: 0 – 10 GPM
 - c. Head Range: 0 - 9 ft.
 - d. Casing: Bronze, with threaded or companion-flange connections.
 - e. Stator Housing: Aluminum
 - f. Impeller: Non-Metallic
 - g. Bearings: Carbon
 - h. O-Ring and Gaskets: EPDM
5. Booster Jet Pump for outdoor water storage tank:
 - a. Grundfos MQ 3-45
 - 1) Manufacturer Link:
<http://www.grundfos.com/products/find-product/mq.html#overview>
 - b. Maximum Flow Range: 22 GPM
 - c. Maximum Pressure: 65 PSI
 - d. Maximum lift: 25 Feet
 - e. Tank Volume: 13.5 oz.
 - f. 1" NPT Inlet and outlet connections
 - g. 115 V



2.2 MOTORS

- A. NEMA MG 1, "Standard for Motors and Generators." Include NEMA listing and labeling.
- B. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- C. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
- C. Support pumps and piping so weight of piping is not supported by pump volute.
- D. Install electrical connections for power, controls, and devices.
- E. Suspend in-line pumps independent from piping. Use continuous-thread hanger rods and vibration isolation hangers. Fabricate brackets or supports as required for pumps.
- F. Install vertical in-line pumps on concrete bases.
- G. Connect piping with valves that are at least the same size as piping connecting to pumps.
- H. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- I. Install shutoff valve and strainer on suction side of pumps.
- J. Install nonslam check valve and throttling valve on discharge side of pumps.
- K. Install thermostats in hot-water return piping.

END OF SECTION 22 11 23



SECTION 22 12 00 - FACILITY POTABLE-WATER STORAGE TANK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Potable Water Storage Tank
- B. Distribution Pipes and Fittings
- C. Cleanouts

1.2 RELATED DOCUMENTS

- A. Construction Documents – P-101, P-102, P-103, P-104, P-105, P-106, P-107, P-108, P-501, P-602
- B. Section 22 11 16 – Domestic Water Piping

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Manufacturer's Instructions

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Chem-tainer
 1. Capacity: 750 gallons
 2. Product Price: \$1,649.00

2.2 POTABLE-WATER STORAGE TANKS

- A. Polyethylene Potable-Water Storage Tanks: One Single-chamber, molded, HDPE construction; fabricated for potable-water storage tank application.
 1. Fill opening: 16-inch- (406-mm-) diameter opening with HDPE or PE access risers to grade and cover.
 2. Outlet/Drain: 1-1/4 in. x 1-1/4 in. (31.75 mm x 31.75mm)



2.3 DISTRIBUTION PIPES AND FITTINGS

- A. PEX Pipes and Fittings, see Section 22 11 16 – Domestic Water Piping

2.4 CLEANOUTS

- A. Cleanouts: ASME A112.36.2M, with round, flanged, cast-iron housing; and secured, scoriated, medium-duty loading class, cast-iron cover. Include cast-iron ferrule and countersunk brass cleanout plug.

PART 3 - EXECUTION

3.1 FACILITY POTABLE-WATER STORAGE TANK INSTALLATION

- A. Install potable-water storage tanks level.
- B. Water tank must be elevated above the ground by 3.5 in (81 mm) in accordance with Solar Decathlon Building Code 5-5d-iii.
- C. Fill potable-water storage tank with water.

END OF SECTION 22 12 00



SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipes and Fittings for Sanitary Waste and Vent Piping
- B. Trap Guard Floor Drain

1.2 RELATED DOCUMENTS

- A. Construction Documents – P-202

1.3 SECTION REQUIREMENTS

- A. Minimum Pressure Requirement for Soil, Waste, and Vent: **10-foot head of water (30 kPa)**.
- B. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. PVC Plastic, DWV Pipe and Fittings: ASTM D 2665, Schedule 40, plain ends with PVC socket-type, DWV pipe fittings.

2.2 FLOOR DRAIN

- A. Manufacturer: Jay R. Smith Floor Drain for Shower
 - 1. Basis-of-Design Adjustable finished area floor drain, Chrome Plated top
 - a. Product Number:
 - b. Reference Keynote: 22 13 16.A01
 - c. Quantity: 1
 - d. Strainer Size: 3-1/2 in.
- B. Manufacturer: Proflo Floor Drain
 - 1. Basis-of-Design Adjustable finished area floor drain, Chrome Plated top
 - a. Product Number: PF42890
 - b. Reference Keynote: 22 13 16.A03



- c. Quantity: 2
- d. Socket Size: 3-1/2 in. IPS Plastic Barrel with 5-3/4 in. Grate with 6 in. metal ring.
- e. Manufacturer Link:
http://www.proflo.com/proflo/showRecordDetail.do?R=PROD_1333328&search=true

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.
- B. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- C. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- D. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping **NPS 3 (DN 80)** and smaller; 1 percent downward in direction of flow for piping **NPS 4 (DN 100)** and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- E. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.



- F. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- G. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- H. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure unless otherwise indicated.
- I. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

- A. Aboveground Applications: Hubless, cast-iron soil pipe and fittings.

END OF SECTION 22 13 16



SECTION 22 13 53 - FACILITY SEPTIC TANKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Septic Tanks
- B. Cleanouts

1.2 RELATED DOCUMENTS

- A. Construction Documents – L-501, P-101, P-102, P-103, P-107, P-108, P-502, P-602

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Manufacturer's Instructions

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Chem-tainer
 - 1. Capacity: 750 gallons
 - 2. Product Price: \$1,649.00

2.2 SEPTIC TANKS

- A. Polyethylene Septic Tanks: One Single-chamber, molded, HDPE construction; fabricated for septic tank application, with access risers and manholes.
 - 1. Fill opening: 16-inch- (406-mm-) diameter opening with HDPE or PE access risers to grade and cover.
 - 2. Outlet/Drain: 1-1/4 in. x 1-1/4 in. (31.75 mm x 31.75mm)



2.3 CLEANOUTS

- A. Cleanouts: ASME A112.36.2M, with round, flanged, cast-iron housing; and secured, scoriated, medium-duty loading class, cast-iron cover. Include cast-iron ferrule and countersunk brass cleanout plug.

PART 3 - EXECUTION

3.1 SEPTIC TANK INSTALLATION

- A. Install septic tanks level.
- B. Septic tank must be elevated above the ground by 3.5 inches in accordance with Solar Decathlon Building Code 5-5d-iii.

END OF SECTION 22 13 53



SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Roof Drain
- B. Cleanouts

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-201, P-202, P-201, P-202, P-602

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Roof Drains:

1. Available Products:
 - a. Manufacturer : Proflo Roof Drains
 - b. Product Number: PF42870
 - c. Keynote: 22 14 23.A01
 - d. 3 in. PVC Roof Drain with Plastic Dome
 - e. Manufacturers Website:
http://www.proflo.com/proflo/showRecordDetail.do?R=PROD_1333313&search=true
2. Standard: ASME A112.6.4, for plastic roof drains.
3. Body Material: PVC.
4. Outlet: Bottom.

B. Cleanouts:

1. Standard: ASME A112.36.2M.
2. Application: Wall cleanout.
3. Body or Ferrule Material: Plastic.
4. Clamping Device: Required.



5. Closure: Plastic plug.
6. Adjustable Housing Material: Plastic with threads.
7. Frame and Cover Material and Finish: Stainless steel.
8. Frame and Cover Shape: Round Insert other or delete this subparagraph.
9. Top-Loading Classification: Light Duty.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- B. Install floor drains at low pints of surface areas and where indicated. Set tops of drains flush with finished floor.
 1. Trap drains connected to sanitary building drain.
 2. Install drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes.
- C. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

END OF SECTION 22 14 23



SECTION 22 33 13 - INSTANTANEOUS ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Water Heaters, General
- B. Instant Electric Water Heaters

1.2 RELATED DOCUMENTS

- A. Construction Documents – P-101, P-102, P-103, P-501
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.
- C. Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

PART 2 - PRODUCTS

2.1 WATER HEATERS, GENERAL

- A. Insulation: Suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.
- B. Anode Rods: Factory installed, magnesium.
- C. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.



- D. Drain Valve: Factory or field installed.

2.2 INSTANT ELECTRIC WATER HEATERS

A. Available Products:

1. Stiebel Eltron DHC 10-2 Series Tankless Electric Water Heater 29 plus
2. Product Website:
<http://www.gotankless.com/install-dhc-tankless.pdf>

B. Thermostat-Control, Instantaneous Electric Water Heaters: UL 499, 0.79-gal. (3.0-L) capacity; with 150-psi (10-bar) working-pressure rating; 240 volts, 9.6 kW.

1. Amperage: 40
2. Minimum required circuit breaker size: 50 Amps
3. Recommended Wire Size: 8 AWG Copper
4. Water Connections: ½" NPT

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install vacuum relief valves in cold-water-inlet piping.
- B. Install shutoff valves and unions at hot- and cold-water piping connections.
- C. Make piping connections with dielectric fittings where dissimilar piping materials are joined.
- D. Electrically ground units according to authorities having jurisdiction.

END OF SECTION 22 33 13



SECTION 22 35 23 - CIRCULATING, DOMESTIC WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Dual Heat Exchanger, Indirect Water Heater

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-104, M-201, M-205, M-602, M-603, P-101, P-102, P-103, P104, P-105, P-501
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 DUAL HEAT EXCHANGER INDIRECT WATER HEATER

- A. Manufacturer: Bradford White
 - 1. Manufacturer Website:
<http://www.bradfordwhite.com/>
- B. Tank Capacity: 70 GALLON Water Heater
- C. Coil Volume: 2.7 Gallons
- D. Coil Heat Transfer Area: 14.2 sq. ft.
- E. Thermostat and Pressure Relief Valve Location (3/4" NPT)
- F. Exchanger 1, Connection 2 Single Wall (1" NPT)
- G. Exchanger 2, Connection 3 Double Wall (3/4" NPT)
- H. Exchanger2, Connection 4 Double Wall (3/4" NPT)
- I. Drain Coupling – 3/4" NPT



- J. Drain Valve – 5/8" NH

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in manufacturer's written instructions.
- B. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.
- C. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.
- D. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.
- E. Correct deficiencies in or remove and reinstall that does not comply with requirements.
- F. Repair, refinish, or replace damaged during installation, as directed by Architect.
- G. Adjust operating parts and hardware for smooth, quiet operation and weathertight closure. Lubricate hardware and moving parts.

END OF SECTION 22 35 23



SECTION 22 41 00 - RESIDENTIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Water Closet
- B. Lavatory
- C. Shower
- D. Kitchen Sink

1.2 RELATED DOCUMENTS

- A. Construction Documents – I-201, I-202, I-203, I-501, I-523, I-524, P-101, P-102, P-103, P-201, P-202, P-501, P-502
- B. Section 12 35 30.13 – Residential Kitchen Casework
- C. Section 12 36 13 – Concrete Sinks and Countertops

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.



PART 2 - PRODUCTS

2.1 WATER CLOSET, Reference Keynote – 22 41 00.A01:

- A. Vitreous-China Water Closet: Elongated, siphon-jet type, floor-mounted, floor outlet with one-piece bowl and tank.
 - 1. Basis-of-Design Product: Kohler San Raphael K-3597 comfort height toilet.
 - 2. Design Consumption: 1.0 gal./flush (3.8 L/flush).
 - 3. ADA Compliant
 - 4. Product Website:
http://www.us.kohler.com/onlinecatalog/pdf/1086530_4.pdf

2.2 LAVATORY , Reference Keynote – 12 36 13.A02:

- A. Concrete Lavatory. See section **12 36 13 Concrete Countertop/Sink:**
- B. Faucets: ASME A112.18.1; solid-brass underbody and brass cover plate.
 - 1. Basis-of-Design Product: Moen 90 Degree chrome faucet
 - 2. Product Number: 6700
 - 3. Type: Center set with central inlets and with pop-up waste.
 - 4. Finish: Polished chrome-plate.
 - 5. Handle(s): Dual, metal lever.
 - 6. Maximum Flow Rate: 1.3 gpm (4.92 L/min.).
 - 7. Reference Keynote – 22 41 00.A03
 - 8. Product Website:
http://www.moen.com/90-degree/chrome-two-handle-high-arc-roman-tub-faucet/_/R-CONSUMER%3AT903
- C. Drain: Brass construction, 1-1/4 in connection, pop up stopper
 - 1. Basis-of-Design Product: Kohler Pop-Up Clicker Drain
 - 2. Product Number: K-7124
 - 3. Finish: Polished Chrome
 - 4. Product Website:
http://www.us.kohler.com/onlinecatalog/detail.jsp?item=11987402&prod_num=7124
- D. Trap: Plastic tubular fittings with slip-joint inlet and wall flange.
- E. Supply and Drain Insulation: Soft-plastic covering; removable at stops.
- F. Fixture Support: Concealed arm for wall-mounting, lavatory-type fixture.



- 2.3 SHOWER, Reference Keynote – 22 41 00.A02:
- A. Shower Base Receptor: Integral Precast Concrete Receptor. Include integral corrosion-resistant-metal drain with removable strainer and NPS 2 (DN 50) bottom outlet.
 - 1. Type: Accessible.
 - B. Pressure Balance Valve Trim:
 - 1. Basis-of-Design Product: Grohe Allure
 - a. Product Number: 19 375
 - b. Price: \$
 - c. Reference Keynote: 22 41 00.A5
 - 2. Body Material: Chrome.
 - 3. ADA Compliant
 - 4. Product Website:
<http://www.groheamerica.com/lib/1/tpi/1362146.pdf>
 - C. Universal Pressure Balance Rough-In Valve:
 - 1. Basis-of-Design Product: Grohesafe
 - a. Product Number: 35 015
 - b. Price: \$
 - 2. Product Website:
<http://www.groheamerica.com/lib/1/tpi/1288624.pdf>
 - 3. Description: Handle limit stop, diaphragm cartridge, check valves, built-in by-pass, service stops, includes cap and plug for 3 port installation, universal connection is ½ in male by copper sweat.
 - 4. Flow Rate:
 - a. Top port: 5.5 gpm at 45 psi (21 L/min)
 - b. Bottom port: 5.8 gpm at 45 psi (22 L/min)
 - 5. Code Compliance: ASME/ANSI A112.18.1M, ASSE Standard 1016, CSA Standard B125.1-05
 - D. Wall Union
 - 1. Basis-of-Design Product: Grohe Accessories
 - a. Product Number: 28 627
 - b. Price: \$
 - 2. Description: Wall union for hand shower hose connection, 1/2 in. NPT female thread inlet.
 - 3. Code Compliance: ASME/ANSI A112.18.1M
 - E. Shower System:
 - 1. Basis-of-Design Product: Euphoria Wall Mounted Diverter Shower System
 - a. Product Number: 27 421



- b. Price: \$695.00
2. Flow Rate: 2.5 GPM at 80 psi (9.5 L/m)
3. Body Material: Chrome.
4. Shower Head: Euphoria shower head
 - a. Product Number: 28 233
 - b. Rain Spray with ball joint, turning angle +/- 20°.
5. Handheld Shower: Euphoria Hand Shower
 - a. Product Number: 27 238
 - b. Normal, eco spray.
6. ADA Compliant
7. Product Website:
<http://www.grohecatalog.com/product/27421>

2.4 KITCHEN SINK , Reference Keynote – 12 36 13.A01:

- A. See section **12 36 13 Concrete Countertop/Sink**
- B. Faucet: Solid-brass underbody and brass cover plate. Maximum **2.2 gpm (0.13 L/s)**.flow rate.
 1. Basis-of-Design Product: Moen 90 Degree Sink Faucet.
 - a. Product Number: S7170
 - b. Reference Keynote – 22 41 00.A04
 - c. Product Price: \$322.00
 - d. Product Website:
http://www.moen.com/90-degree/chrome-one-handle-high-arc-kitchen-faucet/_/R-CONSUMER%3AS7170
 2. Type: Single hole mounting, flexible supply lines with 3/8" fittings connected directly to stops.
 3. Flow: 2.2 gpm (8.3 L/min) at 60psi
 4. Cartridge: 1255 Duralast cartridge for Single-Handle Faucets
 5. ADA Compliant
 6. Finish: Chrome
- C. Drain(s): **3-1/2-inch (89-mm)** grid strainer with **NPS 1-1/2 (DN 40)** tubular-brass tailpiece.
 1. Basis-of-Design Product: Kohler Duostrainer Dry Sink Strainer
 2. Product Number: K-8816
 3. Finish: Polished chrome-plate.
 4. Product Website:
http://www.us.kohler.com/onlinecatalog/detail.jsp?item=469002&prod_num=8816



PART 3 - EXECUTION

3.1 INSTALLATIONS

- A. Install fitting insulation kits on fixtures for people with disabilities.
- B. Install fixtures with flanges and gasket seals.
- C. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- D. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- E. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.
- F. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.
- G. Fasten wall-mounted fittings to reinforcement built into walls.
- H. Fasten counter-mounting plumbing fixtures to casework.
- I. Secure supplies to supports or substrate within pipe space behind fixture.
- J. Set shower receptors and mop basins in leveling bed of cement grout.
- K. Install individual supply inlets, supply stops, supply risers, and tubular brass traps with cleanouts at fixture.
- L. Install water-supply stop valves in accessible locations.
- M. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes unless otherwise indicated.
- N. Install disposers in sink outlets. Install switch where indicated, or in wall adjacent to sink if location is not indicated.
- O. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.
- P. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.



- Q. Install piping connections between plumbing fixtures and piping systems and plumbing equipment. Install insulation on supplies and drains of fixtures for people with disabilities.
- R. Ground equipment.

END OF SECTION 22 41 00



SECTION 22 70 00 - PARALLEL WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Parallel Water Distribution Systems

1.2 RELATED DOCUMENTS

- A. Construction Documents – P-101, P-102, P-104, P-602
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 REFERENCES

- A. ASTM F876 specification for Cross-linked Polyethylene (PEX) tubing
- B. ASTM F877 specification for Cross-linked Polyethylene (PEX) plastic hot and cold water distribution systems.
- C. ASTM F2023 test method for evaluating the oxidative resistance of Cross-linked (PEX) tubing and systems to hot chlorinated water.
- D. ASTM F1807 specification for metal insert fittings utilizing a copper crimping for SDR9 Cross-linked Polyethylene (PEX) tubing
- E. ASTM F2159 specification for plastic insert fittings utilizing a copper crimping for SDR9 Cross-linked Polyethylene (PEX) tubing
- F. CSA CAN/CSA B137.5 Cross-linked Polyethylene (PEX) tubing systems for pressure applications.
- G. NSF 14 – plastic piping component and related materials
- H. NSF 61 – drinking water system components – health effects
- I. AWWA C651 standard for disinfecting water mains
- J. IAPMO Uniform Plumbing Code
- K. IAPMO Uniform Mechanical Code



- L. ICC International Plumbing Code
- M. ICC International Mechanical Code
- N. NAPHCC National Standard Plumbing Code
- O. cULus - UL 1821 listing for Multipurpose residential fire sprinkler systems (ViegaPEX Ultra Black and PEX Press fittings in 3/4" - 2" sizes only).

1.4 QUALITY ASSURANCE

- A. The installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of Cross-linked Polyethylene (PEX) tubing systems.
- B. The installation of Cross-linked Polyethylene (PEX) tubing for hot and cold water distribution systems shall conform to the requirements of the ICC International Plumbing Code or IAPMO Uniform Plumbing Code.

1.5 DELIVERY, STORAGE, HANDLING

- A. The Cross-linked Polyethylene (PEX) tubing shall be shipped to the job site on truck or in such a manner to protect the tubing. The Cross-linked Polyethylene fittings and manifolds shall not be handled rough during shipment. The tubing and fittings shall be unloaded with reasonable care.
- B. Cross-linked Polyethylene plastic tubing and fittings shall be stored in a flat, dry, well ventilated location, not exposed to direct sunlight. Normal care in handling shall be exercised to avoid abuse of the tubing. The tubing and fittings shall not be thrown or dropped on the ground, walked on, or dragged.

1.6 PROJECT CONDITIONS

- A. The location of a manifold with valves shall be accessible and in an area not subject to freezing. Proper support of the manifold shall be provided.
- B. PEX tubing should not be left exposed in direct sunlight for extended periods of time – short periods not to exceed 60 days are permissible.
- C. Plastic manifolds and fittings should not be left exposed in direct sunlight for extended periods of time — short periods not to exceed 15 days are permissible.

1.7 WARRANTY



- A. The tubing and fittings manufacturer shall warrant that the tubing and fittings are free from defects and conform to the designated standard. The warranty shall only be applicable to tubing and fittings installed in accordance with the manufacturer's installation instructions.
- B. The manufacturer of the tubing and fittings shall not be responsible for improper use, handling, or installation of the products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. PureFlow Water System: ViegaPEX manufactured by:
 - 1. Viega LLC, 301 N. Main Street, Floor 9, Wichita, KS 67202, 316-425-7400.
 - 2. Manufacturer Link:
http://www.viega.net/cps/rde/xbcr/en-us/Manabloc_sell_sheet_0310_v3.pdf

2.2 MATERIAL

- A. Tubing Standard: ViegaPEX High-Density Cross-linked polyethylene tubing shall be manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03. The following three standard grade ratings are required.
 - 1. 200 degrees F (93 degrees C) at 80 psig (551 kPa)
 - 2. 180 degrees F (82 degrees C) at 100 psig (689 kPa)
 - 3. 73.4 degrees F (23 degrees C) at 160 psig (1102 kPa)
- B. Chlorine testing: According to ASTM F876 shall meet or exceed the following end use condition.
 - 1. End use conditions of : 100% @ 140°F
 - a. Per PEX 5006 (CL5) or NSF P171 (CLR)
- C. Tubing Standard: FostaPEX High-Density Cross-linked polyethylene tubing shall be manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03. The following three standard grade ratings are required.
 - 1. 200 degrees F (93 degrees C) at 80 psig (551 kPa)
 - 2. 180 degrees F (82 degrees C) at 100 psig (689 kPa)
 - 3. 73.4 degrees F (23 degrees C) at 160 psig (1102 kPa)
- D. Fitting Standard: PEX Press fittings shall be manufactured from UNS C83600, C87700 or C87710 Bronze and meet the requirements of ASTM F877 tested



as a system with ViegaPEX tubing. The PEX Press sleeve shall be manufactured out of a 304 grade or better stainless steel and have one to three view holes incorporated in it to ensure proper PEX tubing insertion.

- E. Fitting Standard: PEX Crimp fittings for use with copper crimp rings shall be manufactured from UNS C36000, C37700, C69300 or C87850 Brass/ Eco Brass® meeting the requirements of ASTM F1807 and or PolyAlloy™ polymer meeting the requirements of ASTM F2159. The PEX Crimp connection shall be made by use of a full circle crimp tool designed to crimp F1807 copper crimp rings.
- F. Manifolds: Acceptable manifolds shall include:
 - 1. Copper Manifolds: Shall be copper material having a male or female solder, ProPress or PEX Crimp inlets. All outlets shall be PEX Press, PEX Crimp or ProPress fittings. Shall be provided by the Cross- linked Polyethylene system manufacturer.
 - 2. Polymer Manifolds: Shall be plastic material having a male NPSM thread, PEX Press or PEX Crimp inlets. All outlets shall be PEX Press, PEX Crimp, or PEX compression connections provided by the PEX system manufacturer.
- G. Adapter Fittings: PEX adapter fittings shall conform to one of the following ASTM standards; F877, F1807, F2159, or ASME B1.20.1 and be listed to the CSA B137.5. The adapter fittings shall mate to NPT threads, copper tubing, copper fittings or ProPress fittings.

2.3 SOURCE QUALITY CONTROL

- A. The PEX tubing and fitting manufacturer shall maintain a third party listing of the tubing and fittings. The tubing and fittings shall be certified in accordance with ANSI/NSF 14/61 to verify suitability to transport potable water. The tubing and fittings shall have the mark "NSF-pw", "cNSF® us pw-G", or "NSF 61" permanently marked on the product to verify the material listing.
- B. The manufacturer of the PEX tubing and fittings shall maintain a quality control program in accordance with ISO 9001 or NSF International in the manufacturing plant to assure that the tubing and fittings are continually being produced to the required standard. The tubing and fittings shall be certified as complying with NSF 14.

PART 3 - EXECUTION

3.1 EXAMINATION



- A. The installing contractor shall carefully examine the PEX tubing for defects, cuts, abrasions, cracks, fading color, or blemishes. There shall be no cracks or heavy deformations of the tubing. Fittings and manifolds shall be checked for any signs of abuse. Any damaged tubing or fittings shall be rejected.

3.2 PREPERATION

- A. ViegaPEX Tubing: Cross-linked Polyethylene tubing shall be cut with a PEX tubing cutter. The tubing shall be cut squarely and neatly to permit a proper connection between the tubing and fitting.
- B. FostaPEX Tubing: Cross-linked Polyethylene tubing shall be cut with a PEX cutter. The tubing shall be cut squarely and neatly to permit a proper connection between the tubing and fitting. The outer polyethylene and aluminum layers shall be removed with a Viega supplied prep tool leaving the inner PEX tubing to accept the PEX Press fitting and stainless press sleeve. The prep tool shall have an internal stop to ensure proper length of exposed inner PEX tubing.

3.3 INSTALLATION GENERAL LOCATIONS

- A. Plans indicate general location and arrangement of PEX system. Identified locations and arrangements are used to size pipe and calculate friction and loss and other design considerations. Install PEX tubing as indicated, except where deviations to layout are approved on coordination drawings.

3.4 INSTALLATION, PEX TUBING

- A. Pressure Rating: Install components having a pressure rating equal to or greater than the system operating pressure.
- B. Install PEX tubing that is free of blemishes, cuts, gouges, kinks or noticeable fading of color.
- C. Changes in Direction: PEX tubing shall not exceed an eight times the tubing outside diameter (OD) free bend radius or a five times the tubing OD supported bend radius, with use of a Viega approved bend support. Install fittings for changes in direction where any minimum bend radius is exceeded and branch connections.
- D. PEX Press Connections: Bronze PEX Press fittings shall be made in accordance with the manufacturer's installation instructions. The Stainless press sleeve shall be placed over the end of the squared off PEX tubing while fully inserting the fitting barb into the tubing. Full tubing insertion shall be verified by a visual confirmation of PEX being present through the view holes before engaging a press connection. The PEX Press connection shall be



made with a Viega supplied ratcheting PEX Press hand tool or PEX Press power tool.

- E. PEX Crimp Connections: PEX Crimp fittings shall be made in accordance with the manufacturer's installation instructions. The copper crimp ring shall be placed over the end of the squared off PEX tubing then the PEX Crimp fitting fully inserted into the tubing. Position the crimp ring 1/8" to 1/4" from the end of the tubing before engaging a crimp connection. The PEX Crimp connection shall be made with a Viega supplied full circle crimp tool or equivalent.
- F. Threaded Joints: Threaded joints shall have a potable water listed joint sealant tape applied to the male threads only. Tighten joint with a wrench and backup wrench as required.
- G. PEX Tubing Protection: Protect PEX tubing from exposure to direct and indirect sunlight exposure. PEX tubing shall be stored under cover, shielded from direct and indirect sunlight when material is stored for any length of time.
- H. Penetration Protection: Provide allowance for thermal expansion and contraction of PEX tubing passing through a wall, floor, ceiling or partition by wrapping with pipe insulation, or by installing through an appropriately sized sleeve. Penetrations of fire resistance rated assemblies shall maintain the rating of the assembly.
- I. Backfill Material: Back fill material must be free of large rocks, glass, or other sharp objects which can damage the PEX tubing.
- J. Horizontal Support: PEX tubing must be supported every 32" horizontally with Viega approved suspension clips or plastic insulators.
- K. Vertical Support: PEX tubing must be supported at each floor or ceiling penetration and every four feet in between.

3.5 FIELD QUALITY CONTROL

- A. Water Testing: The PEX tubing system shall be pressure tested in accordance with local code after installation or to at least minimum system working pressure, no less than 40 psi, and for a period of no less than 15 minutes. Water used for this testing shall come from a potable water source. Test should not exceed pressure rating of PEX tubing and shall have no leaks.
- B. Air Testing: In lieu of a water test, the PEX tubing system shall be air tested in accordance with local code after installation, or at least system working pressure, no less than 40 psi and no greater than 100 psi. The test shall be conducted for a period of no less than 15 minutes and shall have no leaks.



3.6 CLEANING

- A. Disinfection: The PEX hot and cold water distribution system may require system disinfection. When no other method is available, follow the time limitations and exposure levels listed below.
1. Flush the system with potable water until discolored water does not appear at any of the outlets.
 2. Fill the system with a water chlorine solution containing at least 50 parts per million of chlorine. The system shall be valved in the closed position and to stand for 24 hours. Alternatively, the system shall be filled with water chlorine solution containing at least 200 parts per million of chlorine. The System shall be valved in the closed position and allowed to stand for 3 hours.
 3. Following the standing time, the system shall be flushed with water until the chlorine is purged from the system.

END OF SECTION 22 70 00



DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING



SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sleeves
- B. Grout
- C. Motors
- D. Hangars and Supports
- E. Pressure Gages and Test Plugs

1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Mechanical Sleeve Seals: Modular rubber sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- D. PVC Pipe: ASTM D 1785, Schedule 40.

2.2 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2.3 MOTORS

- A. Motor Characteristics:



1. Motors Smaller Than 1/2 HP: Single phase.
2. Frequency Rating: 60 Hz.
3. Voltage Rating: NEMA standard voltage for circuit voltage to which motor is connected.
4. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
5. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
6. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
7. Enclosure: Unless otherwise indicated, open dripproof.
8. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

2.4 HANGERS AND SUPPORTS

- A. Hanger and Pipe Attachments: Factory fabricated with galvanized coatings; nonmetallic coated for hangers in direct contact with copper tubing.
- B. Powder-Actuated Fasteners: Threaded-steel stud, with pull-out and shear capacities appropriate for supported loads and building materials where used.

2.5 PRESSURE GAGES AND TEST PLUGS

- A. Pressure Gages: Direct-mounting, indicating-dial type complying with ASME B40.100. Dry metal case, minimum 2-1/2-inch (63-mm) diameter with red pointer on white face, and plastic window. Minimum accuracy 3 percent of middle half of range. Range two times operating pressure.
- B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating of 500 psig at 200 deg F (3450 kPa at 93 deg C).

PART 3 - EXECUTION

3.1 MOTOR INSTALLATION

- A. Anchor motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions.



3.2 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Install sleeves for pipes passing through concrete walls, and concrete floor and roof slabs.
- D. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
- E. Comply with requirements in Division 07 Section "Penetration Firestopping" for sealing pipe penetrations in fire-rated construction.
- F. Install unions at final connection to each piece of equipment.
- G. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.
- H. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.3 GENERAL EQUIPMENT INSTALLATIONS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.4 BASES, SUPPORTS, AND ANCHORAGES

- A. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger in both directions than supported unit.
 - 2. Install dowel rods on **18-inch (450-mm)** centers around the full perimeter of the base to connect concrete base to concrete floor.



3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Use [3000-psi (20.7-MPa)] <Insert value>, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete"
- B. Mix and install grout for pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

3.5 HANGERS AND SUPPORTS

- A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.
- B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.
- C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.
- D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:



1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**, if longer ends are required for riser clamps.

3.6 VIBRATION ISOLATION AND SEISMIC CONTROL DEVICE INSTALLATION

- A. Adjust vibration isolators to allow free movement of equipment limited by restraints.
- B. Install resilient bolt isolation washers and bushings on equipment anchor bolts.
- C. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

END OF SECTION 23 05 00



SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. General Duty Valves

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 GENERAL-DUTY VALVES

- A. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and **600-psig (4140-kPa)** minimum CWP rating and blowout-proof stem.
- B. Bronze, Swing Check Valves: Class 125, bronze body with bronze or nonmetallic disc and seat.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use gate and ball valves for shutoff duty.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves for each fixture and item of equipment.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in a position to allow full stem movement.



- F. Install check valves for proper direction of flow in horizontal position with hinge pin level.

END OF SECTION 23 05 23



SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Insulation Materials

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Quality Assurance: Labeled with maximum flame-spread index of 25 and maximum smoke-developed index of 50 according to ASTM E 84.

PART 2 - PRODUCTS

- A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- C. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.
- D. Mineral-Fiber Board Insulation: Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ with factory-applied FSK jacket.
- E. Mineral-Fiber, Pipe and Tank Insulation: Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB; and having factory-applied ASJ. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less.
- F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.



- G. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
- H. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- I. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 3 - EXECUTION

3.1 INSULATION INSTALLATION

- A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Division 07 Section "Penetration Firestopping."
- D. Flexible Elastomeric Insulation Installation:
 - 1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Mineral-Fiber Insulation Installation:
 - 1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at **6 inches (150 mm)** o.c.
 - 3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 - 4. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.



5. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier.

F. Polyolefin Insulation Installation:

1. Seal split-tube longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of polyolefin pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

G. Plenums and Ducts Requiring Insulation:

1. Concealed and exposed supply and outdoor air.
2. Concealed and exposed return air located in nonconditioned space.
3. Concealed and exposed exhaust between isolation damper and penetration of building exterior.

H. Plenums and Ducts Not Insulated:

1. Metal ducts with duct liner.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

I. Piping Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawlspaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.2 DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed duct insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
3. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
4. Polyolefin: 1 inch (25 mm) thick.



END OF SECTION 23 07 00



SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ducts
- B. Accessories

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-101, M-103, M-201, M-202, M-203, M-204, M-601: Duct Schedule

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data for fire and smoke dampers[and Shop Drawings detailing duct layout and including locations and types of duct accessories, duct sizes, transitions, radius and vaned elbows, special supports details, and inlets and outlet types and locations].
- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- C. Comply with NFPA 96 for ducts connected to commercial kitchen hoods.
- D. Comply with UL 181 for ducts and closures.

PART 2 - PRODUCTS

2.1 DUCTS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip galvanized coating.
 - 1. Reference Keynote: 23 31 13.13
- B. Joint and Seam Tape, and Sealant: Comply with UL 181A.
- C. Rectangular Metal Duct Fabrication: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Rectangular Transition



- a. Reference Keynote: 23 31 13.19

2.2 ACCESSORIES

- A. Volume Dampers and Control Dampers: Single-blade and multiple opposed-blade dampers, standard leakage rating, and suitable for horizontal or vertical applications; factory fabricated and complete with required hardware and accessories.
- B. Fire Dampers: Rated and labeled according to UL 555 by an NRTL; factory fabricated and complete with required hardware and accessories.
- C. Ceiling Fire Dampers: Labeled according to UL 555C by an NRTL and complying with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory." Provide factory-fabricated units complete with required hardware and accessories.
- D. Smoke Dampers: Labeled according to UL 555S by an NRTL. Combination fire and smoke dampers shall also be rated and labeled according to UL 555. Provide factory-fabricated units complete with required hardware and accessories.
- E. Flexible Connectors: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- F. Flexible Ducts: [Spiral-wound steel spring with flameproof vinyl sheathing] [Corrugated aluminum] [Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-inch- (25-mm-) thick, glass-fiber insulation around a continuous inner liner] complying with UL 181, Class 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
 - 2. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
 - 3. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 4. Unconditioned Space, Return-Air Ducts: Seal Class B.



5. Conditioned Space, Supply-Air Ducts in Pressure Classes **2-Inch wg (500 Pa)** and Lower: Seal Class C.
 6. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than **2-Inch wg (500 Pa)**: Seal Class B.
 7. Conditioned Space, Exhaust Ducts: Seal Class B.
 8. Conditioned Space, Return-Air Ducts: Seal Class C.
- C. Conceal ducts from view in finished and occupied spaces.
 - D. Avoid passing through electrical equipment spaces and enclosures.
 - E. Support ducts to comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Hangers and Supports."
 - F. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
 - G. Install volume and control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
 - H. Install fire dampers according to UL listing.
 - I. Install fusible links in fire dampers.
 - J. Clean new duct system(s) before testing, adjusting, and balancing.
- 3.2 TESTING, ADJUSTING, AND BALANCING
- A. Balance airflow within distribution systems, including submains, branches, and terminals to indicated quantities.

END OF SECTION 23 31 00



SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wall Registers
- B. Wall Grilles

1.2 RELATED DOCUMENTS

- A. Construction Documents – I-201, I-202, I-203, I-204, I-521, I-523, M-101, M-103, M-105, M-201,

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data and color charts for factory finishes.

PART 2 - PRODUCTS

2.1 OUTLETS AND INLETS

A. Wall Registers:

- 1. Available Products:
 - a. To Be Determined.
- 2. Keynote: 23 37 13.A1
- 3. Material: Aluminum.
- 4. Finish: Baked enamel, color selected by Architect.
- 5. Mounting: Lay in wall.

B. Wall Grilles:

- 1. Available Products:
 - a. To be Determined.
- 2. Keynote: 23 37 13.A2
- 3. Material: Aluminum.
- 4. Finish: Baked enamel, color selected by Architect.
- 5. Mounting: Lay in.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13



SECTION 23 56 13.19 - HEATING SOLAR VACUUM-TUBE COLLECTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Heating Solar Vacuum-Tube Collectors

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-101, A-112, E-102, M-602, M-603, P-104, P-105

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Heating Solar Vacuum-Tube Collectors to comply with the following testing standards: SPF Quality Test EN12975-2: 2001, Section 5. SRCC tested according to 600 kPa max pressure.

PART 2 - PRODUCTS

2.1 HEATING SOLAR VACUUM-TUBE COLLECTORS

- A. Manufacturer
 - 1. Apricus Solar Hot Water
6 Sycamore Way, Unit 2
Branford, CT 06405
Tel: 1-877-458-2634
<http://www.energymatters.com.au/images/apricus/Brochure.pdf>
- B. Product Details
 - 1. Length: 1500mm/1800mm
 - 2. Outer Tube Diameter: 58 mm
 - 3. Inner Tube Diameter: 47 mm
 - 4. Glass Thickness: 1.6 mm
- C. Capacities:
 - 1. Tube Material: Borosilicate Glass 3.3
 - 2. Tube Coating: Graded Al-N/A
 - 3. Thermal Expansion: 3.3×10^{-6} C
 - 4. Absorption: >94% (AM 1.5)



5. Emittance: <8% (80 C)
6. Vacuum: $P < 5 \times 10^{-3}$ Pa
7. Stagnation Temperature: >200 F
8. Heat Loss: <0.8 W/(m² C)
9. Maximum Strength: 0.8 MPa

2.2 PERFORMANCE AND DESIGN CRITERIA

A. HEATING SOLAR VACUUM-TUBE COLLECTORS

1. Max Flow Rate: 3.9 G/min (15 L/min)
2. Efficiency: $G = 253$ BTU/ft² (800 W/m²)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's specifications.

END OF SECTION 23 56 13.19



SECTION 23 72 23 - ENERGY RECOVERY VENTILATOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Energy Recovery Ventilator

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-103, M-105, M-201, M-204
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data
- B. Certification: ARI 1060 Certified, ETL listed.

PART 2 - PRODUCTS

2.1 HEAT RECOVERY VENTILATOR

- A. Basis-of-Design Product: Conserv C75 Air-to Air Energy Recovery Ventilator
- B. Manufacturer: Dais Analytic
 - 1. Product Website:
<http://www.conserv.com/commercial/pdf/H%20Series%20Residential%20Systems/H75i.pdf>
 - 2. Product Ratings:
<http://conserv.com/commercial/pdf/Literature/ARI%20Certifications/C75.pdf>
- C. Specifications:
 - 1. Weight: 27 lb.
 - 2. Air Flow:
 - a. Nominal: 75 SCFM
 - b. Maximum: 94 SCFM
 - 3. Voltage: 120 VAC
 - 4. Circuit: 60 hz, single phase
 - 5. Power: 90W



2.2 FILTERS AND INSULATION

- A. Washable polyester fiber filter.
- B. Insulation: 1 in. fiberglass (4.2 R-value)

2.3 CONTROLS

- A. Rocker switch and external terminals operate internal relay.

2.4 DUCT CONNECTION

- A. 5 in (127mm) duct collars.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturer's instructions.

END OF SECTION 23 72 23



SECTION 23 81 13 - PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Packaged Units
- B. Capacities and Characteristics of Packaged Units

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-101, M-102, M-201, M-204, M-602, P-104, P-106
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data, color charts for cabinet finishes, and Shop Drawings, including wall penetrations, and attachments to other work.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.
- D. Warranties: Submit a written warranty signed by manufacturer agreeing to repair or replace components that fail within five years after Substantial Completion.

PART 2 - PRODUCTS

2.1 PACKAGED UNITS

- A. Available Products:
 - 1. Basis-of-Design Product: HPY08 Hi-Performance Hideaway with Plenum, International Environment Corporation.
 - a. Product Website:



<http://www.iec-okc.com/portals/0/documents/l100-90002104.pdf>

- B. General: Factory assembled Hi-Performance horizontal fan coil units complete with water coil, fan, motor, drain pan, and all required piping and controls.
- C. Units shall be constructed of heavy gauge galvanized steel.
- D. The interior surfaces shall be lined with ½" fiberglass insulation.
- E. A heavy gauge plenum shall enclose the blower/motor assembly with bottom or rear return air path.
- F. Units shall be supplied with a ducted collar for supply duct connection.
- G. Units shall have a galvanized drain pan extending the entire width of the coil.
- H. Galvanized drain pans shall be internally coated with a 2-part closed cell foam insulation.
- I. Units shall have throwaway, permanent, or pleated filters.

2.2 CAPACITIES AND CHARACTERISTICS

- A. Airflow: 800 cfm (L/s).
- B. Cooling Capacity
 1. Total MBH: 23.4
 2. Sensible MBH: 17.6

2.3 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Factory test to comply with ARI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
- B. Unit Performance Ratings: Factory test to comply with AHRI Standard 440-2008.
- C. Each coil shall be factory tested for leakage at 300 psig air pressure with coil submerged in water.
- D. Insulation and adhesive shall meet NFPA-90A requirements for flame spread and smoke generation.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set wall sleeve level and plumb in exterior wall. Coordinate installation with exterior wall construction.
- B. Install units level and plumb, and anchor.
- C. Connect units to wiring systems and to ground.

END OF SECTION 23 81 13



SECTION 23 81 43 - AIR SOURCE UNITARY HEAT PUMP

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Reverse Cycle Chiller (Exterior)

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-202, M-205, M-602, P-101, P-106
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with ASHRAE 15 and ASHRAE 90.1.
- D. Comply with safety requirements in UL 484 and UL 1995.
- E. Warranty: Submit a written warranty signed by manufacturer agreeing to repair or replace refrigeration components that fail within five years after Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Basis-of-Design Products: Aqua Products RUUD RQRM 2.5 ton unit with H2O to R410a heat exchanger.

- B. Manufacturer:

- 1. Aqua Products Company, Inc. Tel: 800-849-4264
P.O. Box 39 Fax: 803-321-1980
Prosperity, SC 29127
www.aquaproducts.us



- C. Factory-assembled and -tested, packaged air-source unitary heat pump complete with controls.
- D. Cabinet: Galvanized-steel casing: Front and back access panels for simplified maintenance, surpassed 1000 hour salt spray test, ETL certified internal electrical panel.
- E. Heat Pump:
 - 1. Coils: Copper Tubing with aluminum fins
 - 2. Up to 18 SEER and 9+ HSPF Ratings
- F. Refrigeration:
 - 1. Factory Charged with R-410A
 - 2. Liquid Line enhanced filter dryer
 - 3. Sight glass with moisture indicator
 - 4. Thermal expansion valves
 - 5. High/low pressure safety switches
- G. Water Circuit and Heat Exchanger: High quality, freeze resistant tube and shell, refrigerant and water flow are counter flow for maximum exchange.
 - 1. Water lines: Rigid Copper
 - 2. Flow Rate: 7.5 gpm
 - 3. PSI Drop: 3.3
 - 4. Refrigerant: 40% Glycol Mixture
- H. Electrical Circuit: Single point main power connection, ETL Listed, digital controller, voltage monitor, low ambient fan cycle control, short cycle control:
 - 1. Voltage Range: 208-230
 - 2. Min. Circuit: 20.75
 - 3. Max Fuse: 40
 - 4. RLA: 19.4

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Connect supply and return hydronic piping to heat pump with hose kits.
- B. Install electrical devices furnished by manufacturer but not specified to be factory mounted.
- C. Install piping adjacent to machine to allow service and maintenance.



END OF SECTION 23 81 43



SECTION 23 83 16 - RADIANT-HEATING HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

1. Radiant Heating Hydronic Piping

1.2 RELATED DOCUMENTS

- A. Construction Documents – M-104, M-204, M-205, M-603, P-101, P-104, P-105
- B. Section 03 45 00 – Architectural Precast Concrete
- C. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. PEX Plastic: ASTM F 876. For service at 100 psig (690 kPa) and 180 deg F (82 deg C).
 1. Fittings: 5/8 in. CRIMP RING, metal insert and copper crimp rings.
- B. Product: Radiant PEX Plus, crosslinked PE tubing with EVOH Barrier
 1. Manufacturer:
Watts Radiant, Inc.
4500 E. Progress Place
Springfield, MO 65803
 2. Product Number: PB032081
 3. Product Link:
http://www.pexheat.com/site/download/ph_RadiantPEX-Plus_Brochure.pdf



2.2 PIPING SPECIALTIES

- A. Pre-Cast into Concrete Floor
- B. Wire Mesh: 4 Mesh Stainless Steel .047 in wire, used to hold radiant piping at correct elevation before concrete pour.

2.3 RADIANT HEATING SPECIALTIES

- A. Distribution Manifolds: copper with three-way mixing valve, main shutoff and balancing valves with thermometers, zone shutoff and balancing valves with flow meter, and identification plate.
 - 1. Mixing Valves: Minimum 43 psi at 194 deg F, operating pressure and temperature, brass or cast-bronze body, EPDM seals, and threaded connections.
 - 2. Identification Plate: Valve plate shall identify room served and loop number.
 - 3. Manufacturer:
Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124
 - a. Product Number: A2670201
 - b. Product Link:
http://www.uponor.ca/-/media/Files/Product%20Documents/EP_Manifold_LS_H098_9%2008.aspx?sc_lang=en-CA
 - c. Reference Keynote – 23 83 16.A1

2.4 CONTROLS

- A. Thermostats: 50 to 90 deg F (10 to 32 deg C), 3 position, 24 V for day and night setback and clock program.
 - 1. Manufacturer:
Watts Radiant, Inc.
4500 E. Progress Place
Springfield, MO 65803
- B. Radiant Heating Control Sequence: Flow-through radiant heating piping is modulated to satisfy space thermostat.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping downstream from manifolds without joints.
- B. Secure piping in level fill concrete floors (not reinforced) by attaching pipes to subfloor using tracks, clamps, or staples. Maintain **3/4-inch (19-mm)** minimum cover.
 - 1. Wire Mesh: 4 Mesh Stainless Steel .047 in wire, used to hold radiant piping at correct elevation before concrete pour.
- C. Install manifolds in accessible locations.
- D. Fill system with 40 percent of propylene glycol-to-water solution.

END OF SECTION 23 83 16



SECTION 23 84 16 - DEHUMIDIFIERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ventilating Dehumidification System

1.2 RELATED DOCUMENTS

- A. Construction Documents –

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data
- B. Certification: ETL Listed. Energy Star Rated. Conforms to UL Std. 474

PART 2 - PRODUCTS

2.1 VENTILATING DEHUMIDIFICATION SYSTEM

- A. Basis-of-Design Product: TrueDRY DR65
- B. Manufacturer:
 - 1. Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422
 - 2. Product Website:
http://www.forwardthinking.honeywell.com/related_links/dehumidification/dh65/install/68-3079-01_A.pdf

2.2 PERFORMANCE

- 1. Blower:
 - a. 160 CFM at 0.0 in. WG
 - b. 100 CFM at 0.6 in. WG
- 2. Voltage: 120 VAC, 60 hz
- 3. Amps: 5.2 A
- 4. Power transformer to R/C terminals: 24 VAC, 0.85 A
- 5. Energy Performance: 2.22 liters (4.7 pints) per KWH
- 6. Refrigerant: R-410A
- 7. Operating Temperature Range: 34 – 135 ° F (1.1 -57.2° C)



8. Coverage: Up to 1,800sq. ft.

2.3 FILTERS AND INSULATION

A. Standard MERV-11

2.4 CONNECTION

A. Duct Connection: 8 in. (203.22 mm) Round Inlet, 8 in. (203.22 mm) Round Outlet, ABS Plastic

B. Drain Connection: $\frac{3}{4}$ in. (19 mm) threaded female NPT, with attached $\frac{3}{4}$ in. (19 mm) threaded male NPT

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per manufacturer's instructions.

END OF SECTION 23 84 16



DIVISION 25 – INTEGRATED AUTOMATION



SECTION 25 00 00 - INTEGRATED AUTOMATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Integrated Building Management System for HVAC and Plumbing
- B. Integrated Automation for AV system

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract.
- B. Construction Documents – M-602, M-603

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each system component and software module to be used, including:
 - 1. Preparation instructions and recommendations
 - 2. Storage and handling requirements and recommendations
 - 3. Manufacturer's Installation Instructions: Submit installation instructions for each control system component
 - 4. Manufacturer's certificate: Certify products meet or exceed specified requirements.
- B. Shop Drawings, provided by manufacturer: Indicate the following:
 - 1. Network riser diagrams showing programmable control unit locations and network data conductors.
 - 2. Connected data points, including connected control unit and input-output device.
 - 3. System graphics showing monitored systems, data (connected and calculated).
 - 4. System configuration with peripheral devices, batteries, power supplies, diagrams, modems and interconnections.
 - 5. Control Logic for system description and sequence of operation for operating user.

PART 2 - PRODUCTS



2.1 MANUFACTURERS

A. Acceptable Manufacturer for Building Management Systems:

1. Siemens
19 Chapin Rd. B-200
Pine Brook, NJ 07058
973-575-6300

2.2 CONTROL LOGIC

A. General

1. Scheduling of occupied and unoccupied modes shall be controlled according to the times below:
 - a. Desired Set Points (DSP): 6:00 am to 10:00 pm
 - b. Sleep Set Points (SSP): 10:00 pm to 6:00 am
 - c. Note: When scheduling the system, occupant shall only be required to know the DSP and SSP. All equipment needs to operate to serve the zone shall be activated by the Building Management System (BMS).
2. All Binary Output (BO's) shall have a manual hand-off-auto switch built into the Siemens Controller Board to override automatic operation. The switch shall provide feedback to the Siemens Controller to indicate the switch positions. If the controller does not have a built-in HPA switch, a panel face manual H-O-A switch with a label shall be provided and all positions shall input to binary inputs to indicate the position and enable or disable control loops.
3. It shall be possible from the web control server, any web-based browser, wireless web-enabled device, or keypad, to view the status of all points and any other needed to accomplish the sequences shown on the drawings. This monitoring site will be password protected. A simplified version shall be made public, displaying only net kWh consumption, solar PV kWh production, and space temperatures in the house.

B. Heating Mode

1. Requirement for heating mode shall be determined by the BMS if Desired Set Point (DSP) or Sleep Set Point (SSP) is higher than Zone 1 Dry Bulb Temperature Sensor (Z1DB)
 - a. Override of above schedule is available to maintain DSP at times other than those defined above. Maximum duration of override is 3 hours after which BMS will revert back to the above schedule.



2. To include the following modes:
 - a. Occupied Mode
 - b. Unoccupied Mode
 - c. Sleep Set back
 - d. Domestic Water Pre-heat

C. Cooling Mode

1. Requirement for cooling mode shall be determined by the BMS is DSP or SSP is higher than Zone 1 Dry Bulb Temperature Sensor (Z1DB). Default Relative Humidity (RH) for Zone 1 is 60%
 - a. Override of above schedule is available to maintain DSP at times other than those defined above. Maximum duration of override is 3 hours after which BMS will revert back to the above schedule. User is able to enter override again, immediately after the end of the previous override timeout, if desired.
2. To include the following modes:
 - a. Occupied Mode
 - b. Unoccupied Mode
 - c. Sleep Set back
 - d. Domestic Water Pre-heat

2.3 CONTROL DEVICES

A. Temperature and Humidity Sensors:

1. Duct Sensors: All systems and devices capable of acquiring and handling the sensor's DC 0...10 V or 4...20mA output signal. Mount the sensor in the center of the duct wall.
2. Outside Air Sensors: Mounted on north facing wall to be a 0 to 10 Vdc/Temp 0 to 10 Vdc.
3. Space Sensors: Surface mounted temperature sensor via 20 AWG twisted, shielded cable pair, 1000 OHM Reference Resistance at 32 Deg. F. (0 Deg. C.)

B. Solar Impact Sensor:

1. Sensor for acquiring the impact of solar radiation, output signal 0 to 10 Vdc. Two-wire current output 4 to 20 mA
2. Plastic housing with a transparent cover, an NPT connector for 3/8 in. flexible conduit, and a Pg9 cable entry gland.

C. Current Switches.

1. Current-operated switches shall be used to detect drive belts slip, break, or pump coupling shear.



2.4 INTEGRATION OF BUILDING MANAGEMENT SYSTEM AND HOME AUTOMATION

A. Control and Monitoring Devices:

1. HC330C Home Controller (Control4 device)

a. This device acts as the master controller for the Control4 system, transmitting and receiving commands to the following slave devices:

- 1) Control4 Medial player via IP
 - a) Sends A/V to connected HDTV/Speakers
 - b) Recieves A/V files via an external hard drive connected to the Home Controller
 - c) Has capability to receive A/V files via network Storage
- 2) Control4 Light switch/dimmers via Zigbee
 - a) Recieves Signals to turn on lights
- 3) HDTV via IR
 - a) Allows users to interact with HDTV with Control4 controllers as if it were a remote control
- 4) Control4 Handheld remote via Zigbee
 - a) Handheld remote can control any aspect of Control4 system but will primarily be used to control HDTV
- 5) Control4 Infinity Edge 7 in. via IP – Wi-Fi
 - a) Primary tablet controller for Control4 system
 - b) Capable of displaying and controlling all Control4 compatible systems within the house
 - c) Wall mounted
- 6) Control4 7in Portable via IP--Wi-Fi
 - a) Secondary tablet controller for Control4 system
 - b) Capable of displaying and controlling all Control4 compatible systems within the house
 - c) Portable
- 7) External Hard Drive via USB
 - a) Stores A/V files
 - b) Stores 3rd party Apps

2. Lurton Repeater via IP

- a. Connects with control4 system via IP
- b. Emulates multiple slave light switch/dimmers for control via Control4 tablets and Samsung Galaxy Tab



3. eGauge Energy Monitoring Solution via IP
 - a. Monitors house energy
 - b. Transmits to Control4 Home Controller via eGauge app.
 - c. Transmits to Siemens PXCM via BackNet
 - d. Transmits to eGauge website for alternative viewing
4. Siemens PXC Modular via IP
 - a. Transmits internal temperature to Control4 Home Controller
 - b. Transmits external temperature to Control4 Home Controller
 - c. Transmits set point temperature to Control4 Home Controller
 - d. See Siemens sequence of operations for PXCM logic
5. Samsung Galaxy Tab via IP –Wi-Fi
 - a. Connects to Control4 home controller via web interface
 - b. Connects to Siemens PXCM via web interface
 - c. Connects to Petra Solar for panel status via web interface
 - d. Connects to eGauge via web interface
 - e. Provides user with casual internet access and fun games

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.
- B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding. Commencement of installation is considered acceptance of substrate conditions.



3.3 EXECUTION

- A. Execution Requirements: Requirements for warranties.
 1. Installer shall provide a standard one year warranty on all control products and labor associated with this project.
 2. Installer shall provide five year warranty on all motorized valves and damper operators.
 3. Installer shall provide a three year warranty on all variable speed drives associated with this project.

3.4 FIELD SERVICES

- A. Start and Commission Systems: Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation. Allow time in this contract to work with commissioning agent if required.

3.5 GENERAL WORKMANSHIP

- A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

3.6 INSTALLATION

- A. Install control units and other hardware on permanent walls where not subject to excessive vibration.
- B. Install controller software and implement features of programs to specified requirements and appropriate to sequence of operation.
- C. A 120volt alternating current, dedicated power circuit to each programmable control panel shall be provided by Division 16.
- D. Mechanical Rooms and exposed locations to be in full conduit.



- E. Conduit sleeves in fire rated walls to be caulked with firestop and have bushings on both ends. All conduit stubs and knockouts to have bushings.
- F. Plenum rated cable shall be used above drop ceilings and cable paths ran parallel to building structure or structural steel. Plenum cable to be supported at regular intervals by tie-wrap and anchor or tie wrap and bridal ring combinations at no more than 3 foot intervals.

3.7 SYSTEM CHECKOUT AND TESTING

- A. Startup testing. Complete startup testing to verify operational control system before notifying owner of system demonstration.
 - 1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under sections of Division 15.
 - 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
 - 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
 - 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
 - 5. Verify that analog output devices such as actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
 - 6. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
 - 7. Alarms and Interlocks.
 - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
 - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
 - c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

END OF SECTION 25 00 00



DIVISION 26 – ELECTRICAL



SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

1.2 RELATED DOCUMENTS

- A. Construction Documents – E-201, E-203

1.3 SECTION REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Submittals:
 - 1. Product Data: For sleeve seals.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. Raceways:
 - 1. EMT: ANSI C80.3, zinc-coated steel, with setscrew or compression fittings.
 - 2. ENT: NEMA TC 13, complying with UL 1653.
 - 3. FMC: Zinc-coated steel.
 - 4. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.



5. LFMC: Zinc-coated, flexible steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
6. RNC: NEMA TC 2, [Type EPC-40-PVC,]with NEMA TC3 fittings.
7. Raceway Fittings: Specifically designed for raceway type used in Project.

B. Surface Raceways:

1. Plastic: PVC, extruded and fabricated to size and shape indicated in color selected, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Floor Boxes: Cast metal, semiadjustable, rectangular.

2.2 CONDUCTORS AND CABLES

A. Conductors:

1. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
2. Conductors, Larger Than No. 10 AWG: Stranded copper.
3. Insulation: Thermoplastic, rated at 75 deg C minimum.
4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

B. Cable Type NM-B: Comply with UL 719 with Type THHN/THWN conductors complying with UL 83.

C. Cable Type SEU: Comply with UL 854 with Type THHN/THWN conductors complying with UL 83.

D. Cable Type UF-B: Comply with UL 493 with Type THHN/THWN conductors complying with UL 83.

2.3 GROUNDING MATERIALS

A. Conductors: Solid for No. 8 AWG and smaller, and stranded for No. 6 AWG and larger unless otherwise indicated.

1. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
2. Bare, Solid-Copper Conductors: Comply with ASTM B 3.
3. Bare, Stranded-Copper Conductors: Comply with ASTM B 8.

B. Ground Rods: Copper-clad steel, sectional type; 5/8 by 96 inches (16 by 2400 mm) in diameter.



- C. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts with clamp-type pipe connectors sized for pipe.
- D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 ELECTRICAL IDENTIFICATION MATERIALS

- A. Raceway Identification Materials: Self-adhesive, color-coding vinyl tape; flexible, preprinted, self-adhesive vinyl.
- B. Conductor Identification Materials: Color-Coding Conductor Tape: Self-adhesive vinyl tape 1 to 2 inches (25 to 50 mm) wide.
- C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, polyethylene tape with continuous metallic strip or core.
- D. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with circuit identification legend machine printed by thermal transfer or equivalent process.
- E. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- F. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1.0-mm) galvanized-steel backing; and with colors, legend, and size required for application.
- G. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.
- H. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.5 CONNECTORS

- A. Manufacturer: LAPP Group USA
 - 1. Manufacturer Website:
<http://www.lappusa.com/selector.asp>
- B. Top Entry Hoods:
 - 1. Basis-of-Design Product: EPIC Rectangular Connectors HA $\frac{3}{4}$ Housing: Single Lever on Base



- a. Size of Entry
 - 1) PG: 11
 - 2) NPT: $\frac{1}{2}$ in
- b. With Cable Gland
- 2. Technical Data:
 - a. Number of Contacts: 3
 - b. Rated Voltage: 600V EPIC HA 3
 - c. Rated Current: 10A EPIC HA $\frac{3}{4}$
 - d. Dimension Transient: 4 kV
 - e. Contact Resistance: 1.5 – 4 mOhm
 - f. Test voltage: 4 kv
 - g. Screw termination: AWG 20-14 for solid wire or stranded wire end ferrule and without insulation
 - h. Contacts: Copper alloy, silver plated

C. Cable Coupler Hoods

- 1. Basis-of-Design Product: EPIC Rectangular Connectors HA $\frac{3}{4}$ Housing: Single Lever on Base
 - a. Size of Entry
 - 1) PG: 11
 - 2) NPT: $\frac{1}{2}$ in
 - b. With Cable Gland

D. Rectangular Connectors:

- 1. Basis-of-Design Product: EPIC Rectangular Plugs and Receptacles: Screw Terminated Inserts HA3
 - a. Plug Product Number: 10420000
 - b. Receptacle Product Number: 104210000

2.6 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL ELECTRICAL EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install electrical equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
- B. Install electrical equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.



- C. Install electrical equipment to allow right of way for piping and conduit installed at required slope.
- D. Install electrical equipment to ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.
- E. Install required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Comply with requirements in Division 08 Section "Access Doors and Frames."
- G. Install sleeve and sleeve seals of type and number required for sealing electrical service penetrations of exterior walls.
- H. Comply with NECA 1.

3.2 RACEWAY AND CABLE INSTALLATION

A. Outdoor Raceways Applications:

- 1. Exposed or Concealed: IMC.
- 2. Underground, Single Run: RNC.
- 3. Connection to Vibrating Equipment: LFMC.
- 4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.

B. Indoor Raceways Applications:

- 1. Exposed or Concealed: EMT.
- 2. Connection to Vibrating Equipment: FMC; in wet or damp locations, use LFMC.
- 3. Damp or Wet Locations: IMC.
- 4. Boxes and Enclosures: Metallic, NEMA 250, Type 1, unless otherwise indicated.

- C. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Install raceways and cables at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- E. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least **1-inch- (25-mm-)** thick concrete cover.



1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 2. Space raceways laterally to prevent voids in concrete.
 3. Install conduit larger than 1-inch (27-mm) trade size, parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- F. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- G. Install pull wires in empty raceways.
- H. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch (1830-mm) maximum length of flexible conduit.
- I. Install raceways and cables conceal within finished walls, ceilings, and floors unless otherwise indicated.
- J. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

3.3 GROUNDING

- A. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.
- B. Pipe and Equipment Grounding Conductor Terminations: Bolted.
- C. Install grounding conductors routed along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Install ground rods driven into ground until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
- E. Make connections without exposing steel or damaging coating if any.
- F. Install bonding straps and jumpers in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.



- G. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
- H. Bond to equipment mounted on vibration isolation hangers and supports so vibration is not transmitted to rigidly mounted equipment.
- I. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.4 IDENTIFICATION

- A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive color coding tape-in bands:
 - 1. Fire-Alarm System: Red.
 - 2. Security System: Blue and yellow.
 - 3. Telecommunication System: Green and yellow.
- B. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.
- C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.
- D. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Electrical switchgear and switchboards.
 - c. Transformers.
 - d. Motor-control centers.



- e. Disconnect switches.
 - f. Enclosed circuit breakers.
 - g. Motor starters.
 - h. Push-button stations.
 - i. Power transfer equipment.
 - j. Contactors.
 - k. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
- E. Verify identity of each item before installing identification products.
- F. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- G. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- H. Install system identification color banding for raceways and cables at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (7.6-m)** maximum intervals in congested areas.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

- A. Fasten hangers and supports securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.
- B. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.
- C. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated or required by Code:
- 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Existing Concrete: Expansion anchor fasteners.
 - 4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.



3.6 SEISMIC REQUIREMENTS

- A. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
- B. Install bushing assemblies for anchor bolts for wall- and floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in substrate.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.
- D. Accommodation of Differential Seismic Motion: Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to electrical equipment that is anchored to a different structural element than the one supporting them as they approach equipment.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Comply with requirements in Division 07 Section "Penetration Firestopping."

END OF SECTION 26 05 00



SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lighting Control Devices

1.2 RELATED DOCUMENTS

- A. Construction Documents – E-103

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.4 SYSTEM DESCRIPTION

- A. Radio Frequency Light Control System (RFLCS)
 1. Modular dimming and switching components for installation by contractor or authorized dealer.
 2. Two-way Radio Frequency controlled wall-mounted dimmers, switches, wall keypads, table top keypads and lamp dimmers, plug in dimmers and switches, shades, motion sensors, RF signal repeaters, and interfaces using Clear Connect RF technology.
 3. Requires no central processor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com



2.2 DEVICES

A. Maestro wall mounted dimmers

1. Basis-of-Design Product: Remote Dimmer 1-gang Claro (one dimmer)
2. Quantity: 14
3. Product Number: RRD-F6AN-DV-MN
4. Product Price: \$158.00/EA
5. Finish: Stainless Steel
6. Product Link:
<http://www.lutron.com/Service-Support/Technical/Pages/PerformanceSpecs.aspx>

B. Maestro wall mounted switches

1. Basis-of-Design Product: Remote Dimmer 1-gang Claro (one dimmer)
2. Quantity: 2
3. Product Number: RRD-8ANS-MN
4. Product Price: \$118.00/EA
5. Finish: Stainless Steel
6. Product Link:
<http://www.lutron.com/Service-Support/Technical/Pages/PerformanceSpecs.aspx>

C. Maestro wall mounted keypads

1. Basis-of-Design Product: 6 Buttons with Raise/Lower
2. Quantity: 1
3. Product Number: RRD-W6BRL-E
4. Product Price: \$238.00
5. Finish: Stainless Steel
6. Product Link:
http://www.dimmers.net/pdf/Ra2_Specs_diagrams_Wall_Keypads.pdf

D. Maestro tabletop keypads

1. Basis-of-Design Product: Tabletop Keypad
2. Quantity: 1
3. Product Number: RR-T1ORL-SW
4. Product Price: \$356.00
5. Product Link:
<http://www.lutron.com/Service-Support/Technical/Pages/PerformanceSpecs.aspx>

E. Maestro remote controls

1. Basis-of-Design Product: 10 button with Raise/Lower, All On and All Off
2. Quantity: 2
3. Product Number: RRD-P3BRL-L



4. Product Price: \$78.00/EA.
5. Finish: Stainless Steel
6. Product Link:
<http://www.lutron.com/Service-Support/Technical/Pages/PerformanceSpecs.aspx>

F. Maestro main repeater

1. Basis-of-Design Product: Main Repeater
2. Quantity: 1
3. Product Number: RR-MAIN-REP-WH
4. Product Price: \$396.00
5. Finish: Stainless Steel

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- C. Label time switches and contactors with a unique designation.
- D. Verify actuation of each sensor and adjust time delays.

END OF SECTION 26 09 23



SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Panelboards
- B. Load Center

1.2 RELATED DOCUMENTS

- A. Construction Documents – E-201, E-601
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Eaton: 200 Amp Main Panel Box with 150 A Breaker (32 Circuits)
 - 1. Reference Keynote: 23 24 16.A01
- B. SquareD: 100 Amp 12 circuit load center 120-240 V, Nema 1.
 - 1. Reference Keynote: 23 24 16.A02

2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Common Work Results for Electrical."



- B. Enclosures: Flush- and surface-mounted cabinets; NEMA 250, Type 1.
 - 1. Front: Secured to box with concealed trim clamps.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- C. Incoming Mains Location: Top.
- D. Phase, Neutral, and Ground Buses: Tin-plated aluminum.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum.
 - 2. Main and Neutral Lugs: Compression type.
 - 3. Ground Lugs and Bus Configured Terminators: Compression type.
 - 4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.3 DISTRIBUTION PANELBOARDS

- A. Doors: Omit in fused-switch panelboards.
- B. Mains: Circuit breaker.
- C. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.
- D. Branch Overcurrent Protective Devices: Fused switches.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.
- B. Arrange conductors into groups; bundle and wrap with wire ties.
- C. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory.

END OF SECTION 26 24 16



SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCULDES

- A. Convenience Receptacles
- B. Quadruplex GFCI Convenience Receptacles
- C. Duplex GFCI Convenience Receptacles
- D. Telephone Outlet
- E. TV Outlet
- F. Wall Plates, Finished Areas

1.2 REALTED DOCUMENTS

- A. Construction Documents – I-201, I-202, I-203, I-204, I-522, I-523

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 DEVICES

- A. Convenience Single Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.
 - 1. Available Products: Maestro Receptacles
 - a. Lutron
7200 Suter Road



- Coopersberg, PA 18036
www.lutron.com
 - b. Quantity: 36
 - c. Tamper Resistant Receptacles: 15 A, 125 V
- B. Convenience Duplex Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.
- 1. Available Products: Maestro Receptacles
 - a. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com
 - b. Quantity: 8
 - c. Tamper Resistant Receptacles: 15 A, 125 V
- C. Duplex GFCI Convenience Receptacles: 125 V, 20 A, straight blade, feed-through type. NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- 1. Available Products: Maestro GFCI Receptacles
 - a. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com
 - b. Quantity: 5
 - c. Tamper Resistant Receptacles: 15 A, 125 V
- D. Convenience Triplex Receptacles: NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498.
- 1. Available Products: Maestro Receptacles
 - a. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com
 - b. Quantity: 2
 - c. Tamper Resistant Receptacles: 15 A, 125 V
- E. Quadruplex GFCI Convenience Receptacles: 125 V, 20 A, straight blade, feed-through type. NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- 1. Available Products: Maestro GFCI Receptacles
 - a. Lutron



7200 Suter Road
Coopersberg, PA 18036
www.lutron.com

- b. Quantity: 3
 - c. Tamper Resistant Receptacles: 15 A, 125 V
- F. Telephone Outlet: Single RJ-111 jack for terminating 100-ohm, balanced, 4-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.
- 1. Available Products: Maestro Receptacles
 - a. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com
 - b. Quantity: 4
 - c. Single telephone jack
- G. Data Outlet:
- 1. Available Products: Maestro Receptacles
 - a. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com
 - b. Quantity: 2
- H. Wall Plates, Finished Areas: Satin-finish stainless steel, fastened with metal screws having heads with black plate color.
- 1. Available Products: Maestro
 - a. Lutron
7200 Suter Road
Coopersberg, PA 18036
www.lutron.com

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Install devices and assemblies plumb, level, and square with building lines.



- C. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- D. Install unshared neutral conductors on line and load side of dimmers.
- E. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top unless otherwise indicated. Group adjacent devices under single, multigang wall plates.

END OF SECTION 26 27 26



SECTION 26 31 00 - PHOTOVOLTAIC COLLECTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Photovoltaic Collectors
- B. Micro Inverters
- C. Photovoltaic Mounting System

1.2 RELATED DOCUMENTS

- A. Construction Documents – A-551, A-561, E-102, E-602

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Photovoltaic collectors to comply with the following testing standards: IEC61215, Safety Tested IEC61730, conformity to CE, UL listings: UL1703, cULus, CSA International, Class C fire rating.
- C. Micro Inverters to comply with the following testing standards: UL 1741 and 2008 US NEC

1.4 WARRANTY

- A. Manufacturer's typical residential warranty.

PART 2 - PRODUCTS

2.1 PRODUCT TYPE

- A. Photovoltaic System
 - 1. Product: Petra Solar AC Module
 - 2. Components:
 - a. SunTech 225 Watt Module
 - b. Smart Energy Module (SEM) with built-in Microinverter
 - 3. Quantity: 40 Modules
 - 4. Price:



- a. Suntech 225: \$5.00/W : 9,000 Watts = \$45,000.00
- b. SEM: \$220.00 / Each = \$8,800.00
5. Product Website:
 - a. Suntech 225:
<http://am.suntech-power.com/products-and-services/commercial-a-government.html>
 - b. SEM:
<http://www.petrasolar.com/petra-solar-downloads-datasheets.php>

- B. Access Point Box:
 1. Product: Petra Solar SunWave Communicator SC4
 2. Quantity: 1
- C. Photovoltaic Mounting System
 1. Product: Professional Solar Products, Inc.
 2. Product Website:
<http://www.prosolar.com/index.htm>

2.2 MANUFACTURERS

- A. Photovoltaic Panel
 1. SunTech
71 Stevenson Street, 10th Floor
San Francisco, California 94105
- B. Smart Energy Module
 1. PetraSolar
300-G Corporate Court
South Plainfield, NJ 07080
- C. Photovoltaic Mounting System
 1. Professional Solar Products
1551 S. Rose Ave.
Oxnard, CA 93033

2.3 PERFORMANCE AND DESIGN CRITERIA

- A. Photovoltaic Capacities:
 1. Electrical Characteristics:
 - a. Optimum Operating Voltage (Vmp): 29.6 V
 - b. Optimum Operating Current (Imp): 7.91 A
 - c. Open-Circuit Voltage (Voc): 36.7 V
 - d. Short-Circuit Current (Isc): 8.15 A
 - e. Maximum Power at STC (Pmax): 225 W
 - f. Module Efficiency: 14.3%



- g. Operating Temperature: -40 deg C to +85 deg C
 - h. Max System Voltage: 1000 V DC
 - i. Maximum Series Fuse Rating: 20 A
 - j. Power Tolerance: 0/+5 W
 2. NOCT: Irradiance 800 W/m², ambient temperature 20 degrees C, wind speed 1 m/s:
 - a. Maximum Power (W): 165 W
 - b. Maximum Power Voltage (V): 29.6 V
 - c. Maximum Power Current (A): 6.12 A
 - d. Open Circuit Voltage (Voc): 33.8 V
 - e. Short Circuit Current (Isc): 6.65 A
 - f. Efficiency Reduction (from 1000 W/m² to 200 W/m²): < 4.5%
 3. Mechanical Characteristics:
 - a. Solar Cell: Polycrystalline 156 x 156 mm (6 inches)
 - b. Dimensions: 65.6 x 39 x 2 inches (1665 x 991 x 50 mm)
 - c. Weight: 49.6 lbs (22.5 kgs)
 - d. Front Glass: 0.16 inches (4 mm) tempered glass
 - e. Frame: Anodized aluminum alloy
 - f. Junction Box: IP67 rated
 - g. Output Cables: H + S RADOX Smart cable 0.006 in² (4.0 mm²) symmetrical lengths (-) 39.4 inches (1000 mm) and (+) 39.4 inches (1000 mm), H4 connectors (MC4 compatible)
- B. Micro Inverter Capacities:
1. Operational DC Input Voltage: 20 v - 60 V
 2. AC Power Output: 200W
 3. AC Reactive Power (VARs): 200
 4. AC Output Voltage: 106 V – 132V (120V typ.)
 5. AC Output Frequency: 59.3 Hz – 60.5 Hz
 6. Peak Power Tracking DC Voltage: 60V
 7. Current THD: <5%
 8. Power Factor: >0.99
 9. Peak SEM Efficiency: 95%
 10. CEC SEM Efficiency: 93%
 11. RMS Output Current: 1.67 A
 12. Operating Temperature: -40 deg C- 85 deg C
 13. Output Cable: 12/3 AWG Cable
 14. Certified by CSA to the requirements of UL 1741 and 2008 US NEC

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install according to Manufacturers specifications

END OF SECTION 26 31 00



SECTION 26 32 00 - PACKAGED GENERATOR ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

1.2 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.1 GENERATOR

- A. Available Products:

1. Generator: EU6500is or similar product
2. Manufacturer:
Honda Motor Company, LTD

http://www.electricgeneratorsdirect.com/manuals/Honda%20generator_brochure.pdf

- B. PERFORMANCE AND DESIGN CRITERIA

1. Engine: 13 HP Single Cylinder, Overhead Valve, Air Cooled
2. AC Output: 120/240V, 6500W Max., 5500W rated
3. Receptacles: C, F, H
4. Starting System: Recoil, Electric
5. Fuel Tank Capacity: 4.5 gallons (17 L)
6. Run Time on One Tankful: 4.7 hrs at rated load, 14 hrs at ¼ load
7. Noise Level: 60 dBA at rated load
8. Dry Weight: 253 lbs

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers specifications

END OF SECTION 26 32 00



SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lighting Fixtures and Components, General Requirements
- B. Transformers and Ballasts
- C. Lamps
- D. Requirements for Individual Interior Lighting Fixtures
- E. Mounting Assemblies for Interior Lighting Fixtures

1.2 RELATED DOCUMENTS

- A. Construction Documents – E-103, E-603, E-609, E-611, E-614, I-202, I-501, I-521
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data for each luminaire, including lamps.
- B. Fixtures, Emergency Lighting Units, Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- D. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.



PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- D. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.2 TRANSFORMERS AND BALLASTS

- A. Ballasts for T-5 Fluorescent Lamps : Electronic programmed rapid-start type, complying with ANSI C 82.11.
 - 1. Lamp end-of-life detection and shutdown circuit.
 - 2. Automatic lamp starting after lamp replacement.
 - 3. Sound Rating: A.
 - 4. BF: 0.95 or higher unless otherwise indicated.

2.3 LAMPS

- A. T-5 Fluorescent High Output Lamp
 - 1. Typical T-5 HO Lamp
 - a. Watts: 54 W
 - b. Lumen Output: 5,000
 - c. Lifetime: 24,000 hours
 - d. Color Temperature: 4100 K
 - e. Color Rendering Index: 82
 - f. Quantity:
- B. T-5 Fluorescent Lamp
 - 1. Typical T-5 Lamp
 - a. Watts: 21 W
 - b. Lumen Output: 2,100
 - c. Lifetime: 20,000 hours
 - d. Color Temperature: 4100 K
 - e. Color Rendering Index: 85



3. Quantity: 3
 - a. Length: 4 ft.
 4. Lamps: Quantity 3. T5HO
 5. Voltage: 120 Volt, Dimming
 6. 100% Downlight, Direct Only
 7. Housing Finish: a-lightainium
 8. Mounting: Top Mount
- F. Fixture – Recessed Top of Wall, Reference Keynote – 26 51 00.E01:
1. Basis-of-Design Product: Accolade 3
 2. Series: D3
 3. Quantity: 4
 4. Length: Custom
 5. Lamps: Quantity 4. T5HO
 6. Voltage: 120 Volt, Dimming/Wet Location
 7. Housing Finish: a-lightainium
 8. Mounting: Recess, Top of wall
- G. Fixture – Recessed Top of Wall, Reference Keynote – 26 51 00.F01:
1. Basis-of-Design Product: Arris 5
 2. Series: B5
 3. Quantity: 7
 4. Lamps: Quantity 7. T5HO.
 5. Voltage: 120 Volt, Dimming
 6. Down Light Shielding: No Down Light
 7. Up Light Shielding: Saw tooth reflector 5.75 in. width
 8. Housing Finish: Gloss White T009-WH11
 9. Mounting: N/A

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set units level, plumb, and square with ceiling and walls, and secure.
- B. Support for Recessed and Semirecessed Grid-Type Fluorescent Fixtures:
 1. Install ceiling support system wires at a minimum of four wires for each fixture, located not more than **6 inches (150 mm)** from fixture corners.
 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
- C. Suspended Lighting Fixture Support:



1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's written instructions.

END OF SECTION 26 51 00



SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lighting Fixtures and Components, General Requirements
- B. Requirements for Individual Exterior Lighting Fixtures

1.2 RELATED DOCUMENTS

- A. Construction Documents – E-103, E-603, E-611, L-103, I-203
- B. Project Manual: Appendix B – Electrical Equipment Manufacturer's Specification

1.3 SECTION REQUIREMENTS

- A. Submittals: Product Data for each luminaire, including lamps.
- B. Fixtures, Emergency Lighting Units, Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- D. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Exterior Luminaires: Comply with UL 1598 and listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.



- C. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.2 REQUIREMENTS FOR INDIVIDUAL EXTERIOR LIGHTING FIXTURES

A. Fixture Reference Keynote – 26 56 00.A01

- 1. Manufacturer:
 - A Light
 - 3728 Maritime Way
 - Oceanside, CA 92056
 - <http://alights.com/>
- 2. Basis-of-Design Product: Accolade 3
- 3. Series: D3
- 4. Quantity: 3
 - a. Length: 4 ft.
- 5. Lamps: Quantity 8. T5HO
- 6. Voltage: 120 Volt, Dimming/Wet Location
- 7. Housing Finish: a-lightainium
- 8. Mounting: Wall Recess

B. Fixture Reference Keynote – 26 56 00.B01

- 1. Manufacturer: Troy Landscape
- 2. Manufacturer Website:
<http://troylandscapelighting.com/contents/viewItem.asp?idProduct=79&idCategory=54>
- 3. Basis-of-Design Product: Short Step Light S10B16
- 4. Quantity: 7
- 5. Solid brass junction box with knock outs.
- 6. Heat and impact resistant frosted glass
- 7. Two Bi-pin type G4/GU5.3
- 8. Pre-Wired with 3 foot 16 gauge wire lead
- 9. Mounting: Recessed

C. Fixture Reference Keynote – 26 56 00.C01

- 1. Manufacturer: Dekor
- 2. Basis-of-Design Product:
 - a. Dek Dot Kit Out
 - b. Includes Dek Dot Transformer
 - c. Manufacturer Website:
<http://www.de-kor.com/assets/docs/DEKDOTInstall.pdf>
 - d. Quantity: 1
 - e. Price: \$185.52
- 3. Basis-of-Design Product:
 - a. Dek Dot Exterior Recessed Light
 - b. Manufacturer Website:
<http://www.de-kor.com/outdoor-recessedlights.html>



- c. Quantity: 8 (4 pack)
 - d. Price: \$44.78/each
 - e. Mounting hole diameter: .900 in
 - f. Mounting hole depth: 1"
 - g. Length of wire pigtail: 6 ft.
 - h. Bulb: LED
- D. Fixture Reference Keynote – 26 56 00.D01
- 1. Manufacturer: Hinkley Lighting
 - 2. Manufacturer Website:
 - 3. http://www.hinkleylightinglights.com/product/hinkley-lighting-piza-pathway-landscape-lighting-1548tt.html?gclid=CLD2-pyg1qcCFeM85QodeHNC_w
 - 4. Basis-of-Design Product: Hinkley Piza 1 Light Landscape in Titanium
 - 5. Product Number: 1548TT
 - 6. Price: \$82.00
 - 7. Quantity: 5
 - 8. Voltage: 18 W

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set units level, plumb, and square with ceiling and walls, and secure.
- B. Support for Recessed and Semirecessed Grid-Type Fluorescent Fixtures:
 - 1. Install ceiling support system wires at a minimum of four wires for each fixture, located not more than **6 inches (150 mm)** from fixture corners.
 - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than **48 inches (1200 mm)**, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Fixtures: Install with dampers closed.
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's written instructions.



END OF SECTION 26 56 00



DIVISION 28 - ELECTRONIC SAFETY AND SECURITY



SECTION 28 31 00 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Smoke Detectors
- B. Carbon Monoxide Alarm

1.2 RELATED DOCUMENTS

- A. Construction Documents – F-101

1.3 SECTION REQUIREMENTS

- A. System Description: Noncoded, conventional, hardwired, zoned, 24-V dc loop system.
 - 1. Initiating Device Circuits: NFPA 72, Class B, Style B.
 - 2. Notification Appliance Circuits: NFPA 72, Class B, Style Y.
- B. Submittals: Product Data and system operating description.
- C. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals, make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations.
- D. Comply with NFPA 72.
- E. UL listed and labeled.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 PRODUCT TYPE

- A. Basis-of-Design Product: Kidde Silhouette Wire-in Low Profile, Lifetime Battery Smoke Alarm



1. Product Number: KN-SMFM-i
2. Reference Keynote: 28 31 00.A01
3. Manufacturer: Kidde
4. Manufacturer Website:
<http://www.shopkidde.com/kidde-kn-smfm-i-silhouette-hardwire-low-profile-smoke-alarm-6.html>
5. Price: \$89.99

B. Basis-of-Design Product: Kidde Silhouette Wire-in Low Profile Carbon Monoxide Alarm

1. Product Number: KN-COPF-i
2. Reference Keynote: 28 31 00.A02
3. Manufacturer: Kidde
4. Manufacturer Website:
<http://www.shopkidde.com/kidde-kn-copf-i-silhouette-wire-in-low-profile-carbon-monoxide-alarm.html>
5. Price: \$65.99

2.2 ALARM-INITIATING DEVICES

- A. Smoke Detectors: UL 268, 120 V AC/DC powered, rechargeable battery back-up, self-restoring, ionization sensor, quick connect plug with 6 in pigtails.

2.3 NOTIFICATION APPLIANCES

- A. Bells: 85 dBA at 10 feet (3 m).
- B. Visual Alarm Device: LED Red

2.4 WIRE AND CABLE

- A. General: UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and test systems according to NFPA 72. Comply with NECA 1.
- B. Wiring Method: Install wiring where indicated.



END OF SECTION 28 31 00



Detailed Water Budget

FUNCTION	WATER USE (GALLONS)	CALCULATIONS		NOTES
		GAL	EVENTS	
Hot Water Draws	240	15	16	
Water Vaporization	2.4	0.6	4	
Dishwasher	30	6	5	
Clothes Washer	144	18	8	
Vegetation	100			
Fire Protection	60			
Thermal Storage Tanks	70	70	1	
Initial Systems Fill	5	5	1	
Solar Thermal Collectors	1	1	1	
Radiant Flooring	25	25	1	
Safety Factor	67.74			
WATER REQUIRED	745.14	gallons		

Team Provided Liquids

Team will bring 50 gallons of water, to be used for irrigation of plants. An additional 5 gallons per day of bottled drinking water will be provided daily during house assembly.



Interconnection Application Form

Team New Jersey Lot 104

PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
Sun Tech	Forty (40) SunTech 225 Modules.	8.4

Total DC power of all arrays is 8.4 kW (in tenths)

INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
Petra Solar	N/A	120V	1.9 kW	40

Total AC power of all inverters is 7.8 kVA or kW (in whole numbers)

The following information must be included in the project manual or construction documents. If located in the construction documents, list the drawing locations in this section of the project manual. (Example: B3/E-201)

1. One-Line Electrical schematic - E-601
2. Calculations of service/feeder net computer load and neutral load (NCE 220) - Project Manual - Energy Analysis
3. Plan view of the lot showing the house, decks, ramps, tour paths, the service point and the distribution panel or load center - E-104



Energy Analysis Results and Discussion



TEAM NJ SYSTEMS OVERVIEW

An overarching goal of the ENJOY house is to achieve net zero energy use. All systems were carefully designed with this parameter in mind, from the integration of our solar thermal pre-heat with the domestic hot water and hydronic floor system, to the sizing of the photovoltaic array on the roof. The components selected for the mechanical, electrical and plumbing systems represent some of the best, most efficient products widely available for residential use.

The photovoltaic array will deliver 8.8 kWh of solar energy per day. The panels are orientated south, racked at angles that will yield high efficiency output. Each panel is equipped with a microinverter, a technology that converts each panel's DC electric output to AC individually. Unlike more traditional, end-of-line inverters where the output of a string is only as strong as its weakest panel, the microinverter ensures that the individual power output of each panel is independent of the overall system. The microinverter we are using also has the capability to self-correct power factor issues, and, via wireless communication, provides information on panel-by-panel output. These microinverters allow the house to safely use the array's output during the day should there be a black out in the city grid.

On the roof is one array of 30 evacuated solar tubes that allow us to capture solar energy for the purpose of providing hot water. Due to their round shape, they effectively utilize the sun at any angle and position. Our tubes will be laid on the Western roof panel of the house. The solar thermal system is a closed loop drainback system. This system, effective in cold climates such as the winters experienced in New Jersey, require the least routine service of any active system. The heat transfer fluid is simply non-pressured distilled water, which seldom has to be changed. When the system is at rest (not pumping), the solar collector is empty and the distilled water is stored in a 7-gallon drainback tank, sitting just above our solar storage tank. Our water storage tank holds 70 gallons of hot water. We estimate that a two-person home consumes about 40 gallons per day of hot water in total. The 70 gallon tank gives our house some insurance against a cloudy day scenario. In any cold winter climate, a pumped system is normally required. We are using a 1/8 horsepower circulating pump in our system. This energy sacrifice was justified as the solar hot water system precludes the need for much electric resistive water heating. However, our system is connected to a tankless electric hot water heater for back-up. It is estimated that during summer months the heater will not be necessary at all, and during winter months it will only be used sparingly. A mixing valve outside of the solar storage tank ensures that our system protects against scalding hot water temperature outputs. The solar storage tank is connected to our hydronic floor loop, which represents the main active component of our house's heating scenario.

Heating and cooling are both to be controlled by a reverse-cycle chiller, alternatively referred to as an air-to-water heat pump. The heat pump we have selected has a COP (coefficient of performance) of 5, meaning for every five Btus of heating it provides, it is only consuming 1 Btu of energy. The heat pump sits outside of the house, quietly taking energy from the ambient



environment and using it to create either hot or cold water, which is then circulated into the house for heating and cooling. The pump uses an enhanced refrigeration cycle to provide hot water at temperatures below freezing in winter and in summer acts as a refrigerator, using heat energy to provide cooling. The machine can do both heating and cooling by using a reversing valve.

Our HVAC system provides humidity control and proper ventilation. In heating and cooling scenarios the system interacts with humidity and ventilation in different ways.

In heating, we employ both passive and active systems. A solar house begins with efficient passive solar design, which will significantly decrease the need for active heating. In the ENJOY house, low winter sunlight will pass through large, glazed southern windows, scattering light, and therefore energy, around the house. The concrete walls and floor will passively absorb this heat during the day and expel it throughout the evening and night. Supplementary to this scenario is the active component of our heating system, the hydronic floor loop. PEX tubing, filled with glycol solution, will be installed in the concrete floor. The hydronic system will use a 1/10 hp pump to get the heated water from outside into our MEP central closet, where you will find the manifold connecting three hydronic zones. We have three zones for ease of construction purposes, all connected to one manifold. However, from an energy standpoint we treat the house as if it is one heating zone with a single heating set point.

Our house has minimal air infiltration, which is good from an energy standpoint, but means we must mechanically take in fresh air to allow for proper ventilation. We are using a heating recovery ventilator. This will expel ventilated air from the bathroom passing it through a heat exchanger. As cold, fresh air enters the home, it also passes over the heat exchanger, absorbing some of the energy of the outgoing warm air.

In the house's cooling scenario, we face the challenge of providing cooling and dehumidification, which can be quite energy intensive. The ENJOY home uses highly efficient equipment to cool and dehumidify. Since our heat pump is a reverse cycle chiller, it is capable of producing both hot and cold water. In summer. A section of the hydronic loop will be directed to an air handling unit's fan coils, carrying cold water into the ceiling of the central MEP closet, where a fan will blow over the chilled coils, evenly distributing cool air around the house.

The summer cooling scenario is where humidity becomes a major concern. Humidity is of particular concern in a concrete home, where walls absorb heat. This feature of concrete works to our advantage providing thermal mass in winter, however in summer it produces a challenge. As the concrete releases collected heat and the air cools, the moisture that was able to be absorbed by the warm air gets trapped. In the worst case scenario, humidity may increase until it hits the dewpoint, and can possibly precipitate, or 'sweat'. One active strategy to prevent humidity in 'cooling mode' is with a fan coil system. Our fan coil system forces air to pass over coils filled with chilled water (as cool as 45 ° F) supplied by the heat pump. This chilled water is below the dew point, allowing excess moisture in the air to be precipitated out. Dehumidification is achieved by



keeping the chilled water below the dew point so that excess moisture in the air is precipitated out, collected and drained into an outtake pipe.

Maximum utilization of hydronic floors is a major objective as it is the most effective way to condition our concrete house. Cooling down the floors using the conditioned water from the heat pump presents us with an energy efficient alternative to forced air, with no additional equipment necessary. Condensation on the floors can be avoided by monitoring the slab temperature and ensuring the slab temperature does not fall below the dew point of the air in the zone. A supplementary dehumidifier is incorporated into our system to create a humidity buffer zone.

The conditioned, dehumidified air is then blown throughout the house, providing a comfortable indoor environment. This tiered system also allows for a rapid response time for cooling and dehumidification, which is suited for people living New Jersey where summer humidity levels can be quite high, as well as Washington DC for the competition week.

The conditioned air supply registers are located at the ceiling on the east and west side of the central core and, one return register feeding from the base of the closet out to the southern hallway. This plan is the most effective for cooling the house, and uses the least amount of ducts and power. In summer, the air coming in from the HRV will also pass over the air coils, ensuring proper dehumidification.

ENERGY MODELING

Team NJ is interested in two energy scenarios. The first is how the house is going to perform on the National Mall in D.C. during the period September 23 to October 2, 2011. The second is how it will perform during peak energy loads at its final location in New Jersey, summer and winter.

The house has been modeled and rendered using Revit Architecture. The Engineering team used this detailed house model in a multitude of energy modeling software programs, including Trane Trace 700, eQuest, REMdesign, ACCA's Manual J and Revit MEP.

In the five main energy consumption categories of space heating, space cooling, refrigeration, hot water, and appliances and lighting, the ENJOY house outperforms the national average of houses with similar characteristics. These characteristics include the: construction period, number of occupants, square footage, and Mid Atlantic location. Tight building envelope design and passive solar design principles were stressed early in the design development stage of the competition, and drove initial design considerations. By combining passive and active design strategies with concrete technology, the solar electric and solar thermal energy generated will be enough to power the house during the competition period in Washington, D.C., and on an annual basis in Atlantic City.



PASSIVE SOLAR DESIGN DESIGN ORIENTATION

All of the systems of the house are designed in conjunction with the passive strategies (thermal mass, cross ventilation, etc), material properties, and functions of the house thereby optimizing its performance. The house is orientated on an east-west axis, with the eastern portion of the house rotated 15° off true south. A large glazed area sits on the southern wall, making up over 40% of all the window area in the house. The inverted hip shape roof was primarily designed for rainwater collection; however its south overhang was calibrated to provide the necessary shading on the southern façade of the house. The roof was optimized to provide shading in summer and allow for direct solar gain in winter.

A shading analysis of ENJOY house (Figure 1) done in Ecotect, concluded that in winter, 84% of the southern glazing is exposed to sunlight, while in summer the glazing is over 90% shaded. This design of the south roof overhang will reduce heating and cooling loads year round. Figures 2 and 3 shows how sunlight will enter the living space in the house in winter and summer. The color intensity is related to number of hours of entering sunlight and is a seasonal total.

Figure 1: Shading Analysis of Southern Glazing in ENJOY

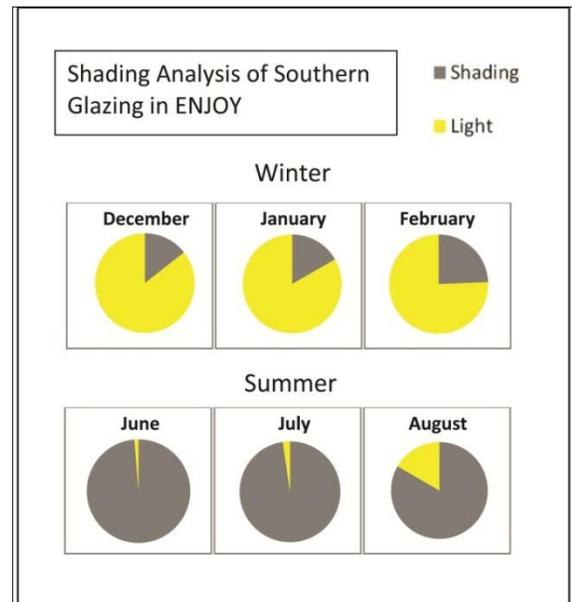




Figure 2: Entering Sunlight in House in Total Seasonal Hours: SUMMER

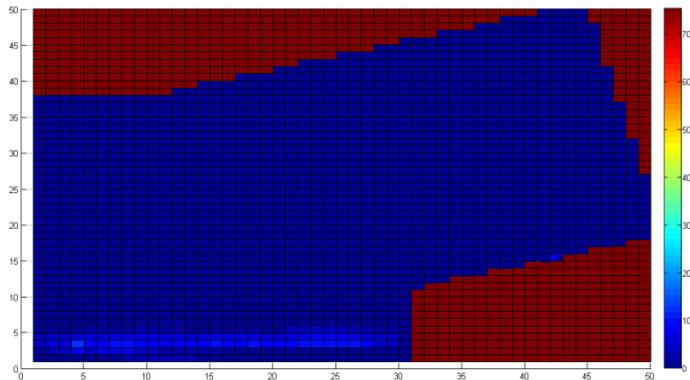
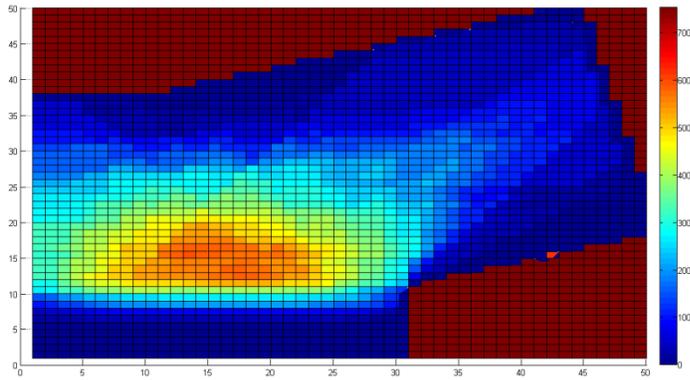


Figure 3: Entering Sunlight in House in Total Seasonal Hours: WINTER

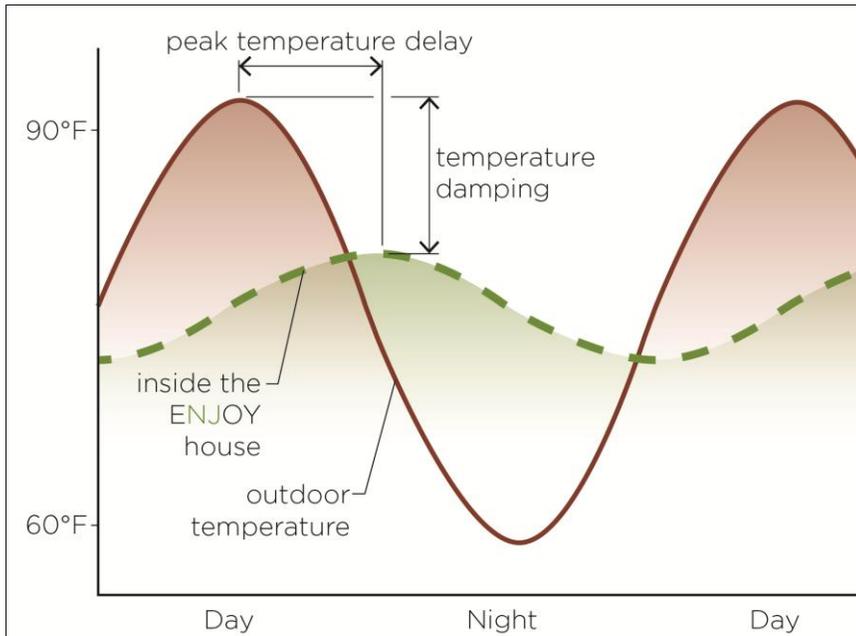


THERMAL MASS

In addition to the orientation and glazing design, the integration of thermal mass is crucial to the passive solar house design. Thermal mass is the ability of a material to capture and retain heat. Concrete, our main construction material, is beneficial because indoor temperature fluctuations are moderated since the heat transfer through the walls is drastically slowed. Thermal mass allows peak demands for heating and cooling to be greatly reduced because it has a damping effect on large temperature swings that otherwise occur from day to night as the sun rises and sets (figure 4). The thermal mass greatly relieves the loads on our mechanical equipment, and reduces energy use overall.



Figure 4: Temperature Damping Effect of Concrete Mass



Diurnal heat capacity (DHC) is a measure of the effectiveness of thermal mass. It shows how well a material can absorb and hold heat before releasing it back to the environment. Team NJ calculated the DHC for concrete, wood, and adobe and compared them in a plot. DHC is a property of a material according to the following formulas¹:

$$DHC_{per\ area} = F_1 s$$

$$s = \sqrt{Pk\rho c / 2\pi}$$

$$F_1 = \sqrt{(\cosh(2x) - \cos(2x)) / (\cosh(2x) + \cos(2x))}$$

$$x = t \sqrt{\pi\rho c / Pk}$$

Where,

- P=period, 24 hours
- K=conductivity, BTU/ft-hr-°F
- ρ=density, lbm/ft³
- c=specific heat, BTU/lbm-°F
- t=thickness, ft

¹ Balcomb, Douglass J. Diurnal Heat Storage in Direct-Gain Passive Solar Buildings. 1983.

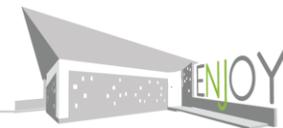
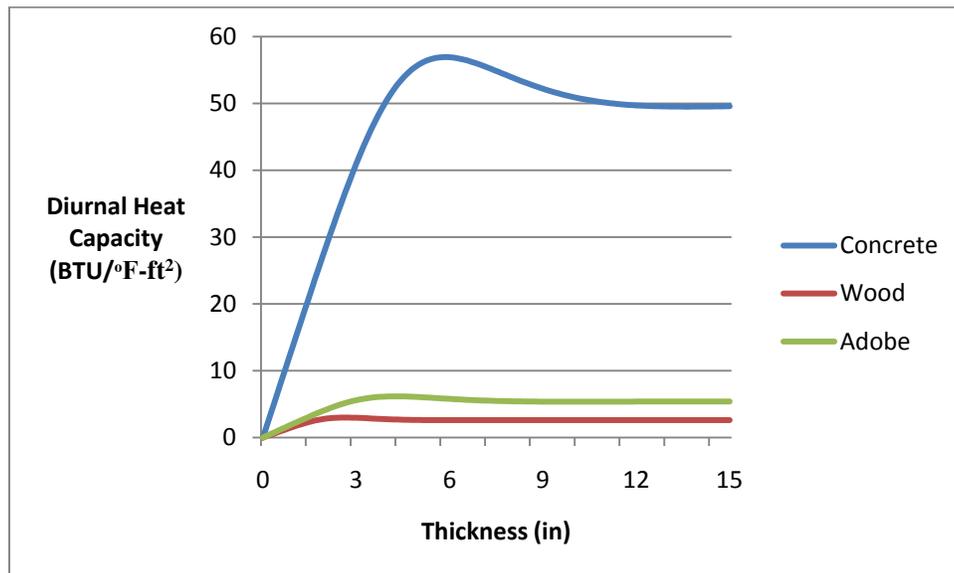


Figure 5: Diurnal Heat Capacity of Various Construction Materials vs. Wall Thickness



Compared with other building materials, concrete is extremely good at absorbing heat energy during the day and releasing it at night. The interior thickness of the concrete walls in the ENJOY house is 6 inches, for a DHC of about 35.

THERMAL ENVELOPE

The building envelope design follows protocol developed by the U.S. Green Building Center for LEED platinum certification and the 2009 International Energy Conservation Code for New Jersey. In many places, it exceeds both. Team New Jersey selected BASF Neopor insulation, which has an R-value of 4.59/inch at 75°F, but actually increases its R value as temperatures drop, achieving an R of 5.07/inch at 23°F, which is about the average January temperature in Atlantic City. The walls, floor, and ceiling all have six inches of insulation, which in winter gives a near continuous whole-house R-value of 30.42. The NJ IECC recommends mass wall insulation to be between 5 to 10 R, and foundation slab to be 10, so in those areas our walls and floors have well-exceeded code.

MECHANICAL EQUIPMENT SIZING

All of this data was modeled to determine heating and cooling loads for the ENJOY house. Team NJ relied on the ACCA Manual J for sizing the heating and cooling loads. Manual J is required as part of the LEED certification process. The team also compared those results with Trace Trane model and the Revit Autodesk calculation, and the results were comparable. The Manual J readout is below. The heating load was found to be 1.2 tons (14442 Btu) and the cooling load, which includes both sensible and latent cooling needs in NJ, was found to be 1.35 tons.



Figure 6: ACCA Manual J Calculation for Sizing Heating and Cooling Loads

FORM J1 _{AE} • ABRIDGED VERSION of MANUAL J, 8TH EDITION										
Project		eNJoy		Design State & City		New Jersey		Atlantic City CO		
Indoor Design Heating db		70	Outdoor 99% db		13	HTD		57		
Indoor Design Cooling db		75	Outdoor 1% db		88	CTD		13		
Indoor Design Cooling RH		55%	Grains Difference		29	Daily Range		Medium		
Latitude		39	Elevation		64	ACF		1.000		
		Glass Direction	Construction Detail			Heating HTM	Cooling HTM	Net Area	Block Load	
									Heating BTUH	Cooling BTUH
6A	Windows & Glass Doors	N	1F-Fr (Fixed), 3 Panes, Pultruded Fiberglass Reinforced Polymer, S			11.40	11.00	34	388	374
		S	1F-Fr (Fixed), 3 Panes, Pultruded Fiberglass Reinforced Polymer, S			11.40	11.51	28	319	322
		E/W	1F-Fr (Fixed), 3 Panes, Pultruded Fiberglass Reinforced Polymer, S			11.40	23.16	114	1300	2640
		N	1F-Or (Operable) 3 panes, Pultruded Fiberglass Reinforced Polyme			11.97	9.90	57	682	564
		S	1F-Or (Operable) 3 panes, Pultruded Fiberglass Reinforced Polyme			11.97	9.90	125	1496	1238
		E/W	1F-Or (Operable) 3 panes, Pultruded Fiberglass Reinforced Polyme			11.97	27.00	38	455	1026
		N	1E-c (Fixed), 2 panes, Fixed Sash, SHGC=0.69			39.33	21.00	6	233	124
		S	1E-c (Fixed), 2 panes, Fixed Sash, SHGC=0.69			39.33	35.00	6	233	207
		E/W	1E-c (Fixed), 2 panes, Fixed Sash, SHGC=0.69			39.33	70.00	12	465	828
6B	Skylights									
7	Wood & Metal Doors	a	11N, Metal, Polystyrene Core			19.95	9.10	42	838	382
		b								
		c								
8	Above Grade Walls	a	14D-33, ICF, R-33, Finish: none, rough concrete			1.94	0.19	322	624	60
		b	14D-33, ICF, R-33, Finish: none, rough concrete			1.94	0.19	265	514	50
		c	14D-33, ICF, R-33, Finish: none, rough concrete			1.94	0.19	269	522	50
		d	14D-33, ICF, R-33, Finish: none, rough concrete			1.94	0.19			
		e	14D-33, ICF, R-33, Finish: none, rough concrete			1.94	0.19			
	Partition Walls	f	14 F-0, 4in Concrete, R-0, rough concrete					11		
		g	14 F-0, 4in Concrete, R-0, rough concrete							
9	Below Grade Walls	a								
		b								
10	Ceilings	a	18B-19, Ceiling below roof joists, R-19; Concrete and grey			29.07	8.16			
		b	18B-19, Ceiling below roof joists, R-19; Concrete and grey			29.07	8.16			
		c	18B-19, Ceiling below roof joists, R-19; Concrete and grey			29.07	8.16			
11	Passive Floors	a								
		b								
	Exposed Floors	c	20R-19 Blanket Insulation, with radiant floor p 342			3.14	0.72	846	2652	605
		d								
	Slab (Perimeter Ft.)	e								
	Basement Floor	f								
		g								
12	Infiltration	Envelope Leakage	Tight	Heated & Cooled Floor Area = Sq. Ft.	940	Above Grade = Cu. Ft.	8500	1421	162	
		No. of Fireplaces								
13	Internal Gains	Number of Bedrooms			3	Occupants	4		920	
		Appliance - 1200 BTUH							1200	
14 Sub Totals								12141	10753	
15	Duct Loss & Gain	7E-T&B SA in Attic, RA Riser in Floor to Ceiling Chase, Perimeter Supply Outlets								
		R-Value = 6	Leakage Class .12/.24		0.189	<input checked="" type="checkbox"/>	0.215	<input checked="" type="checkbox"/>	2300	2316
		Installed Square Feet of Surface or Default = 1	Supply		1		Return	1		
16	Ventilation	Combustion Air From Conditioned Space	<input type="checkbox"/> Furnace	<input type="checkbox"/> Water Heater	None					
19	Blower Heat Gain	Manufacturer's performance data has no blower heat discount								1707
20 Total Sensible Loss or Gain								14442	14776	
					21	Latent Infiltration load for cooling			223	
						Latent load for occupants			800	
						Latent load for plants	Small	Medium	Large	
						Latent load for duct in unconditioned space			338	
Latent ventilation load for cooling										
Total Latent Gain								1362		



Energy use in the ENJOY House was modeled using eQuest software. eQuest performs whole building energy analysis based on variables such as building envelope, location, occupancy, and equipment. The model of the ENJOY house was then compared with that of a typical stick frame house with R12 in walls and floor, R30 ceiling, and identical footprint that uses electric resistive heating and an air conditioning unit.

Some of the data from the eQuest model was particularly helpful, such as the power that will be used to heat and cool the house, which is difficult to model by hand. Other areas, such as the appliances, hot water, and lighting are more arbitrary, so the team repeated these calculations by hand for the competition period. Also, the ENJOY house uses significantly more pumping energy than a typical house because of its reliance on hydronic heating and cooling features.

Figure 7: eQuest Model of Energy Consumption in "Typical" House vs. ENJOY House

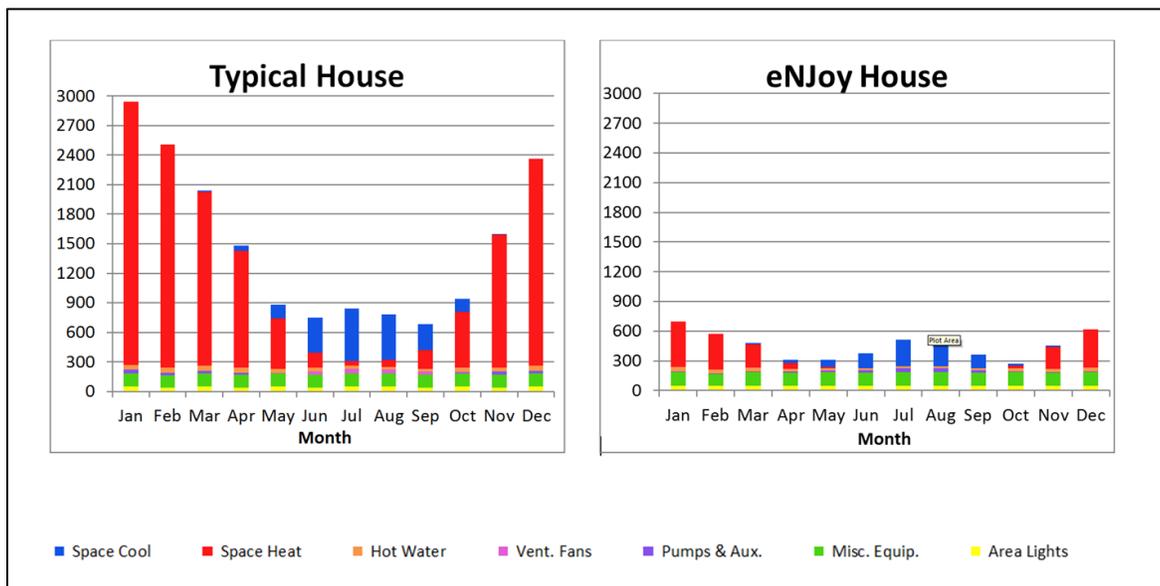


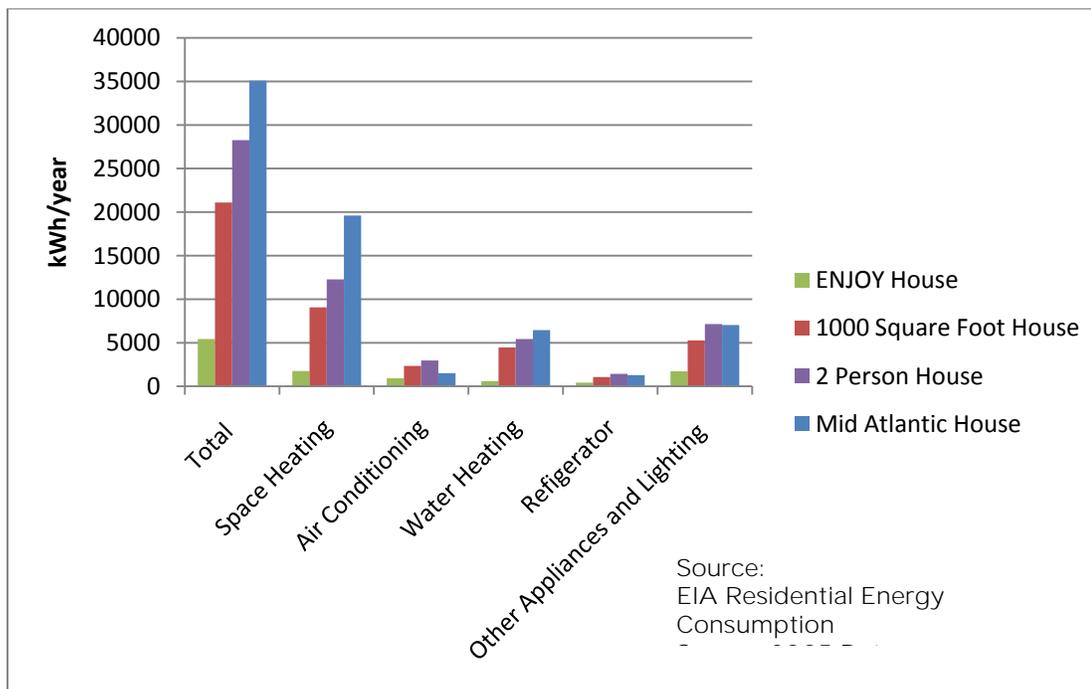


Figure 8: eQuest Model of Energy Consumption in "Typical" House vs. ENJOY House in Tabular Form

Category of Energy Consumption	ENJOY HOUSE	"TYPICAL HOUSE"
	Annual, (kWh)	Annual, (kWh)
Space Cool	921	1830
Space Heat	1767	12900
Hot Water	348	490
Vent. Fans	14	170
Pumps & Aux.	213	190
Misc. Equip.	1576	1590
Area Lights	598	530
Total	5437	17700

The data from Equest was then compared to similar housing types in the U.S., using data from Table US14, *Average Consumption by Energy End Uses, 2005* Million British Thermal Units (Btu) per Household of the Energy Information Administration's 2005 Residential Energy Consumption Survey. The data was converted to kWh for ease of comparison. In each category, the ENJOY house uses considerably less energy than its counterparts. The results in space heating are the most drastic. New Jersey has a long heating season, so reducing the amount of energy to space heat the house was critical.

Figure 9: Comparison of ENJOY with Various Related Housing Types.





PHOTOVOLTAIC ENERGY ANALYSIS

The solar array was sized based on predicted power consumption in the house, while producing as much power possible from each solar AC module while still complying with competition regulations. The height restriction was particularly limiting, since the ideal mounting angle would be nearly 40°. However, at a mounting angle of 25°, September/October production in Washington, DC is affected minimally, therefore the 25° angle was selected for designing the roof slope and 5 out of the 6 branches of panels. The last branch is mounted at a -5 angle to avoid having any problems with exceeding the house's height limit of 18 feet during the competition. However, when the house is moved to NJ, the racking system will be adjusted to bring Branch F to 25°, this will lead to an increase in annual power production of 396 kWh, which is equivalent to the annual power draw of our refrigerator. The results are presented below, both for power production during the competition in Washington and also annually for Atlantic City, NJ.

Figure 10: Power Production by Branch, Total Output for Competition in Washington, DC

	Number of Panels	kW per Branch	Derate= 0.85		PV Watts Daily Avg		Competition Output by Branch (kWh)
			Derated Power Output (kWh)	Mounting Angle (°)	Sept.	Oct.	
Branch A	8	1.80	1.53	25	6.8	6.6	67.4
Branch B	7	1.58	1.34	25	5.9	5.8	58.7
Branch C	6	1.35	1.15	25	5.1	4.9	50.4
Branch D	5	1.13	0.96	25	4.2	4.1	42.1
Branch E	7	1.58	1.34	25	5.9	5.8	58.7
Branch F	7	1.58	1.34	-5	4.9	3.7	46.4
Total	40	9.00	7.65				
Total Power Output During Competition (kWh):							323.8

Figure 11: Power Production by Branch, Monthly Output for Atlantic City, NJ

	Number of Panels	kW per Branch	Derate= 0.85 Derated Power Output (kWh)	Mounting Angle (°)	Monthly Average Output, kWh (AC Energy). Source: PV Watts												Annual (kWh)
					Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	
Branch A	8	1.80	1.53	25	156	171	219	236	253	248	253	240	218	193	146	133	2473
Branch B	7	1.575	1.34	25	137	149	192	207	227	217	222	210	191	168	128	116	2164
Branch C	6	1.35	1.15	25	117	128	164	177	194	186	190	180	164	144	110	100	1854
Branch D	5	1.125	0.96	25	98	107	137	148	162	155	158	150	136	120	91	83	1545
Branch E	7	1.575	1.34	25	137	149	192	207	227	217	222	210	191	168	128	116	2164
Branch F	7	1.575	1.34	-5	70	97	154	188	223	222	222	197	159	115	69	55	1768
Total	40	9	7.65														
Total Power Output, Annual for Atlantic City (kWh):																	11968
Total Power Output, Annual for Atlantic City (kWh), with all branches at 25°:																	12364

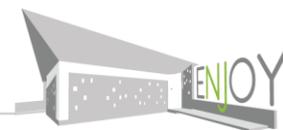


During the competition, if conditions are sunny, we will likely produce around 324 kWh. The production value was based on using a derate factor of 0.85. We calculated power draws based on contest requirement, and for simplicity levelized each component into a daily average for the 10 day competition period. The main area of uncertainty is the energy draw of the heat pump. Testing will commence at the end of the month with the completed model of the house, but for now we chose to over-estimate the heat pump needs, since according to Equest, the house in NJ will use 235.5 kWh in space cooling during the entire month of August, and we will be cooling later in the year when ambient temperature will be lower and only for ten days, and assume total mechanical draws to be more than half that number.



Figure 12: Power Consumption, Competition Period

	VOLTS	AMPS	HOURS PER DAY	WATTS	kWh	TOTALS
CLIMATE CONTROL						
Heat Pump	240	8.5	4.5	2040	9.2	
Dehumidifier	120	5.2	1	624	0.6	
Air Handler	240	1.8	3	432	1.3	
ERV	120	0.75	15	90	1.4	
Pump (hydronic Floor)	115	2	5	230	1.2	
Control System	120	1	16	120	1.9	
Daily Total					15.5	
Competition Total						155.2
HOT WATER						
Instant Hot Water	240	30	0.33	7200	2.4	
Solar Pump	120	0.115	7	13.8	0.1	
Daily Total					2.5	
Competition Total						24.726
APPLIANCES						
Television	120	1.07	0.3	128.4	0.0	
DVD	120	1	0.3	120	0.0	
Wireless Router	5	2.5	16	12.5	0.2	
Dishwasher	120	12	0.5	1440	0.7	
Range Hood	120	1.1	1.4	132	0.2	
Washer	120	13.33	1.2	1599.6	1.9	
Stove	240	12.5	0.6	3000	1.8	
Dryer	120	13.33	1.6	1599.6	2.6	
Galaxy Tab	120	0.166	2	19.92	0.0	
Daily Total				0	7.5	
Competition Total						74.9804
REFRIGERATION						
Refrigeration	120	0.399	24	47.88	1.1	
Daily Total					1.1	
Competition Total						11.4912
LIGHTING						
(Indoor)						
A-LIGHT ARRIS 5	120	0.45	3.5	54	0.2	
A-LIGHT ALURE 2	120	0.35	3.5	42	0.1	
A-LIGHT ACCOLADE 3	120	3.60	3.5	432	1.5	
A-LIGHT ALURE 2	120	1.80	3	216	0.6	
7 A-LIGHT ARRIS 5	120	3.15	3	378	1.1	
(Outdoor)						
A-LIGHT ACCOLADE 3	120	3.60	2.2	432	1.0	
TROY LANDSCAPE S	120	1.17	2.2	140	0.3	
DEKOR DEK DOT	120	1.31	2.2	157.5	0.3	
HINKLEY LIGHTING PIZA	120	0.75	2.2	90	0.2	
Daily Total					5.4	
Competition Total						54.329
				Power Consumed		319.6 kWh
				Available Power		323.8 kWh

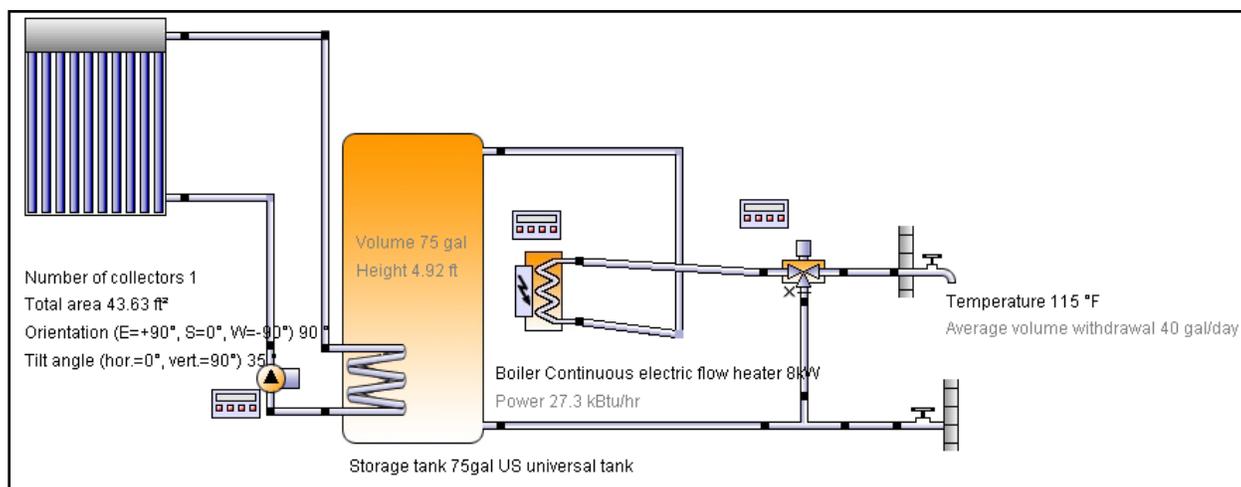


SOLAR HOT WATER ANALYSIS

The solar thermal system was designed to provide the majority of hot water needs during the competition in DC, and it will meet 75% of the ENJOY house's domestic hot water needs annually.

The system was modeled using Polysun, a Vela Solaris software product used to model and size solar thermal systems. Below is a graphic summarizing the inputs to the simplified model, including average daily water draws, hot water storage capacity, back-up heating, and the array components and orientations. Polysun software catalogues the data reported by the SRCC for every solar thermal product on the market, so Team NJ was able to be specific enough to actually name the exact system we are using, which is a 30-evacuated tube system from Apricus.

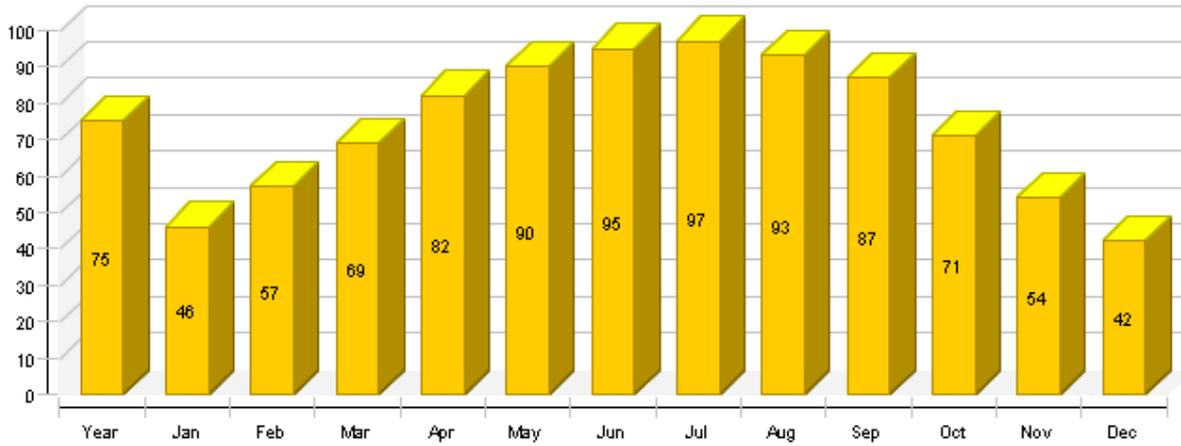
Figure 13: Polysun Model of Solar Thermal System for Domestic Hot Water Use



The design of the solar thermal system in the ENJOY house is rather more complex, since the hot water storage tank is also connected to the radiant floor via a second internal heat exchange coil. The design was simplified here to only show domestic hot water demand. This is a rather realistic way to view the system, since although the radiant floor is tied to the solar hot water loop, the control logics give preference to heating domestic hot water over radiant floor heating when there is not enough excess heat in the tank. This design decision was based on the fact that the reverse cycle chiller can achieve a COP greater than one, while the instantaneous electric water heater is limited to an efficiency of 99%. Hot water demand is estimated to be 40 gallons per day, which is an average draw for a two person household.



Figure 14: Solar Fraction of Hot Water Demand



Although the system is undersized for annual use, it meets nearly all hot water requirements in the summer months. The solar fraction developed by the model shows that the system will deliver 75% of the house's hot water needs annually.



Structural Calculations

Team New Jersey
Solar Decathlon
Structural Calculations

4-01

Revision 0 | November 2010



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1 Structures, Materials, Loading & Codes

1.1 Codes and Standards

1.2 Material Properties

1.3 Location

1.4 Structure

1.5 Loading

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Job Title SOLAR DECATHLON HOUSE

1.0 STRUCTURES, MATERIALS, LOADING & CODES

1.1 CODES AND STANDARDS

1. IBC 2009 - NJ EDITION
2. ASCE 7-05 "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES"
3. AISC 360-05 "SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS"
4. ACI 318-08 "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE AND COMMENTARY"
5. U.S. DEPARTMENT OF ENERGY BUILDING CODE

1.2 MATERIAL PROPERTIES

1. CONCRETE : $f'_c = 5000 \text{ psi}$ $E_c = 4030 \text{ ksi}$
 $\gamma_c = 145 \text{ pcf}$ $\beta_1 = 0.80$
2. MISC. STEEL : $f_y = 36 \text{ ksi}$
 $f_u = 58 \text{ ksi}$
 $E_s = 29000 \text{ ksi}$
3. REINFORCING BARS
 $f_y = 60 \text{ ksi}$
 $E_s = 29000 \text{ ksi}$

1.3 LOCATION

TEMPORARY LOCATION : NATIONAL MALL WASHINGTON D.C

PERMANENT LOCATION : SOUTH OF POINT PLEASANT, NJ

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Job Title SOLAR DECATHLON HOUSE

1.4 STRUCTURE

THIS STRUCTURE IS PRECAST REINFORCED CONCRETE SYSTEM. ALL ROOF, WALL, AND FLOOR PANELS ARE COMPOSED OF ONE LAYER OF EXPANDED POLYSTYRENE (EPS) FOAM SANDWICHED BETWEEN TWO LAYERS OF CONCRETE. THE BUILDING IS FOUNDED ON A SPREAD FOOTING GRID. THE LATERAL FORCE SYSTEM IS COMPRISED TWO RC SHEAR WALLS AROUND THE PERIMETER AND 3 RC SHEAR WALLS FORMING AN I-SHAPE.

Job Title SOLAR DECATHLON

1.5 LOADING

FROM SOLAR DECATHLON BUILDING CODE :

$V_{3s} = 60 \text{ mph}$, EXPOSURE CATEGORY C

RAILINGS LL = 200 lbs ANY DIRECTION

INTERIOR LL = 50 psf

ROOF LL = 20 psf

SNOW LOAD SL = 20 psf

FROM ASCE 7-05 & NJ IBC 2009:

WIND $V_{3s} = 120 \text{ mph}$, EXPOSURE CATEGORY C

WIND DIRECTIONALITY, $K_d = 0.85$

(ASCE 7-05 TABLE 6-4)

IMPORTANCE FACTOR, $I = 1.00$ FOR OCCUPANCY CATEGORY II

(TABLE 6-1)

VELOCITY PRESSURE $K_z = 0.85$ FOR $Z < 15'$
EXPOSURE COEFFICIENT

(TABLE 6-3)

GUST EFFECT FACTOR $G = 0.85$

(6.5.8.1)

TOPOGRAPHIC FACTOR $K_{zt} = 1.0$

(6.5.7.2)

VELOCITY PRESSURE $q_z = 0.00256 K_z K_{zt} K_d V^2 I$

(6.5.10)

$$= 0.00256 (0.85)(1.0)(0.85)(120)^2(1.0) = 26.63 \text{ psf}$$

EARTHQUAKE

EQUIVALENT LATERAL FORCE PROCEDURE

(ASCE 7-05 12.8)

0.2S SPECTRAL RESPONSE ACCELERATION $S_s = 20\% g$ EXACT LOC. UNKNOWN CONSERVATIVE

(FIGURE 22-1)

1.0S SPECTRAL RESPONSE ACCELERATION $S_1 = 6\% g$ EXACT LOC. UNKNOWN CONSERVATIVE

(FIGURE 22-2)

ASSUME SITE CLASS D

(11.4.2)

SITE COEFFICIENTS $F_a = 1.60$ INTERPOLATED

(TABLE 11.4-1)

$F_v = 2.40$

(TABLE 11.4-2)

$$S_{MS} = F_a S_s = (1.60)(0.20) = 0.32$$

(11.4-1)

$$S_{DS} = \frac{2}{3} S_{MS} = (2/3)(0.32) = 0.213$$

(11.4-3)

$$S_{M1} = F_v S_1 = (2.40)(0.06) = 0.144$$

(11.4-2)

$$S_{D1} = \frac{2}{3} S_{M1} = (2/3)(0.144) = 0.096$$

(11.4-4)

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SNOW LOAD

GROUND SNOW LOAD , $p_g = 20 \text{psf}$ (FIGURE 7-1)

EXPOSURE CATEGORY C (6.5.6.3)

EXPOSURE FACTOR , FULLY ENCLOSED , $C_e = 0.9$ (TABLE 7-2)

THERMAL FACTOR , $C_t = 1.0$ (TABLE 7-3)

IMPORTANCE FACTOR , $I = 1.0$ (TABLE 7-4)

$p_f = 0.7 C_e C_t I p_g = 0.7(0.9)(1.0)(1.0)(20 \text{psf}) = 12.6 \text{psf}$ (EQ. 7-1)

NO LESS THAN $p_f = I p_g = 1.0(20 \text{psf}) = 20 \text{psf}$

USE $p_f = 20 \text{psf}$

LIVE LOADS - SOL. DEC. CODE CONTROLS FOR SOME CASES

RESIDENTIAL - PUBLIC ROOMS & CORRIDORS SERVICING , $LL = 100 \text{psf}$ (TABLE 4-1)

" - PRIVATE " " " " , $LL = 40 \text{psf}$ (" ")

ROOFS - ORDINARY FLAT , PITCHED , AND CURVED ROOFS , $LL = 20 \text{psf}$ (TABLE 4-1)

2 Roof Framing

2.1 Precast Roof Slabs

2.1.1 Type 1

2.1.2 End Piece 1

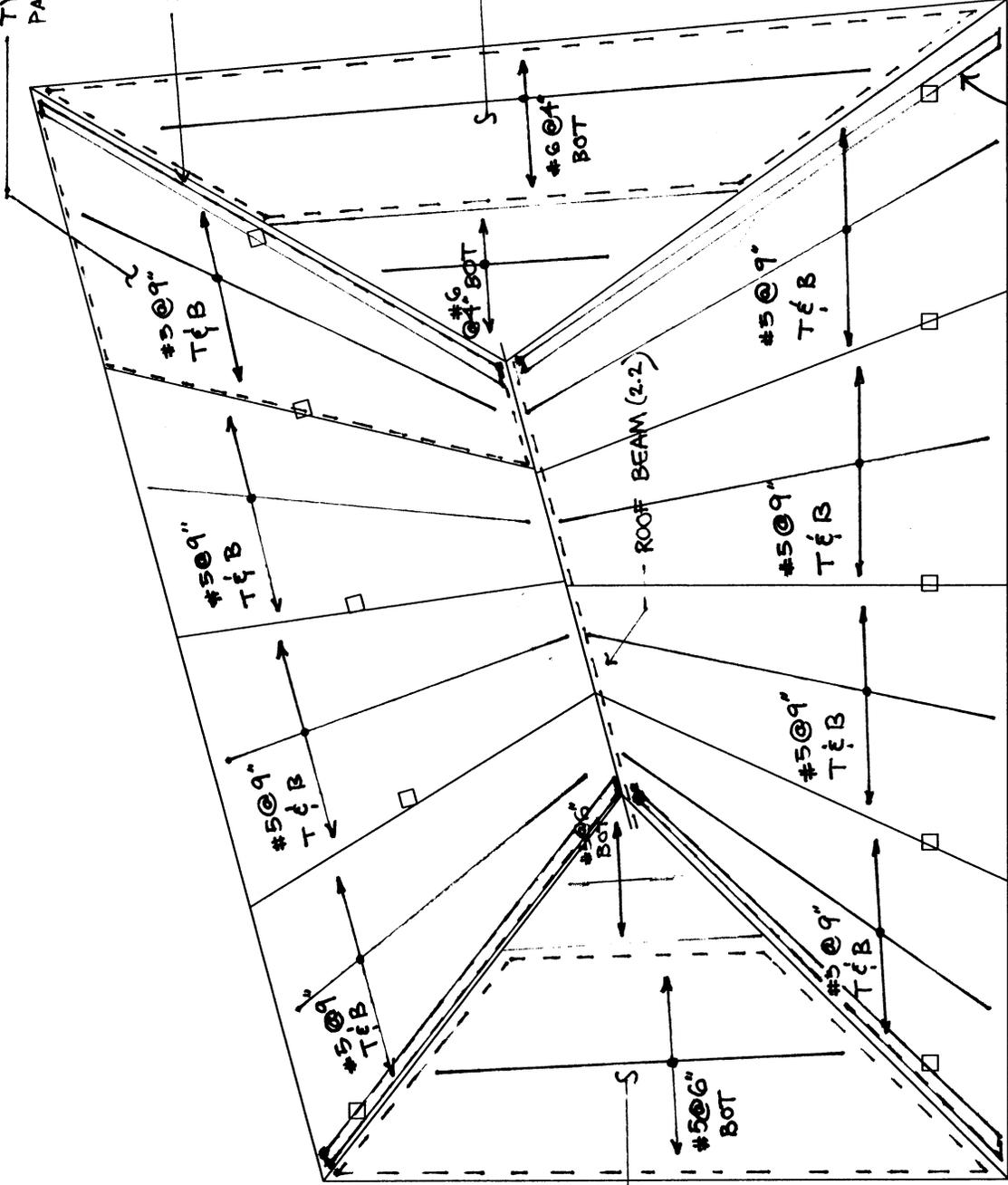
2.1.3 End Piece 2

2.1.4 Integral Beams along End Pieces

TYPICAL
PANEL #1 (2.1.1)

INTEGRAL
BEAM (2.1.4)

END ROOF
SANDWICH PANEL (EAST)
(2.1.2)



4#9 TOP
2#7 BOTTOM
#4 STIRRUPS @ 6"

END ROOF
SANDWICH PANEL
(WEST) (2.1.3)

#5 @ 9"
T & B

#6 @ 4"
BOT

#6 @ 4"
BOT

#5 @ 9"
T & B

#5 @ 9"
T & B

#5 @ 9"
T & B

#5 @ 6"
BOT

#5 @ 9"
T & B

Job No.	Sheet No.	Rev.
Member-Location		
Drg. Ref.		
Made by	AP	Date 11/11/10
		DAL Chd.

2.0 ROOF FRAMING

2.1 PRECAST SANDWICH PANELS

LOADING

DEAD

$$DL_{NWC} = 73 \text{ psf} \quad (6" \text{ THICK NWC})$$

$$DL_{EPS} = 1 \text{ psf}$$

$$SDL_{SERV} = 5 \text{ psf}$$

$$SDL_{PV} = 5 \text{ psf}$$

LIVE

$$LL_r = 20 \text{ psf}$$

SNOW

$$SL = 20 \text{ psf}$$

WIND

BE
NEGATIVE PRESSURE TO BE CALCULATED USING ASCE 7-05 FIGURE 6-14B

$$A_{eff} \approx 150 \text{ ft}^2 \text{ per panel}$$

$$a = 3 \text{ ft}$$

$$\text{ZONE 1 : } GC_p = -1.1$$

$$\text{ZONE 2 : } GC_p = -1.2$$

$$\text{ZONE 3 : } GC_p = -2.0$$

$$q_h = 26.63 \text{ psf} \quad (\text{FROM SECTION 1.4})$$

$$p = -34.1 \text{ psf}^* \quad \text{or} \quad p = -29.3 \text{ psf} \quad (\text{w/o } GC_{pi})$$

$$p = -36.7 \text{ psf}^* \quad \text{or} \quad p = -32.0 \text{ psf} \quad (\text{w/o } GC_{pi})$$

$$p = -53.3 \text{ psf}^* \quad - \text{INTERNAL PRESSURE COEFFICIENT NOT INCLUDED}$$

$$p = q_h [(GC_p) - (GC_{pi})]$$

ASCE 7-05 EQN 6-22

$$GC_{pi} = \pm 0.18$$

ASCE 7-05 FIGURE 6-5

POSITIVE PRESSURE TO BE CALCULATED USING ASCE 7-05 FIGURE 6-14B

$$GC_p = 0.3 \quad (\text{ALL ZONES})$$

$$p = q_h [(GC_p) - (GC_{pi})] \quad p = 12.8 \text{ psf}^*$$

* POSITIVE VALUES INDICATE FORCE TOWARDS SURFACE, NEGATIVE VALUES DENOTES FORCE AWAY FROM SURFACE

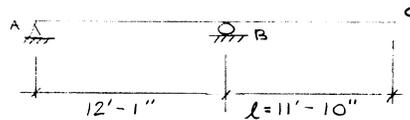
Job Title SOLAR DECATIFLON HOUSE

2.1.1 TYPICAL PANEL # 1

POSSIBLE COMBINATIONS

2. $1.2D + 0.5LL_r$
3. $1.2D + 1.6LL_r + 0.8WL$
4. $1.2D + 1.6W + 0.5L_r$
6. $0.9D + 1.6W$

SPAN ARRANGEMENT



NEGATIVE MOMENT

$$\begin{aligned}
 1. \quad w_u &= 1.2(DL_{NWC} + DL_{EPS} + DL_{SER} + DL_{PV}) + 1.6LL_r + 0.8W \\
 w_u &= 1.2(73 + 1 + 5 + 5) + 1.6(20) + 0.8(12.8) \\
 w_u &= 143 \text{ plf FROM B TO C} \\
 w_u &= 1.2(73 + 1 + 5 + 5) + 0.8W = \\
 w_u &= 111.0 \text{ plf FROM A TO B} \\
 M_{u, \text{neg}} &= \frac{w_u l^2}{2} = \frac{111.0 (11.83)^2}{2} = 7.77 \text{ kip-ft} \approx 8 \text{ kip-ft}
 \end{aligned}$$

POSITIVE MOMENT

$$\begin{aligned}
 6. \quad w_u &= 0.9D + 1.6W \\
 w_u &= 0.9(73 + 1 + 5 + 5) + 1.6(-34.1) \\
 w_u &= 21.0 \text{ plf FROM A TO C-3'} \\
 w_u &= 0.9(73 + 1 + 5 + 5) + 1.6(-32.0) \\
 w_u &= 24.4 \text{ plf FROM C-3" TO C} \\
 M_{u, \text{pos}} &= \frac{w_u L^2}{8} = \frac{21.0 (12.0 \times 3)^2}{8} = 3.07 \text{ kip-ft}
 \end{aligned}$$

↑ CONSERVATIVELY ASSUME SIMPLE SPAN WITH NO OVERHANG

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Job Title SOLAR DECATHLON

$$M_{u,neg} = 8 \text{ kip-ft}$$

$$M_{u,neg} \leq \phi M_n = \phi 0.85 f_c' a b \left(d - \frac{a}{2}\right)$$

$$8(12) = 0.9(0.85)(5)(a)(12)(8.75 - \frac{a}{2})$$

$$8 = 3.83(8.75 - \frac{a}{2})(a)$$

$$8 = 33.51a - 1.92a^2$$

$$a = \frac{+33.51 \pm \sqrt{33.51^2 - 4(1.92)(8)}}{2(1.92)} = 0.242 \text{ in}$$

$$A_s F_y = 0.85 f_c' a b$$

$$A_s (60 \text{ ksi}) = 0.85(5)(0.242)(12)$$

$$A_s = 0.206 \text{ in}^2/\text{ft}$$

CHECK MIN:

$$A_{s,min} = \frac{3\sqrt{f_c'}}{f_y} (12)(8.75) = 0.371 \text{ in}^2/\text{ft}$$

$$A_{s,min} = \frac{200b_w d}{f_y} = \frac{200(12)(8.75)}{60000} = 0.35 \text{ in}^2/\text{ft}$$

TRY #5@9"

$$A_s = 0.31 \text{ in}^2 (12"/9") = 0.413$$

$$A_s F_y = 0.85 f_c' a b$$

$$(0.413)(60) = 0.85(5)(12)(a)$$

$$a = 0.485 \text{ in.}$$

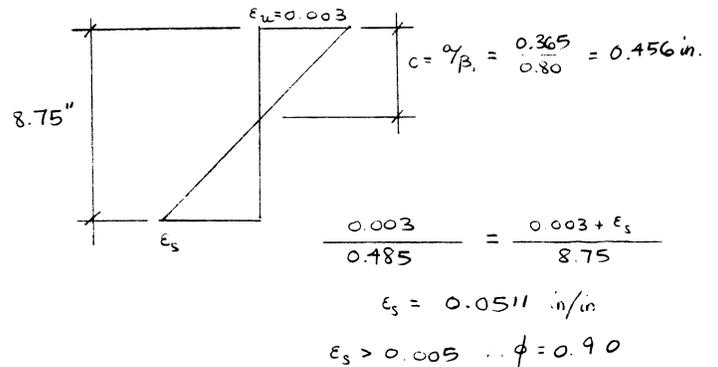
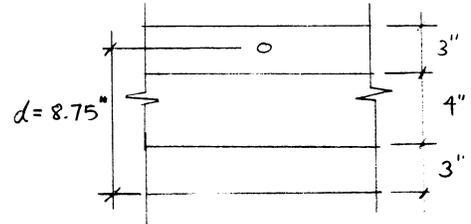
$$\phi M_n = 0.90 A_s F_y \left(d - \frac{a}{2}\right)$$

$$= 0.90(0.413)(60)(8.75 - \frac{0.485}{2}) = 189.7 \text{ kip-in} = 15.8 \text{ kip-ft}$$

$M_{u,pos} = 3 \text{ kip-ft}$ use minimum steel

#5 @ 9 AT BOTTOM

USE #5 @ 9 T \dot{E} B FOR ALL PRECAST ROOF PANELS EXCEPT @ END PANELS



2.1.2 Design of End Roof Sandwich Panel (East)

Loading

$$w_{conc} := 145 \frac{\text{lbf}}{\text{ft}^3} \quad w_{eps} := 2 \frac{\text{lbf}}{\text{ft}^3} \quad w_{serv} := 5\text{psf} \quad w_{pv} := 5\text{psf} \quad LR := 20\text{psf}$$

$$SL := 20\text{psf} \quad WL := 12.8\text{psf} \quad \frac{L}{w} := 42.67\text{ft}$$

Assume unit width of concrete

$$t_{conc} := 7\text{in} \quad b := 1\text{ft} \quad t_{eps} := 5\text{in}$$

← ACTUALLY 6", CONSERVATIVE FOR POSITIVE MOMENT

$$D_{conc} := w_{conc} \cdot t_{conc} \cdot b = 84.583 \cdot \text{plf}$$

$$D_{eps} := w_{eps} \cdot t_{eps} \cdot b = 0.833 \cdot \text{plf}$$

$$SD_{serv} := 5\text{psf} \cdot b = 5 \cdot \text{plf}$$

$$SD_{pv} := 5\text{psf} \cdot b = 5 \cdot \text{plf}$$

$$L_r := LR \cdot b = 20 \cdot \text{plf}$$

$$S_w := SL \cdot b = 20 \cdot \text{plf}$$

$$W_w := WL \cdot b = 12.8 \cdot \text{plf}$$

Max Positive Moment

$$w_{upos} := 1.2 \cdot (D_{conc} + D_{eps} + SD_{serv} + SD_{pv}) + 1.6 \cdot \max(L_r, S) + 0.8 \cdot W = 156.74 \cdot \text{plf}$$

$$M_{upos} := \frac{w_{upos} \cdot L^2}{8} = 35.673 \cdot \text{kip} \cdot \text{ft} \quad V_{upos} := \frac{w_{upos} \cdot L}{2} = 3.344 \cdot \text{kip}$$

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Member-Location END ROOF SANDWICH PANEL (EAST)		
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DESIGN FOR FLEXURE

$$M_{u, pos} = 35.7 \text{ kip-ft}$$

$$\phi M_n = \phi 0.85 f'_c a b \left(d - \frac{a}{2} \right)$$

$$(35.7)(12) = 0.9 (0.85) (5 \text{ ksi}) (a) (12 \text{ in.}) \left(8.625 - \frac{a}{2} \right)$$

$$35.7 = 5.825 a \left(8.625 - \frac{a}{2} \right)$$

$$35.7 = 33.0 a - 1.91 a^2$$

$$a = \frac{33.0 \pm \sqrt{33.0^2 - 4(1.91)(35.7)}}{2(1.91)}$$

$$a = 1.160 \text{ in.} \quad c = 1.45 \text{ in.}$$

$$A_s F_y = 0.85 f'_c a b$$

$$A_s = \frac{0.85 (5 \text{ ksi}) (1.160) (12 \text{ in.})}{60 \text{ ksi}} = 0.986 \text{ in.}^2$$

TRY #6@4"

$$A_s = 0.44 \text{ in.}^2 (12"/4") = 1.32 \text{ in.}^2$$

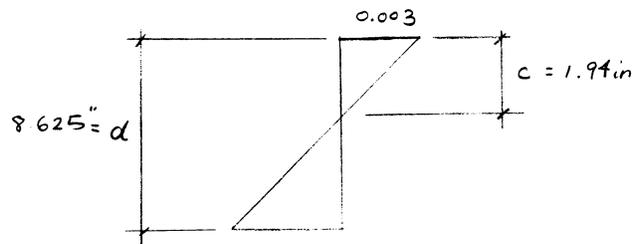
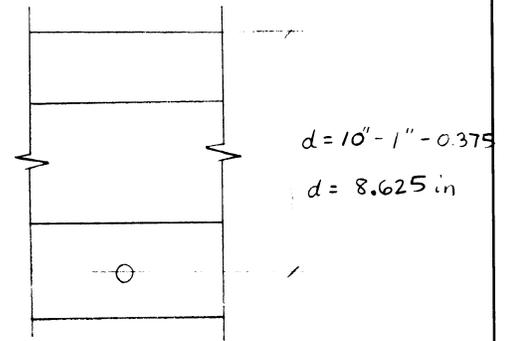
$$A_s F_y = 0.85 f'_c a b$$

$$1.32 (60) = 0.85 (5) (a) (12 \text{ in.})$$

$$a = 1.55 \quad c = 1.94 \text{ in.}$$

$$\phi M_n = \phi A_s F_y \left(d - \frac{a}{2} \right)$$

$$= 0.9 (1.32) (60) \left(8.625 - \frac{1.55}{2} \right) = 559.5 \text{ kip-in.} = 46.6 \text{ kip-ft} \therefore \text{OK}$$



$$\frac{0.003}{1.94} = \frac{0.003 + \epsilon_u}{8.625}$$

$$\epsilon_u = 0.0103 > 0.005$$

$$\phi = 0.9$$

2.1³ Design of End Roof Sandwich Panel (West)

Loading

$$w_{conc} := 145 \frac{\text{lb}}{\text{ft}^3} \quad w_{eps} := 2 \frac{\text{lb}}{\text{ft}^3} \quad w_{serv} := 5 \text{psf} \quad w_{pv} := 5 \text{psf} \quad LR := 20 \text{psf}$$

$$SL := 20 \text{psf} \quad WL := 12.8 \text{psf} \quad \frac{L}{w} := 29.75 \text{ft}$$

Assume unit width of concrete

$$t_{conc} := 7 \text{in} \quad b := 1 \text{ft} \quad t_{eps} := 5 \text{in}$$

← ACTUALLY 6", CONSERVATIVE FOR POSITIVE MOMENT

$$D_{conc} := w_{conc} \cdot t_{conc} \cdot b = 84.583 \cdot \text{plf}$$

$$D_{eps} := w_{eps} \cdot t_{eps} \cdot b = 0.833 \cdot \text{plf}$$

$$SD_{serv} := 5 \text{psf} \cdot b = 5 \cdot \text{plf}$$

$$SD_{pv} := 5 \text{psf} \cdot b = 5 \cdot \text{plf}$$

$$L_r := LR \cdot b = 20 \cdot \text{plf}$$

$$\frac{S}{w} := SL \cdot b = 20 \cdot \text{plf}$$

$$\frac{W}{w} := WL \cdot b = 12.8 \cdot \text{plf}$$

Max Positive Moment

$$w_{upos} := 1.2 \cdot (D_{conc} + D_{eps} + SD_{serv} + SD_{pv}) + 1.6 \cdot \max(L_r, S) + 0.8 \cdot W = 156.74 \cdot \text{plf}$$

$$M_{upos} := \frac{w_{upos} \cdot L^2}{8} = 17.341 \cdot \text{kip} \cdot \text{ft} \quad V_{upos} := \frac{w_{upos} \cdot L}{2} = 2.332 \cdot \text{kip}$$

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Member-Location END ROOF SANDWICH PANEL (WEST)		
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DESIGN FOR FLEXURE

$M_{u,ps} = 17.3 \text{ kip-ft}$

TRY #5@6

$A_s F_y = 0.85 f'_c a b$

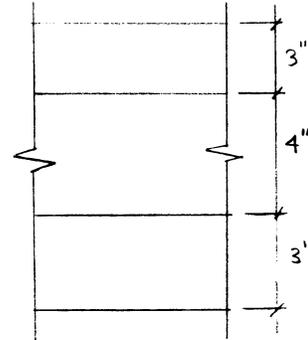
$(0.62 \text{ in}^2)(60) = 0.85(5)(a)(12 \text{ in})$

$a = 0.73 \text{ in.}$

$c = 0.730 \text{ in} / 0.80 = 0.91 \text{ in}$

$d = 10'' - 1'' - c = 8.125''$

$d = 8.69''$



$\phi M_n = \phi A_s F_y (d - \frac{a}{2})$

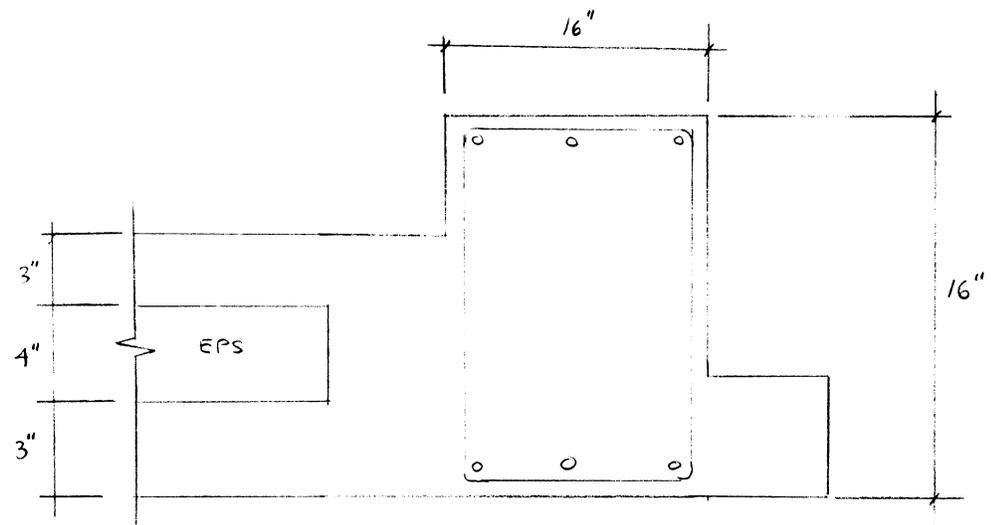
$\phi M_n = 0.90 (0.62)(60) (8.69 - \frac{0.73}{2})$

$\phi M_n = 278.7 \text{ kip-in} = 23.2 \text{ kip-ft} \quad \therefore \text{OK}$

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Member-Location INTEGRAL BEAM		
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Drg. Ref.		
Made by AP	Date 11/12/10	Chd.

2.1.4 INTEGRAL BEAM

SECTION



SPAN ARRANGEMENT (WORST CASE)

NEGATIVE MOMENT



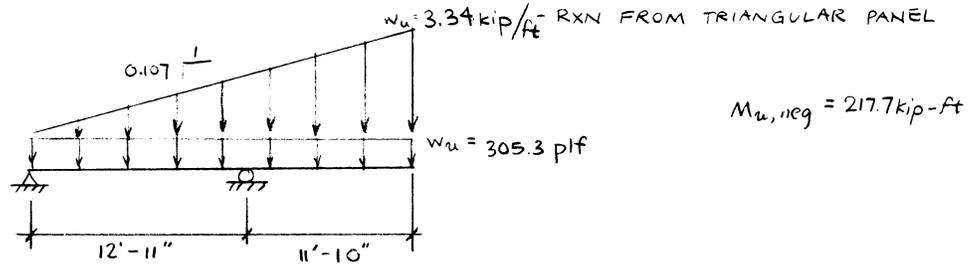
POSITIVE MOMENT



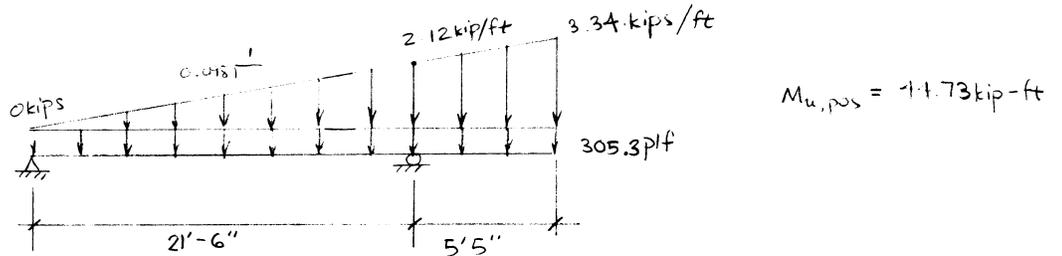
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Made by AP	Date 11/9/10	Chd.

LOADING

①



⑩



①+⑩ $DL_{\text{nwc}} = (16'/12'') (145 \text{ pcf}) = 193 \text{ plf}$

$DL_{\text{serv}} = 5 \text{ psf} (16'/12'') = 6.7 \text{ plf}$

$DL_{\text{pv}} = 6.7 \text{ plf}$ $DL_{\text{eps}} = 1 \text{ plf}$

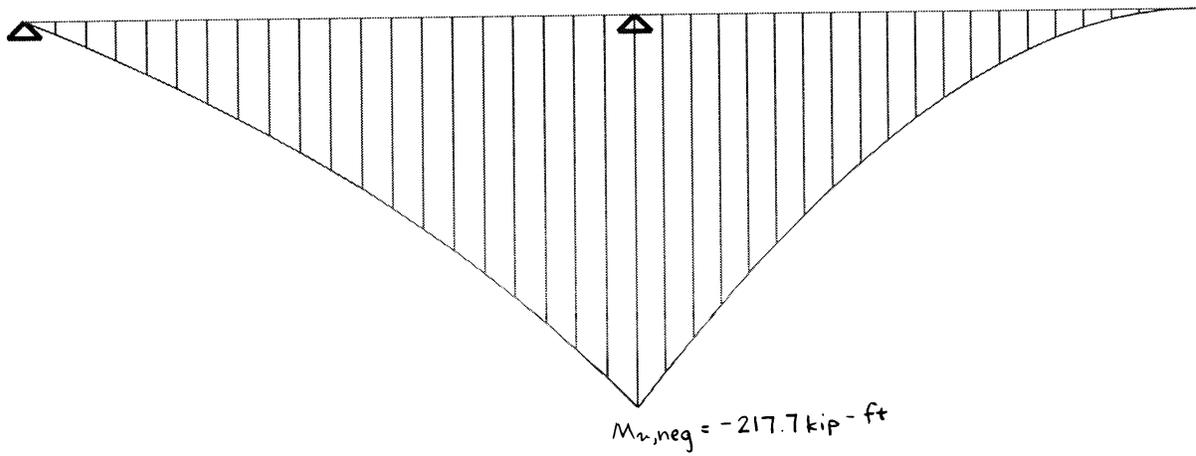
$L_r = 20 \text{ psf} (16'/12'') = 26.7 \text{ plf}$

$w = 12.8 \text{ psf} (16'/12'') = 17.1 \text{ plf}$

$1.2D + 1.6L_r + 0.8W = 1.2(193 + 6.7 + 6.7 + 1) + 1.6(26.7) + 0.8(17.1) = 305.3 \text{ plf}$

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Scale: 1:48.54
Moment, Myy: 500.0 kip-in/pic.cm
Case: L1
Case: A1 : Analysis case 1



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Drg. Ref.		
Made by AP	Date 11-Nov-2010	Checked

Beam and Spring Forces and Moments

The force in an element at any point is the force required to maintain equilibrium if the element is cut at that point and the end 2 part of the element is discarded. Thus: +ve axial forces are tensile
Forces and moments are output in element axis directions
i.e. Fx: axial force; Fy & Fz: shear forces; Mxx: torsion; Myy & Mzz: moments
Element axes for springs are as defined by the spring property axis no.
Case list: 1 : Analysis case 1

Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-ft]	Myy [kip-ft]	Mzz [kip-ft]
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
		25.0%	0.0	0.0	-12.82	0.0	-38.31	0.0
		50.0%	0.0	0.0	-15.91	0.0	-84.33	0.0
		75.0%	0.0	0.0	-20.41	0.0	-142.6	0.0
		2	0.0	0.0	-26.31	0.0	-217.7	0.0
2	A1	2	0.0	0.0	33.64	0.0	-217.7	0.0
		25.0%	0.0	0.0	27.00	0.0	-127.7	0.0
		50.0%	0.0	0.0	19.18	0.0	-59.07	0.0
		75.0%	0.0	0.0	10.18	0.0	-15.35	0.0
		3	0.0	0.0	1.263E-6	0.0	15.81E-6	0.0

Maxima

1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
2	A1	2	0.0	0.0	33.64	0.0	-217.7	0.0
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
2	A1	3	0.0	0.0	1.263E-6	0.0	15.81E-6	0.0
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0

Minima

1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
1	A1	2	0.0	0.0	-26.31	0.0	-217.7	0.0
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0
1	A1	2	0.0	0.0	-26.31	0.0	-217.7	0.0
1	A1	1	0.0	0.0	-11.14	0.0	-275.9E-9	0.0

Design for Flexure

$$\text{Muneg} := 217.7 \text{ kip}\cdot\text{ft} \quad f_c := 5000 \text{ psi} \quad f_y := 60000 \text{ psi} \quad b := 16 \text{ in}$$

$$d := 13 \text{ in} \quad \text{Phi} := 0.9$$

$$x1 := \text{Phi} \cdot 0.85 \cdot f_c \cdot \frac{b}{2} \quad x2 := -\text{Phi} \cdot 0.85 \cdot f_c \cdot b \cdot d \quad x3 := \text{Muneg}$$

$$a := \frac{-x2 - \sqrt{x2^2 - 4x1 \cdot x3}}{2 \cdot x1} = 3.855 \cdot \text{in}$$

$$As1 := \frac{0.85 \cdot f_c \cdot a \cdot b}{f_y} = 4.369 \cdot \text{in}^2$$

Try 4 # 9 @ TOP

$$As := 4 \times 1.00 \text{ in}^2 = 4 \cdot \text{in}^2$$

$$\text{cover} := 1.5 \text{ in} \quad db := \left(\frac{9}{8}\right) \text{ in} = 1.125 \cdot \text{in}$$

$$\tilde{d} := 16 \text{ in} - \text{cover} - \frac{db}{2} = 13.937 \cdot \text{in}$$

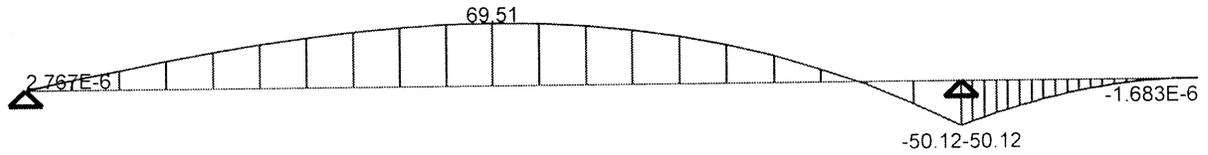
$$\tilde{a} := \frac{As \cdot f_y}{0.85 \cdot f_c \cdot b} = 3.529 \cdot \text{in}$$

$$Mn := As \cdot f_y \cdot \left(d - \frac{a}{2}\right) = 243.456 \cdot \text{kip}\cdot\text{ft}$$

$$\text{PhiMn} := \text{Phi} \cdot Mn = 219.11 \cdot \text{kip}\cdot\text{ft}$$

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72086-10		
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Scale: 1:52.79
Moment, Myy: 83.33 kip-ft/pic.cm
Case: L1
Case: A1 : Analysis case 1



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72086-10		
Drg. Ref.		
Made by AP	Date 11-Nov-2010	Checked

Beam and Spring Forces and Moments

The force in an element at any point is the force required to maintain equilibrium if the element is cut at that point and the end 2 part of the element is discarded. Thus: +ve axial forces are tensile
Forces and moments are output in element axis directions
i.e. Fx: axial force; Fy & Fz: shear forces; Mxx: torsion; Myy & Mzz: moments
Element axes for springs are as defined by the spring property axis no.
Case list: 1 : Analysis case 1

Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-ft]	Myy [kip-ft]	Mzz [kip-ft]
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
		25.0%	0.0	0.0	7.063	0.0	48.78	0.0
		50.0%	0.0	0.0	0.05511	0.0	69.51	0.0
		75.0%	0.0	0.0	-10.53	0.0	42.96	0.0
2	A1	2	0.0	0.0	-24.70	0.0	-50.12	0.0
		25.0%	0.0	0.0	17.90	0.0	-50.12	0.0
		50.0%	0.0	0.0	13.77	0.0	-28.66	0.0
		75.0%	0.0	0.0	9.406	0.0	-12.94	0.0
3	A1		0.0	0.0	4.817	0.0	-3.287	0.0
			0.0	0.0	-71.60E-9	0.0	-1.683E-6	0.0

Maxima

1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
2	A1	2	0.0	0.0	17.90	0.0	-50.12	0.0
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
1	A1	50.0%	0.0	0.0	0.05511	0.0	69.51	0.0
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0

Minima

1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
1	A1	2	0.0	0.0	-24.70	0.0	-50.12	0.0
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0
1	A1	2	0.0	0.0	-24.70	0.0	-50.12	0.0
1	A1	1	0.0	0.0	10.49	0.0	2.767E-6	0.0

Chd:

Design For Flexure

$$M_{upos} := 69.51 \text{ kip}\cdot\text{ft} \quad f_c := 5000 \text{ psi} \quad f_y := 60000 \text{ psi} \quad b := 16 \text{ in}$$

$$d := 13 \text{ in} \quad \Phi := 0.9$$

$$x_1 := \Phi \cdot 0.85 \cdot f_c \cdot \frac{b}{2} \quad x_2 := -\Phi \cdot 0.85 \cdot f_c \cdot b \cdot d \quad x_3 := M_{upos}$$

$$a := \frac{-x_2 - \sqrt{x_2^2 - 4x_1 \cdot x_3}}{2 \cdot x_1} = 1.094 \text{ in}$$

$$A_{s1} := \frac{0.85 \cdot f_c \cdot a \cdot b}{f_y} = 1.24 \text{ in}^2$$

$$A_{s2} := 0.905 \text{ in}^2 \quad A_{s3} := 0.693 \text{ in}^2$$

$$A_{sreqd} := \max(A_{s1}, A_{s2}, A_{s3}) = 1.24 \text{ in}^2$$

Try 2 # 7 @ Bottom

$$A_s := 2 \times 0.60 \text{ in}^2 = 1.2 \text{ in}^2$$

$$\text{cover} := 1.5 \text{ in} \quad d_b := \left(\frac{9}{8}\right) \text{ in} = 1.125 \text{ in}$$

$$d_{\text{eff}} := 16 \text{ in} - \text{cover} - \frac{d_b}{2} = 13.937 \text{ in}$$

$$a_{\text{eff}} := \frac{A_s \cdot f_y}{0.85 \cdot f_c \cdot b} = 1.059 \text{ in}$$

$$M_n := A_s \cdot f_y \cdot \left(d - \frac{a}{2}\right) = 80.449 \text{ kip}\cdot\text{ft}$$

$$\Phi M_n := \Phi \cdot M_n = 72.404 \text{ kip}\cdot\text{ft}$$

Chd:

Shear Design

$$f_c := 5000 \quad b := 16 \quad d := 13.94$$

$$V_c := 2 \cdot \sqrt{f_c b} \cdot \frac{d}{1000} = 31.543 \quad \text{kips}$$

$$V_u := 33.64 \quad \text{kips}$$

$$\Phi := 0.75$$

$$\Phi V_c := \Phi \cdot V_c = 23.657 \quad \text{kips}$$

$$A_v := 2 \cdot 0.20 = 0.4 \quad \text{in}^2$$

$$f_{yt} := 60 \quad \text{ksi}$$

$$s_{reqd} := \frac{\Phi \cdot A_v \cdot f_{yt} \cdot d}{V_u - \Phi \cdot V_c} = 25.135$$

$$f_{yt} := 60000 \quad \text{psi}$$

$$s_{max1} := \min\left(\frac{A_v \cdot f_{yt}}{50 \cdot b}, \frac{A_v \cdot f_{yt}}{0.75 \cdot \sqrt{f_c \cdot b}}\right) = 28.284 \quad \text{in}$$

$$s_{max2} := \frac{d}{2} = 6.97 \quad \text{in}$$

$$s_{max3} := 25 \quad \text{in}$$

$$s_{max} := \min(s_{max1}, s_{max2}, s_{max3}) = 6.97$$

use #4 @ 6in. throughout

2.2 Precast Roof Beam

Job No.	Sheet No.	Rev.
Member-Location		
Drg. Ref.		
Made by	Date	Chd.
AP	11/12/10	

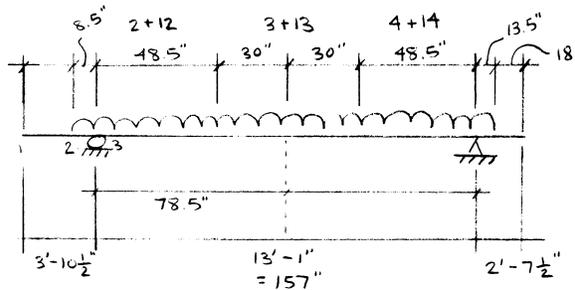
Job Title SOLAR DECATHLON HOUSE

2.2 PRECAST ROOF BEAM

POSSIBLE COMBINATIONS

3. $1.2D + 1.6(LL_r \text{ or } S) + 0.8W$

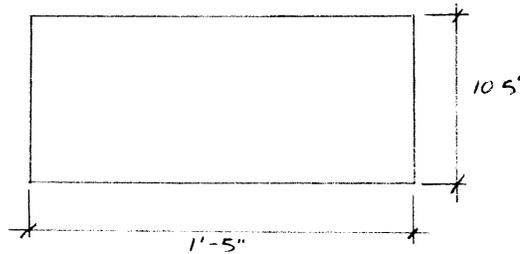
SPAN ARRANGEMENT



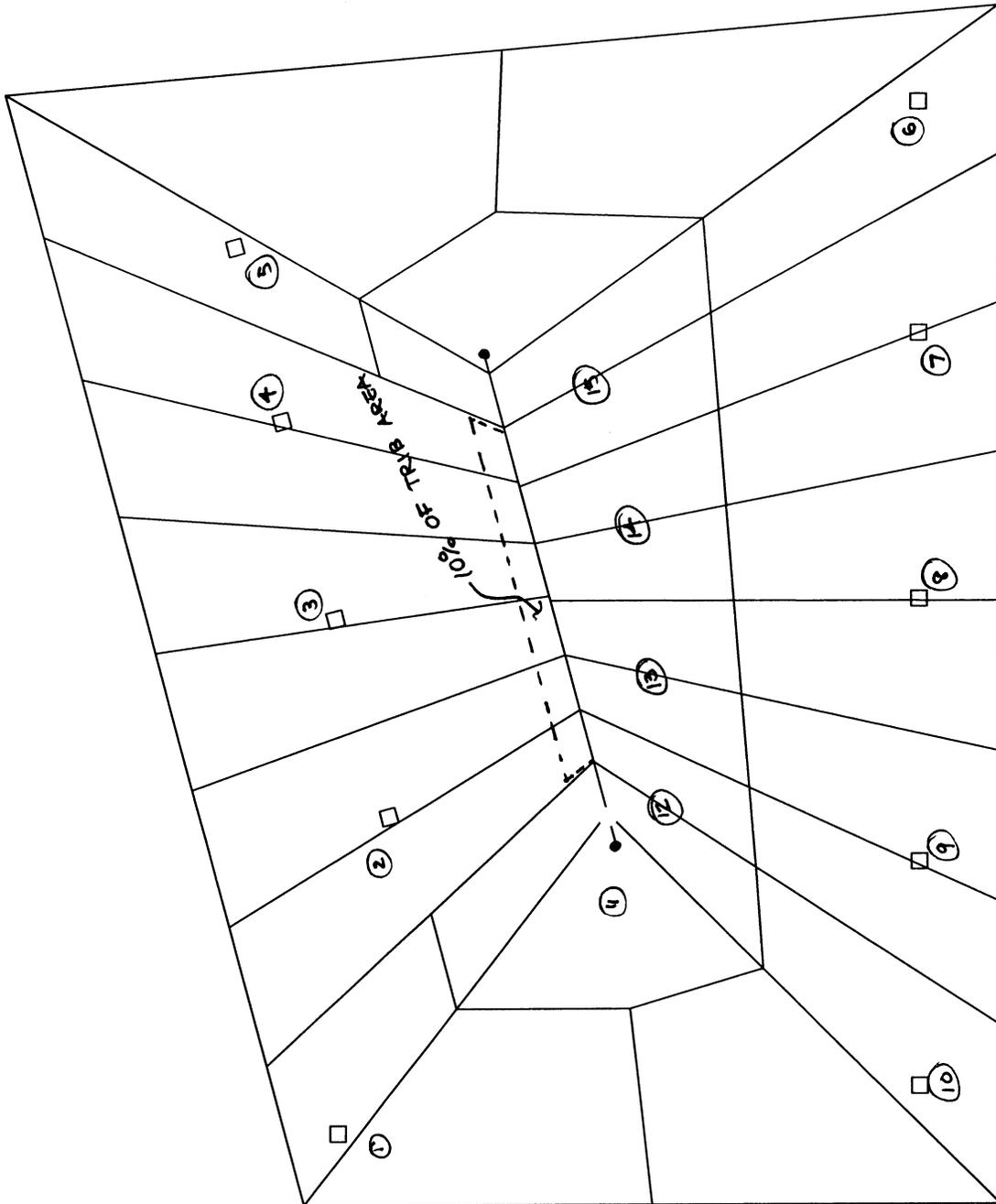
$M_{u,neg} = -671.6 \text{ kip-in}$ positive wind pressure
 $= 56.0 \text{ kip-ft}$

$M_{u,pos} = 63.03 \text{ kip-in}$ negative wind pressure
 $= 5.3 \text{ kip-ft}$

SECTION - SEE NEXT PAGE FOR DETAILS



TRIBUTARY AREAS USED FOR PRECAST ROOF BEAM



CALCULATION OF LOADING FOR ROOF BEAM (NEGATIVE WIND PRESSURE)

Atiup

LOADTYPE	MAGNITUDE	psf	Area (ft ²)	Adjusted Area	L_BEAM (ft)	D_LINVC	D_LEPS	D_L_BEAM	SDL_PV	SDL_SERV	LL_ROOF	SL	WL	1.2D+1.6max(LrS)+0.8W	Load per foot (kip/ft)	1.2D+1.6Lr+0.8W	Load per foot (kip/ft)						
D_LINVC	85		144	14.4	0.00	1.22	0.01	0.00	0.07	0.07	0.29	0.29	-0.49	1.73	0.26	1.27	0.27	1.73	0.36	1.73	0.36	1.73	0.36
D_LEPS	1	psf	145	14.5	0.00	1.23	0.01	0.00	0.07	0.07	0.29	0.29	-0.49	1.74	0.26	1.27	0.25	1.74	0.35	1.74	0.35	1.74	0.35
D_L_BEAM	266.67	plf	148	14.8	0.00	1.26	0.01	0.00	0.07	0.07	0.30	0.30	-0.50	1.77	0.34	1.30	0.25	1.77	0.34	1.77	0.34	1.77	0.34
SDL_PV	5	psf	41	4.1	0.00	3.49	0.04	0.00	0.21	0.21	0.82	0.82	-1.40	4.82	1.04	3.60	0.76	4.82	1.04	4.82	1.04	4.82	1.04
SDL_SERV	5	psf	51	5.1	0.00	4.34	0.05	0.00	0.26	0.26	1.02	1.02	-1.74	6.12	1.23	4.48	0.90	6.12	1.22	6.12	1.22	6.12	1.22
LL_ROOF	20	psf	60	6.0	0.00	5.10	0.06	0.00	0.30	0.30	1.20	1.20	-2.05	7.20	1.39	5.28	1.02	7.20	1.39	7.20	1.39	7.20	1.39
SL	20	psf																					
-L_EGRESS	100	psf																					
WL	-34.1	psf																					
			104	104	20.08	6.16	0.10	4.71	0.48	0.48	1.92	1.92	-3.27	8.29	2.08	8.29	1.717	8.29	2.08	8.29	1.717	8.29	1.717
			96	96	17.67																		

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	8.29	8.29	4.96	4.96	4.96	4.96
9	17.17	17.17	14.09	14.09	14.09	14.09

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/ft)	1.2D+1.6Lr+0.8W	Load (kip/ft)	1.2D+1.6Lr+0.8W	Load (kip/ft)
1	2.00	2.00	0.00	0.00	0.00	0.00
9	3.00	3.00	1.40	1.03	1.40	1.03
	4.00	4.00	1.57	1.15	1.57	1.15
	5.00	5.00	1.74	1.27	1.74	1.27
	6.00	6.00	1.91	1.40	1.91	1.40
	7.00	7.00	2.08	1.53	2.08	1.53
	8.00	8.00	2.25	1.66	2.25	1.66

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

Node	1.2D+1.6max(LrS)+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)	1.2D+1.6Lr+0.8W	Load (kip/m)
1	0.00	0.00	0.00	0.00	0.00	0.00
9	0.117	0.117	0.085	0.085	0.117	0.085
	0.131	0.131	0.096	0.096	0.131	0.096
	0.145	0.145	0.106	0.106	0.145	0.106
	0.159	0.159	0.117	0.117	0.159	0.117
	0.173	0.173	0.127	0.127	0.173	0.127
	0.188	0.188	0.139	0.139	0.188	0.139

CALCULATION OF WIND LOADING (POSITIVE WIND PRESSURE)

LOAD TYPE	MAGNITUDE	psf	Area (ft ²)	Adjusted Area	L_BEAM (ft)	DL_NWC	DL_EPS	DL_BEAM	SDL_PV	SDL_SERV	LL_ROOF	SL	WL	1.2D+1.6max(LrS)+0.8W	Load per foot (kip/ft)	1.2D+1.6Lr+0.8W	Load per foot (kip/ft)	1.2D+1.6Lr+0.8W	Load per foot (kip/ft)	1.2D+1.6Lr+0.8W	Load per foot (kip/ft)
DL_NWC	85				0.00	1.22	0.01	0.00	0.07	0.07	0.29	0.29	0.18	2.17	0.48	1.81	0.38	2.27	0.48	2.27	0.48
DL_EPS	1		14.4	14.4	0.00	1.23	0.01	0.00	0.07	0.07	0.29	0.29	0.19	2.18	0.46	1.82	0.36	2.28	0.46	2.28	0.46
DL_BEAM	266.67		14.5	14.5	0.00	1.26	0.01	0.00	0.07	0.07	0.30	0.30	0.19	2.33	0.45	1.86	0.36	2.33	0.45	2.33	0.45
SDL_PV	5		14.8	14.8	0.00	3.49	0.04	0.00	0.21	0.21	0.82	0.82	0.52	6.44	1.36	5.14	1.08	6.46	1.36	6.46	1.36
SDL_SERV	5		41	41	0.00	4.34	0.05	0.00	0.26	0.26	1.02	1.02	0.65	8.03	1.61	6.40	1.28	8.03	1.61	8.03	1.61
LL_ROOF	20		51	51	0.00	5.10	0.06	0.00	0.30	0.30	1.20	1.20	0.77	9.45	1.83	7.53	1.46	9.45	1.83	9.45	1.83
SL	20		60	60	0.00																
LL_EGRESS	100				20.08	8.16	0.10	4.71	0.52	0.48	2.08	2.08	1.33	13.19	2.67	12.19	2.46	13.19	2.67	13.19	2.67
WL	12.8				17.67						1.92	1.92	1.23	20.77		20.77		20.77		20.77	
			104	104																	
			96	96																	

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Node	1.2D+1.6max(LrS)+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)	1.2D+1.6Lr+0.8W	Force (kips)
1	12.19	12.19	8.86	8.86	17.70	17.70
9	20.77	20.77	17.70	17.70	20.77	20.77

Job No.	Sheet No.	Rev.
72086-10		
Drg. Ref.		
Made by	Date	Checked
AP	11-Nov-2010	

MAXIMUM POSITIVE MOMENT FOR PRECAST BEAM

Beam and Spring Forces and Moments

The force in an element at any point is the force required to maintain equilibrium if the element is cut at that point and the end 2 part of the element is discarded. Thus: +ve axial forces are tensile
 Forces and moments are output in element axis directions
 i.e. Fx: axial force; Fy & Fz: shear forces; Mxx: torsion; Myy & Mzz: moments
 Element axes for springs are as defined by the spring property axis no.

Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-in]	Myy [kip-in]	Mzz [kip-in]
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
		25.0%	0.0	0.0	-8.290	0.0	-78.76	0.0
		50.0%	0.0	0.0	-8.290	0.0	-157.5	0.0
		75.0%	0.0	0.0	-8.290	0.0	-236.3	0.0
		2	0.0	0.0	-8.290	0.0	-315.0	0.0
A2		1	0.0	0.0	-8.290	0.0	169.5E-6	0.0
		25.0%	0.0	0.0	-8.290	0.0	-78.75	0.0
		50.0%	0.0	0.0	-8.290	0.0	-157.5	0.0
		75.0%	0.0	0.0	-8.290	0.0	-236.3	0.0
		2	0.0	0.0	-8.290	0.0	-315.0	0.0
A3		1	0.0	0.0	-4.960	0.0	4.322E-6	0.0
		25.0%	0.0	0.0	-4.960	0.0	-47.12	0.0
		50.0%	0.0	0.0	-4.960	0.0	-94.24	0.0
		75.0%	0.0	0.0	-4.960	0.0	-141.4	0.0
		2	0.0	0.0	-4.960	0.0	-188.5	0.0
2	A1	2	0.0	0.0	-8.290	0.0	-315.0	0.0
		25.0%	0.0	0.0	-8.539	0.0	-332.9	0.0
		50.0%	0.0	0.0	-8.787	0.0	-351.3	0.0
		75.0%	0.0	0.0	-9.036	0.0	-370.2	0.0
		3	0.0	0.0	-9.284	0.0	-389.7	0.0
A2		2	0.0	0.0	-8.290	0.0	-315.0	0.0
		25.0%	0.0	0.0	-8.471	0.0	-332.8	0.0
		50.0%	0.0	0.0	-8.651	0.0	-351.0	0.0
		75.0%	0.0	0.0	-8.832	0.0	-369.6	0.0
		3	0.0	0.0	-9.013	0.0	-388.6	0.0
A3		2	0.0	0.0	-4.960	0.0	-188.5	0.0
		25.0%	0.0	0.0	-5.209	0.0	-199.3	0.0
		50.0%	0.0	0.0	-5.457	0.0	-210.6	0.0
		75.0%	0.0	0.0	-5.706	0.0	-222.5	0.0
		3	0.0	0.0	-5.954	0.0	-234.9	0.0
3	A1	3	0.0	0.0	8.767	0.0	-389.7	0.0
		25.0%	0.0	0.0	7.349	0.0	-292.0	0.0
		50.0%	0.0	0.0	5.930	0.0	-211.5	0.0
		75.0%	0.0	0.0	4.512	0.0	-148.2	0.0
		4	0.0	0.0	3.093	0.0	-102.1	0.0
A2		3	0.0	0.0	6.128	0.0	-388.6	0.0
		25.0%	0.0	0.0	5.098	0.0	-320.5	0.0
		50.0%	0.0	0.0	4.067	0.0	-264.9	0.0
		75.0%	0.0	0.0	3.036	0.0	-221.9	0.0
		4	0.0	0.0	2.006	0.0	-191.3	0.0
A3		3	0.0	0.0	8.399	0.0	-234.9	0.0
		25.0%	0.0	0.0	6.980	0.0	-141.6	0.0
		50.0%	0.0	0.0	5.562	0.0	-65.59	0.0
		75.0%	0.0	0.0	4.143	0.0	-6.754	0.0
		4	0.0	0.0	2.725	0.0	34.88	0.0
4	A1	4	0.0	0.0	3.093	0.0	-102.1	0.0
		25.0%	0.0	0.0	2.110	0.0	-82.59	0.0
		50.0%	0.0	0.0	1.128	0.0	-70.44	0.0
		75.0%	0.0	0.0	0.1454	0.0	-65.67	0.0
		5	0.0	0.0	-0.8371	0.0	-68.26	0.0
A2		4	0.0	0.0	2.006	0.0	-191.3	0.0
		25.0%	0.0	0.0	1.286	0.0	-179.0	0.0
		50.0%	0.0	0.0	0.5657	0.0	-172.0	0.0
		75.0%	0.0	0.0	-0.1543	0.0	-170.5	0.0
		5	0.0	0.0	-0.8743	0.0	-174.3	0.0
A3		4	0.0	0.0	2.725	0.0	34.88	0.0

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Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-in]	Myy [kip-in]	Mzz [kip-in]
		25.0%	0.0	0.0	1.742	0.0	51.63	0.0
		50.0%	0.0	0.0	0.7596	0.0	61.01	0.0
		75.0%	0.0	0.0	-0.2229	0.0	63.03	0.0
5	A1	5	0.0	0.0	-1.205	0.0	57.67	0.0
		5	0.0	0.0	-0.8371	0.0	-68.26	0.0
		25.0%	0.0	0.0	-1.820	0.0	-78.23	0.0
		50.0%	0.0	0.0	-2.802	0.0	-95.56	0.0
		75.0%	0.0	0.0	-3.785	0.0	-120.3	0.0
		6	0.0	0.0	-4.767	0.0	-152.3	0.0
A2		5	0.0	0.0	-0.8743	0.0	-174.3	0.0
		25.0%	0.0	0.0	-1.594	0.0	-183.6	0.0
		50.0%	0.0	0.0	-2.314	0.0	-198.2	0.0
		75.0%	0.0	0.0	-3.034	0.0	-218.3	0.0
		6	0.0	0.0	-3.754	0.0	-243.8	0.0
A3		5	0.0	0.0	-1.205	0.0	57.67	0.0
		25.0%	0.0	0.0	-2.188	0.0	44.94	0.0
		50.0%	0.0	0.0	-3.170	0.0	24.85	0.0
		75.0%	0.0	0.0	-4.153	0.0	-2.611	0.0
		6	0.0	0.0	-5.135	0.0	-37.44	0.0
6	A1	6	0.0	0.0	-4.767	0.0	-152.3	0.0
		25.0%	0.0	0.0	-6.525	0.0	-220.8	0.0
		50.0%	0.0	0.0	-8.283	0.0	-310.6	0.0
		75.0%	0.0	0.0	-10.04	0.0	-421.7	0.0
		7	0.0	0.0	-11.80	0.0	-554.1	0.0
A2		6	0.0	0.0	-3.754	0.0	-243.8	0.0
		25.0%	0.0	0.0	-5.040	0.0	-297.1	0.0
		50.0%	0.0	0.0	-6.325	0.0	-366.0	0.0
		75.0%	0.0	0.0	-7.610	0.0	-450.5	0.0
		7	0.0	0.0	-8.895	0.0	-550.5	0.0
A3		6	0.0	0.0	-5.135	0.0	-37.44	0.0
		25.0%	0.0	0.0	-6.894	0.0	-110.4	0.0
		50.0%	0.0	0.0	-8.652	0.0	-204.6	0.0
		75.0%	0.0	0.0	-10.41	0.0	-320.2	0.0
		7	0.0	0.0	-12.17	0.0	-457.0	0.0
7	A1	7	0.0	0.0	19.13	0.0	-554.1	0.0
		25.0%	0.0	0.0	18.64	0.0	-490.3	0.0
		50.0%	0.0	0.0	18.15	0.0	-428.3	0.0
		75.0%	0.0	0.0	17.66	0.0	-367.8	0.0
		8	0.0	0.0	17.17	0.0	-309.1	0.0
A2		7	0.0	0.0	18.60	0.0	-550.5	0.0
		25.0%	0.0	0.0	18.24	0.0	-488.3	0.0
		50.0%	0.0	0.0	17.89	0.0	-427.4	0.0
		75.0%	0.0	0.0	17.53	0.0	-367.6	0.0
		8	0.0	0.0	17.17	0.0	-309.1	0.0
A3		7	0.0	0.0	16.05	0.0	-457.0	0.0
		25.0%	0.0	0.0	15.56	0.0	-403.7	0.0
		50.0%	0.0	0.0	15.07	0.0	-352.0	0.0
		75.0%	0.0	0.0	14.58	0.0	-302.0	0.0
		8	0.0	0.0	14.09	0.0	-253.6	0.0
8	A1	8	0.0	0.0	17.17	0.0	-309.1	0.0
		25.0%	0.0	0.0	17.17	0.0	-231.8	0.0
		50.0%	0.0	0.0	17.17	0.0	-154.5	0.0
		75.0%	0.0	0.0	17.17	0.0	-77.26	0.0
		9	0.0	0.0	17.17	0.0	11.69E-6	0.0
A2		8	0.0	0.0	17.17	0.0	-309.1	0.0
		25.0%	0.0	0.0	17.17	0.0	-231.8	0.0
		50.0%	0.0	0.0	17.17	0.0	-154.5	0.0
		75.0%	0.0	0.0	17.17	0.0	-77.27	0.0
		9	0.0	0.0	17.17	0.0	-572.7E-6	0.0
A3		8	0.0	0.0	14.09	0.0	-253.6	0.0
		25.0%	0.0	0.0	14.09	0.0	-190.2	0.0
		50.0%	0.0	0.0	14.09	0.0	-126.8	0.0
		75.0%	0.0	0.0	14.09	0.0	-63.40	0.0
		9	0.0	0.0	14.09	0.0	93.61E-6	0.0
Maxima								
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0

ARUP

Solar Decathlon House

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Job No.	Sheet No.	Rev.
72086-10		
Drg. Ref.		
Made by AP	Date 11-Nov-2010	Checked

Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-in]	Myy [kip-in]	Mzz [kip-in]
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
7	A1	7	0.0	0.0	19.13	0.0	-554.1	0.0
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
4	A3	75.0%	0.0	0.0	-0.2229	0.0	63.03	0.0
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
Minima								
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
6	A3	7	0.0	0.0	-12.17	0.0	-457.0	0.0
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0
7	A1	7	0.0	0.0	19.13	0.0	-554.1	0.0
1	A1	1	0.0	0.0	-8.290	0.0	-119.1E-6	0.0

Job No.	Sheet No.	Rev.
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MAXIMUM NEGATIVE MOMENT FOR PRECAST ROOF BEAM

Beam and Spring Forces and Moments

The force in an element at any point is the force required to maintain equilibrium if the element is cut at that point and the end 2 part of the element is discarded. Thus: +ve axial forces are tensile
 Forces and moments are output in element axis directions
 i.e. Fx: axial force; Fy & Fz: shear forces; Mxx: torsion; Myy & Mzz: moments
 Element axes for springs are as defined by the spring property axis no.

Elem Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-in]	Myy [kip-in]	Mzz [kip-in]
1 A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
	25.0%	0.0	0.0	-12.19	0.0	-115.8	0.0
	50.0%	0.0	0.0	-12.19	0.0	-231.6	0.0
	75.0%	0.0	0.0	-12.19	0.0	-347.4	0.0
	2	0.0	0.0	-12.19	0.0	-463.2	0.0
A2	1	0.0	0.0	-12.19	0.0	-84.57E-6	0.0
	25.0%	0.0	0.0	-12.19	0.0	-115.8	0.0
	50.0%	0.0	0.0	-12.19	0.0	-231.6	0.0
	75.0%	0.0	0.0	-12.19	0.0	-347.4	0.0
	2	0.0	0.0	-12.19	0.0	-463.2	0.0
A3	1	0.0	0.0	-8.860	0.0	-127.4E-6	0.0
	25.0%	0.0	0.0	-8.860	0.0	-84.17	0.0
	50.0%	0.0	0.0	-8.860	0.0	-168.3	0.0
	75.0%	0.0	0.0	-8.860	0.0	-252.5	0.0
	2	0.0	0.0	-8.860	0.0	-336.7	0.0
2 A1	2	0.0	0.0	-12.19	0.0	-463.2	0.0
	25.0%	0.0	0.0	-12.52	0.0	-489.5	0.0
	50.0%	0.0	0.0	-12.84	0.0	-516.4	0.0
	75.0%	0.0	0.0	-13.17	0.0	-544.0	0.0
	3	0.0	0.0	-13.49	0.0	-572.4	0.0
A2	2	0.0	0.0	-12.19	0.0	-463.2	0.0
	25.0%	0.0	0.0	-12.45	0.0	-489.4	0.0
	50.0%	0.0	0.0	-12.71	0.0	-516.1	0.0
	75.0%	0.0	0.0	-12.97	0.0	-543.4	0.0
	3	0.0	0.0	-13.23	0.0	-571.2	0.0
A3	2	0.0	0.0	-8.860	0.0	-336.7	0.0
	25.0%	0.0	0.0	-9.185	0.0	-355.9	0.0
	50.0%	0.0	0.0	-9.510	0.0	-375.7	0.0
	75.0%	0.0	0.0	-9.835	0.0	-396.3	0.0
	3	0.0	0.0	-10.16	0.0	-417.5	0.0
3 A1	3	0.0	0.0	12.23	0.0	-572.4	0.0
	25.0%	0.0	0.0	10.37	0.0	-435.4	0.0
	50.0%	0.0	0.0	8.516	0.0	-320.9	0.0
	75.0%	0.0	0.0	6.660	0.0	-228.9	0.0
	4	0.0	0.0	4.805	0.0	-159.4	0.0
A2	3	0.0	0.0	9.628	0.0	-571.2	0.0
	25.0%	0.0	0.0	8.149	0.0	-463.5	0.0
	50.0%	0.0	0.0	6.669	0.0	-373.6	0.0
	75.0%	0.0	0.0	5.190	0.0	-301.7	0.0
	4	0.0	0.0	3.711	0.0	-247.8	0.0
A3	3	0.0	0.0	11.86	0.0	-417.5	0.0
	25.0%	0.0	0.0	10.00	0.0	-285.0	0.0
	50.0%	0.0	0.0	8.145	0.0	-175.0	0.0
	75.0%	0.0	0.0	6.290	0.0	-87.49	0.0
	4	0.0	0.0	4.435	0.0	-22.47	0.0
4 A1	4	0.0	0.0	4.805	0.0	-159.4	0.0
	25.0%	0.0	0.0	3.515	0.0	-128.2	0.0
	50.0%	0.0	0.0	2.225	0.0	-106.6	0.0
	75.0%	0.0	0.0	0.9353	0.0	-94.78	0.0
	5	0.0	0.0	-0.3547	0.0	-92.60	0.0
A2	4	0.0	0.0	3.711	0.0	-247.8	0.0
	25.0%	0.0	0.0	2.683	0.0	-223.8	0.0
	50.0%	0.0	0.0	1.656	0.0	-207.5	0.0
	75.0%	0.0	0.0	0.6284	0.0	-199.0	0.0
	5	0.0	0.0	-0.3991	0.0	-198.1	0.0
A3	4	0.0	0.0	4.435	0.0	-22.47	0.0

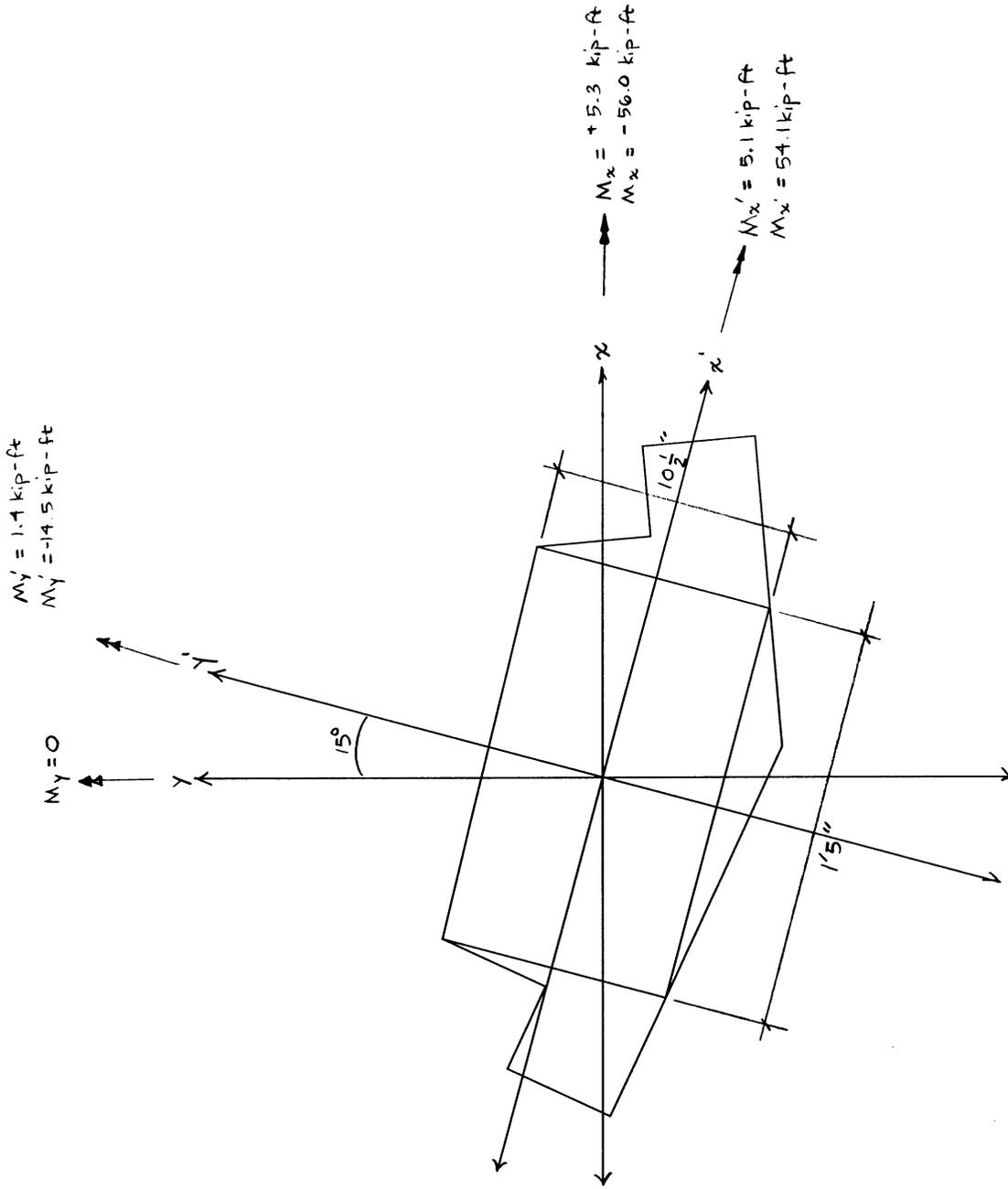
Job No.	Sheet No.	Rev.
72086-10		
Drg. Ref.		
Made by AP	Date 11-Nov-2010	Checked

Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-in]	Myy [kip-in]	Mzz [kip-in]
		25.0%	0.0	0.0	3.145	0.0	5.951	0.0
		50.0%	0.0	0.0	1.855	0.0	24.70	0.0
		75.0%	0.0	0.0	0.5650	0.0	33.78	0.0
5	A1	5	0.0	0.0	-0.7250	0.0	33.17	0.0
		5	0.0	0.0	-0.3547	0.0	-92.60	0.0
		25.0%	0.0	0.0	-1.645	0.0	-100.1	0.0
		50.0%	0.0	0.0	-2.935	0.0	-117.3	0.0
		75.0%	0.0	0.0	-4.225	0.0	-144.1	0.0
A2		6	0.0	0.0	-5.515	0.0	-180.6	0.0
		5	0.0	0.0	-0.3991	0.0	-198.1	0.0
		25.0%	0.0	0.0	-1.427	0.0	-204.9	0.0
		50.0%	0.0	0.0	-2.454	0.0	-219.5	0.0
		75.0%	0.0	0.0	-3.482	0.0	-241.8	0.0
A3		6	0.0	0.0	-4.509	0.0	-271.7	0.0
		5	0.0	0.0	-0.7250	0.0	33.17	0.0
		25.0%	0.0	0.0	-2.015	0.0	22.90	0.0
		50.0%	0.0	0.0	-3.305	0.0	2.949	0.0
		75.0%	0.0	0.0	-4.595	0.0	-26.68	0.0
6	A1	6	0.0	0.0	-5.885	0.0	-65.98	0.0
		6	0.0	0.0	-5.515	0.0	-180.6	0.0
		25.0%	0.0	0.0	-7.818	0.0	-261.5	0.0
		50.0%	0.0	0.0	-10.12	0.0	-370.2	0.0
		75.0%	0.0	0.0	-12.43	0.0	-506.9	0.0
A2		7	0.0	0.0	-14.73	0.0	-671.6	0.0
		6	0.0	0.0	-4.509	0.0	-271.7	0.0
		25.0%	0.0	0.0	-6.340	0.0	-337.5	0.0
		50.0%	0.0	0.0	-8.171	0.0	-425.5	0.0
		75.0%	0.0	0.0	-10.00	0.0	-535.6	0.0
A3		7	0.0	0.0	-11.83	0.0	-668.0	0.0
		6	0.0	0.0	-5.885	0.0	-65.98	0.0
		25.0%	0.0	0.0	-8.189	0.0	-151.3	0.0
		50.0%	0.0	0.0	-10.49	0.0	-264.6	0.0
		75.0%	0.0	0.0	-12.80	0.0	-405.7	0.0
7	A1	7	0.0	0.0	-15.10	0.0	-574.9	0.0
		7	0.0	0.0	23.34	0.0	-671.6	0.0
		25.0%	0.0	0.0	22.69	0.0	-593.9	0.0
		50.0%	0.0	0.0	22.05	0.0	-518.4	0.0
		75.0%	0.0	0.0	21.41	0.0	-445.0	0.0
A2		8	0.0	0.0	20.77	0.0	-373.9	0.0
		7	0.0	0.0	22.81	0.0	-668.0	0.0
		25.0%	0.0	0.0	22.30	0.0	-591.9	0.0
		50.0%	0.0	0.0	21.79	0.0	-517.5	0.0
		75.0%	0.0	0.0	21.28	0.0	-444.8	0.0
A3		8	0.0	0.0	20.77	0.0	-373.9	0.0
		7	0.0	0.0	20.27	0.0	-574.9	0.0
		25.0%	0.0	0.0	19.62	0.0	-507.6	0.0
		50.0%	0.0	0.0	18.98	0.0	-442.4	0.0
		75.0%	0.0	0.0	18.34	0.0	-379.4	0.0
8	A1	8	0.0	0.0	17.70	0.0	-318.6	0.0
		8	0.0	0.0	20.77	0.0	-373.9	0.0
		25.0%	0.0	0.0	20.77	0.0	-280.4	0.0
		50.0%	0.0	0.0	20.77	0.0	-186.9	0.0
		75.0%	0.0	0.0	20.77	0.0	-93.46	0.0
A2		9	0.0	0.0	20.77	0.0	439.2E-6	0.0
		8	0.0	0.0	20.77	0.0	-373.9	0.0
		25.0%	0.0	0.0	20.77	0.0	-280.4	0.0
		50.0%	0.0	0.0	20.77	0.0	-186.9	0.0
		75.0%	0.0	0.0	20.77	0.0	-93.46	0.0
A3		9	0.0	0.0	20.77	0.0	491.6E-6	0.0
		8	0.0	0.0	17.70	0.0	-318.6	0.0
		25.0%	0.0	0.0	17.70	0.0	-238.9	0.0
		50.0%	0.0	0.0	17.70	0.0	-159.3	0.0
		75.0%	0.0	0.0	17.70	0.0	-79.65	0.0
		9	0.0	0.0	17.70	0.0	-90.58E-6	0.0
Maxima								
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0

Job No.	Sheet No.	Rev.
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Drg. Ref.		
Made by AP	Date 11-Nov-2010	Checked

Elem	Case	Pos	Fx [kip]	Fy [kip]	Fz [kip]	Mxx [kip-in]	Myy [kip-in]	Mzz [kip-in]
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
7	A1	7	0.0	0.0	23.34	0.0	-671.6	0.0
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
4	A3	75.0%	0.0	0.0	0.5650	0.0	33.78	0.0
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
Minima								
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
6	A3	7	0.0	0.0	-15.10	0.0	-574.9	0.0
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0
7	A1	7	0.0	0.0	23.34	0.0	-671.6	0.0
1	A1	1	0.0	0.0	-12.19	0.0	76.33E-6	0.0

TRANSFORMATION OF MOMENTS



$$M_{x'} = M_x \cos \theta - M_y \sin \theta$$

$$= 5.3 (\cos 15) - 0 (\sin 15)$$

$$M_{x'} = 5.1 \text{ kip-ft}$$

$$M_{y'} = M_x \sin \theta + M_y \cos \theta$$

$$M_{y'} = -56.0 (\sin 15) + 0 (\cos 15)$$

$$M_{y'} = -14.5 \text{ kip-ft}$$

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FLEXURAL DESIGN

$$b = 17" \quad d = 10.5" - \text{cover} - \frac{d_b}{2} \quad \leftarrow \text{ASSUME \#6 BAR}$$

$$d = 10.5" - 1.5" - \frac{1}{2} \left(\frac{3}{4} \right) = 8.625"$$

NEGATIVE MOMENT ABOUT X'-X'

$$M_u > \phi M_n = \phi 0.85 f_c' a b \left(d - \frac{a}{2} \right)$$

$$671.6 = 0.9 (0.85) (5 \text{ ksi}) (17") (a) (8.625 - \frac{a}{2})$$

$$671.6 = 560.84a - 32.51a^2$$

$$a = \frac{560.84 \pm \sqrt{560.84^2 - 4(32.51)(671.6)}}{2(32.51)} = 1.29 \text{ in}$$

$$A_s F_y = 0.85 f_c' a b$$

$$A_s = \frac{0.85 f_c' a b}{F_y} = \frac{0.85 (5 \text{ ksi}) (1.29 \text{ in.}) (17")}{60 \text{ ksi}} = 1.55 \text{ in.}^2$$

TRY 5#5 $\Rightarrow d = 10.5 - 1.5 - \left(\frac{5}{8} \right) \left(\frac{1}{2} \right) = 8.69 \text{ in.}$

$$A_s = 5(0.31) = 1.55 \text{ in.}^2$$

$$A_s F_y = 0.85 f_c' a b$$

$$(1.55 \text{ in.}^2) (60 \text{ ksi}) = 0.85 (5 \text{ ksi}) (a) (17 \text{ in.})$$

$$a = 1.29 \text{ in}$$

$$\phi M_n = \phi A_s F_y \left(d - \frac{a}{2} \right) = 0.9 (1.55 \text{ in.}^2) (60 \text{ ksi}) \left(8.69 - \frac{1.29}{2} \right) = 673.4 \text{ kip-in} \geq 671.6 \text{ kip-in. OK}$$

POSITIVE MOMENT ABOUT X'-X'

$$M_u \leq \phi M_n = \phi 0.85 f_c' a b \left(d - \frac{a}{2} \right)$$

$$6.3(12) = (0.9)(0.85)(5 \text{ ksi})(17")(8.69 - \frac{a}{2})(a)$$

$$63.03 = 565.06a - 32.51a^2$$

$$a = \frac{-565.06 \pm \sqrt{565.06^2 - 4(32.51)(63.03)}}{2(32.51)} = 0.11 \text{ in.}$$

$$A_s F_y = 0.85 f_c' a b$$

$$A_s (60 \text{ ksi}) = 0.85 (5 \text{ ksi}) (0.11) (17)$$

$$A_s = 0.132 \text{ in.}^2 \quad \therefore \text{USE MINIMUM}$$

$$A_{s, \text{min}} = \frac{3 \sqrt{f_c'}}{f_y} b d = \frac{3 \sqrt{5000 \text{ psi}}}{60000 \text{ psi}} (17 \text{ in.}) (8.69 \text{ in.}) = 0.52 \text{ in.}^2 \geq \frac{200 b d}{F_y} = \frac{200 (17") (8.69)}{60000} = 0.492 \text{ in.}^2$$

USE 3#4

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MOMENT ABOUT Y'-Y'

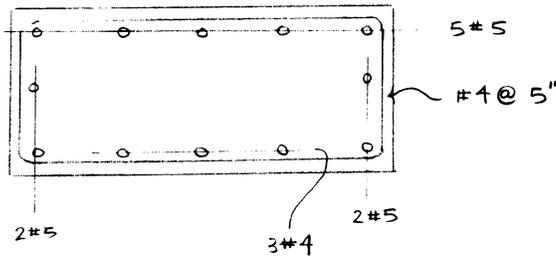
$$b = 10.5 \text{ in.} \quad d = 17'' - \text{cover} - d_b/2$$

$$d = 17'' - 1.5'' - (\frac{3}{4}'')(\frac{1}{2}) = 15.13 \text{ in.}$$

BY INSPECTION
USE MINIMUM REINFORCEMENT

$$A_s = 0.52 \text{ in}^2$$

USE 2#5 ON EACH FACE



SHEAR DESIGN

$$V_u = 23.34 \text{ kips}$$

$$V_c = 2\lambda\sqrt{f'_c}bd = 2(1)\sqrt{5000 \text{ ksi}}(17 \text{ in.})(8.6 \text{ in.}) = 20.67 \text{ kips}$$

USE #4 STIRRUP

$$A_v = 2(0.20 \text{ in}^2) = 0.40 \text{ in}^2$$

$$f_{yt} = 60 \text{ ksi}$$

$$s_{req'd} = \frac{\phi A_v f_{yt} d}{V_u - \phi V_c} = \frac{0.9(0.40)(60 \text{ ksi})(8.6'')}{23.34 - 0.75(20.67)} = 23.70 \text{ in.}$$

$$s_{max} = \frac{A_v f_{yt}}{50b} \leq \frac{A_v f_{yt}}{0.75\sqrt{f'_c}b}$$

$$= \frac{0.40(60000 \text{ psi})}{50(17)} = 28.24 \text{ in}$$

$$\leq \frac{0.40(60000)}{0.75\sqrt{5000}(17)} = 26.62$$

$$s_{max} = 10.5/2 = 5.25 \text{ in.}$$

USE $s = 5''$

3 Columns

3.1.1 Typical Concrete Column

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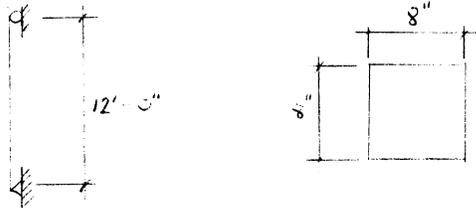
3.0 COLUMNS (TYP)

POSSIBLE COMBINATION

1. 1.2D + 1.6LL_F + 0.8W
2. 1.4D
3. 1.2D + 1.6W + 0.5LL_F

HIGH MOMENT, LOW AXIAL COMPRESSION
WILL CONTROL

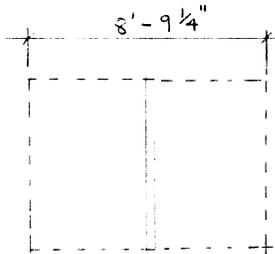
GEOMETRY - TYPICAL ALONG COLUMN LINE 1



AXIAL FORCES

SEE SPREAD SHEET

BENDING MOMENT



EFFECTIVE WIND AREA

$$A_{eff} = (12')(8.77 \text{ ft}) = 105.24 \text{ ft}^2$$

$$C_p = +0.8, -0.9 \quad (\text{ASCE 7-05 FIG 6-17})$$

$$q_h = 26.63 \text{ psf} \quad (\text{SECTION 1.4})$$

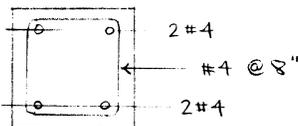
$$M_n = \frac{(26.63 \text{ psf})(8.77)(12')^2}{8}$$

$$M_n = 4203.81 \text{ lb-ft} = 4.2 \text{ kip-ft}$$

WORST CASE

3. 1.2D + 1.6W + 0.5LL_F
- $P_u = 19 \text{ kips}$
 $M_u = 6.8 \text{ kip-ft}$

CAPACITY



SECTION IS ADEQUATE

SEE INTERACTION DIAGRAM SPREADSHEET

AXIAL LOADING ON COLUMNS

Arup

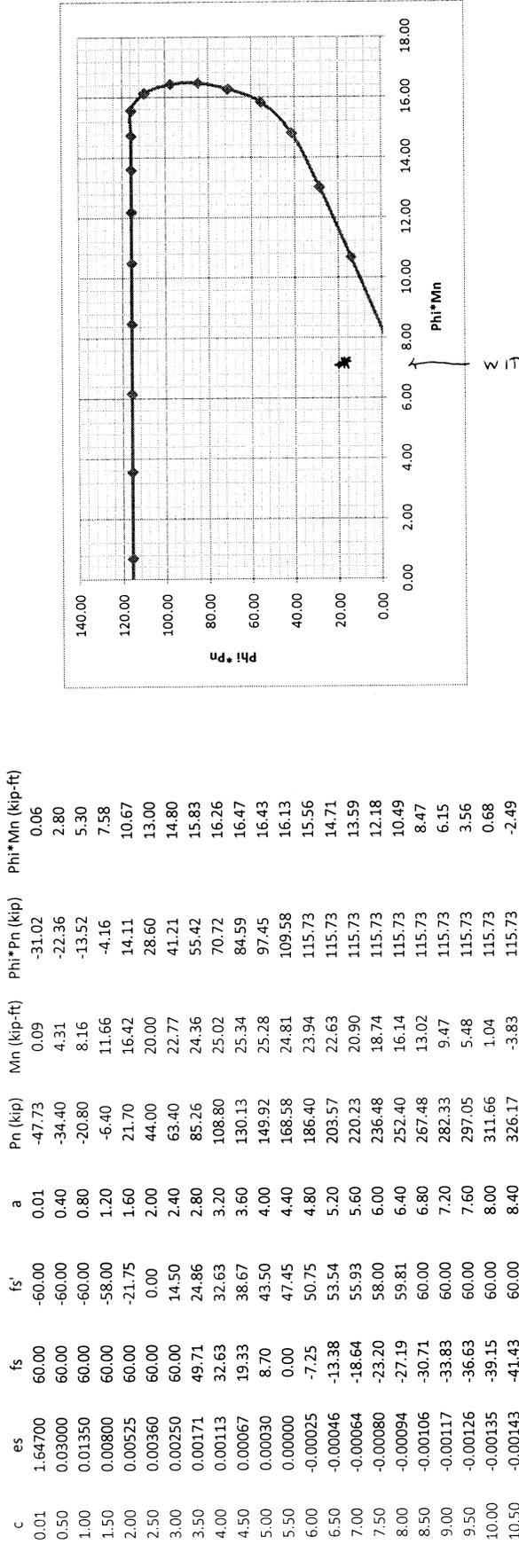
Column Loading

LOAD TYPE	MAGNITUDE	Area (ft ²)	L_BEAM (ft)	DL_LWC	DL_EPS	DL_BEAM	SDL_PV	SDL_SERV	LL_ROOF	SL	1.2D+1.6(Lr or S)+0.8W	1.4D	1.2D+1.6W+0.5(Lr or S)
DL_LWC	85	138	7.42	11.73	0.14	1.14	0.69	0.69	2.76	2.76	22.57	20.15	18.65
DL_EPS	1	144	0.00	12.24	0.14	0.00	0.72	0.72	2.88	2.88	22.12	19.35	18.03
DL_BEAM	154	145	0.00	12.33	0.15	0.00	0.73	0.73	2.90	2.90	22.27	19.49	18.15
SDL_PV	5	148	0.00	12.58	0.15	0.00	0.74	0.74	2.96	2.96	22.73	19.89	18.53
SDL_SERV	5	188	13.67	15.98	0.19	2.10	0.94	0.94	3.76	3.76	31.40	28.21	26.06
LL_ROOF	20	181	12.00	15.39	0.18	1.85	0.91	0.91	3.62	3.62	30.02	26.91	24.88
SL	20	127	0.00	10.80	0.13	0.00	0.64	0.64	2.54	2.54	19.51	17.07	15.90
DL_NWC	88	118	0.00	10.03	0.12	0.00	0.59	0.59	2.36	2.36	18.12	15.86	14.77
LL_EGRESS	100	101	0.00	8.59	0.10	0.00	0.51	0.51	2.02	2.02	15.51	13.57	12.65
		160	10.67	13.60	0.16	1.64	0.80	0.80	3.20	3.20	26.55	23.80	22.00
		104	20.08	8.84	0.10	3.09	0.52	0.52	2.08	2.08	19.69	18.31	16.73
		41	0.00	3.49	0.04	0.00	0.21	0.21	0.82	0.82	6.30	5.51	5.13
		51	0.00	4.34	0.05	0.00	0.26	0.26	1.02	1.02	7.83	6.85	6.39
		60	0.00	5.10	0.06	0.00	0.30	0.30	1.20	1.20	9.22	8.06	7.51
		96	17.67	8.16	0.10	2.72	0.48	0.48	1.92	1.92	18.01	16.71	15.28

CAPACITY OF COLUMN

Column Interaction Diagram

Pu	19 kips	d	5.5	in	Es	29000	ksi	h	8	in.
Mu	6.34 kip-ft	d'	2.5	in	eu	0.003	in/in	Phi	0.65	
fc	5 ksi	As	0.4	in ²	Beta1	0.8		P0	144.664	kips
fy	60 ksi	As'	0.4	in ²	b	8	in			



WITHIN ENVELOPE, SECTION IS ADEQUATE

4 Bearing Walls

4.1 Typical Precast Interior Bearing Wall (Solid Panels)

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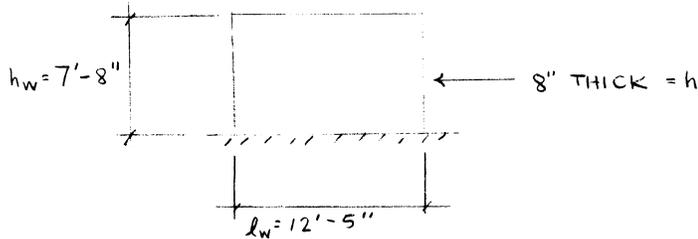
4.0 SHEAR WALLS

4.0.1 TYPICAL INTERIOR WALL

POSSIBLE COMBINATIONS

$$3. 1.2D + 1.0E + 1.0L + 0.2S$$

GEOMETRY



LOADING

$$V_u = 32 \text{ kips}$$

$$M_u = (32 \text{ kips})(7'-8'') = 245.44 \text{ kips}$$

$$N_u = 0 \quad \text{CONSERVATIVELY ASSUME WALL TAKES NO GRAVITY LOAD}$$

CHECK MAXIMUM SHEAR STRENGTH PERMITTED

$$\phi V_n = \phi 10 \sqrt{f'_c} h d \quad (11.9.3)$$

$$d = 0.8 l_w = 0.8(12'-5'') = 9.93 \text{ ft} \quad (11.9.4)$$

$$\phi V_n = \frac{0.75 \times 10 \sqrt{5000} (8'')(9.93' \times 12'')}{1000 \text{ lbs/kip}} = 505.6 \text{ kips}$$

CALCULATE SHEAR STRENGTH PROVIDED BY CONCRETE V_c

$$l_w/2 = \frac{12.42}{2} = 6.21 \text{ ft} \quad (11.9.7)$$

$$\text{or } h_w/2 = 7.67/2 = 3.84 \text{ ft}$$

$$V_c = 3.3 \sqrt{f'_c} h d + \frac{N_u d}{4 l_w} \quad (11-27)$$

$$V_c = \frac{3.3 \sqrt{5000} (8'')(9.93' \times 12'')}{1000 \text{ lbs/kip}} + 0 = 222.4 \text{ kips}$$

$$V_c = \left[0.6\lambda\sqrt{f'_c} + \frac{l_w(1.25\lambda\sqrt{f'_c} + 0.2\frac{N_u}{lwh})}{\frac{M_u}{V_u} - \frac{l_w}{2}} \right] hd \quad (11-28)$$

$$V_u @ 3.84' = 32 \text{ kips}$$

$$M_u @ 3.84' = 122.56 \text{ kip-ft}$$

$$V_c = \left[0.6 \times 1.0 \sqrt{5000} + \frac{(2.42 \times 12)(1.25\sqrt{5000} + 0)}{\frac{122.6 \times 12}{32} - 6.21 \times 12} \right] (8") (9.93' \times 12") = 400 \text{ kips}$$

↑ NEGATIVE 11-28 DOES NOT APPLY

$$V_c = 222 \text{ kips}$$

DETERMINE REQ'D HORIZONTAL SHEAR REINFORCING

$$V_u \leq \phi V_n \quad (11-1)$$

$$\leq \phi (V_c + V_s) \quad (11-2)$$

$$\leq \phi V_c + \frac{A_v f_y d}{s_2} \quad (11-15)$$

$$\frac{A_v}{s_2} = \frac{(V_u - \phi V_c)}{\phi f_y d} < 0$$

MINIMUM HORIZONTAL SHEAR REINFORCING

$$\rho_t \geq 0.0025$$

$$A_s = \rho_t \cdot h \cdot h_w = 0.0025 (8") (92") = 1.84 \text{ in.}^2 \quad (11.9.9.2)$$

$$s \leq \begin{cases} l_w/5 = \frac{12.42'(12"/1)}{5} = 29.81" \\ 3h = 24" \\ 18" \end{cases} \quad (11.9.9.3)$$

TRY 2 #3 @ 9"

$$\frac{h_w}{s} = 10.22 \approx 10 \text{ rows}$$

$$\rho_t = \frac{A_s}{h \cdot h_w} = \frac{0.22 \text{ in.}^2 (10)}{8 (92)} = 0.00299 > 0.0025 \quad \therefore \text{OK}$$

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DETERMINE VERTICAL SHEAR REINFORCING

$$\rho_x = 0.0025 + 0.5(2.5 - h_w/l_w)(f_t - 0.0025) \geq 0.0025 \quad (11-30)$$

$$\rho_x = 0.0025 + 0.5(2.5 - \frac{7.67}{12.42})(0.00299 - 0.0025)$$

$$\rho_x = 0.00287$$

$$A_s = \rho_x \cdot h \cdot l_w = 0.00287 \cdot 8" \cdot 12.42' \cdot 12" = 3.43 \text{ in}^2$$

$$s \leq \begin{cases} l_w/3 = \frac{12.42 \times 12}{3} = 49.68" \\ 3h = 24" \\ 18" \end{cases} \quad (11.9.5)$$

TRY 2#4@16"

$$\frac{l_w}{s} = \frac{12.42' \times 12" \cdot 1}{16} \approx 9 \text{ rows}$$

$$\rho_x = \frac{A_s}{l_w \cdot h} = \frac{(9)(0.4 \text{ in}^2)}{12.42 \times 12' \cdot 8"} = 0.0030 > 0.00287$$

DESIGN FOR FLEXURE

$$M_u = 246 \text{ kip-ft}$$

ASSUME TENSION CONTROLLED ($\phi = 0.9$)

$$R_n = \frac{M_u}{\phi b d^2} = \frac{246 \times 12" \times 1000 \text{ kip}}{0.9(8)(993.12)^2} = 28.88$$

$$\rho = \frac{0.85 f_c'}{f_y} \left(1 - \sqrt{1 - \frac{2R_n}{0.85 f_c'}} \right) = \frac{0.85(5000)}{60000} \left(1 - \sqrt{1 - \frac{2(28.88)}{0.85(5000)}} \right) = 0.000483$$

$$A_s = \rho b d = (0.000483)(8)(993 \times 12") = 0.46 \text{ in}^2$$

USE 1#1 @ EACH END

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EQUIVALENT LATERAL FORCE PROCEDURE

$$S_{DS} = 0.213$$

$$S_{DI} = 0.08$$

A. BEARING WALL SYSTEM

6. ORDINARY PRECAST SHEAR WALLS

$$R = 3$$

$$\Delta = 2\frac{1}{2}$$

$$C_d = 3$$

$$C_s = \frac{S_{DS}}{R/I} = \frac{0.213}{3/1.0} = 0.071$$

(12.8-2)

$$C_t = 0.02 \quad x = 0.75$$

(Table 12.8-2)

$$T_a = C_t h_m^x = (0.02)(10.25)^{0.75} = 0.115 \text{ sec.}$$

(12.8-7)

$$h_m = 10' - 3" \text{ TO TOP OF ROOF}$$

$$T_L = 6 \text{ s}$$

(FIGURE 22-15)

$$C_s = \frac{S_{DI}}{T(R/I)} \quad \text{for } T < T_L \quad \text{UPPER BOUND}$$

$$C_s = \frac{0.13}{0.115(3/1.0)} = 0.376$$

(12.8-3)

USE $C_s = 0.071$

$$W = 451.26 \text{ kips}$$

$$V = C_s W = (0.071)(451.26) = 32.0 \text{ kips}$$

Reinforced Concrete Shear Wall Design (12'-5" WALL)

Code References
ACI 318-05 ACI 318-08

Geometry

$H_w =$	7.67	ft
$L_w =$	12.42	ft
$h =$	8.00	in

Material Properties

$f'_c =$	5000	psi
$f_y =$	60	ksi
$\beta_1 =$	0.8	

Design Loads

$V_u =$	32	kips
$M_u =$	245.44	ft-k
N_u , axial force =	0	kips

1. Calculate Maximum Shear Strength Permitted

$d = 0.8L_w =$	119.23	in	11.10.4	11.9.4
ϕ (shear) =	0.75			
$\phi V_n = \phi 10 \sqrt{f'_c} h d =$	505.9	kips	OK	11.10.3 11.9.3

2. Calculate Shear Strength Provided by concrete V_c

Critical Section = $\text{Min}(L_w/2, H_w/2)$			11.10.7	11.9.7
$L_w/2 =$	6.2	ft		
$H_w/2 =$	3.8	ft		
$V_c = 3.3 \sqrt{f'_c} h d + N_u d / 4L_w$	222.6	kips	Eq (11-29)	Eq (11-28)

$$V_c = [0.6 \sqrt{f'_c} + (L_w / (1.25 \sqrt{f'_c})) (c) + 0.2 N_u / (L_w h)] / (M_u / V_u - L_w / 2) h d$$

$V_c =$	222.6	kips
$\phi V_c =$	166.93	

3. Determine the required horizontal shear reinforcement

$\phi V_c / 2 =$	111.3	kips
$V_u \leq \phi V_c / 2$		

Provide Shear Reinf in accordance with 11.10.9

$V_u \leq \phi V_n$	Eq (11-1)	Eq (11-1)
$V_u \leq \phi (V_c + V_s)$	Eq (11-2)	Eq (11-2)
$V_u \leq \phi V_c + \phi A_v f_y d / s_2$	Eq (11-3)	Eq (11-3)

$$A_v/s_2 = (V_u - \phi V_c) / (\phi f_y d) = -0.0251$$

Horizontal reinf. size=

#3

Number of legs=

2

$A_v =$

0.22 in²

$S_{req'd} =$

-8.75 in - IGNORE, USE MINIMUM

s_2 , Spacing Chosen=

9.00 in

NG

$\rho_h = A_v/A_g > 0.0025$

0.00306

OK

0.000192

11.10.9.2

11.9.9.2

Maximum permissible Spacing

$l_w/5 =$

29.81 in

11.10.9.3

11.9.9.3

3h

24.00 in

18 in

18.00 in

max $s_2 =$

18.00 in

OK

4. Determine Vertical Shear Reinforcement

$$\rho_n = 0.0025 + 0.5(2.5 - h_w/l_w)(\rho_h - 0.002) = 0.00302$$

eq(11-32)

eq(11-30)

Maximum permissible Spacing

$l_w/3 =$

49.68 in

10.10.9.5

11.9.9.5

3h

24.00 in

18 in

18.00 in

max s=

18.00 in

Vert Reinf size=

#4

Number of legs=

2

Spacing=

16.00 in

$A_s =$

0.40 in²

$\rho_n =$

0.00313

5. Design For Flexure

$M_u = V_u H_w =$

245.44

ϕ (flexure)=

0.9

Note: assumption

9.3.2

$R_n = M_u / \phi b d^2 =$

29 ft-kips

$\rho = 0.85 f'_c / f_y (1 - \sqrt{1 - 2R_n / 0.85 f'_c}) =$

0.0005

$A_s = \rho b d =$

0.46 in²

Flex Reinf Provided Each End

Number of Bars per end=

4

Flex Reinf size=

#4

$A_s =$

0.8 in²

Reinforced Concrete Shear Wall Design (11' - 2" WALL)

Code References
 ACI 318-05 ACI 318-08

Geometry

$H_w =$	7.67	ft
$L_w =$	11.17	ft
$h =$	8.00	in

Material Properties

$f'_c =$	5000	psi
$f_y =$	60	ksi
$\beta_1 =$	0.8	

Design Loads

$V_u =$	32	kips
$M_u =$	245.44	ft-k
N_u , axial force =	0	kips

1. Calculate Maximum Shear Strength Permitted

$d = 0.8L_w =$	107.23	in	11.10.4	11.9.4
ϕ (shear) =	0.75			
$\phi V_n = \phi 10 \sqrt{f'_c} h d =$	454.9	kips	OK	11.10.3 11.9.3

2. Calculate Shear Strength Provided by concrete V_c

Critical Section = $\text{Min}(L_w/2, H_w/2)$		11.10.7	11.9.7
$L_w/2 =$	5.6	ft	
$H_w/2 =$	3.8	ft	
$V_c = 3.3 \sqrt{f'_c} h d + N_u d / 4L_w$	200.2	kips	Eq (11-29) Eq (11-28)

$V_c = [0.6 \sqrt{f'_c} + (L_w / (1.25 \sqrt{f'_c} c) + 0.2 N_u / (L_w h)) / (M_u / V_u - L_w / 2)] h d$		kips	Eq (11-30) Eq (11-28)
$V_c =$	200.2	kips	
$\phi V_c =$	150.13		

3. Determine the required horizontal shear reinforcement

$\phi V_c / 2 =$	100.1	kips	
$V_u \leq \phi V_c / 2$			11.10.8

Provide Shear Reinf in accordance with 11.10.9

$V_u \leq \phi V_n$		Eq (11-1)	Eq (11-1)
$V_u \leq \phi (V_c + V_s)$		Eq (11-2)	Eq (11-2)
$V_u \leq \phi V_c + \phi A_v f_y d / s_2$		Eq (11-31)	Eq (11-15)

$$A_v/s_2 = (V_u - \phi V_c) / (\phi f_y d) = -0.0245$$

Horizontal reinf. size=
 Number of legs=
 $A_v = 0.22 \text{ in}^2$

$S_{req'd} = -8.99 \text{ in}$
 s_2 , Spacing Chosen= in
 $\rho_h = A_v/A_g > 0.0025$ 0.00306

NG
 OK 0.000214 11.10.9.2 11.9.9.2

Maximum permissible Spacing
 $l_w/5 = 26.81 \text{ in}$ 11.10.9.3 11.9.9.3
 $3h = 24.00 \text{ in}$
 $18 \text{ in} = 18.00 \text{ in}$

$\max s_2 = 18.00 \text{ in}$ OK

4. Determine Vertical Shear Reinforcement

$\rho_n = 0.0025 + 0.5(2.5 - h_w/l_w)(\rho_h - 0.0025) \geq 0.003$ eq(11-32) eq(11-30)

Maximum permissible Spacing
 $l_w/3 = 44.68 \text{ in}$ 10.10.9.5 11.9.9.5
 $3h = 24.00 \text{ in}$
 $18 \text{ in} = 18.00 \text{ in}$

$\max s = 18.00 \text{ in}$

Vert Reinf size=
 Number of legs=
 Spacing= in
 $A_s = 0.40 \text{ in}^2$

$\rho_n = 0.00313$

5. Design For Flexure

$M_u = V_u H_w = 245.44$
 ϕ (flexure)= 0.9
 $R_n = M_u / \phi b d^2 = 36 \text{ ft-kips}$
 $\rho = 0.85 f'_c / f_y (1 - \sqrt{1 - 2R_n / 0.85 f'_c}) = 0.0006$
 $A_s = \rho b d = 0.51 \text{ in}^2$

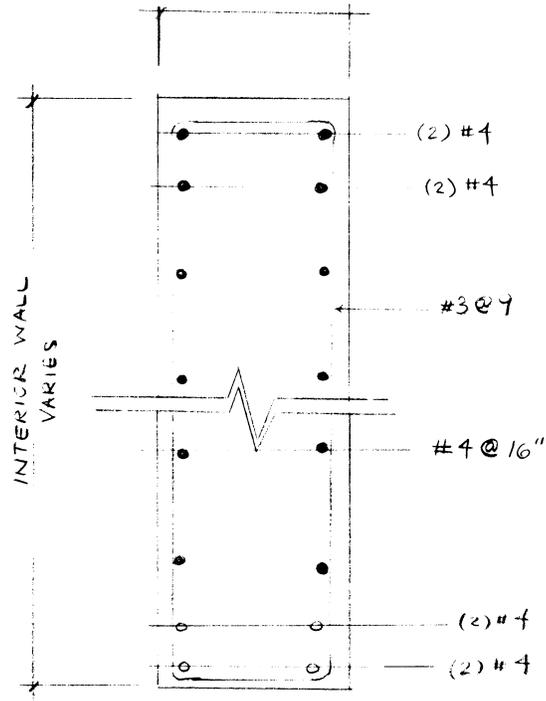
Note: assumption 9.3.2

Flex Reinf Provided Each End
 Number of Bars per end=
 Flex Reinf size=
 $A_s = 0.8 \text{ in}^2$

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SHEAR WALL REBAR LAYOUT



5 Ground Floor Slab

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Job Title SOLAR DECATILTON

5.0 GROUND FLOOR SLAB

MAX SLAB SPAN 11'-0" (SEE DRAWING)

ASSUME ONE WAY SLAB

LOADING

$$LL_{egress} = (100 \text{ psf})(1 \text{ ft}) = 100 \text{ plf}$$

$$DL_{NWC} = (7\frac{1}{2} \text{ in})(145 \text{ plf})(1 \text{ ft}) = 85 \text{ plf}$$

$$DL_{serv} = (5 \text{ psf})(1 \text{ ft}) = 5 \text{ plf}$$

$$DL_{eps} = (1 \text{ psf})(1 \text{ ft}) = 1 \text{ plf}$$

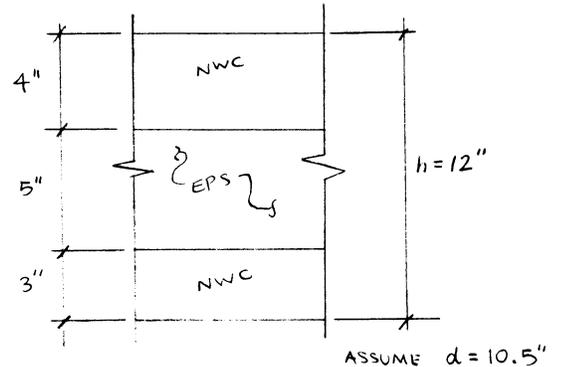
$$w_u = 1.2D + 1.6L$$

$$w_u = 1.2(DL_{NWC} + DL_{serv} + DL_{eps}) + 1.6(LL_{egress})$$

$$w_u = 1.2(85 + 5 + 1) + 1.6(100) = 269.2 \text{ plf}$$

$$V_u = \frac{w_u L}{2} = \frac{(269.2 \text{ plf})(11')}{2} = 1480.6 \text{ lb} = 1.50 \text{ kips}$$

$$M_u = \frac{w_u L^2}{8} = \frac{(269.2 \text{ plf})(11')^2}{8} = 4.1 \text{ kip-ft}$$



DESIGN FOR FLEXURE

$$M_u \leq \phi M_n = 0.85 f_c' a b (d - \frac{a}{2})$$

$$(4.1 \text{ kip-ft})(12 \text{ in/ft}) = 0.85 (5 \text{ ksi})(a)(12 \text{ in})(10.5 \text{ in} - \frac{a}{2})$$

$$492 = 535.5a - 25.5a^2$$

$$a = \frac{535.5 \pm \sqrt{535.5^2 - 4(25.5)(492)}}{2(25.5)} = 0.092 \text{ in.}$$

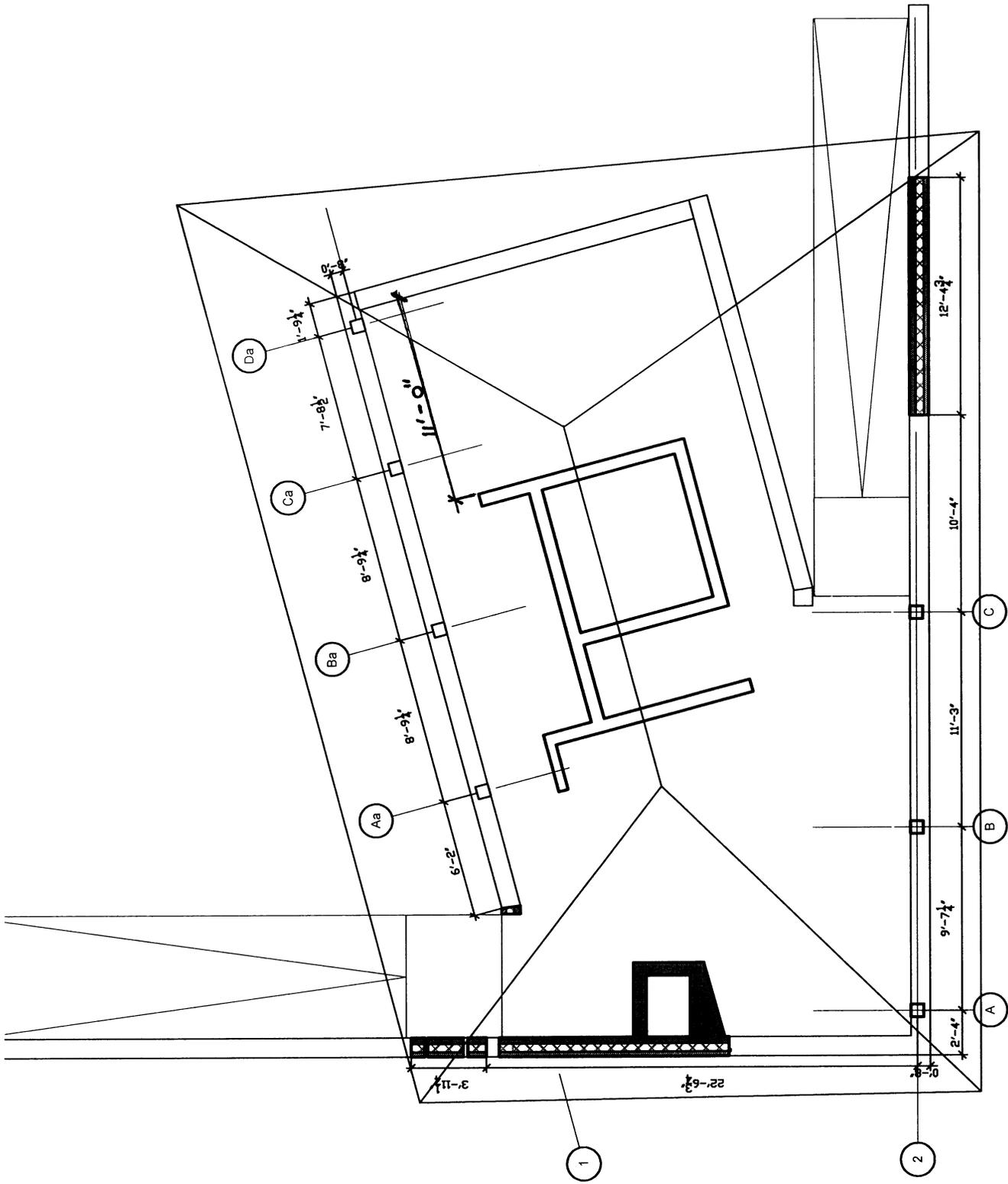
$$A_s F_y = 0.85 f_c' a b$$

$$A_s = \frac{0.85 f_c' a b}{F_y} = \frac{0.85 (5 \text{ ksi})(0.092 \text{ in.})(12 \text{ in.})}{60 \text{ ksi}} = 0.0784 \text{ in.}^2$$

CHECK MINIMUM

$$A_{s, \min} = \frac{3\sqrt{f_c'}}{F_y} b d = \frac{3\sqrt{5000}}{60000} (12)(10.5) = 0.445 \text{ in.}^2/\text{ft} \leq \frac{200 b d}{F_y} = \frac{200(12)(10.5)}{60000} = 0.42 \text{ in.}^2/\text{ft}$$

$$\text{use } A_s = 0.42 \text{ in.}^2/\text{ft}$$



6 Overall Stability & Foundation

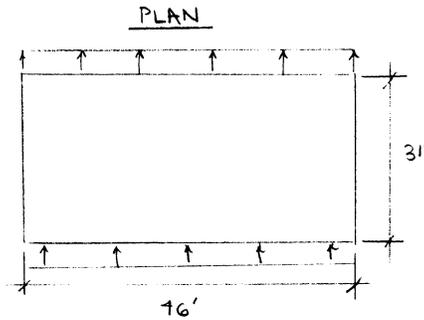
6.1 Overturning & Sliding Due to Wind

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6.1 SLIDING DUE TO WIND CHECK

BASE SHEAR



$$L/B = 31'/46' = 0.674$$

WINDWARD WALL , $C_p = 0.8$ $h \approx 18'$

LEEWARD WALL , $C_p = -0.5$ $h \approx 12'$

$$q_z = 0.0256 K_z K_{zt} K_d V^2 I = 0.00256 (0.85)(1.0)(0.85)(60^2)(1.0) = 6.7 \text{ psf}$$

$$V_w = 0.8(18')(46')(6.7 \text{ psf}) + 0.5(12')(46')(6.7 \text{ psf}) = 6.29 \text{ kips}$$

$$0.6D_{\text{roof}} = 98.4 \text{ kips}$$

$$\mu_s \approx \frac{V_w F.S_{\text{min}}}{0.6D_{\text{roof}}} = \frac{6.29(2.0)}{98.4 \text{ kips}} = 0.127$$

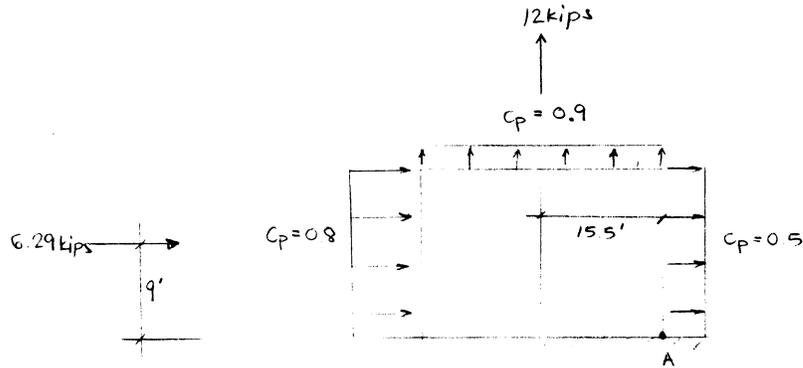
$$\mu_{s \text{ CONC-SOIL}} = 0.30 \text{ minimum}$$

∴ ADEQUATE FOR SLIDING

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6.1 OVERTURNING CHECK



$$\begin{aligned} \text{ROOF UPLIFT IF } V=60 \text{ mph} &\Rightarrow q_z = 6.7 \text{ psf} \\ &= 6.7 \text{ psf} (1800 \text{ ft}^2) = 12 \text{ kips} \end{aligned}$$

$$\text{OVERTURNING MOMENT} = 6.29(9) + 12(15.5) = 242.61 \text{ kip-ft}$$

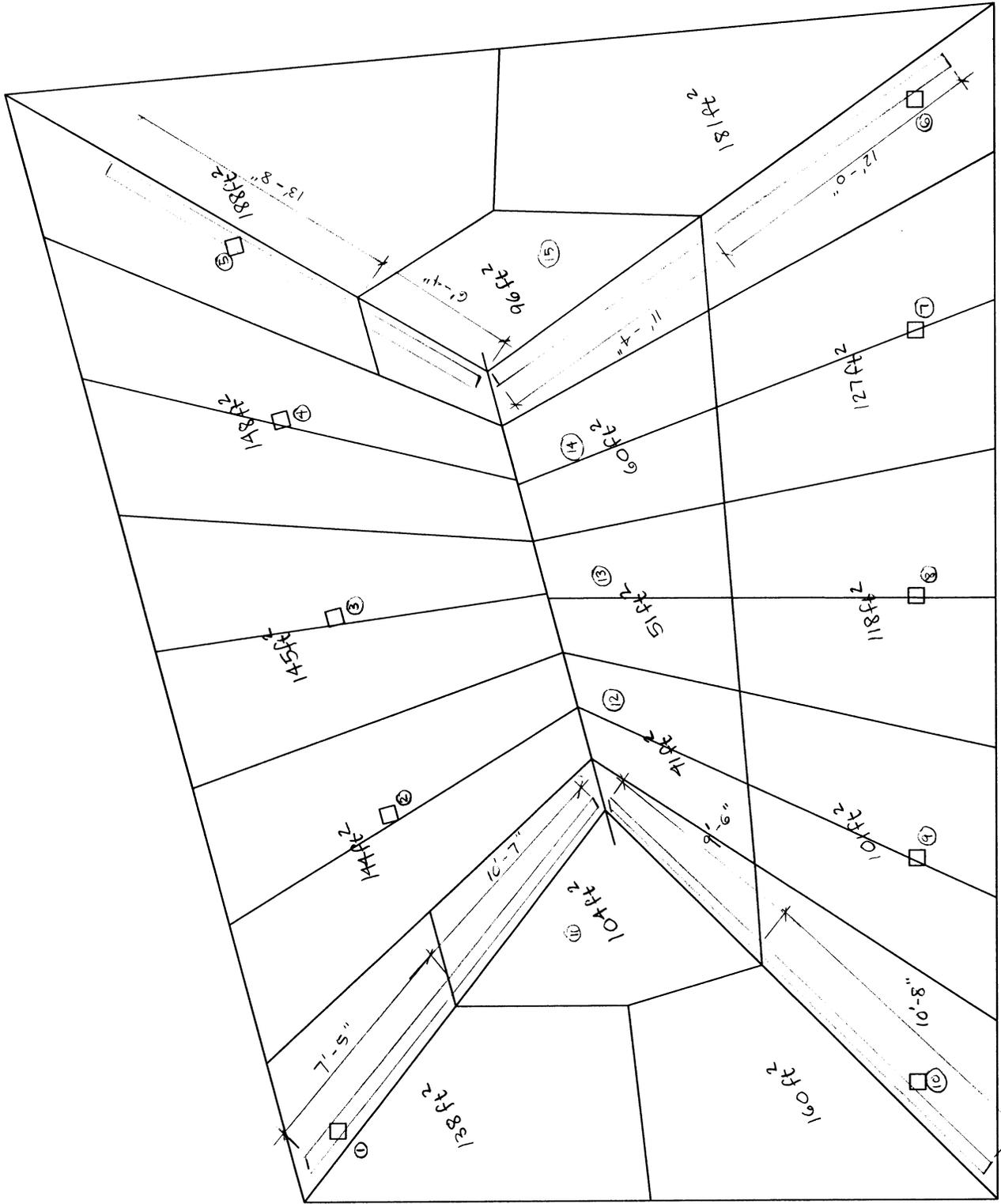
$$\text{RESTORING MOMENT} = 0.6 P_{\text{roof}} (\text{arm}) = 98.4(15.5 \text{ ft}) = 1525 \text{ kip-ft}$$

$$\text{F.S.} = \frac{1525 \text{ kip-ft}}{243 \text{ kip-ft}} = 6.28 > 2.0 \therefore \text{OK}$$

ADEQUATE FOR OVERTURNING

6.2 Temporary Foundation Bearing Pressure

6.2 BEARING PRESSURE TEMPORARY SOL
 ROOF LOADING FOR SOIL BEARING CALCULATION



TRIBUTARY AREAS

ROOF LOADING FOR SOIL BEARING CALCULATIONS

LOAD TYPE	MAGNITUDE	Area (ft2)	L_BEAM (ft)	DL_NWC	DL_EPS	DL_BEAM	SDL_PV	SDL_SERV	LL_ROOF	SL	D+L	D+0.75L+0.75S
DL_NWC	85 psf	138	7.42	DL_NWC	0.14	1.14	0.69	0.69	2.76	2.76	5.42	6.80
DL_EPS	1 psf	144	0.00	12.24	0.14	0.00	0.72	0.72	2.88	2.88	16.70	18.14
DL_BEAM	154 plf	145	0.00	12.33	0.15	0.00	0.73	0.73	2.90	2.90	16.82	18.27
SDL_PV	5 psf	148	0.00	12.58	0.15	0.00	0.74	0.74	2.96	2.96	17.17	18.65
SDL_SERV	5 psf	188	13.67	15.98	0.19	2.10	0.94	0.94	3.76	3.76	23.91	25.79
LL_ROOF	20 psf	181	12.00	15.39	0.18	1.85	0.91	0.91	3.62	3.62	22.84	24.65
SL	20 psf	127	0.00	10.80	0.13	0.00	0.64	0.64	2.54	2.54	14.73	16.00
DL_NWC	85 psf	118	0.00	10.03	0.12	0.00	0.59	0.59	2.36	2.36	13.69	14.87
LL_EGRESS	100 psf	101	0.00	8.59	0.10	0.00	0.51	0.51	2.02	2.02	11.72	12.73
		160	10.67	13.60	0.16	1.64	0.80	0.80	3.20	3.20	20.20	21.80
		104	20.08	8.84	0.10	3.09	0.52	0.52	2.08	2.08	15.16	16.20
		41	0.00	3.49	0.04	0.00	0.21	0.21	0.82	0.82	4.76	5.17
		51	0.00	4.34	0.05	0.00	0.26	0.26	1.02	1.02	5.92	6.43
		60	0.00	5.10	0.06	0.00	0.30	0.30	1.20	1.20	6.96	7.56
		96	17.67	8.16	0.10	2.72	0.48	0.48	1.92	1.92	13.86	14.82

	Wall type		86	psf	15	psf	Weight of SW	Length of SW	Height of SW	Weight of SW	Height of Glass	Length of Glass	Weight of Glass	Weight of Wall	Summary	Weight of Wall Summary
	Sandwich Panels	Glass Curtain Wall														
A	15.50		4.75	6.48	0.00	0.00	0.00	0.00	0.00	6.48	A	6.48				
B	11.50		3.67	3.71	2.00	3.67	0.11	3.82	0.11	3.82	B	4.42				
B	0.00		0.00	0.00	13.25	3.00	0.60	0.60	0.60	0.60	C	7.29				
C	11.50		7.00	7.08	2.00	7.00	0.21	7.29	0.21	7.29	D	9.12				
D	11.50		8.75	8.86	2.00	8.75	0.26	9.12	0.26	9.12	E	8.60				
E	11.50		8.25	8.35	2.00	8.25	0.25	8.60	0.25	8.60	F	8.71				
F	11.50		8.33	8.43	2.25	8.33	0.28	8.71	0.28	8.71	G	4.67				
G	10.75		4.75	4.49	2.42	4.75	0.17	4.67	0.17	4.67	H	5.13				
H	9.92		5.58	4.87	3.08	5.58	0.26	5.13	0.26	5.13	I	4.27				
I	9.08		5.00	4.00	3.58	5.00	0.27	4.27	0.27	4.27	J	6.29				
J	8.67		7.67	5.85	3.83	7.67	0.44	6.29	0.44	6.29	K	4.38				
K	8.67		5.42	4.14	3.00	5.42	0.24	4.38	0.24	4.38	L	4.38				
L	8.67		5.42	4.14	3.00	5.42	0.24	4.38	0.24	4.38	M	4.88				
M	8.67		5.42	4.14	3.00	5.42	0.24	4.38	0.24	4.38	N	3.51				
M	0.00		0.00	0.00	13.25	2.50	0.50	0.50	0.50	0.50	O	4.84				
N	0.00		0.00	0.00	13.25	2.50	0.50	0.50	0.50	0.50	P	4.18				
N	4.17		6.50	2.38	6.50	6.50	0.63	3.02	0.63	3.02	Q	2.58				
O	4.17		10.42	3.82	6.50	10.42	1.02	4.84	1.02	4.84	R	6.21				
P	4.17		9.00	3.30	6.50	9.00	0.88	4.18	0.88	4.18	S	12.54				
Q	4.17		5.50	2.02	6.83	5.50	0.56	2.58	0.56	2.58	T	0.00				
R	10.50		2.75	2.54	7.83	2.75	0.32	2.86	0.32	2.86	U	0.00				
R	12.67		3.00	3.34	0.00	3.00	0.00	3.34	0.00	3.34	V	30				
S	14.25		10.00	12.54	0.00	10.00	0.00	12.54	0.00	12.54	W	24				
T	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	X	7.52				
U	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Y	5.32				
X	4.17		6.00	2.20	0.00	6.00	0.00	2.20	0.00	2.20						
X	11.00		5.50	5.32	0.00	5.50	0.00	5.32	0.00	5.32						
Y	11.00		5.50	5.32	0.00	5.50	0.00	5.32	0.00	5.32						

	Square foot of Wall	Height of wall	Weight (kips)
V	20	10	30
W	16	10	24

Total Weight	D+L	D+0.75L+0.75S	Area Req'd	Side Length (if square)	
A	11.90	13.28	8.85	2.98	say 3' x 3'
B	7.84	7.39	5.23	2.29	say 2.5' x 2.5'
C	27.42	28.41	18.94	4.35	say 4.5' x 4.5'
D	30.31	31.18	20.79	4.56	say 5' x 5'
E	29.94	30.87	20.58	4.54	say 5' x 5'
F	35.47	36.98	24.65	4.97	say 3' x 3'
G	9.80	9.12	6.53	2.56	say " " "
H	11.21	10.41	7.47	2.73	" " " "
I	9.78	9.05	6.52	2.55	say 2.5' x 2.5'
J	8.76	8.44	5.84	2.42	say 2.5' x 2.5'
K	6.85	6.52	4.57	2.14	say " " "
L	6.85	6.52	4.57	2.14	say 3' x 3'
M	11.91	10.98	7.94	2.82	say 4' x 4'
N	21.76	22.34	14.89	3.86	say 4.5' x 4.5'
O	26.81	26.47	17.88	4.23	say " " "
P	28.18	29.28	19.52	4.42	say 2.5' x 2.5'
Q	7.14	6.54	4.76	2.18	say 3' x 3'
R	11.53	10.83	7.69	2.77	say 4' x 4'
S	20.14	19.14	13.43	3.66	say 3' x 3'
T	11.97	10.40	7.98	2.82	say 3.5' x 3.5'
U	15.39	13.37	10.26	3.20	say STRIP UNDERNEATH WALL
V	84.22	81.80	56.15	7.49	" " "
W	85.96	82.75	57.31	7.57	" 5' x 5'
X	30.37	32.18	21.45	4.63	say 4' x 4'
Y	20.06	21.33	14.22	3.77	say

6.3 Uplift

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6.3 UPLIFT CHECK

CONSERVATIVELY ASSUME $C_p = -0.9$ OVER ENTIRE ROOF AREA

(FIGURE 6-6)

$$G = 0.85$$

$$p = 0.85(-0.9)(26.63 \text{ psf}) = -20.37 \text{ psf}$$

$$A_{\text{roof}} \approx 1800 \text{ ft}^2$$

$$\text{UPLIFT FORCE DUE TO WIND} = (-20.37 \text{ psf})(1800 \text{ ft}^2) = 36.7 \text{ kips}$$

WEIGHT OF ROOF ALONE (see spreadsheet)

$$D_{\text{roof}} = 163.92 \text{ kips}$$

$$0.6D = 0.6(163.92 \text{ kips}) = 98.4 \text{ kips}$$

$$W = 36.7 \text{ kips}$$

$$\frac{98.4 \text{ kips}}{36.7 \text{ kips}} = 2.68 > 2.0 \therefore \text{OK}$$

\therefore ADEQUATE FOR UPLIFT

WEIGHT OF ROOF

LOAD TYPE	MAGNITUDE	Area (ft2)	L_BEAM (ft)	DL_NWC	DL_EPS	DL_BEAM	SDL_PV	SDL_SERV	D	0.6*D
DL_NWC	73 psf	138	7.42	10.074	0.14	1.14	0.69	0.69	12.73	7.64
DL_EPS	1 psf	144	0.00	10.51	0.14	0.00	0.72	0.72	12.10	7.26
DL_BEAM	154 plf	145	0.00	10.59	0.15	0.00	0.73	0.73	12.18	7.31
SDL_PV	5 psf	148	0.00	10.80	0.15	0.00	0.74	0.74	12.43	7.46
SDL_SERV	5 psf	20	13.67	13.72	0.19	2.10	0.94	0.94	17.90	10.74
LL_ROOF	20 psf	181	12.00	13.21	0.18	1.85	0.91	0.91	17.05	10.23
SL	20 psf	127	0.00	9.27	0.13	0.00	0.64	0.64	10.67	6.40
DL_NWC	85 psf	118	0.00	8.61	0.12	0.00	0.59	0.59	9.91	5.95
LL_EGRESS	100 psf	101	0.00	7.37	0.10	0.00	0.51	0.51	8.48	5.09
		160	10.67	11.68	0.16	1.64	0.80	0.80	15.08	9.05
		104	20.08	7.59	0.10	3.09	0.52	0.52	11.83	7.10
		41	0.00	2.99	0.04	0.00	0.21	0.21	3.44	2.07
		51	0.00	3.72	0.05	0.00	0.26	0.26	4.28	2.57
		60	0.00	4.38	0.06	0.00	0.30	0.30	5.04	3.02
		96	17.67	7.01	0.10	2.72	0.48	0.48	10.78	6.47
									163.92	98.35
									Total	



Appendix A: Electrical Appliances Manufacturer's Specifications



Built-In Cooktop

FPCC3085K S

30" Induction Hybrid



Product Dimensions

Width	30-3/4"
Depth	21-1/2"
Height	4-3/8"

More Easy-To-Use Features

Cooking Versatility

Gentle enough to melt chocolate and powerful enough to boil water, so it's great for entertaining or getting dinner on the table quickly.

PowerPlus® Boost

Generates rapid heat for a quicker boil.

Exceptional Temperature Control

Adjust heat with greater accuracy than on gas or electric cooktops especially at lower settings.

Pro-Select® Controls

Precise control at your fingertips.

SpaceWise® Bridge Element

A flexible element lets you combine two 7" elements into one to fit larger cookware.

Cooktop Stays Cooler

With induction cooking, heat is transferred directly to the cookware, so the cooktop stays cooler to the touch—making it easier to clean.

Smoothtop Ceramic Glass Cooking Surface

Hot Surface Indicators

Available in:



Stainless
(S)

Elements	Size	Watts
Right Front	Induction 10"	2,500/3,400
Right Rear	Induction 6"	1,500/1,900
Left Front	Electric 7"	1,800
Left Rear	Electric 7"	1,800
Left Bridge	SpaceWise® Bridge	800



More Energy-Efficient

Cooking with induction is 70% more efficient than gas and 20% more efficient than electric.



More Responsive

Cooking with induction is more responsive than gas or electric so you can easily go from simmer to boil.



Cookware Compatibility

Cooktops include a combination of electric elements that are compatible with all cookware, and induction elements that are compatible with most stainless steel and cast iron cookware. If a magnet sticks to the bottom of a pot or pan, it is induction-friendly.



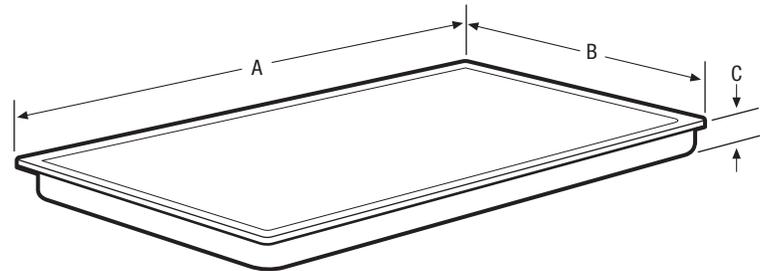
10" and 6" Induction Elements

With two powerfully efficient induction elements, plus up to three electric elements, the Induction Hybrid Cooktop offers the utmost cooking flexibility. And the 10" induction element offers 3,400 watts of power, so you can bring water to a boil quickly.

Features	
Controls	Pro-Select®
Surface Type	Black Ceramic Glass
Right Front Element (Watts)	Induction 10" - 2,500 / 3,400
Right Rear Element (Watts)	Induction 6" - 1,500 / 1,900
Left Front Element (Watts)	Electric 7" - 1,800
Left Rear Element (Watts)	Electric 7" - 1,800
Left Bridge Element (Watts)	SpaceWise® Bridge - 800
Hot Surface Indicators	Yes
Control Location	Right Side
Knob Color	Stainless
Knob Type	Cast Metal
Specifications	
Power Supply Connection Location	Right Rear
Voltage Rating	240V / 208V / 60Hz
Connected Load (kW Rating) @ 240 / 208 Volts ¹	8.2 / 6.6
Amps @ 240 / 208 Volts	34.2 / 31.7
Minimum Circuit Required (Amps)	40
Approved for Electric Single Wall Oven Combination Installation ²	Yes
Shipping Weight (Approx.)	60 Lbs.

¹Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.

²Cooktops are approved for installation above any of our Electric Single Wall Ovens.



NOTE: For planning purposes only. Always consult local and national electric codes. Refer to Product Installation Guide for detailed installation instructions on the web at frigidaire.com.



Product Dimensions		Cutout Dimensions	
A - Width	30-3/4"	Width (Min.) / (Max.)	29-5/8" / 29-3/4"
B - Depth	21-1/2"	Depth (Min.) / (Max.)	20-3/8" / 20-1/2"
C - Height	4-3/8"	Height	4-1/2"

Granite Countertop Installation Kit available.

Accessories information available on the web at frigidaire.com

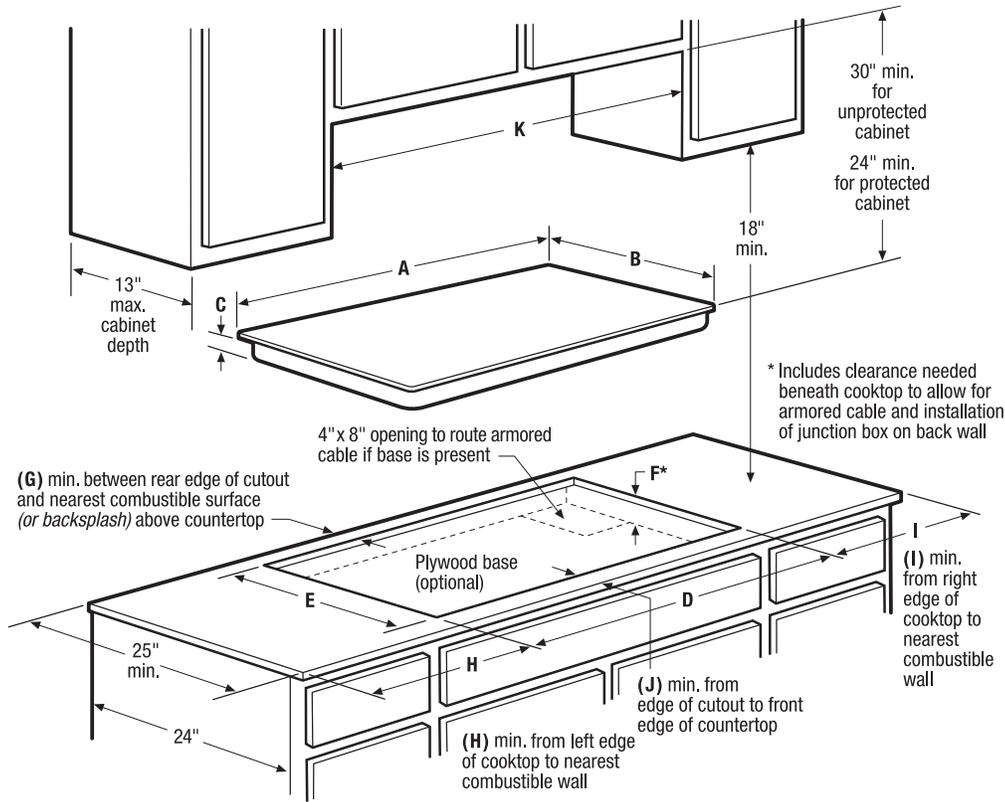
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FPCC3085K 03/11

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Product Dimensions			Required Clearances			
A - Width	B - Depth	C - Height	G (min.)	H (min.)	I (min.)	J (min.)
30-3/4"	21-1/2"	4-3/8"	1-1/2"	7-1/2"	7-1/2"	2-1/2"
Product Cutout Dimensions			K - Cabinet Opening Width (min.)	Utility Connection Locations		
D - Width (min. - max.)	E - Depth (min. - max.)	F - Height (min.)*		Power Supply		
29-5/8" - 29-3/4"	20-3/8" - 20-1/2"	4-1/2"	30-3/4"	Right Rear		

Built-In Cooktop Specifications

- Product Shipping Weight (approx.) - 60 Lbs.
- Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.
- Connected Load (kW Rating) @ 240/208 Volts = 8.2/6.6 kW
- Amps @ 240/208 Volts = 34.2/31.7 Amps
- Recommended Circuit Breaker - 40 Amps
- Always consult local and national electric codes.
- Cooktop cutout height includes clearance needed beneath cooktop to allow for armored cable and installation of junction box on back wall. Position center of junction box 10" inward from right side of cooktop cutout, and 12" down from underside of countertop.
- Overhead cabinetry should not exceed a 13" maximum depth.
- Absolute minimum horizontal distance between overhead cabinets installed to either side of appliance must be no less than 30".
- Allow 30" minimum clearance between top of cooktop platform and bottom of unprotected wood or metal overhead cabinet; or 24" minimum clearance when bottom of wood or metal overhead cabinet is protected by not less than 1/8" flame-retardant millboard covered with not less than No. 28 MGS sheet steel, 0.015" stainless steel, 0.024" aluminum or 0.020" copper.
- Allow 1-1/2" minimum clearance between rear edge of cutout and nearest combustible surface (or backsplash) above countertop.

- Allow 7-1/2" minimum required clearance from left edge of cooktop to nearest combustible wall and 7-1/2" minimum from right edge of cooktop to nearest combustible wall.
- Installation of drawer not recommended beneath cooktop.
- To reduce risk of fire when using overhead cabinetry, install range hood that projects horizontally a recommended minimum of 5" beyond bottom of cabinets.
- Electric Built-In Cooktop model FPCC3085K is approved to be used over any Frigidaire® Electric Single Wall Oven. (Refer to *Electric Cooktop Installation Over 30"/27" Electric Single Wall Oven Specifications page on web.*)
- Electric Built-In Cooktop model FPCC3085K is approved to be used in combination with Frigidaire® 30" Downdraft Vent E30DD75ESS or PL30DD50EC. (Refer to *model-specific Downdraft Vent product page on web for detailed countertop preparation specifications.*)

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.

Optional Accessories

- Granite Countertop Installation Kit - (PN # 903061-9010).

FRIGIDAIRE

USA • 10200 David Taylor Drive • Charlotte, NC 28262 • 1-800-FRIGIDAIRE • frigidaire.com
CANADA • 5855 Terry Fox Way • Mississauga, ON L5V 3E4 • 1-800-265-8352 • frigidaire.ca

FPCC3085K 03/11

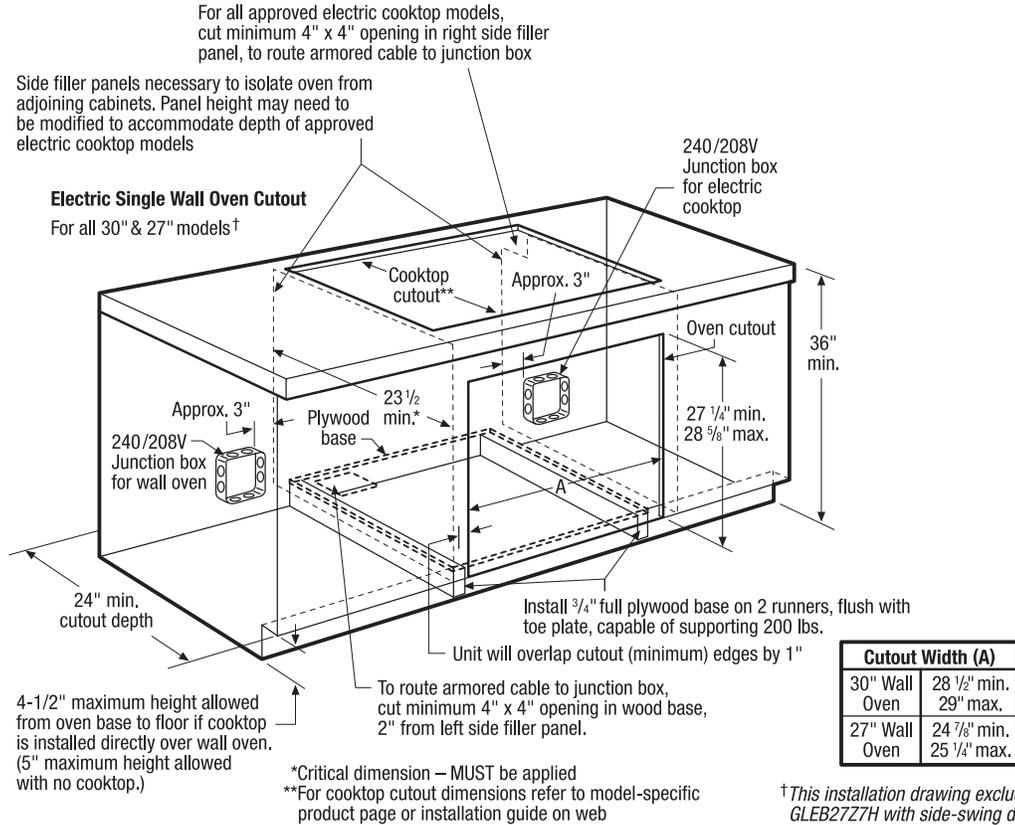
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Accessories information available on the web at frigidaire.com



Specifications subject to change.

Printed in the U.S.A.



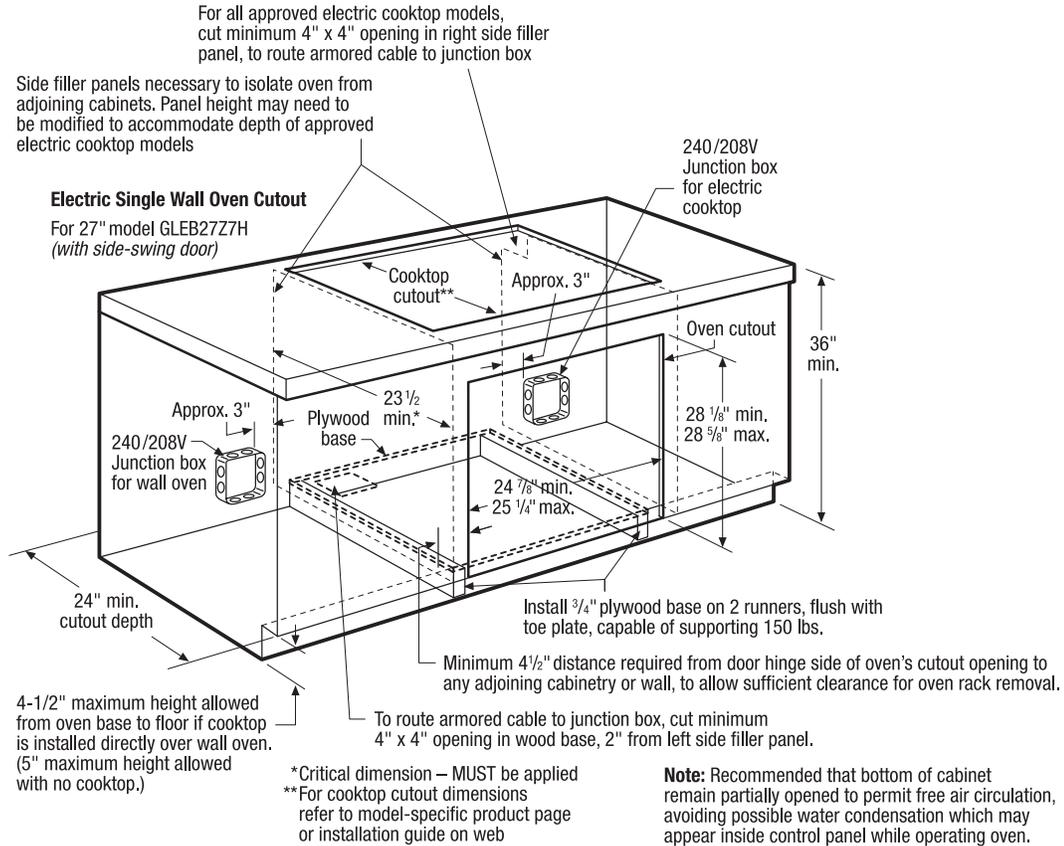
30"/27" Electric Single Wall Oven Under-Counter Installation Specifications

- Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.
- For detailed electrical requirements, refer to model-specific product page and installation guide on web.
- Always consult local and national electric codes.
- Minimum 21" clearance for oven door depth when open.
- Minimum 23-1/2" deep cutout dimension is critical for proper installation, to ensure that oven's faceplate will fit flush against cabinet front.
- Side filler panels necessary to isolate oven from adjoining cabinets.
- Full oven base of solid plywood or similar material required, capable of supporting 200 Lbs. (30" models) or 150 Lbs. (27" models). Install over two runners and flush with toe plate.
- Base must be level and cabinet front must be square.
- Allow 5" maximum height from oven base to floor, if NO cooktop is installed directly over wall oven.

Electric Cooktop Installation Over 30"/27" Electric Single Wall Oven Specifications

- All Frigidaire® Electric Single Wall Ovens are approved to be used beneath any approved Frigidaire® Electric Cooktop. (This installation page excludes approved wall oven model GLEB27Z7H. For model-specific installation details, refer to Electric Cooktop Installation Over 27" Electric Single Wall Oven GLEB27Z7H Specifications pages on web.)
- For detailed Electric Cooktop installation, refer to model-specific product page and installation guide on web.
- Side filler panel height may need to be modified to accommodate the depth of approved electric cooktop models.
 - To route armored cable to junction box, cut minimum 4" x 4" opening in right side filler panel.
 - Allow 4-1/2" maximum height from oven base to floor, if cooktop is installed directly over wall oven.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.



27" Electric Single Wall Oven (GLEB27Z7H) Under-Counter Installation Specifications

- Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.
- For detailed electrical requirements, refer to model-specific product page and installation guide on web.
- Always consult local and national electric codes.
- Minimum 27-1/4" clearance for oven door depth when open.
- Minimum 23-1/2" deep cutout dimension is critical for proper installation, to ensure that oven's faceplate will fit flush against cabinet front.
- Minimum 4-1/2" distance required from door hinge side of oven's cutout opening to any adjoining cabinetry or wall, to allow sufficient clearance for oven rack removal.
- Side filler panels necessary to isolate oven from adjoining cabinets.
- Oven base of solid plywood or similar material required, capable of supporting 150 Lbs. Install over two runners and flush with toe plate.
- Base must be level and cabinet front must be square.
- Recommended that bottom of cabinet remain partially opened to permit free air circulation, avoiding possible water condensation which may appear inside control panel while operating oven.
- Allow 5" maximum height from oven base to floor, if NO cooktop is installed directly over wall oven.

Electric Cooktop Installation Over 27" Electric Single Wall Oven (GLEB27Z7H) Specifications

- Frigidaire® Single Wall Oven model GLEB27Z7H is approved to be used beneath any approved Frigidaire® Electric Cooktop.
- For detailed Electric Cooktop installation, refer to model-specific product page and installation guide on web.
- Side filler panel height may need to be modified to accommodate the depth of approved electric cooktop models.
 - To route armored cable to junction box, cut minimum 4" x 4" opening in right side filler panel.
 - Allow 4-1/2" maximum height from oven base to floor, if cooktop is installed directly over wall oven.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.



Single Wall Ovens

FFEW2725L S/W/B

27" Electric



Product Dimensions

Height	29"
Width	27"
Depth	24-1/2"

More Easy-To-Use Features

Keep Warm

Timer Lock-Out

Oven Rack Handles

Oven racks are designed with space for you to easily pull out the racks, even when wearing an oven mitt.

Extra-Large Window

Our extra-large oven window lets you easily see what's inside.

Bright Oven Lighting

Our bright lighting makes it easy to see what's inside.

Delay Clean

Set the oven to begin cleaning on your schedule.

Delay Bake

Timed Cook Option

Auto Shut-Off

As an extra safety measure, the oven will automatically shut off after 12 hours.

Attractive Stainless Steel Exterior¹

A.D.A. Compliant²

Sabbath Mode (Star-K® Certified)

Available in:



Stainless (S)

White (W)

Black (B)

¹Select models only.

²When properly installed, meets the appliance standards in the Americans with Disabilities Act and the Architectural Barriers Act Accessibility Guidelines as published by the United States Access Board on June 23, 2004, as amended August 5, 2005.

Signature Features

Ready-Select™ Controls

Easily select options or control cooking temperature with our easy-to-use controls.

Even Baking Technology

Our latest technology ensures even baking every time.

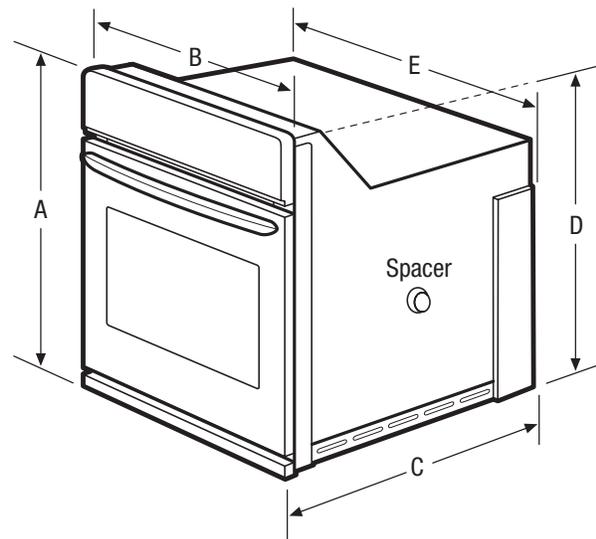
Self-Cleaning

Ovens clean themselves — so you don't have to.

Vari-Broil™ Option

Allows you to choose between two heat levels.

Features	
Oven Control/Timing System	Ready-Select™
Window	Extra-Large
Exterior Door Finish	Stainless Steel (S), Color-Coordinated (W/B)
Handle Design	Stainless Steel (S), Color-Coordinated (W/B)
Oven Cleaning System	Self Clean
Oven Controls	
Bake/Broil	Yes/ Variable (Hi - Lo)
Convection Conversion	
Convection Bake/Broil/Roast	
Quick Bake Convection	
PowerPlus™/Quick Preheat	
My Favorite	
Chicken Nugget Button	
Pizza Button	
Keep Warm	Yes
Add-a-Minute	
Delay Bake	Yes
Self-Clean	Yes
Rapid/Quick Clean Option	Quick
Delay Clean	2, 3 Hours
Kitchen Timer	Yes
Timed Cook Option	Yes
Control Lock	Yes
Auto Oven Shutoff	12 Hours
Oven Lock-Out	
Oven Features	
Capacity (Cu. Ft.)	3.5
Convection System	
Oven Light	1
Hidden Bake Element	
Rack Configuration	2 Handle Racks
Baking System	Even Baking Technology
Broiling System	Vari-Broil™
Bake/Broil Element (Watts)	2,300/3,400
Certifications	
A.D.A. Compliant ¹	Yes
Sabbath Mode (Star-K® Certified)	Yes
Specifications	
Oven Interior (H x W x D)	16-1/2" x 20-1/2" x 18-1/32"
Power Supply Connection Location	Left Bottom Rear
Voltage Rating	240V / 208V / 60Hz
Connected Load (kW Rating) @ 240/208 Volts ²	3.4/2.6
Amps @ 240/208 Volts	14.5/12.5
Minimum Circuit Required (Amps)	20
Approved for Under-Counter Installation	Yes
Shipping Weight (Approx.)	155 Lbs.



NOTE: For planning purposes only. Always consult local and national electric codes. Refer to Product Installation Guide for detailed installation instructions on the web at frigidaire.com.



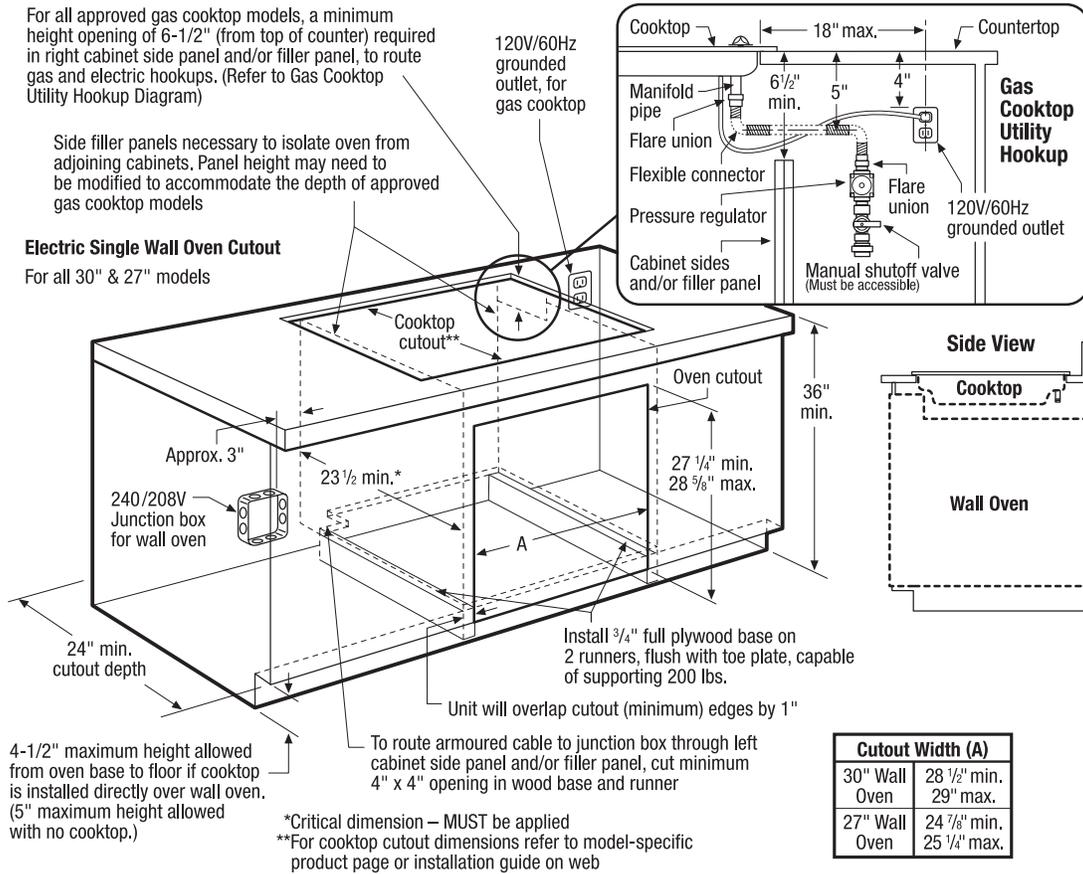
Product Dimensions	
A - Height	29"
B - Width	27"
C - Depth	24-1/2"
D - Height (Wrapper)	27-3/16"
E - Width (Wrapper)	24-5/8"
Depth with Door Open 90°	44-1/2"

Cutout Dimensions	
Height (Min.)	27-1/4"
Height (Max.)	28-5/8"
Width (Min.)	24-7/8"
Width (Max.)	25-1/4"
Depth (Min.)	23-1/2"

¹When properly installed, meets the appliance standards in the Americans with Disabilities Act and the Architectural Barriers Act Accessibility Guidelines as published by the United States Access Board on June 23, 2004, as amended August 5, 2005.

²Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.

Accessories information available on the web at frigidaire.com



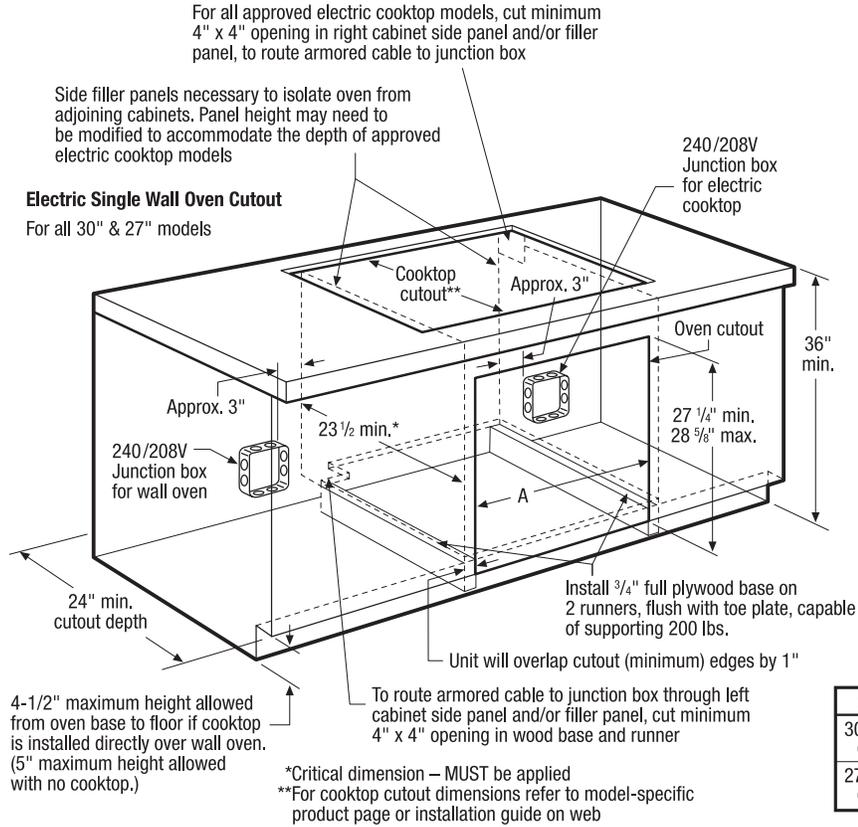
30"/27" Electric Single Wall Oven Under-Counter Installation Specifications

- Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.
- For detailed electrical requirements, refer to model-specific product page and installation guide on web.
- Always consult local and national electric codes.
- Minimum 21" clearance for oven door depth when open.
- Minimum 23-1/2" deep cutout dimension is critical for proper installation, to ensure that oven's faceplate will fit flush against cabinet front.
- Full oven base of solid plywood or similar material required, capable of supporting 200 Lbs. Install over two runners and flush with toe plate.
- Base must be level and cabinet front must be square.
- Allow 5" maximum height from oven base to floor, if NO cooktop is installed directly over wall oven.

Gas Cooktop Installation Over 30"/27" Electric Single Wall Oven Specifications

- All Frigidaire® Electric Single Wall Ovens are approved to be used beneath any approved Frigidaire® Gas Cooktop.
- For detailed Gas Cooktop installation, refer to model-specific product page and installation guide on web.
- Side filler panels necessary to isolate oven from adjoining cabinets. Panel height may need to be modified to accommodate the depth of approved gas cooktop models.
 - Minimum height opening of 6-1/2" (from top of counter) required in right cabinet side panel and/or filler panel, to route gas and electric hookups.
 - Allow 4-1/2" maximum height from oven base to floor, if cooktop is installed directly over wall oven.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.



30"/27" Electric Single Wall Oven Under-Counter Installation Specifications

- Single phase 3- or 4-wire cable, 120/240 or 120/208 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line.
- For detailed electrical requirements, refer to model-specific product page and installation guide on web.
- Always consult local and national electric codes.
- Minimum 21" clearance for oven door depth when open.
- Minimum 23-1/2" deep cutout dimension is critical for proper installation, to ensure that oven's faceplate will fit flush against cabinet front.
- Full oven base of solid plywood or similar material required, capable of supporting 200 Lbs. Install over two runners and flush with toe plate.
- Base must be level and cabinet front must be square.
- Allow 5" maximum height from oven base to floor, if NO cooktop is installed directly over wall oven.

Electric Cooktop Installation Over 30"/27" Electric Single Wall Oven Specifications

- All Frigidaire® Electric Single Wall Ovens are approved to be used beneath any approved Frigidaire® Electric Cooktop.
- For detailed Electric Cooktop installation, refer to model-specific product page and installation guide on web.
- Side filler panels necessary to isolate oven from adjoining cabinets. Panel height may need to be modified to accommodate the depth of approved electric cooktop models.
 - To route armored cable to junction box, cut minimum 4" x 4" opening in right cabinet side panel.
 - Allow 4-1/2" maximum height from oven base to floor, if cooktop is installed directly over wall oven.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.



SPECIFICATIONS
ESSEV SERIES
 RANGE HOODS

ENERGY STAR® Power Unit Insert

• **Dimensions**

Overall bottom projection - 11"
 Height - 11"
 Widths: 28" (for 30" canopy) and 31.25" (for 36" canopy or larger)

• **Body**

Galvanized steel body with stainless steel fascia.
 Install at least 24" above the cooking surface.

• **Lighting**

Electronic Quick Start Ballast – Use 2 - Triple 4 pin PL lamps.
 Maximum 18 Watts each.

• **Ducting**

Vertical ducting: 6" round ducting with all metal outlet adapter
 and back draft damper

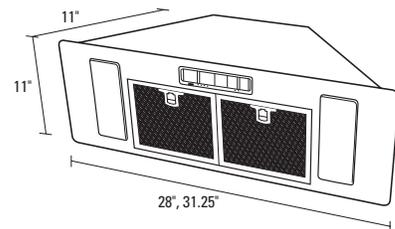
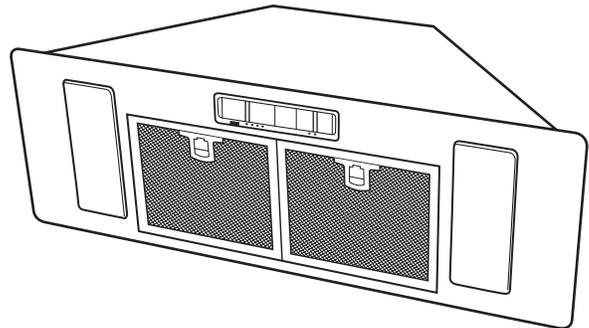
• **Filters**

Dishwasher safe, aluminum mesh grease filters (included).

• **Blower**

3 speed, permanently split capacitor motor. Rated 120 volts, 60 hz. with a dual
 inlet, electronically balanced polymeric centrifugal blower wheel

PERFORMANCE: High - 300 CFM @ 4.5 Sones, HVI Certified
 Medium - 200 CFM @ 2.0 Sones, HVI Certified
 Low (Normal Operating Speed) - 140 CFM @ 0.7 Sones, HVI Certified



MODEL	CFM		SONES		LIGHTING	DUCT SIZE	WIDTH	HEIGHT	DEPTH
	HIGH/MED/LOW	HIGH/MED/LOW	HIGH/MED/LOW	HIGH/MED/LOW					
ESSEV28	300/200/140	4.5/2.0/0.7	2-18W Fluorescent	6" round	28"	11"	11"		
ESSEV30	300/200/140	4.5/2.0/0.7	2-18W Fluorescent	6" round	31.25"	11"	11"		

PROJECT							ARCHITECT			
LOCATION							ENGINEER			
CONTRACTOR							SUBMITTED BY			DATE
FAN NUMBER	MODEL NUMBER	CFM	IN W.C.	RPM	WATTS	AMPS	SONES	QTY	OPTIONAL EQUIPMENT & REMARKS	



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 Fax: (610) 696-8048
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 Fax: (905) 456-1015
 Email: casales@airkinglimited.com

LIEBHERR

Design Guide 2009

Freestanding / Semi Built-In Models 24" and 48"



Welcome

Liebherr's engineering excellence in Germany provides the largest selection of freezers, refrigerators and wine refrigerators worldwide.

Liebherr appliances consistently specializes in the manufacturing of high quality freezers and refrigerators. With more than 300 basic models, we have the widest selection in the world. Liebherr appliances feature premium quality, numerous innovative product ideas and advanced design. Liebherr freezers and refrigerators are manufactured at three modern production plants:

Liebherr Marica in Bulgaria, Liebherr-Hausgeräte Ochsenhausen GmbH in Germany and the Liebherr-Hausgeräte Lienz GmbH in Austria.

We produce more than 2.3 million quality freezers, refrigerators and wine refrigerators each year, and these are sold all over the world. Liebherr-Hausgeräte Ochsenhausen GmbH in Germany makes over 1,100,000 appliances a year and employs 1,900 people. The Liebherr-Hausgeräte Lienz GmbH manufactures more than 700,000 freezers and refrigerators and employs 1,500 people.

The appliances for the North American market are produced in Austria and in Germany.

Liebherr is committed to the protection of the environment and recognizes it as a critical priority. To guarantee an optimum and consistent implementation, all ecological aspects were observed and integrated into the quality control of Liebherr in compliance with DIN EN ISO 9001.

Liebherr's Commitment to the Environment

The components of Liebherr products can be recycled when the necessary resources are applied. A concern for the environment and a desire to protect resources has led to increased levels of recycling year after year. When Liebherr manufactures products, it is essential that the recyclable recovery rate of the materials we use constantly increases.

Recycling is a common goal among all manufacturers, municipalities and recycling companies to protect our environment. Protecting the environment and producing products which have a low impact on the environment, is one of Liebherr's core values. Whether you are replacing a unit or starting fresh, remember to dispose of your old appliance in an environmentally safe and friendly manner.

Introduction

LIEBHERR WARRANTY PLAN

FULL TWO YEAR WARRANTY - For two years from the date of original purchase, your Liebherr Warranty covers all parts and labor to repair or replace any part of the product which proves to be defective in materials or workmanship.

FULL FIVE YEAR WARRANTY - For five years from the date of original purchase, your Liebherr Warranty covers all parts and labor to repair or replace any components that prove to be defective in materials or workmanship in the sealed system. The "Sealed System" means only the compressor, condenser, evaporator, drier and all connecting tubing.

LIMITED 6TH THROUGH 12TH YEAR WARRANTY - From the 6th through 12th year from the date of original purchase, your Liebherr Warranty covers all parts that prove to be defective in materials or workmanship in the sealed system (parts only).



Customer Service

If your appliance is not working properly, or if the temperature display reads "F0" to "F5", please call the numbers listed below.

Give the **fault number displayed**, together with the **Type Designation, Service Number** and **Appliance Number (Serial Number)** from the model plate, to ensure prompt, accurate servicing. The model plate is located inside the appliance.

Leave the appliance door closed until the customer service technician arrives to minimize any further cold loss.

For Service and Parts in the U.S.: Liebherr Service Center

15545 N. 77th Street
Scottsdale, AZ 85260

Phone: (480) 998-0141
Fax: (480) 998-7877
Toll Free: **1-866-LIEBHERR or
1-866-543-2437**

www.liebherr-appliances.com

For Service and Parts in Canada: Euro Parts

579 Campbell Street,
P.O. Box 759,
Lucknow, Ontario, N0G 2H0

Phone: (519)528-5005
Fax: (519)528-5001
Toll Free: **1-888-Liebherr or
1-888-543-2437**

www.euro-parts.ca

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General Remarks

I. Safety Warnings

PLEASE READ AND FOLLOW THESE INSTRUCTIONS

This design guide contains Warning and Caution statements. This information is important for safe and efficient installation.

This design guide is not replacing the use and care manual which contains important information on how to use Liebherr appliances.

Always read and follow all Warning and Caution statements!

██████████ WARNING ██████████

States a hazard that may cause serious injury or death if precautions are not followed.

██████████ CAUTION ██████████

Signals a situation where minor injury or product damage may occur if you do not follow instructions.

██████████ DANGER ██████████

States a hazard will cause serious injury or death if precautions are not followed.

IMPORTANT

This highlights information that is especially relevant to a problem-free installation.

Make sure incoming voltage is the same as the unit rating.

To reduce the risk of fire, electric shock, or personal injury, the installation work and electrical wiring must be done by a qualified electrician in accordance with all applicable codes and standards, including fire rated construction.

To the Installer

It is very important that the guidelines and instructions are followed in this design guide to ensure proper installation and operation of the unit. The Installation Guidelines section contains important information for making sure the installation is correct. Read and understand all the information and installation guidelines in this manual before the unit is installed.

It is also very important to **know** the Safety Information.

General Remarks

II. Electrical Requirements & Safety

A 115 Volt, 60 Hz, 15 Amp (20 Amp for side-by-side installation) fused electrical supply is required. Connect undercounter wine cabinet to a 115 VAC, 10 amp (15 Amp for side-by-side installations) circuit that is controlled by a circuit breaker or fuse.

We recommend using a dedicated circuit for these appliances to prevent electrical overload. Comply with the National Electrical Code as well as local codes and ordinances when installing the receptacle.

The power cord is equipped with a three-prong (grounding) plug for your protection against possible shock hazards. To maintain this protection:

- Do not modify the plug by removing the round grounding prong.
- Do not use a power cord that is frayed or damaged.



WARNING

Do not ground to a gas pipe. Check with a qualified electrician if you are not sure the appliance is properly grounded. Do not have a fuse in the neutral or grounding circuit.



WARNING

ELECTROCUTION HAZARD

Electrical Grounding Required. This appliance is equipped with a three-prong(grounding) polarized plug for your protection against possible shock hazards.

- **DO NOT** remove the round grounding prong from the plug.
- **DO NOT** use a two-prong grounding adapter.
- **DO NOT** use an extension cord to connect power to the unit.

III. IceMaker (if equipped)

The icemaker is located in the freezer compartment. It must be connected to the water supply to function properly. The appliance must be level for the icemaker to function properly.

The water pressure must be between 21.8-87.0 psi (1.5-6 bar). Use a 1/4" OD copper line to connect the water supply to the solenoid valve. This is not supplied with the refrigerator.

If you have hard water, we recommend you install a water softener. Also, a filter must be installed if the water contains solids such as sand. All equipment and devices used to supply the water to the appliance must comply with the current regulations for your geographical area.

Safety Instructions and Warnings

- Do not attach the water source while the appliance is connected to an electrical outlet.
- A shut-off valve, must be installed between the hose line and the main water supply so that the water supply can be stopped if necessary. Do not install the shut-off valve behind the refrigeration unit.
- The connection to the water supply may only be made by a trained and licensed plumber.
- The water quality must comply with the drinking water regulations for the geographical area where the appliance is located.
- The icemaker is designed exclusively to make ice cubes in quantities needed by a household and may only be operated with water appropriate for this purpose.
- All repairs and work on the icemaker may only be done by customer service personnel or other trained personnel.
- The manufacturer cannot accept liability for damage caused by equipment or water lines between the solenoid valve and the water supply.

General Remarks

IV. Area Requirements

Verify the following:

- Floors can support refrigerator's weight plus approximately 1200 pounds (544 kg) of food weight. Not all Liebherr products are designed for 1200 pounds (544 kg) of food. Some units are smaller and total weights may vary.
- Finished kitchen floor height is level. Refrigerator must be shimmed to the floor level, or levelled, to make sure, air vents are not obstructed.
- Remove anything attached to the rear or side walls that can obstruct refrigerator opening.
- Cutout dimensions are accurate.
- Electrical outlet is in correct location.

Do not install this unit next to any other refrigerator or freezer except another Liebherr model. Liebherr models are designed to allow side by side installation. They are equipped with a heating system to eliminate condensation when units are installed side by side. Installing this unit next to any other refrigerator or freezer can cause condensation or cause damage to the Liebherr unit.

CAUTION

To protect the refrigerator from possible damage, allow the appliance to stand 1/2 to 1 hour in place before turning the electricity on. This allows the refrigerant and system lubrication to reach equilibrium.

Blocking For Safety

The anti-tip brackets must be installed to prevent the unit from tipping after it is installed.

V. Safety Regulations

The appliance complies with UL250 and CAN/CSA-C 22,2 No. 63 and is designed to cool, freeze, store food as well as make ice (if equipped). It is designed as a household appliance. If used commercially, the relevant regulations on commercial use must be observed.

The appliance is set to operate within specific ambient temperature limits according to its climate rating. These temperature limits should not be exceeded. The correct climate rating for your appliance is indicated on the model plate.

This is explained as follows:

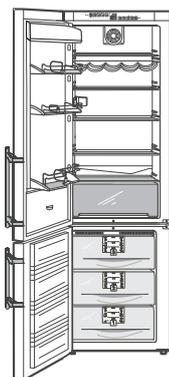
Climate Rating	Set for Ambient Temperatures of
SN	50°F to 90°F (10°C to 32°C)
N	61°F to 90°F (16°C to 32°C)
ST	61°F to 101°F (16°C to 38°C)
T	61°F to 110°F (16°C to 43°C)
SN-ST	50°F to 101°F (10°C to 38°C)
SN-T	50°F to 110°F (10°C to 43°C)

- The refrigerant circuit has been tested for leaks.

24" and 48" Models: CS13..., SBS26S1

The unique design of Liebherr's freestanding models features fully stainless steel doors, and even stainless steel side walls - a perfect combination of design and functionality. New Swing Line doors with bevelled edges are a particularly elegant feature of this combination. Practical lever handles with integrated opening mechanisms make opening the appliance almost effortless.

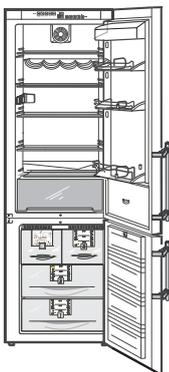
24" and 48" Models



CS 1311

Energy Star:	qualified
Energy consumption p. a.:	420 kWh
Energy Supply:	115V/60Hz/350W
Total capacity:	13 cu ft (369 L)
Refrigerator:	9.7 cu ft (275 L)
Freezer:	3.3 cu ft (94 L)
Climate Rating:	SN-T
Door hinges:	left/reversible

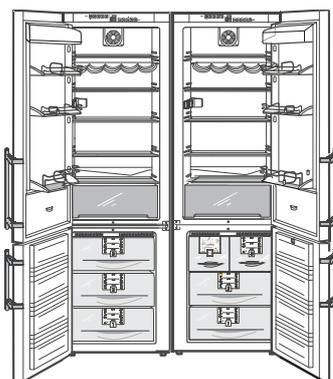
- Automatic refrigerator defrosting
- Automatic freezer compartment defrosting
- LED lighting for refrigerator
- Full extension vegetable drawers on telescopic rails



CS 1360

Energy Star:	qualified
Energy consumption p. a.:	420 kWh
Energy Supply:	115V/60Hz/350W
Total capacity:	13 cu ft (369 L)
Refrigerator:	9.7 cu ft (275 L)
Freezer:	3.3 cu ft (94 L)
Ice cube capacity:	2.2 lbs./24h
Ice cube stock:	3.3 lbs.
Climate Rating:	SN-T
Door hinges:	right/reversible

- Automatic refrigerator defrosting
- Automatic freezer compartment defrosting
- Automatic IceMaker can be switched off
- LED lighting for refrigerator
- Full extension vegetable drawers on telescopic rails

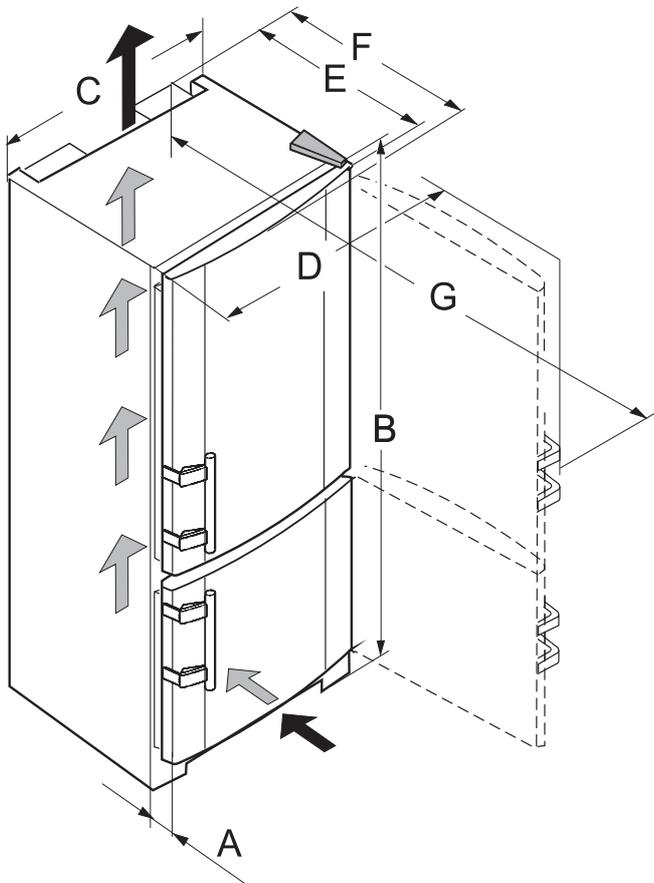


SBS 26S1 (CS 1311 & CS 1360)

Energy Supply:	115V/60Hz/700W
Total capacity:	26 cu ft (738 L)
Refrigerator:	19.4 cu ft (550 L)
Freezer:	6.6 cu ft (188 L)
Ice cube capacity:	2.2 lbs./24h
Ice cube stock:	3.3 lbs.
Climate Rating:	SN-T
Door hinges:	left / right

- Automatic refrigerator defrosting
- Automatic freezer compartment defrosting
- Automatic IceMaker can be switched off
- LED lighting for refrigerator and freezer
- Full extension vegetable drawers on telescopic rails

Unit Dimensions

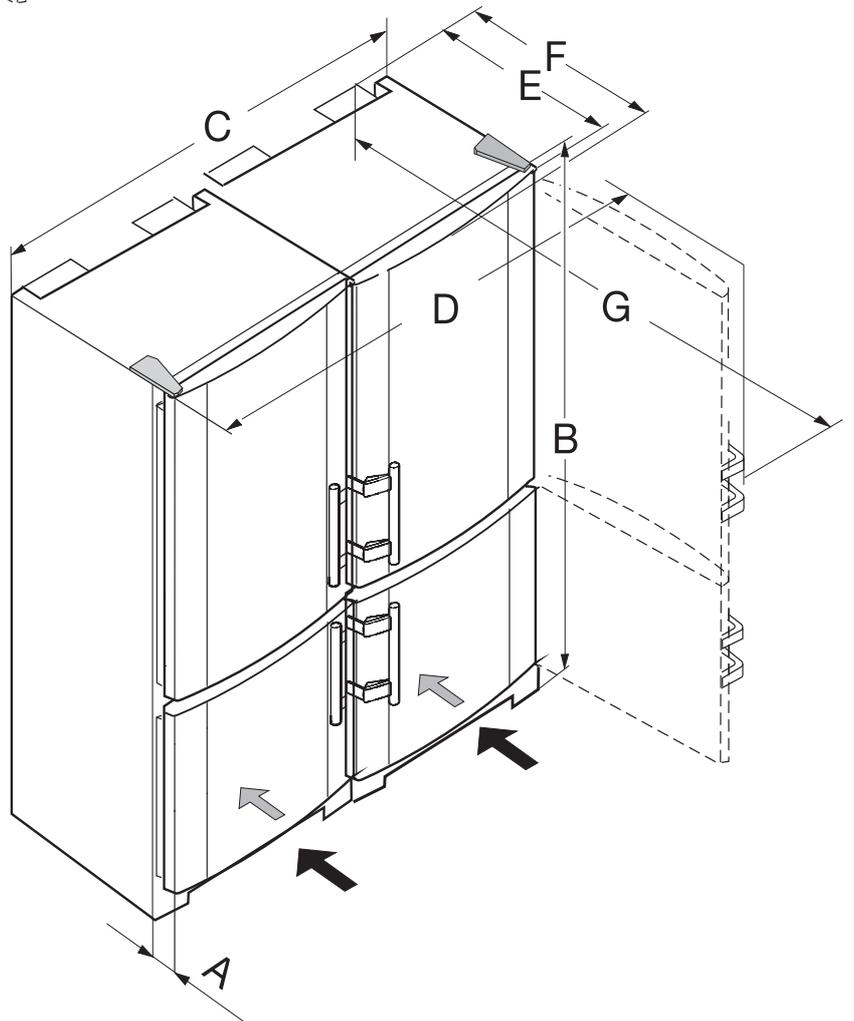


CS 1311 & CS 1360

- A. 2-7/32" (56.5 mm)
- B. 79-3/16" (2011 mm)
- C. 23-1/2" (597 mm)
- D. 25-3/32" (637 mm)
- E. 24-1/8" (613 mm)
- F. 24-3/4" (629 mm)
- G. 46-3/8" (1178 mm)

SBS 26S1 (CS 1311 & CS 1360)

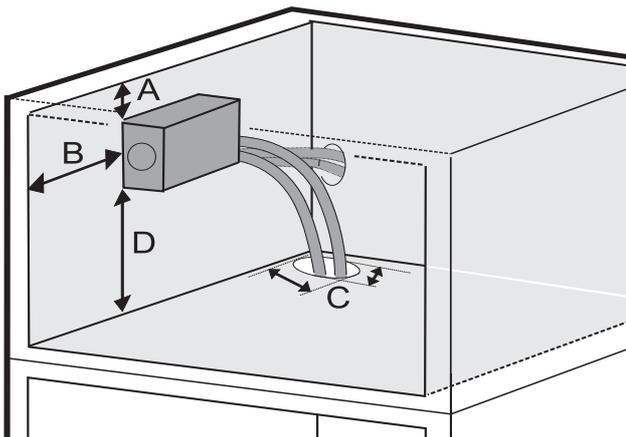
- A. 2-7/32" (56.5 mm)
- B. 79-3/16" (2011 mm)
- C. 47-13/32" (1204 mm)
- D. 48-31/32" (1244 mm)
- E. 24-1/8" (613 mm)
- F. 24-3/4" (629 mm)
- G. 46-17/32" (1182 mm)



Kitchen cabinet setup for the water filter

To ensure optimum water quality for the production of ice cubes (only CS 1360) an external water filter module is available as an accessory.

It should be installed near the appliance in the cabinet, for example, in the adapter cabinet above the appliance. To connect the filter to the appliance, it may be necessary to make an opening (C) in the floor of the adapter cabinet through which the hoses will be routed. The maximum length of the water hose is 98-7/16 " (2.5 m). The filter cover must be installed during assembly to leave sufficient space around the filter module.



Maintain the dimensions shown in Fig. so that the filter can be replaced and the cover can be removed.

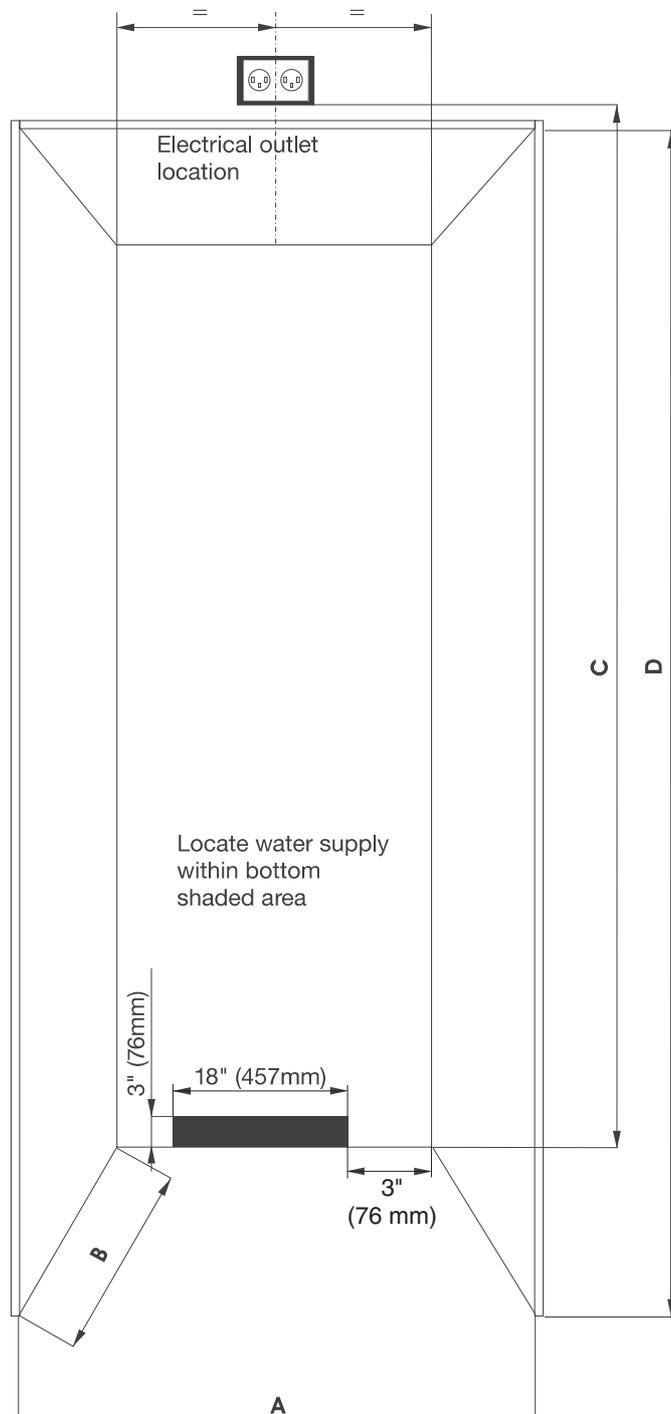
(A) 13/16in (20mm)

(B) 3-15/16in (100mm)

(C) 1-3/16in. x 3/8in. (30mm x10mm)

(D) min. 4in (100mm)

Cabinet Opening Dimensions



The appliance can be integrated into the kitchen units. To adapt the appliance to the height of the row of kitchen units, a suitable top cupboard can be fitted above the appliance.

Unit Venting

DO NOT restrict the air flow. An air flow of at least 2" (50mm) must be provided. The opening can either be directly over the appliance or on the back of the cabinet on top of the unit (see ventilation requirements).

The CS models can be installed in standard 24" (609mm) deep cabinets. You will only have to make sure that the door swing clearance is enough. It is possible to push all CS models to the rear wall of the cabinet without modification.

When installing the appliance next to a wall, a distance on the hinge side of 1 13/32 inches (36 mm) minimum is required between the appliance and the wall to allow for the door handle projection when the door is open.

Minimum Cabinet Opening Dimensions:

CS 1311, 1360

- A. 23-7/8" (606 mm)
- B. 24" (609 mm)
- C. 85-29/32" (2182 mm)
- D. 80" (2032 mm)*

SBS 26S1 (CS 1311 & CS 1360)

- A. 47-23/32" (1212 mm)
- B. 24" (609 mm)
- C. 85-29/32" (2182 mm)
- D. 80" (2032 mm)*

***Note:** The given cabinet opening height dimension includes space for top air vent. If you choose to place the vent above the cabinet or in a soffit, you will need to adjust the height dimension accordingly. Please refer to Ventilation Requirements.

Ventilation Requirements

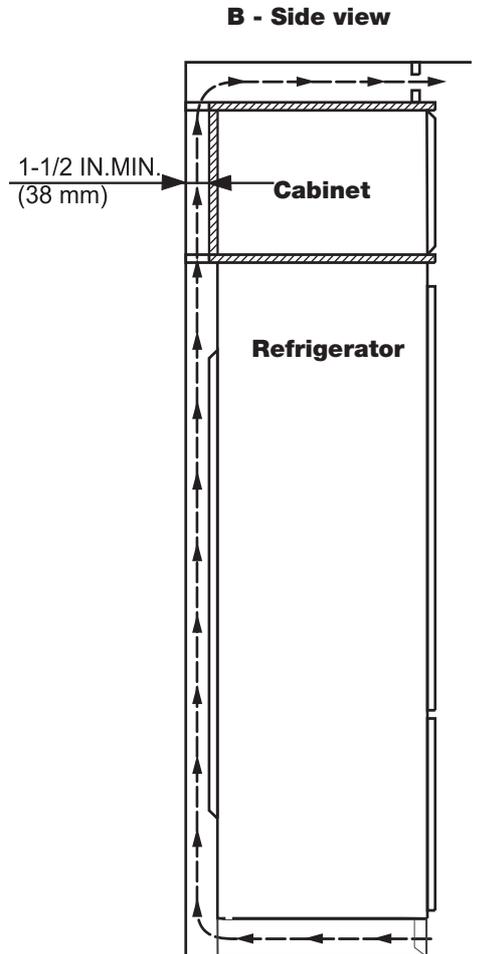
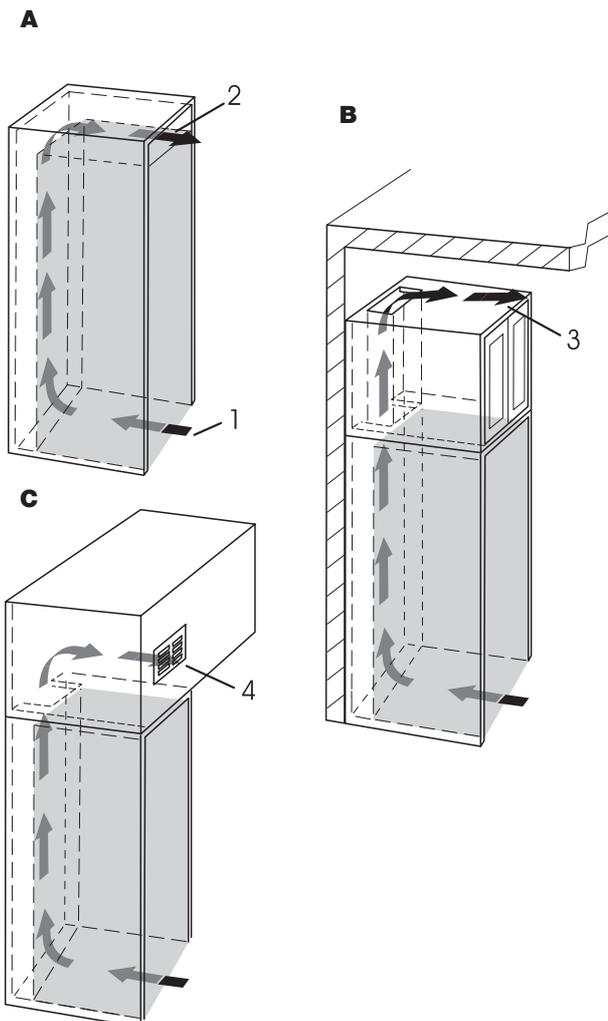
This type of cabinet must be carefully constructed using the correct dimensions and it must provide suitable ventilation to ensure proper appliance operation.

Kitchen Cabinet Airflow

1. The following ventilation dimensions must be observed:

There must be a ventilation space at least 31 in.² (200 cm²) at the airflow inlet (1) and at the airflow outlet (2). The top ventilation space can be directed in one of the following ways:

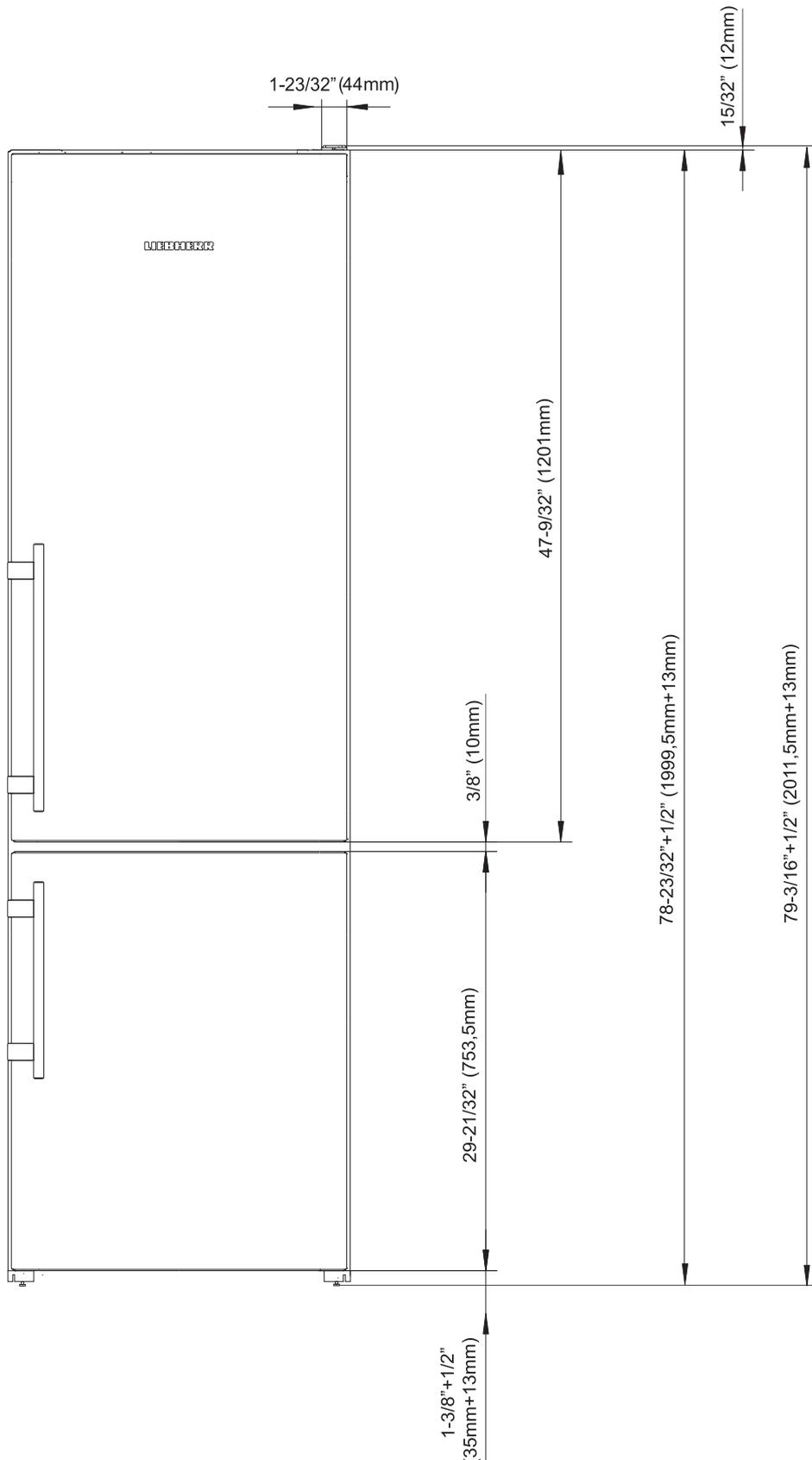
- A) Directly over the appliance (2) with a gap of at least 2 inches between the ceiling of the unit and the cabinet.
- B) Above the cabinet and below the ceiling (3).
- C) Through a vent installed in a soffit (4).



The refrigerator is designed to allow proper air flow when the appliance is installed up against the wall. A minimum space of 1 1/2" (38mm) is required when a cabinet is built above.

Top Door Hinge Clearance CS 13.. - SBS 26S1

When installing CS units into a row of cabinets or wall units; use these dimensions to achieve a custom look with the cabinetry while providing the necessary clearance for the top door hinge.





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Design Guide 2009

BOSCH

YOUR LIFE. OUR INSPIRATION.

DISHWASHER USE AND CARE MANUAL

MODEL: SHE44C / SHE46C / SHE47C / SHE56C / SHU43C / SHX46A / SHX46L / SHX43E
SHV46C / SHE43F / SHE43M / SHX43M / SHE45M / SHV45M / SHX45M / SHE55M

GUIDE D'ENTRETIEN ET D'UTILISATION DU LAVE-VAISSELLE

MODÈLE: SHE44C / SHE46C / SHE47C / SHE56C / SHU43C / SHX46A / SHX46L / SHX43E
SHV46C / SHE43F / SHE43M / SHX43M / SHE45M / SHV45M / SHX45M / SHE55M

MANUAL DE USO Y CUIDADO PARA LAVADORA DE PLATOS

MODELOS: SHE44C / SHE46C / SHE47C / SHE56C / SHU43C / SHX46A / SHX46L / SHX43E
SHV46C / SHE43F / SHE43M / SHX43M / SHE45M / SHV45M / SHX45M / SHE55M



Congratulations, and Thank You from Bosch!

Thank you for selecting a Bosch dishwasher. You have joined the many consumers who demand quiet and superior performance from their dishwashers.

This manual was written with your safety and convenience in mind, and the information contained herein is very important. We highly recommend that you read this manual before you use your dishwasher for the first time.

To learn even more about your dishwasher and available accessories, as well as many other top-quality Bosch appliances, visit our website at www.boschappliances.com.

Please contact us if you have any questions or comments. Call **1-800-944-2904**, or write to:

BSH Home Appliances, Corp.
5551 McFadden Avenue
Huntington Beach, CA 92649

Enjoy!

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⚠ Important Safety Instructions - Save This Information ⚠

ATTENTION

Never use steam cleaning products to clean your dishwasher. The manufacturer will not be liable for possible damages or consequences.

ATTENTION

Never use harsh chemicals to clean your dishwasher. Some chloride-containing cleaning products can damage your dishwasher and may present health hazards!

ATTENTION

It is highly recommended for the end use consumer to become familiar with the procedure to shut off the incoming water supply and the procedure to shut off the incoming power supply. See the Installation Instructions or speak with your installer for more information.

WARNING

Misuse of the dishwasher can result in serious injury or death. Do not use the dishwasher in any way not covered in this manual or for any purpose other than those explained on the following pages.

WARNING

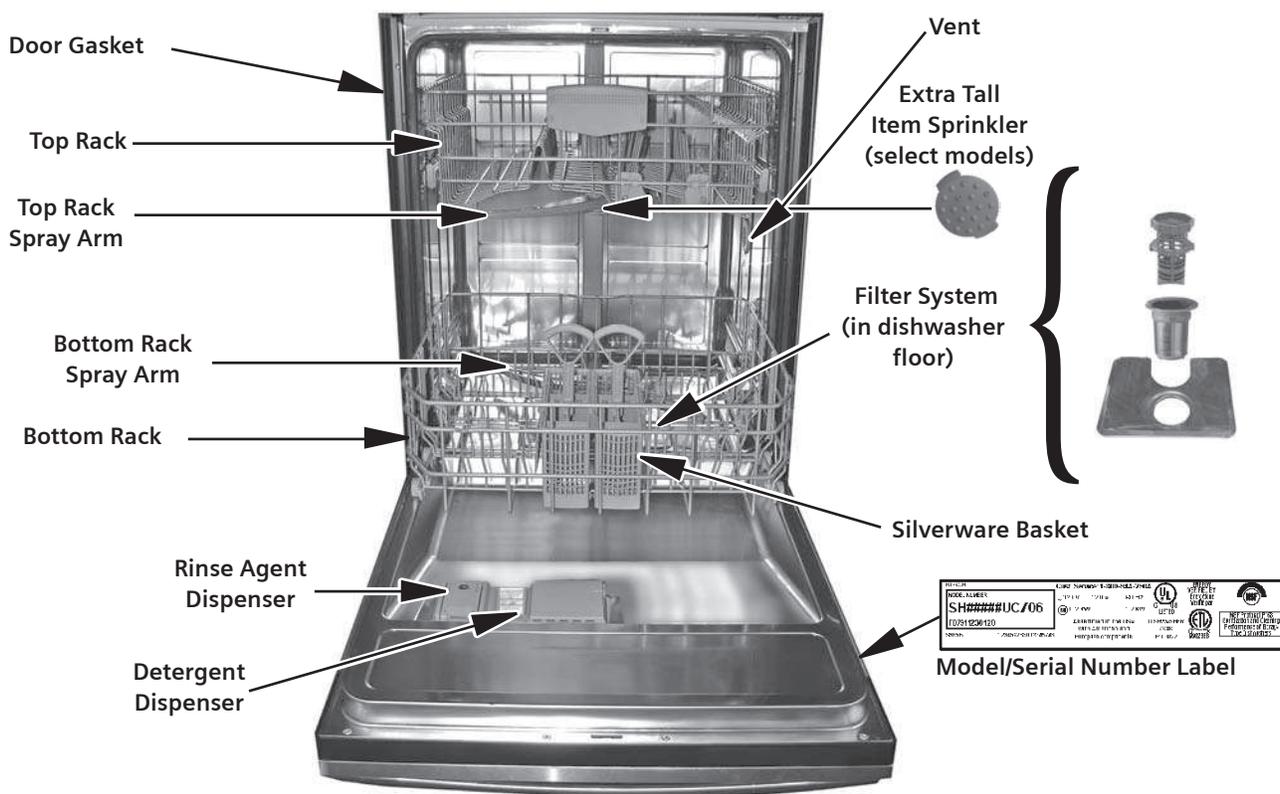
Severe product damage and/or injury could result from the use of unqualified service technicians or non-original replacement parts. All repairs must be performed by a qualified service technician using only original equipment factory replacement parts.

WARNING

Electrical shock or fire could result if the electrical supply for the dishwasher covered in this manual is incorrectly installed or if the dishwasher has been improperly grounded. Do not use the dishwasher covered in this manual if you are not certain the electrical supply has been correctly installed or the dishwasher has been properly grounded.

- This appliance must be grounded to a metal, permanent wiring system, or an equipment grounding conductor must be run with the circuit conductors and connected to the equipment grounding terminal or lead on the dishwasher. See the **Installation Instructions** included with this dishwasher for more information on electrical requirements.
- Use this dishwasher only for its intended function, which is the washing of household dishware and kitchenware.
- This dishwasher is provided with **Installation Instructions** and this **Use and Care Manual**. Read and understand all instructions before using the dishwasher.
- Use only detergents or rinsing agents recommended for use in a dishwasher, and keep them out of the reach of children.
- When loading items to be washed:
 - Locate sharp items so that they are not likely to damage the door seal.
 - Load knives and other sharp utensils with their HANDLES UP to reduce the risk of cut-type injuries.
- Do not wash plastic items unless they are marked "dishwasher safe" or the equivalent. For plastic items not so marked, check the manufacturer's recommendations.
- Do not operate your dishwasher unless all enclosure panels are in place.
- Do not tamper with or override controls and interlocks.
- Do not abuse, sit on, or stand on the door or dish racks of the dishwasher.
- To reduce the risk of injury, do not allow children to play in or on the dishwasher.
- When children become old enough to operate the appliance, it is the legal responsibility of the parents or legal guardians to ensure that they are instructed in safe practices by qualified persons.
- Under certain conditions, hydrogen gas may be produced in a hot water system that has not been used for two weeks or more. Hydrogen gas is explosive. Before using a dishwasher that is connected to a hot water system that has been unused for two weeks or longer, turn on all hot water faucets and let the water flow from each for several minutes. This will release any accumulated hydrogen gas. As the gas is explosive, do not smoke or use an open flame during this time.
- Remove the door to the washing compartment when removing an old dishwasher from service or discarding.
- To avoid floor damage and possible mold growth, do not allow wet areas to remain around or under the dishwasher.
- Protect your dishwasher from the elements. Protect against freezing to avoid possible damage to the fill valve. Damage caused by freezing is not covered by the warranty.

Dishwasher Components



Dishwasher Features and Options

Noise Reduction System: A two-pump motor system, the Suspension Motor™, and triple insulation make this dishwasher one of the quietest in North America.

Stainless Steel TALLTUB™: A rust-free, hygienic interior surface with a lifetime warranty.

Nylon Coated Racks: Eliminate cuts and nicks, and have a five-year warranty.

Flow-Through Heater™: Heats water to a temperature of up to 161°F.

Condensation Drying: A high temperature final rinse, a low temperature stainless steel tub, and the sheeting action of a rinse agent result in drying that is hygienic, energy efficient, and economical.

SENSOTRONIC™ Water Condition Monitor: Checks water condition and decides whether a second fresh water fill is necessary.

Filter System: Three filters ensure distribution of clean water and protect the main pump and the drain pump from foreign material.

Water Shut-Off: A safety feature that stops the flow of incoming water, if water is detected in the base of the dishwasher.

Fully Integrated Unit (select models): Fully integrated units that feature a custom front door.

Info Light (select models): A red beam shines on the floor to indicate that the unit is running.

ECO function (select models): This option saves energy by reducing water temperature.

See chart next page for complete feature and option set for your model.

Model Number	SHE44C	SHE46C	SHE47C	SHE56C	SHU43C	SHX43E	SHX46A	SHX46L	SHV46C	SHE43M	SHX43M	SHE45M	SHV45M	SHX45M	SHE55M	SHE43F
Control Panel Design	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Exposed Front Control	Hidden Top Control	Exposed Front Control	Hidden Top Control	Hidden Top Control	Exposed Front Control	Exposed Front Control
Audible Cycle Completion Signal	no	no	no	no	no	yes	yes	yes	yes	no	yes	yes	yes	no	yes	no
Clean Light	no	no	no	no	no	yes	yes	no	yes	no	no	no	yes	yes	no	no
Countdown Display	yes	yes	yes	yes	yes	no	no	yes	no	yes	yes	yes	yes	yes	yes	yes
Refill Rinse Agent Indicator Light	yes	yes	Shown on Display as *	yes	yes	yes	yes	Shown on Display as *	yes	yes	Shown on Display as *	yes	Shown on Display as *	Shown on Display as *	yes	yes
Sanitized Indicator Light	yes	yes	Shown on Display as 	yes	yes	yes	yes	Shown on Display as 	yes	yes	Shown on Display as 	yes	Shown on Display as 	Shown on Display as 	yes	yes
Delay Start	no	19 hours	24 hours	19 hours	no	no	no	19 hours	no	19 hours	19 hours	19 hours	19 hours	19 hours	19 hours	no
Child Safety Latch	no	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no
Child Lock (control)	no	no	no	no	no	no	no	no	no	yes	no	yes	no	no	yes	no
Upper Rack Flip Tines	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Lower Rack Flip Tines	no	yes	yes	yes	no	yes	yes	yes	yes	no	no	yes	yes	yes	yes	no
Silverware Basket	Standard	Premium Flexible	Premium Flexible	Premium Flexible	Standard	Premium Flexible	Premium Flexible	Premium Flexible	Premium Flexible	Standard	Standard	Premium Flexible	Premium Flexible	Premium Flexible	Premium Flexible	Standard
Top Rack Only or Half Load	no	yes	yes	no	no	no	yes	yes	yes	no	no	yes	yes	yes	yes	no
Extra Dry Heat	yes	yes	yes	yes	yes	no	no	yes	no	no	no	yes	yes	yes	yes	yes
OPTIDRY™	yes	yes	yes	yes	no	no	no	yes	no	no	no	yes	yes	yes	yes	no
Info Light	no	no	no	no	no	no	no	no	no	no	no	yes	yes	yes	yes	no
ECO	no	no	no	no	no	no	no	no	no	no	no	no	no	no	yes	no

Dishware Materials

NOTE: Before using your dishwasher for the first time, check the information in this section. Some items are not dishwasher safe and should be hand-washed; others require special loading. Contact the item's manufacturer if you are unsure about the item's dishwasher suitability.

Recommended

Aluminum: Colored anodized aluminum may fade over time. Minerals in your water may cause the aluminum to darken or spot. This can usually be removed by using a soap-filled steel wool pad.

China, Crystal, Stoneware: Some hand-painted pieces may discolor, fade, or spot. Hand-wash these pieces. Position fragile glassware so that it will not topple over or contact other pieces during the wash cycle.

Glass: Milk glass may yellow.

Non-Stick Coatings: Apply a light coating of vegetable oil to non-stick surfaces after drying.

Plastics: Make sure the piece is dishwasher safe.

Stainless Steel, Sterling Silver, and Silver Plate: Place these pieces so that they do not contact dissimilar metals.

Not Recommended

Acrylic: crazing (small cracks throughout the acrylic) may occur.

Adhesive-Joined Pieces: Adhesives that join materials such as plastic, wood, bone, steel copper, tin, etc. may loosen.

Bone-Handled Utensils: Handles may separate.

Iron: Iron will rust. Hand-wash and dry immediately.

Non-Dishware Items: Your dishwasher is intended for use in cleaning ONLY standard household dishware and kitchenware.

Pewter, Brass, Bronze: Pewter will tarnish. Hand-wash and dry immediately.

Tin: Tin will rust. Hand-wash and dry immediately.

Wood: Wooden bowls, wooden utensils, and wood-handled utensils can crack, warp, and lose their finish.

Preparing and Loading the Dishware

Dishware Preparation

Do not pre-wash items having loosely-attached soiling. Remove large food particles, bones, seeds, toothpicks, and excessive grease. Items having burned-on, baked-on or starchy soils may require pre-treatment.

Loading the Dishwasher

Check the Materials section of this manual if you are unsure about an item's dishwasher suitability.

Load only dishwasher-safe items into the dishwasher. Load dishes in the dishwasher racks so that the insides of bowls, pots, and pans are facing the spray arms. Avoid nesting and contact points between dishes. Separate items of dissimilar metals.

Loading the Top Rack

Figures 1 and 2 show typical 10 and 12 place load patterns for the top rack.

NOTE: Make sure items do not protrude through the bottom of the racks and block the spray arms.

ATTENTION

To avoid dishwasher damage, do not load the dishwasher with objects such as paper products, plastic bags, packing materials, or anything other than normal dishware and kitchenware. Do not load the dishwasher with anything other than dishwasher-safe dishware and kitchenware.

Figure 1
10 place setting top rack



Figure 2
12 place setting top rack

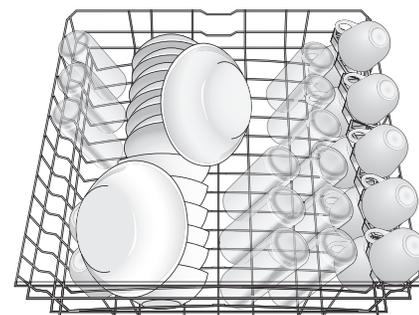


Figure 3

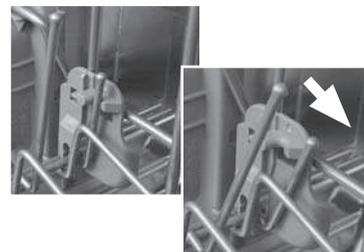


Figure 4

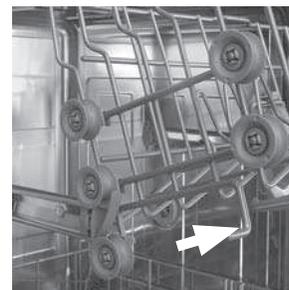


Figure 5

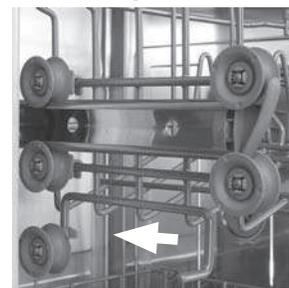


Figure 6

10 place setting bottom rack

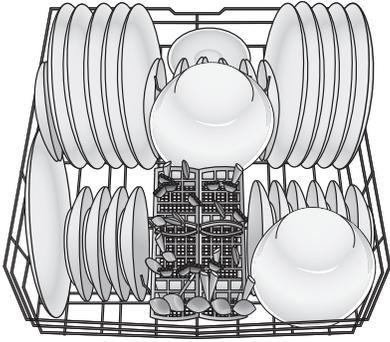


Figure 7

12 place setting bottom rack

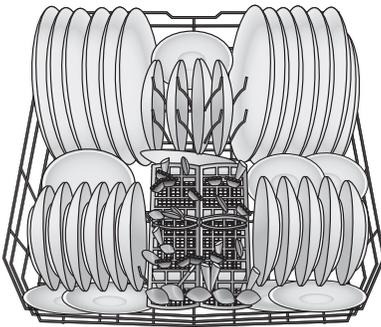


Figure 8



Figure 9

Do not block vent.



Top Rack Accessories

Top Rack Flip Tines

Flip Tines fold down to make loading the racks easier in some instances. Grasp the tines, release from notch, and fold the tines downward. When the top rack is loaded, push it into the dishwasher.

NOTE: When pushing the top rack into the dishwasher, push it until it stops against the back of the tub so the top rack spray arm will connect to the water supply. Do not push the top rack with the door.

Top Rack Height Adjustment

Remove the empty upper rack by pulling it out of the dishwasher to the point that it can be lifted upward, as shown in Figure 4. Pull the rack outward and up until the rollers are completely free of the roller guides. Re-insert the rack with the other set of rollers on the roller guides, as shown in Figure 5.

Loading the Bottom Rack

Place large items in the bottom rack. Load pots, pans and bowls upside-down. Figures 6 and 7 show typical mixed loads for the bottom rack.

Bottom Rack Flip Tines

Flip Tines fold down to make loading the racks easier in some instances. Grasp the tines and fold them downward.

Loading Extra Tall Items (select models)

If an item is too tall to be placed into the bottom rack even with the top rack in the raised position, remove the empty top rack by pulling it out of the dishwasher until it stops rolling. Pull the front of the rack upward and outward until the rollers are completely free of the roller guides. Set the top rack aside. Push the roller guides back into the dishwasher. Insert the Extra Tall Item Sprinkler into the top rack spray outlet and turn the sprinkler clockwise to lock it into position as shown in Figure 8. Place your extra tall item(s) in the bottom rack as shown in Figure 9.

NOTE: Keep the vent on the tub's right side clear by placing tall items such as plastic cutting boards and tall baking sheets on the bottom rack's left side, center, or back.

ATTENTION

To avoid dishwasher damage, do not reinstall the top rack without removing the extra tall item sprinkler. Do not reinstall the top rack with the sprinkler installed.

To remove the sprinkler and return the dishwasher to its normal condition:

1. Turn the sprinkler counterclockwise and remove it.
2. Retrieve the top rack.
3. Tilt the top rack upwards and position the top rack rollers onto the roller guides.
4. Continue pushing the top rack until the rollers are on the guide.
5. Push the top rack into the dishwasher.

Loading the Silverware Basket

NOTE: The silverware basket tops can be folded up to accommodate large or oddly-shaped items.

With the silverware basket tops down, load the silverware basket following the patterns suggested in Figures 10 (for standard basket) and 11 (for flexible basket). Place knives with their handles up, and forks and spoons with their handles down.

If large or oddly-shaped items are to be loaded into the silverware basket with the tops up, load the items so that they do not nest together. Load knives and sharp utensils with their handles up.

CAUTION

The sharp points and edges of knives and other sharp utensils can cause serious injuries. Load knives and other sharp utensils with sharp points and edges down. Do not allow children to handle or play near knives and sharp utensils.

The Standard Silverware Basket

This basket fits in the front-middle of the lower rack.

The Flexible Silverware Basket

This basket is designed for maximum versatility. The basket splits along its length, resulting in two halves that may be placed in a variety of positions in the lower rack, greatly increasing the lower rack's loading versatility.

To split the Flexible Silverware Basket:

1. Grasp the basket as shown in Figure 12A, and slide the two halves in opposite directions, as shown in Figure 12A.
2. Pull the two halves apart, as shown in Figure 12B.

Some suggestions for placing the two halves in the lower rack are shown in Figure 13.

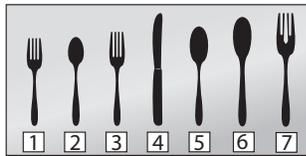
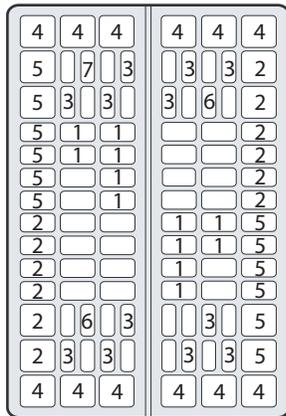
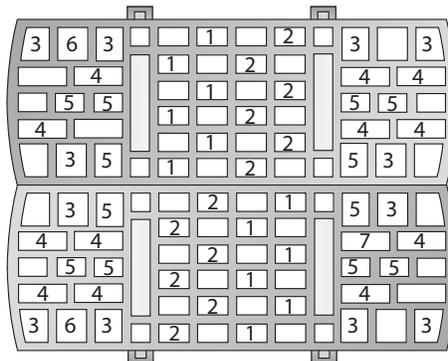


Figure 10



12 place setting
(Models SHE44C, SHU43C,
SHE43F, SHE43M, SHX43M)

Figure 11



12 place setting
(Excluding Models SHE44C, SHU43C,
SHE43F, SHE43M, SHX43M)

Figure 12

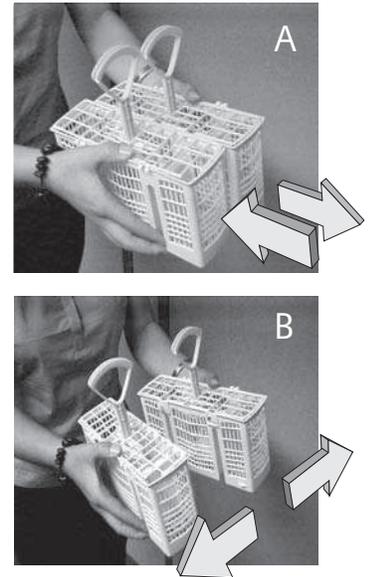


Figure 13

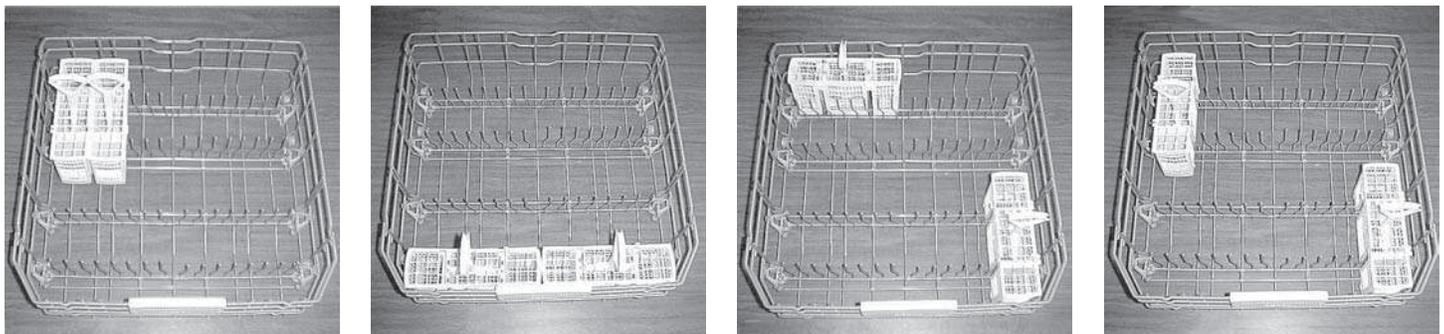
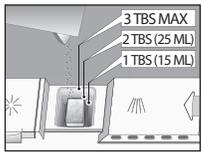


Figure 14



Add Detergent

- Use fresh powdered detergent for best results
- 1 tablespoon will clean most loads
- 3 tablespoons Max, do not overfill
- When using detergent tabs, lay them flat to avoid contact with the cover

Adding Detergent and Rinse Agent

Detergent

Use only detergent specifically designed for dishwashers. For best results, use fresh powdered dishwashing detergent.

ATTENTION

To avoid dishwasher damage, do not use hand dishwashing products in your dishwasher.

This dishwasher uses less water so you need to use less detergent. With soft water, 1 tablespoon (15ml) of detergent will clean most loads. The detergent dispenser cup has lines that measure detergent to 1 tablespoon (15ml) and 1.75 tablespoons (25ml). 3 tablespoons (45ml) of detergent will completely fill the detergent dispenser cup.

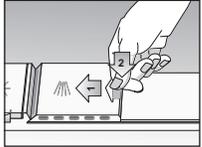
ATTENTION

To avoid dishware damage, do not use too much detergent if your water supply is soft. Using too much detergent in soft water may cause etching in glassware.

NOTE: If you do not know the hardness of your water supply, use 15ml of detergent. Increase the amount of detergent, if necessary, to the least amount required to get your dishware and kitchenware clean.

Use the measuring lines in the detergent dispenser cup as a guide to measure the amount of detergent recommended in Table 1.

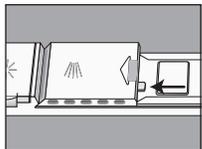
Figure 15



To close

- 1 Slide cover fully left
- 2 Push rear of cover down firmly until you hear the **CLICK**

Figure 16

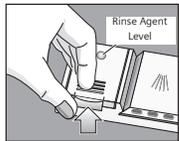


To open the cover

- Push the blue button in (NOT DOWN)

Figure 17

Always use Rinse Agent even if your detergent contains Rinse Agent



Lift tab to open

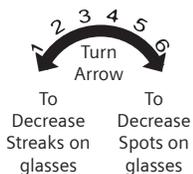
- Add Rinse Agent when the light on the control panel illuminates or (Model Dependent)
- Rinse Agent Level indicator on the dispenser changes to a light silver color

Table 1 - Recommended Detergent Amount				
Wash Cycle	Unit	Water Type		
		Hard	Medium	Soft
Power Scrub Plus/Auto Plus	ml	45	45	25-45
	Tbsp	3	3	1.75 to 3
Auto Wash	ml	25-45	25	15-25
	Tbsp	1.75 to 3	1.75	1 to 1.75
Regular Wash	ml	25-45	25	15-25
	Tbsp	1.75 to 3	1.75	1 to 1.75
Delicate/Economy	ml	25	15-25	15
	Tbsp	1.75	1 to 1.75	1
Quick Wash	ml	25	15-25	15
	Tbsp	1.75	1 to 1.75	1
Rinse Hold		None	None	None

Figure 18



- To add Rinse Agent pour on the arrow
- Turn arrow to adjust the amount of rinse agent dispensed



Filling the Detergent Dispenser

Fill the dispenser cup as recommend in Table 1. (See Figure 14 for additional information.)

To close, slide the detergent dispenser cover in the direction shown in Figure 15 and press it down firmly so the cover snaps shut.

To open the detergent dispenser cover, press the blue release tab in the direction shown in Figure 16. Pressing down on the release tab will not open the cover.

Rinse Agents

To achieve proper drying, always use a liquid rinse agent, even if your detergent contains a rinse agent or drying additive.

Rinse Agent Dispenser

Open the rinse agent dispenser by lifting the tab with your thumb as shown in Figure 17.

NOTE: The dishwasher indicates low rinse agent either by showing the symbol * in the countdown display, or illuminating the refill rinse agent light (model dependent).

Add liquid rinse agent to the dispenser as shown in Figure 18 until the rinse agent reservoir is full. Wipe up any excess rinse agent that puddles when the dispenser reservoir is full.

NOTE: After filling the rinse agent dispenser, the indicator light will go out in a few minutes after the dishwasher door is shut (select models).

Operating the Dishwasher

Always make sure your dishware is dishwasher safe. Refer to the **Dishware Materials** section of this manual for guidance.

Wash Cycles (See Cycle Chart)

Power Scrub Plus

Cleans items having baked-on or hard dried-on food soils. These items may require soaking or hand scouring.

Regular

Thoroughly cleans large loads having loosely attached normal soiling.

Delicate/Economy

For delicate or heirloom dishwasher and silverware or other special items. Always make sure that the items are dishwasher safe. Refer to the Materials section of this manual for further information. Hand washing may be the best treatment of such items.

Quick Wash

For lightly soiled items with easy to remove food soils.

Rinse and Hold

Allows you to rinse the food soil off of a partial load and hold them in the dishwasher until there is a full load.

Auto Wash

The sensors in the dishwasher automatically adjust the cycle length, temperature and water changes based on the soil load. This cycle contains additional sensor decisions when compared to other cycles.

More information on dishwasher cycles is located in the Wash Cycle Information section of this manual.

Wash Cycle Options (See Option Chart)

Half Load

In the Power Scrub Plus, Regular and Auto Wash cycles you can reduce the energy and water consumption when washing small, lightly soiled loads that fill approximately half of the dishwasher's capacity. To activate, select the Half Load button in addition to the Power Scrub Plus, Regular or Auto Wash cycle button.

Top Rack Only

This option allows you to save energy and water by washing loads small enough to fill the top rack only. To activate, select the Top Rack Only button in addition to a cycle. When using the Top Rack Only feature, dishes should only be loaded in the top rack.

Extra Dry Heat

With this option you can raise the temperature of the rinse water and increase the drying time which will result in improved drying.

To activate:

- Press and hold the left "Cancel Drain" button, then press and hold the On/Off button.

	Wash Cycles					
	Power Scrub Plus	Regular	Delicate/Economy	Quick Wash	Rinse and Hold	Auto Wash
SHE46C	X	X			X	X
SHE44C	X	X		X	X	
SHU43C	X	X		X	X	
SHE56C	X	X		X	X	X
SHE47C	X	X		X		X
SHX46L	X	X	X	X		
SHX43E	X	X	X		X	
SHX46A	X	X	X		X	
SHV46C	X	X	X		X	
SHE45C	X	X		X	X	
SHX45C	X	X	X		X	
SHE43M	X	X		X		X
SHX43M	X	X		X		X
SHE45M	X	X		X		X
SHV45M	X	X		X		X
SHX45M	X	X		X		X
SHE55M	X	X	X	X		X
SHE43F	X	X		X	X	

	Wash Cycle Options					
	Top Rack Only or Half Load	Extra Dry Heat	Delay Start	Cycle Completion Signal	OPTIDRY™	ECO
SHE46C	X	X	19h		X	
SHE44C		X			X	
SHU43C		X				
SHE56C		X	19h		X	
SHE47C	X	X	24h		X	
SHX46L	X	X	19h	X	X	
SHX43E				X		
SHX46A	X			X		
SHV46C	X			X		
SHE45C		X			X	
SHX45C	X			X		
SHE43M			19h			
SHX43M			19h	X		
SHE45M	X	X	19h		X	
SHV45M	X	X	19h	X		
SHX45M	X	X	19h	X	X	
SHE55M	X	X	19h		X	X
SHE43F		X				

- When the LED display shows a "00" or a "01" release both buttons.
- To enable the Additional Drying Heat, press the left "Cancel Drain" button until the LED display shows a "01".
- To disable the Additional Drying Heat, press the left "Cancel Drain" button until the LED display shows a "00".
- Press the On/Off button to save the setting.

Delay Start

This option allows you to delay the start time of your dishwasher.

To activate:

- Turn the dishwasher on.
- Select the desired wash cycle.
- Press and hold the Delay Start button. Release when the desired delay time is shown in the display window.

The Cycle Completion Signal

This Cycle Completion Signal is a tone that sounds to alert you when your dishwasher finishes washing and drying your dishes. You can either disable the tone or set the volume.

To activate:

- Press and hold the right "Cancel Drain" button then press and hold the On/Off button.
- When the light on the "Cancel Drain" button you are pressing illuminates and the tone begins to sound, release both buttons.
- Press the right-most "Cancel Drain" button until the tone is either at the desired volume or is silent.
- Press the On/Off Button. The Cycle Completion Signal is now set.

OPTIDRY™

This feature senses when the unit is low on rinse agent and automatically increases the drying time. For best performance, always use a liquid rinse agent even if your detergent contains a drying additive.

ECO function (select models): This option saves energy by reducing water temperature.

Starting the Dishwasher

To start the dishwasher, follow the instructions in Figures 19 and 20 depending the control location.

Interrupting a Cycle

NOTE: Should you need to interrupt a cycle (to add or remove an item, to add detergent, etc.), it is best to do so within the first 30 minutes of the cycle.

Exposed Front Controls (See Figure 19)

1. Press the On/Off button to turn the unit off.
2. Wait at least ten seconds or until the water noises stop before opening the dishwasher door.
3. To resume the cycle, close the dishwasher door and then press the On/Off button.

Hidden Top Controls (See Figure 20)

1. Open the dishwasher door just far enough to expose the control panel.
2. Press the On/Off button to turn the unit off.
3. Wait at least ten seconds or until the water noises stop before opening the dishwasher door.
4. To resume the cycle, press the On/Off button and close the dishwasher door.

WARNING

You could be seriously scalded if you allow hot water to splash out of the dishwasher. **OPEN THE DOOR CAREFULLY** during any wash or rinse cycle. Do not fully open the door until water noises have stopped.

Wait at least ten seconds or until water noises stop before opening the dishwasher door. To

Figure 19

Exposed Front Controls

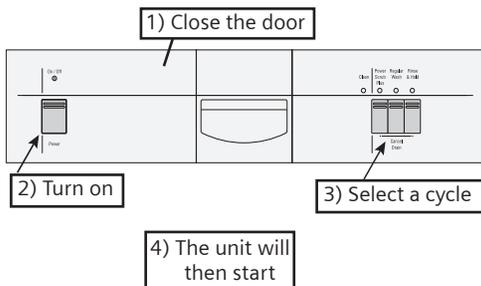
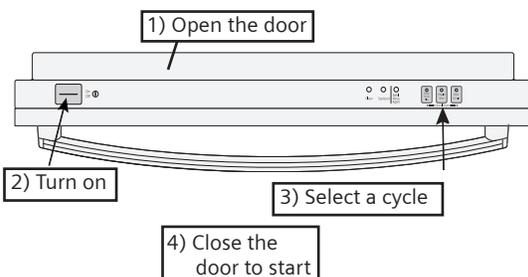


Figure 20

Hidden Top Controls



resume the cycle, press the On/Off button and shut the dishwasher door.

Canceling or Changing a Cycle

To cancel or change a cycle, open the dishwasher door far enough to expose the control buttons then press and hold for three seconds the two buttons labeled "Cancel Drain" as shown in Figure 21.

Close the door and wait until the dishwasher completes the cycle (approximately 1 minute). Open the door and press the ON/OFF button.

You may now begin a new cycle.

Child Safety Latch (select models)

Your dishwasher is shipped from the factory with the Child Safety Latch disengaged and in the normal operating mode. Pull on the door handle to open the door. The Child Safety latch activation lever is located in the recess for the door handle. You must look up into the recess to find the Child Safety Latch activation lever (see Figure 22).

To activate the Child Safety Latch insert a matchstick or other non-metal object into the opening as shown in Figure 22. The activation lever will release and move toward the left.

You have now activated the Child Safety Latch. Each time you open the dishwasher door you will need to **slide the activation lever to the right** to release the door locking mechanism, you can then pull the door open (See Figure 23). After you open the door you should release the Child Safety Latch Activation lever and let it slide back toward the left.

To deactivate the Child Safety Latch insert a matchstick or other non-metal object into the opening as shown in Figure 24. Slide the activation lever to the right and hold. Remove the matchstick and release the lever. The feature has now been deactivated and you can open the door by pulling the handle.

Child Lock (select models)

The Child Lock feature allows you to disable the dishwasher control panel to prevent accidental activation. To activate this feature press and hold the button labeled "Child Lock" for 4 seconds and the "Child lock" indicator light will illuminate. To disable the feature, press and hold the "Child Lock" button for 4 seconds.

Dishware Drying

At the end of the cycle the dishwasher will stop and a period of condensation drying will follow. After drying, the cycle is complete and:

- the "Clean" light will illuminate (select models).
- the completion signal will sound (select models).
- the "Sanitized" light may appear. See section on Sanitization for more information.
- the countdown display will show "0" (select models).

NOTE: If your household water supply is too hot, your dishwasher's heating time may be reduced and the "Sanitized" light may not illuminate. Your Dishwasher Installation Manual has information on the recommended temperature for your household hot water supply.

NOTE: To accelerate and enhance drying, open the dishwasher door, pull the top rack a few inches out of the dishwasher, and prop the dishwasher door against the top rack.

Sanitized Light

When the Sanitized light appears, it means that the dishware and kitchenware that was just washed has been sanitized according to the requirements of the National Sanitation Foundation (NSF). For more information on NSF certification, refer to the Wash Cycle Information section of this manual.

Unloading the Dishwasher

Unload the bottom rack first.

Unload the silverware basket(s). They are easily removed for unloading.

Unload the top rack.

If the Extra Tall Item Sprinkler was installed, return the dishwasher to its normal condition (see the Loading Extra Tall Items instructions in the "Loading the Dishwasher" section of this manual).

Figure 21

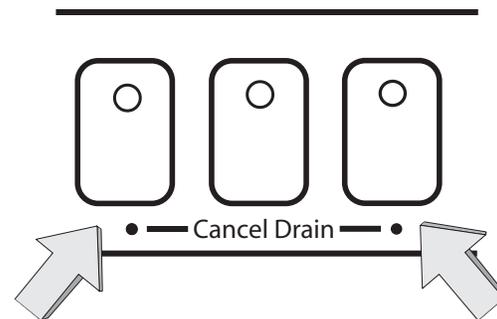


Figure 22

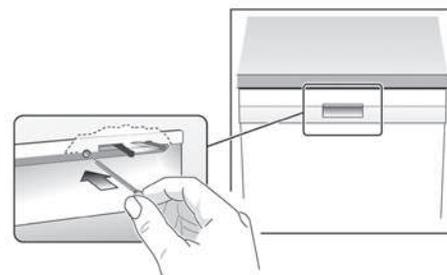


Figure 23

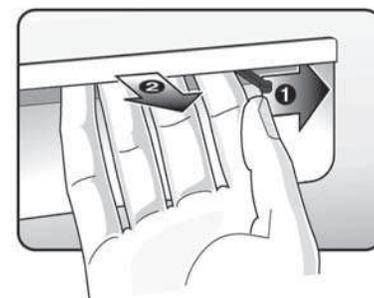


Figure 24

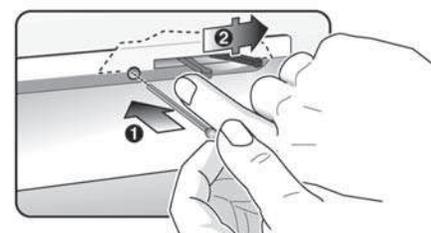
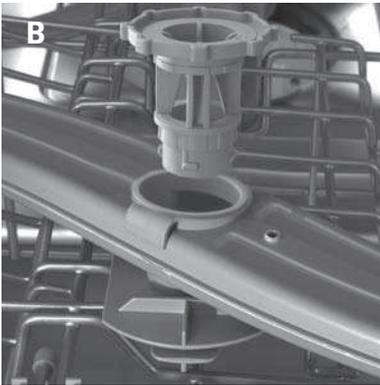
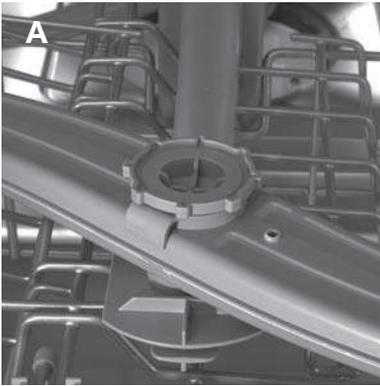


Figure 25



Care and Maintenance

Maintenance Tasks

Certain areas of your dishwasher require occasional maintenance. The maintenance tasks are easy to do and will ensure continued superior performance from your dishwasher. These tasks are:

- Winterizing Your Dishwasher
- Wiping up Spills and Splash-out
- Clean the Stainless Steel Inner Door and Tub
- Check/Clean the Spray Arm Nozzles
- Check/Clean the Filter System
- Clean the Exterior Door Panel
- Clean the Door Gasket

Winterizing Your Dishwasher

If your dishwasher will be unused for an extended period of time in a location that experiences freezing temperatures (e.g., in a holiday home or through a vacation period), have your dishwasher winterized by an authorized service center.

ATTENTION

To avoid dishwasher damage, do not allow water to remain in your dishwasher systems through extended periods of freezing temperatures. Freezing temperatures can damage your dishwasher.

Wiping Up Spills and Splash-out

Water may occasionally splash out of your dishwasher, especially if you interrupt a cycle or open the dishwasher door during a cycle. To avoid floor damage and possible mold growth, do not allow wet areas to remain around or under the dishwasher.

Check/Clean the Stainless Steel Inner Door and Tub

Clean the outer edges of the inside door panel regularly to remove debris that might collect there from normal loading.

If spots begin to appear on the stainless steel tub or inner door, make sure the rinse agent reservoir is full.

Check/Clean the Spray Arm Nozzles

Occasionally check the spray arms to ensure that the spray arm nozzles (holes) are unobstructed. You must remove the spray arms to check them for obstruction.

To remove the top spray arm:

1. Remove the empty top rack from the dishwasher.
2. Turn the rack upside-down. The top spray arm is held in position by a locking nut as shown in Figure 25A. Turn the locking nut counter-clockwise 1/8 turn and remove it, as shown in Figure 25B to release the spray arm.
3. Remove the spray arm as shown in Figure 26.
4. Look for obstruction in the spray nozzles.
5. If the spray nozzles need cleaning, flush them under running water.

To reinstall the top spray arm:

1. Return the top spray arm to its installed position.
2. Return the locking nut to its installed position and turn it 1/8 turn clockwise.

Figure 26

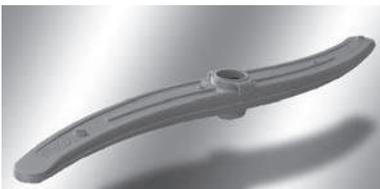
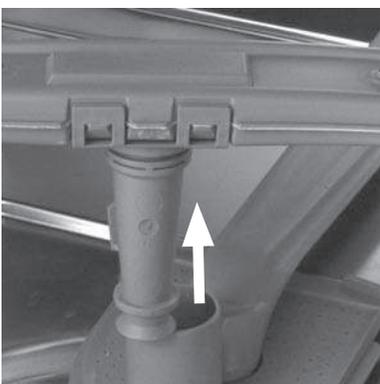


Figure 27



3. Return the top rack to the top rack roller guides.

To remove the bottom spray arm:

1. Remove the empty bottom rack from the dishwasher tub.
2. Grasp and lift the bottom spray arm as shown in Figure 27.
3. Look for obstruction in the spray nozzles.
4. If the spray nozzles need cleaning, flush them under running water.

To reinstall the bottom spray arm:

1. Return the bottom spray arm to its installed position and press it so that it snaps into place.
2. Return the bottom rack to its installed position.

Check/Clean the Filter System

This dishwasher has a filter system that consists of a Large Object Trap/Cylinder Filter assembly and a Fine Filter. Select models have an additional Micro Filter. The filter system is located on the inside of your dishwasher under the lower rack and is easily accessible.

During normal use, the filter system is self-cleaning. You should occasionally inspect it for foreign objects and clean it when necessary.

⚠ CAUTION

To avoid injury, do not reach into the large object trap with your fingers. The large object trap could contain sharp objects.

This dishwasher has a filter system that consists of a Large Object Trap/Cylinder Filter assembly and a Fine Filter. The filter system is located on the inside of your dishwasher under the lower rack and is easily accessible.

During normal use, the filter system is self-cleaning. You should occasionally inspect it for foreign objects and clean it when necessary.

To Remove the Large Object Trap/Cylinder Filter Assembly:

1. Remove the bottom rack.
2. Grasp the assembly as shown in Figure 28 and turn it counterclockwise 1/4 turn.
3. Lift out the assembly as shown in Figure 29.
4. Carefully examine the assembly. If you find debris in the Large Object Trap, turn it upside-down and gently tap it on a surface such as a countertop to dislodge and remove the debris. Flush the Cylinder Filter clean by holding it under running water.

To Remove the Fine Filter:

1. Lift the Fine Filter from the dishwasher floor as shown in Figure 30 and flush it clean by holding it under running water.

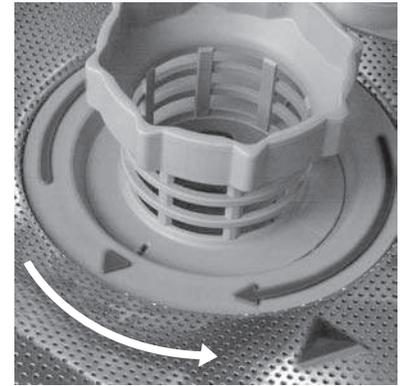
To reinstall the filter system:

1. Return the Fine Filter to its installed position.
2. Place the Large Object Trap/Cylinder Filter Assembly into its installed position in the dishwasher floor.
3. Turn the ring handle clockwise 1/4 turn until it is locked. The arrow on the ring handle and the arrow on the Fine Filter should point to each other, as shown by the circle in Figure 31.
4. Gently pull the ring handle to ensure that the assembly is locked into place.

ATTENTION

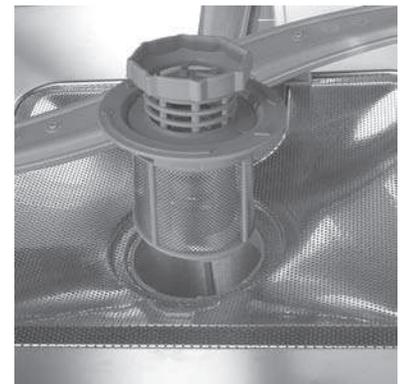
To avoid possible dishwasher damage, do not use harsh chemicals, abrasive cleaners, scouring pads (metal or plastic), or abrasive cloths/paper towels to clean your dishwasher's exterior door panel. Your dishwasher's exterior door panel can be damaged by doing so.

Figure 28



To open - turn counterclockwise.

Figure 29

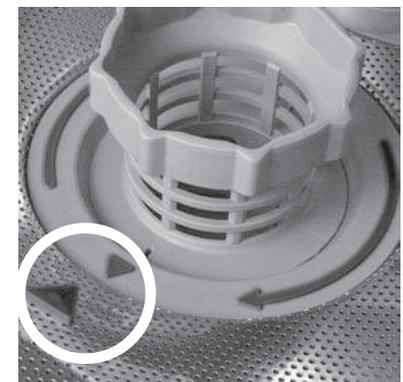


Large Object Trap/Cylinder Filter

Figure 30



Figure 31



To close - turn clockwise.

Clean the Exterior Door Panel

Colored Doors

Use only a soft cloth that is lightly dampened with soapy water.

Stainless Steel Doors

Use a soft cloth with a non-abrasive cleaner (preferably a liquid spray) made for cleaning stainless steel. For the best results, apply the stainless steel cleaner to the cloth, then wipe the surface.

Clean the Door Gasket and Door Seal

Regularly clean the door gasket with a damp cloth to remove food particles and other debris. Also clean the door seal, located inside the dishwasher at the bottom of the door.

Wash Cycle Information

NOTE: To save energy, this dishwasher has a “Smart Control” that automatically adjust the cycle based on soil loads and incoming water temperature. The “Smart Control” makes decisions that can cause the cycle time and water usage to adjust intermittently. The cycle times listed in the Use and Care manual are based on normal soil loads and 120°F incoming water and will vary based on your actual conditions.

See the Cycles and Options Charts on pages 11 and 12 to determine the cycles available for your specific model.

NOTE: On select models, the Half Load feature will reduce the water consumption by approximately 30 percent in the Power Scrub Plus, Regular, and Auto Wash cycles. The ECO option may be selected for the Power Scrub Plus, Auto, Regular and Delicate cycles on select models. This reduces energy consumption approximately 10% due to lower main wash and final rinse temperatures, but extends cycle length 5 - 10 minutes to maintain drying performance and the water usage will be unmodified in comparison to the normal program cycles.



A dishwasher or a dishwasher cycle that has the NSF symbol has been certified by the NSF International to meet very strict requirements of wash time and water temperature to ensure dishware and kitchenware sanitization. These requirements are explained in the document NSF/ANSI 184, Residential Dishwashers. More information on NSF Certification is available at the NSF website, <http://www.nsfconsumer.org/home/appliances.asp>.

Your dishwasher is NSF certified. The dishwasher cycles that are NSF certified are shown in the chart above. When these cycles are complete, the “Sanitized” indicator on your dishwasher control panel will illuminate.

NOTE: If your household water supply is too hot, your dishwasher’s heating time may be reduced and the “Sanitized” light or symbol may not illuminate. Your Dishwasher Installation Manual has information on the recommended temperature for your household hot water supply.

Cycle Data

(Models SHE43M, SHE43F, SHX43M, SHE45M, SHV45M, SHX45M, SHE55M)

		 Power Scrub Plus	 Auto Wash	Regular Wash	 Delicate/Economy	Quick Wash	Rinse & Hold
	Cycle Time (in minutes)	135	105-125	119	80	30	9
Water Consumption in gallons	Minimum	6.1	4.5	2.4	3.5	3.5	1.2
	Maximum	7.2	7.0	5.9	3.5	3.5	1.2
Water Consumption in liters	Minimum	23.2	17	8.9	13.1	13.1	4.7
	Maximum	27.4	26.4	22.5	13.1	13.1	4.7
Wash Temp °F Rinse Temp °F		<u>160°</u> 156°	<u>130-150°</u> 156°	<u>131°</u> 156°	<u>122°</u> 156°	<u>113°</u> 122°	Incoming Incoming

Cycle Data

(Models SHE44C, SHE46C, SHE47C, SHE56C, SHU43, SHX46A, SHX46L, SHX43E, SHV46C)

		 Power Scrub Plus	 Auto Wash	Regular Wash	 Delicate/Economy	Quick Wash	Rinse & Hold
	Cycle Time (in minutes)	135	105-120	119	80	39	9
Water Consumption in gallons	Minimum	6.1	2.8	2.8	3.5	3.5	1.2
	Maximum	7.2	5.9	5.9	3.5	3.5	1.2
Water Consumption in liters	Minimum	23.2	10.4	10.4	13.1	13.1	4.7
	Maximum	27.4	22.5	22.5	13.1	13.1	4.7
Wash Temp °F Rinse Temp °F		<u>160°</u> 156°	<u>130-150°</u> 156°	<u>131°</u> 156°	<u>122°</u> 156°	<u>104°</u> 140°	Incoming Incoming

Self Help

Dishwashers may occasionally exhibit problems that are unrelated to a malfunction of the dishwasher itself. The following information may help you with a dishwasher problem without your having to call a repair person.

Dishes do not dry

The rinse agent dispenser may be empty. Check the rinse-aid dispenser and refill it if necessary. Dishware drying can be accelerated and enhanced by opening the dishwasher door slightly and propping it open with the top rack.

Indicator light(s) do not come on

A fuse may have blown or a circuit breaker tripped. Check the fuse or circuit breaker at your fuse box/breaker box and replace the fuse or reset the breaker if necessary.

Dishwasher does not start

The dishwasher door may not be properly shut. Make certain the dishwasher door is shut and latched.

Dishwasher runs a long time

If the dishwasher completes the cycle, but the run time seems exceptionally long, it may be due to cold incoming water. Before starting the dishwasher, open the hot water faucet at the sink nearest the dishwasher. Run the water until it runs hot, then turn off the water and start the dishwasher.

Machine cycle does not advance to rinse

NOTE: The Installation Manual that came with your dishwasher will help you with the following instructions. The water supply line may be shut off. Check the water supply valve and open it if it's shut.

White spots left on dishes

More rinse agent is needed. Go to the Adding Detergent and Rinse Agent section of this manual for instructions on increasing the amount of rinse agent dispensed.

Water not pumped from dishwasher

Make certain the drain hose isn't kinked, clogged, or improperly installed. Make certain a portion of the drain hose is at least 20 inches above the dishwasher's enclosure floor (see the Installation Manual). Filters may be clogged. Make certain the filter system isn't clogged (see the Care and Maintenance section of this manual). The kitchen sink drain may be clogged; you may need a plumber rather than a serviceman for the dishwasher. If an air gap is installed at sink, it may be clogged.

Detergent dispenser cover will not shut

You may not be correctly shutting the detergent dispenser cover, or a cycle was not finished and should be cancelled. Go to the Adding Detergent and Rinse Agent section of this manual for instructions on shutting the detergent dispenser cover. Go to the Operating the Dishwasher section of this manual for instructions on canceling a cycle.

Streaks on glassware

Too much rinse agent is being dispensed. Go to the Adding Detergent and Rinse Agent section of this manual for instructions on decreasing the amount of rinse agent dispensed.

Rattling noises

Utensils may not be properly arranged.

Suds in dishwasher

You may have used the wrong type of dishwashing detergent. Use only automatic dishwasher detergents.

Unsatisfactory washing results

- Incorrect amount of detergent.
- Utensils incorrectly arranged or rack overloaded.
- Spray arm rotation blocked by utensils.
- Spray arm nozzles need cleaning.
- Filters not properly fitted into position.
- Unsuitable cycle selected.

Statement of Limited Product Warranty

Bosch Dishwashers

What this Warranty Covers & Who it Applies to: The limited warranty provided BSH Home Appliances ("Bosch") in this Statement of Limited Product Warranty applies only to Bosch dishwashers ("Product") sold to you, the first using purchaser, provided that the Product was purchased: (1) for your normal, household (non-commercial) use, and has in fact at all times only been used for normal household purposes; (2) new at retail (not a display, "as is", or previously returned model), and not for resale, or commercial use; and (3) within the United States or Canada, and has at all times remained within the country of original purchase. The warranties stated herein apply only to the first purchaser of the Product and are not transferable.

- Please make sure to return your registration card; while not necessary to effectuate warranty coverage, it is the best way for Bosch to notify you in the unlikely event of a safety notice or product recall.

How Long the Warranty Lasts: Bosch warrants that the Product is free from defects in materials and workmanship for a period of three hundred sixty five (365) days (i.e., 1 year) from the date of purchase. The foregoing timeline begins to run upon the date of purchase, and shall not be stalled, tolled, extended, or suspended, for any reason whatsoever. Labor and shipping costs are included in this basic coverage.

Extended Limited Warranty: Bosch also provides these additional limited warranties:

- **2 Year Limited Warranty:** Bosch will repair or replace any component that proves to be defective in materials or workmanship (excludes labor charges).
- **5 Year Limited Warranty on Electronics:** Bosch will repair or replace any Bosch microprocessor or printed circuit board if it proves to be defective in materials or workmanship (excludes labor charges).
- **5 Year Limited Warranty on Dish Racks:** Bosch will replace the upper or lower dish rack (excluding rack components), if the rack proves defective in materials or workmanship (excludes labor charges).
- **Lifetime Warranty against Stainless Steel Rust Through:** Bosch will replace your dishwasher with the same model or a current model that is substantially equivalent or better in functionality, if the inner liner should rust through (excludes labor charges). Bosch will replace the stainless steel door if the door should rust through (excludes labor charges).

The foregoing timeline begins to run upon the date of purchase, and shall not be stalled, tolled, extended, or suspended, for any reason whatsoever.

Repair/Replace as Your Exclusive Remedy: During this warranty period, Bosch or one of its authorized service providers will repair your Product without charge to you (subject to certain limitations stated herein) if your Product proves to have been manufactured with a defect in materials or workmanship. If reasonable attempts to repair the Product have been made without success, then Bosch will replace your Product (upgraded models may be available to you, in Bosch's sole discretion, for an additional charge). All removed parts and components shall become the property of Bosch at its sole option. All replaced and/or repaired parts shall assume the identity of the original part for purposes of this warranty and this warranty shall not be extended with respect to such parts. Bosch's sole liability and responsibility hereunder is to repair manufacturer-defective Product only, using a Bosch-authorized service provider during normal business hours. For safety and property damage concerns, Bosch highly recommends that you do not attempt to repair the Product yourself, or use an un-authorized servicer; Bosch will have no responsibility or liability for repairs or work performed by a non-authorized servicer. If you choose to have someone other than an authorized service provider work on your Product, THIS WARRANTY WILL AUTOMATICALLY BECOME NULL AND VOID. Authorized service providers are those persons or companies that have been specially trained on Bosch products, and who possess, in Bosch's opinion, a superior reputation for customer service and technical ability (note that they are independent entities and are not agents, partners, affiliates or representatives of Bosch). Notwithstanding the foregoing, Bosch will not incur any liability, or have responsibility, for the Product if it is located in a remote area (more than 100 miles from an authorized service

provider) or is reasonably inaccessible, hazardous, threatening, or treacherous locale, surroundings, or environment; in any such event, if you request, Bosch would still pay for labor and parts and ship the parts to the nearest authorized service provider, but you would still be fully liable and responsible for any travel time or other special charges by the service company, assuming they agree to make the service call.

Out of Warranty Product: Bosch is under no obligation, at law or otherwise, to provide you with any concessions, including repairs, pro-rates, or Product replacement, once this warranty has expired.

Warranty Exclusions: The warranty coverage described herein excludes all defects or damage that are not the direct fault of Bosch, including without limitation, one or more of the following: (1) use of the Product in anything other than its normal, customary and intended manner (including without limitation, any form of commercial use, use or storage of an indoor product outdoors, use of the Product in conjunction with air or water-going vessels); (2) any party's willful misconduct, negligence, misuse, abuse, accidents, neglect, improper operation, failure to maintain, improper or negligent installation, tampering, failure to follow operating instructions, mishandling, unauthorized service (including self-performed "fixing" or exploration of the appliance's internal workings); (3) adjustment, alteration or modification of any kind; (4) a failure to comply with any applicable state, local, city, or county electrical, plumbing and/or building codes, regulations, or laws, including failure to install the product in strict conformity with local fire and building codes and regulations; (5) ordinary wear and tear, spills of food, liquid, grease accumulations, or other substances that accumulate on, in, or around the Product; and (6) any external, elemental and/or environmental forces and factors, including without limitation, rain, wind, sand, floods, fires, mud slides, freezing temperatures, excessive moisture or extended exposure to humidity, lightning, power surges, structural failures surrounding the appliance, and acts of God. In no event shall Bosch have any liability or responsibility whatsoever for damage to surrounding property, including cabinetry, floors, ceilings, and other structures or objects around the Product. Also excluded from this warranty are scratches, nicks, minor dents, and cosmetic damages on external surfaces and exposed parts; Products on which the serial numbers have been altered, defaced, or removed; service visits to teach you how to use the Product, or visits where there is nothing wrong with the Product; correction of installation problems (you are solely responsible for any structure and setting for the Product, including all electrical, plumbing or other connecting facilities, for proper foundation/flooring, and for any alterations including without limitation cabinetry, walls, floors, shelving, etc.); and resetting of breakers or fuses. **TO THE EXTENT ALLOWED BY LAW, THIS WARRANTY SETS OUT YOUR EXCLUSIVE REMEDIES WITH RESPECT TO PRODUCT, WHETHER THE CLAIM ARISES IN CONTRACT OR TORT (INCLUDING STRICT LIABILITY, OR NEGLIGENCE) OR OTHERWISE. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED. ANY WARRANTY IMPLIED BY LAW, WHETHER FOR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE, SHALL BE EFFECTIVE ONLY FOR THE PERIOD THAT THIS EXPRESS LIMITED WARRANTY IS EFFECTIVE. IN NO EVENT WILL THE MANUFACTURER BE LIABLE FOR CONSEQUENTIAL, SPECIAL, INCIDENTAL, INDIRECT, "BUSINESS LOSS", AND/OR PUNITIVE DAMAGES, LOSSES, OR EXPENSES, INCLUDING WITHOUT LIMITATION TIME AWAY FROM WORK, HOTELS AND/OR RESTAURANT MEALS, REMODELLING EXPENSES IN EXCESS OF DIRECT DAMAGES WHICH ARE DEFINITELY CAUSED EXCLUSIVELY BY BOSCH, OR OTHERWISE. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, AND SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE. No attempt to alter, modify or amend this warranty shall be effective unless authorized in writing by an officer of BSH.**

How to Obtain Warranty Service: TO OBTAIN WARRANTY SERVICE FOR YOUR PRODUCT, YOU SHOULD CONTACT THE NEAREST BOSCH AUTHORIZED SERVICE CENTER, OR CALL 800-944-2904, or write Bosch at: BSH Home Appliances - 5551 McFadden Avenue, Huntington Beach, CA 92649 /

Customer Service

Your Bosch dishwasher requires no special care other than that described in the Care and Maintenance section. If you are having a problem with your dishwasher, before calling for service please refer to the Self Help section. If service is necessary, contact your dealer or installer or an authorized service center. **Do not attempt to repair the appliance yourself.** Any work performed by unauthorized personnel may void the warranty.

If you are having a problem with your Bosch dishwasher and are not pleased with the service you have received, please take the following steps (in the order listed below) until the problem is corrected to your satisfaction:

1. Contact your installer or the Bosch Authorized Service Contractor in your area.
2. E-mail us from the customer service section of our website, www.boschappliances.com.
3. Write us at the address below:

BSH Home Appliances, Corporation
 5551 McFadden Avenue
 Huntington Beach, CA 92649

4. Call us at 1-800-944-2904.

Please be sure to include your model information listed below as well as an explanation of the problem and the date it originated.

You will find the model and serial number information on the label located on the right edge of the dishwasher door as shown in Figure 32.

Also, if you are writing, please include a daytime phone number where you can be reached.

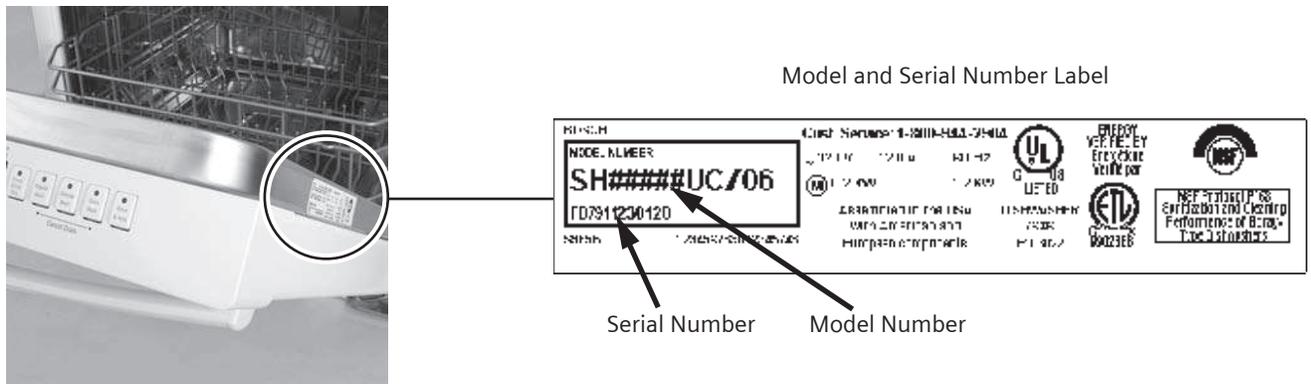
Please make a copy of your invoice and keep it with this manual. The customer must show proof of purchase to obtain warranty service.

Your Model Information:

- Model Number _____
- Serial Number _____
- Date Purchased _____
- Date Installed _____

CAUTION
 Removing any cover or pulling the dishwasher from the cabinet can expose hot water connections, electrical power and sharp edges or points.

Figure 32



Félicitations et merci de Bosch !

Merci d'avoir choisi un lave-vaisselle Bosch. Vous avez rejoint les nombreux consommateurs qui exigent un rendement supérieur et silencieux de leur lave-vaisselle.

Ce guide a été écrit avec sécurité et côté pratique en tête et l'information contenue ici est importante. Nous recommandons fortement de lire ce guide avant d'utiliser ce lave-vaisselle la première fois.

Pour en connaître plus sur ce lave-vaisselle et les accessoires disponibles ainsi que les autres appareils Bosch de haute qualité, visitez notre site : www.boschappliances.com.

Vous pouvez communiquer avec nous pour tout commentaire et toute question en téléphonant au **1.800.944.2904** ou en écrivant à :

BSH Home Appliances, Corp.
5551 McFadden Avenue
Huntington Beach, CA 92649

Merci !

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⚠ Instructions de sécurité importantes-Conservé ces Instructions ⚠

ATTENTION

Ne jamais utiliser des produits nettoyants à vapeur dans le lave-vaisselle. Le fabricant n'est pas responsable des dommages ou conséquences possible.

ATTENTION

Ne jamais utiliser des produits chimiques pour nettoyer le lave-vaisselle. Certains produits contenant du chlore peuvent endommager le lave-vaisselle et poser un risque pour la santé.

ATTENTION

Il est recommandé que l'utilisateur se familiarise avec la marche à suivre d'arrêt de l'alimentation en eau entrante ainsi que de l'alimentation électrique. Voir les instructions d'installation ou communiquer avec l'installateur pour plus de détails.

AVERTISSEMENT

Une mauvaise utilisation du lave-vaisselle peut causer des blessures ou la mort. Ne pas utiliser d'une façon autre que celle couverte dans ce guide ou à d'autres fins que celles expliquées dans les pages suivantes.

AVERTISSEMENT

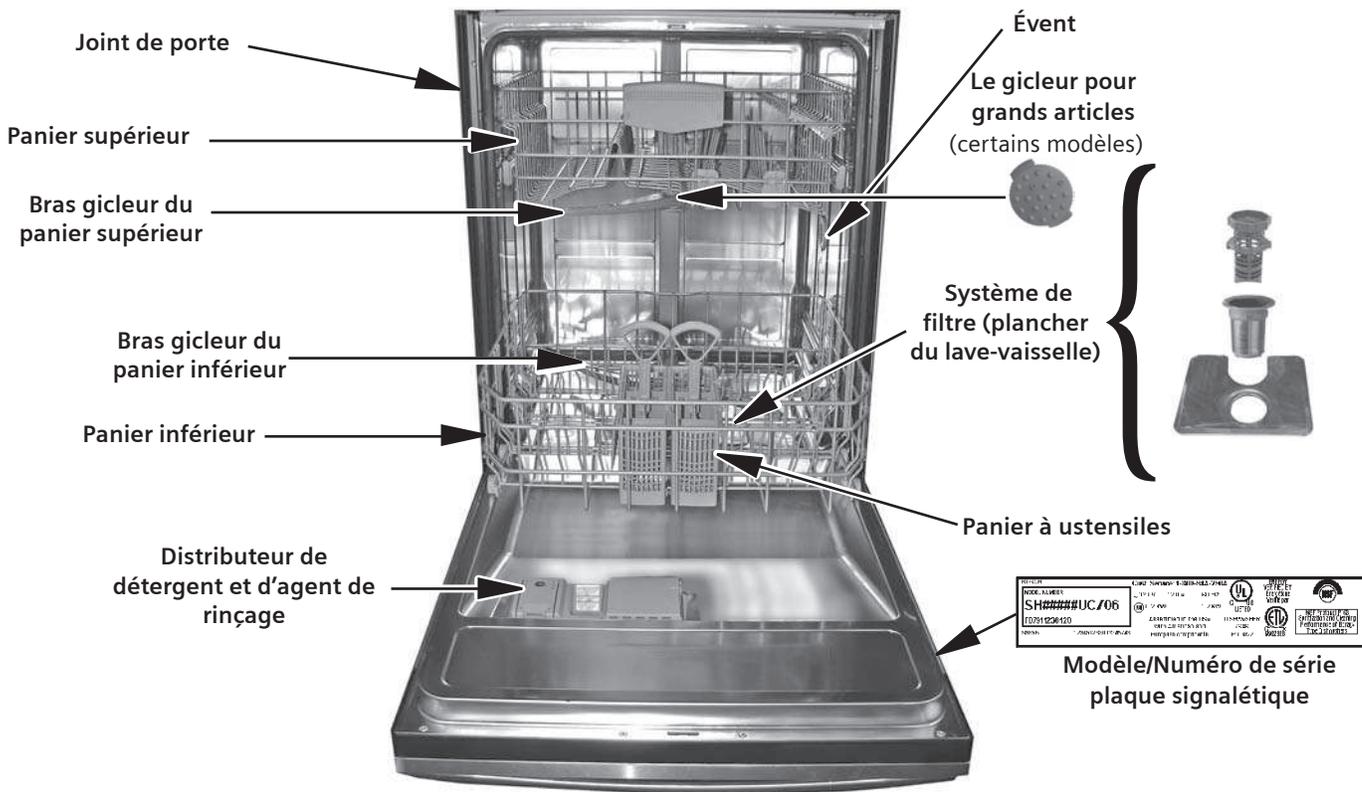
Des dommages aux produits et/ou des blessures peuvent résulter à cause d'un technicien non qualifié ou par des pièces de rechange non d'origine. Toute réparation doit être effectuée par un technicien qualifié utilisant seulement des pièces de rechange d'origine.

AVERTISSEMENT

Il peut en résulter un choc électrique ou un incendie si l'alimentation électrique du lave-vaisselle indiquée dans ce guide est inadéquatement installée ou si le lave-vaisselle n'est pas adéquatement mis à la terre. Ne pas utiliser le lave-vaisselle si l'on n'est pas certain que l'alimentation électrique a été effectuée correctement ou que la mise à la terre est adéquate.

- Cet appareil doit être mis à la terre sur un système de câblage permanent ou un connecteur de mise à la terre d'équipement doit être acheminé avec des connecteurs de circuit et branché sur un fil ou une borne mis à la terre du lave-vaisselle. Voir les instructions d'installation comprises avec le lave-vaisselle pour plus de détails concernant les exigences électriques.
- Utiliser le lave-vaisselle seulement pour l'usage auquel il est destiné, qui est de laver la vaisselle et articles de cuisine.
- Les lave-vaisselle sont dotés d'un guide contenant **les instructions d'installation et d'utilisation et d'entretien**. Lire et comprendre toutes les instructions avant d'utiliser le lave-vaisselle.
- Utiliser seulement du détergent et de l'agent de rinçage recommandés pour l'utilisation avec lave-vaisselle et les conserver hors de la portée des enfants.
- Au moment de charger des articles à laver :
 - Placer les articles affûtés de façon à ne pas endommager le joint.
 - Charger les couteaux et autres articles affûtés, **LES MANCHES VERS LE HAUT**, pour réduire le risque de blessures.
- Ne pas laver d'articles en plastique à moins qu'ils ne portent la marque «va au lave-vaisselle» ou l'équivalent. Pour ceux qui ne portent pas de marque, vérifier les recommandations du fabricant.
- Ne pas actionner le lave-vaisselle tant que tous les panneaux ne sont pas en place.
- Ne pas jouer avec ni outrepasser les contrôles et les verrouillages.
- Ne pas abuser, s'asseoir, ni se tenir debout sur la porte ou les paniers du lave-vaisselle.
- Pour réduire le risque de blessure, ne pas laisser les enfants jouer dans ou avec le lave-vaisselle.
- Lorsque les enfants sont suffisamment âgés pour actionner l'appareil, il incombe aux parents ou tuteur légal de s'assurer de montrer les instructions à des fins d'utilisation sécuritaire.
- Dans certains cas, de l'hydrogène peut se produire dans un système d'eau chaude qui n'a pas été utilisé pendant plus de 2 semaines. L'hydrogène est un gaz explosif. Avant d'utiliser un lave-vaisselle branché sur un système d'eau chaude non utilisé pendant plus de 2 semaines, ouvrir tous les robinets d'eau chaude et laisser couler l'eau quelques minutes. Ceci relâche tout hydrogène accumulé. Puisqu'il s'agit d'un gaz explosif, ne pas fumer ni utiliser de flamme nue pendant ce temps.
- Enlever la porte de l'appareil si l'on enlève un ancien lave-vaisselle pour le jeter.
- Pour éviter des dommages au plancher et de la moisissure, ne pas laisser des zones mouillées autour et sous le lave-vaisselle.
- Protéger le lave-vaisselle des éléments. Protéger contre le gel afin d'éviter tout dommage à la soupape de remplissage. Les dommages causés par le gel ne sont pas couverts par la garantie.

Composants du lave-vaisselle



Caractéristiques et options du lave vaisselle

Système de réduction de bruit: Un système de moteur à deux pompes, Suspension Motor™, et la triple isolation rendent ce lave-vaisselle le plus silencieux en Amérique du Nord.

Grande cuve en acier inoxydable TALLTUB™: sans rouille, surface intérieure hygiénique, garantie à vie.

Paniers enduits de nylon: élimine les coupures et accros ; garantis 5 ans.

Chauffe-eau Flow-Through™: chauffe l'eau jusqu'à une température de 161 °F.

Séchage par condensation: un rinçage final à haute température, cuve en acier inoxydable à basse température, action de l'agent de rinçage pour un séchage hygiénique, énergétique et économique.

Moniteur condition d'eau SENSOTRONIC™: vérifie la condition de l'eau et décide si un second remplissage d'eau fraîche est nécessaire.

Système de filtre: trois filtres assurent une distribution d'eau propre et protégeant la pompe principale et celle de vidage des objets étrangers.

Arrêt de l'eau: caractéristique de sécurité qui arrête l'entrée d'eau si de l'eau est détectée à la base du lave-vaisselle.

Appareil entièrement intégré (modèle SHV46C13): requiert une porte sur mesure.

Modèle	SHE44C	SHE46C	SHE47C	SHE56C	SHE43C	SHX43E	SHX46A	SHX46L	SHE46C	SHE43M	SHX43M	SHE45M	SHE45M	SHE45M	SHX45M	SHE55M	SHE43F
Design de panneau de contrôle	Contrôles avants exposés	Contrôles avants exposés	Contrôles avants exposés	Contrôles avants exposés	Contrôles avants exposés	Contrôles supérieurs dissimulés	Contrôles supérieurs dissimulés	Contrôles supérieurs dissimulés	Contrôles avants exposés	Contrôles avants exposés	Contrôles supérieurs dissimulés	Contrôles avants exposés	Contrôles supérieurs dissimulés	Contrôles supérieurs dissimulés	Contrôles supérieurs dissimulés	Contrôles avants exposés	Contrôles avants exposés
Signal de fin de cycle audible	non	non	non	non	non	oui	oui	oui	oui	non	oui	oui	oui	non	non	oui	non
Voyant de propreté	non	non	non	non	non	oui	oui	non	oui	non	non	non	non	non	non	non	non
Affichage à rebours	oui	oui	oui	oui	oui	non	non	oui	non	oui	oui	oui	oui	oui	oui	oui	oui
Voyant de remplissage d'agent de rinçage	oui	oui	Shown on Display as *	oui	oui	oui	Figure à l'affichage comme*	Figure à l'affichage comme*	oui	Figure à l'affichage comme*	Figure à l'affichage comme*	oui	Figure à l'affichage comme*	Figure à l'affichage comme*	oui	oui	oui
Voyant hygiénique	oui	oui	Figure à l'affichage comme	oui	oui	oui	oui	Figure à l'affichage comme	oui	Figure à l'affichage comme	Figure à l'affichage comme	oui	Figure à l'affichage comme	Figure à l'affichage comme	oui	oui	oui
Marche différée	non	19 hours	24 hours	19 hours	non	non	non	19 hours	non	19 hours	19 hours	19 hours	19 hours	19 hours	19 hours	19 hours	non
Verrouillage enfant sécuritaire	non	non	oui	non	non	non	no	no	non	non	non	non	non	non	non	non	non
Verrouillage enfant	non	non	non	non	non	non	no	no	non	oui	non	oui	non	non	oui	non	non
Dents rabattables du panier supérieur	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui	oui
Dents rabattables inférieur	non	oui	oui	oui	non	oui	oui	oui	oui	non	non	oui	oui	oui	oui	oui	non
Panier à ustensiles	Standard	Flexible de qualité supérieure	Flexible de qualité supérieure	Flexible de qualité supérieure	Standard	Flexible de qualité supérieure	Flexible de qualité supérieure	Flexible de qualité supérieure	Flexible de qualité supérieure	Standard	Standard	Flexible de qualité supérieure	Flexible de qualité supérieure	Flexible de qualité supérieure	Flexible de qualité supérieure	Flexible de qualité supérieure	Standard
Panier supérieur seulement ou Demi	non	oui	oui	non	non	non	oui	oui	oui	non	non	oui	oui	oui	oui	oui	non
Chaleur extra sèche	oui	oui	oui	oui	oui	non	non	oui	non	non	non	oui	oui	oui	oui	oui	oui
OPTIDRY™	oui	oui	oui	oui	non	non	non	oui	non	non	non	oui	oui	oui	oui	oui	non
Lumière d'info	non	non	non	non	non	non	non	non	non	non	non	oui	oui	oui	oui	oui	non
ECO	non	non	non	non	non	non	non	non	non	non	non	non	non	non	non	oui	non

Matériaux

REMARQUE: avant d'utiliser le lave-vaisselle Bosch la première fois, vérifier la rubrique Information. Certains articles que l'on désire laver ne sont peut-être pas sécuritaires au lave-vaisselle et devraient être lavés à la main. Communiquer avec le fabricant afin de s'assurer que ces articles vont au lave-vaisselle.

Recommandés

Aluminium: l'aluminium anodisé coloré peut s'estomper avec le temps. Les minéraux dans l'eau peuvent causer des taches ou noircir l'aluminium. Ceci peut habituellement être enlevé à l'aide d'un tampon en laine d'acier savonneux.

Porcelaine, cristal, faïence: certains articles peints à la main peuvent se décolorer, pâlir ou tacher. Laver à la main. Positionner la verrerie de façon à ce qu'elle ne s'entrechoque pas avec les autres pièces pendant le lavage.

Verre: les verres de lait peuvent jaunir.

Enduits non adhésifs: appliquer une légère couche d'huile végétale légère sur les surfaces antiadhésives après le séchage.

Plastique: s'assurer que les articles peuvent aller au lave-vaisselle.

Acier inoxydable, argent fin, argent plaqué: pour éviter la corrosion, placer les articles fabriqués de différents métaux de façon à ce qu'ils n'entrent pas en contact les uns avec les autres.

Non recommandé

Acrylique: des craquelures peuvent survenir.

Pièces collées: les adhésifs qui relient les joints comme du plastique, bois, os, cuivre, étain, etc. peuvent se défaire.

Ustensiles avec manches en os: les manches peuvent se détacher.

Fer: rouillera. Laver à la main et assécher immédiatement.

Articles n'allant pas au lave-vaisselle: le lave-vaisselle est destiné à des fins de nettoyage de vaisselle et accessoires de cuisine standard SEULEMENT.

Étain, laiton, bronze: l'étain ternit. Laver à la main et assécher immédiatement.

Fer blanc: rouillera. Laver à la main et assécher immédiatement.

Bois: les bols, ustensiles et manches en bois peuvent craqueler, se voiler et perdre leur fini.

Préparation et chargement du lave-vaisselle

Préparation

Ne pas prélever les articles peu sales. Enlever les grosses particules d'aliments, os, graines, cure-dents et graisse excessive. Les articles ayant des aliments tenaces, cuits, etc. peuvent demander un pré-lavage.

Chargement

Vérifier la rubrique sur les matériaux en cas d'incertitude concernant un article. Mettre seulement des articles allant au lave-vaisselle. Charger la vaisselle dans les paniers afin que les bols, pots et casseroles soient faces aux bras gicleurs. Éviter de regrouper et les points de contact entre la vaisselle. Séparer les articles en métal semblables.

Chargement du panier supérieur

Les figures 1 et 2 montrent un chargement pour 10 ou 12 couverts.

REMARQUE: s'assurer que les articles ne dépassent pas le fond des paniers et n'obstruent pas les bras gicleurs.

ATTENTION

Pour éviter tout dommage au lave-vaisselle, ne pas le charger avec des objets tels papier, sac de plastique, matériel d'emballage autres que la vaisselle et ustensiles de cuisine. Charger seulement de la vaisselle et ustensiles de cuisine allant au lave-vaisselle.

Figure 1

Panier supérieur à 10 couverts



Figure 2

Panier supérieur à 12 couverts

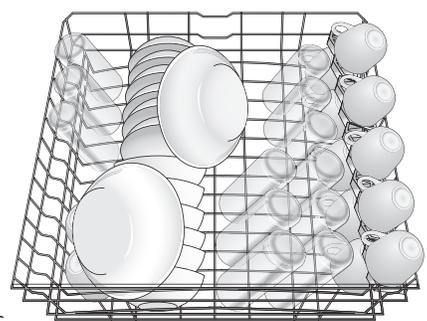


Figure 3



Figure 4

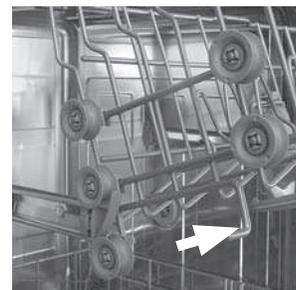


Figure 5

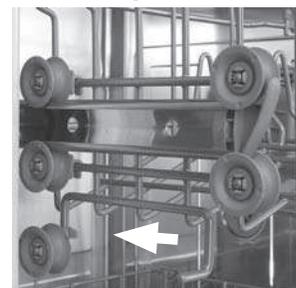


Figure 6

Panier inférieur à 10 couverts

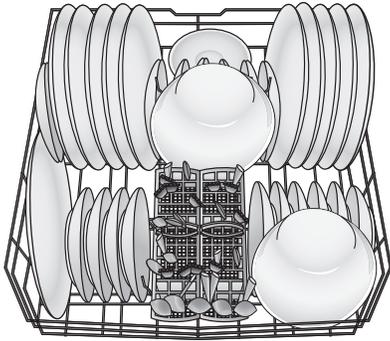


Figure 7

Panier inférieur à 12 couverts

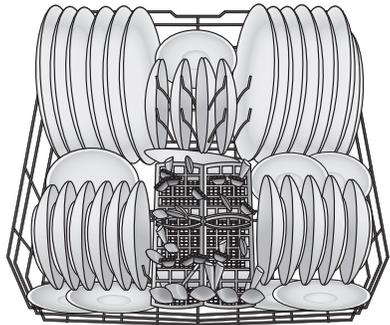


Figure 8



Figure 9

Ne pas obstruer l'évent



Accessoires du panier supérieur

Dents rabattables

Les dents se rabattent pour faciliter le chargement du panier dans certains cas. Saisir les dents, figure 3, et abaisser. Lorsque le panier supérieur est chargé, le pousser dans le lave-vaisselle.

REMARQUE: au moment de pousser le panier, le faire jusqu'à la butée à l'arrière de la cuve afin que le bras gicleur se branche sur l'alimentation en eau.

Réglage de la hauteur du panier supérieur

Retirer le panier supérieur vide en le tirant hors de l'appareil jusqu'à ce qu'il puisse être levé, figure 4. Tirer le panier vers le haut jusqu'à ce que les roulettes se libèrent des guides. Remettre le panier avec l'autre jeu de roulettes dans les guides, figure 5.

Chargement du panier inférieur

Placer les grands articles dans le panier inférieur. Charger les casseroles, les bols à l'envers. Les figures 6 et 7 montrent une charge mixte dans le panier inférieur.

Dents rabattables

Les dents se rabattent pour faciliter le chargement du panier dans certains cas. Saisir les dents et abaisser.

Charger de grands articles (certains modèles)

Si un article est trop haut pour être placé dans le panier inférieur même avec le panier supérieur en position élevée, enlever ce dernier en le tirant jusqu'à la butée. Tirer le devant du panier vers le haut et l'extérieur jusqu'à ce que les roulettes se libèrent. Mettre le panier de côté. Pousser les guides dans l'appareil. Insérer le gicleur pour grands articles dans la sortie du panier supérieur et tourner le gicleur dans le sens horaire pour verrouiller, figure 9.

REMARQUE: ne pas obstruer l'évent du côté droit de la cuve. Placer les articles comme planche à découper en plastique, tôle à biscuits sur le côté gauche, au centre ou à l'arrière.

ATTENTION

Pour éviter tout dommage, ne pas réinstaller le panier supérieur sans enlever le gicleur pour grands articles. NE pas installer le panier si le gicleur est en place.

Pour enlever le gicleur et reprendre le fonctionnement normal:

1. Tourner le gicleur dans le sens contre horaire et l'enlever.
2. Reprendre le panier supérieur.
3. Incliner le panier vers le haut et positionner les roulettes sur les guides.
4. Continuer à pousser le panier jusqu'à ce que les roulettes soient sur les guides.
5. Pousser le panier supérieur dans le lave-vaisselle.

Chargement du panier à ustensiles

REMARQUE: le dessus du panier à ustensiles peut être rabattu pour accommoder les articles plus gros ou de forme inhabituelle.

Le dessus du panier abaissé, charge le panier comme indiqué aux figures 10 (panier standard) et 11 (panier flexible). Placer les couteaux avec les manches vers le haut et les fourchettes et cuillères avec les manches vers le bas.

Si de grands articles de forme diverse doivent être chargés dans le panier à ustensiles avec dessus élevé, les charger afin qu'ils ne soient pas tous les uns sur les autres. Charger les couteaux et ustensiles affûtés les manches vers le haut.

ATTENTION

Les bords affûtés et tranchants des couteaux et autres ustensiles peuvent causer des blessures. Charger ces articles les pointes vers le bas. Ne pas laisser les enfants manipuler ni jouer avec les couteaux et autres articles semblables.

Panier à ustensiles standard

Ce panier s'ajuste au centre avant du panier inférieur.

Panier à ustensiles flexible

Ce panier est conçu pour une efficacité maximale, il est fendu sur sa longueur offrant ainsi deux demies pouvant être placées de différentes façons.

Pour séparer le panier flexible

1. Saisir le panier, figure 12A, et faire glisser les demies en direction opposée, figure 12A.
2. Séparer les deux moitiés, figure 12B.

Quelques suggestions pour placer les deux moitiés dans le panier inférieur données à la figure 13.

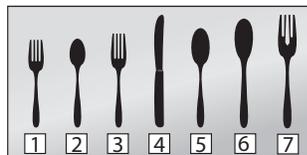
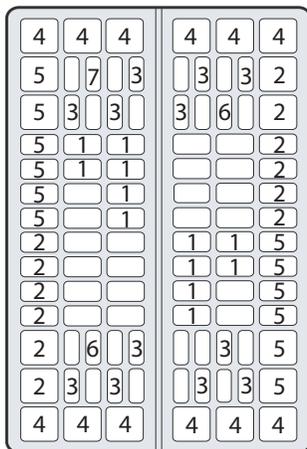
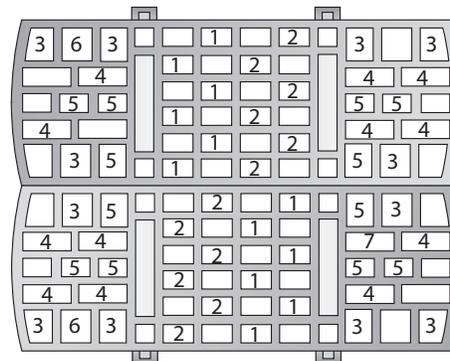


Figure 10



12 couverts
(Modèles SHE44C, SHU43C,
SHE43F, SHE43M, SHX43M)

Figure 11



12 couverts
(Tous les modèles sauf SHE44C, SHU43C,
SHE43F, SHE43M, SHX43M)

Figure 12

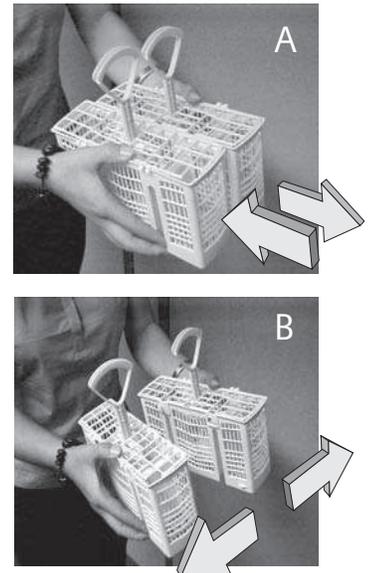


Figure 13

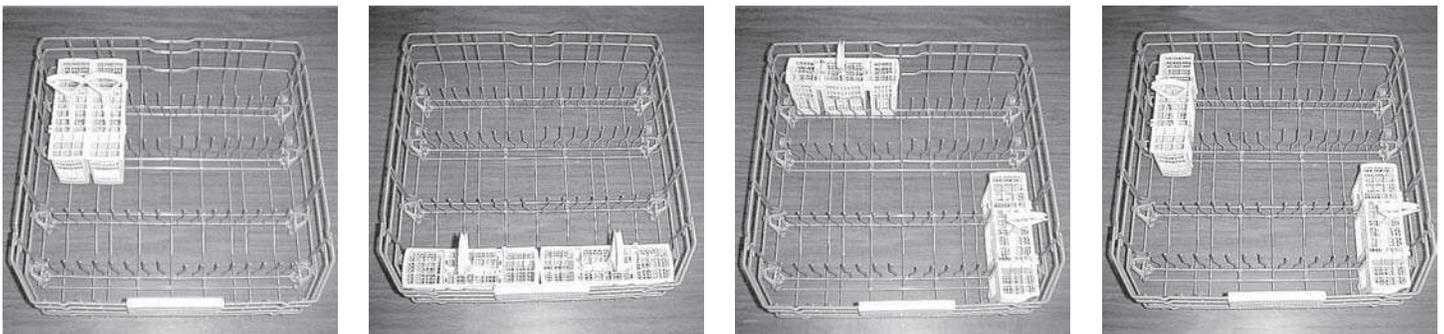
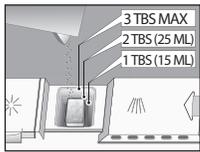


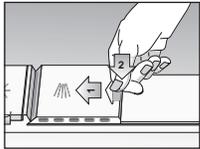
Figure 14



- 1 c. à table nettoie la plupart des charges
- 3 c. à table maximum, ne pas trop remplir
- Avec du détergent en tablette, le poser à plat pour éviter tout contact avec le couvercle

Utiliser du détergent en poudre frais pour de meilleurs résultats

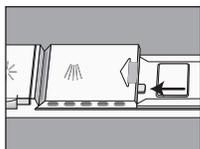
Figure 15



- Glisser le couvercle vers la gauche
- Pousser l'arrière du couvercle fermement pour entendre un CLIC

Pour fermer

Figure 16



- Pousser le bouton bleu (NON ILLUSTRÉ)

Pour ouvrir le couvercle

Figure 17

Toujours utiliser de l'agent de rinçage même si le détergent en contient

- Ajouter de l'agent de rinçage lorsque le voyant s'allume au panneau de contrôles ou (selon le modèle).

L'indicateur de niveau d'agent de rinçage du distributeur passe au argenté pâle



Soulever la languette pour ouvrir

Figure 18



- Pour ajouter de l'agent de rinçage, verser sur la flèche
- Tourner la flèche pour régler la quantité d'agent de rinçage distribuée



Diminuer s'il y a des rayures sur les verres
Augmenter s'il y a des taches sur les verres

Ajout de détergent et d'agent de rinçage

Distributeur

Utiliser seulement du détergent conçu pour lave-vaisselle. Pour de meilleurs résultats, utiliser du détergent en poudre.

ATTENTION

Pour éviter tout dommage, ne pas laver les articles avec du détergent à main dans le lave-vaisselle.

Ce lave-vaisselle utilise moins d'eau ; il faut donc moins de détergent. Avec de l'eau douce, 1 c. à table (15 ml) est suffisant. Le godet à détergent est doté de lignes pour 1 c. à table (15 ml), et 1,75 c. à table (25 ml). 3 c. à table (45 ml) de détergent remplissent complètement le godet.

ATTENTION

Pour éviter tout dommage, ne pas utiliser trop de détergent si l'eau est douce. Trop de détergent dans une eau douce causera des rayures sur les verres.

REMARQUE: si l'on ne connaît pas la dureté de l'eau, commencer par 15 ml de détergent et augmenter au besoin à la quantité minimal requise pour nettoyer la vaisselle. Utiliser les lignes du distributeur comme guide pour mesurer la quantité de détergent nécessaire comme montré au tableau 1.

Cycle lavage	Unit	Type d'eau		
		Dure	Moyenne	Douce
Récurage plus	ml	45	45	25-45
	Tbsp	3	3	1.75 to 3
Lavage automatique	ml	25-45	25	15-25
	Tbsp	1.75 to 3	1.75	1 to 1.75
Lavage régulier	ml	25-45	25	15-25
	Tbsp	1.75 to 3	1.75	1 to 1.75
Délicat/Écono	ml	25	15-25	15
	Tbsp	1.75	1 to 1.75	1
Lavage rapide	ml	25	15-25	15
	Tbsp	1.75	1 to 1.75	1
Rinçage et attente		Aucun	Aucun	Aucun

Remplir le distributeur de détergent

Remplir le godet comme indiqué au tableau 1. (Voir figure 14 pour plus de détails). Pour fermer, faire glisser le couvercle du distributeur de détergent, figure 15, et presser fermement pour que le couvercle s'enclenche.

Pour ouvrir, presser la languette de dégagement bleue dans la direction indiquée à la figure 16. Si l'on presse la languette, cela ne dégage pas le couvercle.

Agent de rinçage

Pour un séchage approprié, toujours utiliser de l'agent de rinçage, même si le détergent en contient.

Ajout d'agent de rinçage

Ouvrir le distributeur d'agent de rinçage en soulevant la languette avec le pouce, figure 17.

REMARQUE: l'appareil affiche un symbole * pour faible en agent de rinçage.

Ajouter l'agent de rinçage, figure 18, jusqu'à ce que le réservoir soit plein. Essuyer l'excès accumulé lorsque le réservoir est plein.

REMARQUE: Après avoir rempli distributeur d'agent de rinçage, l'indicateur sortira en quelques minutes après que la porte de lave-vaisselle soit fermée (certains modèles seulement).

Fonctionnement du lave-vaisselle

Toujours s'assurer que la vaisselle va au lave-vaisselle. Voir la rubrique Matériaux dans ce guide pour plus de détails.

Cycle de lavage

Récurage puissant

Nettoie les articles avec aliments séchés ou tenaces. Ces articles peuvent nécessiter un pré trempage ou un récurage à la main.

Régulier

Nettoie les grosses charges ayant des taches normales.

Délicat/économique

Pour la vaisselle délicate, l'argenterie ou autres articles spéciaux. Toujours s'assurer que les articles vont au lave-vaisselle. Voir la rubrique Matériaux dans ce guide pour plus de détails. Le lavage à la main est préférable.

Lavage rapide

Pour les articles légèrement sales dont les aliments d'enlève facilement.

Rinçage et attente

Permet de rincer la charge partielle et attendre que le lave-vaisselle soit plein.

Lavage automatique

Les capteurs du lave-vaisselle règlent automatiquement la durée du cycle, la température et l'eau selon la saleté de la charge. Ce cycle offre des décisions par capteur additionnelles lorsque comparé à d'autres cycles. Plus de détails sur les cycles à la rubrique Cycle de lavage dans ce guide.

Options de cycle de lavage

Demi Charge

Aux cycles récurage plus, ordinaire et lavage automatique, l'on peut réduire la consommation d'énergie et d'eau au moment de laver de petites charges légèrement sales remplissant environ la moitié de la capacité du lave-vaisselle. Pour activer, choisir la touche demi charge en plus de la touche récurage plus, ordinaire ou lavage automatique.

Panier supérieur seulement

Cette option permet d'économiser énergie et eau en lavant les charges assez petites pour remplir le panier supérieur. Pour activer, choisir la touche panier supérieur seulement en plus d'un cycle. Avec cette option, charger la vaisselle dans le panier supérieur.

Chaleur très sèche

Avec cette option, l'on peut augmenter la température de l'eau de rinçage et augmenter la durée de séchage pour de meilleurs résultats.

Pour activer

- Presser et maintenir la touche annulation drainage (Cancel Drain), puis presser et maintenir la touche marche-arrêt.

	Cycles disponibles					
	Récurage plus	Lavage régulier	Délicat/Écono	Lavage rapide	Rinçage et attente	Lavage automatique
SHE46C	X	X			X	X
SHE44C	X	X		X	X	
SHU43C	X	X		X	X	
SHE56C	X	X		X	X	X
SHE47C	X	X		X		X
SHX46L	X	X	X	X		
SHX43E	X	X	X		X	
SHX46A	X	X	X		X	
SHV46C	X	X	X		X	
SHE45C	X	X		X	X	
SHX45C	X	X	X		X	
SHE43M	X	X		X		X
SHX43M	X	X		X		X
SHE45M	X	X		X		X
SHV45M	X	X		X		X
SHX45M	X	X		X		X
SHE55M	X	X	X	X		X
SHE43F	X	X		X	X	

	Options de cycle disponibles					
	Panier supérieur seulement ou Demi charge	Chaleur extra sèche	Marche différée	Signal de fin de cycle	OPTIDRY™	ECO
SHE46C	X	X	19h		X	
SHE44C		X			X	
SHU43C		X				
SHE56C		X	19h		X	
SHE47C	X	X	24h		X	
SHX46L	X	X	19h	X	X	
SHX43E				X		
SHX46A	X			X		
SHV46C	X			X		
SHE45C		X			X	
SHX45C	X			X		
SHE43M			19h			
SHX43M			19h	X		
SHE45M	X	X	19h		X	
SHV45M	X	X	19h	X		
SHX45M	X	X	19h	X	X	
SHE55M	X	X	19h		X	X
SHE43F		X				

- Lorsque l'affichage DEL indique « 00 » ou « 01 », relâcher les 2 touches.
- Pour activer la chaleur de séchage supplémentaire, presser la touche « annulation drainage » gauche jusqu'à ce que l'affichage DEL indique « 01 ».
- Pour désactiver cette fonction, presser la touche « annulation drainage » gauche jusqu'à ce que l'affichage DEL indique « 00 ».
- Presser la touche marche-arrêt pour sauvegarder le réglage.

Marche différée

Cette option permet de différer la mise en marche de l'appareil.

Pour activer :

- Mettre le lave-vaisselle en circuit.
- Choisir le cycle désiré.
- Presser la touche marche différée jusqu'à ce que la durée désirée figure à l'affichage.

Signal de fin de cycle

Ce signal est une tonalité qui avertit lorsque le lave-vaisselle a terminé le lavage et le séchage de la vaisselle. Désactiver la tonalité ou régler le volume.

Pour activer:

- Presser et maintenir la touche annulation drainage droite, puis presser et maintenir la touche marche-arrêt.
- Lorsque le voyant de la touche annulation drainage s'allume et que la tonalité retentit, relâcher les touches.
- Presser la touche annulation drainage la plus à droite jusqu'à ce que la tonalité soit au volume désiré ou supprimée.
- Presser la touche marche-arrêt. Le signal de fin de cycle est réglé.

OPTIDRY™

Cette fonction détecte si l'appareil est faible en agent de rinçage et augmente automatiquement la durée de séchage. Pour un meilleur rendement, toujours utiliser de l'agent de rinçage liquide, même si le détergent en contient.

Mise en marche du lave-vaisselle

Pour mettre le lave-vaisselle en marche, voir les instructions aux figures 19 et 20 selon l'emplacement des contrôles.

Interruption d'un cycle

REMARQUE: S'il faut arrêter un cycle (pour ajouter ou enlever un article, détergent, etc.), il est préférable de le faire dans les 30 premières minutes du cycle.

Contrôles avant exposés (figure 19)

1. Presser la touche marche-arrêt pour mettre l'appareil hors circuit.
2. Attendre au moins 10 secondes ou jusqu'à ce que les bruits d'eau cessent avant d'ouvrir la porte.
3. Pour poursuivre le cycle, fermer la porte et presser la touche marche-arrêt.

Contrôles supérieurs dissimulés (figure 20)

1. Ouvrir suffisamment la porte pour exposer le panneau de contrôles.
2. Presser la touche marche-arrêt pour mettre l'appareil hors circuit.
3. Attendre au moins 10 secondes ou jusqu'à ce que les bruits d'eau cessent avant d'ouvrir la porte.
4. Pour poursuivre le cycle, presser la touche marche-arrêt et fermer la porte.

⚠ AVERTISSEMENT

Il y a risque de brûlures si la porte du lave-vaisselle est ouverte trop rapidement pendant un cycle de lavage ou de rinçage. **OUVRIRE DÉLICATEMENT LA PORTE** pendant tout cycle de lavage ou rinçage. Ne pas ouvrir la porte tant que les bruits d'eau n'ont pas cessé.

Figure 19

Contrôles avant exposés

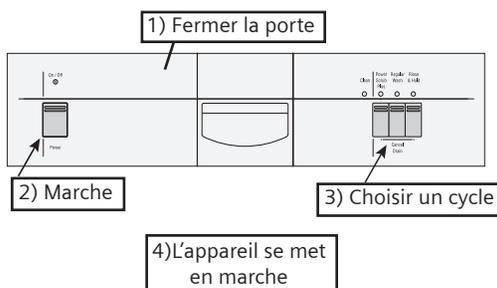
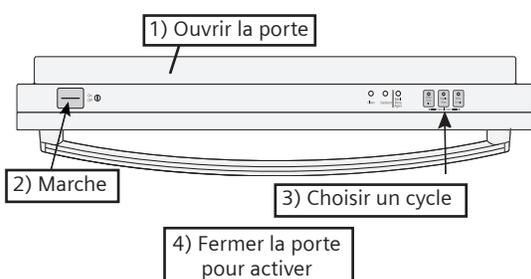


Figure 20

Contrôles supérieurs dissimulés



Attendre au moins 10 secondes ou jusqu'à ce que les bruits d'eau cessent avant d'ouvrir la porte. Pour poursuivre le cycle, presser la touche marche-arrêt et fermer la porte.

Annulation ou changement de cycle

Pour annuler ou changer un cycle, ouvrir suffisamment la porte pour exposer les touches, puis presser et maintenir pendant 3 secondes les deux touches annulation drainage, figure 21.

Fermer la porte et attendre que le lave-vaisselle ait complété le cycle (environ 1 minute). Ouvrir la porte et presser la touche marche-arrêt.

Un nouveau cycle peut maintenant être activé.

Verrouillage de sécurité (certains modèles)

Ce lave-vaisselle est expédié de l'usine avec le verrou de sécurité désactivé et en mode de fonctionnement normal. Tirer sur la poignée pour ouvrir la porte. Le levier d'activation du verrou de sécurité est situé dans le creux de la poignée de porte. Il faut regarder dans le creux pour trouver le levier d'activation (voir figure 22).

Pour activer le verrou de sécurité, insérer une allumette ou un objet non métallique dans l'ouverture, figure 22. Le levier se dégage et se déplace vers la gauche.

Le verrou de sécurité est maintenant activé. Chaque fois que l'on ouvre la porte du lave-vaisselle, il faut faire glisser le levier d'activation vers la droite pour dégager le mécanisme de verrouillage de la porte, puis tirer pour l'ouvrir (figure 23). Après avoir ouvert la porte, relâcher le levier d'activation pour qu'il se remette vers la gauche.

Pour désactiver le levier d'activation, insérer une allumette ou un objet non métallique dans l'ouverture, figure 24. Faire glisser le levier d'activation vers la droite et maintenir, retirer l'allumette et relâcher le levier. La fonction est maintenant désactivée et l'on peut ouvrir la porte en tirant sur la poignée.

Verrouillage enfant (certains modèles)

Cette fonction permet de désactiver le panneau de contrôle du lave-vaisselle pour éviter toute activation accidentelle. Pour activer cette fonction, presser et maintenir la touche «verrouillage enfant» pendant 4 secondes et le voyant verrouillage enfant s'allume. Pour annuler, presser et maintenir la touche «verrouillage enfant» pendant 4 secondes.

Séchage

À la fin du cycle, l'appareil s'arrête et une période de séchage par condensation suit. Après le séchage, le cycle est complété et :

- le voyant propre s'allume (certains modèles).
- le signal de fin de cycle retentit (certains modèles).
- le voyant hygiénique peut s'allumer. Voir la section sur cette fonction pour plus de détails.
- l'affichage à rebours indique "0" (certains modèles).

REMARQUE: si l'alimentation en eau est trop chaude, le temps de chauffage peut être réduit et le voyant SANITIZED (désinfectant) peut ne pas s'allumer. Le guide d'installation du lave-vaisselle comprend des informations concernant la température recommandée pour l'alimentation en eau chaude.

REMARQUE: pour accélérer et maximiser le séchage, ouvrir la porte, tirer de quelques pouces le panier supérieur et y appuyer la porte.

Voyant hygiénique

 Lorsque le voyant hygiénique figure à l'affichage, cela indique que la vaisselle lavée est hygiénique selon les exigences de la Fondation sanitaire nationale (NSF). Pour plus de détails, voir la rubrique Cycle de lavage dans ce guide.

Décharger le lave-vaisselle

Vider le panier inférieur d'abord.

Vider le(s) panier(s) à ustensiles. Ils s'enlèvent pour plus de facilité.

Vider le panier supérieur.

Si le gicleur pour grands articles est installé, remettre le lave-vaisselle à son état d'origine (voir les instructions à cet effet à la rubrique Chargement dans ce guide).

Figure 21

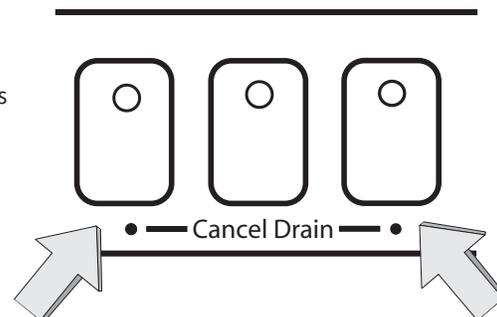


Figure 22

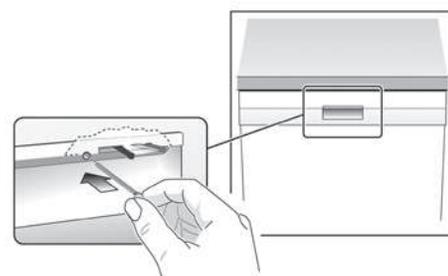


Figure 23

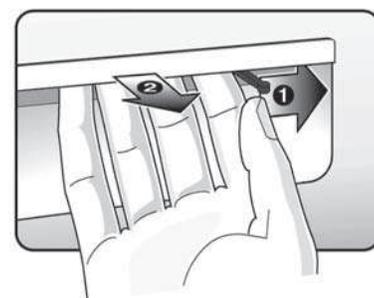


Figure 24

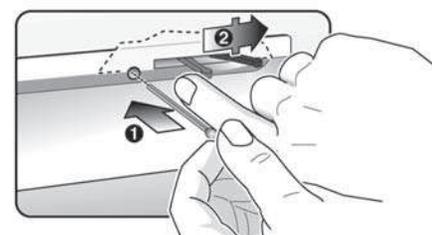
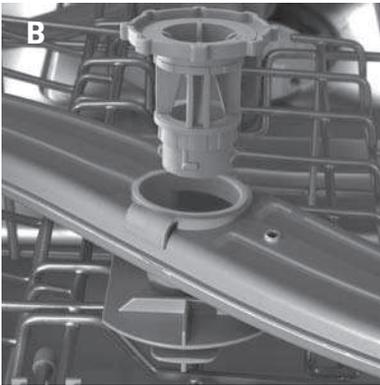
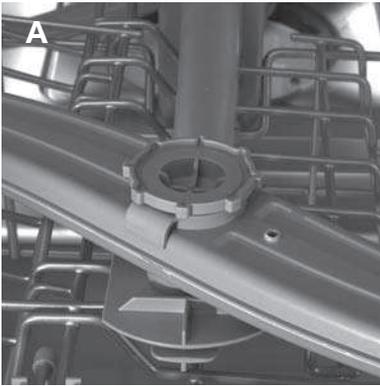


Figure 25



Entretien

Entretien

Certaines sections du lave-vaisselle requièrent un entretien occasionnel facile à faire pour un rendement supérieur.

- Hivérifier le lave-vaisselle
- Essuyer les déversements
- Nettoyer la cuve et l'intérieur de porte en acier inoxydable
- Vérifier et nettoyer les embouts du bras gicleur
- Vérifier et nettoyer le système de filtre
- Nettoyer le panneau de porte extérieur
- Nettoyer le joint de porte

Hivérifier le lave-vaisselle

Si le lave-vaisselle n'est pas utilisé pendant une longue période dans un endroit où il fait froid (ex. : dans un chalet), faire hivérifier l'appareil par un centre de service autorisé.

ATTENTION

Pour éviter tout dommage, ne pas laisser l'eau dans le système du lave-vaisselle pendant de longues périodes de gel. Le gel peut endommager l'appareil.

Essuyer les déversements

L'eau peut occasionnellement éclabousser hors du lave-vaisselle surtout si l'on arrête un cycle ou ouvre la porte pendant un cycle. Pour éviter des dommages de plancher et la croissance possible de moule, ne laissez pas les secteurs humides rester autour ou sous du lave-vaisselle.

Vérifier et nettoyer la cuve et l'intérieur de porte en acier inoxydable

Nettoyer les bords extérieurs du panneau de porte intérieure régulièrement pour enlever tout débris accumulé. Si des taches commencent à paraître sur l'acier inoxydable, s'assurer que le distributeur d'agent de rinçage est plein.

Vérifier et nettoyer les embouts de bras gicleur

Vérifier occasionnellement s'il y a des obstructions dans l'embout (trous) du bras gicleur. Il faut enlever le bras pour vérifier.

Enlever le bras gicleur supérieur:

1. Enlever le panier supérieur vide.
2. Mettre le panier à l'envers. Le bras gicleur est maintenu en position par un écrou de verrouillage, figure 25A. Tourner cet écrou dans le sens contre horaire 1/8 de tour et l'enlever, figure 25B, pour dégager le bras.
3. Enlever le bras gicleur, figure 26.
4. Vérifier les obstructions.
5. Si les embouts doivent être nettoyés, les passer à l'eau courante.

Pour réinstaller le bras gicleur supérieur:

1. Remettre le bras gicleur supérieur à sa position.
2. Remettre l'écrou de verrouillage à sa position et le tourner 1/8 de tour dans le sens horaire.
3. Remettre le panier supérieur dans ses guides.

Figure 26

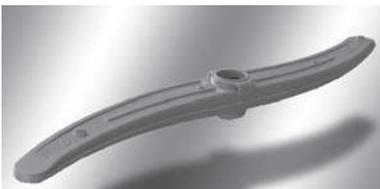
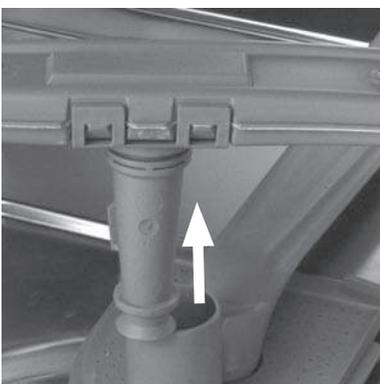


Figure 27



Enlever le bras gicleur inférieur:

1. Enlever le panier inférieur vide.
2. Saisir et soulever le bras gicleur inférieur, figure 27.
3. Vérifier s'il y a obstruction dans les embouts du bras gicleur.
4. Si le bras doit être nettoyé, le passer à l'eau courante.

Réinstaller le bras gicleur:

1. Remettre le bras gicleur en position et le presser pour qu'il s'enclenche en place.
2. Remettre le panier inférieur en place.

Vérifier / nettoyer le système de filtration

Ce lave-vaisselle est doté d'un système de filtration soit un assemblage filtre cylindrique/ crépine pour objets larges et d'un filtre fin. Le système est situé à l'intérieur du lave-vaisselle sous le panier inférieur et est facile d'accès.

Pendant un usage normal, le système de filtration est autonettoyant. Il faut occasionnellement le vérifier et le nettoyer des objets étrangers au besoin.

ATTENTION

Pour éviter toute blessure, ne pas prendre les gros objets coincés avec les doigts. La crépine peut contenir des objets affûtés.

Pour enlever l'assemblage filtre cylindrique/crèpine large:

1. Enlever le panier inférieur.
2. Saisir l'assemblage, figure 28 et le tourner $\frac{1}{4}$ de tour dans le sens contre horaire.
3. Soulever l'assemblage, figure 29.
4. Vérifier l'assemblage. S'il y a des débris dans la crépine large, la tourner à l'envers et taper légèrement sur une surface pour déloger les débris. Passer à l'eau courant pour enlever tout objet.

Pour enlever le filtre fin:

1. Soulever le filtre fin du plancher du lave-vaisselle comme à la figure 30 et le passer à l'eau courante pour le nettoyer.

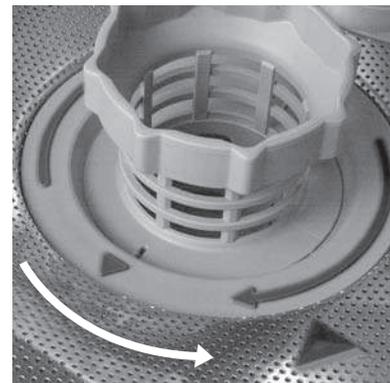
Pour réinstaller le système de filtration:

1. Remettre le filtre fin à sa position initiale.
2. Remettre l'assemblage filtre cylindrique/crèpine large à sa position initiale.
3. Tourner la poignée anneau dans le sens horaire $\frac{1}{4}$ de tour jusqu'à ce qu'elle se verrouille. La flèche sur la poignée et celle sur le filtre fin doivent pointer une vers l'autre, comme illustré par le cercle à la figure 31.
4. Tirer délicatement sur la poignée pour s'assurer que l'assemblage est bien verrouillé en place.

ATTENTION

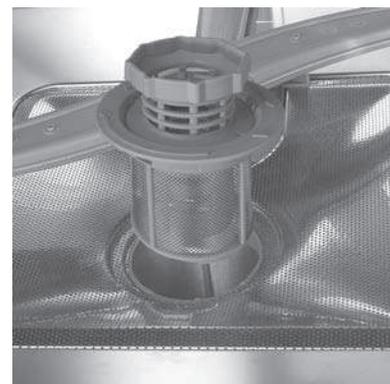
Pour éviter tout dommage possible au lave-vaisselle, ne pas utiliser de produits chimiques, nettoyants abrasifs, tampons à récurer (métal ou plastique), chiffons/es-suie-tout abrasif pour nettoyer le panneau de porte extérieur. Cela peut endommager le panneau de porte extérieur.

Figure 28



Pour ouvrir, tourner dans le sens inverse des aiguilles d'une montre

Figure 29

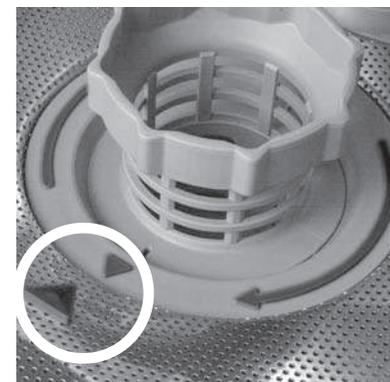


Filtre cylindrique/crèpine

Figure 30



Figure 31



Pour fermer, tourner dans le sens des aiguilles d'une montre

Nettoyer le panneau de porte extérieur

Porte de couleur

Utiliser seulement un chiffon doux légèrement humide d'eau savonneuse.

Porte en acier inoxydable

Utiliser un chiffon doux avec un produit non abrasif (préférentiellement liquide à vaporiser) conçu pour l'acier inoxydable. Pour de meilleurs résultats, appliquer le produit sur le chiffon, puis essuyer la surface.

Nettoyer le joint de porte

Nettoyer régulièrement le joint de porte avec un chiffon humide pour enlever les particules d'aliments et autres objets.

Information sur le cycle de lavage

REMARQUE: pour économiser l'énergie, le lave-vaisselle est doté d'un contrôle intelligent qui règle automatiquement le cycle en fonction de la charge sale et de la température d'eau entrante. Ce contrôle prend les décisions où la durée du cycle et l'utilisation d'eau sont réglées, à sa discrétion, et change subitement à mi cycle. Les durées de cycle données dans le guide d'utilisation et d'entretien sont en fonction de charges sales normales et de l'eau entrante à 120 °F et varient selon les conditions réelles.

REMARQUE: S'il n'y a plus d'agent de rinçage, la fonction OPTIDRY prolonge automatiquement la durée du cycle d'environ 10 minutes.

REMARQUE: Si chaleur de séchage additionnelle est sélectionnée, le cycle est prolongé d'environ 20 minutes.

REMARQUE: Si le prétrempage est sélectionné, le cycle est prolongé d'environ 5-10 minutes.



SYMBOLE NSF

Residential

Un lave-vaisselle ou un cycle portant le symbole NSF est certifié par NSF International pour répondre aux exigences strictes de durée de lavage et de température d'eau pour en assurer une vaisselle sanitaire. Ces exigences sont expliquées dans le document NSF/ANSI 184, lave-vaisselle résidentiels. Plus de détails sur la certification NSF disponible sur le site : <http://www.nsfconsumer.org/home/appliances.asp>.

Ce lave-vaisselle est NSF certifié. Les cycles de lavage certifiés NSF sont indiqués dans le tableau ci-dessus. Lorsque ces cycles sont complétés, le voyant «Sanitized» (sanitaire) sur le panneau de contrôle du lave-vaisselle s'allume.

REMARQUE: si l'alimentation en eau de la résidence est trop chaude, le temps de chauffage du lave-vaisselle peut être réduit et le voyant Sanitized peut ne pas s'allumer. Le guide d'installation du lave-vaisselle donne les informations quant à la température recommandée pour l'alimentation en eau chaude.

Information sur le cycle de lavage

(Modèles SHE43M, SHE43F, SHX43M, SHE45M, SHV45M, SHX45M, SHE55M)

		 Récirage plus	 Lavage automatique	Lavage Régulier	 Délicat/Écono	Lavage Rapide	Rinçage & attente
	Durée Cycle (minutes)	135	105-125	119	80	30	9
Conosomma- tion en eau en gallons	Minimum	6.1	4.5	2.4	3.5	3.5	1.2
	Maximum	7.2	7.0	5.9	3.5	3.5	1.2
Conosomma- tion en eau en litres	Minimum	23.2	17	8.9	13.1	13.1	4.7
	Maximum	27.4	26.4	22.5	13.1	13.1	4.7
Temp Lavage °F Temp Rinçage °F		$\frac{160^\circ}{156^\circ}$	$\frac{130-150^\circ}{156^\circ}$	$\frac{131^\circ}{156^\circ}$	$\frac{122^\circ}{156^\circ}$	$\frac{113^\circ}{122^\circ}$	Entrante Entrante

Information sur le cycle de lavage

(Modèles SHE44C, SHE46C, SHE47C, SHE56C, SHU43, SHX46A, SHX46L, SHX43E, SHV46C)

		 Récirage plus	 Lavage au- tomatique	Lavage Régulier	 Délicat/Écono	Lavage Rapide	Rinçage & attente
	Durée Cycle (minutes)	135	105-120	119	80	39	9
Conosomma- tion en eau en gallons	Minimum	6.1	2.8	2.8	3.5	3.5	1.2
	Maximum	7.2	5.9	5.9	3.5	3.5	1.2
Conosomma- tion en eau en litres	Minimum	23.2	10.4	10.4	13.1	13.1	4.7
	Maximum	27.4	22.5	22.5	13.1	13.1	4.7
Temp Lavage °F Temp Rinçage °F		$\frac{160^\circ}{156^\circ}$	$\frac{130-150^\circ}{156^\circ}$	$\frac{131^\circ}{156^\circ}$	$\frac{122^\circ}{156^\circ}$	$\frac{104^\circ}{140^\circ}$	Entrante Entrante

Aide

Les lave-vaisselle peuvent parfois présenter des problèmes non reliés à un mauvais fonctionnement. L'information suivante peut aider à résoudre un problème sans avoir recours à un technicien.

Vaisselle non sèche

Le distributeur d'agent de rinçage peut être vide. Le vérifier et le remplir au besoin. Le séchage de la vaisselle peut être accéléré en ouvrant la porte du lave-vaisselle et en la laissant entrouverte avec le panier supérieur.

Voyant(s) non allumé(s)

Vérifier le fusible ou coupe-circuit à la boîte électrique et remplacer le fusible ou réenclencher le coupe-circuit au besoin.

Pas de mise en marche

S'assurer que la porte du lave-vaisselle est bien fermée et verrouillée.

Lave-vaisselle fonctionne longtemps

Peut être causé par de l'eau froide qui entre. Avant de mettre le lave-vaisselle en marche, ouvrir le robinet d'eau chaude à l'évier jusqu'à ce qu'elle soit chaude, fermer le robinet. Mettre le lave-vaisselle en marche.

Cycle ne passant pas au rinçage

REMARQUE: le guide d'installation fourni avec le lave-vaisselle peut aider avec les instructions suivantes : La canalisation en eau peut être fermée. Vérifier la soupape d'alimentation en eau et l'ouvrir au besoin.

Taches blanches ou rayures sur vaisselle et verres

Agent de rinçage additionnel nécessaire. Voir la rubrique Ajout de détergent et agent de rinçage pour plus de détails sur la quantité appropriée à utiliser.

Eau non vidée du lave-vaisselle

S'assurer que le tuyau de vidage n'est pas plié, obstrué ou mal installé. S'assurer qu'une portion du tuyau est au moins à 20 po au-dessus du plancher (voir le guide d'installation). Les filtres peuvent être obstrués. S'assurer que le système de filtre n'est pas obstrué (voir la rubrique Entretien). Le drain de l'évier peut être obstrué ; il faudra peut-être un plombier plutôt qu'un technicien. Si un intervalle d'air est installé à l'évier, il peut être obstrué.

Couvercle du distributeur de détergent ne ferme pas

Le couvercle est mal fermé ou un cycle n'était pas terminé et doit être annulé. Voir la rubrique Ajout de détergent et agent de rinçage pour plus de détails. Voir la rubrique Fonctionnement pour plus de détails sur l'annulation d'un cycle.

Rainures sur les verres

Trop d'agent de rinçage. Aller à la rubrique Ajout de détergent et agent de rinçage dans ce guide d'instructions concernant les quantités appropriées.

Bruits

Les ustensiles sont mal placés.

Mousse dans le lave-vaisselle

Mauvais type de détergent utilisé. Prendre seulement du détergent pour lave-vaisselle automatiques.

Résultats insatisfaisants

- Quantité incorrecte de détergent.
- Ustensiles mal placés ou panier trop plein.
- Rotation du bras gicleur bloquée par des ustensiles.
- Embouts du bras gicleur à nettoyer.
- Filtres mal placés.
- Cycle inadéquat sélectionné.

Énoncé de garantie limitée de produit

Lave-vaisselle Bosch

Couverture et application de la garantie: la garantie limitée fournie par BSH Home Appliances (« Bosch ») dans cet énoncé de garantie limitée s'applique seulement aux lave-vaisselle Bosch (« produit ») vendus au client, le premier acheteur utilisateur, en autant que le produit ait été acheté : (1) pour une utilisation domestique (non commerciale) normale et que dans les faits, a été utilisé seulement à des fins domestiques normales ; (2) nouveau au détail (non comme modèle en montre, « tel quel » ou modèle retourné) et non pour la revente ou utilisation commerciale ; et (3) aux États-Unis ou au Canada et est, en tout temps, demeuré dans le pays de l'achat d'origine. Les garanties indiquées ci-après s'appliquent seulement au premier acheteur du produit et ne sont pas transférables.

•S'assurer de retourner la carte d'enregistrement ; quoique non nécessaire pour la couverture de la garantie, cela est la meilleure façon pour Bosch d'aviser le client en cas d'avis concernant la sécurité ou pour rappel de produit.

Durée de la garantie: Bosch garantit que le produit ne présente aucun défaut de matériaux et de fabrication pendant une période de trois-cent-soixante-cinq (365) jours (c.-à-d. 1 an) à compter de la date d'achat. La durée commence à compter de la date d'achat et ne sera pas retardée, restreinte, prolongée ni suspendue pour quelle que raison que ce soit. Les frais de main-d'oeuvre et d'expédition sont compris dans la couverture de base.

Garantie limitée prolongée: Bosch offre également ces garanties limitées additionnelles :

•**Garantie limitée de 2 ans:** Bosch réparera ou remplacera tout composant présentant un défaut de matériaux ou de fabrication (excluant les frais de main-d'oeuvre).

•**Garantie limitée de 5 ans sur pièces électroniques:** Bosch réparera ou remplacera tout microprocesseur ou panneau de circuits imprimés Bosch qui présente un défaut de matériaux ou de fabrication (excluant les frais de main-d'oeuvre).

•**Garantie limitée de 5 ans sur les paniers à vaisselle:** Bosch réparera ou remplacera le panier supérieur ou inférieur (excluant les composants de paniers), si le panier présente un défaut de matériaux ou de fabrication (excluant les frais de main-d'oeuvre).

•**Garantie à vie contre la perforation de l'acier inoxydable par la rouille:** Bosch remplacera le lave-vaisselle par un modèle semblable ou un modèle curant qui est l'équivalent substantiel ou meilleur, si la doublure intérieure est perforée par la rouille (excluant les frais de main-d'oeuvre). Bosch remplacera la porte en acier inoxydable si elle est perforée par la rouille (excluant les frais de main-d'oeuvre).

La durée commence à compter de la date d'achat et ne sera pas retardée, restreinte, prolongée ni suspendue pour quelle que raison que ce soit.

Réparation/remplacement comme solution exclusive: pendant cette période de garantie, Bosch ou un de ces centres de service autorisés réparera le produit sans frais au client (sujet à certaines limitations énoncées ci-après) si le produit présente un défaut de matériaux ou de fabrication. Si des tentatives raisonnables de réparer le produit sont vaines, alors Bosch remplacera le produit (des modèles mis à niveau peuvent être disponibles au client, à la seule discrétion de Bosch, pour des frais additionnels). Tout composant et pièce enlevé devient la propriété de Bosch, à sa seule option. Toute pièce remplacée et/ou réparée doit assumer l'identité de la pièce d'origine à des fins de cette garantie et cette garantie ne sera pas prolongée en regard à ces pièces. La seule responsabilité de Bosch est de réparer seulement le produit présentant un défaut de fabrication, par un centre de service autorisé Bosch aux heures d'affaires normales. Pour des questions de sécurité et des soucis de dommages à la propriété, Bosch recommande fortement de ne pas tenter de réparer soi-même le produit, ni utiliser les services d'un centre de service non autorisé ; Bosch ne sera aucunement tenu responsable pour les réparations effectuées par un centre de service non autorisé. Si le client décide qu'une personne autre qu'un centre de service autorisé effectue la réparation du produit, **CETTE GARANTIE DEVIENT AUTOMATIQUEMENT NULLE ET NON AVENUE.** Les centres de service autorisés sont des personnes ou des compagnies qui ont été spécialement formées pour les produits Bosch et qui possèdent, à la discrétion de Bosch, une meilleure réputation pour le service à la clientèle et une habileté technique (il est à noter qu'ils sont des parties indépendantes et ne sont pas des agents, partenaires, affiliés ou représentants de Bosch. Nonobstant ce qui suit, Bosch n'aura aucune responsabilité ou ne sera tenu responsable d'un produit s'il est situé dans une région éloignée (plus de 100 milles d'un centre de service autorisé)

ou s'il est raisonnablement inaccessible, dans un endroit, environnement ou zone dangereux, menaçant ou hasardeux ; dans un tel cas, à la demande du client, Bosch pourrait payer pour la main-d'oeuvre et les pièces et expédier les pièces à un centre de service autorisé environnant, mais le client serait entièrement responsable pour tout déplacement ou autres frais spéciaux requis par le centre de service si ce dernier convient d'effectuer un appel de service.

Produit hors garantie : Bosch n'est pas tenu, par loi ou autre, d'offrir au client toute concession, incluant réparations, prorata ou remplacement de produit une fois la garantie expirée.

Exclusions de la garantie : la couverture de garantie décrite dans la présente exclut tout défaut ou dommage qui n'est pas directement une faute de Bosch, incluant sans limitation, un ou plusieurs de ce qui suit : (1) utilisation du produit d'une façon autre que normale, habituelle et pour l'usage auquel il est destiné (incluant sans limitation, toute forme d'utilisation commerciale, utilisation ou rangement d'un produit pour l'intérieur à l'extérieur, utilisation du produit avec des avions ou bateaux quels qu'ils soient) ; (2) mauvaise conduite de toute partie, négligence, mauvaise utilisation, abus, accidents, fonctionnement inadéquat, manquement à l'entretien, installation inadéquate ou négligée, manipulation, manquement à observer les instructions, manipulation sans précaution, service non autorisé (incluant « réparation » soi-même ou exploration du fonctionnement interne de l'appareil) ; (3) réglage, altération ou modification de toute sorte ; (4) manquement à se conformer à tous les codes électriques, de plomberie et/ou de construction de la province/état, locaux, municipaux ou autres, règlements ou lois, incluant le manquement à installer le produit conformément aux codes et règlement d'incendie et de construction ; (5) bris et usure ordinaires, déversements d'aliments, liquides, accumulation de graisse, ou autres substances accumulées sur, dans ou autour du produit ; (6) et tout facteur ou force environnemental, élémentaire et/ou externe, incluant sans limitation, pluie, vent, sable, inondation, incendie, glissement de terrain, gel, humidité excessive ou exposition prolongée à l'humidité, foudre, surtension, bris de structure environnante de l'appareil, et actes de Dieu. En aucun cas, Bosch ne sera tenu responsable des dommages survenus à la propriété environnante, incluant armoires, planchers, plafonds et autres structures ou objets autour du produit. Également exclus de la garantie sont les égratignures, éraflures, encoches mineures et dommages esthétiques sur les surfaces externes et les pièces exposées ; les produits dont les numéros de série ont été modifiés, effacés ou enlevés ; visites de service pour montrer au client comment utiliser le produit ou les visites lorsque le produit ne présente aucun problème, correction de problèmes d'installation (le client est responsable de toute structure et réglage du produit, incluant électricité, plomberie ou autres services utilitaires, pour un plancher/fondation approprié et pour toute modification incluant sans limitation armoires, murs, planchers, tablettes, etc.) ; et remise en fonction des coupe-circuits ou fusible. **SELON CE QUI EST PERMIS PAR LA LOI, CETTE GARANTIE ÉTABLIT DES SOLUTIONS EXCLUSIVES EN REGARD DU PRODUIT, PAR RÉCLAMATION PAR CONTRAT OU TORT (INCLUANT RESPONSABILITÉ STRICTE OU NÉGLIGENCE) OU AUTREMENT. CETTE GARANTIE EST EN LIEU DE TOUTE AUTRE GARANTIE, EXPRESSE OU IMPLICITE. TOUTE GARANTIE IMPLICITE PAR LOI, SOIT POUR COMMERCIALISATION OU À DES FINS PARTICULIÈRES, OU AUTRE, SERA EN VIGUEUR SEULEMENT POUR LA PÉRIODE PENDANT LAQUELLE CETTE GARANTIE LIMITÉE EXPRESSE EST EN VIGUEUR. EN AUCUN CAS, LE FABRICANT NE SERA TENU RESPONSABLE DES DOMMAGES ACCESSOIRES, SPÉCIAUX, INTÉRÊTS, INDIRECTS, « PERTE D'AFFAIRES » ET/OU PUNITIFS, PERTES OU DÉPENSES, INCLUANT SANS LIMITATION, CONGÉ DE TRAVAIL, REPAS À L'HÔTEL ET/OU AU RESTAURANT, DÉPENSES POUR RÉNOVATIONS EN EXCÈS DES DOMMAGES DIRECTS QUI SONT DÉFINITIVEMENT CAUSÉS, EXCLUSIVEMENT, PAR BOSCH OU AUTREMENT. CERTAINS ÉTATS NE PERMETTENT PAS LA LIMITATION DE LA DURÉE D'UNE GARANTIE IMPLICITE, PAR CONSÉQUENT, LES LIMITATIONS SUSMENTIONNÉES PEUVENT NE PAS S'APPLIQUER. CETTE GARANTIE DONNE DES DROITS LÉGAUX SPÉCIFIQUES ET LE CLIENT PEUT EN AVOIR D'AUTRES QUI VARIENT D'UN ÉTAT/PROVINCE À L'AUTRE.** Aucune tentative d'altérer, modifier ou amender cette garantie ne sera effective sans une autorisation écrite par un responsable de BSH.

Pour obtenir un service sous garantie: POUR OBTENIR UN SERVICE SOUS GARANTIE POUR LE PRODUIT, COMMUNIQUER AVEC UN CENTRE DE SERVICE AUTORISÉ BOSCH OU TÉLÉPHONER AU 800.944.2904, ou écrire à Bosch : BSH Home Appliances - 5551 McFadden Avenue, Huntington Beach, CA 92649

Service à la clientèle

Ce lave-vaisselle Bosch ne requiert aucun entretien spécial autre que ce qui est décrit dans la section Entretien. En cas de problème avec le lave-vaisselle, avant d'effectuer un appel de service, voir la section Aide. Si un service est nécessaire, communiquer avec le marchand ou l'installateur ou un centre de service autorisé. **Ne pas tenter d'effectuer soi-même la réparation.** Toute réparation effectuée par un personnel non autorisé peut annuler la garantie.

Si l'on a un problème avec le lave-vaisselle Bosch et que l'on n'est pas satisfait du service reçu, prendre les mesures suivantes (dans l'ordre indiqué ci-dessous) jusqu'à ce que le problème soit corrigé :

1. Communiquer avec l'installateur ou le centre de service Bosch dans la région.
2. Envoyer un courriel par la section service à la clientèle de notre site web : www.boschappliances.com.
3. Écrire à :
BSH Home Appliances, Corp.
5551 McFadden Avenue
Huntington Beach, CA 92649
4. Téléphoner au 1.800.944.2904.

S'assurer d'inclure le numéro de modèle donné ci-dessous ainsi qu'une explication du problème et la date du début du problème.

Les numéros de modèle et de série sont situés sur la plaque signalétique, bord droit de la porte du lave-vaisselle, figure 32.

De plus, si par écrit, inclure un numéro de téléphone pendant la journée.

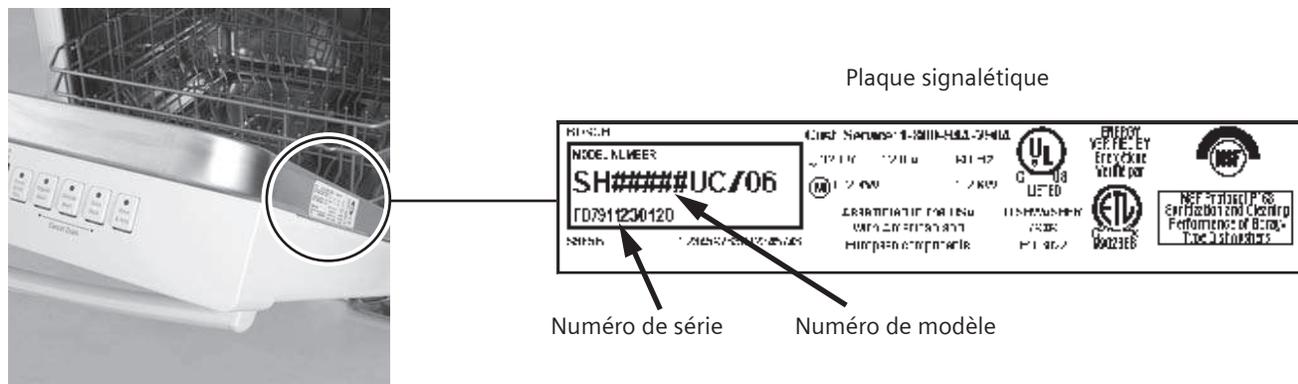
Faire une copie de la facture et la conserver dans ce guide. Le consommateur doit fournir une preuve d'achat pour obtenir un service sous garantie.

Information sur le modèle :

- Numéro de modèle _____
- Numéro de série _____
- Date d'achat _____
- Date d'installation _____

⚠ ATTENTION
Enlever tout couvercle ou tirer l'appareil hors de l'armoire peut exposer les connexions d'eau chaude, alimentation électrique et les bords ou points affûtés.

Figure 32



¡Felicidades y Gracias de parte de Bosch!

Gracias por haber escogido un lavavajillas Bosch. Usted se ha unido a muchos clientes quienes exigen un rendimiento silencioso y excepcional de su lavavajillas.

Este manual ha sido escrito tomando en cuenta su seguridad y comodidad. La información incluida es muy importante. Le aconsejamos que lea este manual antes de utilizar su lavavajillas por la primera vez.

Para averiguar aún más detalles acerca de su lavavajillas y los accesorios disponibles, además de muchos otros aparatos domésticos de la alta calidad Bosch, visite nuestro sitio web a www.boschappliances.com.

Por favor comuníquese con nosotros en caso que tenga preguntas o comentarios. Nos puede llamar al número telefónico gratis:1-800-944-2904, o nos puede escribir a:

BSH Home Appliances, Corp.
5551 McFadden Avenue
Huntington Beach, CA 92649

¡Disfrútelo!

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⚠ Instrucciones Importantes de Seguridad-Guarde esta Información ⚠

CUIDADO

Nunca use productos de limpieza con vapor para limpiar su lavavajillas. El fabricante no será responsable de posibles daños o consecuencias.

CUIDADO

¡Nunca use químicos agresivos para limpiar su lavavajillas. Algunos productos de limpieza que contienen cloruro pueden dañar su lavavajillas y constituyen un riesgo para la salud!

CUIDADO

Recomendamos altamente que el consumidor final se familiarice con los procedimientos para apagar el suministro del agua entrante y para apagar la alimentación eléctrica. Consulte las instrucciones de instalación o hable con su instalador para más información.

ADVERTENCIA

El mal uso del lavavajillas puede causar lesiones serias o la muerte. No use el lavavajillas cubierto por este manual de otra forma o para algún otro propósito que no sea explicado en las siguientes páginas.

ADVERTENCIA

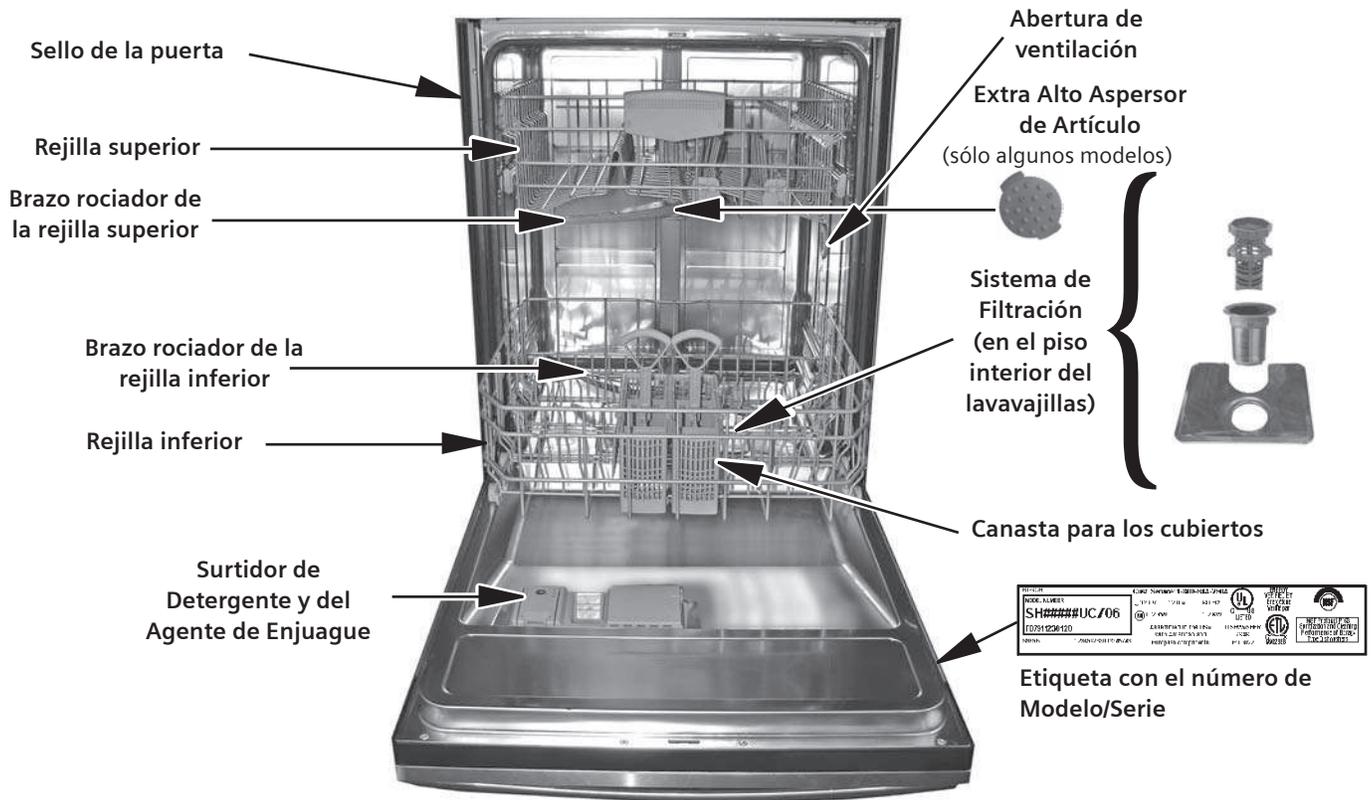
El empleo de técnicos de servicio no calificados o el uso de refacciones no originales puede dañar el producto severamente y/o causar lesiones. Todas las reparaciones deben ser realizadas por un técnico de servicio calificado utilizando solamente refacciones originales de fábrica.

ADVERTENCIA

Cuando se instala incorrectamente la alimentación eléctrica para su lavavajillas cubierto en este manual o cuando el lavavajillas ha sido conectado mal a tierra, existe el riesgo de una descarga eléctrica o un fuego. No use el lavavajillas cubierto en este manual, si usted no está seguro que la alimentación eléctrica ha sido instalada correctamente o que el lavavajillas ha sido aterrizado correctamente.

- Este aparato debe estar puesto a tierra por medio de un sistema permanente de cableo metálico o de un dispositivo conductor de puesta a tierra instalado con los conductores de circuito y conectado a la borna de la puesta a tierra del equipo o del lavavajillas. Consulte el Manual de Instalación que acompaña este lavavajillas para averiguar más información acerca de los requisitos del equipo eléctrico.
- Utilice los lavavajillas de Bosch únicamente para realizar la función intencionada que es la de lavar la vajilla y los utensilios de cocina en su hogar.
- El lavavajillas de Bosch incluye Instrucciones de Instalación así como este Manual de Uso y Cuidado. Lea y comprenda todas las instrucciones antes de utilizar el lavavajillas.
- Utilice únicamente detergentes o agentes de enjuague recomendados para uso en el lavavajillas y manténgalos fuera del alcance de niños.
- A medida que cargue los artículos para lavar:
 - Acomode los artículos filosos de modo que no dañen el sello de la puerta.
 - Cargue los cuchillos y otros utensilios filosos CON EL MANGO HACIA ARRIBA para reducir el riesgo de cortarse.
- No lave artículos de plástico a menos de que indiquen "a prueba de lavavajillas" [*dishwasher safe*]. En cuanto a los productos de plástico que no lleven tal aviso, consulte el fabricante para averiguar sus recomendaciones.
- No opere su lavavajillas a menos de que todos los paneles del gabinete estén instalados correctamente.
- No intente alterar, modificar o sobrecontrolar los controles o los interruptores de seguridad eléctricos.
- No abuse ni se siente o se pare en la puerta o en las rejillas para trastes del lavavajillas.
- Con el fin de reducir el riesgo de heridas, no permita que niños jueguen adentro o encima del lavavajillas.
- Cuando los niños llegan a una edad suficiente para operar el aparato, es la responsabilidad legal de los padres o de los tutores legales asegurar que personas calificadas los instruyan sobre prácticas seguras.
- Bajo ciertas condiciones, el gas hidrógeno podría acumularse en un sistema de agua caliente que no se ha usado durante por lo menos dos semanas. El gas hidrógeno es explosivo. Antes de usar un lavavajillas conectado a un sistema de agua caliente que no ha sido operada por dos o más semanas, abra todas las llaves de agua caliente y permita que corra el agua por algunos minutos. De este modo se dispersa el gas hidrógeno que se acumuló. Ya que el gas podría explotar, no fume ni prenda una llama durante este proceso.
- Quite la puerta del compartimiento de lavado (la tina) antes de poner el lavavajillas fuera de servicio o cuando lo deseche.
- Para no dañar el piso y evitar la posible formación de moho, no permita áreas húmedas alrededor o abajo del lavavajillas.
- Proteja su lavavajillas de los elementos. Protéjalo de la congelación para evitar posibles daños a la válvula de llenado. La garantía no cubre daños causados por la congelación.

Componentes del Lavavajillas



Características y Opciones del Lavavajillas

Sistema de Reducción de Ruido: Un sistema motorizado con dos bombas, el motor suspendido (Suspension Motor™), y el triple aislamiento hacen que este lavavajillas sea uno de los más silenciosos en Norteamérica.

Tina Alta de Acero Inoxidable [Stainless Steel TALLTUB™]: Proporciona una superficie interior inoxidable e higiénica con garantía de por vida.

Rejillas revestidas de nylon: Eliminan cortes y mellas y vienen con una garantía de cinco años.

Calentador de Paso (Flow-Through Heater™): Calienta el agua hasta una temperatura de 161°F (72°C).

Secado por Condensación: El enjuague final realizado a una temperatura alta, la tina de acero inoxidable a una temperatura más baja junto con la acción del agua que se escurre en forma de láminas gracias al agente del enjuague resulta en un secado higiénico, económico y eficiente en el uso de energía eléctrica.

SENSOTRONIC™ Monitor de la condición del agua: Revisa la condición del agua y determina la necesidad de llenar con agua fresca por segunda vez.

Sistema de Filtración: Tres filtros le aseguran la distribución de agua limpia y protegen la bomba principal y la bomba de evacuación contra materiales ajenos.

Cierre de Agua [Water Shut-Off]: Un dispositivo de seguridad que interrumpe la circulación del agua de entrada cuando detecta agua en la base del lavavajillas.

Unidad totalmente integrada (Modelo SHV46C13): Una unidad totalmente integrada que requiere una puerta delantera personalizada.

Materiales de Vajillas

NOTA: Antes de usar su lavavajillas por primera vez, revise la información en esta sección. Algunos artículos que usted desea limpiar no están a prueba de lavavajillas y deben ser lavados a mano; otros requieren de un acomodo especial. Póngase en contacto con el fabricante del artículo si usted tiene dudas acerca de que el uso del lavavajillas sea apropiado.

Recomendado

Aluminio: El aluminio anodizado de color puede oscurecerse con el tiempo. Los minerales en su agua pueden causar que el aluminio se oscurezca o que se manche. Generalmente se pueden quitar estas manchas usando esponjillas de fibra metálica rellenas de jabón.

Porcelana, Cristal, Cerámica: Algunas piezas pintadas a mano pueden perder el color, oscurecerse o mancharse. Lave estas piezas a mano. Posicione piezas frágiles de vidrio de tal modo que no se puedan voltear y que no tengan contacto con otras piezas durante el ciclo de lavado.

Vidrio: El vidrio opalino puede ponerse amarillo.

Capas antiadherentes: Aplique una ligera capa de aceite vegetal a las superficies antiadherentes después del secado.

Plásticos: Asegúrese que la pieza está apta para ser usada en un lavavajillas.

Acero Inoxidable, Plata de Ley, y Plateado: Para evitar la posible corrosión, coloque las piezas hechas de metales diferentes de tal modo que no tengan contacto una con la otra pieza.

No Recomendado

Acrílico: Puede ocurrir el craquelado (grietas pequeñas en el acrílico).

Piezas unidas por adhesivos: Se pueden aflojar los adhesivos que unen materiales como plástico, madera, hueso, acero, cobre, estaño, etc.

Utensilios con mango de hueso: Se pueden separar los mangos.

Hierro: El hierro se oxida. Lave las piezas de hierro a mano y séquelas de inmediato.

Piezas no diseñadas para lavavajillas: Su lavavajillas está diseñada para limpiar SÓLO trastes y artículos de cocina caseros.

Pewter, Latón, Bronce: El pewter se manchará. lave las piezas de pewter a mano y séquelas de inmediato.

Estaño: El estaño se oxidará. Lave las piezas de hierro a mano y séquelas de inmediato.

Madera: Los tazones de madera, utensilios de madera y piezas con mango de madera pueden agrietarse, doblarse y perder su acabado.

Preparar y Cargar la Vajilla

Preparar la Vajilla

No haga ningún lavado preliminar de los artículos con suciedad pegada ligeramente. Elimine las partículas grandes de alimentos, los huesos, semillas, palillos para los dientes y la grasa excesiva. Tal vez es necesario pretratar (remojar o frotar a mano) las piezas con suciedades pegadas, quemadas o endurecidas.

Cargar el Lavavajillas

Revise la sección Materiales de este manual para asegurarse de que algún artículo en particular se preste a limpiarse en lavavajillas.

Cargue únicamente artículos a prueba del lavavajillas [*dishwasher-safe*] en su lavavajillas. Cargue su vajilla en las rejillas del lavavajillas de tal forma que los interiores de platos, ollas y sartenes encaran los brazos rociadores. Evite amontonar las piezas y los puntos de contacto entre éstas. Separe los artículos hechos de metales diferentes.

Cómo Cargar la Rejilla Superior

Las Ilustraciones 1 y 2 muestran cargas típicas de 10 o 12 personas para la rejilla superior.

NOTA: Asegúrese que los artículos no se salgan del fondo de las rejillas y que bloqueen los brazos rociadores.

CUIDADO

Para evitar daños al lavavajillas, no lo cargue con objetos o materiales tal como productos de

Ilustración 1
Juego de vajilla para 10 personas

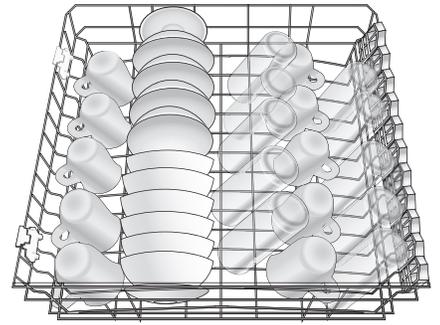


Ilustración 2
Juego de vajilla para 12 personas

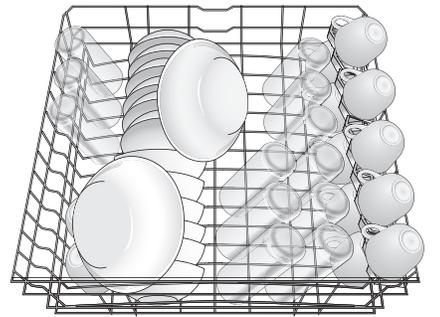


Ilustración 3

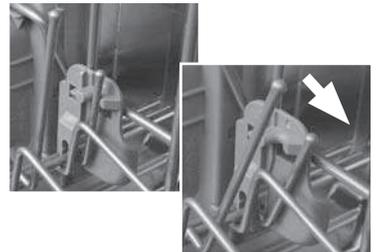


Ilustración 4

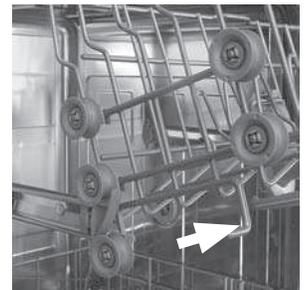


Ilustración 5

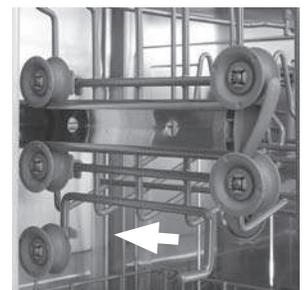


Ilustración 6

Juego de vajilla para 10 personas

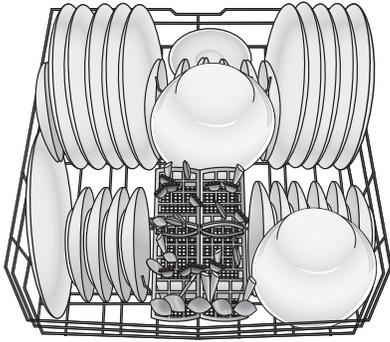


Ilustración 7

Juego de vajilla para 12 personas

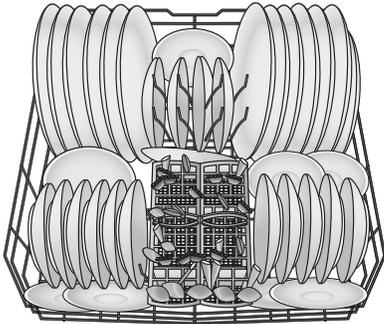


Ilustración 8

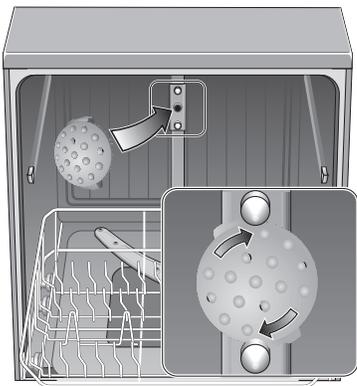


Ilustración 9

No tape la abertura de ventilación.



papel, bolsas de plástico, material de embalaje o cualquier otra cosa que no sea vajilla o utensilio de cocina normales. No cargue ningún artículo en su lavavajillas que no sea vajilla o utensilio de cocina a prueba de lavavajillas.

Accesorios en la rejilla superior

Púas plegables en la rejilla superior

Las púas plegables se doblan hacia abajo para facilitar la carga de las rejillas en ciertas ocasiones. Agarre las púas tal como se muestra en la Ilustración 3 y dóblelas hacia abajo. Cuando la rejilla superior está cargada, empújela hacia adentro del lavavajillas.

NOTA: Cuando reintroduzca la rejilla superior hacia adentro del lavavajillas, empújela hasta que se detenga contra la pared trasera de la tina de tal modo que el brazo rociador de la rejilla superior se conectará al sistema de alimentación de agua.

Ajustar la altura de la rejilla superior

Extraiga la rejilla superior vacía jalándola hacia afuera del lavavajillas hasta que se pueda levantar como se muestra en la Ilustración 4. Jale la rejilla hacia arriba y hacia afuera hasta que los rodillos queden completamente libres de los rieles guías. Vuelva a introducir la rejilla con el otro juego de rodillos en los rieles guías como se muestra en la Ilustración 5.

Cómo Cargar la Rejilla Inferior

Acomode los artículos grandes en la rejilla inferior. Cargue las ollas y cazuelas de modo invertido. Las Ilustraciones 6 y 7 muestran cargas mixtas típicas de la rejilla inferior.

Púas plegables

Las púas plegables se doblan hacia abajo para facilitar la carga de las rejillas en ciertas ocasiones. Agarre las púas y dóblelas hacia abajo.

Cómo Cargar Artículos Extra Altos (sólo algunos modelos)

Si algún artículo está demasiado alto para poder colocarse en la rejilla inferior aún con la rejilla superior en la posición elevada, extraiga la rejilla superior vacía jalándola hacia afuera del lavavajillas hasta que se detenga. Jale hacia arriba y hacia afuera la orilla delantera de la rejilla hasta que los rodillos queden completamente libres de los rieles guías. Guarde la rejilla al lado. Empuje los rieles guías de nuevo hacia adentro del lavavajillas. Encaje el Rociador para Artículos Extra Altos [Extra Tall Item Sprinkler] en la salida de agua para la rejilla superior y dele vuelta al sentido del reloj hasta asentarlo en su posición como muestra la Ilustración 8. Acomode los artículos extra altos en la rejilla inferior como muestra la Ilustración 9.

NOTA: No tape la abertura de ventilación que se encuentra en la pared derecha de la tina acomodando artículos altos (como las tablas de plástico para cortar alimentos y las bandejas para hornear galletas) en el lado izquierdo, el trasero o hacia el centro de la rejilla inferior.

⚠ CUIDADO

Para evitar daños al lavavajillas, no vuelva a instalar la rejilla superior antes de quitar el rociador para artículos extra altos. No trate de reinstalar la rejilla superior mientras el rociador esté todavía instalado.

Para extraer el rociador y restablecer el lavavajillas a su condición normal:

1. Gire el rociador en el sentido contrario del reloj del reloj y sáquelo.
2. Recoja la rejilla superior.
3. Inclíne la orilla delantera de la rejilla superior hacia arriba y acomode los rodillos en los rieles guías.
4. Siga empujando la rejilla superior hacia adentro hasta que todos los rodillos se acomoden en los rieles.
5. Empuje la rejilla superior hacia adentro del lavavajillas.

Cómo Cargar la Canasta para los Cubiertos

NOTA: Las tapaderas de las canastas para los cubiertos se pueden doblar hacia arriba para poder acomodar artículos grandes o los de forma irregular.

Con las tapaderas dobladas hacia abajo, cargue la canasta para los cubiertos según el modelo indicado en las Ilustraciones 10 (para la canasta estándar) y 11 (para la canasta flexible). Acomode los cuchillos con el mango hacia arriba pero los tenedores y cucharas con el mango hacia abajo.

En caso de que tenga que cargar artículos grandes o algunos de forma irregular en la canasta para los cubiertos (con la tapadera hacia arriba), acomódelos de modo que no se aniden y así impidan el efecto de los chorritos de agua. Acomode los cuchillos y otros utensilios filosos con el mango hacia arriba.

⚠ CUIDADO

Las puntas filosas o los filos de cuchillos y otros utensilios filosos pueden causar lesiones graves. Trate de acomodar los cuchillos y otros utensilios filosos con la punta o el filo hacia abajo. No permita que los niños toquen o jueguen cerca de cuchillos y otros utensilios filosos.

La Canasta Estándar para los Cubiertost

Esta canasta cabe en la parte central delantera de la rejilla inferior

La Canasta Flexible para los Cubiertost

Se diseñó esta canasta para uso muy variado. Esta canasta se parte por todo su largo. Se pueden instalar las dos mitades en muchas diferentes posiciones en la rejilla inferior y así ampliar considerablemente su versatilidad para cargarla.

Para Dividir la Canasta Flexible para los Cubiertost:

1. Agarre la canasta como muestra la Ilustración 12A, y deslice los dos lados en direcciones opuestas, tal como muestra la Ilustración 12A.
2. Jale y separe las dos mitades como se ve en la Ilustración 12B.

La Ilustración 13 muestra algunas diferentes maneras de acomodar las dos mitades en la rejilla inferior.

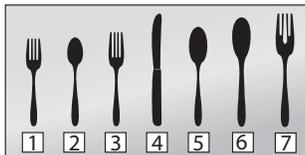
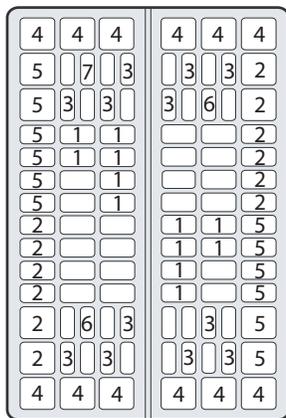
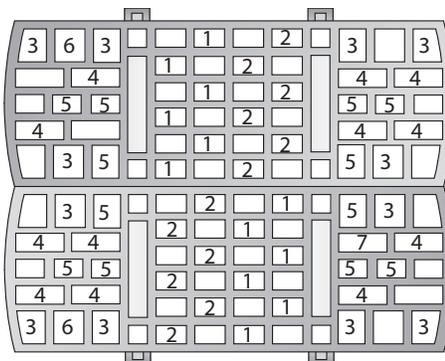


Ilustración 10



Juego de vajilla para 12 personas
(Modelos SHE44C, SHU43C,
SHE43F, SHE43M, SHX43M)

Ilustración 11



Juego de vajilla para 12 personas
(Todos los modelos excepto SHE44C,
SHU43C, SHE43F, SHE43M, SHX43M)

Ilustración 12

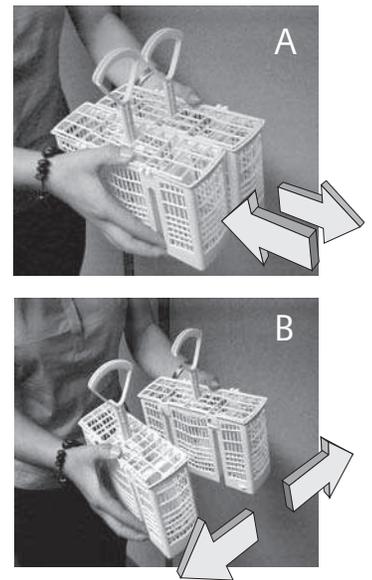


Ilustración 13

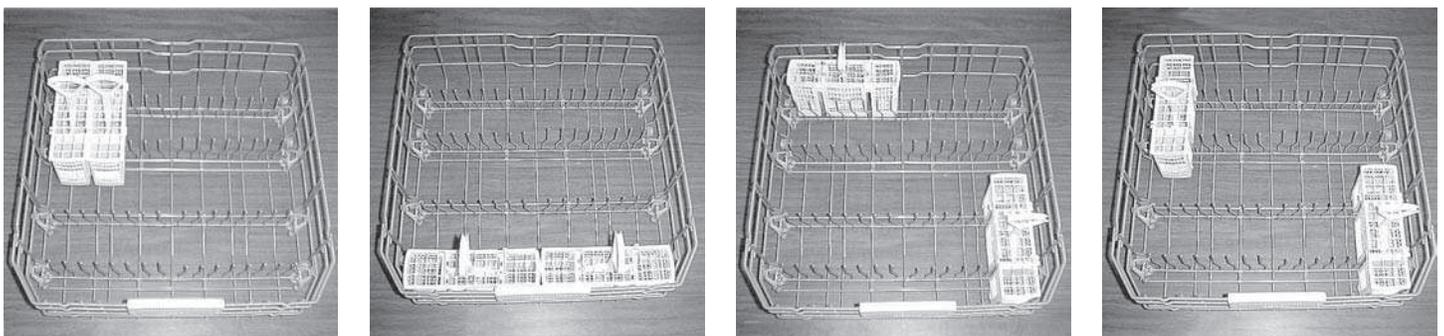
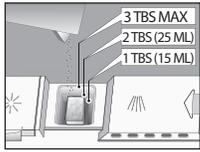


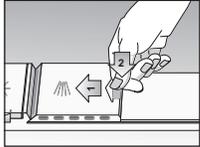
Ilustración 14



Añadir detergente

- Use detergente nuevo en polvo para lograr mejores resultados
- 1 cucharada es suficiente para lavar la mayoría de las cargas
- 3 cucharas máximo, no llene más
- Cuando use tiras de detergente, colóquelas de un modo plano para no tener contacto con la tapa

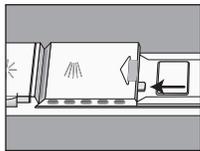
Ilustración 15



Para cerrar

- 1 Deslice la tapa completamente hacia la izquierda
- 2 Empuje firmemente sobre la tapa trasera hasta que escuche el **CLICK**

Ilustración 16



Para abrir la tapa

- Empuje el botón azul hacia adentro (NO HACIA ABAJO)

Ilustración 17

Siempre use agente de enjuague aún cuando su detergente contiene un agente de enjuague



Levante la pestaña para abrir

- Añada agente de enjuague cuando se ilumina la luz en el panel de control o (depende del modelo)
- La luz indicadora de nivel del agente de enjuague en el surtidor cambia a un color plata claro

Ilustración 18



- Para añadir agente de enjuague, échelo sobre la flecha
- Gire la flecha para ajustar la cantidad del agente de enjuague despachado



Disminuya cuando sus vasos salgan rayados
 Incremente cuando sus vasos salgan manchados

Cómo Añadir Detergente y Agente de Enjuague

Detergente

Use únicamente detergentes diseñados específicamente para lavavajillas. Para obtener mejores resultados, use detergentes frescos en polvo para uso en lavavajillas.

CUIDADO

Para evitar daños al lavavajillas, no use productos para lavar la vajilla a mano.

El lavavajillas utiliza menos agua, así que debe usar menos detergente. Con agua blanda, 15 ml (1 cucharada) de detergente limpiará la mayoría de las cargas. La copa para detergente en el surtidor tiene rayas que miden la cantidad de detergente cada 15 y 25 ml (1 y 1.75 cucharas). 45 ml (3 cucharas) de detergente llena la copa totalmente.

CUIDADO

Para no dañar la vajilla, no use demasiado detergente si el agua en su casa es blanda. Demasiado detergente en agua muy blanda puede rayar la cristalería.

NOTA: Si usted no sabe si el agua es blanda o dura, empiece con 15 ml de detergente. Aumente la cantidad de detergente, si es necesario, hasta la cantidad mínima que se necesita para realizar la limpieza de su vajilla y los utensilios de cocina.

Guíese por las rayas de medición en la copa para detergente en el surtidor para echar la cantidad adecuada de detergente recomendada en la Tabla 1.

Tabla 1 - Recommended Detergent Amount				
		Tipo de Agua		
Ciclo de Lavado	Unidad	Dura	Media	Blanda
Fregado Extra Fuerte/ Auto Plus	ml	45	45	25-45
	Cuch.	3	3	1.75 a 3
Lavado Automático	ml	25-45	25	15-25
	Cuch.	1.75 a 3	1.75	1 a 1.75
Lavado Regular	ml	25-45	25	15-25
	Cuch.	1.75 a 3	1.75	1 a 1.75
Delicado/Económico	ml	25	15-25	15
	Cuch.	1.75	1 to 1.75	1
Lavado Rápido	ml	25	15-25	15
	Cuch.	1.75	1 to 1.75	1
Enjuagar Retener		Nada	Nada	Nada

Cómo Llenar el Surtidor de Detergente

Llene la copa para el detergente como recomienda la Tabla 1. (Vea la Ilustración 14 para información adicional.)

Para cerrar, deslice la tapa del surtidor de detergente en la dirección indicada en la Ilustración 15 y presiónela firmemente hasta que la tapa cierre a presión.

Para abrir la tapa del surtidor de detergente, presione la pestaña azul en la dirección indicada en la Ilustración 16. Si presiona sobre la pestaña, no se abrirá la tapa.

Agentes de Enjuague

Para lograr un secado apropiado, siempre use un agente de enjuague líquido, aún si su detergente también contiene algún agente de enjuague o aditivo para secado.

Surtidor de Agente de Enjuague

Abra el surtidor del agente de enjuague levantando la pestaña con su pulgar como se muestra en la Ilustración 17.

NOTA: El lavavajillas indica la falta del agente de enjuague por medio del símbolo * en el visualizador de tiempo restante.

Llene el surtidor con agente de enjuague en forma líquida como muestra la Ilustración 18 hasta que el tanque quede lleno. Limpie cualquier exceso de agente de enjuague que se haya derramado.

NOTA: Después de llenar el dispensador del agente de enjuague, el indicador saldrá en algunos minutos después de que se cierre la puerta del lavavajillas (sólo algunos modelos).

Cómo Funciona el Lavavajillas

Siempre asegúrese que su vajilla esté a prueba de lavavajillas. Consulte la sección sobre materiales de las vajillas en este manual como guía.

Ciclos de Lavado

Fregado Extra Fuerte

Limpia vajillas con restos alimenticios endurecidos por el horno o muy pegados. Puede ser necesario remojar o restregar estos trastes a mano.

Lavado Regular

El ciclo regular limpia a fondo cargas grandes con suciedad ordinaria pegada ligeramente.

Delicado/Económico

Para lavar la vajilla, cristalería o los cubiertos delicados o de gran valor, u otros artículos especiales. Asegúrese siempre que los artículos estén a prueba de lavavajillas. Consulte la sección de Materiales en este manual para más información. Puede que el mejor tratamiento sea lavar estos artículos a mano.

Lavado Rápido

Para vajillas ligeramente sucias con restos alimenticios que son fáciles de remover.

Enjuagar y Retener

Le permite enjuagar los restos alimenticios de una carga parcial de vajillas y retener o guardarlos en el lavavajillas hasta que se llene éste.

Lavado Automático

Los sensores en el lavavajillas ajustan automáticamente la longitud del ciclo, la temperatura y los cambios de agua basado en la carga de suciedades. Este ciclo contiene decisiones adicionales del sensor comparado con otros ciclos.

Más información sobre los ciclos del lavavajillas se encuentra en la sección de Información de los Ciclos de Lavado en este manual.

Opciones de los Ciclos de Lavado

Media Carga

En los ciclos de lavado Power Scrub Plus (Fregado Extra Fuerte), Normal y Lavado Automático, usted puede reducir el consumo de energía y de agua cuando lava cargas pequeñas, ligeramente sucias que llenan aproximadamente mitad de la capacidad del lavavajillas. Para activarlo, seleccione el botón Media Carga (Half Load) además del botón de ciclo de lavado para Power Scrub Plus (Fregado Extra Fuerte), Normal y Lavado Automático.

Solamente la Rejilla Superior

Esta opción le permite ahorrar energía y agua al lavar cargas pequeñas para llenar solamente la rejilla superior. Para activarlo, seleccione el botón Top Rack Only (Solamente la Rejilla Superior) además de un ciclo de lavado. Cuando usa la opción Solamente la Rejilla Superior, se deben poner los trastes solamente en la rejilla superior.

Calor Extra Secante

Con esta opción usted puede subir la temperatura del agua de enjuague y aumentar el tiempo de secado lo cual producirá un secado mejor.

Para activarlo:

- Presionar y sostener el botón izquierdo "Cancelar Drenaje" (Cancel Drain), entonces presionar y sostener el botón On/Off.

	Ciclos de Lavado					
	Fregado Extra Fuerte	Lavado Regular	Delicado/Económico	Lavado Rápido	Enjuagar y Retener	Lavado Automático
SHE46C	X	X			X	X
SHE44C	X	X		X	X	
SHU43C	X	X		X	X	
SHE56C	X	X		X	X	X
SHE47C	X	X		X		X
SHX46L	X	X	X	X		
SHX43E	X	X	X		X	
SHX46A	X	X	X		X	
SHV46C	X	X	X		X	
SHE45C	X	X		X	X	
SHX45C	X	X	X		X	
SHE43M	X	X		X		X
SHX43M	X	X		X		X
SHE45M	X	X		X		X
SHV45M	X	X		X		X
SHX45M	X	X		X		X
SHE55M	X	X	X	X		X
SHE43F	X	X		X	X	

	Opciones de Ciclos de Lavado					
	Sólo Rejilla Superior o Media Carga	Calor Extra Secante	Retardar Puesta en	Señal de Terminación del Ciclo	OPTIDRY™	ECO
SHE46C	X	X	19h		X	
SHE44C		X			X	
SHU43C		X				
SHE56C		X	19h		X	
SHE47C	X	X	24h		X	
SHX46L	X	X	19h	X	X	
SHX43E				X		
SHX46A	X			X		
SHV46C	X			X		
SHE45C		X			X	
SHX45C	X			X		
SHE43M			19h			
SHX43M			19h	X		
SHE45M	X	X	19h		X	
SHV45M	X	X	19h	X		
SHX45M	X	X	19h	X	X	
SHE55M	X	X	19h		X	X
SHE43F		X				

- Cuando el visualizador LED indica un "00" o un "01" suelte ambos botones.
- Para activar el calor de secado adicional, pulse el botón izquierdo "Cancelar Drenaje" (Cancel Drain) hasta que el visualizador LED indique un "01".
- Para desactivar el calor de secado adicional, pulse el botón izquierdo "Cancelar Drenaje" (Cancel Drain) hasta que el visualizador LED indique un "00".
- Pulse el botón On/Off para guardar la configuración.

Retardar la Puesta en Marcha

Esta opción le permite retardar el tiempo de la puesta en marcha para su lavavajillas.

Para activarla:

- Prenda el lavavajillas.
- Seleccione el ciclo de lavado deseado.
- Pulse el botón Retardar la Puesta en Marcha (Delay Start) hasta que el visualizador indique el tiempo de retardo deseado.

La señal de terminación del ciclo

Esta señal de terminación del ciclo es un tono que suena cuando su lavavajillas ha terminado el lavado y el secado de sus trastes. Usted puede deshabilitar el tono o ajustar el volumen.

Para activarla::

- Mantenga pulsado el botón derecho de "Cancelar Drenaje" (Cancel Drain), luego mantenga pulsado el botón On/Off.
- Cuando se ilumina la luz en el botón "Cancelar Drenaje" que usted está pulsando y el tono comienza a escucharse, suelte ambos botones.
- Pulse el botón derecho de "Cancelar Drenaje" hasta que el tono esté en el volumen deseado o hasta que se apague.
- Pulse el botón On/Off. Ahora usted ajustó la señal de terminación del ciclo.

OPTIDRY™

Esta opción registra cuando falta agente de enjuague en el lavavajillas y automáticamente incrementa el tiempo de secado. Para un mejor resultado, siempre use un agente de enjuague líquido, aún cuando su detergente contiene un aditivo de secado.

Cómo Poner en Marcha a el Lavavajillas

Para poner en marcha el lavavajillas, siga las instrucciones en las **Ilustraciones 19 y 20**, dependiendo del lugar de control.

Cómo Interrumpir un Ciclo

NOTA: En caso que usted necesite interrumpir un ciclo (tal como para cargar o sacar algún artículo, para añadir detergente, etc.), es preferible que lo haga dentro de los primeros 30 minutos del ciclo.

Controles delanteros expuestos (Vea la Ilustración 19)

1. Pulse el botón On/Off (Prender/Apagar) para apagar la unidad.
2. Espere por lo menos diez segundos o hasta que cese el ruido del agua antes de abrir la puerta del lavavajillas.
3. Para reanudar el ciclo, cierre la puerta del lavavajillas y luego pulse el botón On/Off (Prender/Apagar).

Controles superiores ocultos (Vea la Ilustración 20)

1. Abra la puerta del lavavajillas suficientemente para exponer el panel de control.
2. Pulse el botón On/Off (Prender/Apagar) para apagar la unidad.
3. Espere por lo menos diez segundos o hasta que cese el ruido del agua antes de abrir la puerta del lavavajillas.
4. Para reanudar el ciclo, pulse el botón On/Off (Prender/Apagar) y cierre la puerta del lavavajillas.

Ilustración 19
Controles delanteros expuestos

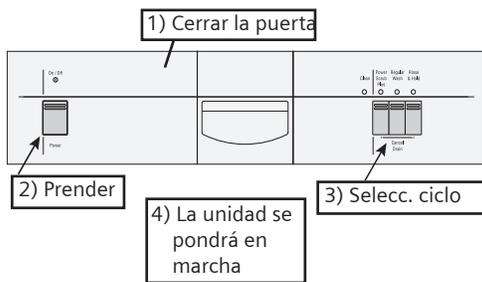
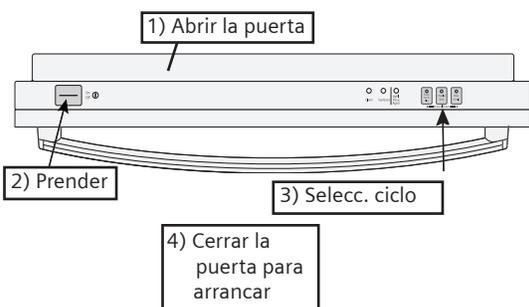


Ilustración 20
Controles superiores ocultos



⚠️ ADVERTENCIA

Usted podría sufrir quemaduras graves por agua caliente que salpica del lavavajillas. **ABRA LA PUERTA CUIDADOSAMENTE** durante cualquier ciclo de lavado o de enjuague. Espere hasta que cese el ruido del agua antes de abrir la puerta completamente.

Espere por lo menos diez segundos o hasta que cese el ruido del agua antes de abrir la puerta del lavavajillas. (Prender/Apagar) y cierre la puerta del lavavajillas.

Cómo Cancelar o Cambiar un Ciclo

Para cancelar o cambiar un ciclo, abra la puerta del lavavajillas suficientemente para exponer los botones de control luego pulse y oprima los dos botones rotulados "Cancel Drain" (Cancelar Evacuar) por tres segundos, como muestra la Ilustración 21.

Cierre la puerta y espere hasta que el lavavajillas termine el ciclo (aproximadamente un minuto). Abra la puerta y pulse el botón "On/Off" (Prender/Apagar).

Ahora usted puede poner otro ciclo en marcha.

Cerrojo de seguridad para niños (algunos modelos) Su lavavajillas viene equipado desde la fábrica con el cerrojo de seguridad para niños desconectado y en el modo normal de operación. Jale la agarradera de la puerta para abrir la puerta. La palanca de activación del cerrojo de seguridad para niños se encuentra en el hueco para la agarradera de la puerta. Usted debe mirar hacia arriba en el hueco para encontrar la palanca de activación del cerrojo de seguridad para niños (vea la Ilustración 22).

Para activar el cerrojo de seguridad para niños inserte un palillo u otro objeto no metálico en la abertura como se muestra en la Ilustración 22. Se libera la palanca de activación y se mueve hacia la izquierda.

Usted ahora ha activado el cerrojo de seguridad para niños. Cada vez que abre la puerta del lavavajillas usted deberá **deslizar la palanca de activación hacia la derecha** para liberar el mecanismo de bloqueo de la puerta para poder abrir luego la puerta (vea la Ilustración 23). Después de abrir la puerta, usted debería soltar la palanca de activación del cerrojo de seguridad para niños y dejar que se deslice nuevamente hacia la izquierda.

Para desactivar el cerrojo de seguridad para niños inserte un palillo u otro objeto no metálico en la abertura como se muestra en la Ilustración 24. Mueva la palanca de activación hacia la derecha y manténgala en su posición, ahora quite el palillo (o cerillo) y suelte la palanca. Ahora se ha desactivado la opción y usted puede abrir la puerta jalando la agarradera.

Bloqueo para protección de niños (algunos modelos) La opción del bloqueo para protección de niños le permite deshabilitar el panel de control de la lavavajillas para evitar que se prenda accidentalmente. Para activar esta opción, mantenga presionado el botón rotulado "Child Lock" (Bloqueo para protección de niños) durante 4 segundos y se iluminará la luz indicadora "Child lock". Para desactivar esta opción, mantenga presionado el botón rotulado "Child Lock" (Bloqueo para protección de niños) durante 4 segundos.

Cómo Secar la Vajilla

Cuando termina el ciclo, el lavavajillas deja de funcionar y empieza un período de secado por condensación. Después del secado, el ciclo ha terminado y:

- se iluminará la luz "Limpio" (Clean) (algunos modelos).
- se escuchará la señal de terminación del ciclo (algunos modelos).
- la luz indicadora "Desinfectado" ("Sanitized") puede aparecer. Vea la sección sobre desinfección para más información.
- el visualizador de tiempo restante indicará "0" (algunos modelos).

NOTA: Si el suministro de agua en su casa está muy caliente, se puede reducir el tiempo de calentamiento de su lavavajillas y es posible que no se ilumine la luz indicadora de "Desinfectado". El Manual de Instalación de su lavavajillas contiene información acerca de la temperatura recomendada para el suministro de agua caliente en su hogar.

NOTA: Para acelerar y mejorar el secado, abra la puerta del lavavajillas, jale la rejilla superior sólo lo suficiente como para mantener la puerta abierta.

Indicador "Desinfectado" (Sanitized)

Cuando se ilumina el indicador de "Desinfectado" [Sanitized] , esto significa que las vajillas y ollas que se acaban de lavar, han sido desinfectadas conforme a las normas de la Fundación Nacional de Salubridad (National Sanitation Foundation (NSF)). Para averiguar más información acerca de la certificación NSF, consulte la sección Información Acerca de los Ciclos de Lavado de este manual.

Cómo Descargar el Lavavajillas

Descargue primero la rejilla inferior..

Descargue las canastas para los cubiertos. Se pueden sacar sin esfuerzo para facilitar la descarga de lo demás.

Ilustración 21

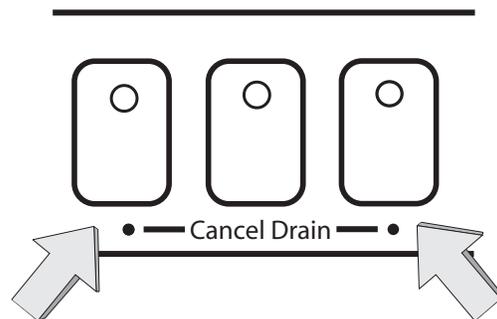


Ilustración 22

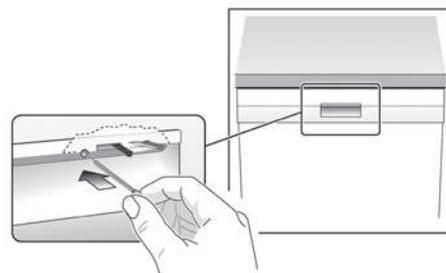


Ilustración 23

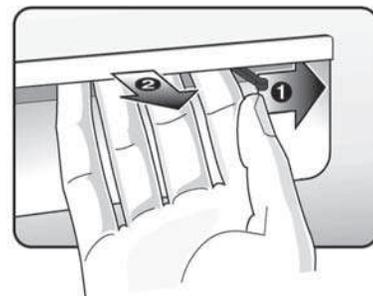


Ilustración 24

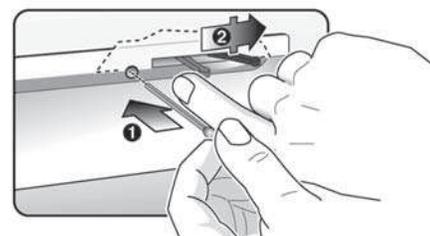


Ilustración 25

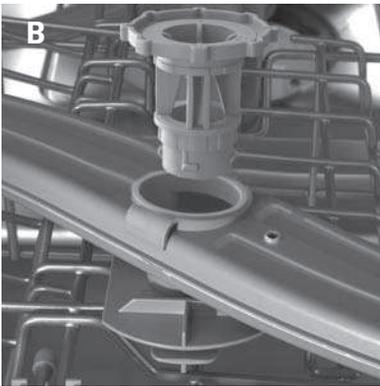
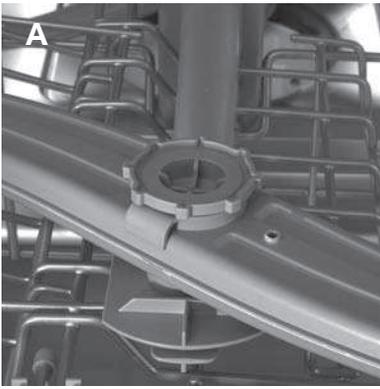


Ilustración 26

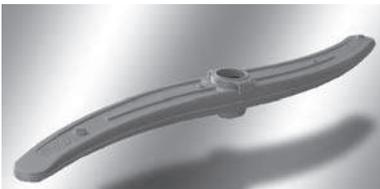
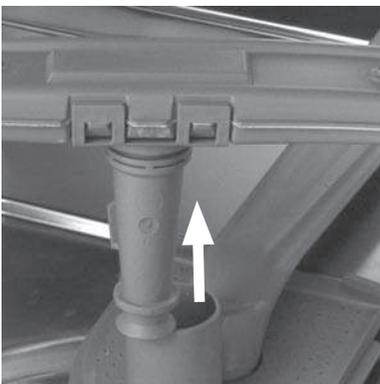


Ilustración 27



Descargue la rejilla superior.

Si instaló el Rociador para los Artículos Extra Altos, restablezca el lavavajillas a su condición normal (consulte las instrucciones de Como Cargar Artículos Extra Altos en la sección “Cómo Cargar la Lavavajillas” de este manual).

Cuidado y Mantenimiento

Tareas de Mantenimiento

Algunas partes de su lavavajillas requieren que se mantengan periódicamente. Las tareas de mantenimiento se realizan fácilmente y le aseguran un desempeño superior continuo de su lavavajillas. Estas tareas incluyen:

- Preparar su lavavajillas para el invierno
- Secar derrames de agua
- Limpiar la cara interior de la puerta y de la tina, fabricadas de acero inoxidable
- Revisar/limpiar las boquillas de los brazos rociadores
- Revisar/limpiar el sistema de filtración
- Limpiar la cara exterior de la puerta
- Limpiar el sello de la puerta

Cómo Preparar su Lavavajillas para el Invierno

En caso de que su lavavajillas quedara sin usarse durante un período largo en un lugar expuesto a temperaturas glaciales (por ejemplo en su casa de campo o en su hogar durante un viaje), usted debería solicitar ayuda de un centro de servicio autorizado para preparar su lavavajillas para el invierno.

CUIDADO

Para evitar daños al lavavajillas, no permita que permanezca agua en los sistemas de alimentación o drenaje del lavavajillas durante períodos largos de temperaturas congelantes. Las temperaturas glaciales pueden dañar su lavavajillas

Secar Derrames de Agua

Ocasionalmente, agua se derrama o salpica de su lavavajillas, particularmente cuando se abre la puerta y se interrumpe un ciclo de operación. Seque inmediatamente el agua que salpica de su lavavajillas.

Revisar/Limpiar la Cara Interior de la Puerta y de la Tina Hechas de Acero Inoxidable

Limpe las orillas del panel interior habitualmente para eliminar desechos que se acumulan durante el proceso de cargar la vajilla.

Cuando se forman manchas en la tina o en el panel interior de la puerta, llene el tanque de agente de enjuague.

Revisar/Limpiar las Boquillas de los Brazos Rociadores

De vez en cuando examine los brazos rociadores para verificar que las boquillas rociadoras (orificios) no estén tapadas.

Extraer el brazo rociador superior:

1. Saque del lavavajillas la rejilla superior vacía.
2. Invierta la rejilla.
El brazo rociador superior está sujetado con una contratuerca como muestra la Ilustración 25A. Dele a la tuerca 1/8 de la vuelta al sentido contrario del reloj y quítela, como muestra la Ilustración 25B, para soltar el brazo rociador.
3. Desprenda el brazo rociador como muestra la Ilustración 26.
4. Revise que las boquillas rociadoras no estén obstruidas.
5. Si se necesita destapar las boquillas, límpielas bajo un chorro de agua.

Reinstalar el brazo rociador superior:

1. Reacomode el brazo rociador en su posición como instalado.

2. Regrese la contratuerca en su posición como instalada y dele 1/8 de la vuelta al sentido del reloj.
3. Reacomode los rodillos de la rejilla superior en los rieles guías.

Extraer el brazo rociador inferior:

1. Saque de la tina del lavavajillas la rejilla inferior vacía.
2. Agarre y jale hacia arriba el brazo rociador inferior como muestra la Ilustración 27.
3. Revise que las boquillas rociadoras no estén obstruidas.
4. Si se necesita destapar las boquillas, límpielas bajo un chorro de agua.

Reinstalar el brazo rociador inferior:

1. Reacomode el brazo rociador inferior en su posición como instalado y oprímelo hasta que se encaje repentinamente.
2. Reacomode la rejilla inferior en su posición como instalado.

Revisar/Limpiar el Sistema de Filtración

Su lavavajillas cuenta con un sistema de filtración que se compone de una trampa para objetos grandes/conjunto de filtro cilíndrico y de un filtro fino. Algunos modelos selectos tienen un micro filtro adicional. El sistema de filtración se instaló en el piso del lavavajillas debajo de la rejilla inferior para facilitar el acceso.

Normalmente el sistema de filtración se limpia a sí mismo, sin embargo, de vez en cuando usted debería revisarlo para eliminar objetos ajenos y limpiarlo cuando sea necesario.

⚠ CUIDADO

Para evitar lesiones, no meta los dedos en la trampa para objetos grandes. La trampa para objetos grandes podría contener objetos filosos.

Su lavavajillas cuenta con un sistema de filtración que se compone de una trampa para objetos grandes/conjunto de filtro cilíndrico y de un filtro fino. El sistema de filtración se instaló en el piso del lavavajillas debajo de la rejilla inferior para facilitar el acceso.

Normalmente el sistema de filtración se limpia a sí mismo, sin embargo, de vez en cuando usted debería revisarlo para eliminar objetos ajenos y limpiarlo cuando sea necesario.

Para quitar la trampa para objetos grandes/conjunto de filtro cilíndrico:

1. Saque la rejilla inferior.
2. Agarre el conjunto como se muestra en la Ilustración 28 y gírelo 1/4 de vuelta en sentido contrario del reloj.
3. Jale el conjunto hacía arriba como se muestra en la Ilustración 29.
4. Examine cuidadosamente el conjunto. Si nota desechos en la trampa para objetos grandes, voltéela y dele un golpe ligero en alguna superficie tal como una mesa para desalojar y eliminar los desechos. Limpie el filtro cilíndrico bajo un chorro de agua.

Para quitar el filtro fino:

1. Levante el filtro fino para quitarlo del piso del lavavajillas como se muestra en la Ilustración 30 y límpielo bajo un chorro de agua.

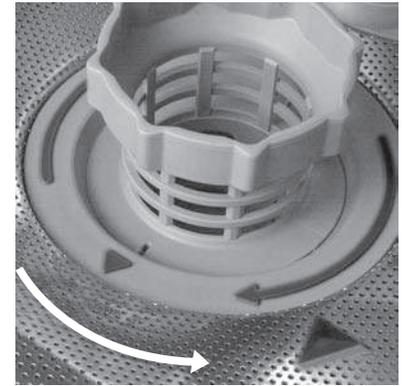
Para reinstalar el sistema de filtración:

1. Reacomode el filtro fino en su posición instalada.
2. Acomode la trampa para objetos grandes/conjunto de filtro cilíndrico en su posición instalada en el piso del lavavajillas.
3. Dele un 1/4 de la vuelta en el sentido del reloj a la agarradera de anillo hasta que enganche. La flecha en la agarradera de anillo y la flecha en el filtro fino deben apuntarse una a la otra, como se muestra el círculo en la Ilustración 31.
4. Delicadamente jale la agarradera para verificar que el conjunto está instalado correctamente.

CUIDADO

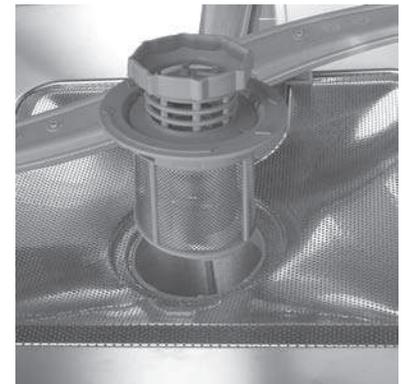
Para evitar posibles daños al lavavajillas, no use químicos cáusticos, limpiadores abrasivos, estropajos (sean de metal o de plástico), toallas abrasivas de tela o de papel para limpiar el panel exterior de la puerta de su lavavajillas. De otro modo se puede dañar el panel exterior de la puerta del lavavajillas.

Ilustración 28



Para abrir – gire en sentido contrario de las manecillas de reloj.

Ilustración 29

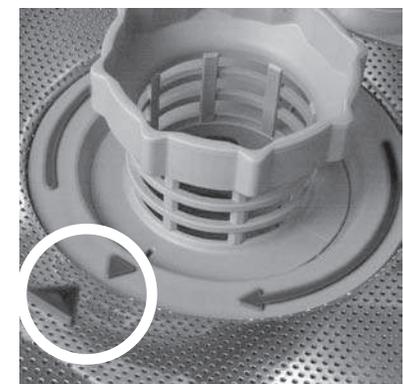


La trampa para objetos grandes/filtro cilíndrico

Ilustración 30



Ilustración 31



Para cerrar gire en sentido de las manecillas del reloj.

Limpiar la Cara Exterior de la Puerta

Puertas Pintadas

Use únicamente un paño suave ligeramente humedecido con agua enjabonada.

Puertas de Acero Inoxidable

Use un paño suave con un limpiador no abrasivo (preferiblemente en forma líquida suministrado a través de un atomizador) fabricado especialmente para limpiar el acero inoxidable. Para realizar los mejores resultados, primero moje el paño con el limpiador de acero inoxidable para después pasarlo por la superficie.

Limpiar el Empaque y el Sello de la Puerta

Limpie habitualmente el empaque de la puerta con un paño mojado para eliminar las partículas de alimentos y los otros desechos que se le hayan pegado. Limpie también el sello de la puerta que se encuentra adentro del lavavajillas en la parte inferior de la puerta.

Información del ciclo de lavado

NOTA: Para ahorrar energía, este lavavajillas viene con un “Control Inteligente” [Smart Control], que automáticamente ajusta el ciclo basado en las cargas de suciedades y la temperatura del agua que entra. El “Control Inteligente” toma decisiones que pueden causar que en ciertos momentos se ajuste el tiempo del ciclo y el uso de agua, para luego cambiar repentinamente a mitad del ciclo. Los tiempos de ciclos listados en el Manual de Uso y Cuidado se basan en cargas de suciedades normales y una temperatura del agua entrante de 120°F (49°C) y varían dependiendo de sus condiciones reales.

NOTA: Cuando se agota el agente de enjuague, la opción **OPTIDRY™** extenderá el ciclo automáticamente por aproximadamente 10 minutos.

NOTA: Cuando seleccione el calor secante adicional, el ciclo se extiende por aproximadamente 20 minutos.

NOTA: Cuando seleccione Premojar, el ciclo se extiende por aproximadamente 5-10 minutos.



EL SÍMBOLO DE NSF

Un lavavajillas o un ciclo del lavavajillas que exhibe el símbolo NSF ha sido certificado por la Fundación Nacional de Salubridad (NSF por sus siglas en inglés) por haber cumplido con los requisitos muy rigurosos del tiempo de lavado y de la temperatura del agua para desinfectar la vajilla y los utensilios de cocina. Estos requisitos se explican en el documento referente a lavavajillas para uso residencial ANSI/NSF 184, “Residential Dishwashers”. Averigüe más información acerca de la Certificación NSF en el sitio web: <http://www.nsfconsumer.org/home/appliances/asp>.

Su lavavajillas está certificado por la NSF. La tabla arriba muestra los ciclos del lavavajillas que están certificados por la NSF. Cuando terminan estos ciclos, el indicador “Sanitized” (Desinfectado) brilla en el panel de control.

NOTA: Si el agua alimentada por su casa está excesivamente caliente, se podría reducir el tiempo del calentamiento que realiza el lavavajillas y tal vez no se enciende el símbolo o la luz “Sanitized”. El Manual de Instalación para su Lavavajillas contiene información acerca de la temperatura recomendada del agua suministrada por el sistema en su hogar.

Información del ciclo de lavado

(Models SHE43M, SHE43F, SHX43M, SHE45M, SHV45M, SHX45M, SHE55M)

		 Récirage plus	 Lavado Automático	Lavado Regular	 Delicado/Económico	Lavado Rapido	Remojar y Reterner
	Duración (en minutos)	135	105-125	119	80	30	9
Consumo de Agua en galones	Mínimo	6.1	4.5	2.4	3.5	3.5	1.2
	Máximo	7.2	7.0	5.9	3.5	3.5	1.2
Consumo de Agua en litros	Mínimo	23.2	17	8.9	13.1	13.1	4.7
	Máximo	27.4	26.4	22.5	13.1	13.1	4.7
Temp del Agua de Lavado °F		<u>160°</u>	<u>130-150°</u>	<u>131°</u>	<u>122°</u>	<u>113°</u>	<u>Al Entrar</u>
Temp del Agua del Enjuague °F		<u>156°</u>	<u>156°</u>	<u>156°</u>	<u>156°</u>	<u>122°</u>	<u>Al Entrar</u>

Información del ciclo de lavado

(Models SHE44C, SHE46C, SHE47C, SHE56C, SHU43, SHX46A, SHX46L, SHX43E, SHV46C)

		 Récirage plus	 Lavado Automático	Lavado Regular	 Delicado/Económico	Lavado Rapido	Remojar y Reterner
	Duración (en minutos)	135	105-120	119	80	39	9
Consumo de Agua en galones	Mínimo	6.1	2.8	2.8	3.5	3.5	1.2
	Máximo	7.2	5.9	5.9	3.5	3.5	1.2
Consumo de Agua en litros	Mínimo	23.2	10.4	10.4	13.1	13.1	4.7
	Máximo	27.4	22.5	22.5	13.1	13.1	4.7
Temp del Agua de Lavado °F		<u>160°</u>	<u>130-150°</u>	<u>131°</u>	<u>122°</u>	<u>104°</u>	<u>Al Entrar</u>
Temp del Agua del Enjuague °F		<u>156°</u>	<u>156°</u>	<u>156°</u>	<u>156°</u>	<u>140°</u>	<u>Al Entrar</u>

Autoayuda

A veces los lavavajillas exhiben problemas que no tienen nada que ver con el funcionamiento de la máquina en sí. La información a continuación le podría ayudar a resolver algún problema sin tener que acudir a un técnico de reparaciones.

La vajilla no se seca

El surtidor de agente de enjuague podría estar vacío. Revíselo y llénelo de nuevo si es necesario. El secado de la vajilla puede acelerarse y mejorarse si abre la puerta del lavavajillas un poquito y si la deja abierta sacando un poco la rejilla superior.

Las luces indicadoras no se encienden

Pudo haberse fundido un fusible o un cortacircuitos pudo haber interrumpido la corriente. Revise los fusibles o los cortacircuitos de su habitación en la caja de fusibles/cortacircuitos y cambie el fusible o restablezca el interruptor si es necesario.

La lavavajillas no se pone en marcha

Tal vez no cerró bien la puerta del lavavajillas. Revise que la puerta del lavavajillas esté bien cerrada y trancada.

El ciclo dura demasiado tiempo en terminarse

Cuando el lavavajillas termina el ciclo de lavado pero el tiempo de funcionamiento parece demasiado largo, esto podría ser debido a que el agua alimentada está muy fría. Antes de poner en marcha al lavavajillas, abra la llave de agua caliente en la pila o lavabo más cerca del lavavajillas. Deje la llave abierta hasta que el agua corra caliente. Entonces cierre la llave y ponga el lavavajillas en marcha.

El ciclo de lavado no avanza al de enjuague

NOTA: El Manual de Instalación que acompaña a su lavavajillas le ayudará con las instrucciones siguientes: El conducto de alimentación de agua podría estar cerrado. Revise la válvula de la fuente de agua y ábrala si está cerrada.

Manchas blancas que quedan en la vajilla

Se necesita más agente de enjuague. Consulte la sección Como Añadir Detergente y Agente de Enjuague de este manual para averiguar las instrucciones de como aumentar la cantidad de agente de enjuague que surte el lavavajillas.

El agua no se evacúa del lavavajillas

Revise que la manguera de desagüe no esté torcida, obstruida o instalada incorrectamente. Asegúrese de que una porción de la manguera de desagüe esté por lo menos a 20" (50 cm.) arriba del piso del gabinete del lavavajillas (véase el Manual de Instalación). Los filtros podrían estar obstruidos. Asegúrese de que el sistema de filtración no esté tapado (véase la sección Cuidado y Mantenimiento de este manual). El desagüe de la pila en la cocina podría estar tapado. Usted podría tener que acudir a un plomero más bien que a un técnico de reparaciones de lavavajillas. Si se instaló un dispositivo con intervalo de aire [*air gap*] en la pila, éste podría estar tapado.

La tapa del surtidor de detergente no se cierra

Usted podría estar tratando de cerrar incorrectamente la tapa del surtidor, o tal vez no se terminó algún ciclo que entonces usted tendrá que cancelar. Consulte la sección Como Añadir Detergente y Agente de Enjuague de este manual para averiguar las instrucciones de cómo cerrar la tapa. Consulte la sección Cómo Funciona la Lavavajillas de este manual para averiguar cómo se cancela un ciclo.

Hay rayas en los artículos de cristal

Se está aplicando demasiado agente de enjuague. Consulte la sección Como Añadir Detergente y Agente de Enjuague de este manual para averiguar las instrucciones de como disminuir la cantidad de agente de enjuague que surte el lavavajillas.

Ruido matraqueo

Los utensilios no están acomodados correctamente.

Espuma en el lavavajillas

Tal vez usted utilizó un tipo de detergente incorrecto. Use únicamente los detergentes fabricados especialmente para uso en lavavajillas automáticas.

El lavado resulta insatisfactorio

- Cantidad incorrecta de detergente.
- Los utensilios están arreglados de modo incorrecto o la rejilla está sobrecargado.
- Algún utensilio impide la rotación del brazo rociador.
- Las boquillas de los brazos rociadores necesitan limpiarse.
- Los filtros están instalados incorrectamente.
- Se seleccionó un ciclo inadecuado.

Declaratoria de Garantía Limitada del Producto Lavavajillas Bosch

Lo que esta garantía cubre y para quiénes aplica: Las garantías ofrecidas por BSH Home Appliances ("Bosch") en esta Declaratoria de Garantía Limitada aplican sólo a los lavavajillas Bosch ("Producto") que usted compró, el primer usuario comprador, siempre y cuando el Producto fue adquirido (1) para su uso casero normal (no comercial) y que en realidad ha sido utilizado siempre para propósitos domésticos normales; (2) nuevo en la tienda (no un equipo de exhibición, "tal como es", o un modelo previamente devuelto) y no para la reventa o uso comercial; y (3) en los Estados Unidos o Canadá y que siempre ha permanecido en el país de la compra original. Las garantías declaradas aquí aplican sólo al primer usuario comprador del Producto y no se pueden transferir.

- Asegúrese por favor de devolver su tarjeta de registro; aunque no es necesario para efectuar la cobertura de la garantía, es la mejor manera para Bosch de notificarle a usted en el caso poco probable de un aviso de seguridad o una devolución del producto.

Duración de la garantía: Bosch garantiza que el Producto está libre de defectos en materiales y mano de obra por un período de trescientos sesenta y cinco (365) días (i.e. 1 año) a partir de la fecha de compra. El tiempo mencionado arriba comienza a ejecutarse a partir de la fecha de compra y no se puede detener, estar sujeto a derechos, extender o suspender por ningún motivo. En esta cobertura básica se incluyen los costos de la mano de obra y del envío.

Garantía limitada extendida: Bosch otorga además estas garantías limitadas adicionales:

- **Garantía Limitada de 2 años:** Bosch reparará o reemplazará cualquier componente que resulte defectuoso en materiales o fabricación (excluye la mano de obra).
- **Garantía Limitada de 5 años sobre partes electrónicas:** Bosch reparará o reemplazará cualquier microprocesador Bosch o tarjeta de circuito impreso si resulta defectuoso en materiales o fabricación (excluye la mano de obra).
- **Garantía Limitada de 5 años sobre las rejillas:** Bosch reemplazará la rejilla superior o inferior (excluye componentes de las rejillas), si la rejilla resulta defectuosa en materiales o fabricación (excluye la mano de obra).
- **Garantía de por vida contra la oxidación del acero inoxidable:** Bosch reemplazará su lavavajillas con el mismo modelo o con un modelo más nuevo que es sustancialmente igual o mejor en funcionalidad, si la camisa interior llega a oxidarse (excluye la mano de obra). Bosch reemplazará la puerta de acero inoxidable en caso de oxidarse (excluye la mano de obra).

El tiempo mencionado arriba comienza a ejecutarse a partir de la fecha de compra y no se puede detener, estar sujeto a derechos, extender o suspender por ningún motivo.

Reparación/Reemplazo como su único remedio: Durante el período de garantía, Bosch o uno de sus centros de servicio autorizados va a reparar su Producto sin costo alguno para usted (sujeto a ciertas limitaciones mencionadas aquí), si su Producto resulta defectuoso en materiales y fabricación. Si se hicieron intentos razonables para reparar el Producto sin éxito, entonces Bosch va a reemplazar su Producto (modelos más actuales pueden estar disponibles para usted, a discreción exclusiva de Bosch, con un cargo adicional). Todas las partes y componentes remiados se convertirán en propiedad de Bosch a su discreción. Todas las partes reemplazadas y/o reparadas asumirán la identidad de la parte original para los propósitos de esta garantía y esta garantía no se puede extender con respecto a tales partes. La única responsabilidad de Bosch bajo esta garantía es reparar el Producto defectuoso de fábrica usando un proveedor de servicio autorizado por Bosch durante horarios normales de trabajo. Por cuestión de seguridad y daños al producto, Bosch recomienda altamente que usted mismo no intente reparar el Producto o usar un centro de servicio no autorizado; Bosch no será responsable de reparaciones o trabajos realizados por un centro de servicio no autorizado. Si usted elige a alguien diferente que un proveedor de servicio autorizado para trabajar con su Producto, ESTA GARANTÍA PERDERÁ AUTOMÁTICAMENTE SU VALIDEZ. Proveedores de servicio autorizados son aquellas personas o empresas que han sido entrenados especialmente en productos de Bosch y quienes tienen, en opinión de Bosch, una excelente reputación para dar servicio al cliente y ofrecer servicios técnicos de gran calidad (Se trata de entidades independientes y no de agentes, socios, afiliados o representantes de Bosch). No obstante lo anterior, Bosch no será responsable para el Producto si está ubicado en un área remota (más de 100 millas (160 kilómetros) de un proveedor de servicio autorizado) o si está en un entorno o ambiente inaccesible, peligroso, amenazador o traicionero;

en cualquier caso, si usted lo solicita, Bosch aún así pagará la mano de obra y las partes y enviará las partes al proveedor de servicio autorizado más cercano, pero usted tendría toda la responsabilidad de viajar y enfrentar los gastos especiales generados por la empresa de servicio, suponiendo que ésta acepta la visita para dar el servicio.

Producto fuera de garantía: Bosch no está obligado por la ley o de otra forma, de proporcionarle a usted alguna concesión, incluyendo reparaciones, prorratas, o el reemplazo del Producto, una vez que esta garantía haya llegado a su vencimiento.

Exclusiones de la garantía: La cobertura de la garantía que se describe aquí excluye todos los defectos o daños que no son la responsabilidad directa de Bosch, incluyendo sin limitación, uno o más de los siguientes puntos: (1) el uso del Producto en un modo diferente de su uso normal, usual e intencionado (incluyendo sin limitación cualquier forma de uso comercial, el uso o almacenamiento de un producto para interiores en el exterior, el uso del Producto junto con naves marítimas o aéreas); (2) el mal comportamiento intencional de cualquier parte, negligencia, mal uso, abuso, accidentes, descuido, operación incorrecta, falta de mantenimiento, instalación incorrecta o negligente, manipulación, falta de observar las instrucciones de operación, mal manejo, servicio no autorizado (incluyendo "arreglos" hechos por usted mismo o explorar el funcionamiento interno del aparato); (3) ajustes o alteraciones o modificaciones de cualquier tipo, (4) la falta de cumplir con los códigos, regulaciones o leyes eléctricas y/o de construcción estatales, locales y municipales que pueden aplicar, incluyendo la falta de instalar el producto conforme a los códigos y las regulaciones locales de fuego y construcción; (5) el desgaste normal, derrames de alimentos o líquidos, acumulaciones de grasa u otras sustancias acumuladas sobre, en o alrededor del Producto y (6) fuerzas y factores externos, elementales y ambientales, incluyendo sin limitación, lluvia, viento, arena, inundaciones, fuegos, deslizamiento de lodo, temperaturas bajo cero, exceso de humedad o exposición extendida a humedad, relámpagos, sobretensiones, fallas estructurales alrededor del aparato y casos fortuitos. Por ningún motivo Bosch será responsable de daños a la propiedad cercana al aparato, incluyendo gabinetes, pisos, techos y otras estructuras u objetos que rodean el Producto. También se excluyen de esta garantía raspaduras, hendiduras, abolladuras ligeras y daños cosméticos en superficies externas y partes expuestas; Productos donde se alteró, se desfiguró o se quitó el número de serie; visitas de servicio para enseñarle como usar el Producto, o visitas donde no hay nada malo con el Producto; la corrección de problemas de la instalación (usted es el único responsable de cualquier estructura y entorno para el producto, incluyendo todas las instalaciones eléctricas, hidráulicas u otras conexiones, para una cimentación/pisos adecuados y para alteraciones incluyendo sin limitación gabinetes, paredes, pisos, estantes, etc.); y para poner o reemplazar cortacircuitos o fusibles. **AL GRADO PERMITIDO POR LA LEY, ESTA GARANTÍA ESTABLECE SUS REMEDIOS EXCLUSIVOS CON RESPECTO AL PRODUCTO, SIN IMPORTAR SI LA RECLAMACIÓN SURGE EN CONTRATO O AGRAVIO (INCLUYENDO LA RESPONSABILIDAD ESTRUCTURAL, O NEGLIGENCIA). ESTA GARANTÍA SUSTITUYE TODAS LAS OTRAS GARANTÍAS EXPRESAS O IMPLÍCITAS. CUALQUIER GARANTÍA IMPLICADA POR LA LEY, YA SEA DE COMERCIABILIDAD O APTITUD PARA ALGÚN PROPÓSITO PARTICULAR, SERÁ EFECTIVA SOLAMENTE POR EL PERÍODO EFECTIVO EXPRESADO EN ESTA GARANTÍA. BAJO NINGÚN MOTIVO EL FABRICANTE SERÁ RESPONSABLE DE DAÑOS CONSECUENCIALES, ESPECIALES, INCIDENTALES, INDIRECTOS, LA "PÉRDIDA DE NEGOCIO" Y/O DAÑOS PUNITIVOS, PÉRDIDAS, O GASTOS, INCLUYENDO SIN LIMITACIÓN EL TIEMPO AUSENTE DEL TRABAJO, HOTELES Y/O COMIDAS EN RESTAURANTES, GASTOS DE REMODELACIÓN EN EXCESO DE LOS DAÑOS DIRECTOS QUE DEFINITIVAMENTE FUERON CAUSADOS EXCLUSIVAMENTE POR BOSCH, O DE OTRA FORMA. ALGUNOS ESTADOS NO PERMITEN LA EXCLUSIÓN O LIMITACIÓN DE DAÑOS INCIDENTALES O CONSECUENCIALES, Y ALGUNOS ESTADOS TAMPOCO PERMITEN LIMITAR LA DURACIÓN DEL PERÍODO DE TIEMPO DE UNA GARANTÍA IMPLICADA, DE MODO QUE LAS LIMITACIONES MENCIONADAS ARRIBA TAL VEZ NO APLICAN PARA USTED. ESTA GARANTÍA LE OTORGA DERECHOS ESPECÍFICOS, Y USTED PUEDE TENER TAMBIÉN OTROS DERECHOS QUE VARÍAN DE ESTADO A ESTADO. Ningún intento de alterar, modificar o enmendar esta garantía será efectivo a menos que haya sido autorizado por escrito por un ejecutivo de BSH.**

Cómo obtener el servicio de garantía: PARA OBTENER SERVICIO DE GARANTÍA PARA SU PRODUCTO, PÓNGASE EN CONTACTO CON SU CENTRO DE SERVICIO AUTORIZADO DE BOSCH MÁS CERCANO, O LLAME AL 800-944-2904, o escriba a Bosch a: BSH Home Appliances - 5551 McFadden Avenue, Huntington Beach, CA 92649 /

Servicio al cliente

Su lavavajillas Bosch no requiere de ningún otro cuidado especial del que se describe en la sección de Cuidado y Mantenimiento. Si usted tiene algún problema con su lavavajillas, antes de solicitar servicio técnico, por favor consulte la sección de Autoayuda. Si se necesita servicio, póngase en contacto con su distribuidor o instalador o con un centro de servicio autorizado. **No trate de reparar el aparato usted mismo.** Todo trabajo realizado por personas no autorizadas puede invalidar la garantía.

Si usted tiene algún problema con su lavavajillas Bosch y no está contento con el servicio que haya recibido, tome los siguientes pasos por favor (en el orden listado abajo) hasta corregir el problema a su entera satisfacción:

1. Contacte a su instalador o al contratista de servicio autorizado por Bosch en su área.
2. Mándenos un correo electrónico desde la sección de servicio al cliente en nuestra página Web, www.boschappliances.com.
3. Escríbanos a la siguiente dirección:

BSH Home Appliances, Corp.
5551 McFadden Avenue
Huntington Beach, CA 92649

4. Llámenos al 1-800-944-2904.

Por favor incluya la información de su modelo listado abajo así como una explicación del problema y la fecha cuando se originó.

Usted podrá encontrar la información sobre el número de modelo y el número de serie en la placa (etiqueta) que se encuentra en la orilla derecha de la puerta del lavavajillas tal como se muestra en la Ilustración 32.

Además, si nos escribe, favor de incluir un número telefónico donde lo podamos localizar durante el día.

Por favor saque una copia de su factura y guárdela junto con este manual. El cliente debe mostrar un comprobante de compra para obtener el servicio de garantía.

Información de su modelo:

- Número de modelo _____
- Número de serie _____
- Fecha de compra _____
- Fecha de instalación _____



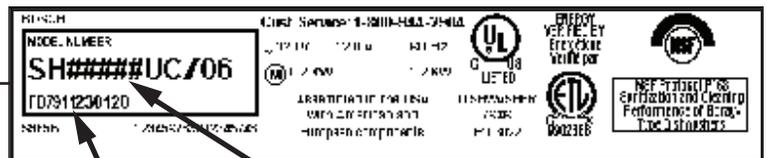
¡ CUIDADO

Quitar alguna tapa o jalar el lavavajillas fuera del gabinete puede exponer conexiones de agua caliente, de corriente eléctrica o bordes o puntas filosas.

Ilustración 32



Etiqueta con el Número de Modelo y el Número de Serie



Número de Serie

Modelo

BSH reserves the right to change specifications or design without notice. Some models are certified for use in Canada. BSH is not responsible for products which are transported from the United States for use in Canada. Check with your local Canadian distributor or dealer. BSH Home Appliances, Corporation, 5551 McFadden Avenue, Huntington Beach, CA 92649.

For the most up to date critical installation dimensions by fax, use your fax handset and call 775/833-3600. Use code #8030.

BSH se réserve le droit de modifier les données techniques ou le design sans préavis. Certains modèles sont certifiés pour une utilisation au Canada. BSH n'est pas responsable pour les produits transportés des États-Unis pour une utilisation au Canada. Vérifier auprès d'un marchand ou distributeur canadien. BSH Home Appliances Corporation, 5551 McFadden Avenue, Huntington Beach, CA 92649.

Pour les dimensions d'installation à jour par télécopieur, utiliser le combiné du télécopieur et composer le 775.833.3600. Utiliser le code n° 8030.

BSH se reserva el derecho de modificar las especificaciones o el diseño sin previo aviso. Algunos modelos están certificados para ser usados en Canadá. BSH no es responsable de productos que son transportados desde los Estados Unidos para ser utilizados en Canadá. Consulte a su distribuidor local en Canadá. BSH Home Appliances Corporation, 5551 McFadden Avenue, Huntington Beach, CA 92649.

Para recibir las dimensiones de instalación más actuales por fax, use su fax y llame al (775) 833-3600. Use el código #8030.

BOSCH



Front-Loading Automatic Washer

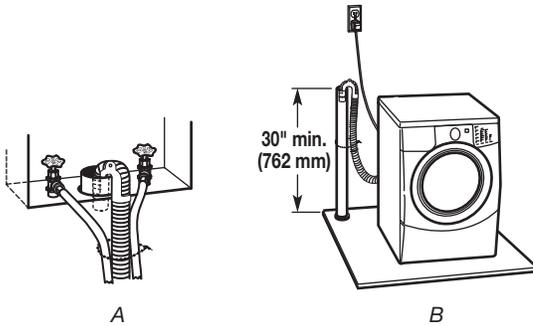
PRODUCT MODEL NUMBERS

WFW9150W

Electrical: A 120 volt, 60 Hz., AC only, 15- or 20-amp, fused electrical supply is required. A time-delay fuse or circuit breaker is recommended. It is recommended that a separate circuit serving only this appliance be provided.

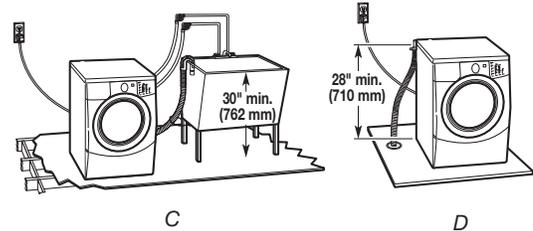
Drain System Options

Standpipe drain system - wall or floor (views A & B)
The standpipe drain requires a minimum diameter standpipe of 2" (50 mm). The minimum carry-away capacity can be no less than 17 gal. (64 L) per minute. The top of the standpipe must be at least 30" (762 mm) high and no higher than 96" (2.4 m) from the bottom of the washer.



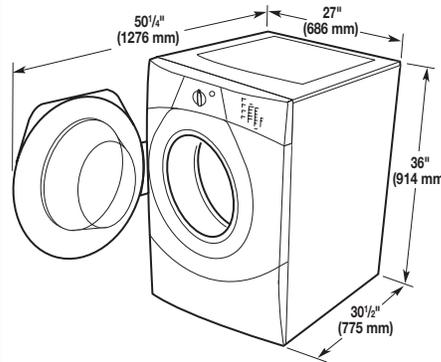
Laundry tub drain system (view C)
The laundry tub needs a minimum 20 gal. (76 L) capacity. The top of the laundry tub must be at least 30" (762 mm) above the floor.

Floor drain system (view D)
The floor drain system requires a siphon break that may be purchased separately. See "Tools and Parts." The siphon break must be a minimum of 28" (710 mm) from the bottom of the washer. Additional hoses might be needed.

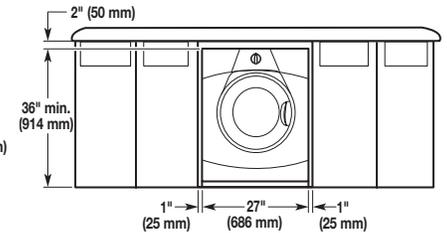


OVERALL DIMENSIONS

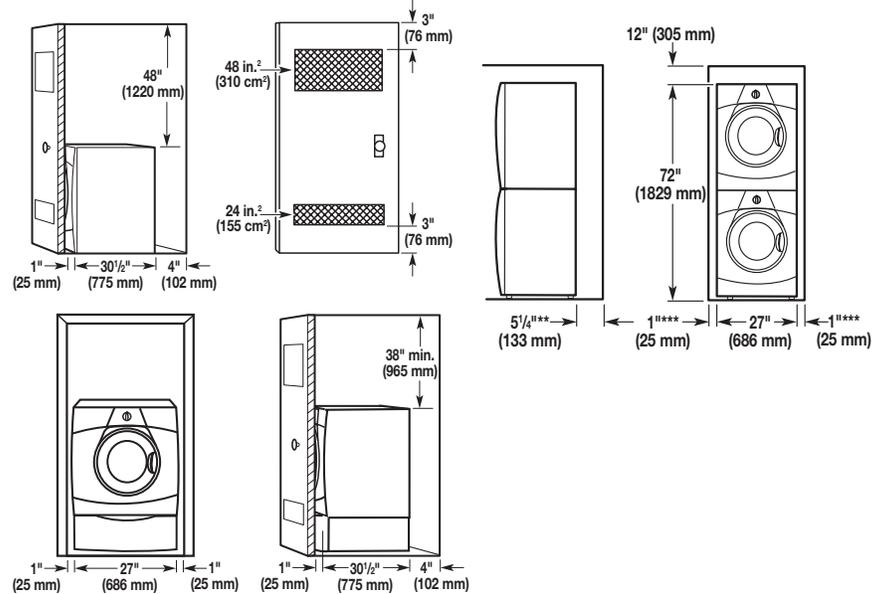
Washer dimensions



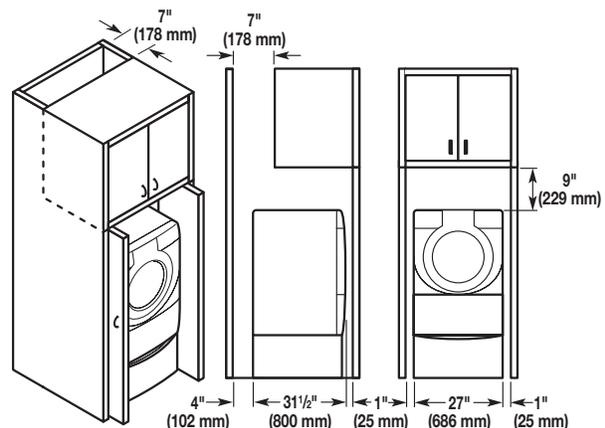
Custom undercounter installation-dryer only



For closet installation, with a door, the minimum ventilation openings in the top and bottom of the door are required. Louvered doors with equivalent air ventilation openings are acceptable.



For cabinet installation, with a door, the minimum ventilation openings in the top are required.





Electric Dryer

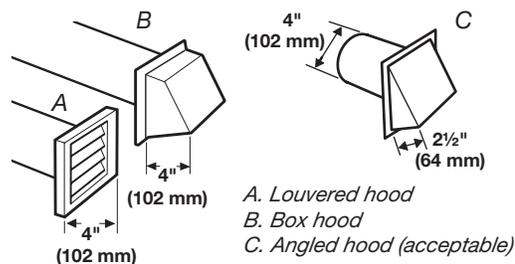
PRODUCT MODEL NUMBERS

WED9150W, WED9250W,
WED9050X, WED9270X

Electrical: This dryer requires a 3 or 4 wire, single phase, 120/240 volt, 60 Hz, AC only electrical supply (or 3 or 4 wire, 120/208 volt electrical supply, if specified on the serial/rating plate) on a separate 30-amp circuit, fused on both sides of the line. Connect to an individual branch circuit. Do not have a fuse in the neutral or grounding circuit.

Exhaust venting: Exhaust your dryer to the outside. 4" (102 mm) diameter vent is required. Rigid or flexible metal exhaust vent must be used. Do not use plastic or metal foil vet. Exhaust hood must be at least 12" (305 mm) from the ground or any object that may be in the path of the exhaust.

Hood styles: A & B are recommended.



The Vent system chart provides venting requirements that will help achieve best drying performance.

NOTE: Side and bottom exhaust installation have a 90° turn inside the dryer. To determine maximum exhaust length, add one 90° turn to the chart.

Vent system chart			
Number of 90° elbows	Type of vent	Box/louvered hoods	Angled hoods
0	Rigid metal	64 ft. (20 m)	58 ft. (17.7 m)
1	Rigid metal	54 ft. (16.5 m)	48 ft. (14.6 m)
2	Rigid metal	44 ft. (13.4 m)	38 ft. (11.6 m)
3	Rigid metal	35 ft. (10.7 m)	29 ft. (8.8 m)
4	Rigid metal	27 ft. (8.2 m)	21 ft. (6.4 m)

Do not use vent runs longer than specified in vent length chart.

Determine the number of elbows you will need.

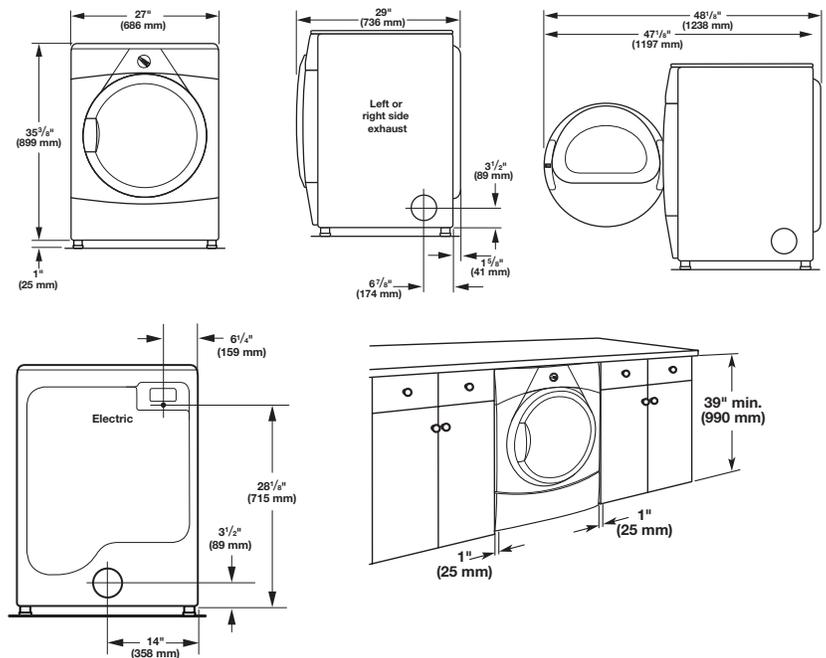
Select the route that will provide the straightest and most direct path outdoors.

Plan the installation to use the fewest number of elbows and turns.

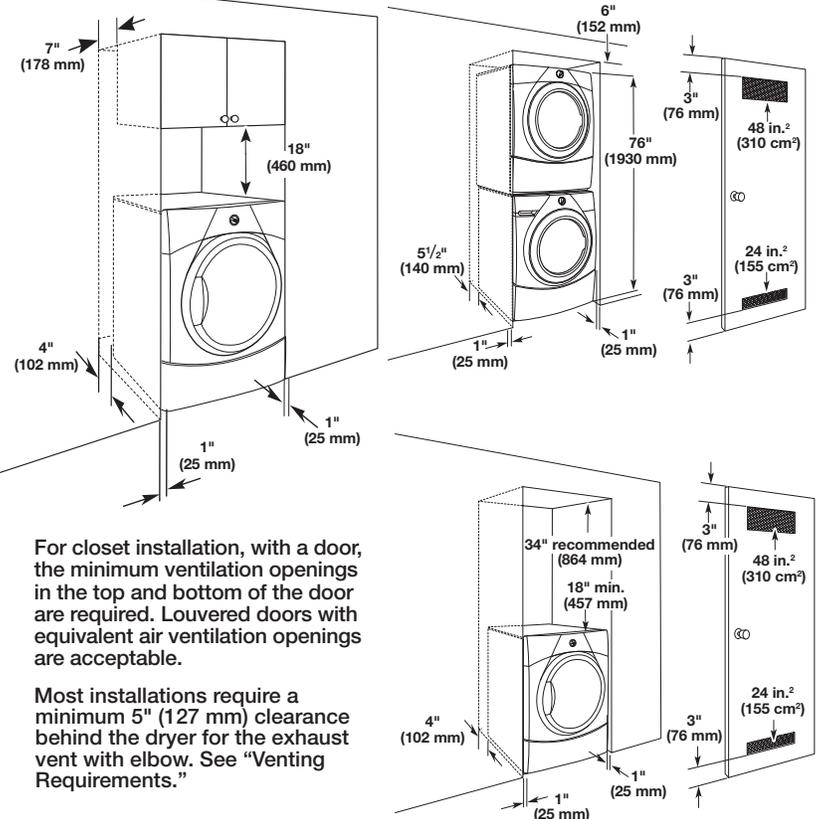
Use the fewest 90° turns possible.

OVERALL DIMENSIONS

Dryer dimensions



Minimum Required Spacing





Appendix B: Electrical Equipment Manufacturer's Specifications

DHC 3-1, DHC 3-2, DHC 4-2, DHC 4-3, DHC 5-2, DHC 6-2, DHC 8-2, DHC 10-2

English

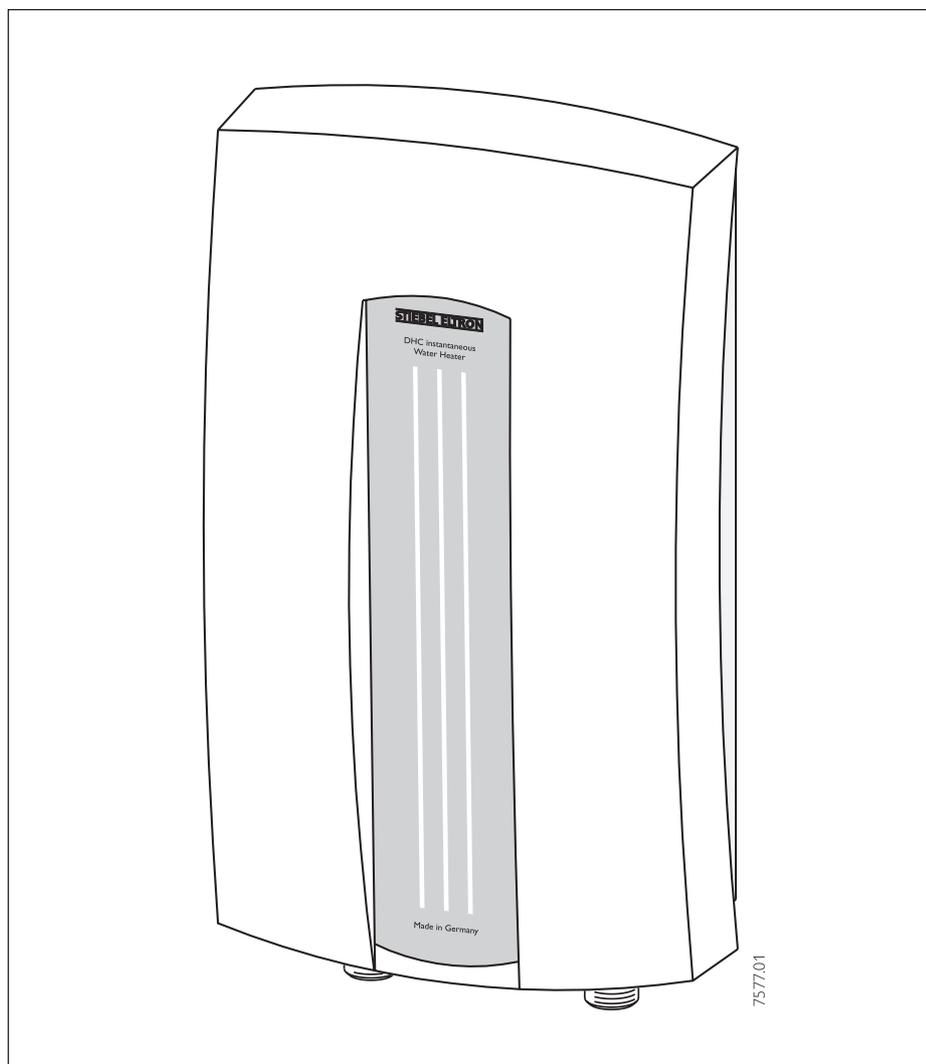
DHC TANKLESS ELECTRIC WATER HEATERS INSTALLATION INSTRUCTIONS FOR THE LICENSED PLUMBER AND ELECTRICIAN

Français

CHAUFFE-EAU ELECTRIQUES DHC SANS ACCUMULATEUR INSTRUCTIONS D'INSTALLATION POUR LE PLOMBIER ET L'ELECTRICIEN PROFESSIONNEL

Español

CALENTADORES DE AGUA INSTANTANEOS SIN TANQUE INSTRUCCIONES DE INSTALACION PARA EL PLOMERO Y ELECTRICISTA LICENCIADO.

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Français Sommaire

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NEW JERSEY SCHOOL OF ARCHITECTURE

Richard Garber, AIA
Associate Professor

8 July 2011

Mr. Tom Myers
Colorado Code Consulting – 2011 Solar Decathlon
4610 S Ulster Street, Suite 150
Denver, CO 80237

Dear Tom:

I am writing as Faculty Advisor regarding rescue egress from Team New Jersey's Solar Decathlon house. I recall discussing this issue with you in Orlando in January, and thought we agreed that our rear exterior door would suffice as a means of egress due to its proximity to the bedroom. Based on my understanding of IRC 2009 and the related 2009 New Jersey Edition, and the circumstances surrounding our design decisions for our house, I am writing to you to formally request your consideration in accepting the rear door as a means of exit and safety egress from that room. My reason for this request stems from an alternate way of determining egress requirements for larger buildings designed for maximum allowable occupancies much greater than our maximum occupancy per code, as well as the materials and methods of construction for our house.

First, the maximum diagonal dimension from the southeast to northwest corner of the house is 50'-4". By halving that dimension it seems reasonable to suggest that the maximum dimension of an egress path within the house to an exterior exit is 25'-4".

Next, the doors that allow us to close off the bedroom on either side are ¾" sliding panels that do not have latches, meaning the doors could never be locked into a closed position. Additionally fire resistance ratings exceed IRC requirements due to the house's 100% precast concrete construction and sprinkler system. Finally, I can confirm through our window manufacturer Serious Windows that our 525 Series 48" x 32" Casement Window labeled E7 in the bedroom already qualifies as an egress window as it's dimensions are 47.625" tall by 31.75" wide – I believe minimum requirements are 45.5" x 31". Still it is possible to install a quick release egress hinge in the event of emergency if you feel it is necessary.

Please find further information listed on the following page for your reference. We will also provide a revised egress plan under separate cover to graphically show egress paths. I hope these combined conditions will satisfy any concerns you might have, and I am comfortable that there is no increased safety hazard given our alternative solution to the code.

Egress Tabulation Data – Team New Jersey

1. The Team NJ bedroom is provided with 2 separate means of egress doors. The doors are separated by 14'-10" (C.L. of door) along the east bedroom wall, representing 69% of the overall diagonal of the room, which is 21'-4".
2. The egress travel distance from the center of the bedroom is 36'-1" via exit 1 (the front door) and 25'-1" via exit 2 (the rear door).
3. The Team NJ building is protected with a fire suppression sprinkler system.
4. The Team NJ building is constructed entirely of concrete construction.
5. Window E7 in the bedroom already meets the minimum egress dimensions of 31" x 45.5" – that window is 31.75" wide by 47.625 inches tall, and can be modified to open with quick release by installation of a "egress hinge"

Kindly let me know if you have any questions, and we look forward to seeing you in September.

Sincerely,

A handwritten signature in black ink, appearing to read "Rus J Garber". The signature is fluid and cursive, with a large initial "R" and "G".

Richard Garber, AIA - NJ License No. 21AI01735200

cc. Urs Gauchat, Clint Andrews, Sal DiCrsitina, Jen Switala, Joseph Simon

Temperature increase above ambient water temperature.

Élévation de température au delà de la température ambiante de l'eau.

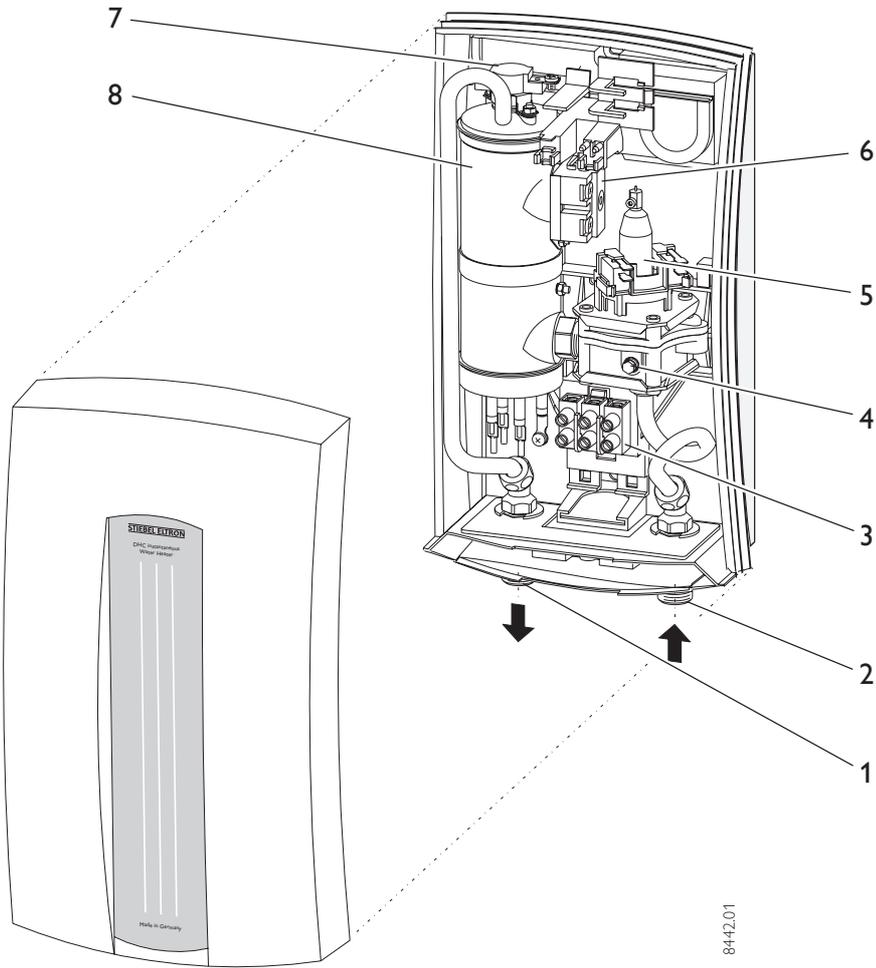
Aumento de temperatura del agua.

		[°F]									
Typ / Type	kW	GPM (gallon par minute / galones por minuto)									
		0.32	0.42	0.48	0.5	0.69	0.75	0.79	1.0	1.5	2.0
DHC 3-1	3.0	65	49	43	41	30	27	26	20	14	10
DHC 3-2	2.5	54	40	35	34	25	23	21	17	11	9
	3.3	71	53	47	45	33	30	28	22	15	11
DHC 4-2	2.9	-	47	41	40	29	26	25	20	13	10
	3.8	-	61	54	52	38	35	33	26	17	13
DHC 4-3	4.5	-	73	64	61	45	41	39	31	20	15
DHC 5-2	3.6	-	58	51	49	36	33	31	25	16	12
	4.8	-	77	68	65	48	44	41	33	22	16
DHC 6-2	4.5	-	-	64	61	45	41	39	31	20	15
	6.0	-	-	85	82	60	55	52	41	27	20
DHC 8-2	5.4	-	-	-	-	54	49	46	37	25	18
	7.2	-	-	-	-	71	65	62	49	33	25
DHC 10-2	7.2	-	-	-	-	-	-	62	49	33	25
	9.6	-	-	-	-	-	-	82	65	44	33

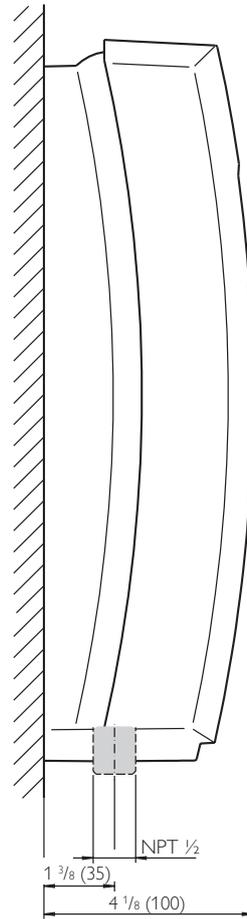
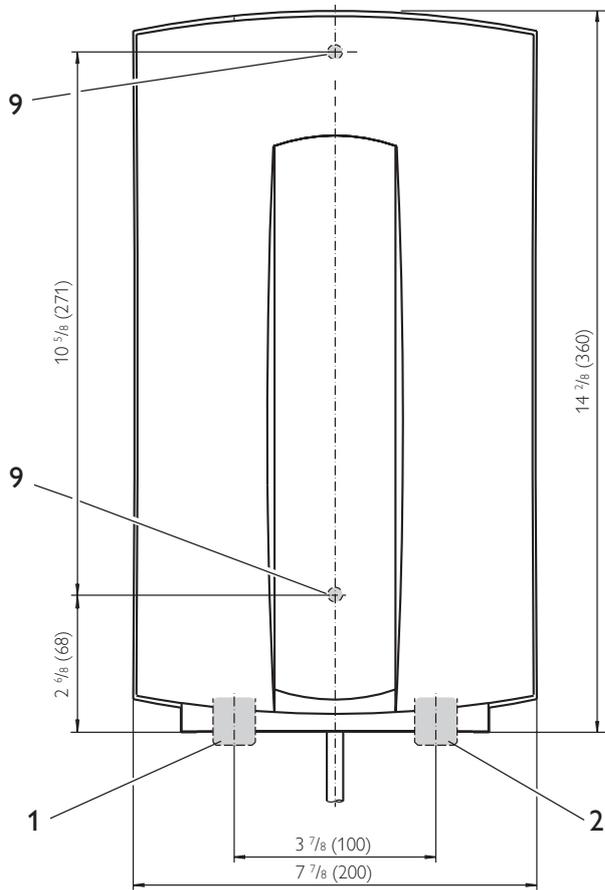
Min. water flow to activate unit. / Débit d'eau minimum pour activer l'appareil. /
 Flujo de agua mínimo para activar la unidad.

		[°C]								
Typ / Type	kW	l/min / l/mn								
		1.2	1.6	1.8	2.0	2.6	3.0	4.0	5.0	7.5
DHC 3-1	3.0	36	27	24	22	17	14	11	9	6
DHC 3-2	2.5	30	22	20	18	14	12	9	7	5
	3.3	39	30	26	24	18	16	12	9	6
DHC 4-2	2.9	-	26	23	21	16	14	10	8	6
	3.8	-	34	30	27	21	18	14	11	7
DHC 4-3	4.5	-	40	36	32	25	22	16	13	9
DHC 5-2	3.6	-	32	29	26	20	17	13	10	7
	4.8	-	43	38	34	26	23	17	14	9
DHC 6-2	4.5	-	-	36	32	25	22	16	13	9
	6.0	-	-	48	43	33	29	22	17	11
DHC 8-2	5.4	-	-	-	-	30	26	19	15	10
	7.2	-	-	-	-	40	34	26	21	14
DHC 10-2	7.2	-	-	-	-	-	34	26	21	14
	9.6	-	-	-	-	-	46	34	28	18

Min. water flow to activate unit. / Débit d'eau minimum pour activer l'appareil. /
 Flujo de agua mínimo para activar la unidad.

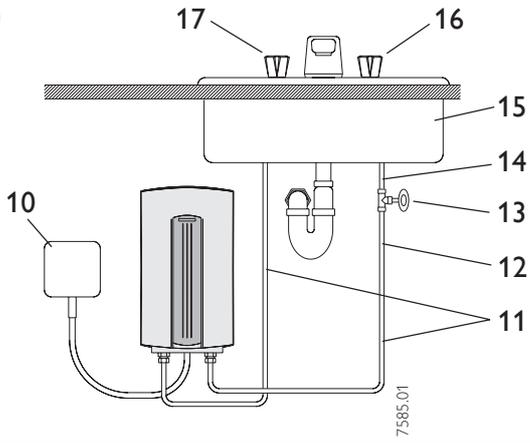
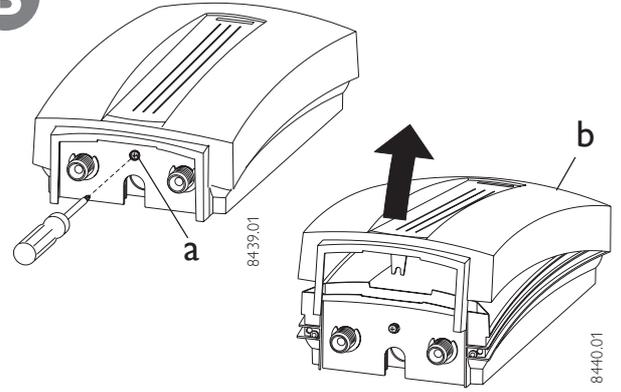
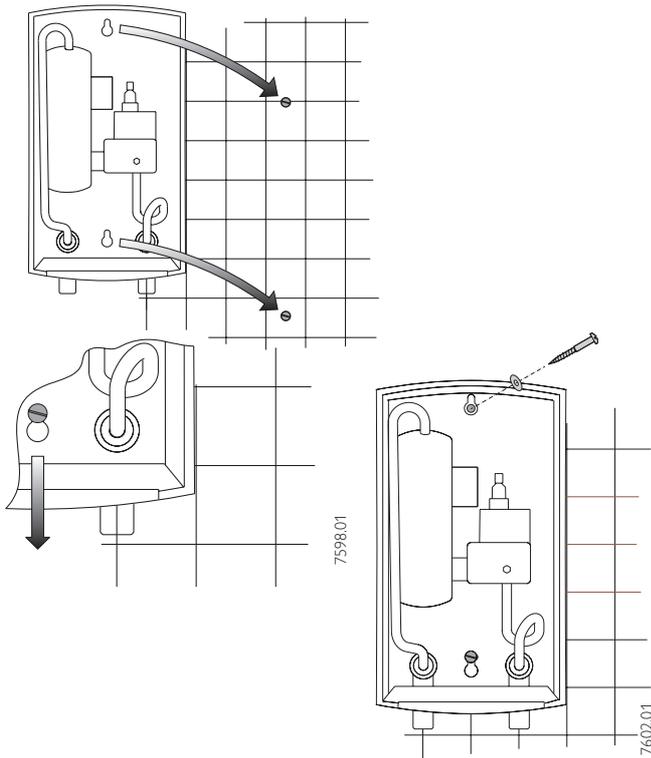
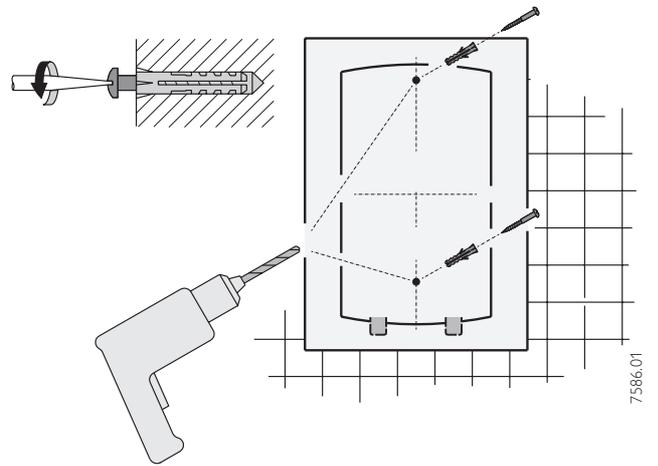
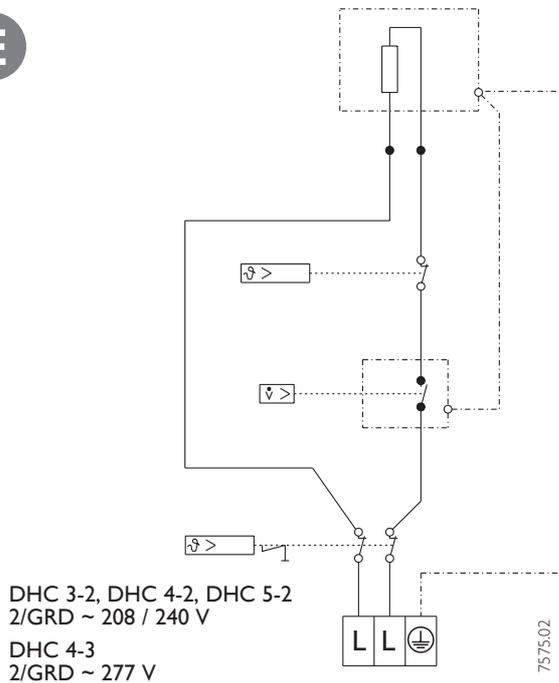
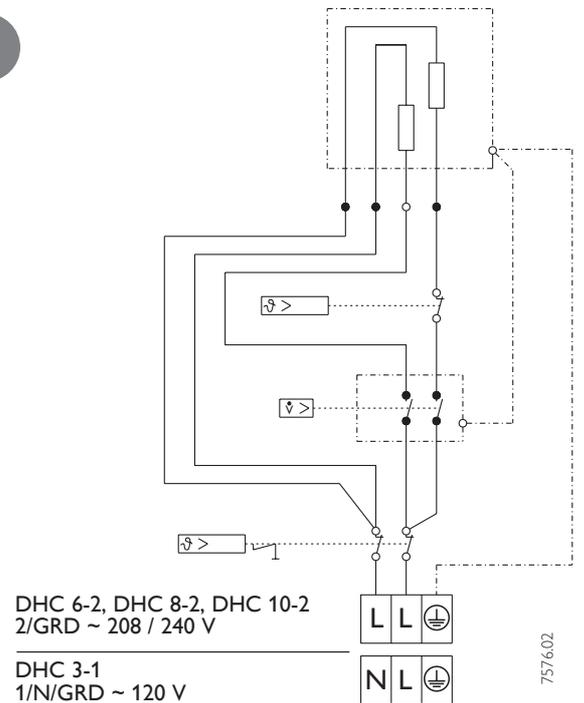


8442.01



[inch (mm)]
[pouce / pulgada (mm)]

7587.01

A**B****D****C****E****F**

THIS MANUAL MUST BE READ CAREFULLY BEFORE ATTEMPTING TO INSTALL THE DHC WATER HEATER. IF YOU DO NOT FOLLOW THE SAFETY RULES OR THE INSTRUCTIONS OUTLINED IN THIS MANUAL, THE UNIT MAY NOT OPERATE PROPERLY AND IT COULD CAUSE PROPERTY DAMAGE, SERIOUS BODILY INJURY AND/OR DEATH.

STIEBEL ELTRON, INC. WILL NOT BE LIABLE FOR ANY DAMAGES BECAUSE OF FAILURE TO COMPLY WITH THE INSTALLATION AND OPERATING INSTRUCTIONS OUTLINED IN THIS MANUAL OR BECAUSE OF IMPROPER USE. IMPROPER USE INCLUDES THE USE OF THIS APPLIANCE TO HEAT ANY LIQUID OTHER THAN WATER. FAILURE TO COMPLY WITH THE INSTALLATION AND OPERATING INSTRUCTIONS OR IMPROPER USE VOIDS WARRANTY. NEVER REMOVE THE UNIT'S PLASTIC COVER UNLESS THE ELECTRICITY IS TURNED OFF.

IF YOU HAVE ANY QUESTIONS REGARDING THE INSTALLATION OR OPERATION OF THIS WATER HEATER, OR IF YOU NEED AN ADDITIONAL INSTALLATION MANUAL, PLEASE CALL OUR TECHNICAL SERVICE LINE AT 800-582-8423 (USA AND CANADA ONLY). IF YOU ARE CALLING FROM OUTSIDE THE U.S. AND CANADA, PLEASE CALL USA 413-247-3380 AND WE WILL REFER YOU TO A QUALIFIED STIEBEL ELTRON SERVICE REPRESENTATIVE IN YOUR AREA.

Legend to figures

- 1 Hot water connection
- 2 Cold water connection
- 3 Wiring block
- 4 Flow adjustment screw
- 5 Flow switch
- 6 Safety thermal cut out with reset button
- 7 Thermostat
- 8 Heating system
- 9 Mounting holes
- 10 Electrical junction box
- 11 Water supply line for faucet installation
- 12 3/8" compression-T
- 13 Shut-off valve
- 14 1/2" main pipe
- 15 Sink
- 16 Cold valve (right)
- 17 Hot valve (left)
- 18 Wire strain relief clamp
- 19 Wire inlet
- 20 Filter screen
- 21 Reset button from safety thermal cut out

General

The DHC tankless water heater differs from conventional storage type water heaters in several ways. It does not store hot water. Instead, water is heated instantaneously as it flows through the unit. The powerful heating elements are activated by a flow switch as water is drawn from a hot water faucet connected to the DHC. Due to the absence of stand-by losses, the DHC has greater energy efficiency than storage type water heaters.

The temperature of the hot water delivered by the DHC depends on the wattage of the heating element, the temperature of the incoming cold water, and the water flow rate through the unit. In order for the DHC to operate properly, it must be carefully matched to the application.

In case you have questions regarding the way you plan to use the DHC, please call our technical service line at 800-582-8423 (USA and Canada). For service outside the U.S. and Canada, please call us at USA 413-247-3380. You can also e-mail us at info@stiebel-eltron-usa.com or fax us at 413-247-3369.

The DHC can be used for hand washing type applications in the U.S. and Canada:

- Restroom sinks in commercial/industrial facilities and homes
- Kitchen areas in commercial /industrial facilities and homes
- Cabins
- Special uses in photo developing shops, laboratories etc.

The DHC can also be used for whole apartments and homes in warm climate zones such as the Caribbean region, Central America and Mexico due to the higher ambient water temperatures.

Mounting the unit

⚠ UNIT MUST BE INSTALLED IN A VERTICAL POSITION WITH THE WATER FITTINGS POINTING DOWNWARD. DO NOT INSTALL UNIT WHERE IT WOULD ROUTINELY BE SPLASHED WITH WATER. ELECTRIC SHOCK MAY RESULT.

1. Install DHC as close as possible to the hot water draw-off point, for example, directly underneath the sink or next to the shower stall.
2. Install DHC in a frost free area. If frost may occur, remove unit before freezing temperatures set in.
3. Leave a minimum of 5" of clearance on all sides for servicing.
4. Remove plastic cover **B**.
5. Mount unit securely to wall by putting two screws through mounting holes **C** **D**. Screws and plastic wall anchors for mounting on masonry or wood are provided.

Water connections

1. All plumbing work must comply with national and applicable state and local plumbing codes.
2. A pressure reducing valve must be installed if the cold water supply pressure exceeds 150 PSI (10 bar).
3. Make certain that the cold water supply line has been flushed to remove any scale and dirt.
4. Install isolating valve in cold water line as shown in illustration **A**-13. This allows the unit to be isolated for maintenance purposes.
5. Cold water connection (inlet) is on the right side of the unit, hot water connection (outlet) is on the left side of unit.

⚠ NOTE: EXCESSIVE HEAT FROM SOLDERING ON COPPER PIPES NEAR THE DHC MAY CAUSE DAMAGE.

6. Tankless water heaters such as the DHC are not required to be equipped with a Pressure and Temperature Relief Valve (PTRV). If the local inspector will not pass the installation without a PTRV, it should be installed on the hot water outlet side of unit.
7. In case you are connecting to 1/2" water pipe, solder 1/2" NPT tapered female adapter by copper on ends of cold and hot water lines. In case you are connecting to 3/8" water pipe, use a 1/2" female pipe thread by 3/8" compression adapter. Braided flexible connectors will work as well. Connect cold and hot water lines to the unit.
8. When all plumbing work is completed, check for leaks and take corrective action before proceeding.

Electrical connection

⚠ WARNING: BEFORE BEGINNING ANY WORK ON THE ELECTRIC INSTALLATION, BE SURE THAT MAIN BREAKER PANEL SWITCH IS „OFF“ TO AVOID ANY DANGER OF ELECTRIC SHOCK. ALL MOUNTING AND PLUMBING MUST BE COMPLETED BEFORE PROCEEDING WITH ELECTRICAL HOOK-UP. WHERE REQUIRED BY LOCAL, STATE OR NATIONAL ELECTRICAL CODES THE CIRCUIT SHOULD BE EQUIPPED WITH A „GROUND FAULT INTERRUPTER“.

1. All electrical work must comply with national and applicable state and local electrical codes.
2. The DHC should be connected to a properly grounded dedicated branch circuit of proper voltage rating. In installations with several DHC units, each unit requires an independent circuit. Please refer to the technical data table for the correct wire and circuit breaker size.
3. The wire must be fed through the rubber seal located between the hot and cold water connections **G**. Then feed wires through strain relief clamp and tighten clamp down on wire. The „live“ wires must be connected to the slots on the terminal block marked N and L (DHC 3-1 only) or L and L (all other versions). The ground wire must be connected to slot marked with the ground symbol.
4. Reinstall plastic cover.

⚠ WARNING: AS WITH ANY ELECTRIC APPLIANCE, FAILURE TO ELECTRICALLY GROUND UNIT MAY RESULT IN SERIOUS INJURY OR DEATH.

Putting the water heater into operation

⚠ WARNING: OPEN HOT WATER FAUCET FOR A FEW MINUTES UNTIL WATER FLOW IS CONTINUOUS AND ALL AIR IS PURGED FROM WATER PIPES. THE UNIT'S PLASTIC COVER MUST BE INSTALLED BEFORE THE CIRCUIT BREAKER IS TURNED ON.

1. Turn on circuit breaker to bring electrical power to the unit.
2. Open hot water faucet to a degree so that water flow is „typical“ i.e. until the water flow is the same as that encountered during normal use.
3. Wait twenty seconds until temperature has stabilized. Then check water temperature. If temperature is too low, the water flow rate needs to be reduced. In order to do this, turn off the unit's circuit breaker, remove the cover and turn the flow adjustment screw shown in illustration **H** clockwise 1/2 turn

(180 degrees). Then reinstall plastic cover, turn on circuit breaker and check water temperature. This procedure should be repeated until the desired temperature is achieved. In case the water temperature is too high, turn the flow adjustment screw counter clockwise in the same manner until the desired temperature is achieved. The arrows in illustration **H** refer to the water temperature.

4. In order to obtain temperature control at a single spout mixer-type faucet, restrict cold water flow to faucet by partially closing the cold water shut-off valve under the sink until cold water and hot water flow rates are approximately the same.

Normal maintenance

STIEBEL ELTRON DHC tankless heaters are designed for a very long service life. Actual life expectancy will vary with water quality and use. The unit itself does not require any regular maintenance. However, to ensure consistent water flow, it is recommended to periodically remove scale and dirt that may build up at the aerator of the faucet or in the shower head. Also, the DHC has a built in filter screen that should be cleaned from time to time. In order to do this, turn off the cold water supply at the isolating valve and remove the ground wire **I**. Twist cold water supply tube counterclockwise by 90° and pull towards bottom of unit. Clean screen and put the screen, the cold water supply tube and the ground wire back into their original position. Please be sure that the ground wire is reinstalled and that ground screw is securely tightened after this procedure.

⚠ OTHER THAN THE FILTER SCREEN, THE DHC DOES NOT CONTAIN ANY PARTS SERVICEABLE BY THE LAY PERSON. IN CASE OF MALFUNCTION PLEASE CONTACT A LICENSED PLUMBER OR ELECTRICIAN.

Technical Data

Model	DHC 3-1		DHC 3-2		DHC 4-2		DHC 4-3		DHC 5-2		DHC 6-2		DHC 8-2		DHC 10-2	
Phase	1		1		1		1		1		1		1		1	
Voltage V	120	208	240	208	240	277	208	240	208	240	208	240	208	240	208	240
Wattage kW	3.0	2.5	3.3	2.9	3.8	4.5	3.6	4.8	4.5	6.0	5.4	7.2	7.2	9.6		
Ampere A	25	12	14	14	16	17	18	20	22	25	26	30	35	40		
Min. required circuit breaker size A	30	15	20	20	20	20	30	30	30	30	40	40	40	50		
Recommended wire size AWG COPPER	10	14	12	12	12	12	10	10	10	10	8	8	8	8		
Min. water flow to activate unit GPM / l/min	0.32 / 1.2	0.32 / 1.2		0.42 / 1.6		0.42 / 1.6	0.42 / 1.6		0.48 / 1.8		0.69 / 2.6		0.79 / 3.0			
Pressure loss in unit PSI / bar	2.88 / 0.23	2.88 / 0.23		2.88 / 0.23		2.88 / 0.23	2.88 / 0.23		2.88 / 0.23		3.13 / 0.25		3.75 / 0.30			
Nominal water volume	0.13 GAL / 0.5 l															
Working pressure max.	150 PSI / 10 bar															
Tested to pressure	300 PSI / 20 bar															
Weight lbs. / kg	4.6 / 2.1	5.3 / 2.4		5.3 / 2.4		4.6 / 2.1	4.6 / 2.1		5.3 / 2.4		5.3 / 2.4		5.3 / 2.4			
Water connections	1/2" NPT															

- Suitable for supply with cold water
- Tankless water heaters are considered a non-continuous load
- Conductors should be sized to maintain a voltage drop of less than 3 % under load

Troubleshooting

Symptom	Possible cause	Solution
No hot water but audible click can be heard when water is turned on	<ul style="list-style-type: none"> – circuit breaker off – safety thermal cut-out tripped 	<ul style="list-style-type: none"> – circuit breaker on. – reset thermal cut-out J.
No hot water and no audible click can be heard when water is turned on	<ul style="list-style-type: none"> – water flow too low to activate flow switch 	<ul style="list-style-type: none"> – clean faucet aerator. – open shut-off valve completely. – open flow adjustment screw H. – clean filter screen at DHC unit I.
Water not warm enough	<ul style="list-style-type: none"> – water flow too high – voltage too low 	<ul style="list-style-type: none"> – reduce water flow, close flow adjustment screw H. – supply correct voltage to unit.

If you are not able to resolve a problem please contact us toll free at 800-582-8423 before removing the unit from the wall. STIEBEL ELTRON is happy to provide technical assistance. In most instances, we can resolve the problem over the phone.

Spare parts **K**

No. Spare part	Model	DHC 3-1	DHC 3-2	DHC 4-2	DHC 4-3	DHC 5-2	DHC 6-2	DHC 8-2	DHC 10-2						
① Heating system		16 58 89	16 77 69	16 77 70	16 58 90	16 77 71	17 11 17	16 77 72	16 77 73						
② Flow switch		16 52 73	16 52 73	16 21 62	16 21 62	16 21 62	17 11 05	16 21 64	16 21 65						
③ Thermostat		16 24 72													
④ Switch		16 80 26													
⑤ Housing (back)		16 58 91													
⑥ Plumbing connection		17 07 89													
⑦ Housing (front)		16 58 92													
⑧ Safety thermal cut out		16 24 74													
⑨ Wiring block		16 22 02	16 50 49												
⑩ Copper tube		16 23 14													
⑪ Module chassis		16 24 62													
⑫ Wire strain relief clamp		05 57 54													

LIRE ATTENTIVEMENT CE MANUEL AVANT D'ESSAYER D'INSTALLER LE CHAUFFE-EAU DHC. SI VOUS NE SUIVEZ PAS LES CONSIGNES DE SECURITE OU LES INSTRUCTIONS DEFINIES DANS CE MANUEL, L'APPAREIL RISQUE DE NE PAS FONCTIONNER CORRECTEMENT ET POURRAIT CAUSER DES DOMMAGES MATERIELS, DE SERIEUSES BLESSURES ET/OU LA MORT.

STIEBEL ELTRON, INC. NE SERA PAS RESPONSABLE DE DOMMAGES DUS A LA NON OBSERVATION DES INSTRUCTIONS D'INSTALLATION ET DE FONCTIONNEMENT DECRITES DANS CE MANUEL OU DUS A UNE UTILISATION INAPPROPRIEE. L'UTILISATION INAPPROPRIEE COMPREND EGALEMENT L'USAGE DE CET APPAREIL POUR CHAUFFER UN AUTRE LIQUIDE QUE DE L'EAU. LA NON OBSERVATION DES INSTRUCTIONS D'INSTALLATION ET DE FONCTIONNEMENT OU L'UTILISATION INAPPROPRIEE ANNULENT LA GARANTIE. NE JAMAIS RETIRER LE CACHE EN PLASTIQUE AVANT D'AVOIR COUPE L'ELECTRICITE.

POUR TOUTE QUESTION CONCERNANT L'INSTALLATION OU LE FONCTIONNEMENT DE CE CHAUFFE-EAU, OU SI VOUS AVEZ BESOIN D'UN MANUEL D'INSTALLATION SUPPLEMENTAIRE, TELEPHONEZ A NOTRE SERVICE TECHNIQUE AU N° 800-582-8423 (USA ET CANADA SEULEMENT), SI VOUS APPELZ D'UN AUTRE PAYS, APPELZ NOTRE N° 413-247-3380 AUX USA ET NOUS VOUS INDIQUERONS UN REPRESENTANT DU SERVICE APRES-VENTE QUALIFIE DE STIEBEL ELTRON SITUE DANS VOTRE ZONE GEOGRAPHIQUE.

Légendes des figures

- 1 Raccordement d'eau chaude
- 2 Raccordement d'eau froide
- 3 Bloc de câblage
- 4 Vis de réglage du débit
- 5 Commutateur de débit
- 6 Disjoncteur de sécurité avec bouton de réarmement
- 7 Thermostat
- 8 Système de chauffage
- 9 Trous de montage
- 10 Boîte de raccordement électrique
- 11 Conduite d'alimentation en eau pour installation à robinet
- 12 T de réduction 3/8"
- 13 Vanne de fermeture
- 14 Tuyau principal 1/2"
- 15 Evier
- 16 Robinet d'eau (droit)
- 17 Robinet d'eau (gauche)
- 18 Collier de serrage
- 19 Entrée de câble
- 20 Filtre
- 21 Bouton de réarmement du disjoncteur de sécurité

Généralités

Le chauffe-eau DHC sans accumulateur diffère à plusieurs égards des chauffe-eau conventionnels à ballon d'eau chaude. Il ne stocke pas d'eau chaude. En fait, l'eau est chauffée instantanément lorsqu'elle passe dans l'appareil. Les puissants éléments chauffants sont activés par un commutateur de débit lorsque l'eau est tirée d'un robinet d'eau chaude relié au DHC. Comme il n'y a pas de perte due à la réserve d'eau, le DHC a une plus grande efficacité énergétique que les chauffe-eau à accumulation. La température de l'eau chaude fournie par le DHC dépend de la puissance de l'élément chauffant, de la température de l'eau froide d'arrivée et du débit de l'eau à travers l'appareil. Afin que le DHC fonctionne correctement, il doit répondre exactement à son application.

Au cas où vous auriez des questions sur la manière dont vous prévoyez d'utiliser le DHC, n'hésitez pas à appeler notre service technique au n° 800-582-8423 (USA et Canada). Pour le service après-vente dans les autres pays, appelez nous au n° 413-247-3380 aux USA, vous pouvez aussi nous envoyer un e-mail à l'adresse info@stiebel-eltron-usa.com ou nous envoyer un fax au n° suivant: 413-247-3369.

Le DHC peut être utilisé pour se laver les mains, aux USA et au Canada:

- Lavabos dans les toilettes de locaux commerciaux / industriels et d'habitations
- Cuisines dans les locaux commerciaux / industriels et les habitations
- Cabines
- Usages spéciaux dans les magasins de développement de photos, les laboratoires, etc.

Le DHC peut aussi être utilisé pour des appartements entiers et des habitations dans des zones à climat chaud comme dans la région des caraïbes, l'Amérique Centrale et le Mexique en raison des températures d'eau ambiante plus élevées.

Montage de l'appareil

 **L'APPAREIL DOIT ETRE INSTALLE EN POSITION VERTICALE AVEC LES SORTIES D'EAU DIRIGES VERS LE BAS. NE PAS INSTALLER L'APPAREIL A UN ENDROIT OU IL SERAIT REGULIEREMENT ECLABOUSSE. UN CHOC ELECTRIQUE POURRAIT EN RESULTER.**

1. Installer le DHC aussi près que possible du point de tirage d'eau chaude, par exemple directement en dessous de l'évier ou juste à côté de la cabine de douche.
2. Installer le DHC dans une zone non exposée au gel. En cas de risque de gel, enlever l'appareil avant l'apparition des températures négatives.
3. Laisser un minimum de 5" d'espace libre sur tous les côtés pour la maintenance.
4. Enlever le cache en plastique **(B)**.
5. Fixer solidement l'appareil en faisant coulisser les trous de montage sur les deux vis préalablement fixées au mur **(C)** et **(D)**. Les vis et les chevilles en plastique pour montage sur maçonnerie ou bois sont fournies.

Raccordements d'eau

1. Tout le travail de plomberie doit répondre aux normes de plomberie nationales et locales applicables.
2. Une vanne de réduction de pression doit être installée si la pression d'alimentation d'eau froide dépasse 150 PSI (10 bar).
3. Assurez-vous que la conduite d'alimentation d'eau froide a été purgée pour enlever tout dépôt ou saleté.
4. Installer une vanne d'isolation dans la conduite d'eau froide comme le montre l'illustration **(A)**-13. Cela permet à l'appareil d'être isolé pour des opérations de maintenance.
5. Le raccordement d'eau froide (entrée) est situé du côté droit de l'appareil, le raccordement d'eau chaude (sortie) est situé du côté gauche de l'appareil.

 **ATTENTION! UNE CHALEUR EXCESSIVE DE SOUDAGE SUR LES TUYAUX DE CUIVRE A PROXIMITE DU DHC PEUT CAUSER DES DEGATS.**

6. Les chauffe-eau sans accumulateur tels que le DHC n'ont pas besoin d'être équipés d'une vanne de décharge de température et de pression. Si l'inspecteur local n'agrée pas l'installation sans cette vanne, la vanne devra être installée du côté de la sortie d'eau chaude de l'appareil.
7. Si vous faites un branchement à un tuyau d'eau d'1/2", soudez un adaptateur femelle conique de 1/2" NPT avec du cuivre aux extrémités des conduites d'eau froide et d'eau chaude. Si vous faites un branchement à un tuyau d'eau de 3/8", utilisez un tuyau femelle d'1/2" fileté avec un adaptateur de réduction de 3/8". Les raccords flexibles tressés conviendront également. Connectez les conduites d'eau froide et d'eau chaude à l'appareil.

8. Lorsque tout le travail de plomberie est terminé, chercher les fuites et prendre une action corrective avant d'aller plus loin.

Raccordement électrique

 **ATTENTION: AVANT DE COMMENCER TOUTE OPERATION SUR L'INSTALLATION ELECTRIQUE, S'ASSURER QUE L'INTERRUPTEUR DU DISJONCTEUR PRINCIPAL EST EN POSITION "ARRET" POUR EVITER TOUT RISQUE D'ELECTROCUTION. TOUTES OPERATIONS DE MONTAGE ET DE PLOMBERIE DOIVENT ETRE TERMINEES AVANT DE PROCEDER A L'ASSEMBLAGE ELECTRIQUE. SI LES NORMES ELECTRIQUES LOCALES OU NATIONALES L'EXIGENT, LE CIRCUIT DOIT ETRE EQUIPE D'UN "INTERRUPTEUR DE TERRE".**

1. Toutes les opérations électriques doivent répondre aux normes électriques nationales et locales applicables.
2. Le DHC doit être relié à un circuit de branchement dédié, correctement mis à la terre et d'une tension adéquate. Dans les installations ayant plusieurs DHC, chaque unité a besoin d'un circuit indépendant. Se référer au tableau de caractéristiques techniques pour la bonne taille des câbles et du coupe-circuit.
3. Le câble doit être alimenté à travers le joint de caoutchouc situé entre les branchements de l'eau chaude et de l'eau froide **(G)**. Ensuite, faire passer le câble à travers le collier de serrage et resserrer le collier sur le câble. Les extrémités dénudées des câbles doivent être insérées dans les fentes sur le bloc terminal marqué N et L (pour le DHC 3-1 seulement) ou L et L (pour toutes les autres versions). Le conducteur de terre doit être inséré dans la fente identifiée par le symbole de la terre.
4. Réinstaller le cache en plastique.

 **ATTENTION: COMME AVEC N'IMPORTE QUEL APPAREIL ELECTRIQUE, L'ABSENCE DE MISE A LA TERRE PEUT ENTRAINER LA MORT.**

Mise en œuvre du chauffe-eau

 **ATTENTION: OUVRIR LE ROBINET D'EAU CHAUDE QUELQUES MINUTES AVANT QUE LE DEBIT D'EAU SOIT CONTINU ET QUE TOUT L'AIR SOIT PURGE DES CANALISATIONS D'EAU. LE CACHE EN PLASTIQUE DE L'APPAREIL DOIT ETRE INSTALLE AVANT QUE LE DISJONCTEUR SOIT MIS EN POSITION DE MARCHÉ.**

1. Mettre le disjoncteur en position de "marche" pour amener l'électricité à l'appareil.

2. Ouvrir le robinet d'eau chaude à un degré tel que l'écoulement d'eau soit "typique" c'est-à-dire avant que l'écoulement d'eau soit le même que celui qu'on rencontre en utilisation normale.
3. Attendre vingt secondes jusqu'à ce que la température soit stabilisée. Ensuite, vérifier la température de l'eau. Si la température est trop basse, le débit d'eau doit être réduit. Pour ce faire, fermer le disjoncteur de l'appareil, enlever le cache et tourner la vis de réglage de débit, montrée dans l'illustration **(H)**, d'un 1/2 tour (à 180 degrés) dans le sens horaire. Ensuite, réinstaller le cache en plastique, remettre le disjoncteur en position "marche" et vérifier la température de l'eau. Cette procédure doit être répétée jusqu'à ce que la température désirée soit atteinte. Au cas où la température de l'eau est trop élevée, tourner de la même manière la vis de réglage de débit dans le sens anti-horaire jusqu'à ce que la température désirée soit atteinte. Les flèches dans l'illustration **(H)** se réfèrent à la température de l'eau.
4. Afin d'obtenir le contrôle de la température sur un robinet unique de type mitigeur, limiter le débit d'eau froide au robinet en fermant partiellement la vanne de fermeture d'eau froide sous l'évier jusqu'à ce que les débits d'eau froide et d'eau chaude soient approximativement les mêmes.

Maintenance normale

Les chauffe-eau **DHC de STIEBEL ELTRON** sont conçus pour une très longue durée de vie. La durée de vie réelle escomptée va varier avec la qualité et l'utilisation de l'eau. L'appareil lui-même ne nécessite pas de maintenance régulière. Cependant, pour assurer un écoulement d'eau homogène, il est recommandé d'enlever périodiquement les dépôts et saletés qui peuvent se constituer sur l'évent du robinet ou dans la pomme de douche. Le DHC a aussi un écran de filtrage intégré qui doit être nettoyé de temps en temps. Pour ce faire, fermer l'alimentation d'eau froide à la vanne d'isolation et enlever le conducteur de mise à la terre **(I)**. Tourner le tube d'alimentation d'eau froide dans le sens anti-horaire à 90° et tirer vers le fond de l'appareil. Nettoyer le filtre et remettre dans leur position d'origine le filtre, le tube d'alimentation d'eau froide et le conducteur de mise à la terre. S'assurer que le conducteur de mise à la terre est réinstallé et que la vis de mise à la terre est bien serrée après cette procédure.

 **MIS A PART LE FILTRE, LE DHC NE CONTIENT AUCUNE PIECE NECESSITANT UN ENTRETIEN PARTICULIER. EN CAS DE MAUVAIS FONCTIONNEMENT, CONTACTER UN PLOMBIER OU UN ELECTRICIEN PROFESSIONNEL.**

Caractéristiques techniques

Modèle	DHC 3-1	DHC 3-2		DHC 4-2		DHC 4-3	DHC 5-2		DHC 6-2		DHC 8-2		DHC 10-2		
Phase	1	1		1		1	1		1		1		1		
Voltage	V	120	208	240	208	240	277	208	240	208	240	208	240	208	240
Puissance	kW	3.0	2.5	3.3	2.9	3.8	4.5	3.6	4.8	4.5	6.0	5.4	7.2	7.2	9.6
Intensité	A	25	12	14	14	16	17	18	20	22	25	26	30	35	40
Taille minimale nécessaire du disjoncteur	A	30	15	20	20	20	20	30	30	30	30	40	40	40	50
Taille des fils de cuivre AWG COPPER		10	14	12	12	12	12	10	10	10	10	8	8	8	8
Écoulement d'eau minimum pour activer l'appareil	GPM / l/min	0.32 / 1.2	0.32 / 1.2		0.42 / 1.6		0.42 / 1.6	0.42 / 1.6		0.48 / 1.8		0.69 / 2.6		0.79 / 3.0	
Perte de pression dans l'appareil	PSI / bar	2.88 / 0.23	2.88 / 0.23		2.88 / 0.23		2.88 / 0.23	2.88 / 0.23		2.88 / 0.23		3.13 / 0.25		3.75 / 0.30	
Volume d'eau nominal		0.13 GAL / 0.5 l													
Pression de travail maximale		150 PSI / 10 bar													
Testée à la pression		300 PSI / 20 bar													
Poids	libres / kg	4.6 / 2.1	5.3 / 2.4		5.3 / 2.4		4.6 / 2.1	4.6 / 2.1		5.3 / 2.4		5.3 / 2.4		5.3 / 2.4	
Branchements d'eau		1/2" NPT													

- Convenant pour l'alimentation en eau froide
- Les chauffe-eau sans accumulateur sont considérés comme charge non continue
- Les conducteurs doivent être calibrés pour maintenir une chute de tension de moins de 3% sous charge

Dépannage

Symptôme	Cause possible	Solution
Pas d'eau chaude mais on entend un cliquetis quand l'eau est ouverte	<ul style="list-style-type: none"> – disjoncteur fermé – le disjoncteur de sécurité s'est déclenché 	<ul style="list-style-type: none"> – mettre le disjoncteur en marche. – réarmer le disjoncteur J.
Pas d'eau chaude et on n'entend pas de cliquetis quand l'eau est ouverte	<ul style="list-style-type: none"> – l'écoulement d'eau est trop bas pour activer le commutateur de débit 	<ul style="list-style-type: none"> – nettoyer l'évent du robinet. – ouvrir complètement la vanne de fermeture. – ouvrir la vis de réglage de débit H. – nettoyer le filtre sur l'appareil DHC I.
L'eau n'est pas assez chaude	<ul style="list-style-type: none"> – écoulement d'eau trop haut – tension trop basse 	<ul style="list-style-type: none"> – réduire l'écoulement d'eau, fermer la vis de réglage de l'écoulement H. – fournir la tension correcte à l'appareil.

Si vous n'arrivez pas à résoudre un problème, contactez nous en appelant le numéro gratuit 800-582-8423 avant d'enlever l'appareil du mur. STIEBEL ELTRON est heureuse de vous fournir son assistance technique. Dans la plupart des cas, il s'agit d'un problème que nous pouvons résoudre par téléphone.

Pièces de rechange **K**

N° de pièce de rechange	Modèle	DHC 3-1	DHC 3-2	DHC 4-2	DHC 4-3	DHC 5-2	DHC 6-2	DHC 8-2	DHC 10-2	
①	Système de chauffage	16 58 89	16 77 69	16 77 70	16 58 90	16 77 71	17 11 17	16 77 72	16 77 73	
②	Commutateur de débit	16 52 73	16 52 73	16 21 62	16 21 62	16 21 62	17 11 05	16 21 64	16 21 65	
③	Thermostat	16 24 72								
④	Commutateur	16 80 26								
⑤	Carter (arrière)	16 58 91								
⑥	Branchement de plomberie	17 07 89								
⑦	Carter (avant)	16 58 92								
⑧	Disjoncteur thermique de sécurité	16 24 74								
⑨	Bloc de câblage	16 22 02	16 50 49							
⑩	Tube de cuivre	16 23 14								
⑪	Châssis du module	16 24 62								
⑫	Collier de serrage	05 57 54								

ESTE MANUAL DEBE SER LEIDO CUIDADOSAMENTE Y EN SU TOTALIDAD. SI NO SE SIGUEN LAS INSTRUCCIONES ESPECIFICADAS EN ESTE MANUAL ANTES DE TRATAR DE INSTALAR UN CALENTADOR DE AGUA MODELO DHC, LA UNIDAD PUEDE QUE FUNCIONE INDEBIDAMENTE Y PUEDE CAUSAR DAÑOS A LA PROPIEDAD, SERIAS LESIONES AL CUERPO Y/O LA MUERTE.

STIEBEL ELTRON, INC. Y/O SU REPRESENTANTE NO SE HACEN RESPONSABLES POR CUALQUIER DAÑO OCASIONADO POR NO SEGUIR LAS INSTRUCCIONES DE INSTALACIÓN Y DE USO ESPECIFICADAS EN ESTE MANUAL NI POR USO IMPROPIO DEL PRODUCTO.

SI USTED TIENE CUALQUIER DUDA O PREGUNTA RELACIONADA CON LA OPERACIÓN O INSTALACIÓN DE ESTE CALENTADOR DE AGUA, POR FAVOR LLAME A NUESTRA LINEA DE SERVICIO TÉCNICO AL 800-582-8423 (PUERTO RICO: 787-787-1808). DESDE OTROS PAISES FAVOR LLAMAR AL 413-247-3380.

Leyenda

- 1 conexión de agua caliente
- 2 conexión de agua fría
- 3 bloque de alambrado
- 4 tornillo de ajuste de flujo
- 5 „Flow switch“
- 6 „Protección termal“
- 7 termostato
- 8 sistema de calentamiento
- 9 perforación para montaje
- 10 caja eléctrica
- 11 línea de agua
- 12 entrada a válvula T-3/8"
- 13 válvula de servicio
- 14 reducido a 1/2"
- 15 lavamanos
- 16 válvula de agua fría
- 17 válvula de agua caliente
- 18 abrazadera para cables eléctricos
- 19 entrada para cables
- 20 rejilla de filtrado
- 21 protección termal con botón de activación

General

Los calentadores de agua DHC difieren de los calentadores de tanque en muchas maneras. Este calentador no almacena agua caliente. Al contrario, calienta el agua instantáneamente cuando esta fluye a través de la unidad. El poderoso elemento que calienta, es activado solamente cuando se abre una llave de agua caliente la cual esta conectada al sistema alimentado por el calentador.

La temperatura del agua caliente suministrada por el DHC depende de la potencia del elemento resistivo y del flujo de agua que entra al calentador (DHC). Para que el DHC funcione adecuadamente debe ser instalado siguiendo cuidadosamente las instrucciones. Si usted tiene alguna pregunta sobre el funcionamiento y operación de su calentador DHC favor de llamar a nuestra línea de servicio técnico al 1-800-582-8423.

Usos

Los calentadores eléctricos DHC son ideales para el uso en casas, apartamentos o cabinas en áreas de un clima subtropical y tropical como el Caribe, muchas partes de México, Centro América y América del Sur.

Los modelos DHC ocupan muy poco espacio, son fáciles de instalar y proveen agua caliente continua y sin limite. Se pueden usar con sistemas eléctricos bien sea de 60 Hz o de 50 Hz.

La unidad se activa solo cuando hay demanda para agua caliente, evitando así, consumo y gasto innecesario de energía eléctrica y de agua.

Los importantes ahorros en el consumo de electricidad que ofrecen los modelos DHC pueden llegar hasta un 50 % cuando se comparan con el consumo de los calentadores eléctricos tipo "tanque".

INSTALACIÓN FÍSICA

⚠ LA UNIDAD DEBE INSTALARSE EN POSICIÓN VERTICAL CON LAS CONEXIONES DE AGUA EN LA PARTE DE ABAJO. NO INSTALE LA UNIDAD DONDE PUEDA MOJARSE, ESTO PODRÍA OCASIONAR UNA DESCARGA ELÉCTRICA.

1. Instale la unidad DHC lo más cerca posible del lugar de mayor uso de agua caliente.
2. Proveer un mínimo de cinco pulgadas a cada lado con fines de servicio.
3. Remover cubierta plástica **B**.
4. Instale la unidad DHC en la pared fijando los tornillos provistos en cada apertura de anclaje **C D**.

CONEXIÓN DE AGUA

1. Todo trabajo de plomería debe cumplir con los códigos de plomería. Nacional y/o Local.
2. Una válvula reductora de presión debe ser instalada si la línea de suministro de agua excede una presión de 150 PSI.
3. Asegúrese de dejar correr el agua por la línea de suministro antes de cualquier conexión para eliminar cualquier depósito o sucio en la misma.
4. Instalar válvula de servicio en línea de suministro de agua **A-13**. Esto permite aislar la unidad para propósitos de mantenimiento.
5. Conexión de agua de suministro (entrada) es al lado derecho de la unidad. La conexión de agua caliente (salida) debe ser al lado izquierdo de la unidad.

⚠ NOTA: CALOR EXESIVO DE LAS SOLDADURAS EN LAS LINEAS DE COBRE PUEDE CAUSAR DAÑOS AL CALENTADOR.

6. El calentador de agua DHC no requiere una válvula de alivio por presión y temperatura (PTRV). Si el inspector la requiere se debe instalarla después de la salida de agua caliente de la unidad.
7. Conectar uniones de 1/2 (media) pulgada NPT a sus respectivas líneas de agua fría o caliente. Proveer reductores cuando estos sean necesarios sin el código de plomería Nacional y/o Local.
8. Cuando finalice el trabajo de plomería verifique si hay goteos y corrija estos antes de proceder.

CONEXIÓN

⚠ PELIGRO: ANTES DE COMENZAR LA INSTALACION ELECTRICA ASEGURESE DE QUE EL INTERRUPTOR TERMOMAGNETICO PRINCIPAL DEL PANEL ELECTRICO ESTE APAGADO PARA EVITAR POSIBLE DESCARGA ELECTRICA.

NOTA: TODA INSTALACION ELECTRICA Y DE PLOMERIA DEBE COMPLETARSE ANTES DE ENCENDER EL INTERRUPTOR TERMOMAGNETICO PRINCIPAL. EL CIRCUITO DEBE SER EQUIPADO CON UN INTERRUPTOR DE CONEXIÓN A TIERRA („GROUND FAULT INTERRUPTER“) CUANDO SEA REQUERIDO POR EL CODIGO ELECTRICO NACIONAL Y/O LOCAL.

1. Todo trabajo eléctrico debe cumplir con las disposiciones del Colegio de Peritos Electricistas y Códigos Nacionales y/o Locales.
2. La unidad DHC debe tener su circuito independiente utilizando tres (3) alambres de cobre de tamaño apropiado y protegido por un interruptor termomagnético (breaker) correctamente seleccionado. Para instalar varias unidades DHC se requiere un circuito independiente para cada una.
3. La cablearía debe entrar a la unidad a través del sello de goma localizado en la parte inferior de la misma entre las conexiones de agua fría y caliente **G**. Alimente los cables a través de la abrazadera localizada dentro de la unidad y ajuste esta firmemente contra los cables. Los cables vivos deben ser conectados en los terminales N y L para los modelos DHC 3-1. El DHC 3-2 y en todos los demás modelos los cables vivos deben ser conectados en los terminales L y L (Favor ver diagramas E y F).
4. Reinstalar cubierta plástica. El cable de conexión a tierra „ground“ debe ser conectado al terminal marcado con el símbolo de tierra.

⚠ ADVERTENCIA: COMO CUALQUIER OTRO APARATO ELECTRICO EL NO CONECTARLO A TIERRA PUEDE RESULTAR EN UNA DESCARGA ELECTRICA, GRAVE LESION Y/O INCLUSO OCASIONAR MUERTE.

OPERACION DE LA UNIDAD

⚠ ADVERTENCIA: ABRA LA LLAVE DE AGUA CALIENTE POR VARIOS MINUTOS HASTA QUE EL FLUJO DE AGUA SEA CONTINUO Y TODO EL AIRE HAYA SALIDO DE LA TUBERIA. ADVERENCIA: LA COBERTURA PLASTICA DE LA UNIDAD DEBE SER INSTALADA ANTES DE ENCENDER EL „BREAKER“ DEL CIRCUITO.

1. Encender el „breaker“ del circuito para proveer corriente a la unidad. Abrir la llave de agua caliente a un punto típico, o sea, hasta que el flujo de agua sea igual al de uso normal. Espere 60 segundos hasta que la temperatura se estabilize.
2. Probar temperatura del agua, si la temperatura es muy baja, el flujo de agua debe ser reducido. Para reducir el flujo apague el „breaker“ de circuito, remueva cobertura plástica y dele media vuelta (180 grados) en dirección manecillas del reloj („clockwise“) al tornillo de ajuste de flujo (ver fig. 1).
3. Reinstale cobertura plástica, encienda el „breaker“ y verifique la temperatura del agua nuevamente. Este procedimiento debe repetirse hasta que se obtenga la temperatura de agua deseada. Por lo contrario, si la temperatura de agua es muy alta ajuste el tornillo de flujo, en contra de las manecillas del reloj (counterclockwise) de la misma manera hasta obtener la temperatura deseada.
4. Para obtener control de temperatura con una llave tipo mezcladora, restrinja el flujo de agua fría a la mezcladora cerrando parcialmente la llave de paso de dicha mezcladora hasta tanto el flujo de agua fría y caliente sean aproximadamente iguales.

MANTENIMIENTO

Los calentadores de agua Stiebel Eltron DHC estan diseñados para una larga y duradera vida de servicio. La vida útil del equipo depende de la calidad de agua y del uso. La unidad, de por sí, no requiere de ningún tipo de mantenimiento. Sin embargo, para asegurar el flujo de agua se recomienda que se remuevan los depósitos que puedan acumularse en el filtro („aerator“) del lavamanos o en las duchas.

⚠ EN CASO DE MAL FUNCIONAMIENTO DEL EQUIPO FAVOR SOLICITAR LOS SERVICIOS DE UN PLOMERO O ELECTRICISTA CERTIFICADO. POR FAVOR NO INTENTE REPARARLO USTED MISMO.

DATOS TÉCNICOS

Modelo		DHC 3-1		DHC 3-2		DHC 4-2		DHC 4-3		DHC 5-2		DHC 6-2		DHC 8-2		DHC 10-2	
Fase		1	1		1		1		1		1		1		1		
Voltaje	V	120	208	240	208	240	277	208	240	208	240	208	240	208	240	208	240
Potencia	kW	3.0	2.5	3.3	2.9	3.8	4.5	3.6	4.8	4.5	6.0	5.4	7.2	7.2	9.6		
AMPS	A	25	12	14	14	16	17	18	20	22	25	26	30	35	40		
Tamaño Mínimo Requerido del Interruptor Auto. "Braeker"	A	30	15	20	20	20	20	30	30	30	30	40	40	40	50		
Cable	AWG Cobre	10	14	12	12	12	12	10	10	10	10	8	8	8	8		
Min. flujo Req.	GPM / l/min	0.32 / 1.2	0.32 / 1.2		0.42 / 1.6		0.42 / 1.6		0.42 / 1.6		0.48 / 1.8		0.69 / 2.6		0.79 / 3.0		
Caida en presión	PSI / bar	2.88 / 0.23	2.88 / 0.23		2.88 / 0.23		2.88 / 0.23		2.88 / 0.23		2.88 / 0.23		3.13 / 0.25		3.75 / 0.30		
Volumen de agua		0.13 GAL / 0.5 l															
Presión máxima		150 PSI / 10 bar															
Presión de prueba		300 PSI / 20 bar															
Peso	lbs. / kg	4.6 / 2.1	5.3 / 2.4		5.3 / 2.4		4.6 / 2.1	4.6 / 2.1	5.3 / 2.4	5.3 / 2.4	5.3 / 2.4	5.3 / 2.4	5.3 / 2.4	5.3 / 2.4	5.3 / 2.4		
Conexion de tubería		1/2" NPT															

La línea de agua de entrada (suministro) que se conecta a los calentadores DHC solo debe ser la línea de "agua fría" del sistema de plomería.

RESOLUCIÓN DE INCIDENCIAS (TROUBLESHOOTING)

Síntoma	Posible causa	Solución
No hay agua caliente pero se escucha el „click“ al abrir agua caliente.	<ul style="list-style-type: none"> – se cayó el breaker – protección termal activada. 	<ul style="list-style-type: none"> – usar breaker adecuado. – oprimir protector termal (botón) J.
No hay agua caliente y no se oye el „click“.	<ul style="list-style-type: none"> – No hay flujo de agua suficiente para activar unidad. 	<ul style="list-style-type: none"> – limpiar „aerators“. – abrir valvula al máximo H. – abrir tornillo de ajuste de flujo I.
Agua no caliente suficiente	<ul style="list-style-type: none"> – demasiado flujo de agua – voltaje muy bajo ó incorrecto. 	<ul style="list-style-type: none"> – disminuir flujo de agua (cerrar tornillo de ajuste) H. – suministrar voltaje correcto.

Nota Importante:

La Stiebel Eltron, Inc. está a sus ordenes para ayudar en resolver cualquier problema de instalación o servicio de sus productos.

La mayoría de los problemas de instalación y operación de los calentadores DHC pueden resolverse fácilmente por teléfono consultando a su distribuidor local.

Nuestro Departamento Técnico puede ser contactado en los EE.UU. al 1-800-582-8423 y para llamadas desde el exterior favor marcar el 413-538-7850. El horario es de 9:00 a 5:00, Lunes a Viernes, Hora del Este. Correo electrónico al: info@stiebel-eltron-usa.com

REPUESTOS **K**

Numero y Descripción	Modelo	DHC 3-1	DHC 3-2	DHC 4-2	DHC 4-3	DHC 5-2	DHC 6-2	DHC 8-2	DHC 10-2	
① Sistema de Calentamiento		16 58 89	16 77 69	16 77 70	16 58 90	16 77 71	17 11 17	16 77 72	16 77 73	
② Interruptor de Flujo		16 52 73	16 52 73	16 21 62	16 21 62	16 21 62	17 11 05	16 21 64	16 21 65	
③ Termostato		16 24 72								
④ Interruptor		16 80 26								
⑤ Caja Exterior (parte trasera)		16 58 91								
⑥ Conexiones de Tubería		17 07 89								
⑦ Caja Exterior (parte delantera)		16 58 92								
⑧ Interruptor de Seguridad (temperatura)		16 24 74								
⑨ Bloque de Alambrado		16 22 02	16 50 49							
⑩ Tubo de Cobre		16 23 14								
⑪ Armazón Interior		16 24 62								
⑫ Abrazadera para Cables Eléctricos		05 57 54								

WARRANTY

RESIDENTIAL & COMMERCIAL WARRANTY: STIEBEL ELTRON WARRANTS TO THE ORIGINAL OWNER THAT THE DHC TANKLESS ELECTRIC WATER HEATER WILL BE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF THREE YEARS FROM THE DATE OF PURCHASE. SHOULD THE PART(S) PROVE TO BE DEFECTIVE UNDER NORMAL USE DURING THIS PERIOD, STIEBEL ELTRON, INC. WILL BE RESPONSIBLE FOR REPLACEMENT OF THE DEFECTIVE PART(S) ONLY. STIEBEL ELTRON, INC. IS NOT RESPONSIBLE FOR LABOR CHARGES TO REMOVE AND/OR REPLACE THE DEFECTIVE PART(S), OR ANY INCIDENTAL OR CONSEQUENTIAL EXPENSES.

SHOULD THE OWNER WISH TO RETURN THE TANKLESS ELECTRIC WATER HEATER FOR REPAIR, THE OWNER MUST FIRST SECURE WRITTEN AUTHORIZATION FROM STIEBEL ELTRON, INC. THE OWNER SHALL BE REQUIRED TO SHOW PROOF OF PURCHASE DATE, AND TO PAY ALL TRANSPORTATION COSTS TO RETURN THE DEFECTIVE PART(S) OR TANKLESS ELECTRIC WATER HEATER FOR REPAIR OR REPLACEMENT. WARRANTY IS VOID IF WATER HEATER HAS BEEN INSTALLED OR USED IMPROPERLY OR IF DESIGN HAS BEEN ALTERED IN ANY WAY.

STIEBEL ELTRON, INC.

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West Hatfield, MA 01088
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E-Mail info@stiebel-eltron-usa.com
www.stiebel-eltron-usa.com

GARANTIE

GARANTIE POUR USAGE PRIVE & COMMERCIAL: STIEBEL ELTRON GARANTIT AU PROPRIETAIRE INITIAL QUE LE CHAUFFE-EAU ELECTRIQUE DHC SANS ACCUMULATEUR EST GARANTI PIECES ET MAIN D'ŒUVRE POUR UNE PERIODE DE TROIS ANS A PARTIR DE LA DATE D'ACHAT. SI LA OU LES PIECE(S) SE REVELAI(EN)T DEFECTUEUSE(S) EN UTILISATION NORMALE PENDANT CETTE PERIODE, STIEBEL ELTRON INC. SERA RESPONSABLE UNIQUEMENT DU REMPLACEMENT DE LA OU DES PIECE(S) DEFECTUEUSE(S). STIEBEL ELTRON INC. N'EST PAS RESPONSABLE DES FRAIS D'ENLEVEMENT OU DE REMPLACEMENT DE LA OU DES PIECE(S) DEFECTUEUSE(S) NI D'AUCUNE DEPENSE CONSECUTIVE OU INDIRECTE.

SI LE PROPRIETAIRE SOUHAITE RETOURNER LE CHAUFFE-EAU ELECTRIQUE SANS ACCUMULATEUR POUR REPARATION, IL DOIT D'ABORD EN OBTENIR L'AUTORISATION ECRITE DE STIEBEL ELTRON INC. IL SERA DEMANDE AU PROPRIETAIRE DE MONTRER LA PREUVE DE LA DATE D'ACHAT ET DE PAYER TOUS LES FRAIS DE TRANSPORT POUR RETOURNER LA OU LES PIECE(S) DEFECTUEUSE(S) OU LE CHAUFFE-EAU ELECTRIQUE SANS ACCUMULATEUR POUR REPARATION OU REMPLACEMENT. LA GARANTIE NE S'APPLIQUE PAS SI LE CHAUFFE-EAU A ETE INSTALLE OU UTILISE DE MANIERE INADEQUATE OU SI SA CONCEPTION A ETE MODIFIEE DE QUELQUE NATURE DE CE SOIT.

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GARANTIA**GARANTIA RESIDENCIAL Y COMERCIAL.**

STIEBEL ELTRON GARANTIZA AL DUEÑO ORIGINAL QUE EL CALENTADOR DE AGUA MODELO DHC; ESTARA LIBRE DE DEFECTOS DE MANO DE OBRA Y MATERIALES POR UN PERIODO DE 3 AÑOS DESDE EL DIA DE COMPRA. SI ALGUNA PARTE DE ESTE PRUEBA ESTAR DEFECTUOSA BAJO USO NORMAL DURANTE ESTE PERIODO, STIEBEL ELTRON SE HACE RESPONSABLE POR EL REEMPLAZO DE SOLAMENTE LAS PARTES DEFECTUOSAS. STIEBEL ELTRON NO SE HACE RESPONSABLE POR COSTOS DE LABOR DEBIDO A LA REMOCION O REPARACIÓN DE PARTES DEFECTUOSAS Y POR INCIDENTES O GASTOS CONSECUTENTES.

SI EL DUEÑO DESEA DEVOLVER EL CALENTADOR DE AGUA PARA REPARACION SERA RESPONSABILIDAD DEL MISMO, EL ASEGURARSE PRIMERO DE OBTENER UNA AUTORIZACION ESCRITA DE STIEBEL ELTRON. AL DUEÑO SE LE EXIGIRA PRUEBA DE FECHA DE COMPRA Y PAGAR TODOS LOS GASTOS NECESARIOS PARA LA TRANSPORTACION DE PIEZAS DEFECTUOSAS PARA SER REEMPLAZADAS. LA GARANTIA SE ANULARIA SI EL CALENTADOR HA SIDO INSTALADO O UTILIZADO INADECUADAMENTE, O SI EL DISEÑO HA SIDO ALTERADO DE ALGUNA MANERA.

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Shown actual size: Maestro dimmer and 1-gang Claro wallplate in White (WH).

Product family features

- True multi-location dimming from every location
- Tap on to favorite level; tap off; tap twice for full on
- Touch rocker to adjust light level
- LEDs indicate light level and glow softly in the dark as a locator light
- Delayed off provides light as you exit the room
- Line frequency compensation maintains stable light levels, despite power line frequency and voltage variations
- Programming allows customized functions
- **eco-dim®**, **eco-minder™** and **eco-timer** models available
- Mechanical air-gap to disconnect load power
- 100% factory tested
- Coordinating Claro®, Satin Colors® and Stainless Steel wallplates only available separately
- Custom engraving available for wallplates, see pg. 155

Control types

-  Single-pole (one location)
-  Multi-location dimming from every location (up to ten locations)

Direct load type compatibility

-  Incandescent/halogen lighting
-  Magnetic low-voltage lighting
-  Electronic low-voltage lighting
-  Fluorescent lighting
-  LED lighting
-  Ceiling fans
-  Ceiling fan/lights

Load type requiring load interface

Lighting load interfaces may be applicable for some load type, voltage and capacity combinations.

For additional information, see pg. 174.

Dimmers and switches

Digital fade dimmers



- Tap on to favorite level; tap off
- Tap twice for full on
- Press, hold and release for delayed fade-to-off
- Touch rocker to adjust light level
- Provides true dimming from each location (with companion dimmers)
- **eco-dim®** model guarantees at least 15% energy savings compared to a standard switch
- **eco-minder™** green LED demonstrates 15% or more energy savings compared to a standard switch
- Dimmer advanced programming features available



eco-minder™

Digital switches



- For multi-location switching, use one Maestro multi-location switch with Maestro companion switches
- Tap switch on/off

Timers

Countdown timer switches (5–60 minutes/full on)



- Use with exhaust fans to reduce moisture, mold and mildew in bathrooms and kitchens
- Use with lighting
- Tap on to start timer; tap off
- Tap twice for untimed on
- Touch rocker to adjust countdown time
- One minute warning before lights/fan go off
- Top LED is full on with no timer action
- Timer advanced programming features available
- Multi-location control with companion switch

Countdown eco-timer switch (30 minutes)



- Use with exhaust fans to reduce moisture, mold and mildew in bathrooms and kitchens
- Use with lighting
- Tap on to start timer; tap off
- Touch rocker to adjust countdown time
- One minute warning before lights/fan go off
- **Timer always turns off**
- Single-location only
- Timer advanced programming features available

Dimmers and switches with sensors*

Dimmers with occupancy/vacancy sensor



Dimmer (top)

- Tap on to favorite light level; tap off
- Tap twice for full on
- Touch rocker to adjust light level
- Works with up to nine companion dimmers (MA-R-)
- Dimmer advanced programming features available, see pg. 49

Sensor (bottom)

- Turns lights off to save energy when no one is in the room
- Vacancy models meet California Title 24 Section 119(j) requirements. Lights are turned on manually and off by the sensor.
- 180° field of view motion sensor
- Sensor advanced programming features available, see pg. 49

Switches with occupancy/vacancy sensor



Switch (top)

- Tap switch on/off
- Works with up to nine companion switches (MA-AS-)

Sensor (bottom)

- Turns lights off to save energy when no one is in the room
- Vacancy models meet California Title 24 Section 119(j) requirements. Lights are turned on manually and off by the sensor.
- 180° field of view motion sensor
- Sensor advanced programming features available, see pg. 49

Companion dimmers and switches

Companion dimmers



- For true multi-location dimming from every location, use up to nine companion dimmers with only one Maestro® multi-location dimmer
- Use standard single-pole and 3-way wiring

Companion switches

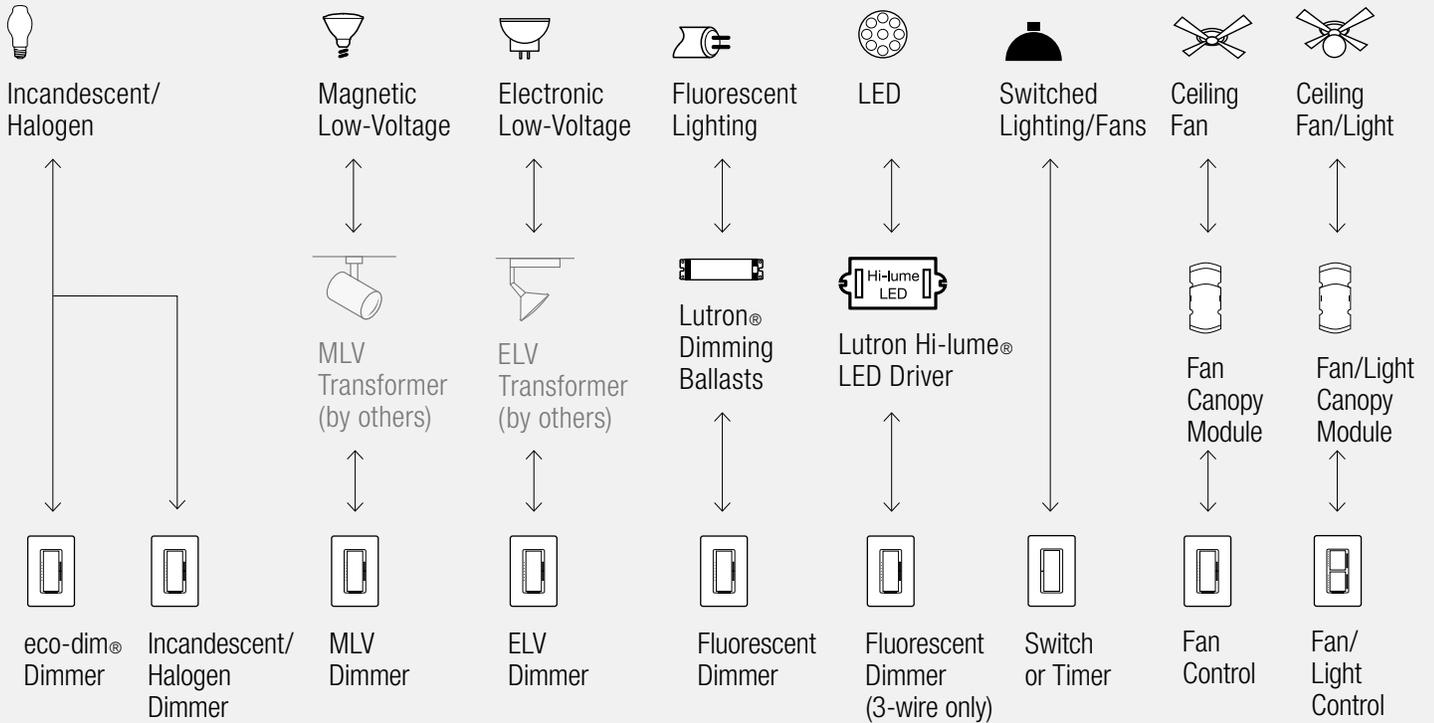


- For use with multi-location switches, use up to nine Maestro companion switches with one Maestro multi-location switch
- Can be used with multi-location countdown timer switch
- Use standard single-pole and 3-way wiring

*For more information on Maestro dimmers and switches with occupancy/vacancy sensor, see pg. 140.

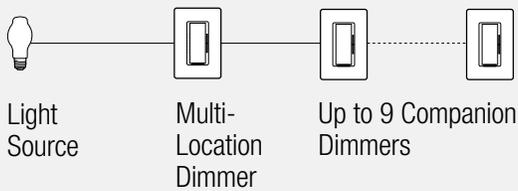
Connections overview

Load connections*

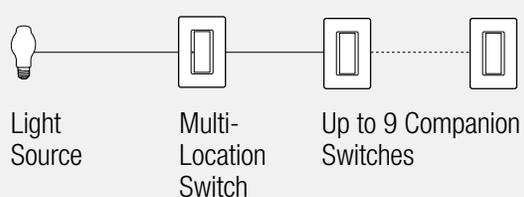


Control types (for 2 or more locations)

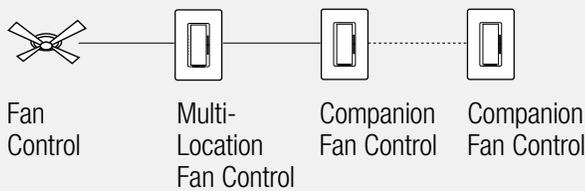
Dim from multiple-locations (up to 10)



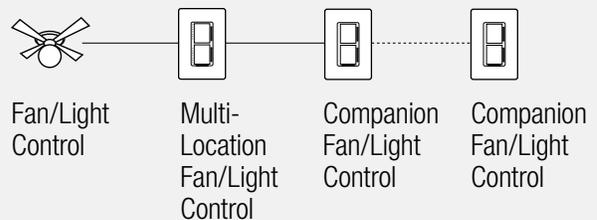
Switch from multiple-locations (up to 10)



Fan control from up to 3 locations



Fan/light control from up to 3 locations



For more information on ballasts, visit www.lutron.com/ballasts.
 For more information on LED drivers, visit www.lutron.com/LED.

***For illustration purposes only.** Consult model number pages for specific voltage and capacity information.

Dimmer model numbers

 **Incandescent/halogen dimmers****

Digital fade dimmers

Multi-location/single-pole 120V 600W	MA-600- CC ³
Multi-location/single-pole 120V 600W	MSC-600M- CC ⁴
Multi-location/single-pole 120V 1000W	MA-1000- CC ³
Multi-location/single-pole 120V 1000W	MSC-1000M- CC ⁴

eco-dim® digital fade dimmer**

Multi-location/single-pole 120V 600W	MA-600G- EE ²
---	---------------------------------

eco-dim model guarantees at least 15% energy savings and triples lamp life compared to a standard switch.

eco-minder™ digital fade dimmer**

Multi-location/single-pole 120V 600W	MA-600I- EE ²
---	---------------------------------

eco-minder green LED lights demonstrate 15% or more energy savings compared to a standard switch.

 **Magnetic low-voltage dimmers****

Digital fade dimmers

Multi-location/single-pole 120V 600VA (450W)	MALV-600- CC ³
Multi-location/single-pole 120V 600VA (450W)	MSCLV-600M- CC ⁴
Multi-location/single-pole 120V 1000VA (800W)	MALV-1000- CC ³
Multi-location/single-pole 120V 1000VA (800W)	MSCLV-1000M- CC ⁴

The stated VA (Volt-Ampere) rating includes the magnetic transformer heat losses and the lamp load. The stated W (Watt) rating is the maximum lamp wattage based on assumed 20% transformer loss.

 **Electronic low-voltage dimmers***

Digital fade dimmers

Multi-location/single-pole 120V 600W	MAELV-600- CC ³
Multi-location/single-pole 120V 600W	MSCELV-600M- CC ⁴

Only certain LED drivers are dimmable using an ELV dimmer, for more information visit www.lutron.com/LED.

CC³: Gloss color codes, see pg. 47
CC⁴: Satin color codes, see pg. 47
EE²: Available in White (WH), Ivory (IV), Almond (AL) and Light Almond (LA)
 (Wallplates not included with above, order separately, see pg. 160)

All models must be derated if ganged unless otherwise noted, see pg. 170.
***Requires neutral wire connection.**
****Minimum load is 40W/VA.**

Dimmer model numbers

3-wire fluorescent dimmers*

Digital fade dimmers (two loads)

Multi-location/single-pole 120V 6A	MAF-6AM- CC ³
Multi-location/single-pole 120V 6A	MSCF-6AM- CC ⁴
Multi-location/single-pole 277V 6A	MAF-6AM-277- CC ³
Multi-location/single-pole 277V 6A	MSCF-6AM-277- CC ⁴

For use with Hi-lume®, Hi-lume® Compact SE, Hi-lume® 3D, Eco-10®, EcoSystem® ballasts.

Fixed low-end trim (non-adjustable).

Hi-lume® LED drivers: 3-wire fluorescent dimmers*

Digital fade dimmers

Multi-location/single-pole 120V 6A	MAF-6AM- CC ³
Multi-location/single-pole 120V 6A	MSCF-6AM- CC ⁴
Multi-location/single-pole 277V 6A	MAF-6AM-277- CC ³
Multi-location/single-pole 277V 6A	MSCF-6AM-277- CC ⁴

For use with Hi-lume LED driver only.

For more information on Hi-lume LED drivers, visit www.lutron.com/HilumeLED.

Fixed low-end trim (non-adjustable).

CC¹: Gloss and Satin color codes, see pg. 47

CC³: Gloss color codes, see pg. 47

CC⁴: Satin color codes, see pg. 47

(Wallplates not included with above, order separately, see pg. 160)

Dimmers and switches with sensor model numbers

Incandescent/halogen dimmers with occupancy/vacancy sensor

Digital fade dimmer with occupancy/vacancy sensor**

Multi-location/single-pole 120V 600W	MS-OP600M- CC ¹
---	-----------------------------------

Digital fade dimmer with vacancy only sensor

Multi-location/single-pole 120V 600W	MS-VP600M- CC ¹
---	-----------------------------------

Not for use with mechanical 3-way or 4-way switches.

Switches with occupancy/vacancy sensor

Digital switch with occupancy/vacancy sensor*

Multi-location/single-pole 120V 5A	MS-OPS5AM- CC ¹
---------------------------------------	-----------------------------------

Rated for: incandescent/halogen, magnetic low-voltage, electronic low-voltage, non-dim fluorescent ballasts, non-dim LED drivers.

Digital switch with vacancy only sensor*

Multi-location/single-pole 120V 5A	MS-VPS5AM- CC ¹
---------------------------------------	-----------------------------------

Rated for: incandescent/halogen, magnetic low-voltage, electronic low-voltage, non-dim fluorescent ballasts, non-dim LED drivers.

For more information on Lutron ballasts, visit www.lutron.com/ballasts.

All models must be derated if ganged unless otherwise noted, see pg. 170.

*Requires neutral wire connection.

**Minimum load is 40W/VA.

Switch model numbers

Switches

Digital switches

Multi-location/single-pole* MA-S8AM-**CC**³
120V 8A light or 3A fan

Multi-location/single-pole* MSC-S8AM-**CC**⁴
120V 8A light or 3A fan

Rated for: incandescent/halogen, magnetic low-voltage, electronic low-voltage, non-dim fluorescent ballasts, general purpose fans and most non-dim LED drivers.

Multi-location/single-pole* MSCF-S6AM-277-**CC**⁴
277V 6A light

Multi-location/single-pole* MAF-S6AM-277-**CC**³
277V 6A light

Rated for: incandescent/halogen, magnetic low-voltage, electronic low-voltage, non-dim fluorescent ballasts and most non-dim LED drivers.

Timer model numbers

Timers

Countdown timer control switch (5–60 minutes/full on)**

Single-pole, no neutral required MA-T51-**CC**¹
120V 600W/VA (5A) on/off lighting load
(incandescent/halogen, MLV)
OR 3A general purpose fan(s)

Multi-location/single-pole* MA-T51MN-**CC**¹
120V 600W/VA (5A) on/off lighting load
(incandescent/halogen, MLV, ELV, fluorescent)
OR 3A general purpose fan(s)

Use MA-T51MN- with a companion switch (MA-AS- or MSC-AS-) for multi-location switching.

Countdown eco-timer control switch (30 minutes/full on)**

Single-pole MA-T530G-**EE**²
120V 600W/VA (5A) on/off lighting load
(incandescent/halogen, MLV)
OR 3A general purpose fan(s)

CC¹: Gloss and Satin color codes, see pg. 47

CC³: Gloss color codes, see pg. 47

CC⁴: Satin color codes, see pg. 47

EE²: Available in White (WH), Ivory (IV), Almond (AL) and Light Almond (LA)
(Wallplates not included with above, order separately, see pg. 160)

All models must be derated if ganged unless otherwise noted, see pg. 170.

***Requires neutral wire connection.**

**Minimum load is 40W/VA.

Dual device model numbers

Incandescent/halogen dimmer and Incandescent/halogen dimmer**

Dual dimmers

Single-pole	MA-L3L3- CC ¹
120V 300W light (top)	
Incandescent/halogen	
120V 300W light (bottom)	
Incandescent/halogen	

Incandescent/halogen dimmer and switch**

Dual dimmer/switch

Single-pole	MA-L3S25- CC ¹
120V 300W light (top)	
Incandescent/halogen	
2.5A switch (bottom)	
Lighting load and/or general purpose fan(s)	

Incandescent/halogen dimmer and timer switch**

Dual dimmer/timer switch

Single-pole	MA-L3T251- CC ¹
120V 300W light (top)	
Incandescent/halogen	
2.5A timer switch (bottom)	
Lighting load and/or general purpose fan(s)	

Companion control model numbers

Companion controls

Companion dimmers

Companion dimmer	MA-R- CC ³
120V	MSC-AD- CC ⁴
Companion dimmer	MA-R-277- CC ³
277V	MSC-AD-277- CC ⁴

No derating required if ganged.

Companion switches

Companion switch	MA-AS- CC ³
120V	
Companion switch	MSC-AS- CC ⁴
120V	
Companion switch	MA-AS-277- CC ³
277V	
Companion switch	MSC-AS-277- CC ⁴
277V	

No derating required if ganged.

CC¹: Gloss and Satin color codes, see pg. 47

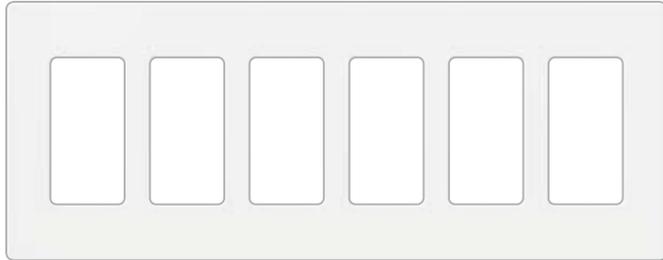
CC³: Gloss color codes, see pg. 47

CC⁴: Satin color codes, see pg. 47

(Wallplates not included with above, order separately, see pg. 160)

All models must be derated if ganged unless otherwise noted, see pg. 170.

**Minimum load is 40W/VA.



6-gang* CW-6-**CC**²
SC-6-**CC**⁴

W: 12.00in (305mm); H: 4.69in (119mm);
D: .30in (7.6mm)

Cable jacks



- F-style, 75-Ohm coaxial cable

Single cable jack* CA-CJH-**CC**³
SC-CJ-**CC**⁴

Telephone jacks



- 6-conductor telephone jack, RJ11

Single telephone jack* CA-PJH-**CC**³
SC-PJ-**CC**⁴

CC²: Gloss and Stainless Steel color codes, see pg. 161

CC³: Gloss color codes, see pg. 161

CC⁴: Satin color codes, see pg. 161

Receptacles



Tamper resistant receptacles

15A, 125V*	CARS-15-TR- CC ³ SCRS-15-TR- CC ⁴
20A, 125V*	SCRS-20-TR- CC ⁴

Receptacles

15A, 125V*	CAR-15H- CC ³ SCR-15- CC ⁴
20A, 125V*	SCR-20- CC ⁴

GFCI Receptacles



- Press test button to confirm LED indicator status
- Press reset button to reset GFCI after circuit interruption

Tamper resistant GFCI receptacles

15A, 125V*	GFCI	CAR-15-GFTR- CC ³ SCR-15-GFTR- CC ⁴
20A, 125V*	GFCI	SCR-20-GFTR- CC ⁴

*Stainless Steel finish only available as separate wallplate. Match with separate Black (BL) or Midnight (MN) controls and accessories.

Receptacles for dimming use



- Duplex for dimming both connected loads
- Projecting nubs prevent standard plugs from being used
- Requires replacement plugs for dimming use

Duplex for dimming use

15 A	120/125V*	CAR-15-DFDU- CC ²
15 A	120/125V*	SCR-15-DFDU- CC ⁴
20 A	120/125V*	CAR-20-DFDU- CC ²
20 A	120/125V*	SCR-20-DFDU- CC ⁴

Receptacles for dimming use



- Top half for dimming
- Projecting nub prevents standard plug from being used
- Requires replacement plugs for dimming use
- Bottom half is a general use receptacle and will fit standard duplex plugs

Split duplex (half for dimming use)

15 A	120/125V*	CAR-15-HFDU- CC ²
15 A	120/125V*	SCR-15-HFDU- CC ⁴
20 A	120/125V*	CAR-20-HFDU- CC ²
20 A	120/125V*	SCR-20-HFDU- CC ⁴

Receptacles for dimming use



- Duplex for dimming both connected loads
- Projecting nubs prevent standard plugs from being used
- Requires replacement plugs for dimming use
- 15 A model shown
- Tamper resistant shutter mechanism

Dual dimming tamper resistant

15 A	120/125V*	CAR-15-DDTR- CC ²
15 A	120/125V*	SCR-15-DDTR- CC ⁴
20 A	120/125V*	CAR-20-DDTR- CC ²
20 A	120/125V*	SCR-20-DDTR- CC ⁴

Receptacles for dimming use



- Top half for dimming
- Projecting nub prevents standard plug from being used
- Requires replacement plugs for dimming use
- Bottom half is a general use receptacle and will fit standard duplex plugs
- 15 A model shown
- Tamper resistant shutter mechanism

Half dimming tamper resistant

15 A	120/125V*	CAR-15-HDTR- CC ²
15 A	120/125V*	SCR-15-HDTR- CC ⁴
20 A	120/125V*	CAR-20-HDTR- CC ²
20 A	120/125V*	SCR-20-HDTR- CC ⁴

CC²: Gloss color code and Stainless Steel, see pg. 161

CC⁴: Satin color codes, see pg. 161

*Stainless Steel finish only available as separate wallplate. Match with separate Black (BL) or Midnight (MN) controls and accessories.

Field customizable 6-port frame



- Shipped with six blanks in matching colors
- Connectors and wallplate sold separately
- Connectors snap in (no tools required)
- Connectors available in White (WH), unless noted

6-port frame*	CA-6PF- CC ³ SC-6PF- CC ⁴
---------------	--

Connectors for 6-port frame

Telephone/network jacks

 8-conductor, RJ45 category 3	CON-1P-C3- EE ⁴
8-conductor, RJ45 category 5e	CON-1P-C5E- EE ⁴
8-conductor, RJ45 category 6	CON-1P-C6- EE ⁴

Fiber jacks

 MT-RJ feed through	CON-1F-MTRJ-WH
 SC simplex	CON-1F-SC-WH
 LC non-flush mount	CON-1F-LG-WH
 ST style	CON-1F-ST-WH

Cable jack

 F-style, 75-Ohm coaxial cable	CON-1C- EE ⁴
---	--------------------------------

BNC jack

 BNC connector, 50-Ohm	CON-1B-WH
---	-----------

Connectors only for use with 6-port frame.

Switches



- Paddle turns on/off
- Use with any 15A load
- General purpose switching of all sources and motor loads
- No derating if ganged

General purpose switches (120/277 V)

Single-pole	15A*	CA-1PSH- CC ³ SC-1PS- CC ⁴
3-way	15A*	CA-3PSH- CC ³ SC-3PS- CC ⁴
4-way	15A*	CA-4PSH- CC ³ SC-4PS- CC ⁴

General purpose switch with locator light (120V only)

Single-pole	15A*	CA-1PSNL- EE ² SC-1PSNL- EE ¹⁰
3-way	15A*	CA-3PSNL- EE ² SC-3PSNL- EE ¹⁰
4-way	15A*	CA-4PSNL- EE ² SC-4PSNL- EE ¹⁰

CC³: Gloss color codes, see pg. 161

CC⁴: Satin color codes, see pg. 161

EE²: Only available in Almond (AL), Ivory (IV), Light Almond (LA) and White (WH)

EE⁴: Only available in White (WH) and Black (BL)

EE¹⁰: Available in Biscuit (BI), Eggshell (ES), Goldstone (GS), Limestone (LS), Sea Glass (SG) and Snow (SW)

*Stainless Steel finish only available as separate wallplate. Match with separate Black (BL) or Midnight (MN) controls and accessories.

How to understand ganging and derating

Standard ganging

Ganging is the side-by-side mounting of two or more dimmers or accessory devices under a multi-gang wallplate.

Standard multi-gang installation:

- Uses standard multi-gang electrical backboxes
- Uses standard multi-gang wallplates
- Requires fins to be removed from dimmers for proper spacing (“Fins Broken” ganging)
- May require derating (i.e., reduction of dimmer capacity due to fin removal), see Derating Tables, pgs. 172–173

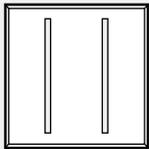
Custom ganging for Architectural style controls

For Architectural style dimmers and switches, it is possible to retain the maximum capacity of dimmers in multi-gang applications via custom architectural multi-gang:

- May require customized, wider-than-standard wallplates
- May require wider-than-standard electrical backboxes
- Allows full capacity (“No Fins Broken”) ganging
- Required for Nova® dimmers and for larger width (high capacity) architectural controls
- Visit www.lutron.com/customganging for additional information

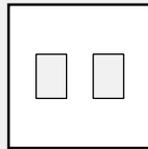
Standard ganging for dimmers, switches and accessories

New Architectural



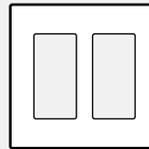
pg. 148

Architectural



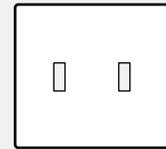
pg. 152

Designer

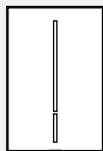


pg. 160

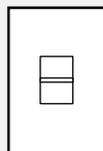
Traditional



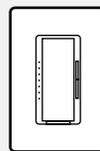
pg. 166



Vierti®



Vareo®
Nova T☆®



Maestro®
Maestro IR®
Maestro Wireless®
Spacer System®
Diva®
Lyneo® Lx
Skylark®
Skylark Contour™



Abella®
Ceana®
Ariadni®
Glyder®
Rotary

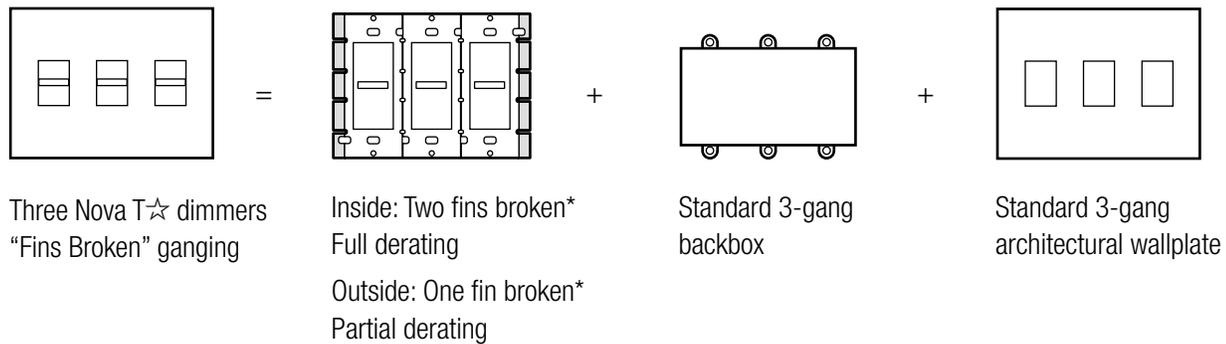
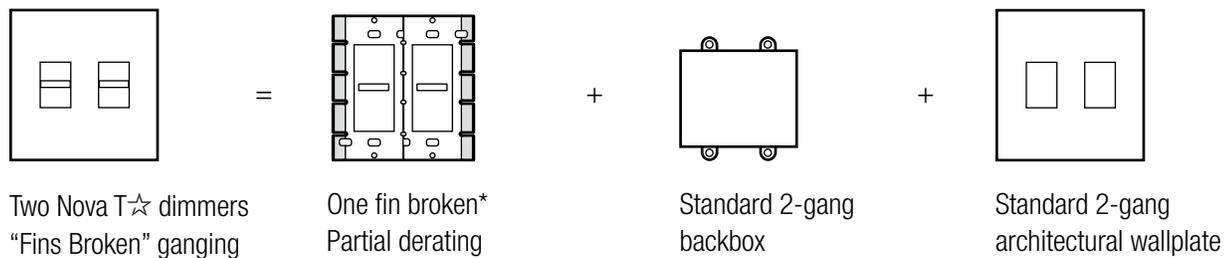
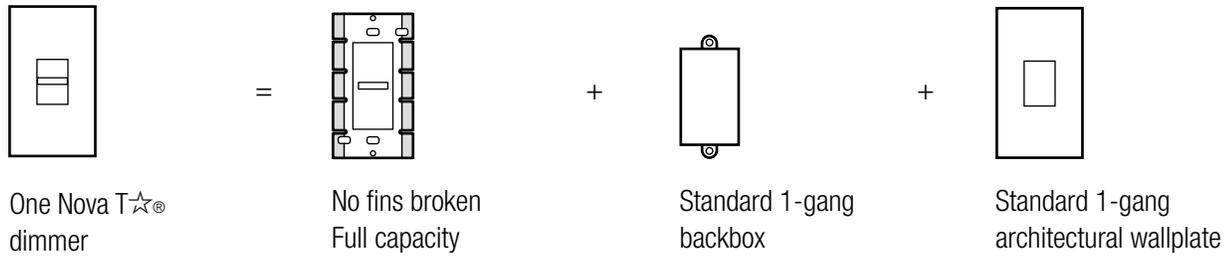
Derating Table 1
pg. 172

Derating Table 2
pg. 173

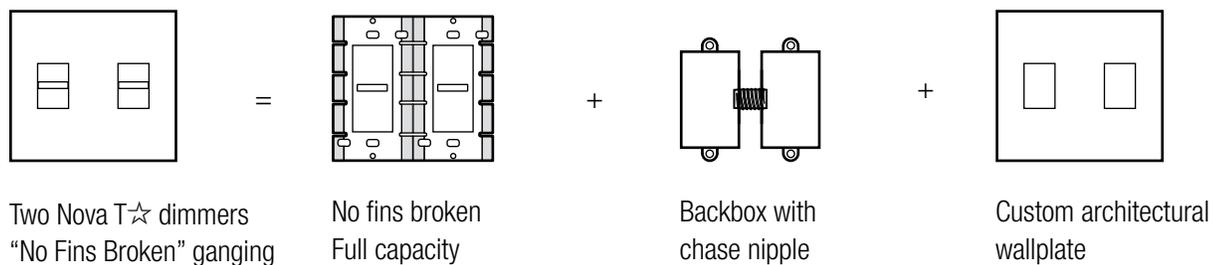
Derating Table 1
pg. 172

Derating Table 1
pg. 172

Standard ganging and fins broken derating examples:



Custom Architectural ganging example:



For further information on ganging and derating, visit www.lutron.com/multigang.
 *The fins are scored and designed to be removed easily.

Derating Table 1

New Architectural | Verti®

Designer | Maestro®, Maestro IR®, Maestro Wireless®, Spacer System®, Diva®, Lyneo® Lx, Skylark Contour™, Skylark®

Traditional | Abella®, Ceano®, Ariadni®, Glyder®, Rotary



No fins broken



1 fin broken



2 fins broken

	No fins broken	1 fin broken	2 fins broken
Incandescent			
Dimmers	600W	500W	400W
	1000W	800W	650W
Dual dimmers	300W	250W	200W
	300W	250W	200W
Magnetic low-voltage			
Dimmers	600VA/450W	500VA/400W	400VA/300W
	1000VA/800W	800VA/650W	650VA/500W
Electronic low-voltage			
Dimmers	300W	250W	200W
	500W	450W	400W
	600W	500W	400W
Fluorescent			
Hi-lume®/Hi-lume® Compact SE/Eco-10®/EcoSystem®			
Verti	60 ballasts/6A	50 ballasts/5A	35 ballasts/3.5A
Maestro/Spacer System	20 ballasts/6A	20 ballasts/5A	20 ballasts/3.5A
Diva, Skylark, Lyneo Lx and Ariadni	no derating	no derating	no derating
Tu-Wire®: Spacer System, Diva, Skylark	5A	4A	3.3A
Fan controls			
Quiet 7-speed	1.0A/300W	1.0A/300W	1.0A/300W
Quiet 3-speed	1.5A	1.5A	1.5A
Fully variable	5A	4A	3A
Fan/light controls			
Quiet 7-speed	1.0A/300W	1.0A/300W	1.0A/300W
Quiet 3-speed	1.5A/300W	1.5A/300W	1.5A/300W
	1.5A/360W	1.5A/360W	1.5A/360W
Fully variable	2.5A/300W	2.1A/250W	1.7A/200W
Electronic switches			
Verti	6A/3A	5A/3A	3.5A/3A
Maestro (light/fan)	8A/3A	6.5A/3A	5A/3A
Abella (light/fan)	6A/3A	5A/3A	3.5A/3A

Derating Table 2

Architectural | Vareo®, Nova T☆®



No fins broken



1 fin broken



2 fins broken

	No fins broken	1 fin broken	2 fins broken
Incandescent			
Dimmers	600W	500W	300W
	1000W	900W	700W
	1500W	1250W	1000W
	1950W	–	–
Magnetic low-voltage			
Dimmers	600 VA/450 W	500 VA/400 W	300 VA/250 W
	1000 VA/800 W	900 VA/750 W	700 VA/500 W
	1500 VA/1200 W	1250 VA/1000 W	1000 VA/800 W
Electronic low-voltage			
Dimmers	300W	300W	250W
	600W	500W	400W
Fluorescent			
Hi-lume®/Hi-lume® Compact SE/Eco-10®/EcoSystem®			
Vareo	20 ballasts /8 A	20 ballasts /6 A	20 ballasts /4.5 A
Nova T☆	6 A	no derating	no derating
	8 A	no derating	no derating
	16 A	no derating	no derating
0-10VDC control ¹	30mA ballasts	no derating	no derating
Tu-Wire®	5 A	4 A	3.3 A
Fan controls			
Quiet 3-speed	1.5 A	no derating	no derating
Fully variable	6 A	4.2 A	2.5 A
Fully variable	12 A	10 A	8.3 A
Electronic tapswitches²			
VETS-1000-	1000W	800W	650W
VETS-1000-SL-	1000W	900W	700W
VETN-1000-	1000 VA	700 VA	550 VA

For further information on ganging Nova®, visit www.lutron.com/customganging.

¹PowerPack required for line voltage switching.

²VETS-R-Auxiliary electronic tapswitches do not require derating.

Dimmer capabilities and interface requirements

- M** Multi-location—true dimming from each location
- E** eco-model available
- Compatible dimmer (no interface)
- WBX** **TVI** **3F** **PA** Requires interface, see notes below



Dimmers	capacity†	M				
Incandescent/halogen 120V	600W				M	
	1000W				M	
	1500W			WBX		
	2000W			WBX		
Magnetic low-voltage 120V	600 VA (450W)					
	1000 VA (800W)					
	1500 VA (1200W)			WBX		
	2000 VA (1600W)			WBX	WBX	
Magnetic low-voltage 277V	600 VA (450W)			WBX		WBX
	1000 VA (800W)			WBX		WBX
Electronic low-voltage 120V	300W			WBX		
	450W			WBX	WBX	
	600W			WBX		WBX
Electronic low-voltage 277V	16A			WBX	WBX	WBX
Neon/cold cathode				WBX	WBX	
3-wire ballasts and Hi-lume® LED driver 120V	6A					
	Hi-lume, Hi-lume Compact SE,	8A				
	Eco-10® and EcoSystem® ballasts	16A			3F	
3-wire ballasts and Hi-lume LED driver 277V	6A			3F		
	Hi-lume, Hi-lume Compact SE,	8A			3F	
	Eco-10 and EcoSystem ballasts	16A			3F	3F
					3F	3F
Tu-Wire® ballasts 120V	5A			PA		
0-10VDC (ballasts or LED Drivers) 120/277V	16A	TVI		TVI		

WBX: Wallbox Phase Adaptive Power Module (PHPM-WBX-DV-WH)

3F: Fluorescent Power Module (PHPM-3F-DV-WH)

TVI: 0-10V Interface (GRX-TVI)

PA: Phase Adaptive Power Module (PHPM-PA-DV-WH)

See pgs. 178–179 for specific compatible dimmer models and switching interface solutions.

*Consult Lutron Technical Support for information on interfaces with Vierti.

†UL listed for FULL wattage indicated (derate capacity only if ganged with other devices).

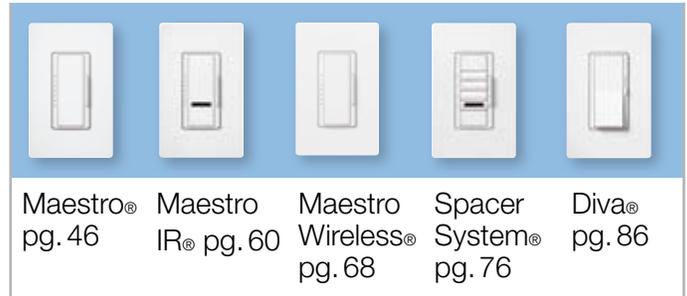
Dimmer capabilities and interface requirements

M Multi-location—true dimming from each location

E eco-model available

 Compatible dimmer (no interface)

WBX **TVI** **3F** **PA** Requires interface, see notes below



Dimmers	capacity†	M	M	M	M		
 Incandescent/halogen 120V	600W	E				E	
	1000W						
	1500W	WBX		WBX	WBX	WBX	
	2000W	WBX		WBX	WBX	WBX	
 Magnetic low-voltage 120V	600VA (450W)						
	1000VA (800W)						
	1500VA (1200W)	WBX		WBX	WBX	WBX	
	2000VA (1600W)	WBX		WBX	WBX	WBX	
 Magnetic low-voltage 277V	600VA (450W)	WBX		WBX	WBX	WBX	
	1000VA (800W)	WBX		WBX	WBX	WBX	
 Electronic low-voltage 120V	300W			WBX			
	450W			WBX		WBX	
	600W			WBX		WBX	
 Electronic low-voltage 277V	16A	WBX		WBX	WBX	WBX	
 Neon/cold cathode				WBX		WBX	
 3-wire ballasts and Hi-lume® LED driver 120V	6A						
	Hi-lume, Hi-lume Compact SE, Eco-10® and EcoSystem® ballasts	8A	3F		3F	3F	
	16A	3F		3F	3F	3F	
 3-wire ballasts and Hi-lume LED driver 277V	6A						
	Hi-lume, Hi-lume Compact SE, Eco-10 and EcoSystem ballasts	8A	3F		3F	3F	3F
	16A	3F		3F	3F	3F	
 Tu-Wire® ballasts 120V	5A	PA		PA			
 0-10VDC (ballasts or LED Drivers) 120/277V	16A	TVI		TVI	TVI	TVI	

WBX: Wallbox Phase Adaptive Power Module (PHPM-WBX-DV-WH)

3F: Fluorescent Power Module (PHPM-3F-DV-WH)

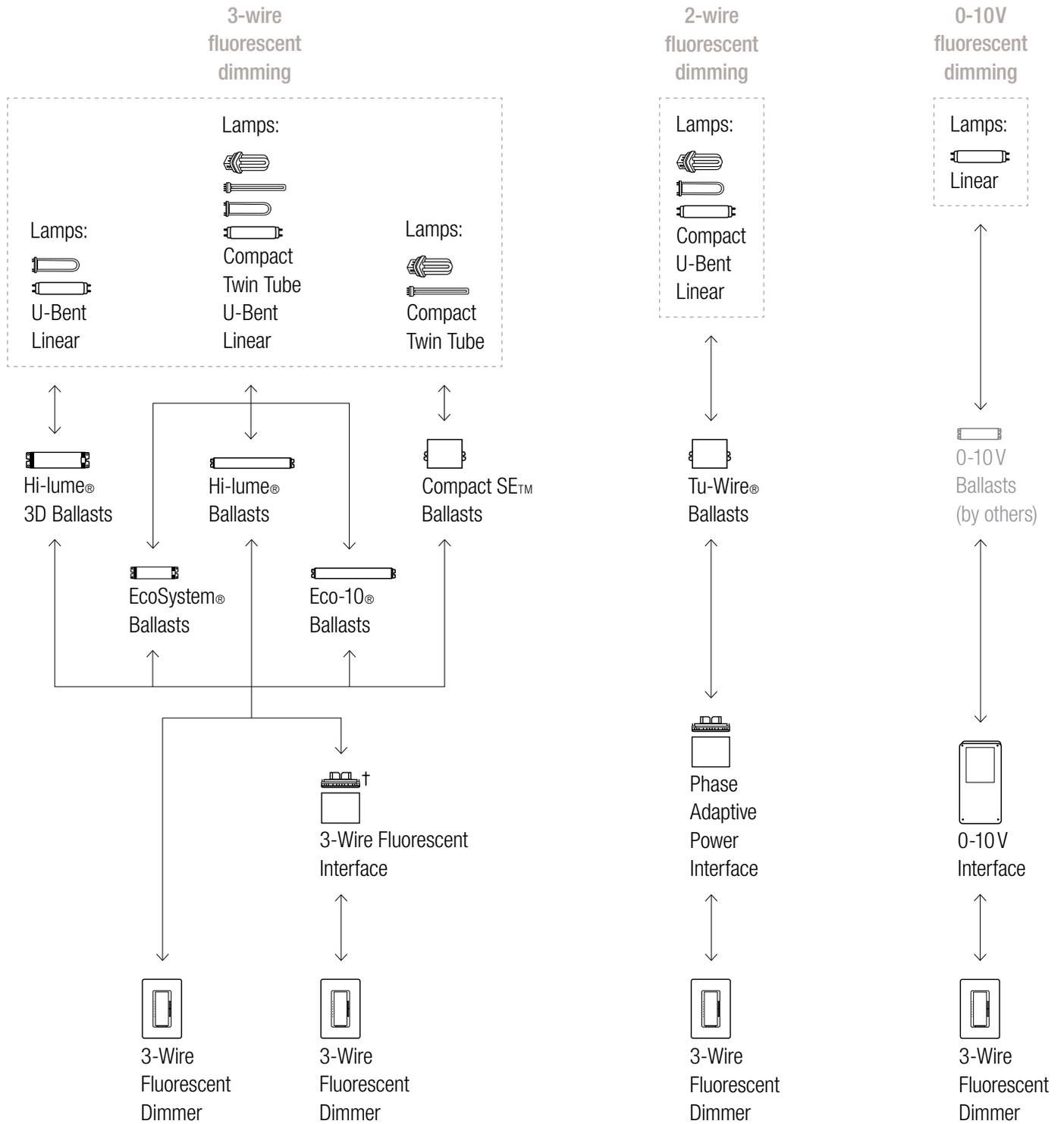
TVI: 0-10V Interface (GRX-TVI)

PA: Phase Adaptive Power Module (PHPM-PA-DV-WH)

See pgs. 178–179 for specific compatible dimmer models and switching interface solutions.

†UL listed for FULL wattage indicated (derate capacity only if ganged with other devices).

Maestro®

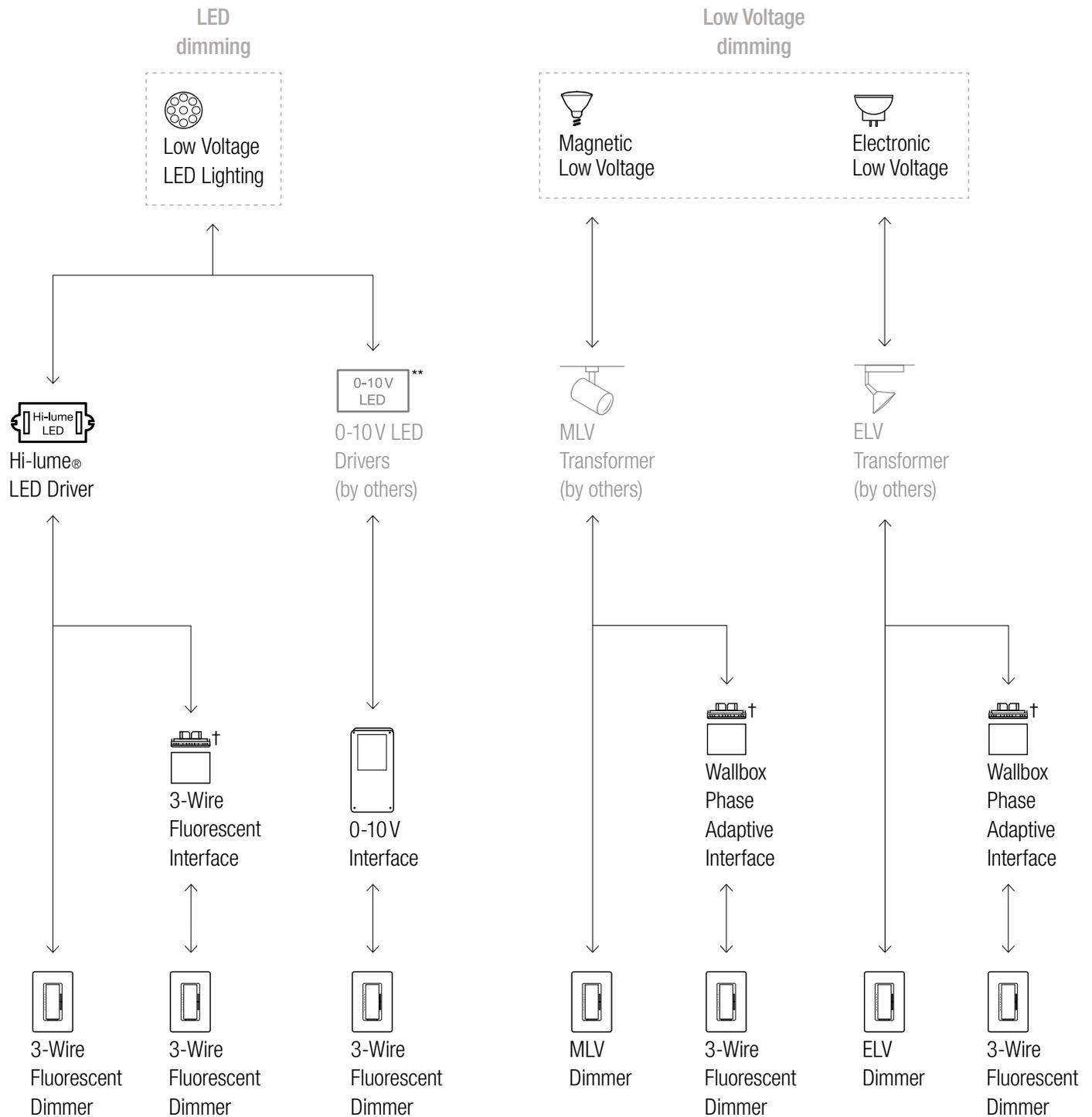


For illustration purposes only. Consult model number pages for specific voltage and capacity information.

For more information on LED drivers, visit www.lutron.com/LED.

†Interface provides additional capacity and/or may be different voltage than dimmer.

Maestro®



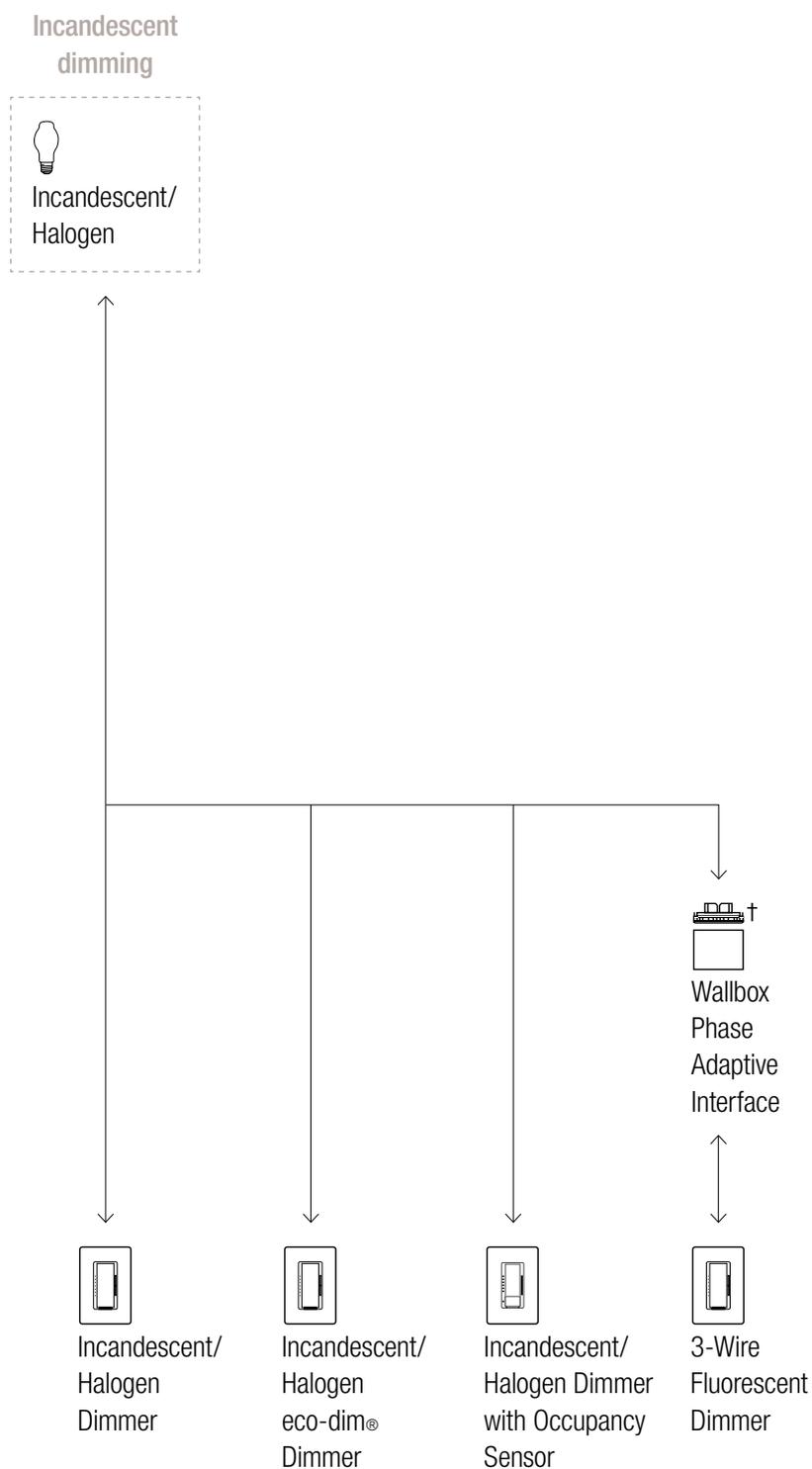
For illustration purposes only. Consult model number pages for specific voltage and capacity information.

For more information on LED drivers, visit www.lutron.com/LED.

**Consult www.lutron.com/LED for compatible 0-10V LED drivers.

†Interface provides additional capacity and/or may be different voltage than dimmer.

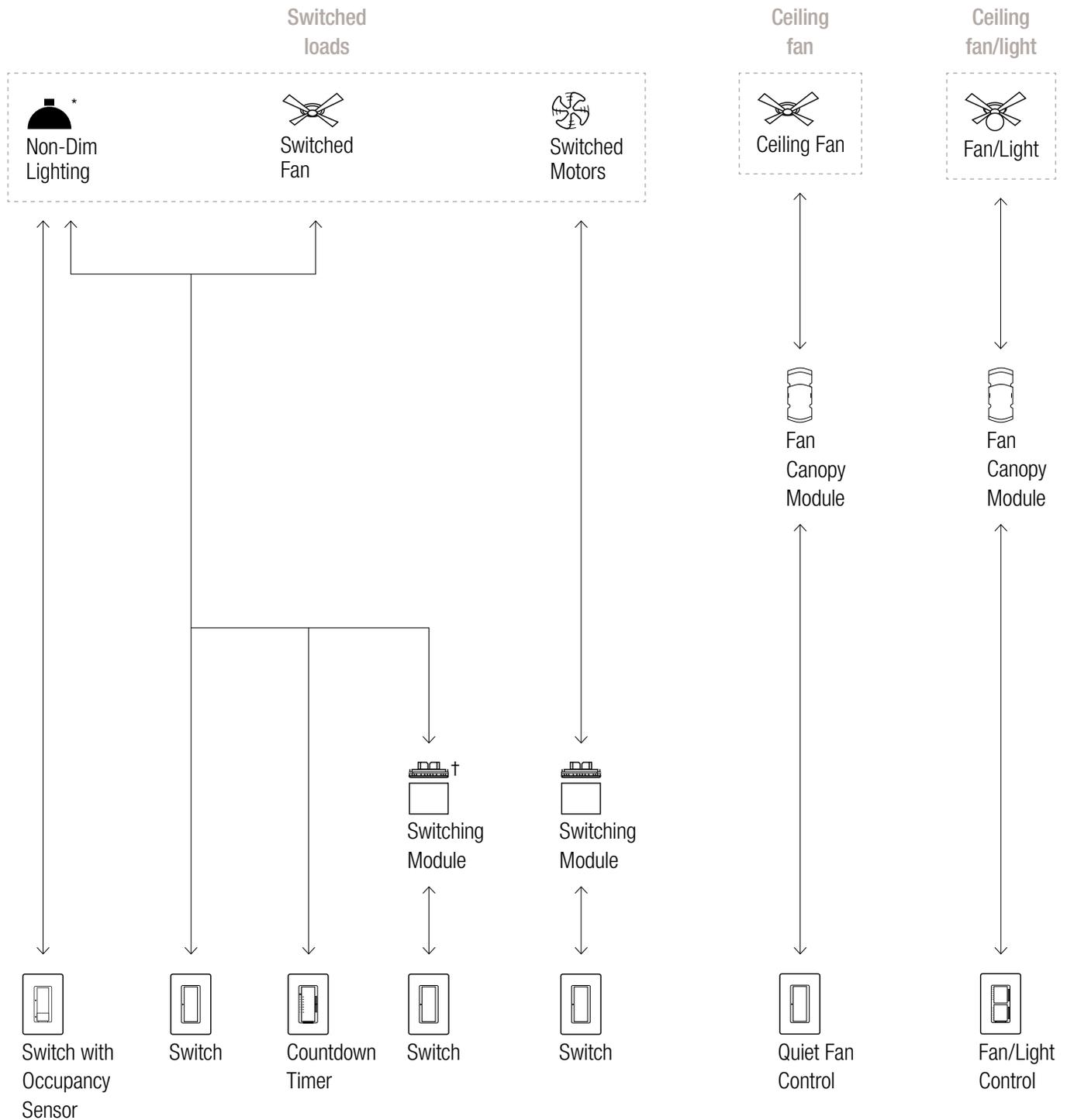
Maestro®



For illustration purposes only. Consult model number pages for specific voltage and capacity information.

†Interface provides additional capacity and/or may be different voltage than dimmer.

Maestro®

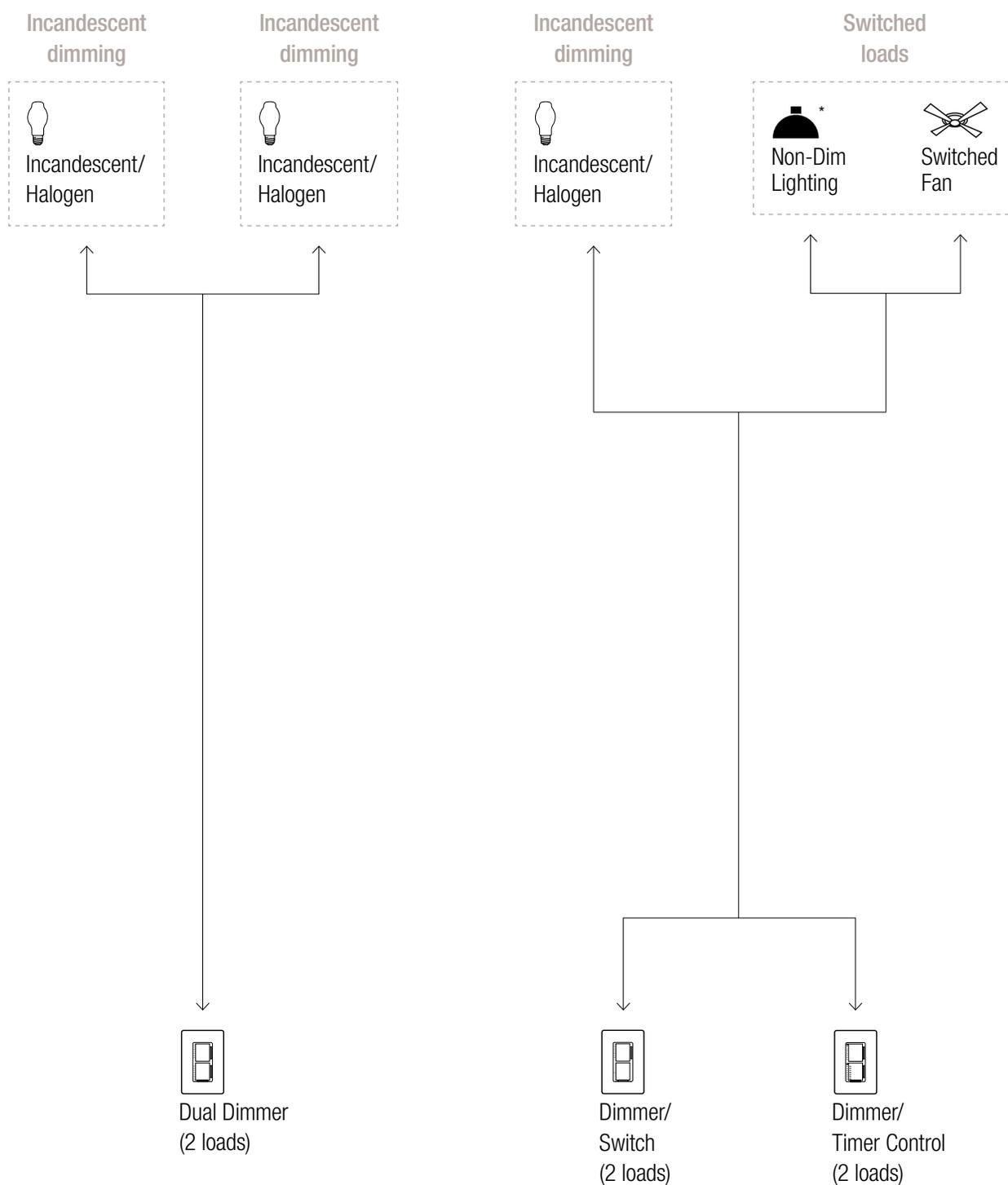


For illustration purposes only. Consult model number pages for specific voltage and capacity information.

*Refer to pg. 54 for specific load type.

†Interface provides additional capacity and/or may be different voltage than dimmer.

Maestro®



For illustration purposes only. Consult model number pages for specific voltage and capacity information.

*Refer to pg. 54 for specific load type.

DEK-DOT RECESSED LIGHT KIT INSTALLATION INSTRUCTIONS



Usage:

These waterproof, weatherproof, salt air resistant LED recessed lights are perfect for decks, steps, stairs, patios, dock lights and marine lighting. You can even embed them in concrete walkways or steps --wherever accent lighting is desired.

Outdoor Recessed Light kit contains:

- (8) Recessed DEK DOT lights w/ 6' pigtails
- (1) Custom sized (.900) diameter Forstner Bit
- (1) Washer and (1) Snap Ring
- (1) Waterproof 12V DC Power Supply
- (16) Outdoor UL approved Gel Filled Wire Nuts
- (1) Photo Timer
- (1) Installation Instructions

Additional Tools or Items Required:

- Outdoor UL approved Wire (18 gauge)*
- Power Drill
- Measuring Tape

* No wire is supplied in kit but can be purchased through our website

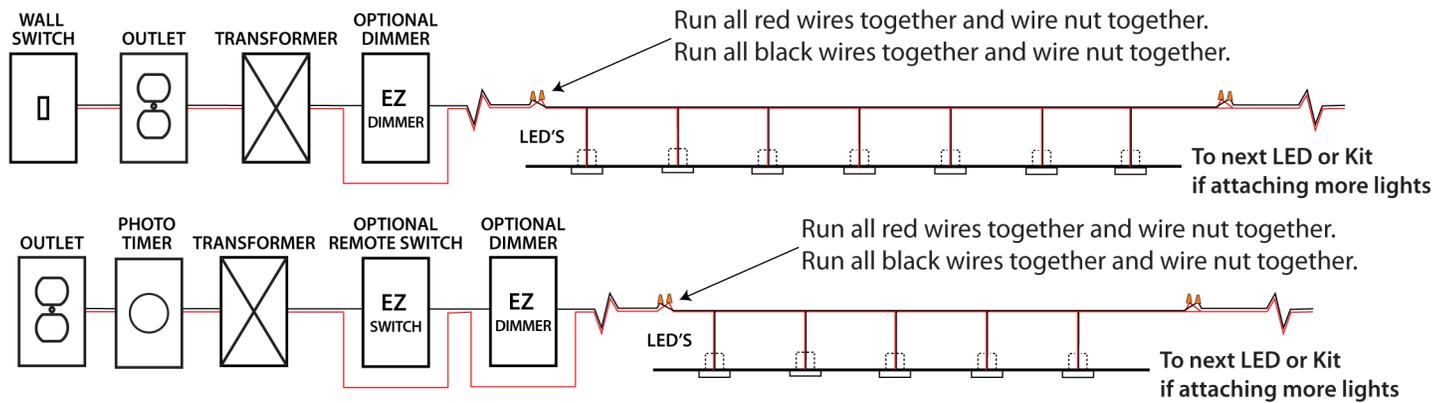
Optional Add-Ons

- Remote Controlled Dimmer
- EZSWITCH
- 32 more recessed LED Lights**

** Power supply supports 40 DEK DOT LED light elements available for purchase in handy 4 packs. Please consult our online calculator for usage with other DEKOR lights.

PLAN YOUR INSTALLATION

Sample Wiring Diagram for Recessed Lights



Step 1 Transformer Location

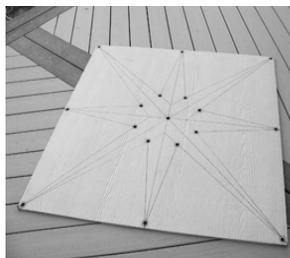
Determine where you will plug in your transformer / power supply. Locate transformer in a location that is accessible in the unlikely event of servicing.

You can have the transformer hooked up to a wall outlet that is switched or hard wire the transformer directly to a switched circuit as long as you leave access to the transformer per electrical code.



Step 2 Wire Requirements and Connections

We recommend using 18 gauge stranded outdoor wire (available at www.de-kor.com) for our products where the total wire run is less than 100'. If wire run will exceed 100' increase wire gage size to 16 or 14 gage. For making the connections use our gel filled UL approved wire nuts.



Step 3 Location of Lights

Choose the location of where the light will be installed.

DEK DOT's have numerous location possibilities. Shown in the picture is a compass pattern on one project. The customer made a simple board layout and transferred the pattern onto the deck. Just let your imagination go. For use as stair lights and because the light is totally flush and hardly visible you can put it about anywhere from the riser to the tread to the stringer.

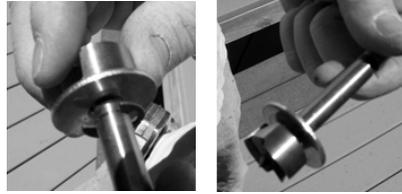
Each and every project is unique. These instructions are given as know approaches and general guidelines to installing our product. Your project may dictate an entirely different installation approach, which makes your installation unique. If you have questions regarding your installation please contact Customer Support 1-800-258-0344 or your local electrical contractor.

INSTALLATION AND WIRING



Step 4 Drill Stop Assembly

Your kit includes a custom sized Forstner bit, a large washer and a snap ring. Place the washer on the shaft of the bit and slide down past the snap ring groove. Now take the snap ring and install it in the groove as shown. You should only need finger pressure to install the snap ring but pliers may be necessary.



Step 5 Drilling

At this point you've figured out where you want to install the DEK DOT's. Using a drill motor drill the installation hole perpendicular to the surface. Drill until the washer bottoms out against material being drilled. **Caution: When drilling composite material make sure the washer does not spin on surface as marring of surface may occur. Because drill filings have no place to go make sure to clean hole out periodically during the drilling process to avoid build up of material in hole.**



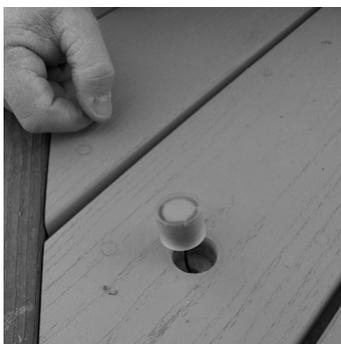
Using the drill motor drill a hole in the center of the installation hole for wires to pass through. Any size around a 1/4" will do.



Step 6 Insert DEK DOT's

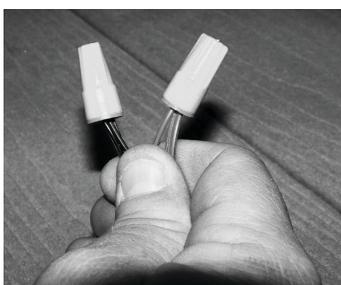
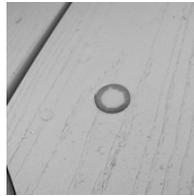
Thread wires into through hole. Never pull on the wires from the opposite side. Using your thumb or a soft-ended tool push DEK DOT housing into the hole.

**** CAUTION: Do not pull LED into cup by pulling on wires! They as they will break eternally, guaranteed!**



Step 7 Verify Flushness

Either by feel or placing a straight edge on the DEK DOT to verify that the light is flush with mounting surface. If it's not remove DEK DOT and re-drill hole. If the DEK DOT is below the surface for whatever reason place a small amount of clear silicone in the bottom of hole and push the DEK DOT down until it is flush. Allow the silicone to dry overnight before walking on DEK DOT.



Step 8 Combine pigtail wires and additional wire if needed

Run all red wires together and wire nut together. Run all black wires and wire nut together. Use the 6' pigtail to your advantage by combining as many wires as you can into one wire nut.

Wire all + (red wires) and all -(black wires) in parallel to the transformer. Our wire has white lettering on one wire to designate it as your + wire through the circuit per UL guidelines.

Step 9 Connect Wires to Transformer and Power Up

Connect main bus wires to transformer maintaining polarity in circuit. In other words (+) to all the red LED wires and (-) to all the black wires. Finally, plug your transformer in and lights should light up. If they do not, the problem will be most likely in the wiring.



DEK•DOT RECESSED LIGHT KIT INSTALLATION INSTRUCTIONS

TROUBLE SHOOTING TIPS:

1. Verify that there is power coming from the transformer. No power no light.
2. If you have power make sure the polarity is correct. Red wires (+) to positive on transformer, black wires (-) to negative on transformer.
3. If one of your lights will not light and the others do and you have verified the wiring, take one of the other lighted lights and try it at the same location. If it still doesn't light then contact customer service at DEKOR.

TECHNICAL INFORMATION

Transformer:

3amp 12v DC constant current
 Light capacity 40-recess or DEK DOT lights
 Thermal and voltage overload circuits
 Physical size 1 3/4" tall x 1 7/8" wide x 7" long
 Works with US and European voltages
 Waterproof design IP66 rated
 UL and CUL approved

LED's:

No thermal/heat output
 3500 Kelvin Color (warm white)
 Waterproof and can be submerged in water
 Highest grade LED and high lumen output

ORDERING INFORMATION:

<u>Model Number</u>	<u>Description</u>
WIRE18/2LV100	Outdoor UL approved Wire
WIRENUTSMGF	Wire nut gel filled.
EZREMDIM1	Remote Controlled Dimmer
EZSWITCH	Remote Controlled Switch
DEKDOT4xx	DEK DOT 4 Pack

DUAL HEAT EXCHANGER INDIRECT WATER HEATER

A Spanish language version of these instructions is available by contacting the manufacturer listed on the rating plate.
La version española de estas instrucciones se puede obtener al escribirle a la fábrica cuyo nombre aparece en la placa de especificaciones.

INSTALLATION/OPERATING MANUAL WITH PARTS LISTING AND TROUBLESHOOTING GUIDE

WARNING

To avoid damage or injury, there must be no materials stored against the water heater and proper care shall be taken to avoid unnecessary contact (especially by children) with the water heater.

- ❑ Do not store or use gasoline or other flammable liquids in the vicinity of this water heater or any other appliance.



For your family's comfort, safety, and convenience, we recommend this water heater be installed and serviced by a plumbing professional.

CONGRATULATIONS!

You have just purchased one of the finest water heaters on the market today!

This installation, operation, and instruction manual will explain in detail the installation and maintenance of your new water heater. We strongly recommend that you contact a plumbing professional for the installation of this water heater.

We require that you carefully read this manual, as well as the enclosed warranty, and refer to it if questions arise. If you have any specific questions concerning your warranty, please consult the plumbing professional from whom your water heater was purchased. For your records we recommend that you write the model, serial number and installation date of your water heater in the back of this manual.

This manual should be kept with the water heater.

We're committed to providing you with the finest water heater made.

SECTION I
IMPORTANT INFORMATION
-READ CAREFULLY-

The equipment must be installed in accordance with those installation regulations required in the area where the installation is to be made. These regulations must be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

All wiring on water heaters installed in the USA must be in accordance with the National Electrical Code, ANSI/NFPA 70, latest edition, and/or local regulations; or in Canada, installed in accordance with the Canadian Electrical Code, CSA C22.1, latest edition and/or local regulations.

The following terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.



DANGER

Indicates an imminently hazardous situation, which, if not avoided, will result in death, serious injury, or substantial property damage.



CAUTION

Indicates a potentially hazardous situation, which, if not avoided, may result in moderate, or minor injury or property damage.



WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in death, serious injury, or substantial property damage.

NOTICE

Indicates special instructions on installation, operation or maintenance, which are important but not related to personal injury hazards.

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 **DANGER**

DO NOT store or use gasoline or other flammable, combustible, or corrosive vapors and/or liquids in the vicinity of this or any other appliance.

IF YOU SMELL GAS:

- DO NOT** try to light any appliance.
- DO NOT** touch any electric switch; do not use any telephone in your building.
- Immediately call your gas supplier from a telephone in another building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

DO NOT OPERATE THE APPLIANCE UNTIL THE LEAKAGE IS CORRECTED!

Liquefied petroleum gas/propane gas is heavier than air and will remain at floor level if there is a leak. Basements, crawl spaces, closets, and areas below ground level will serve as pockets for accumulation of leaking gas.

This water heater is supplied with adjustable thermostats to control water temperature. Hot water temperatures required for automatic dishwasher and laundry use can cause scald burns resulting in serious personal injury and/or death. The temperature at which injury occurs varies with the person's age and the time of exposure. The slower response time of disabled persons increases the hazards to them. **NEVER** allow small children to use a hot water tap or to draw their own bath water. **NEVER** leave a child or disabled person unattended in a bathtub or shower.

 **WARNING**

Installation is not complete unless a properly sized/capacity pressure and temperature relief valve is installed into the side of the water heater. See the General Information section of this manual for details.

This water heater contains very hot water under high pressure. Do not unscrew any pipe fittings or attempt to disconnect any components of this water heater without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up, or servicing this water heater to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the water heater. This water heater contains components that become very hot. Do not touch any components unless they are cool.

Improper installation, adjustments, alteration, service or maintenance can cause property damage, personal injury or loss of life. Failure to follow all instructions in the proper order can cause personal injury or death. Read and understand all instructions, including all those contained in component manufacturer's manuals, which are provided with the appliance before installing, starting-up, operating, maintaining, or servicing this appliance. Keep this manual and literature in legible condition and posted near the appliance for reference by owner and service technician.

This water heater requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Installation, maintenance, and service must be performed only by an experienced, skilled, and knowledgeable installer or service agency.

 **WARNING**

It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is complete.

DO NOT operate the water heater with jumpered or absent controls or safety devices.

DO NOT tamper with or alter the water heater and/or controls.

DO NOT operate the water heater if any external part or control has been submerged in water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system that was under water.

This water heater is suitable for installation on combustible flooring. **DO NOT** install this water heater on carpeting.

DO NOT operate this water heater without first being certain it is filled with water.

Flammable items, pressurized containers, or any other potential fire hazardous articles must never be placed on or adjacent to the heater. Containers of flammable gases should not be stored or used in the same room with this water heater.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time (generally two weeks or more). Hydrogen gas is extremely flammable. To prevent the possibility of injury under these conditions, it is recommended that a water faucet be opened for several minutes at the kitchen sink before you use any electrical appliance that is connected to the hot water system. If hydrogen is present, there will be unusual sounds such as air escaping through the pipes as hot water begins to flow. Do not smoke or have open flame near the faucet at the time it is open.

 **CAUTION**

The maximum supply temperature to the heat exchangers must not exceed 250°F (121°C).

SECTION II SPECIFICATIONS

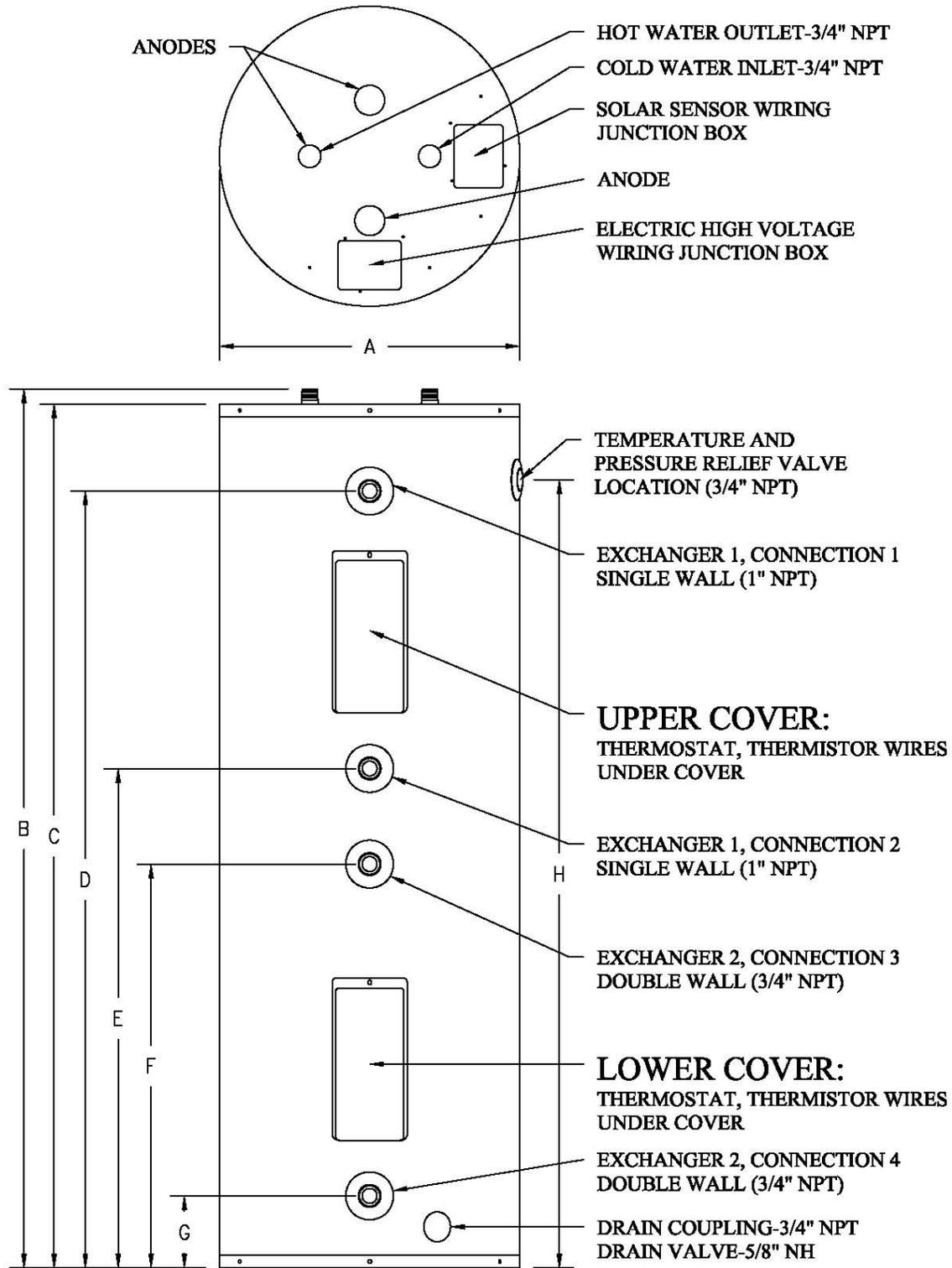


Figure 1 – Tank Layout

Table 1: Water Heater Dimension (Inches)

MODE L	A	B	C	D	E	F	G	H
55-Gal.	22	60	59-1/4	56	37-1/2	27-1/2	5-3/8	53
70-Gal.	24	60	59-1/4	56	37-1/2	27-1/2	5-3/8	53

110-Gal.	28 1/4	63-1/4	62-1/2	57-3/4	39-1/4	27-1/2	5-3/8	55-3/4
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Table 2: Water Heater Capacities

MODEL	Tank Capacity (Gal)	Coil Volume* (Gal)	Coil Heat Transfer Area* (Sq Ft)	Approximate Dry Weight (Lbs)	Approximate Wet Weight (Lbs)
55-Gal.	55	2.7	14.2	282	702
70-Gal.	70	2.7	14.2	313	843
110-Gal.	110	2.7	14.2	442	1,277

*Note: Both upper and lower heat exchanger coils are identical in coil volume and heat transfer area.

Heat Exchanger Flow Specifications

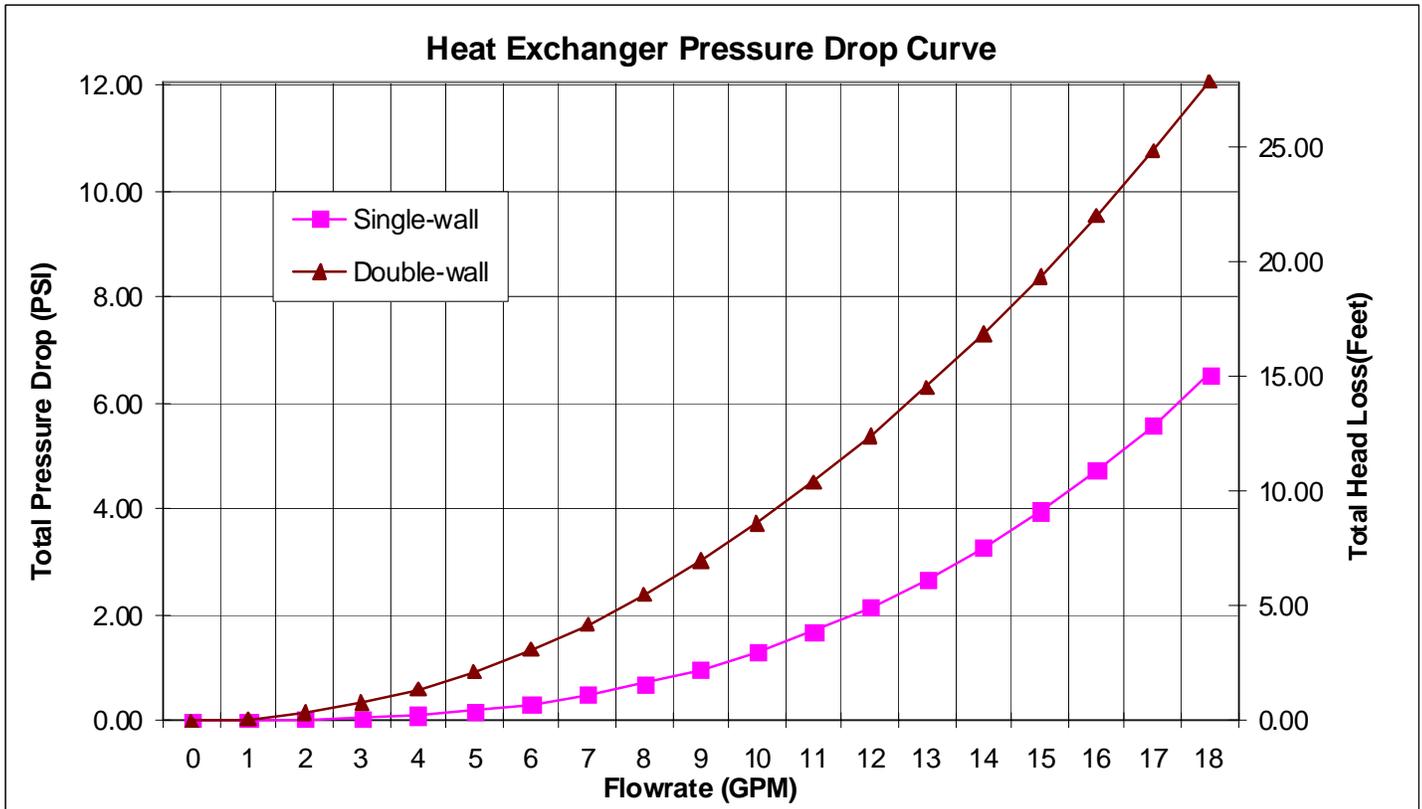


Figure 2 –Heat Exchanger Pressure Drop Chart

SECTION III GENERAL INFORMATION

FEATURES

This water heater contains the following features:

HEAT EXCHANGER – The heat exchangers (coils) are made of porcelain coated carbon steel tubing and female fittings. If a confirmed leak occurs, contact the plumbing professional who installed the water heater or the manufacturer listed on the rating plate, for additional guidance.

DOUBLE-WALL HEAT EXCHANGER –The lower heat exchanger (Heat Exchanger 2) is a double-wall heat exchanger and has a slight gap between the two tubes that makes up the heat exchanger coil. The ¾” female fittings provide an atmospheric vent for any fluid that enters the gap between the tubes.

SINGLE-WALL HEAT EXCHANGER – The upper heat exchanger (Heat Exchanger 1) is a single-wall heat exchanger with 1” female fittings. Water heaters with single-wall heat exchangers meet the Uniform Plumbing Code for installation in all potable water systems provided that:

- The heat transfer medium (including additives) is practically non-toxic, having toxicity rating of class of 1 as listed in Clinical Toxicology of Commercial Products.
- The heat transfer medium pressure is limited to maximum 30 psig by approved relief valve.
- The heat transfer medium is potable water or contains only substances that are recognized as safe by the U.S. Food and Drug Administration (FDA).
- The pressure of the heat transfer medium is maintained less than the normal minimum operating pressure of the potable water system.
- The equipment is permanently labeled to indicate that only additives recognized as safe by the FDA shall be used in the heat transfer medium.

SENSOR WIRES FOR SOLAR THERMISTOR CONNECTIONS – Twisted wires are provided under the covers. These wires have been provided as a means for connecting thermistors to a solar controller. **NOTICE: Neither a solar controller nor thermistors are provided with the indirect water heater and must be purchased separately.** In a solar application, the thermistor wires can connect a thermistor for temperature comparison with the solar collector temperature to determine if an appropriate temperature difference for heat transfer is available.

MIXING DEVICE – An ASSE approved temperature mixing device is supplied with the water heater. In solar heating systems, heat may transfer into the water heater above the temperature limits considered safe for immediate use. This may create the potential for scald injury. To protect against such injury, you must install the supplied ASSE approved mixing valve (a device to limit the temperature of water to protect against scald injury via mixing hot and cold water supply) or equivalent in the water system. This valve will reduce point of discharge temperature in branch supply lines. Refer to the instructions supplied with the mixing device for installation procedures and device specifications.



This water heater must NOT be operated without the mixing device installed.

SACRIFICIAL ANODES — Three sacrificial anode rods have been installed in the tank head to extend tank life. The anode rods should be inspected annually to determine the amount of sacrificial decay and replaced when necessary to prolong tank life. The permanent removal of these anodes, for any reason, will nullify the warranty. Water conditions in your area will influence the time interval for inspection and replacement of the anode rods. The use of a water softener may increase the speed of anode consumption. More frequent inspection of the anodes are needed when using softened (or phosphate treated) water. Contact the plumbing professional who installed the water heater or the manufacturer, listed on the rating plate, for anode replacement information.

TEMPERATURE AND PRESSURE RELIEF VALVE



Keep clear of the combination temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

For protection against excessive temperatures and pressure, install temperature and pressure protective equipment required by local codes, but not less than a combination temperature and pressure relief valve certified by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials as meeting the requirements of the Standard for *Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems*, ANSI Z21.22 and the Standard *CAN1-4.4 Temperature, Pressure, Temperature and Pressure Relief Valves and Vacuum Relief Valves*. The combination temperature and pressure relief valve must be marked with a maximum set pressure not to exceed the maximum working pressure of the water heater. The combination temperature and pressure relief valve must also have an hourly rated temperature steam BTU discharge capacity not less than the hourly rating of the water heater/storage unit. The supplied combination temperature and pressure relief valve, when properly installed and unrestricted, will discharge the maximum input produced by a 250°F (121°C) collector supply temperature. For solar installations, a lower collector supply temperature will reduce the input required to be discharged in the event of excessive potable water temperatures.

Install the combination temperature and pressure relief valve into the opening provided and marked for this purpose on the water heater/storage unit.

Some models may already be equipped or supplied with a combination temperature and pressure relief valve. Verify that the combination temperature and pressure relief valve complies with local codes. If the combination temperature and pressure relief valve does not comply with local codes, replace it with one that does.

Install a discharge line so that water discharged from the combination temperature and pressure relief valve will exit within six (6) inches above, or any distance below the structural floor and cannot contact any live electrical part. The discharge line is to be installed to allow for complete drainage of both the temperature and pressure relief valve and the discharge line. The discharge opening must not be subjected to blockage or freezing. **DO NOT** thread, plug, or cap the discharge line. It is recommended that a minimum clearance of four (4) inches be provided on the side of the water heater/storage unit for servicing and maintenance of the combination temperature and pressure relief valve

Do not place a valve between the combination temperature and pressure relief valve and the tank!

SECTION IV PRE-INSTALLATION

UNPACKING

INSPECT SHIPMENT carefully for any signs of damage. If damage is noted, do not install the product. Contact the shipper or manufacturer listed on the rating plate. All equipment is carefully manufactured, inspected, and packed. Our responsibility ceases upon delivery of the packaged water heater to the carrier in good condition.

NOTE: Any claims for damage or shortage in shipment must be filed immediately against the carrier by the consignee.

This water heater **MUST** be installed indoors out of the wind and weather.

CAUTION

This water heater must be located in an area where leakage of the tank, water line connections, or the temperature and pressure relief valve will not result in damage to the area adjacent to the water heater/storage unit or to lower floors of the structure. When such locations cannot be avoided, a suitable drain pan must be installed under the water heater/storage unit. The drain pan depth must be suitable for draining and collecting water. The drain pan can be purchased from your plumbing professional. The drain pan must be piped to an adequate drain. The piping must be at least 3/4 inch in diameter and pitched for proper drainage.

Component Location

Clearance from Combustible Materials			
Top	Sides	Front	Rear
0"	0"	0"	0"

Table 3 – Combustible Material Clearances

Recommended Service Clearances			
Non-Piping Side	Front (Heat Exchangers)	Rear	T & P Relief Valve Side
4"	16"	0"	6"

Table 4 – Service Clearances

1. **Heater Location** – For fastest delivery of hot water, place the indirect water heater closest to the points of use.

Additional Recommended Components

1. **Shut-off Valves** – Allows isolation of water heater from domestic water system and the connected heating system during service.
2. **Unions** – Allows water heater movement during service if adequate clearance cannot be provided.
3. **Thermal Expansion Tank** – If the water heater is installed in a closed water supply system, such as one having a back-flow preventer in the cold water line, provide thermal expansion control. Contact the water supplier or local plumbing inspector for additional information.

MOVE THE WATER HEATER TO A PERMANENT POSITION BY SLIDING OR WALKING.

CAUTION

Do not drop water heater. Do not bump water heater jacket against floor.

NOTICE

For California installation this water heater must be braced, anchored, or strapped to avoid falling or moving during an earthquake. See instructions for correct installation procedures. Instructions may be obtained from California Office of the State Architect, 400 P Street, Sacramento, CA 95814.

SOLAR WATER HEATING FUNDAMENTALS

The solar heating system puts the most amount of heat into the storage tank when the internal heat exchanger is located in cold water. This allows the collector temperature to be lower and still transfer heat into the storage tank. As a rule, solar installations will use the lower or both heat exchangers. This will allow for the greatest solar fraction possible.

When hot water is taken from the top of the tank, cool water is delivered to the tank bottom by means of a diptube. The amount of heat transferred into the tank due to solar heating is variable. The more heat stored in the tank through solar heating, the lower the operating costs. The mixing device must be installed to ensure that if higher temperatures are achieved, safe water temperature delivery occurs. It is recommended that storage tank temperatures are not allowed above 185°F.

GEOHERMAL WATER HEATING FUNDAMENTALS

The use of an internal heat exchanger in the water heater can be used in a closed-loop geothermal heating system without a desuperheater installed in the geothermal heat pump unit. The desuperheater is a heat exchanger attachment that allows potable water from the water heater to flow through the geothermal unit. In an open-loop geothermal application, the desuperheater must be installed. In geothermal water heating, the heat available is considered supplemental due to the lower than typically desired temperatures achieved.

The maximum amount of heat available for the water heater in a geothermal application is in the summer months as the unit is attempting to discharge gained heat. It should be noted that no heat is available for the water heater in periods where the geothermal unit is not running as no fluid is flowing.

SECTION V WATER CONNECTIONS

INSTALL TEMPERATURE AND PRESSURE RELIEF VALVE (if not factory installed)

WARNING

FAILURE TO INSTALL AND MAINTAIN A NEW, LISTED TEMPERATURE AND PRESSURE RELIEF VALVE WILL RELEASE THE MANUFACTURER FROM ANY CLAIM WHICH MIGHT RESULT FROM EXCESSIVE TEMPERATURE AND PRESSURES.

Hydrogen gas can be produced in an operating water heater that has not had water drawn from the tank for a long period of time. **HYDROGEN GAS IS EXTREMELY FLAMMABLE.** To prevent the possibility of injury under these conditions, we recommend the hot water faucet be opened for several minutes at the kitchen sink before you use any electrical appliance that is connected to the hot water system. If hydrogen is present, there will be an unusual sound such as air escaping through the pipes as hot water begins to flow. **Do not smoke or have open flame near the faucet at the time it is open.**

Keep clear of the temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Keep clear of the temperature and pressure relief valve discharge line outlet. The discharge may be hot enough to cause scald injury. The water is under pressure and may splash.

Temperature and pressure relief valve discharge piping must be piped near the floor to eliminate potential of severe burns. Do not pipe in any area where freezing could occur. Do not install any shut-off valves, plugs or caps to the temperature and pressure relief valve or piping.

CAUTION

If sweat fittings are to be used, DO NOT apply heat to the nipples on top of the water heater. Sweat the tubing to the adapter before fitting the adapter to the water connections. It is imperative that heat is not applied to the nipples containing a plastic liner.

INSTRUCTIONS FOR POTABLE CONNECTIONS

1. **BEFORE PROCEEDING WITH THE INSTALLATION, CLOSE THE MAIN WATER SUPPLY VALVE.** After shutting off the main water supply, open a faucet to relieve the water line pressure to prevent any water from leaking out of the pipes while making the water connections to the water heater. After the pressure has been relieved, close the faucet. The **COLD** water inlet and **HOT** water outlet are identified on the top of the water heater. Install the mixing device supplied with the indirect water heater, following the installation instructions included with the mixing device. Make the proper plumbing connections between the mixing device on the water heater and the plumbing system to the house. Install a shut-off valve in the cold water supply line.
2. If this water heater is installed in a closed water supply system, such as one having a back-flow preventer in the cold water supply, provisions must be made to control thermal expansion. **DO NOT** operate this water heater in a closed system without provisions for controlling thermal expansion. Warranties do not cover damages from thermal expansions such as pressure bulges and/or deformities. A properly sized expansion tank will alleviate most problems. Your water supplier or local plumbing inspector should be contacted on how to control this situation.
3. After installation of the water lines, open the main water supply valve and fill the water heater. While the water heater is filling, open several hot water faucets to allow air to escape from the water system. When steady streams of water flow through the faucets, close them and check all water connections for possible leaks.
4. **NEVER OPERATE THE WATER HEATER WITHOUT FIRST BEING CERTAIN THAT IT IS FILLED WITH WATER.**

HEAT EXCHANGER SYSTEM CONNECTIONS

The two heat exchangers located inside the tank may be connected to a variety of different heating systems. As a result, both upper and lower control locations contain a surface mounted thermostat with a high temperature cut-out device and wiring for a thermistor. The surface mounted thermostat is for applications such as a boiler where a specific temperature is desired to control a circulator. The thermistor wiring is for applications such as solar where a thermistor is connected and used in a solar controller. A solar controller compares the thermistor temperature to the solar collector temperature and determines if a sufficient temperature differential exists to transfer heat into the water storage tank.

Since multiple heating systems may be applied to the heat exchangers, separate and combined configurations will be provided as guidelines. When only one exchanger is shown, the other will be covered in the section appropriated to that heating system. In all cases, a qualified installer must design the system to ensure proper and safe operation.

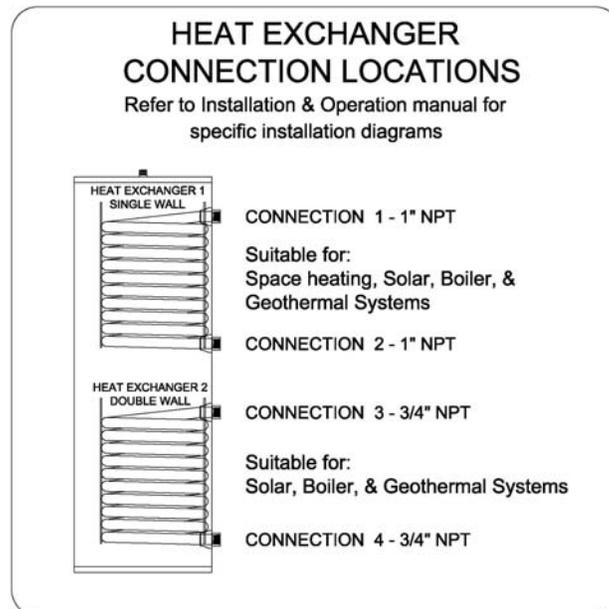


Figure 3 – Heat Exchanger System Capabilities

Recommended System Combinations

Space Heating System – when space heating is used with this water heater, that system should only be connected to the upper heat exchanger, Heat Exchanger 1. As water is heated, it rises to the top of the tank. By using the upper heat exchanger for space heating, the hottest water is applied and the best space heating is available.

Solar Heating System – when solar heating is used with this water heater, that system should be connected to the lower heat exchanger, Heat Exchanger 2. The exception to this rule is when both heat exchangers are to be used for maximum heat transfer capability. The lower heat exchanger is used to maximize the transfer of solar heat into the tank as the cold water is delivered into the tank bottom.

Geothermal Heating System – when geothermal heating is used with this water heater, that system should follow the Solar Heating System guidelines as indicated above. If geothermal and solar heating is desired in the same heater, geothermal is recommended to be connected to Heat Exchanger 2 and solar is recommended to be connected to Heat Exchanger 1. This is a result of Geothermal heating attaining only supplemental temperature limits while solar can attain higher temperatures.

Boiler Heating System – when boiler heating is used, that system can be connected in any heat exchanger configuration, Heat Exchanger 1, 2 or both. If used in combination with a space heating, solar or geothermal system, the general rules for heat exchanger use in those systems must take precedence.

FILLING THE HEAT EXCHANGER SYSTEM WITH HEAT TRANSFER FLUID

1. Refer to the appropriate diagram for general piping schematics. Verify that a full port ball valve is located between a drain and the cold water supply. This must be established such that when the full port ball valve is closed, water will flow in the same direction as it will when operation. This is important for systems that include check valves. A shorter distance between the drain and the cold water supply is beneficial.
2. Close the full port ball valve and open the drain valve. Make sure that an appropriate drain hose is connected and securely applied to a location that the overflowing fluid can be dumped into.
3. Fill the heat exchanger system with water or a propylene glycol/water mix.
4. When the water or propylene glycol/water mix is flowing from the drain, slowly close the drain.
5. With the drain closed, open the full port ball valve to allow the water or propylene glycol mix to fill the remaining pipe volume.
6. Activate the space heating circulator(s), verifying circulator flow and direction. Purge all air from the heat exchanger system piping.
7. Check system for leaks. Repair as necessary.
 - a. In a closed loop system, check for leaks when flow is stopped and the operating pressure is maintained.

CONNECTIONS FOR SPACE HEATING

When a space heating system is used, connect the upper heat exchanger (heat exchanger 1) as shown in Figure 4. Due to each system being independent of each other, the lower system's connection to heat exchanger 2 is not shown. The space heating connection designated as CONNECTION 1 should be piped to the space heating supply piping. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is necessary to eliminate air in the system. Pipe and fittings between the space heating system and water heater must be $\frac{3}{4}$ " diameter or larger. The water heater connection designated as CONNECTION 2 should be piped to the space heating return piping.

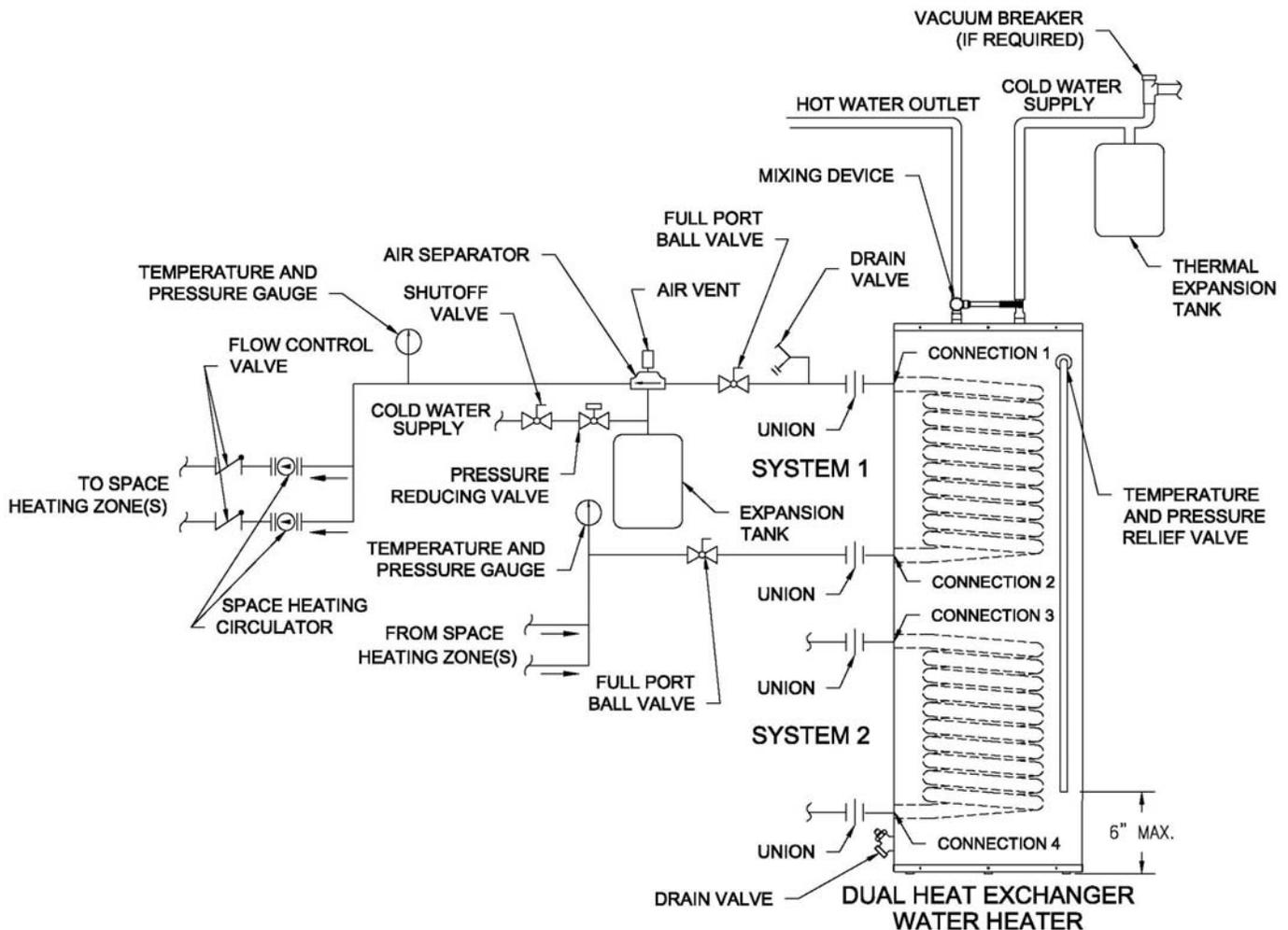


Figure 4 – Space Heating Piping in Closed-loop Installation for Single Heat Exchanger (SYSTEM 1)

CONNECTIONS FOR SOLAR HEATING

FILL SOLAR COLLECTOR SYSTEM

1. Fill solar heating system appropriately with water or a propylene glycol/water mix.
2. Verify circulator flow and direction. In a closed loop system, purge all air from the collector/water heater piping.
3. Check system for leaks. Repair as necessary.
 - a. In a closed loop system, check for leaks when flow is stopped and the operating pressure is maintained.

Single Heat Exchanger Use

When multiple systems are used with closed loop solar heating, connect the lower heat exchanger (heat exchanger 2) as shown in Figure 5. Due to each system being independent of each other, the upper system's connection to heat exchanger 1 is not shown. The dual indirect water heater connection designated as CONNECTION 3 should be piped to the solar collector supply piping. Mount the circulator making sure the flow arrow points away from the water heater. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the solar collector and solar water heater must be $\frac{3}{4}$ " diameter or larger. The solar water heater connection designated as CONNECTION 4 should be piped to the solar collector return piping.

When a single heat exchanger is used in solar heating it is recommended that the lower heat exchanger be used for maximum solar collector efficiency and the best solar fraction. In generic terms, solar fraction is a ratio of the amount of hot water supplied by solar heating in respect to the amount of hot water used.

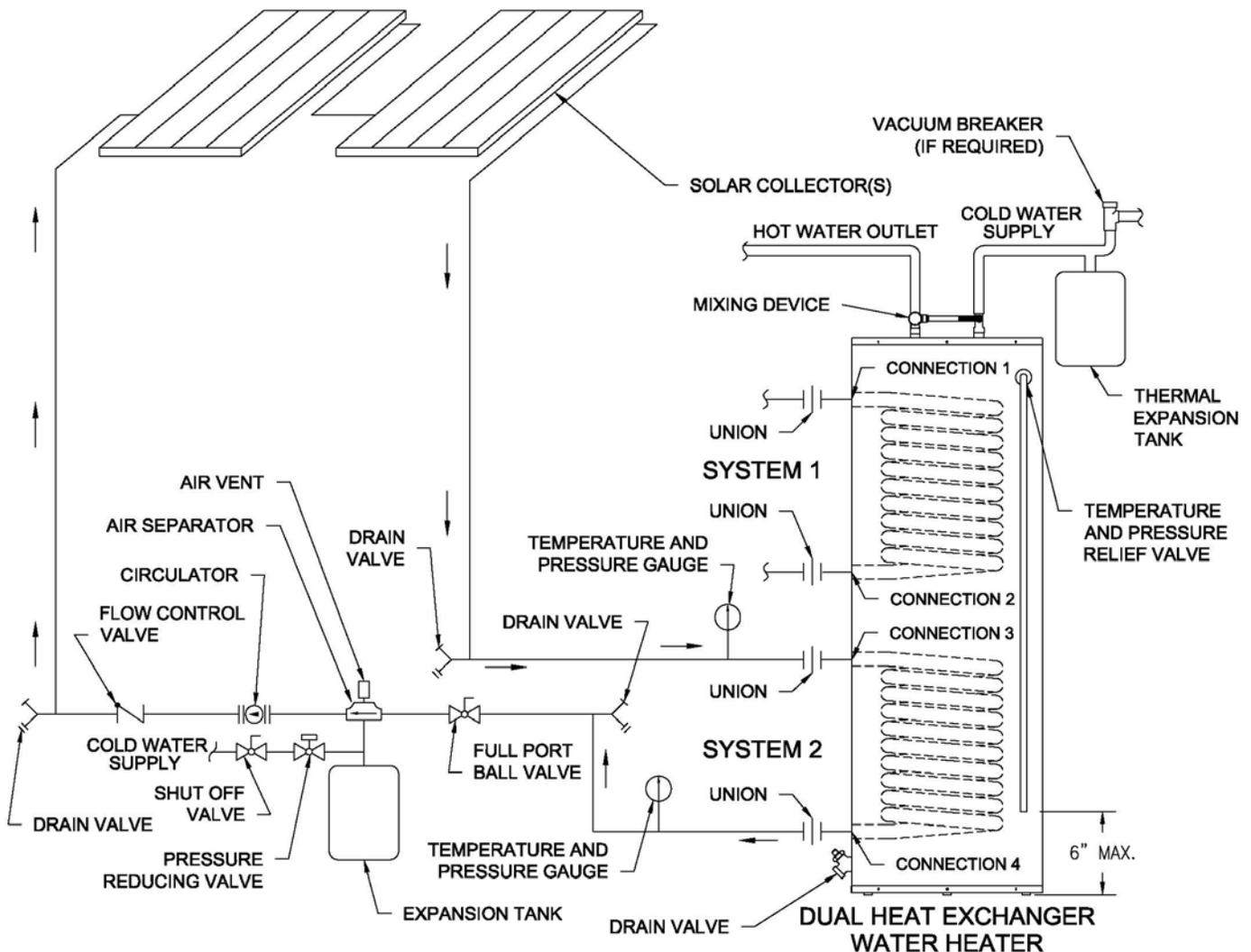


Figure 5 – Solar Collector Piping in Closed-loop Installation for Single Heat Exchanger (SYSTEM 2)



CAUTION

Maximum solar collector water supply temperature to the solar heat exchanger must not exceed 250°F (121°C).

DRAINBACK APPLICATION

For a drainback solar heating system, refer to Figure 6. The dual indirect water heater connection designated as CONNECTION 3 should be piped to the solar collector supply piping. Mount the pump making sure the flow arrow points away from the water heater. The use of shut-off valves and unions are recommended for future service convenience. Pipe and fittings between the solar collector and dual indirect water heater must be ¾" diameter or larger. The piping or drainback tank must have a site glass located at a level above the circulator and water heater. The drainback tank and water level should be located in a controlled temperature location. The drainback tank should be at the highest point below the collectors possible to reduce the amount of head necessary to pump the fluid into the collectors. It is imperative that no check valves are in the solar system and that all piping is oriented to allow fluid to drain back into the tank.

When a single heat exchanger is used in solar heating it is recommended that the lower heat exchanger be used for maximum solar collector efficiency and the best solar fraction. In generic terms, solar fraction is a ratio of the amount of hot water supplied by solar heating in respect to the amount of hot water used.

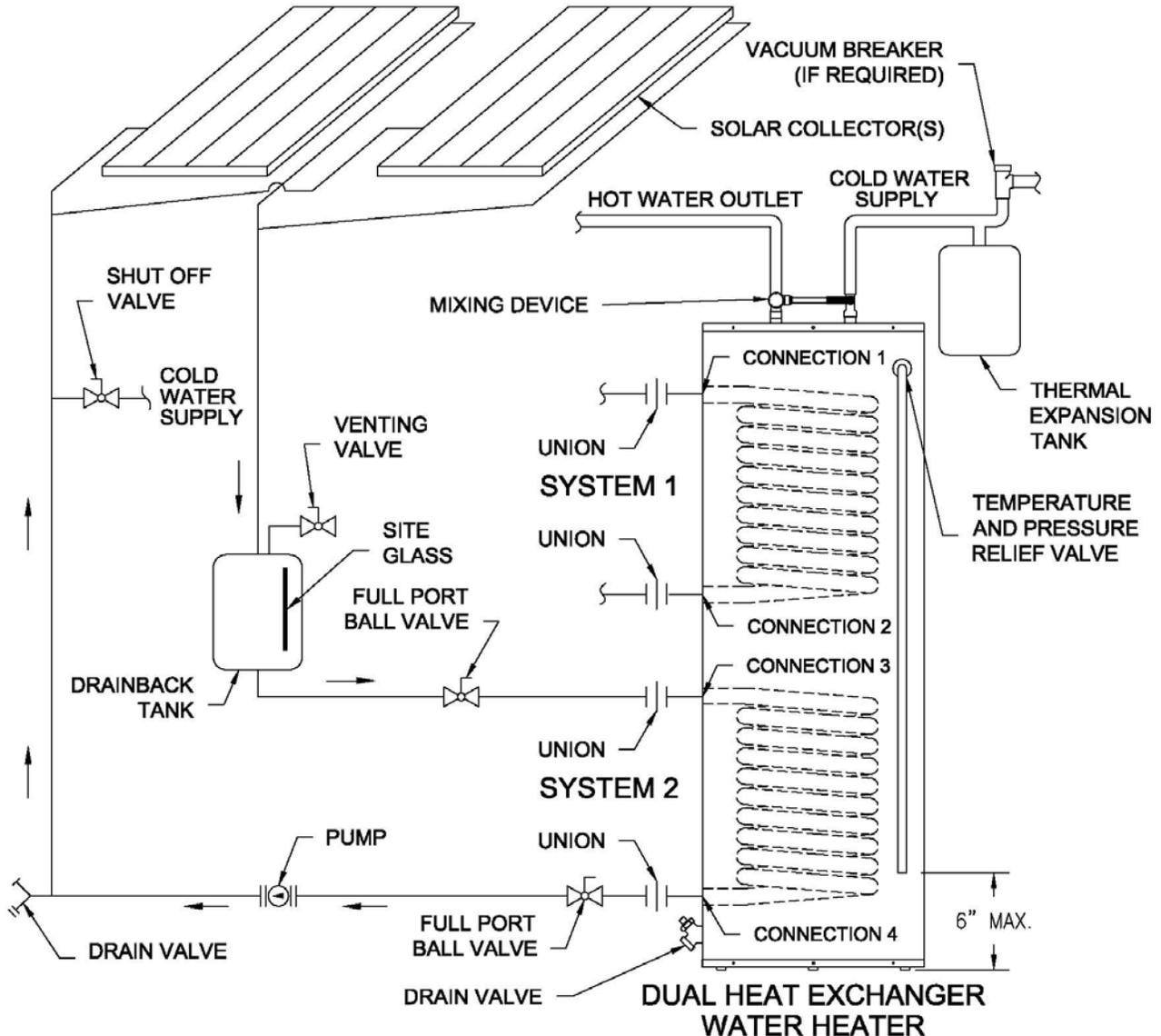


Figure 6 – Solar Collector Piping in Drainback Installation for Single Heat Exchanger (SYSTEM 2)

Dual Heat Exchanger Use

When both heat exchangers are used with closed loop solar heating, make connections as shown in Figure 7. The solar water heater connection designated as CONNECTION 1 according to Figure 3 should be piped to the solar collector supply piping. Mount the circulator making sure the flow arrow points away from the water heater. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the solar collector and solar water heater must be $\frac{3}{4}$ " diameter or larger. Provide an appropriate connection from CONNECTION 2 to CONNECTION 3 as shown. The solar water heater connection designated as CONNECTION 4 according to Figure 3 should be piped to the solar collector return piping.

When both heat exchangers are used in solar heating it is recommended that the CONNECTION 1 is piped to the solar collector supply piping to allow for the maximum amount of heat to be transferred in the upper portion of the water heater. The heat that is not transferred in the upper heat exchanger can be transferred through the lower heat exchanger. This allows maximum hot water deliverability, maximum solar collector efficiency and the best solar fraction. In generic terms, solar fraction is a ratio of the amount of hot water supplied by solar heating in respect to the amount of hot water used.

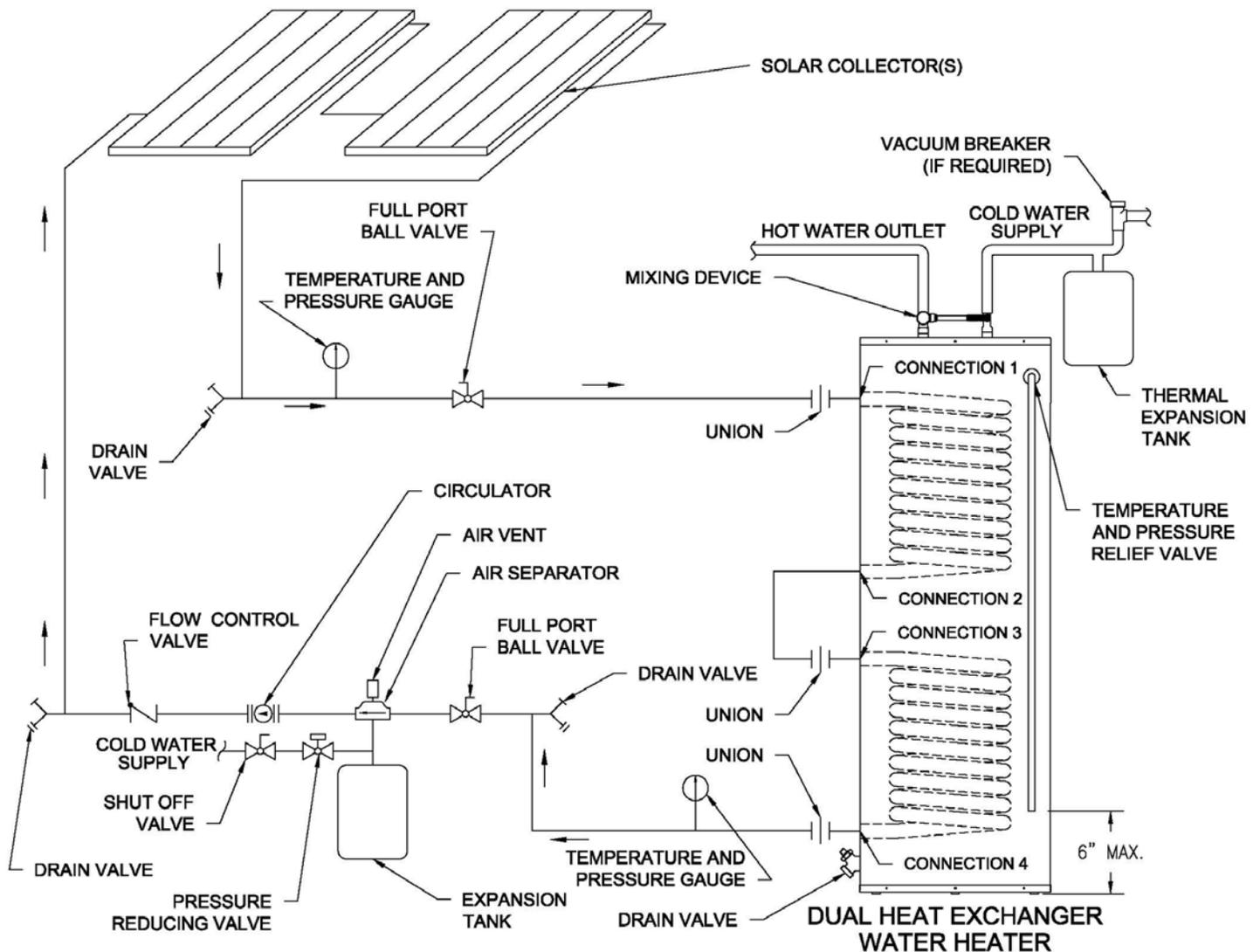


Figure 7 – Solar Collector Piping in Closed-loop Installation for Both Heat Exchangers

CONNECTIONS FOR GEOTHERMAL HEATING

Follow the instructions for solar heating connections for either single or dual heat exchanger use. Refer to the Recommended System Combinations in Section V, Water Connections, for information regarding which heat exchanger to use when multiple heating systems are connected to the indirect water heater.

CONNECTIONS FOR BOILER HEATING

FILL BOILER SYSTEM

- 1) On new boiler installations, do not purge the boiler or space heating system through the water heater. During any boiler or space heating system flushing, cleaning, or purging, the water heater should be isolated to avoid possible attack on the carbon steel coil by chemical additives.
- 2) Purge air from boiler/water heater piping.
- 3) Check system for leaks. Repair as necessary.

Single Heat Exchanger Use

1. For a boiler heating system that utilizes a single heat exchanger, refer to Figure 8. Due to each system being independent of each other, the upper system's connection to heat exchanger 1 is not shown. The indirect water heater connection designated as CONNECTION 3 should be piped to the boiler supply piping. Mount the circulator making sure the flow arrow points toward the water heater. The use of shut-off valves and unions are recommended for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the boiler and indirect-fired water heater must be $\frac{3}{4}$ " diameter or larger. The indirect water heater connection designated as CONNECTION 4 according to Figure 8 should be piped to the boiler return piping.

If the upper heat exchanger is to be used to heat the potable water, the system connections are the same, but with CONNECTION 1 taking the place of CONNECTION 3 and CONNECTION 2 taking the place of CONNECTION 4.

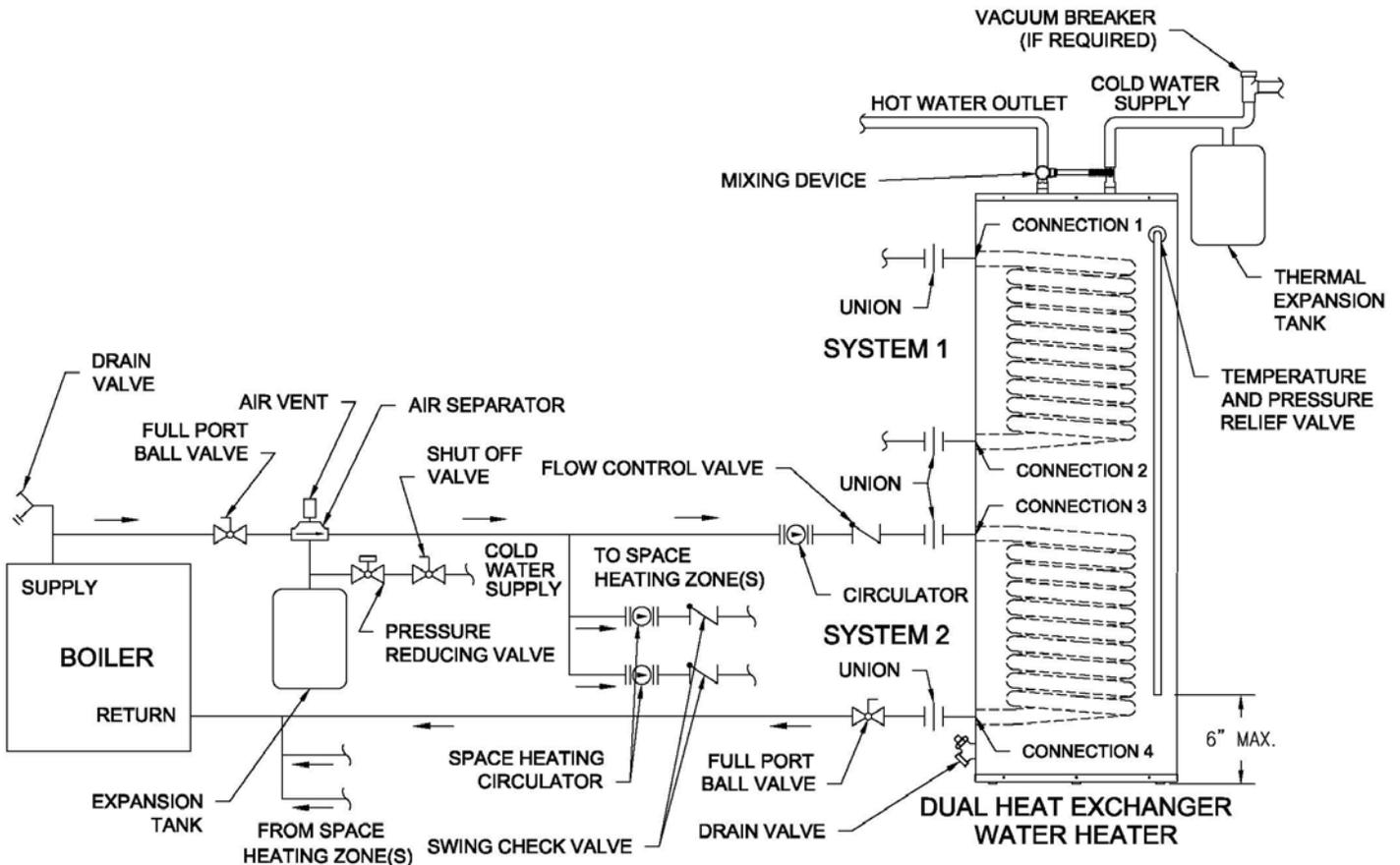


Figure 8 – Boiler Piping in Closed-loop Installation for Single Heat Exchanger

Dual Heat Exchanger Use - Parallel

When both heat exchangers are used with a boiler, make connections as shown in Figure 9. The dual indirect water heater connections designated as CONNECTION 1 and CONNECTION 3 should be piped to the boiler supply piping. Mount the circulators making sure the flow arrows points toward the water heater. The use of shut-off valves and unions are required for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the boiler and dual indirect water heater must be $\frac{3}{4}$ " diameter or larger. The dual indirect water heater connections designated as CONNECTION 2 and CONNECTION 4 according to Figure 9 should be piped to the boiler return piping.

When both heat exchangers are used in a boiler heating system it is recommended that CONNECTION 1 and CONNECTION 3 are piped to the boiler supply to allow for the maximum amount of heat to be transferred in the dual indirect water heater if needed. When a typical draw occurs, the lower circulator can be activated. When a significant draw occurs, both circulators can be activated, supplying each heat exchanger with boiler supply water. This allows for maximum hot water deliverability and the greatest efficiency.

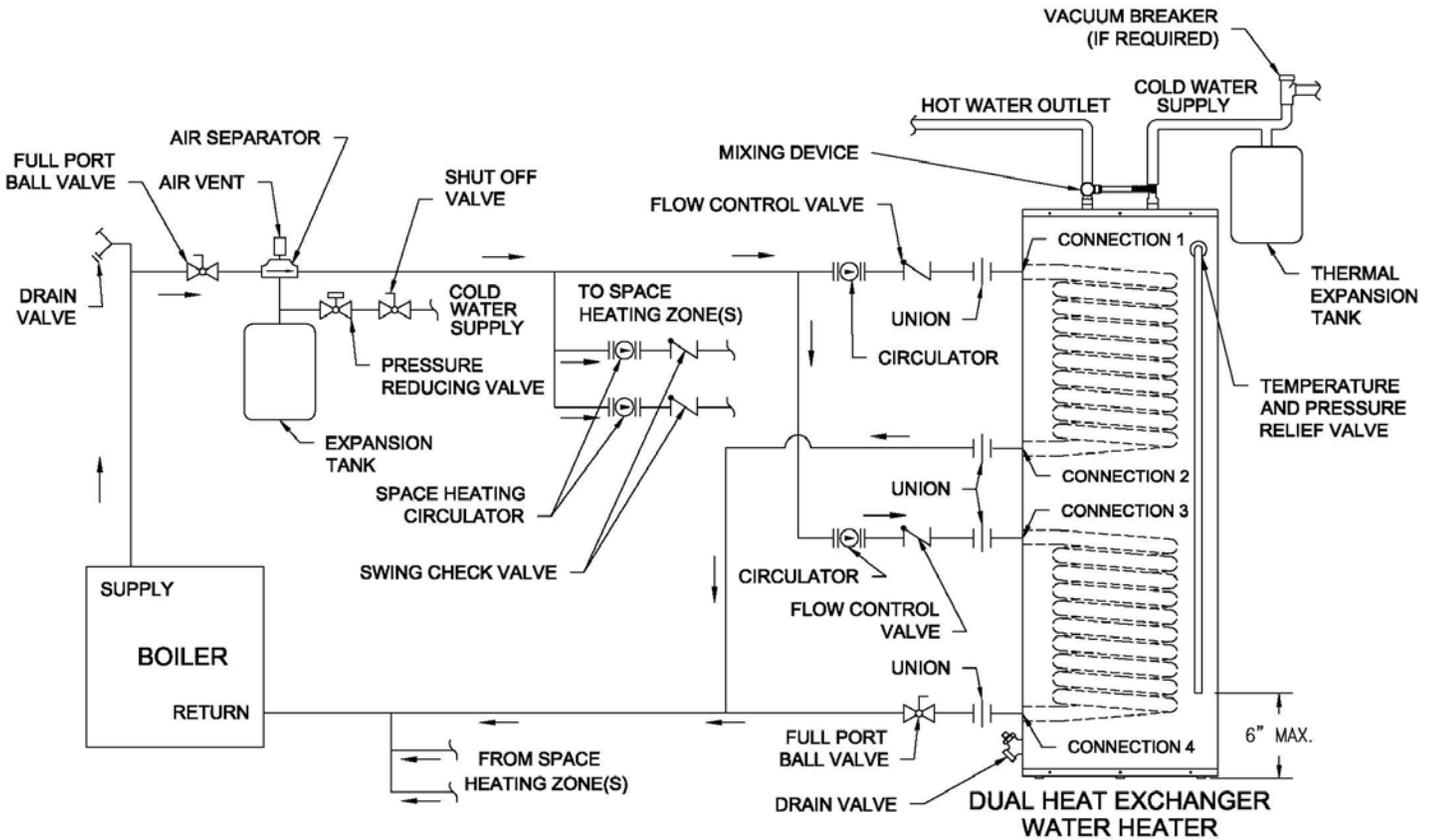


Figure 9 – Boiler Piping Installation for Both Heat Exchangers using Both Thermostats

Dual Heat Exchanger Use - Series

An alternate installation when both heat exchangers are used with a boiler, is to make connections as shown in Figure 10. The dual indirect water heater connection designated as CONNECTION 1 should be piped to the boiler supply piping. Mount the circulator making sure the flow arrow points toward the water heater. The use of shut-off valves and unions are required for future service convenience. The use of an air separator and vent is required to eliminate air in the system. Pipe and fittings between the boiler and dual indirect water heater must be $\frac{3}{4}$ " diameter or larger. CONNECTION 2 should be plumbed to CONNECTION 3 as shown. The dual indirect water heater connections designated as CONNECTION 4 according to Figure 10 should be piped to the boiler return piping.

When both heat exchangers are used in a boiler heating system and is connected as shown in Figure 10, the lower thermostat must be used to activate the circulator.

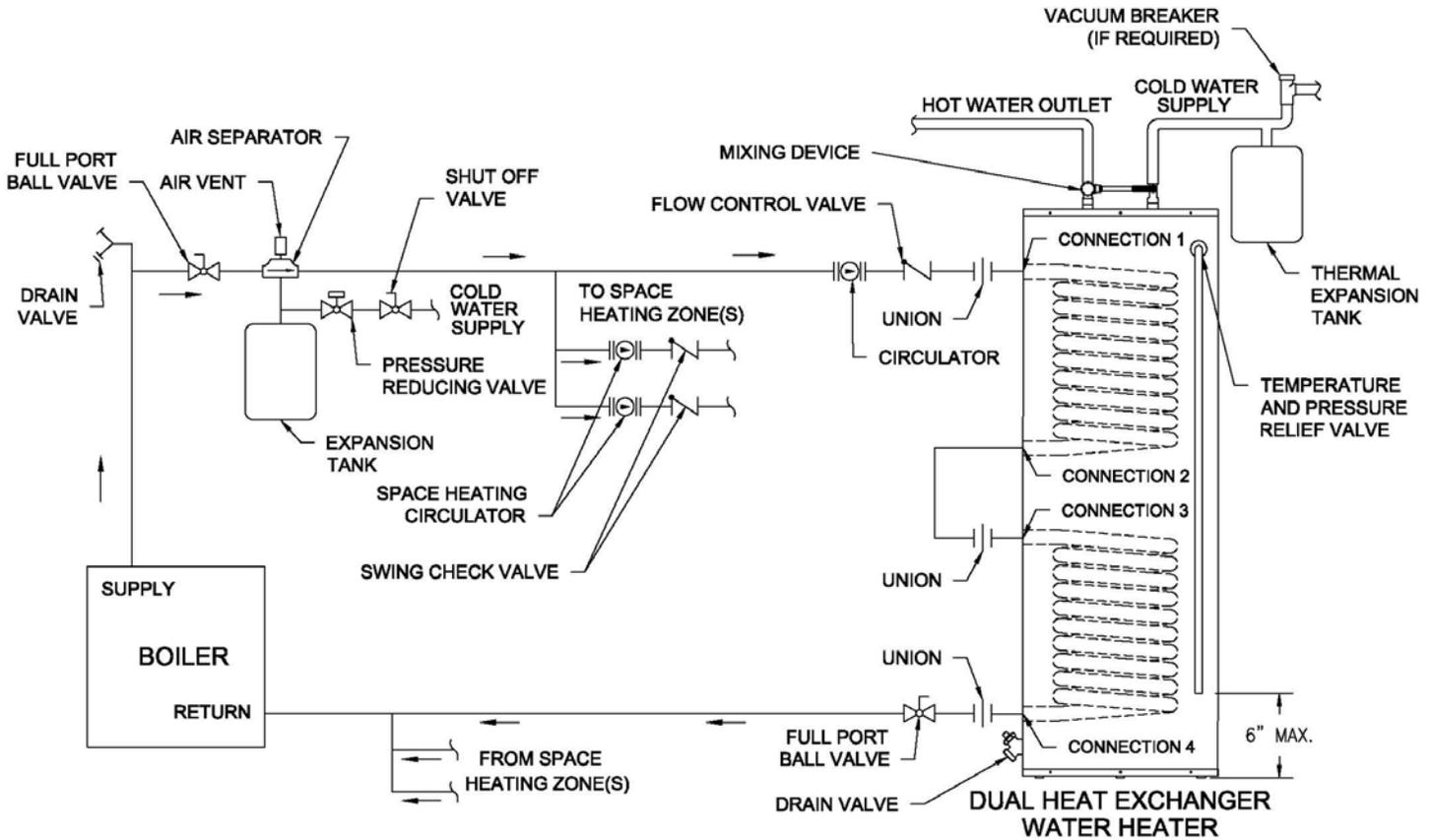


Figure 10 – Boiler Piping Installation for Both Heat Exchangers using the Lower Thermostat

SECTION VI ELECTRICAL CONNECTIONS

Install electric wiring in accordance with the National Electric, ANSI/NFPA 70, or in Canada the CSA C22.1 Electric Code, latest editions.

DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the water heater or building. Lock out all electrical boxes with padlock once power is turned off.

WARNING

When installed, the water heater must be electrically grounded in accordance with local codes or, in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, or in Canada the CSA C22.1 Electric Code, latest editions.

Failure to properly wire electrical connections to the water heater may result in serious physical harm.

Electrical power may be from more than one source. Make sure all power is off before attempting any electrical work.

CONNECT THERMOSTATS FOR BOILER OPERATION

Before any electrical connections are made, be sure that the water heater is full of water and that the valve in the cold water supply line is open. The dual indirect water heater is supplied with thermostats that incorporate manual reset temperature-limiting devices. Please refer to the TROUBLESHOOTING GUIDE section for manual reset operation. Both upper and lower thermostats incorporate a manual adjustable temperature indicator to change the potable water temperature setting. Refer to WATER TEMPERATURE ADJUSTMENT in the OPERATING INSTRUCTIONS section for proper instruction in adjusting water temperature. Turn off all power related to the heating system before proceeding with the electrical connections. Any and all wiring shall be sized and installed to satisfy the voltage and amperage used. The water heater must be well grounded. A green ground screw is provided at the electrical connection point for connecting a ground wire. All wiring shall be done in accordance with all applicable local and state codes.

WARNING

Water heaters are heat-producing appliances. To avoid damage or injury there must be no materials stored against the water heater, and proper care must be taken to avoid unnecessary contact (especially by children) with the water heater.

UNDER NO CIRCUMSTANCES SHALL FLAMMABLE MATERIALS, SUCH AS GASOLINE OR PAINT THINNER BE USED OR STORED IN THE VICINITY OF THE WATER HEATER OR IN ANY LOCATION FROM WHICH FUMES COULD REACH THE WATER HEATER.

Installation or service of this water heater requires ability equivalent to that of a licensed tradesman in the field involved. Plumbing and electrical work are required.

CONNECT THERMISTORS FOR SOLAR OPERATION

Sensor wires are provided for connection to the solar controller in a separate junction box located on top of the water heater. The brown twisted wires provide thermistor wiring from the controller to the lower heat exchanger. The orange twisted wires provide thermistor wiring from the solar controller to the upper heat exchanger location.

NOTICE

A solar control and thermistors are not supplied with this water heater. The Tekmar 156, when installed according to manufacturer's instructions, is an acceptable controller. Other solar controller manufacturers such as Steca and Resol provide controllers appropriate for use with this water heater.

Thermistors are not included with the water heater. Thermistors must be purchased with the solar controller to ensure capability with the selected control. Contact the solar controller manufacturer for details.

Refer to Figure 11 for connecting the thermistor(s) and pressing it against the tank. This figure illustrates the opening under the upper and lower control cover.

1. Positively assure all electrical connections are unpowered whenever removing the control covers.
2. Strip the twisted wire ends and use wire nuts to securely connect the thermistor wires.
3. With a flat blade screwdriver or similar tool to be used as a lever, gently pry the sensor plate away slightly from the water heater tank.
4. Slide the thermistor between the sensor plate and the water heater tank as shown.
 - a. The tank thermistor(s) should be inserted as shown in the upright position.
5. Verify that the sensor plate provides enough pressure to hold the thermistor in place.
6. Return power to the water heater once the covers are in place.

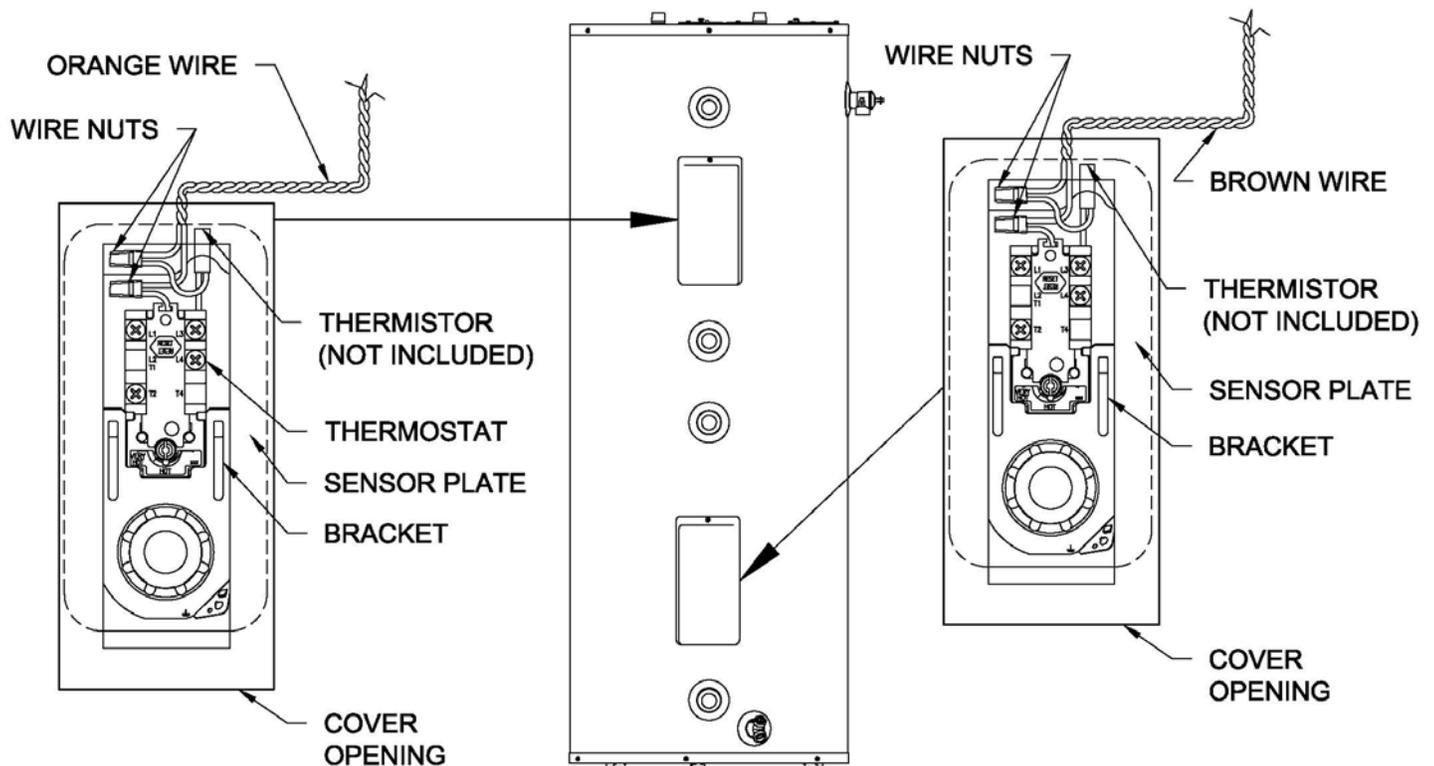


Figure 11 – Wiring and Placement for the Solar Control Thermistors

SECTION VII OPERATING INSTRUCTIONS

SYSTEM START-UP

Follow the appropriate installation instructions to place the heating system or space heating system in operation. Ensure that fluid flow operation is established in the heat exchanger for the installed system.

WATER TEMPERATURE ADJUSTMENT

Table 5 details the approximate relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.

 **WARNING**

SCALDING

This water heater can deliver scalding temperature water at any faucet in the system. Be careful whenever using hot water to avoid scalding injury. By setting the thermostat on this water heater to obtain an increased water temperature, you may create the potential for scald injury. To protect against injury, you should install an ASSE approved mixing valve (a device to limit the temperature of water to protect against scald injury via mixing hot and cold water supply) in the water system. This valve will reduce point of discharge temperature in branch supply lines. This water heater was shipped with an ASSE approved mixing valve. Install this valve according to the directions in the mixing device container. DO NOT OPERATE THIS WATER HEATER A MIXING DEVICE. If this water heater was shipped without a mixing device, contact the manufacturer.



Water temperature over 125°F can cause severe burns instantly or death from scalds.

Children, disabled and are at highest risk of being scalded.

Review this instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Temperature limiting valves are available

Figure 12 – Scald Warning

APPROXIMATE TIME/TEMPERATURE RELATIONSHIPS IN SCALDS	
120°F	More than 5 minutes
125°F	1 ½ to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 ½ seconds
155°F	About 1 second

Table 5 – Scald Relationships

SEQUENCE OF HEATING OPERATIONS –SPACE HEATING

- 1) The space heating zone control senses a need for heat.
 - a) The zone control activates the appropriate space heating circulator to begin circulating heated fluid through the zone and deactivates the circulator when the desired temperature is achieved.

SEQUENCE OF HEATING OPERATIONS -SOLAR BACKUP

1. The solar controller senses a large enough temperature difference between the tank and the solar collector to transfer heat into the tank.
 - a. The solar controller activates a circulator/pump to flow fluid through the heat exchanger and solar collector, transferring heat into the storage tank until the temperature difference is significantly reduced.

SEQUENCE OF HEATING OPERATIONS -BOILER BACKUP

1. The boiler senses through the surface mounted thermostat that the indirect water heater needs heat.
 - a. The circulator begins flowing water through the heat exchanger and the boiler turns on. The circulator continues to flow water through the exchanger until the temperature in the tank satisfies the surface mounted thermostat.



Before adjusting the thermostat, turn off all power supplied to the dual heat exchanger indirect water heater.

The minimum potable water temperature can be changed by adjusting the thermostat. Before any work is done on the water heater, disconnect all power to the water heater and heat source (solar collector) by opening the switch(s) at the main electrical circuit breaker or fuse box. Remove the cover and fold the insulation outward away from the control. Adjust the thermostat dial using a screwdriver until the minimum acceptable temperature is achieved. The thermostat has been factory preset to 120°F (49°C). **Remember that lower temperature settings are more energy efficient.** Rotate the temperature dial **clockwise** ⤵ to increase water temperature. Rotate the thermostat dial **counter-clockwise** ⤴ to decrease the temperature setting. Replace the insulation making sure that the control is well covered and that the plastic terminal shield has not been displaced. Replace the access panel. The water heater is now ready for operation and the main switch can be closed.

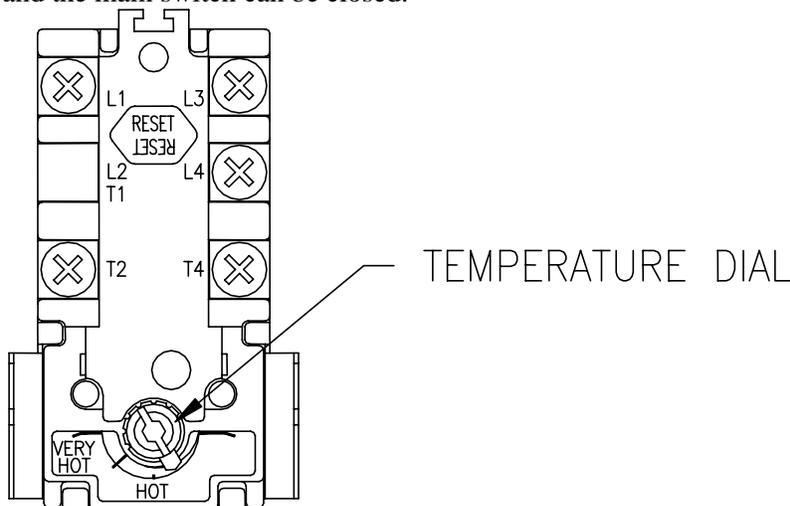


Figure 13 – Thermostat

After the water heater completes a heat-up cycle, check the water temperature at a faucet. Allow enough water to flow to ensure that the faucet water temperature reflects the discharge temperature. Adjust the water heater's or mixing device's temperature setting as necessary.

Adjusting to a lower tank temperature setting will not immediately affect water temperature. Draw sufficient water or allow the water heater to remain idle until a heat-up cycle is initiated. After the heater's heat-up cycle is complete, check the water temperature at a faucet to determine if further adjustment is necessary.

Adjusting to a higher tank temperature may not immediately affect water temperature. If a heat-up cycle begins, allow the heat-up cycle to complete before checking the water temperature. If a heat-up cycle does not begin, draw sufficient water or allow the water heater to remain idle until a heat-up cycle is initiated. After the heater's heat-up cycle is complete, check the water temperature at a faucet to determine if further adjustment is necessary.

SECTION VIII MAINTENANCE

This indirect water heater is intended to provide a service life of many years. Components that require service, however, may be subject to failure. Failure to use the correct procedures or parts in these circumstances may make the water heater unsafe.

The owner should arrange to have the following inspections and simple maintenance procedure performed by qualified service personnel at the frequencies suggested.

1. **System and Domestic Water Piping (Annual)** - Check all piping for signs of leakage at joints, unions, and shut-off valves. Repair as needed.
2. **Temperature-Pressure Relief Valve (Annual)** - The temperature-pressure relief valve should be checked to ensure that it is in operating condition. To check the relief valve, lift the lever at the end of the valve several times. The valve should seat properly and operate freely. If water does not flow, remove and inspect for obstructions or corrosion. Replace with a new valve of the recommended capacity as necessary. Do not attempt to repair the valve, as this could result in improper operation and a tank explosion. In areas with poor water conditions, it may be necessary to inspect the temperature-pressure relief valve more often than once a year.



Before manually operating the valve, make sure that a drain line has been attached to the valve to direct the discharge to an open drain. Failure to take this precaution could mean contact with extremely hot water discharging from the valve during this checking operation.

If the temperature–pressure relief valve on the heater discharges periodically or continuously, it may be due to thermal expansion of water in a closed water supply system, or it may be due to a faulty relief valve. Thermal expansion is the normal response of water when it is heated. In a closed system, thermal expansion will cause the system pressure to build until the relief valve actuation pressure is equaled. Then the relief valve will open, allowing some water to escape, slightly lowering the pressure. Contact your water supplier or local plumbing inspector on how to control this situation.

ABOVE ALL, DO NOT PLUG THE TEMPERATURE AND PRESSURE RELIEF VALVE. THIS IS NOT A SOLUTION AND CAN CREATE A HAZARDOUS SITUATION.

3. **Anode Inspection and Replacement** - This water heater is equipped with multiple sacrificial anodes. Anodes protect the glass-lined tank from corrosion by sacrificing themselves through electrolysis. When the anode material is consumed, there is no more protection and tank corrosion accelerates. Inspection of the anodes every year allows you to identify spent anodes and replace. Replace the anodes when its diameter is 3/8 of an inch, or every other year, whichever is first. Aggressive, very hot and softened water causes rapid consumption of the anode, requiring frequent inspections. Anodes are available from your distributor or from the manufacturer.

To inspect or replace an anode:

The anodes on this water heater are easily accessible from the top of the heater making replacement simple and quick.

- a. Turn the water heater and, if applicable, solar controller or circulator electricity off. Flow water until the discharge is cool or allow enough time for the potable water to cool naturally. Connect a hose to the drain valve. Locate the hose's discharge in an area where any remaining hot water will not cause any damage or injury.
- b. Open the drain valve to flush any sediment out of the bottom to the heater.
- c. Shut off the cold water supply. Make sure all hot water fixtures and circulating pumps are turned off.
- d. Wait for water flow from the hose to stop. Remove the anode using a socket of the appropriate size. Do not use an impact wrench.
- e. Inspect and replace the anode as required. Use pipe tape or sealant when reinstalling the anode.
- f. Close the drain valve. Open a hot water fixture to allow air to escape. Open the cold water supply to the heater and allow the tank to fill.
- g. Check your anode and drain valve for leaks.
- h. Turn the water heater and, if applicable, solar controller or circulator electricity on.

Maintenance continued-

4. ***Sediment (Annual, but harsh water quality may dictate more frequent service)*** - Depending on water conditions, a varying amount of sediment may collect in the tank. Levels requiring service are indicated by a small temperature difference in the supply and return lines (See also “Scale” below). Repeated flushing usually clears such material. As a preventive measure, water should be drawn from the tank at the drain valve until it runs clear.
5. ***Scale (Annual)*** - Hard water may cause scale to build-up on the outside of the heat exchanger coil. A water softener will prevent this problem (See also “Sediment” above). Symptoms would be reduced recovery capacity. Repeated flushing should resolve the problem.
6. ***Circulator*** -The circulator manufacturer may have a recommended maintenance procedure. Refer to the installation and operation manual that was received with the circulator.

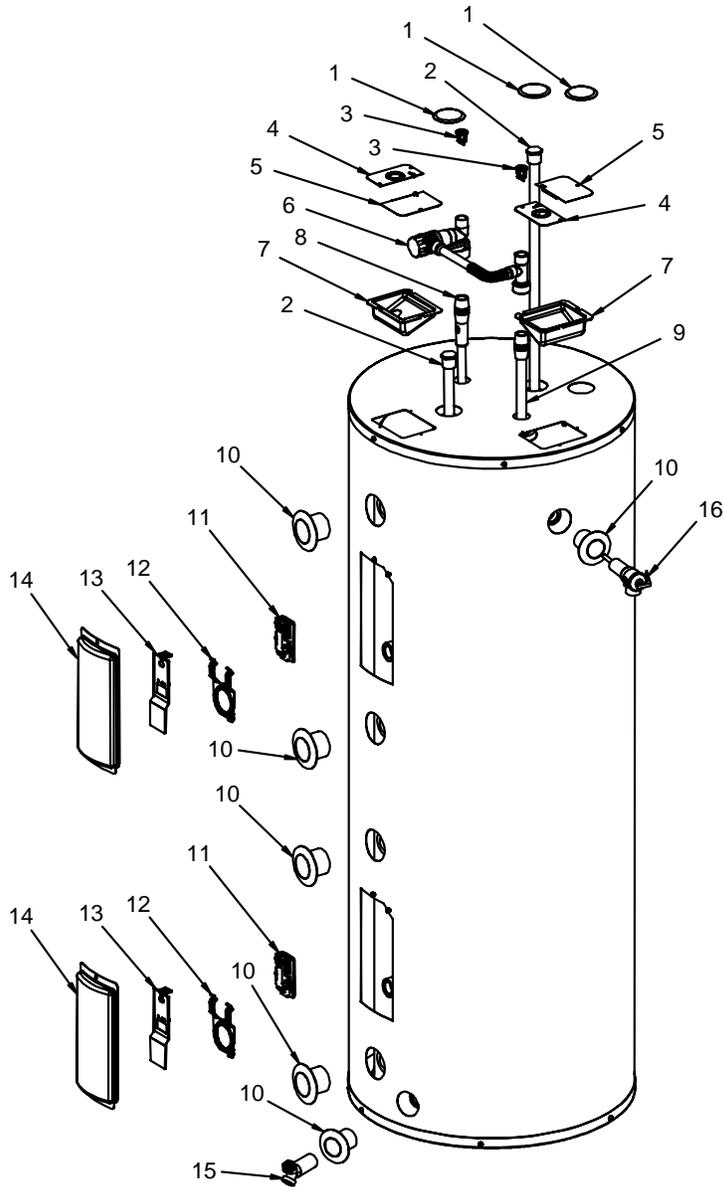
If in a Solar Heating System

7. ***Solar Controller*** -The solar controller manufacturer may have a recommended maintenance procedure. Refer to the installation and operation manual that was received with the solar controller.
8. ***Solar Collector Panels*** - The solar collector panel manufacturer may have a recommended maintenance procedure. Refer to the installation and operation manual that was received with the solar collector panels.

SECTION IX TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
No hot water at faucet	ECO on thermostat tripped	Determine why ECO trip occurred in system. Correct or replace as necessary. Depress red "RESET" button on thermostat
	Improper thermostat setting or calibration	Adjust tank thermostat to appropriate setting See Section VII
	Circulator does not pump fluid through system	Check electrical connections
		Check that proper valves are open
		Check that system is bled
		Replace as necessary
	Electrical problem (Control, wiring, etc.)	Check fuse and replace
		Check circuit breaker and reset (if applicable)
Check power supply		
Scale build-up	If controls, heat sources, circulator, and tank are operating satisfactorily, coil may have scale coating. See Section VIII: Maintenance	
Clogged cold water filter	Clean or replace filter or strainer	
Water at faucet too hot	Thermostat set too high	Adjust thermostat setting. See Section VII
	Improper system plumbing	Compare plumbing to Section V
	Improper system wiring	Compare wiring to Section VI
	Mixing Device temperature set too high	Adjust Mixing Device setting. Refer to Mixing Device instructions.
Insufficient hot water	Thermostat setting too low	Adjust thermostat to higher setting. See Section VII
	Undersized heat source	Review calculations for proper heat source size and possible orientation
	Faulty system sensor or controller	Check connections, power and sensor resistance. Replace as necessary.
	Peak use of hot water is greater than tank storage capacity	Determine peak usage and compare to tank capacity
	Circulator does not pump fluid	Check electrical connections
		Check that proper valves are open
		Check that system is bled
Replace as necessary		
Faulty tank thermostat	Replace thermostat	

SECTION X PARTS LIST



PART NAME & DESCRIPTION	
1. Hole Closure	9. Cold Water Inlet Diptube
2. Hex Head Anode	10. Escutcheon
3. Heat Trap	11. Thermostat with ECO (89T33)
4. Conduit Grounding Cover	12. Thermostat Mounting Bracket
5. Electrical Outlet Cover	13. Thermostat Protector (Large)
6. Approved Mixing Device	14. Access Cover
7. Junction Box	15. Brass Drain Valve
8. Hot Water Outlet/Anode	16. T&P Relief Valve

Contact your supplier or plumbing professional for replacement parts or contact the company at the address given on the rating plate of the water heater.

Provide the part name, model, and serial numbers of the water heater when ordering parts.

READ THE WARRANTY FOR A FULL EXPLANATION OF THE LENGTH OF TIME THAT PARTS AND THE WATER HEATER ARE WARRANTED.

Manufactured under one or more of the following U.S. Patents: RE.34,534;B1 5,341,770; 4,416,222; 4,628,184; 4,669,448; 4,672,919; 4,808,356; 4,829,983; 4,861,968; 4,904,428; 5,000,893; 5,023,031; 5,052,346; 5,081,696; 5,092,519; 5,115,767; 5,199,385; 5,277,171; 5,372,185; 5,485,879; 5,574,822; 5,596,952; 5,660,165; 5,682,666; 5,761,379; 5,943,984; 5,954,492; 5,988,117; 6,142,216; 6,395,280; 6,684,821; 7,007,748; 7,063,132

Other U.S. and Foreign patent applications pending. Current Canadian Patents: 1,272,914; 1,280,043; 1,289,832; 2,045,862; 2,092,105; 2,107,012; 2,108,186; 2,112,515

Complete the following information and retain for future reference:

Model No: _____

Serial No: _____

Service Phone

Days: _____ Nights: _____

Address: _____

Supplier: _____

Supplier Phone No: _____

NOTES

NOTES

PureFlow[®] MANABLOC[®] Parallel Water Distribution System For ViegaPEX[™], ViegaPEX[™] Ultra and FostaPEX[®] SDR-9 Cross-linked Polyethylene (PEX)

Scope

This specification designates requirements for the PureFlow MANABLOC parallel water distribution system which supplies water to individual plumbing fixtures through dedicated ports and distribution lines. Each port (outlet) is equipped with a built-in shut-off valve to provide control for each fixture from a central location. The MANABLOC has separate hot and cold water inlets and ports to manage the entire plumbing system. A variety of standard and Zero Lead¹ fitting options are available for the MANABLOC distribution ports, including PEX Compression, Bronze PEX Press, Brass PEX Crimp and PolyAlloy PEX Crimp fittings. These distribution connections come complete with the MANABLOC when ordered. However, supply connections and fixture transition fittings are not included with the unit but are available separately.

Materials

The modular MANABLOC sections are molded from polysulfone (PLS) plastic. This material is used extensively in the medical industry and is highly resistant to hot water, chlorine and other chemicals typically found in potable water systems. The other components making up the MANABLOC consist of corrosion-resistant metals and engineered plastics that have been chosen specifically for each purpose. The stiffener used in the compression port fitting assembly is manufactured from 304 stainless steel.

Marking and Certification

MANABLOC units are marked with the product name, unit part number, material designation, production date and marks of third-party certifications by NSF International (NSF-pw) to ASTM F877, ANSI/NSF standards 14 and 61 CSA B137.5 and are listed with IAPMO as meeting the requirements of the Uniform Plumbing Code.

Recommended Uses

The MANABLOC is recommended for use in hot and cold potable water distribution systems in single and multifamily dwellings, as well as multiple-unit structures (apartments, condos, hotels, motels, etc.). Maximum pressure/temperature rating is 100 psi @ 180°F. The MANABLOC is not to be used directly in line with hot water domestic recirculation loops. PureFlow MANABLOC system components are not interchangeable with components and tubing from other suppliers. For information on other hot and cold applications not listed here, consult with your Viega representative.

Handling and Installation

The MANABLOC must be protected from UV exposure and petroleum products that can damage them. Use of these materials in hot and cold water distribution systems must be in accordance with good plumbing practices, applicable code requirements, and current installation practices available from Viega. Contact a Viega representative or the applicable code enforcement bureau for information about approvals for specific applications.

Capacities and K-Factor

Specifications	English Units	SI
Main Waterway (each side)	1-1/4"	31.8mm
Main Inlet/Outlet Connection	1" Male NPSM	-
Fixture Ports	3/8" CTS and 1/2" CTS	9.5mm and 12.7mm
Fixture Port Rating (each)	3/8" - 2.5 GPM	3/8" - 9.5 LPM
(@ 8 FPS tubing velocity)	1/2" - 4 GPM	1/2" - 15.1 LPM
Fixture Port K-Factor	3/8" - .35	3/8" - 1.66 x 10 ⁻³
	1/2" - .21	1/2" - 9.997 x 10 ⁻⁴
	(PSI=KxGPM ²)	(BAR=KxLPM ²)
Main Bore Flow Capacity (each side) (2006 IPC Table 604.10.1)	31 GPM	117.3 LPM
Main Bore Through Feed K Factor	0.012	56.98x10 ⁻⁶
(36 Ports with "Y" Block)	(PSI=KxGPM ²)	(BAR=KxLPM ²)
WSFU Capacity (each side) (2006 IPC, table E103.3)	60	-

1. "Zero Lead" identifies Viega products meeting the lead free requirements of California and Vermont law, effective January 1, 2010, as tested and listed against NSF- 61, Annex G

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TechData

viega

Quality Assurance

When the product is marked with the ASTM F877 designation, it affirms that all MANABLOC manifold control units are factory-assembled and pretested prior to delivery to the field. Viega utilizes protective packaging to reduce risk of damage during shipping and storage. MANABLOC manifolds are not intended to be fabricated or disassembled in the field. MANABLOC manifolds are intended for potable water use only.

Certification

cNSF@us pw-G

- Zero lead listing meeting California AB 1953 and Vermont ACT 193
- NSF International Performance and Health Effects (Standards 14 & 61)
- NSF certified to CSA B137.5 (Canadian Standards Association)



- IAPMO Certified

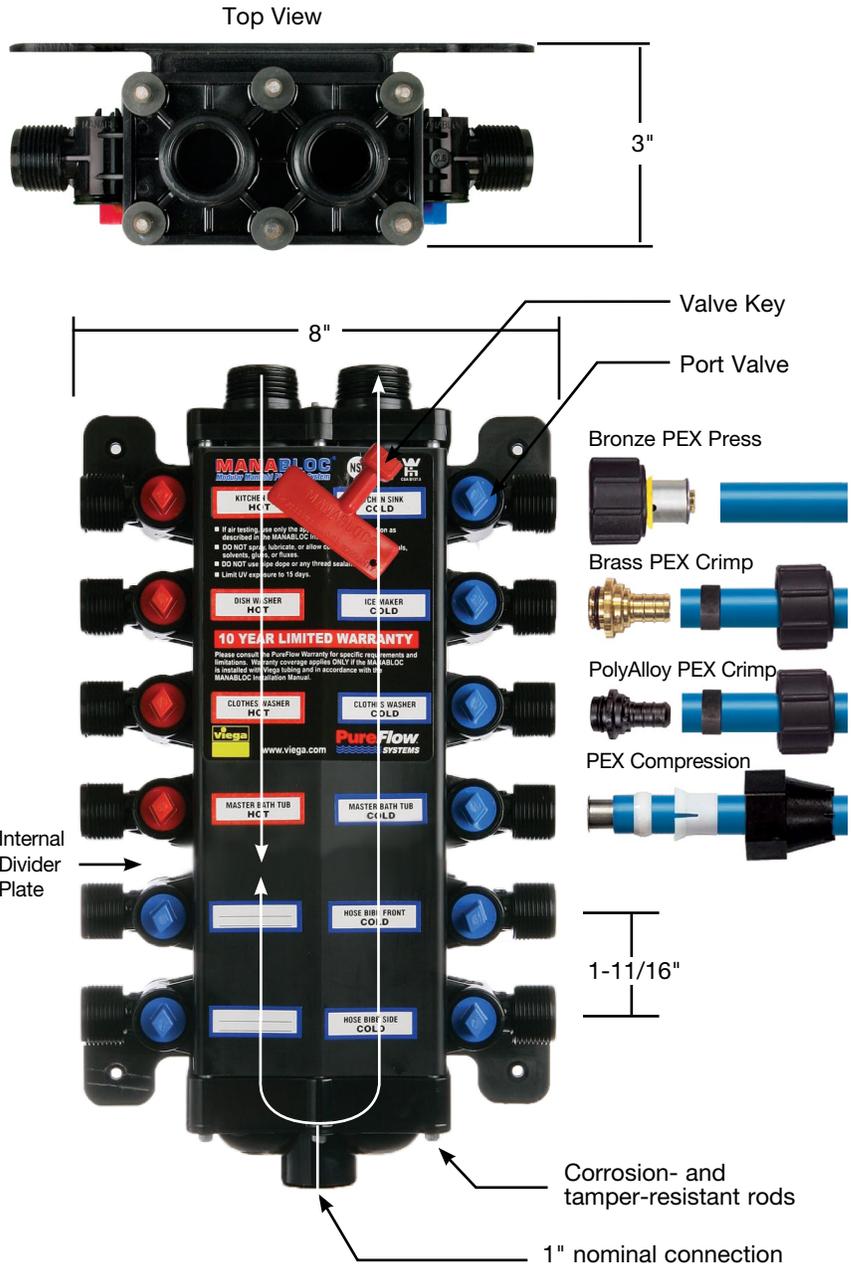
MANABLOC Dimensions

Total Ports	Length
14	15 - 15/16"
18	19 - 3/8"
24	24 - 3/8"
30	29 - 1/2"
36	34 - 3/8"

Dimensions reflect stock MANABLOC sizes.

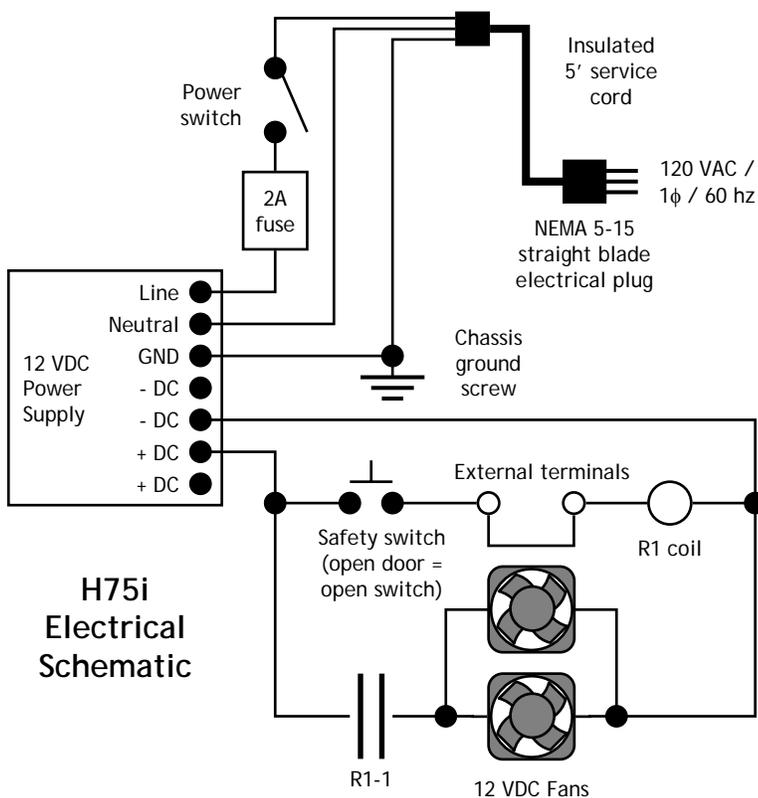
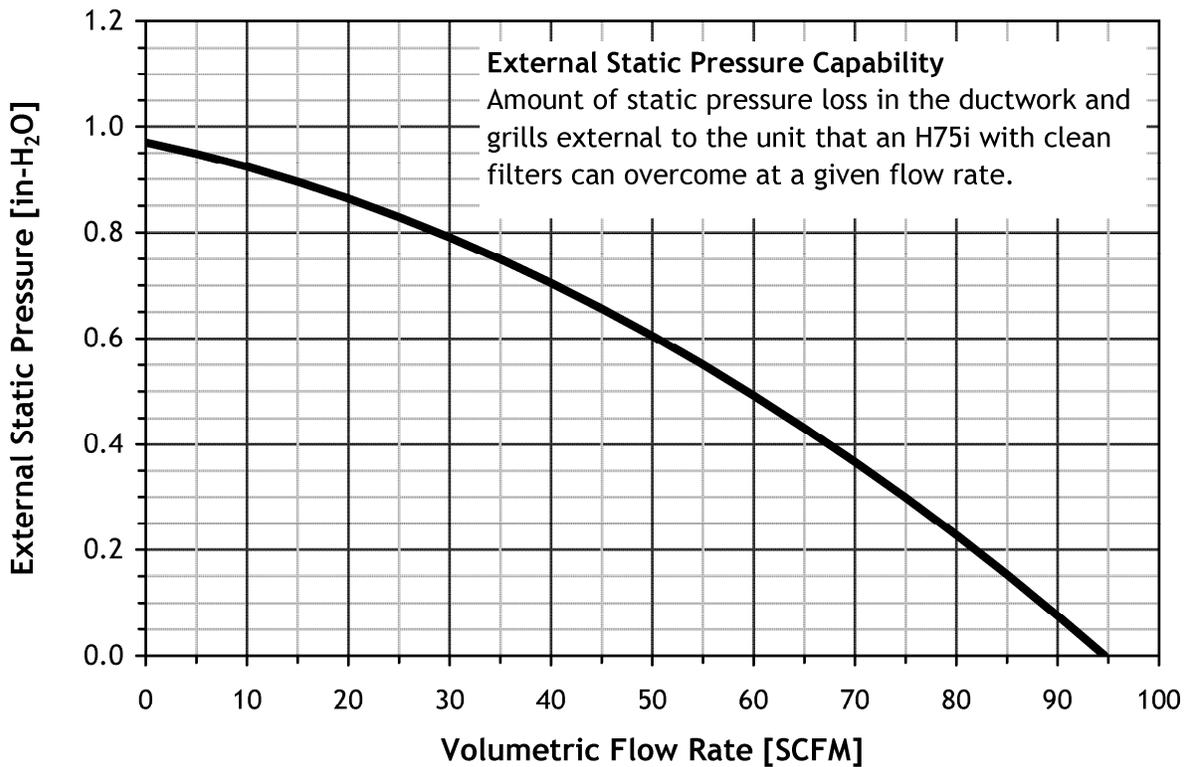
MANABLOC Pressure Drop Table Expressed as PSI Drop Through Port

Port Size	Rated Flow	PSI Drop
3/8"	2.5 gpm	2 psi
1/2"	4 gpm	3.4 psi



Viega... The global leader in plumbing and heating systems.

H75i Residential System



Specifications	
Weight	27 lb
Air Flow	75 SCFM nominal, 94 SCFM maximum
Voltage	120 VAC
Circuit	60 hz, single phase
Power	90 W
FLA	0.75 A
MCA	1.0 A
MOP	15 A
Cord	5' long, grounded plug
Certification	ARI 1060 certified ETL listed
Filters	Washable polyester fiber
Insulation	1" fiberglass (4.2 R-value)
Control	Rocker switch and external terminals operate internal relay

NOTES:

SYSTEM IS INTENDED FOR INDOOR USE ONLY.

OA - OUTSIDE AIR INTAKE [FRESH AIR]
 SA - SUPPLY AIR EXIT [FRESH AIR]
 RA- RETURN AIR INTAKE [STALE AIR]
 EA - EXHAUST AIR EXIT [STALE AIR]

AIR STREAMS ARE **NOT** INTERCHANGEABLE AND INPUTS SHOULD **NOT** BE REVERSED DURING INSTALLATION.

SYSTEM WEIGHT = 27 LB.

ELECTRICAL CONNECTION VIA 60" INSULATED 115 VAC SERVICE CORD (INCLUDED BUT NOT SHOWN).

MANUAL ON/OFF SWITCH OR REMOTE OPERATION VIA RELAY AND EXTERNAL TERMINALS PROVIDED.

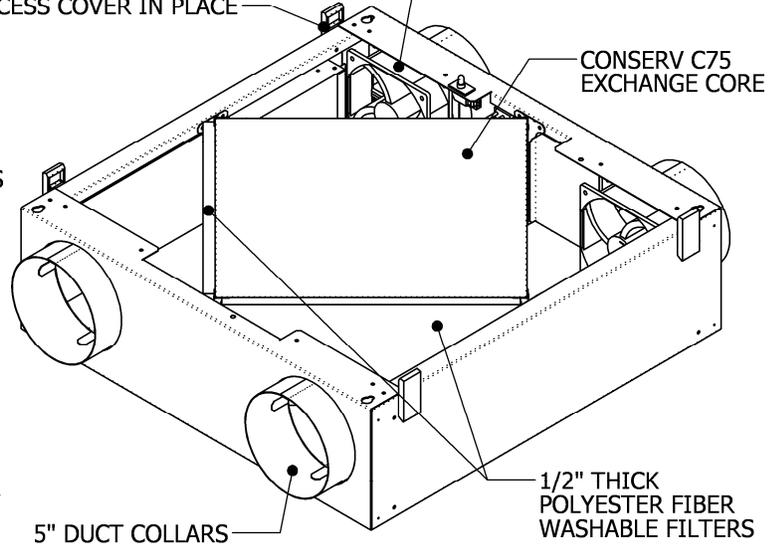
1" THICK FIBERGLASS INSULATION IS STANDARD.

INSTALLATION KIT INCLUDES 72" OF MOUNTING CHAIN, FOUR BRACKETS AND SCREWS TO ATTACH TO UNIT.

LIFTOFF CLASPS SECURE ACCESS COVER IN PLACE

BRUSHLESS DC FANS

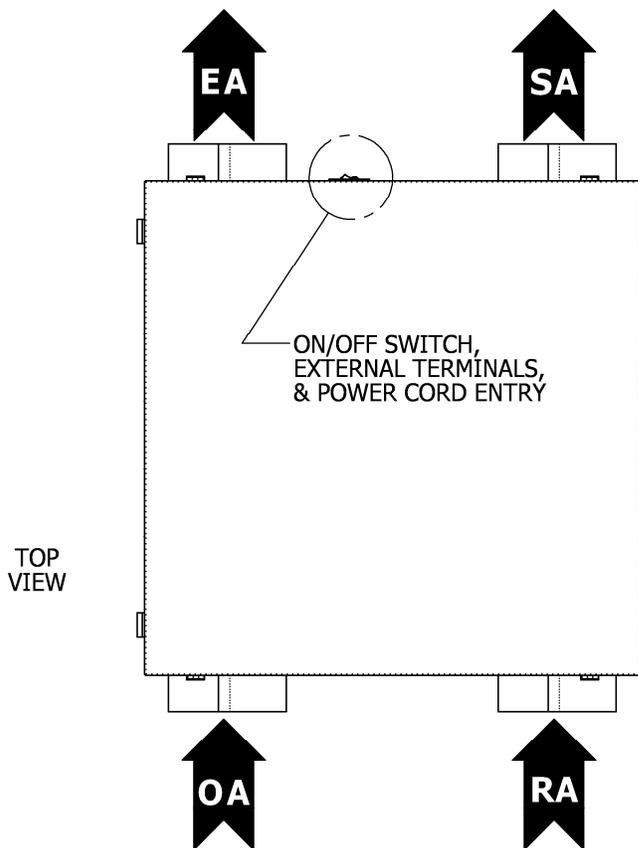
CONSERV C75 EXCHANGE CORE



5" DUCT COLLARS

1/2" THICK POLYESTER FIBER WASHABLE FILTERS

SHOWN WITH ACCESS COVER REMOVED

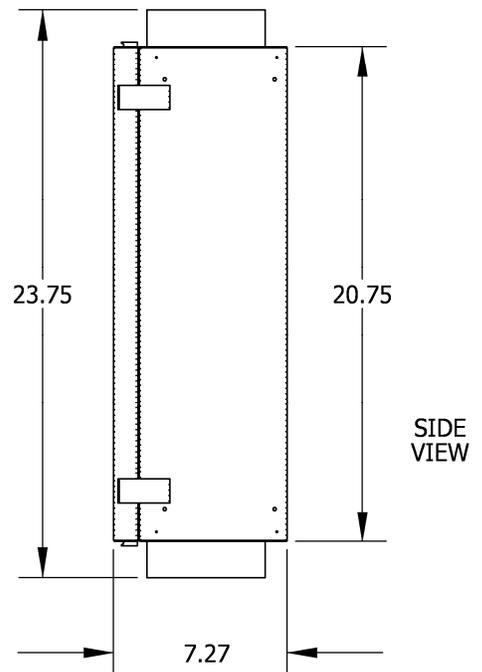


TOP VIEW

ON/OFF SWITCH, EXTERNAL TERMINALS, & POWER CORD ENTRY

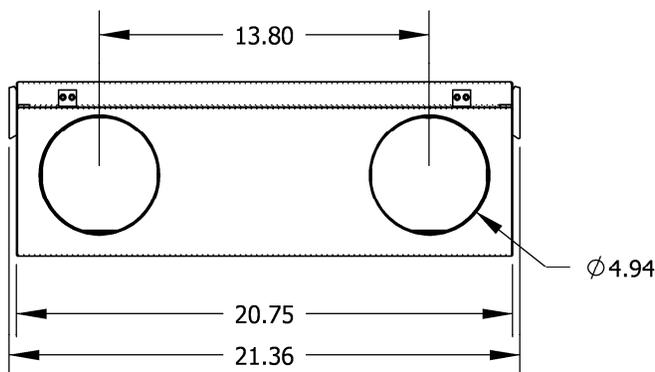
OA

RA



SIDE VIEW

FRONT VIEW



NOTES:

UNIT CAN BE MOUNTED AND OPERATED IN ANY ORIENTATION.

ACCESS COVER CAN BE INSTALLED IN ANY OF FOUR DIRECTIONS TO KEEP GRAPHICS IN PROPER POSITION.

RETAINING POSTS ON THE ACCESS COVER AND KEYHOLE SLOTS IN THE MAIN UNIT PREVENT ACCIDENTAL DISLODGMET OF THE ACCESS COVER WHEN UNLATCHED.

SIZE A	REV. 1	MODIFIED 1/14/2009	RESIDENTIAL ERV SYSTEM		MODEL H75i
www.conserv.com		DO NOT SCALE DRAWING		87	DIMENSIONS IN INCHES www.conserv.com

Hi-Performance Series

FAN COIL TECHNICAL CATALOG



BUILD YOUR REPUTATION ON OURS

Hi-Performance Series

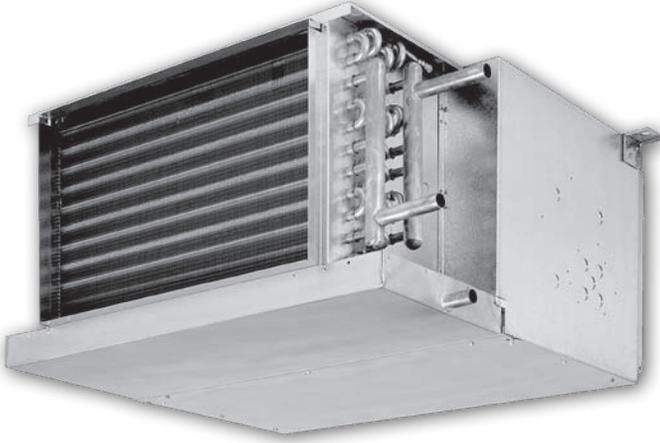
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International Environmental Corporation (IEC) works continually to improve its products. As a result, the design and specifications of each product may be changed without notice and may not be as described herein. Please contact IEC for information regarding current design and product specifications. Statements and other information contained herein are not express warranties and do not form the basis of any bargain between the parties but are merely IEC's opinion or commendation of its products. Manufacturer's standard limited warranty applies.

Hi-Performance Series

PORTFOLIO, Cont'd.



HPY - Hi-Performance Hideaway with Plenum 600 CFM to 2000 CFM

The Hi-Performance Hideaway with Plenum (HPY) fan coil unit provides the same basic features as the HHY plus a return air plenum. HPY units are shipped from the factory ready for installation with the plenum section in place. No field fabrication is required. HPY units are designed with interchangeable panels so that the unit may be modified on site to accommodate a rear or bottom return. Standard HPY units are provided with a galvanized finish.

HLY - Hi-Performance Cabinet 600 CFM to 2000 CFM

The Hi-Performance Cabinet (HLY) fan coil unit is suited for under-ceiling, mounted applications where high capacities are required. HLY units are supplied with an integral double-deflection discharge grille and hinged bar type, return air grille with a throwaway filter. Standard HLY units are provided with a powder-coat paint finish. HLY units are not suitable for ducted applications.



HXY - Hi-Performance Horizontal Cased 600 CFM to 2000 CFM

The Hi-Performance Cased (HXY) fan coil unit is designed for above or below the ceiling and is ideal for high-static, ducted applications where high output is required. Standard HXY units are fabricated of heavy gauge steel and are provided with a galvanized finish.



Application Fit

- Multiple cabinet choices are available in 8 nominal sizes for application in a variety of room layouts.
 - Hideaway model (HHY) units are installed above the ceiling with or without ducted supply air and open “soffit” return with an optional ceiling-mounted return air filter-grille.
 - Hideaway model with plenum (HPY) units are installed above the ceiling with or without ducted supply air and ducted return air. The return air filter is either mounted on the unit plenum or installed in an optional ceiling filter-grille.
 - Cabinet model (HLY) units are equipped with a painted cabinet suitable for under-ceiling exposed applications. Specially selected motor and blower designs make this unit especially suited for non-ducted applications.
 - Horizontal cased model, high static (HXY) units are equipped with a galvanized cabinet suitable for above or below the ceiling, and are ideal for ducted supply and return air.
 - Vertical cased units (VEY) are ideal for air conditioning in apartments, offices, schools and many other applications. Top supply units are often located in mechanical rooms and supply air is ducted into multiple zones. Front or bottom return units with filter frames are available.

Design Flexibility

- Easy to use ratings program to speed up project design.
- Standard and high capacity hydronic coils and DX coils are available to match the heating and cooling loads of the space.
- Optional powder paint finish colors and grille selections will complement most décors (HLY units).

- Optional 6" legs are available for the vertical (VEY) unit.
- Customizable cabinetry (HLY or HXY) makes these units ideal for renovation jobs or where special sizes are required to fit oversized valves and controls packages.
- HPY optional airflow configuration (rear return or bottom return) can be factory configured or field converted for maximum flexibility.
- Wide variety of factory assembled valve packages to meet desired controls specifications.
- Wide variety of optional insulation materials are available to address IAQ concerns.
- Optional condensate overflow switches are available to address latest building codes where required.

Ease of Installation

- Optional factory assembled valve packages minimize the piping work at the job site.
- Optional unit mounted controls, service switches and fusing minimize the electrical work required on site.
- Units are tagged at the factory for clear identification on the job site.
- Opposite end connection units may minimize the field piping work on renovation jobs.

Ease of Service

- All components are accessible by simply removing the access panel.
- Filters can be replaced without tools.
- Blower assembly easily removed from the rear of the coil for service and cleaning.

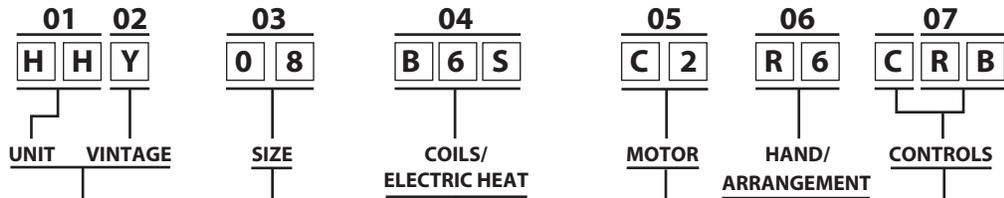
Quality and Safety

- Every unit tested and inspected at the factory for trouble-free start-up.
- ETL listed. AHRI rated where applicable.

Hi-Performance Series

UNIT MODEL KEY

Code Items Code



- HHY • Hi-Performance Hideaway
- HPY • Hi-Performance Hideaway with Plenum
- HLY • Hi-Performance Cabinet
- HXY • Hi-Performance Horizontal Cased
- VEY • Hi-Performance Vertical Cased

- 06 • 600 CFM
- 08 • 800 CFM
- 10 • 1000 CFM
- 12 • 1200 CFM
- 14 • 1400 CFM
- 16 • 1600 CFM
- 18 • 1800 CFM
- 20 • 2000 CFM

- Voltage**
- C • 115-1-60
 - D • 208-1-60
 - E • 230-1-60
 - F • 277-1-60
 - V • 220-1-50*
 - U • 240-1-50*

- Type**
- 2 • Permanent Split Capacitor

- Hand****
- R • Right
 - L • Left
- Arrangement**
- 5
 - 6

Two-pipe Cooling and Heating or Four-pipe Cooling

- A • 3-Row
- B • 4-Row
- K • 6-Row

Four-pipe Heating

- Y • None
- 6 • 1-Row
- 7 • 2-Row

or, if electric heat

Voltage

- C • 120 V
- D • 208 V
- E • 240 V
- F • 277 V
- V • 220 V (50)*
- U • 240 V (50)*

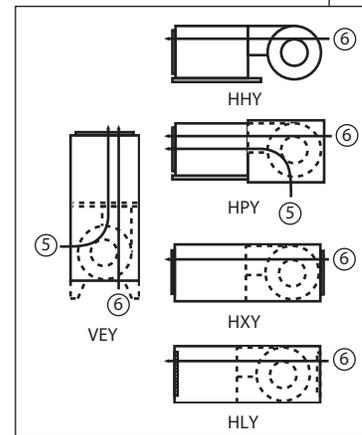
Coil Connection

- Y • None
- S • Same End
- O • Opposite End

or, if electric heat

kW

- D • 2.00
- F • 3.00
- G • 4.00
- H • 5.00
- J • 6.00
- K • 7.00
- L • 8.00
- M • 9.00
- N • 10.00
- P • 12.00
- Q • 14.00



Voltage

- B • 24 V
- C • 120 V
- D • 208 V
- E • 240 V
- F • 277 V
- V • 220 V (50)*
- U • 240 V (50)*

System / Thermostat

Manual Fan Operation

- A2 • Standard Wall Mount (Switch Only)

Valve Cycle Control

- G • 2-Pipe Heat Only
- H • 2-Pipe Cool Only
- J • 2-Pipe Heat and Cool, MCO
- K • 2-Pipe Heat and Cool, ACO
- L • 2-Pipe Heat and Cool w/ Aux. Elec. Heat, MCO
- M • 2-Pipe Heat and Cool w/ Aux. Elec. Heat, ACO
- N • 2-Pipe Cool w/ Total Elec. Heat, MCO
- P • 2-Pipe Cool w/ Total Elec. Heat, ACO
- Q • 4-Pipe Heat and Cool, MCO
- R • 4-Pipe Heat and Cool, ACO

Thermostat

- 4 • Basic Wall Series
- A • Horizontal Wall Series
- B • Vertical Wall Series
- P • 24 V Programmable Wall Series
- N • 24 V Non-Programmable Wall Series

* Consult factory for 50 Hz applications.

** Standing in front of the unit, hand is determined by looking into the air supply and assigning the hand to match the location of the cooling coil connections.

Air Delivery (60 Hz)

Model	Coil	Unit Size	CFM @ 0.0 ESP For Fan Speed			High Speed CFM @ ESP Indicated						
			Low	Med	High	0.10	0.20	0.25	0.30	0.40	0.50	0.60
HHY	3-Row	06	545	645	800	740	680	650	620	560	470	330
		08	645	885	1080	1010	940	910	870	800	710	590
		10	825	1045	1280	1260	1240	1190	1130	1010	910	640
		12	945	1125	1450	1360	1270	1220	1180	1090	990	850
		14	890	1405	1875	1730	1590	1520	1450	1310	1170	920
		16	900	1420	2080	1940	1800	1730	1660	1510	1350	1110
		18	1160	1720	2630	2570	2485	2415	2340	2170	1945	-
		20	1225	1860	2780	2700	2605	2545	2470	2310	2120	-
	4-Row	06	530	630	780	720	660	630	600	540	430	260
		08	630	870	1060	990	920	890	850	770	680	540
		10	805	1020	1250	1230	1210	1160	1100	970	840	700
		12	925	1100	1420	1330	1240	1200	1150	1060	950	790
		14	860	1355	1810	1680	1550	1490	1420	1270	1110	890
		16	875	1385	2030	1890	1750	1680	1610	1460	1280	1000
		18	1145	1685	2445	2380	2285	2215	2145	1985	1770	-
		20	1210	1825	2595	2510	2405	2345	2275	2125	1950	-
	6-Row	06	505	595	740	680	620	590	560	470	330	-
		08	600	830	1010	940	870	840	800	710	590	-
		10	765	975	1190	1170	1140	1090	1030	890	720	-
		12	885	1055	1360	1270	1180	1130	1090	990	850	-
		14	820	1300	1730	1590	1450	1380	1310	1170	970	-
		16	845	1335	1960	1810	1660	1590	1510	1350	1110	-
		18	1115	1615	2075	1990	1885	1820	1755	1615	1425	-
		20	1180	1755	2225	2120	2010	1945	1885	1755	1600	-
HPY HXY VEY	3-Row	06	535	630	780	710	640	600	570	500	410	280
		08	590	810	990	920	850	820	780	700	590	430
		10	755	955	1170	1140	1100	1040	990	910	810	700
		12	1040	1240	1600	1480	1360	1300	1240	1120	980	780
		14	1290	1770	1940	1795	1660	1595	1525	1390	1280	1085
		16	1105	1710	2380	2230	2100	2015	1945	1785	1640	-
		18	1105	1675	2515	2450	2355	2275	2185	2045	1850	-
		20	1170	1815	2690	2580	2475	2405	2315	2185	2025	-
	4-Row	06	520	610	760	690	620	580	550	470	380	230
		08	575	795	970	900	830	790	760	670	550	350
		10	735	930	1140	1110	1070	1010	960	860	760	660
		12	1035	1235	1590	1460	1330	1270	1200	1070	920	700
		14	1260	1710	1880	1740	1610	1550	1485	1350	1210	1015
		16	1075	1650	2320	2175	2050	1970	1905	1745	1570	-
		18	1090	1640	2355	2260	2155	2075	1990	1860	1657	-
		20	1155	1780	2505	2390	2275	2205	2120	2000	1855	-
	6-Row	06	485	570	710	640	570	540	500	410	280	-
		08	560	770	940	860	780	740	700	590	430	-
		10	690	875	1070	1030	990	930	880	760	620	-
		12	965	1145	1480	1360	1240	1180	1120	980	780	-
		14	1200	1590	1745	1625	1510	1455	1400	1265	1065	-
		16	1015	1530	2180	2060	1950	1875	1820	1660	1425	-
		18	1060	1570	1990	1870	1755	1680	1600	1490	1330	-
		20	1125	1710	2140	2000	1880	1810	1730	1630	1505	-

NOTES: 1. Tabled values are standard CFM at sea level, 70°F with dry coil.
 2. Ratings include factory-installed filter and/or grille, where applicable.

Hi-Performance Series

MOTOR DATA, Cont'd.

Motor Performance Data - HPY, HXY, VEY

Voltage	Fan Speed	Unit Size	06	08	10	12	14	16	18	20
		Nominal HP	1/8	1/5	1/4	(2) 1/8	(2) 1/5	(2) 1/4	(2) 1/4	(2) 1/4
115 V 60 Hz 1-Phase	High	Amps	2.60	3.00	4.50	5.40	6.80	9.80	10.20	10.20
		Watts	265	310	440	550	690	900	1015	1020
	Medium	Amps	1.95	2.30	3.40	3.90	5.40	7.70	7.80	7.80
		Watts	195	220	330	390	560	725	745	750
	Low	Amps	1.54	1.50	2.50	3.10	3.50	5.24	5.30	5.30
		Watts	155	140	225	305	280	450	450	460
Voltage	Fan Speed	Nominal HP	1/10	1/5	1/4	(2) 1/5	(2) 1/5	(2) 1/5	(2) 1/4	(2) 1/4
208 V/ 230 V 60 Hz 1-Phase	High	Amps	1.00	1.45	1.80	3.20	3.30	3.00	3.70	3.70
		Watts	235	325	410	700	720	680	820	820
	Medium	Amps	0.72	0.95	1.10	2.00	2.00	2.00	2.20	2.20
		Watts	165	210	250	430	440	445	500	510
	Low	Amps	0.49	0.62	0.76	1.48	1.48	1.33	1.50	1.50
		Watts	110	135	160	305	310	285	330	330
Voltage	Fan Speed	Nominal HP	1/5	1/5	1/4	(2) 1/5	(2) 1/4	(2) 1/4	(2) 1/4	(2) 1/4
277 V 60 Hz 1-Phase	High	Amps	1.10	1.40	1.51	2.40	2.65	3.20	3.50	3.52
		Watts	275	275	395	535	700	830	900	925
	Medium	Amps	0.70	0.69	1.10	1.40	1.96	2.00	2.23	2.23
		Watts	175	175	260	360	495	510	550	550
	Low	Amps	0.33	0.34	0.65	0.70	1.30	1.30	1.36	1.36
		Watts	90	90	155	190	300	300	320	320

Motor Performance Data - HLY

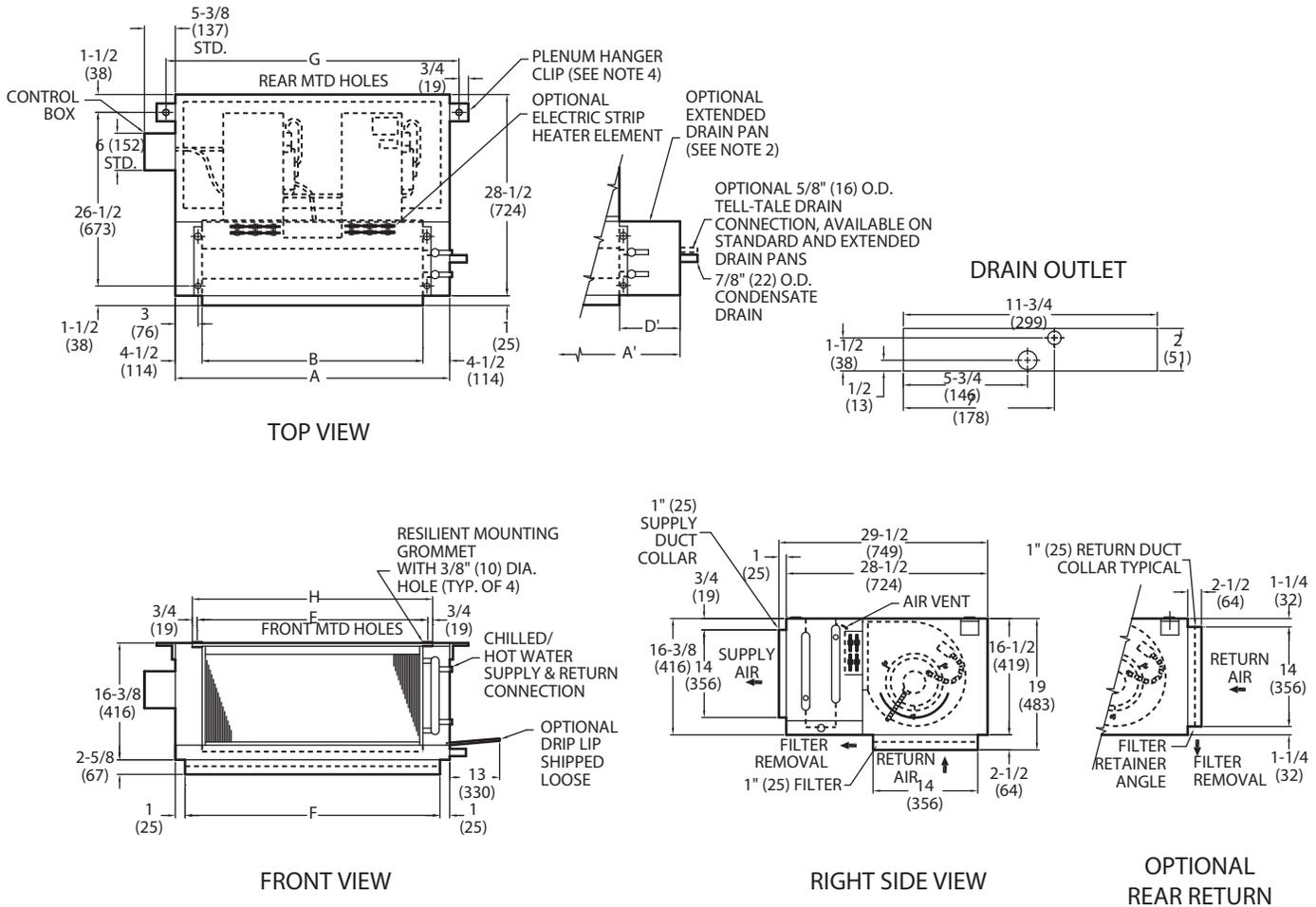
Voltage	Fan Speed	Unit Size	06	08	10	12	14	16	18	20
		Nominal HP	1/10	1/8	1/5	(2) 1/10	(2) 1/10	(2) 1/5	(2) 1/5	(2) 1/5
115 V 60 Hz 1-Phase	High	Amps	2.40	3.10	3.70	4.40	5.00	6.50	7.40	8.20
		Watts	260	275	380	490	520	670	800	840
	Medium	Amps	1.70	2.10	3.00	3.00	3.00	4.80	6.60	6.60
		Watts	195	205	300	310	320	470	670	685
	Low	Amps	1.15	1.58	2.00	2.10	2.10	3.10	4.10	4.20
		Watts	125	155	210	210	210	300	420	425
Voltage	Fan Speed	Nominal HP	1/10	1/8	1/4	(2) 1/10	(2) 1/10	(2) 1/8	(2) 1/5	(2) 1/4
208 V/ 230 V 60 Hz 1-Phase	High	Amps	1.00	1.05	1.80	2.00	2.10	2.90	3.20	3.44
		Watts	235	230	410	450	470	590	705	810
	Medium	Amps	0.72	0.65	1.05	1.40	1.50	2.10	2.00	2.20
		Watts	165	145	220	300	340	440	420	495
	Low	Amps	0.48	0.48	0.75	1.05	1.10	1.45	1.55	1.50
		Watts	105	105	160	224	230	300	315	320
Voltage	Fan Speed	Nominal HP	1/10	1/10	1/5	(2) 1/10	(2) 1/10	(2) 1/10	(2) 1/5	(2) 1/4
277 V 60 Hz 1-Phase	High	Amps	0.72	0.90	1.27	1.44	1.60	1.70	2.80	3.30
		Watts	205	270	285	370	450	470	620	870
	Medium	Amps	0.51	0.71	0.73	0.89	1.28	1.20	1.65	2.20
		Watts	140	190	180	235	330	350	420	545
	Low	Amps	0.31	0.57	0.37	0.63	0.90	0.90	0.95	1.36
		Watts	90	155	95	165	250	250	230	320

NOTE: Total unit motor Amps and Watts are shown.

Hi-Performance Series

PHYSICAL DATA, Cont'd.

HPY – Hi-Performance Hideaway with Plenum and Optional Electric Heat



Unit Model	Dimensions – Inches (Millimeters)								Quantity/Unit		Unit Weight*
	A	A'	B	D'	E	F	G	H	Blower	Motor	
HPY06	23 (584)	32 (813)	14 (356)	13-1/2 (343)	17 (432)	21 (533)	25-1/2 (648)	18-3/4 (476)	1	1	94
HPY08	28 (711)	37 (940)	19 (483)	13-1/2 (343)	22 (559)	26 (660)	30-1/2 (775)	23-3/4 (603)	1	1	107
HPY10	32 (813)	42 (1067)	23 (584)	14-1/2 (368)	26 (660)	30 (762)	34-1/2 (877)	27-3/4 (705)	1	1	150
HPY12	37 (940)	47 (1194)	28 (711)	14-1/2 (368)	31 (787)	35 (889)	39-1/2 (1004)	32-3/4 (832)	2	2	169
HPY14	42 (1067)	52 (1321)	33 (838)	14-1/2 (368)	36 (914)	40 (1016)	44-1/2 (1131)	37-3/4 (959)	2	2	174
HPY16	47 (1194)	56 (1422)	38 (965)	13-1/2 (343)	41 (1041)	45 (1143)	49-1/2 (1258)	42-3/4 (1086)	2	2	178
HPY18	52 (1321)	52 (1321)	43 (1092)	14-1/2 (368)	46 (1168)	50 (1270)	54-1/2 (1385)	47-3/4 (1213)	2	2	195
HPY20	56 (1422)	66 (1676)	47 (1194)	14-1/2 (368)	50 (1270)	54 (1372)	58-1/2 (1487)	51-3/4 (1314)	2	2	220

- NOTES:**
- * Unit weights (shown in pounds) are based on dry coils, minimum rows and exclude packaging, valves or other components.
 - 1. Any modifications to product specifications by any person are subject to acceptance of the IEC Home Office. Product specifications are subject to change without notice.
 - 2. All dimensions are +/- 1/4".
 - 3. Optional drip lip is not required with optional extended drain pan.
 - 4. Plenum hanger clip location may vary depending on unit accessories.
 - 5. Control box size and location may vary.
 - 6. A' dimension is for extended drain pan option.
 - 7. RH shown, LH opposite

Drawing is not to scale and is provided for reference only. Dimensions may vary with options ordered. Consult IEC web site for up to date drawings.

Nominal Filter Sizes

All Hi-Performance Series units have nonwoven synthetic throwaway filters furnished as standard equipment. Cleanable filters are optional.

Unit Size	Nominal One-Inch Filter Size – Inches (Millimeters)				
	HH & HP	HX	HL	VE	VE (Bottom Return) ¹
06	14" x 21" (356 x 533)	14" x 14-3/4" (356 x 375)	14" x 14" (356 x 356)	21" x 12-3/4" (533 x 324)	20" x 12-3/4" (508 x 324)
08	14" x 26" (356 x 660)	14" x 19-3/4" (356 x 502)	14" x 20" (356 x 508)	26" x 12-3/4" (660 x 324)	25" x 12-3/4" (635 x 324)
10	14" x 30" (356 x 762)	14" x 23-3/4" (356 x 603)	14" x 24" (356 x 610)	30" x 12-3/4" (762 x 324)	29" x 12-3/4" (737 x 324)
12	14" x 35" (356 x 889)	14" x 28-3/4" (356 x 730)	14" x 28" (356 x 711)	35" x 12-3/4" (889 x 324)	34" x 12-3/4" (864 x 324)
14	14" x 40" (356 x 1016)	14" x 33-3/4" (356 x 857)	14" x 34" (356 x 864)	40" x 12-3/4" (1016 x 324)	39" x 12-3/4" (991 x 324)
16	14" x 45" (356 x 1143)	14" x 38-3/4" (356 x 984)	14" x 38" (356 x 965)	45" x 12-3/4" (1143 x 324)	44" x 12-3/4" (1118 x 324)
18	14" x 50" (356 x 1270)	14" x 43-3/4" (356 x 1111)	14" x 44" (356 x 1118)	50" x 12-3/4" (1270 x 324)	49" x 12-3/4" (1245 x 324)
20	14" x 54" (356 x 1372)	14" x 47-3/4" (356 x 1213)	14" x 48" (356 x 1219)	54" x 12-3/4" (1372 x 324)	53" x 12-3/4" (1346 x 324)

- NOTES:**
1. Use when bottom return and 6" legs are supplied.
 2. Filter sizes for the HH model are recommended filter sizes only. No filter is factory provided with this model.
 3. Sizes shown are nominal ordering sizes.
 4. Filter sizes for the HL model are for filter included with standard aluminum filter grille.



C. HPY Horizontal Hideaway with Plenum Units:

1. Units shall be constructed of heavy gauge galvanized steel.
2. The interior surfaces shall be lined with 1/2" Fiberglass (1/2" Premium Fiberglass, 1/2" Foil Face or 1/4" closed cell) insulation.
3. A heavy gauge plenum shall enclose the blower/motor assembly with bottom or rear return air path.
4. Units shall be supplied with a ducted collar for supply duct connection.
5. Units shall have a galvanized (or stainless steel) drain pan extending the entire width of the coil (with second drain connection).
6. Galvanized drain pans shall be internally coated with a 2-part closed cell foam insulation.
7. Units shall have throwaway, permanent or pleated filters.



D. HLY Horizontal Cabinet, Low Static Units:

1. Units shall be constructed of heavy gauge galvanized steel.
2. The interior surfaces shall be lined with 1/2" Fiberglass (1/2" Premium Fiberglass, 1/2" Foil Face or 1/4" closed cell) insulation.
3. Cabinet shall be painted with an Arctic White powder-coat finish.
4. The unit shall have a double deflection steel discharge grille.
5. The unit shall have a hinged, bar type aluminum finish, return air grille with throwaway filter.
6. Units shall have a galvanized (or stainless steel) drain pan extending the entire width of the coil (with second drain connection).
7. Galvanized drain pans shall be internally coated with a 2-part closed cell foam insulation.

Hi-Performance Series

MECHANICAL SPECIFICATIONS, Cont'd.



E. HXY Horizontal Cased, High Static Units:

1. Units shall be constructed of heavy gauge galvanized steel.
2. The interior surfaces shall be lined with 1/2" Fiberglass (1/2" Premium Fiberglass, 1/2" Foil Face or 1/4" closed cell) insulation.
3. The unit shall have a throwaway, permanent or pleated filter.
4. Units shall have a galvanized (or stainless steel) drain pan extending the entire width of the coil (with second drain connection).
5. Galvanized drain pans shall be internally coated with a 2-part closed cell foam insulation.
6. Units shall be supplied with a ducted collar for supply and return connections.



F. VEY Vertical Cased Units:

1. Units shall be constructed of heavy gauge galvanized steel.
2. The interior surfaces shall be lined with 1/2" Fiberglass (1/2" Premium Fiberglass, 1/2" Foil Face or 1/4" closed cell) insulation.
3. The unit shall have a throwaway, permanent or pleated filter.
4. Units shall have a galvanized (or stainless steel) drain pan extending the entire width of the coil (with second drain connection).
5. Galvanized drain pans shall be internally coated with a 2-part closed cell foam insulation.
6. Units shall be supplied with a ducted collar for supply duct connection.
7. Units can be supplied with optional 6" legs.

2.3 CERTIFICATION

A. Safety:

Units shall be listed by Electronics Testing Laboratories, Inc. with the listing indicating the units comply with the minimum requirements of the U.S. and Canadian national product safety standard, UL 1995/CSA C22.2 No. 236.

B. Capacities:

Coil capacities are tested in accordance with AHRI-440-2008.

2.3.1 MATERIALS

A. Coils:

All coils shall have 1/2" copper tubes, manual (or automatic air vents), and aluminum fins, 10 fins per inch spacing. Coil fins shall be mechanically bonded to copper tubes. Copper tubes must comply with ASTM B-75. Fin thickness shall be 0.0045" and tube thickness shall be 0.016". All coils shall be leak tested with air at 300 psig under water.

B. Fans:

1. Fans shall be direct-drive, double-width fan wheels with forward-curved blades.
2. Blower wheels shall be statically and dynamically balanced.
3. Scrolls and fan wheels shall be constructed of galvanized steel.
4. Shall be easily removable.

C. Fan Speed and Temperature Control:

3 (high, medium, low) speed control, (off, on, auto), (wall or unit) (auto or manual) thermostat.

D. Motors:

1. Motors shall be 3-speed, single phase, 60 Hz permanent split capacitor type for 115 V (208 V, 230 V, or 277 V), permanently lubricated, with sleeve bearings.
2. Motors shall be equipped with quick connect electrical plugs.
3. Motors shall have thermal overload protection with automatic reset.

E. Controls and Safeties:

1. Controls:

Unit shall be furnished with a 3-speed, 4-position fan switch on a wall plate for field installation.

2. Safeties:

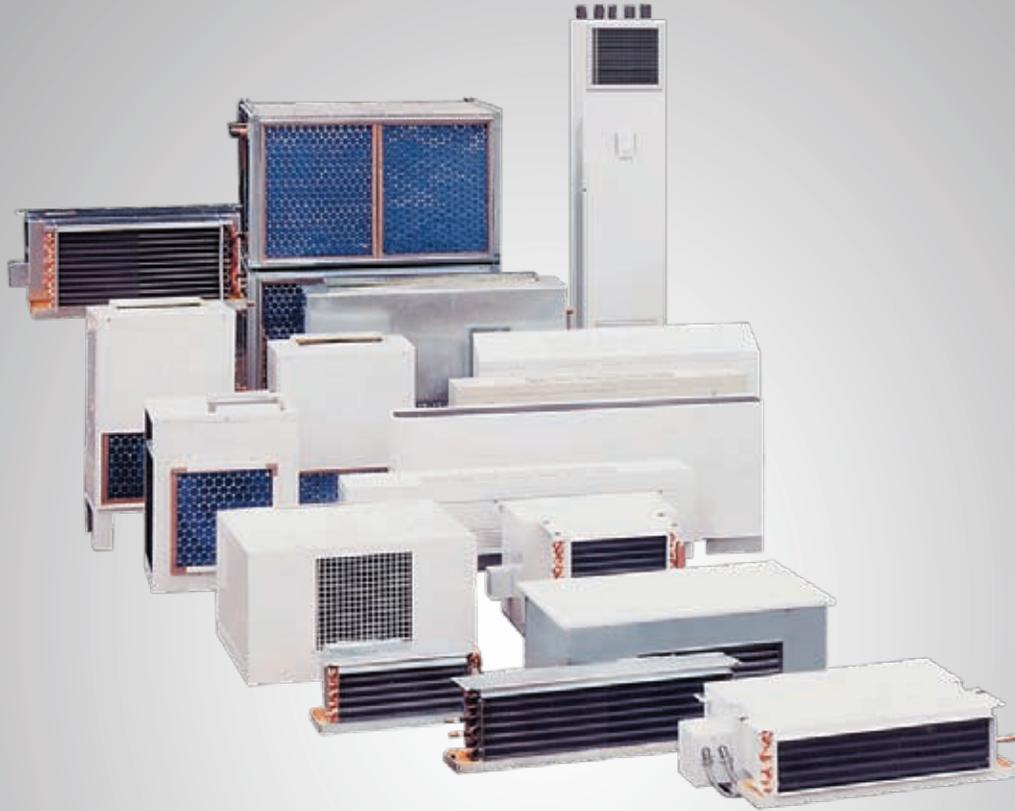
Unit fan motor shall be equipped with integral motor protection.

F. Electrical Requirements:

1. Standard unit shall operate on 115 V (208 V, 230 V or 277 V), single phase, 60 Hz electrical power, and all exposed wiring shall be in flexible conduit.

G. Option and Accessories:

1. Unit shall be equipped with nichrome wire strip electric heaters for total or auxiliary electric heat as specified on the equipment schedule.
 - a. Heaters shall be protected by an automatic reset safety cutout switch and a fusible link.
 - b. Heater capacity shall be as specified on the equipment schedule.
 - c. Heaters shall be single phase, 120 V (208 V, 240 V or 277 V) as specified on the equipment schedule.
 - d. For total electric heat, unit controls shall include a sequenced heating and cooling thermostat in lieu of the heating/cooling thermostat and automatic changeover device.
 - e. For auxiliary electric heat, unit controls shall include thermistor and purge cycle to verify system mode.
 - f. A junction box and fuse shall be factory furnished and installed to protect the motor and control circuit when electric heaters are installed in a unit with a single power source.
2. Service switch shall be factory installed.
3. Units shall be equipped with 24 V controls.
4. Units shall be equipped with condensate overflow switch.



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IEC is dedicated to the environment and for its part, IEC has elected to use recycled materials whenever possible for printed sales materials.



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CA-040 Revision 3

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www.iec-okc.com



Reverse Cycle Chiller™

Geo-Thermal Alternative

2 Ton - R-410A - 208-230/60/1

Description:

Reverse Cycle Chiller™ is designed to re-circulate water and glycol to maintain the set temperature for hot water heating or chilled water air conditioning in residential and light commercial applications. Consists of a high efficiency heat pump, heat exchanger, poly vented insulated tank, systems pump and controls built entirely into a single cabinet. Each Reverse Cycle Chiller™ is ETL listed for end-user confidence.

Dimensions

Model	W	H	D	Weight
RCS-024A-S1A (R LP)	59"	29 1/8"	33"	495

Specifications

Capacity 2 ton: 24,000 BTU/H

Cooling Design Conditions:

44° F - Leaving Water Temp

54° F - Entering Water Temp

Ambient Design: Up to 105° F

Heating Design Conditions: **HOT AIR OR RADIANT FLOOR**

Up to 115° F - Leaving Water Temp

105° F - Entering Water Temp

Ambient Design: Down to 17° F **

** System has performed in temperatures down to -15° F. If this is going to be considered for design, there must be a form of backup (ie, Heat strips, water heater, electric boiler, etc.) with the system. Please consult factory for more information.



Cabinet

- Surpassed 1000 hour salt spray test.
- Front and back access panels for simplified maintenance.
- ETL certified internal electrical panel.

Heat Pump

- Coils are constructed of copper tubing with aluminum fins for durability and long lasting efficient operation.
- Fan motor qualified for outdoor operation.
- Up to 14 SEER and 8 HSPF Ratings.

Refrigeration

- Factory charged with ozone friendly R-410A.
- Liquid line enhanced filter dryer.
- Sight glass with moisture indicator.
- Thermal expansion valves.
- High/low pressure safety switches.

**WITH PREHEAT
HOT WATER COIL BUILT
INTO OUR TANK FOR
SOLAR ASSIST - OPTIONAL**

Aqua Products Company, Inc.
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Reverse Cycle Chiller™

Geo-Thermal Alternative

2 Ton - R-410A - 208-230/60/1

Electrical Data

Model	Voltage Range	Min. Circuit	Max Fuse	RLA
RCS-024A (R-LP)	187-252	23.62	35	18.9

Electrical Data

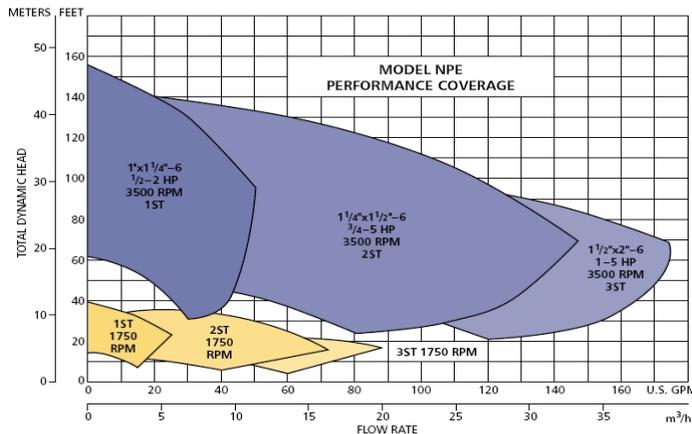
- Single point main power connection.
- ETL listed.
- Digital controller.
- Voltage monitor. *(Protects against power spikes.)*
- Low ambient fan cycle control.
- Short cycle control.

Water Circuit & Heat Exchanger

- Heat exchanger: High quality, freeze resistant tube and shell.
- Refrigerant and water flow are counter flow for maximum exchange.
- Water lines are constructed of rigid copper.
- Water lines stubbed outside of cabinet with female fittings for simplified installation.
- Water temperature indicators which provide a

Water Data

Model	In	Out	Flow Rate	PSI Drop
RCS-024A (R-LP)	3/4"	3/4"	5	2.35



Buffer Tank - Required

- 25 Gallon Poly Vented Tank standard
- Tank Insulated
- Designed for Water Glycol

Pump

- 1/2 HP pump is standard
- Optional pump are custom ordered
- Custom designed pumps are priced per your requirements.

Design Flexibility

- Use in Radiant Floor Heating for commercial and residential applications.
- Use in forced air applications with hydronic air handlers, fan coils unit or high wall ductless mini-split units.



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RADIANT HEATING AND
COOLING SYSTEMS

ENGINEERED
PLASTIC (EP)
HEATING MANIFOLD

LAUNCH SHEET

Uponor Offers New Engineered Plastic (EP) Heating Manifold for Radiant Heating and Cooling Applications



For cost-effective, durable, hydronic radiant systems, Uponor now offers the Engineered Plastic (EP) Heating Manifold. This new manifold is comprised of thermoplastic, high-performance, advanced materials suitable for use under conditions of high impact, heat and moisture. Successfully installed throughout Europe for the past five years, Uponor now offers this innovative new product in the United States and Canada.

This strong, durable manifold is made of an advanced engineered plastic, which withstands corrosive environments and is unaffected by the rising cost of metal, making it an economical solution for all radiant projects.

It is available in 2- through 8-loop configurations, with single loops available for expansion up to 12 loops total. And installation is easy, simply fasten the mounting bracket to a wall and snap in the manifold.

Features and Benefits

- Flexible, modular design for expansion in the field
- Resists corrosion, pitting, scaling, high chlorine levels and ultraviolet light
- Offers cost-effective solution to copper, brass and other metal alternatives
- Attached flow meters provide fast, easy balancing for radiant loops
- Offers vent and purge capability

Temperature Ratings

- 140°F at 87 psi
- 158°F at 72 psi
- 176°F at 58 psi
- 194°F at 43 psi

Uponor EP Heating Manifold Products and Accessories

Part No.	Part Description	Dimensions (Body-Outlets-Body)	Each Qty.
A2670201	EP Heating Manifold Assembly with Flow Meter, 2-loop	R32-R20-R32	1
A2670301	EP Heating Manifold Assembly with Flow Meter, 3-loop	R32-R20-R32	1
A2670401	EP Heating Manifold Assembly with Flow Meter, 4-loop	R32-R20-R32	1
A2670501	EP Heating Manifold Assembly with Flow Meter, 5-loop	R32-R20-R32	1
A2670601	EP Heating Manifold Assembly with Flow Meter, 6-loop	R32-R20-R32	1
A2670701	EP Heating Manifold Assembly with Flow Meter, 7-loop	R32-R20-R32	1
A2670801	EP Heating Manifold Assembly with Flow Meter, 8-loop	R32-R20-R32	1
A2670001	EP Heating Manifold Single Section, with Isolation Valve	R20	1
A2670003	EP Heating Manifold Single Section, with Balancing Valve and Flow Meter	R32-R20-R32	1
A2670032	EP Heating Manifold Connection Piece with R32 Union and Thermometer	R32	1
A2670090	EP Heating Manifold Elbow, set of 2	N/A	1
A2671250	EP Heating Manifold End Cap with Vent and Drain	N/A	1
A2670006	EP Heating Manifold Bracket, set of 2	N/A	1
A2670004	Isolation Valve Body for EP Heating Manifold	N/A	1
A2670005	Flow Meter Valve Body for EP Heating Manifold	N/A	1
A2670132	Thermometer for EP Heating Manifold Connection, set of 2	N/A	1
A2670007	Valve Replacement Tool	N/A	1
A2670008	O-ring 28.5 x 3mm EPDM for EP Heating Manifold	N/A	1
A2671300	Actuator Adapter for EP Heating Manifold	N/A	1



A2670401



A2670001



A2670003



A2670032



A2670090



A2671250



A2670006



A2670004



A2670005



A2670132



A2670007



A2670008



A2671300

For more information, visit our websites listed below.

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uponor

Meter Centers & Loadcenters

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Meter Centers & Loadcenters

Group Metering — Meter Packs and Meter Centers 26.1-1
Type CH Loadcenters & Circuit Breakers 26.2-1
Type BR Loadcenters & Circuit Breakers 26.3-1

Specifications

See Eaton’s Cutler-Hammer Product Specification Guide on Enclosed CD-ROM:

1995 CSI Format: Meter Centers and Meter Stacks **Section 16432**
 Type CH Loadcenters **Section 16471A**
 Type BR Loadcenters **Section 16471B**
 Meter Breakers **Section 16472**

2004 CSI Format: Meter Centers and Meter Stacks **Section 26 27 13.15**
 Type CH Loadcenters **Section 26 24 16.11**
 Type BR Loadcenters **Section 26 24 16.13**
 Meter Breakers **Section 26 27 13.13**



Group Metering and Meter Breaker Family



Residential Loadcenters and Breaker Family

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General Description — Meter Centers

Group Metering Systems for Residential and Commercial Applications



*Systems for Residential and
Commercial Application*

Product Description

Group metering is a service entrance product line that consists of a main device and multiple meter sockets in one enclosure or several connected enclosures. Group metering allows the customer to install a multiple tenant-metering device in one location while providing a space and installation cost savings.

Application Description

Eaton's electrical business offers two group metering designs which are Meter Packs and Gangable Metering (Meter Centers).

Meter Packs

The first type of group metering is Meter Packs which are also called All-in-Ones. Meter packs consist of main lugs and up to six meter sockets in one enclosure. Meter packs are supplied as one complete unit and the user cannot "add" additional meter sockets to the unit in the future. The most common application for meter packs is garden apartments, small condominiums and townhouses where six or less units are metered through one centrally located meter pack.

Meter Centers (Main Service Modules and Meter Stacks)

The second type of group metering is Gangable Metering, which consists of a Main Service Module used in conjunction with a Meter Stack to make a custom metering lineup. The Main Service Module can be main lug, main circuit breaker, main fusible switch or bolted pressure switch. The Meter Stack is offered with various meter sockets and bus ratings. This type of custom lineup allows the owner to add/remove meter sockets and main devices to meet future need. Gangable Metering is often used in large condominiums, strip malls and light commercial applications where more than six units are metered, or there will be a future need to add more units.

Standards and Certifications

- UL® listed.

Features, Functions and Benefits

Clip-Tight™ Socket



Clip-Tight Socket

Cutler-Hammer® 1MP, 1MM, 3MM metering devices incorporate the only socket base in the industry without fasteners. This component utilizes jaws on both sides of a thermoplastic polyester glass fiber reinforced (PBT) base eliminating the need for self tapping screw connections to vertical bus bars.

One-Piece Vertical Bus Bar



One-Piece Vertical Bus Bar

Cutler-Hammer 1MP, 1MM, 3MM meter stacks embody a one-piece bus bar construction to each socket, as well as a one-piece cross bus to each tenant main. Because the Cutler-Hammer design utilizes the Clip-Tight meter socket and does not have bus bar joints, the chance of hot spots occurring is virtually eliminated.

Field Phase Balancing

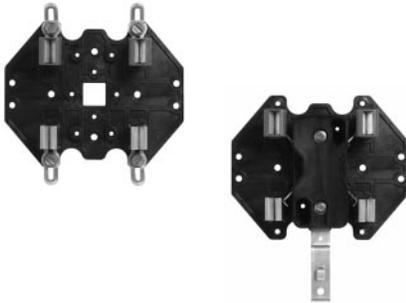


Field Phase Balancing

Due to popular incoming 3-phase voltage systems and single-phase outgoing loads, installers have the option to field phase balance on the individual stack (A-B, B-C, A-C). This feature eliminates the chance of installing an incorrectly phased device due to its versatility.

Group Metering Features, Functions and Benefits (Continued)

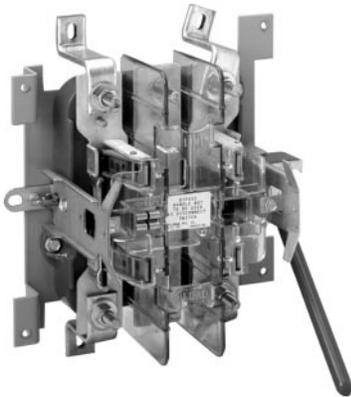
Horn and Manual Bypass



Horn and Manual Bypass

With an increasing demand for uninterrupted power, Eaton's Cutler-Hammer 1MP, 1MM and 3MM meter sockets offer horn (ringless style) and manual (ring style) field-installable bypass accessories. These accessories provide uninterrupted tenant service if a meter is pulled for inspection or replacement.

Lever Bypass



Lever Bypass

Due to commercial requirements, Eaton offers a lever bypass (as standard) on all 35MM and 37MM devices. Each socket base consists of a lever bypass which also releases the jaws (when lever is engaged in bypass position) enabling utility company mechanics to easily remove and/or insert utility meter.

Test Bypass Disconnects



Test Bypass Disconnects

Eaton also provides commercial meter stacks with EUSERC required test-bypass disconnects (35SS and 37SS). This bypass is used in the same applications as the lever bypass and it is required by EUSERC utilities.

Main Tenant Breaker Cover



Main Tenant Breaker Cover

Each tenant circuit breaker is protected by a lockable raintight cover which secures the breaker against unauthorized operation. The tenant breaker cover is a high impact plastic to resist wear, rusting and corrosion.

Mounting Features



Mounting Features

A standard mounting rail and factory installed swing away feet, speed up and simplify installation.

General Description — Meter Packs

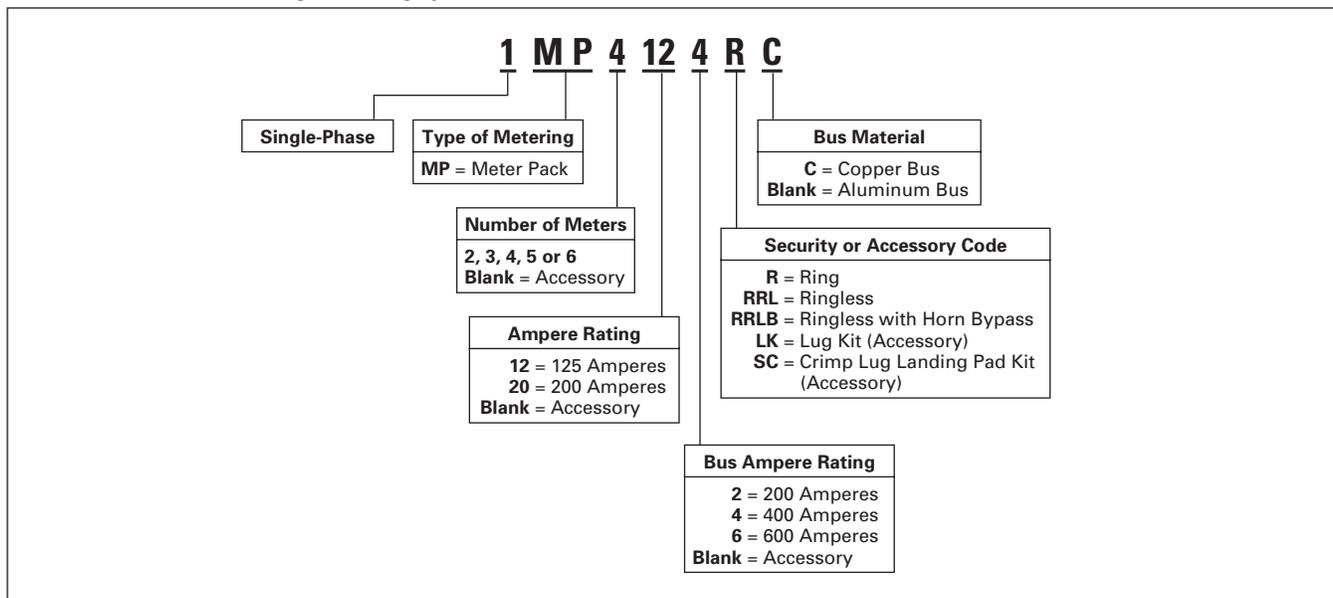


Meter Pack

- Cutler-Hammer 1MP units by Eaton Corporation are self-contained (main terminal box included) for installations requiring up to six meter socket positions in a single enclosure.
- Units are not gangable with any other metering device.
- Approved by major power companies, UL listed, suitable as service equipment and meets the service and electrical requirements of EUSERC and CECHA.
- Series rating up to 100,000 AIC.
- All ringless cover devices include fifth jaw as standard.
- Ring type devices do not include fifth jaw as standard. Order 1MM5JK if needed.
- Bondable neutral.
- 120/240 Vac, single-phase 3-wire metering device.
- Up to 600 ampere maximum horizontal bus rating.
- Incoming lugs not included (phase A, phase B, and neutral).
- Indoor/outdoor construction.
- Provision for 2-pole breaker (plug-on type for 125 ampere sockets and bolt-on type for 200 ampere sockets) — circuit breakers not included.
- Underground incoming feed.
- Aluminum or copper bus.

Catalog Numbering System

Table 26.1-1. Meter Pack Catalog Numbering System



When Ordering:

1. Determine catalog number of the basic device.
2. Include Lug Kit for incoming section. See **Table 26.1-4**.
3. Find quantity and catalog numbers for tenant circuit breakers. (Order one breaker per socket.) See **Page 26.1-7**.
4. Select required accessories. See **Pages 26.1-33 and 26.1-34**.

Meter Pack Selections

Table 26.1-2. Aluminum Bus, 120/240 Vac, Single-Phase, 3-Wire

Socket Ampere Rating	Number of Meter Sockets	Bus Ampacity	Main Tenant Breaker Type See Table 26.1-6	Catalog Number	Semi-flush Flange Kit Catalog Number	Dimensions
Ring Style Meter Socket Covers ①						
125 ②	2 ④	200	Plug-on Type	1MP2122R ⑤⑥	1MPSFK1	See Page 26.1-8
	3	400	BR_	1MP3124R	1MPSFK2	
	4	400	BRH_	1MP4124R	1MPSFK2	
	5 ④	600	BRHH_	1MP5126R	1MPSFK3	
	6 ④	600	—	1MP6126R	1MPSFK3	
200 ③	2	400	Bolt-on Type	1MP2204R	1MPSFK4	See Page 26.1-9
	3	600	CC2_X	1MP3206R	1MPSFK5	
	4	600	CHH2_H2X	1MP4206R	1MPSFK5	
	5	600	CHH2_H4X	1MP5206R	1MPSFK6	
	6	600	CHH_X	1MP6206R	1MPSFK6	
Ringless Style Meter Socket Covers ⑦						
125	2	200	Plug-on Type	1MP2122RRL ⑤⑥	1MPSFK1	See Page 26.1-8
	3	400	BR_	1MP3124RRL	1MPSFK2	
	4	400	BRH_	1MP4124RRL	1MPSFK2	
	5	600	BRHH_	1MP5126RRL	1MPSFK3	
	6	600	—	1MP6126RRL	1MPSFK3	
200	2	400	Bolt-on Type	1MP2204RRL	1MPSFK4	See Page 26.1-9
	3	600	CC2_X	1MP3206RRL	1MPSFK5	
	4	600	CHH2_H2X	1MP4206RRL	1MPSFK5	
	5	600	CHH2_H4X	1MP5206RRL	1MPSFK6	
	6	600	CHH_X	1MP6206RRL	1MPSFK6	
Ringless Style Covers with Horn Bypass ⑦						
125	2	200	Plug-on Type	1MP2122RRLB ⑤⑥	1MPSFK1	See Page 26.1-8
	3	400	BR_	1MP3124RRLB	1MPSFK2	
	4	400	BRH_	1MP4124RRLB	1MPSFK2	
	5	600	BRHH_	1MP5126RRLB	1MPSFK3	
	6	600	—	1MP6126RRLB	1MPSFK3	
200	2	400	Bolt-on Type	1MP2204RRLB	1MPSFK4	See Page 26.1-9
	3	600	CC2_X	1MP3206RRLB	1MPSFK5	
	4	600	CHH2_H2X	1MP4206RRLB	1MPSFK5	
	5	600	CHH2_H4X	1MP5206RRLB	1MPSFK6	
	6	600	CHH_X	1MP6206RRLB	1MPSFK6	

① Ring Style Meter Packs do not come with fifth jaw. Order 1MM5KJ if needed.

② To change in field from ring to ringless — order 1MMRC125.

③ To change in field from ring to ringless — order 1MMRC200.

④ To change from ring to ringless covers, the top socket only in 2, 5 and 6 socket designs — order 1MMRC125T. Top socket only — other sockets see ⑥.

⑤ Main lugs included. #6 – 300 kcmil. (Optional lugs are not available.)

⑥ Bottom feed only.

⑦ Fifth jaw factory installed at 9 o'clock position.

Note: See Table 26.1-4 for Main Lug Kit selection. See Table 26.1-5 for Wire Sizes.

Technical Data — Meter Packs

Meter Pack Selections

Table 26.1-3. Copper Bus, 120/240 Vac, Single-Phase, 3-Wire

Socket Ampere Rating	Number of Meter Sockets	Bus Ampacity	Main Tenant Breaker Type (See Table 26.1-6)	Catalog Number	Semi-flush Flange Kit Catalog Number	Dimensions
Ring Style Meter Socket Covers ①						
125 ②	2	200	Plug-on Type	1MP2122RC	1MPSFK1	See Page 26.1-8
	3	400	Plug-on Type	1MP3124RC	1MPSFK2	
	4	400	BR_	1MP4124RC	1MPSFK2	
	5 ④	600	BRH_	1MP5126RC	1MPSFK3	
	6 ④	600	BRHH_	1MP6126RC	1MPSFK3	
200 ③	2	400	Bolt-on Type	1MP2204RC	1MPSFK4	See Page 26.1-9
	3	600	CC2_X	1MP3206RC	1MPSFK5	
	4	600	CHH2_H2X	1MP4206RC	1MPSFK5	
	5	600	CHH2_H4X	1MP5206RC	1MPSFK6	
	6	600	CHH_X	1MP6206RC	1MPSFK6	
Ringless Style Meter Socket Covers ⑤						
125	2	200	Plug-on Type	1MP2122RRLC	1MPSFK1	See Page 26.1-8
	3	400	Plug-on Type	1MP3124RRLC	1MPSFK2	
	4	400	BR_	1MP4124RRLC	1MPSFK2	
	5	600	BRH_	1MP5126RRLC	1MPSFK3	
	6	600	BRHH_	1MP6126RRLC	1MPSFK3	
200	2	400	Bolt-on Type	1MP2204RRLC	1MPSFK4	See Page 26.1-9
	3	600	CC2_X	1MP3206RRLC	1MPSFK5	
	4	600	CHH2_H2X	1MP4206RRLC	1MPSFK5	
	5	600	CHH2_H4X	1MP5206RRLC	1MPSFK6	
	6	600	CHH_X	1MP6206RRLC	1MPSFK6	
Ringless Style Covers with Horn Bypass ⑤						
125	2	200	Plug-on Type	1MP2122RRLBC	1MPSFK1	See Page 26.1-8
	3	400	Plug-on Type	1MP3124RRLBC	1MPSFK2	
	4	400	BR_	1MP4124RRLBC	1MPSFK2	
	5	600	BRH_	1MP5126RRLBC	1MPSFK3	
	6	600	BRHH_	1MP6126RRLBC	1MPSFK3	
200	2	400	Bolt-on Type	1MP2204RRLBC	1MPSFK4	See Page 26.1-9
	3	600	CC2_X	1MP3206RRLBC	1MPSFK5	
	4	600	CHH2_H2X	1MP4206RRLBC	1MPSFK5	
	5	600	CHH2_H4X	1MP5206RRLBC	1MPSFK6	
	6	600	CHH_X	1MP6206RRLBC	1MPSFK6	

① Ring Style Meter Packs do not come with fifth jaw. Order **1MM5KJ** if needed.② To change in field from ring to ringless — order **1MMRC125**.③ To change in field from ring to ringless — order **1MMRC200**.④ To change in field from ring to ringless covers, the top socket only in 5 to 6 socket design — order **1MMRC125T**.
Top socket only — other sockets see ②.

⑤ Fifth jaw factory installed at 9 o'clock position.

Table 26.1-4. Main Lug Kit Selection — Field Installed Kits for Either 400 or 600 Ampere Main Bus

Line Lug and Wire Sizes Order Separately and Field Install	Line Lug Kit Catalog Number Each Kit Comes With 3 Lugs, Two Lines and a Neutral
(1) #6 – 600 kcmil or (2) 2/0 – 250 kcmil	1MPLK1
(2) 250 – 500 kcmil	1MPLK3
(3) #4 – 300 kcmil	1MPLK4 ⑥
(1) 750 kcmil	1MPLK2 ⑦
Crimp lug landing pad 250 – 750 kcmil	1MPSC1 ⑥

⑥ This kit comes with three pads for two lines and neutral. Each pad will accept one or two crimp lugs. Cannot be used on **1MP2122R**, **RL** and **RLB** EUSERC underground termination.

⑦ This lug is not UL listed.

**1MPLK3**

Table 26.1-5. Wire Sizes — Neutral and Ground Lugs

Description	Wire Size, Al/Cu	Catalog Number
Neutral — 125 A meter pack	#6 – 2/0	—
Neutral — 200 A meter pack	#1/0 – 300 kcmil	—
Equipment Ground Bar — 125 A meter pack	#14 – #2	—
Equipment Ground Bar — 200 A meter pack	#14 – 2/0	—
Optional Ground Bar	#6 – 2/0	1MMGBK

Note: Each stack includes a neutral and ground bar. If an extra ground bar is needed, order **1MMGBK**.

1MP Tenant Circuit Breakers

- The following Cutler-Hammer breakers are to be used on 1MP meter packs.
- Series rating information available on **Pages 26.1-38 through 26.1-40.**
- 120/240 Vac — **field installed.**



BR2100



CC2200

Product Selection

Table 26.1-6. 1MP Main Tenant Circuit Breakers

Description	Number of Poles	Main Tenant Circuit Breaker Ampere Rating	10,000 AIC	22,000 AIC	25,000 AIC	42,000 AIC	100,000 AIC
			Catalog Number				
Plug-on type circuit breakers used with 1MP, 125 A modular metering stacks	2	60	BR260	BRH260	—	BRHH260	—
	2	70	BR270	BRH270	—	BRHH270	—
	2	80	BR280	BRH280	—	BRHH280	—
	2	90	BR290	BRH290	—	BRHH290	—
	2	100	BR2100	BRH2100	—	BRHH2100	—
	2	110	BR2110	BRH2110	—	BRHH2110	—
Bolt-on type circuit breakers used with 1MP, 200 A modular metering stacks	2	125	BR2125	BRH2125	—	BRHH2125	—
	2	60	—	—	CHH2060H2X	CHH2060H4X	CHH2060X
	2	70	—	—	CHH2070H2X	CHH2070H4X	CHH2070X
	2	80	—	—	CHH2080H2X	CHH2080H4X	CHH2080X
	2	90	—	—	CHH2090H2X	CHH2090H4X	CHH2090X
	2	100	CC2100X	—	CHH2100H2X	CHH2100H4X	CHH2100X
	2	125	CC2125X	—	CHH2125H2X	CHH2125H4X	CHH2125X
	2	150	CC2150X	—	CHH2150H2X	CHH2150H4X	CHH2150X
	2	175	CC2175X	—	CHH2175H2X	CHH2175H4X	CHH2175X
	2	200	CC2200X	—	CHH2200H2X	CHH2200H4X	CHH2200X

Dimensions — Meter Packs

Dimensions and Knockouts (in Inches) — 1MP, 125 Ampere Meter Packs — Aluminum and Copper Bus

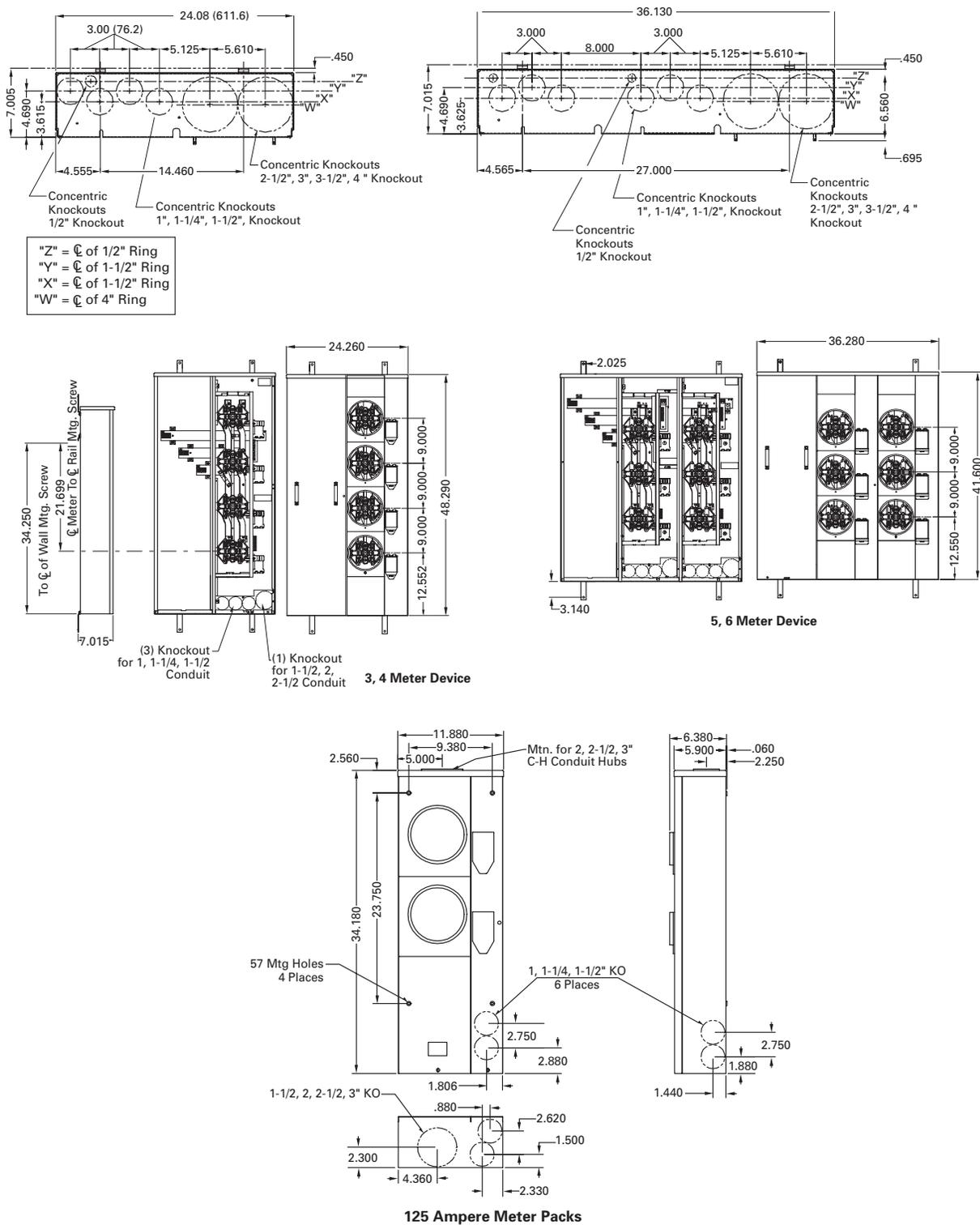


Figure 26.1-1. 125 Ampere Maximum Tenant Breaker

General Description — Meter Centers

Meter Center Description

Gangable sections of the following:

- Main terminal box.
- Main circuit breaker.
- Main bolted pressure switch.
- Main fusible switch.
- Main fusible switch with pull box.
- Underground pull box.
- Meter stacks.



Main Terminal Box



Main Fusible Switch



Main Circuit Breaker



Underground Pull Box



Main Fusible Switch with Pull Box



Main Terminal Box with Pull Box



Main Circuit Breaker with Pull Box



1MM and 3MM Metering Stack Modules

Features, Benefits and Functions

Eaton's Cutler-Hammer Gangable Meter Stacks with Main Service Modules

- Offering: main terminal/lug compartment, main circuit breaker, main fusible switch, main bolted pressure switch, main fusible switch with pull box (meets EUSERC electrical requirements), underground pull box termination compartment without cross bus (meets EUSERC electrical requirements).
- Mechanically and electrically built for use with 1MM, 3MM, 35MM, 37MM, 35SS and 37SS modular metering stacks.
- For integrated system short circuit ratings with main devices, see series ratings on **Page 26.1-38**.
- All main service modules include both left and right horizontal bus closure plates.
- Two-pole devices are applied to 1-phase, 3-wire, 120/240 volt or 208Y/120 volt systems, 3-pole devices to 208Y/240 volts or 120/240 volts delta systems.
- Single-phase mains couple to any modular metering stack (1MM, 3MM, 35MM, 37MM, 35SS and 37SS).
- 3-phase mains require 3-phase bussed stacks. These modular metering stacks are 3MM, 35MM, 37MM, 35SS and 37SS.
- If the ampere rating of the main service module is greater than the horizontal bus rating of the meter stack (Residential or Commercial), the main service module must be center fed. Examples: 1200 ampere Main Circuit Breaker (1MCB1200R) with a 800 ampere residential stack (1MM512R). 1600 ampere Main Terminal Box (3MTB1600R) with a 1200 ampere residential stack (3MM212R12).
- Most main service modules are available with aluminum or copper bus.

TVSS Surge Protection



Group Metering — Surge Cubicle

Product Description

The Eaton's Cutler-Hammer multiple metering product family is proud to announce the availability of main surge devices. The new main surge is mounted between the main service module and the meter stacks and serves the purpose of providing surge protection for downstream multiple metering products. The main surge is compatible with all meter stacks currently manufactured (1MM, 3MM, 35MM and 37MM).

Features, Functions and Benefits

- Utilizes the Clipper Power System (CPS) with GD frame breaker.
- The cover contains a window for surge status viewing.

- Copper bus.
- The device is grounded through the enclosure and an additional ground lug is provided for equipment grounding.
- Compatible with 37MM enclosure accessories.
- Basic Diagnostics consist of status indicator lights on each phase. Standard Diagnostics consist of Basic Diagnostic features along with a TRI-MONITOR™ flashing trouble alarm and 200 kAIC internal fusing.
- Offers surge protection for all units fed from a main service module.
- Benefit for building/complex owners who want to offer surge protection to their tenants. Owner can market their apartment complex as being surge friendly to appliances and electronics.
- **Attain local utility company approval.**

Surge Selections

Table 26.1-7. TVSS Surge Protection

Voltage	Surge Current per Phase (kA)	Diagnostics	Catalog Number
120/240 Volts Single-Phase	100 (CPS-B) 200 (CPS-B)	Basic Standard	1MMSURGE 1MMSURGEH
208Y/120 Volts Three-Phase	100 (CPS-S3) 200 (CPS-S3)	Basic Standard	3MMSURGE 3MMSURGEH

Dimensions in Inches

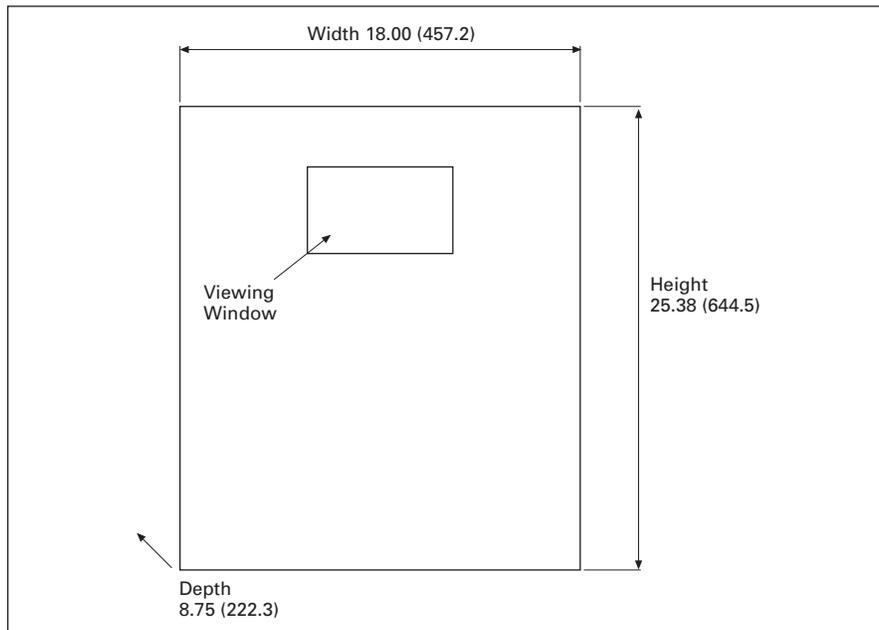


Figure 26.1-3. TVSS Surge Device

Features, Functions and Benefits

1MM and 3MM Meter Stack Modules

A. Barrier

Meter socket and tenant main breaker/wireway sections are separated by a solid metal barrier to guard unmetereed bus against power theft.

B. Tenant Breaker

Reliable bus bar-to-bus bar connection. 200 ampere modules accept bolt-on breakers 60 – 200 amperes. 125 ampere modules accept 15 – 125 ampere plug-on breakers.

C. Moveable Phase Connector

Four-wire horizontal bus lets you use any 3MM module for single- or 3-phase incoming service. Shipped with A and B phase connection, phase balancing is easily accomplished in the field by moving one, front-accessible phase connector post per module.

D. Neutral Assembly

A convenient termination for neutral conductors is in the wireway of each module.

E. Enclosed Horizontal Bus

Added security because a non-removable barrier encloses the 800 or 1200 ampere horizontal bus passing through tenant breaker section.

F. Equipment Ground Bar

Factory installed in side gutter, a standard feature that's moveable to the top or bottom gutter.

G. Raintight Cap

Shipped on each outdoor meter module and main device.

H. Knockouts

Tangential in bottom endwall.

I. Superior Finish

Rust inhibiting phosphate primer and gray baked enamel is standard. All outdoor enclosures are of galvanized steel construction.

J. Meter Socket

Our unique meter socket base is installed without any fasteners — reducing chances for hot spots, easily replaceable, and improves connection to vertical bus.

K. Bus Connection

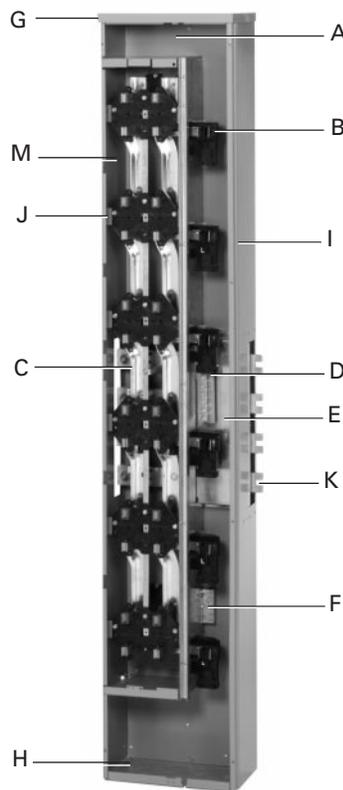
Mains and modules slip together quickly and smoothly with front-accessible captive bolts securing the juncture without removing socket interiors or bus access plate. Main bus joint bolts torque to 25 foot pounds.

L. Separate Wireway Cover

Separate covers allow easy access to tenant breaker and wireway section, permit work on breakers or in wireway without disturbing meters or meter covers. (Not shown.)

M. Vertical Bus Bar

One-piece vertical bus bar from phase balancing joints to meter socket eliminating any chance for hot spots.



1MM Meter Stack Module

- Cutler-Hammer 1MM stacks are single-phase in, single-phase out design.
- Cutler-Hammer 3MM stacks are 3-phase in, single-phase out design.
- Stacks with single-phase horizontal bus are rated 240/120 volts, single-phase, 3-wire. Stacks with 3-phase horizontal bus are rated 208Y/120 volts, 3-phase, 4-wire but can be used on 240/120 volts, 3-phase, 4-wire delta systems.
- All 3-phase horizontal bus modules have 4-wire cross bus, connected A-B phase to vertical bus, readily reconnectable for phase balance on installation.

Note: Individual sockets cannot be phase balanced, only each stack.

- Short circuit ratings up to 100,000 amperes rms symmetrical depending upon AIC rating of installed main tenant circuit breakers and main device.
- Main tenant feeders can exit bottom or back. Knockouts are available at all exit locations.
- If being used in outdoor application and exiting the top, mount Myer type hubs on rainproof cap.
- Provision for 2-pole breaker (plug-on type for 125 ampere sockets and bolt-on type for 200 ampere sockets) — circuit breakers not included.
- Mechanically and electrically built to bolt-up with main service modules and commercial modular metering stacks.
- Aluminum or copper bus.
- 800 or 1200 ampere horizontal bus.
- All 3MM stacks include fifth jaw at 9 o'clock position.
- All 1MM stacks do not include fifth jaw. Order 1MM5JK if needed.



1MM and 3MM Metering Stack Modules

Features, Functions and Benefits

Commercial Meter Stack Modules (35MM, 37MM, 35SS and 37SS)

A. End Walls

The top cap is removable and does not contain knockouts, so contractors can position and punch holes where they need them. There are numerous KOs in the back and bottom for flexibility.

B. Ground Bars

The factory installed equipment ground bars are provided in both the top and bottom gutters.

C. Meter Socket

The 5-jaw meter socket and 7-jaw meter socket includes a built-in manual bypass and jaw release. The ground wire is factory connected in both 35MM and 37MM modules.

D. Separate Wireway Cover

If work on the breakers or cables is necessary, it can be accomplished without disturbing the meters or meter covers, thanks to a separate cover that allows easy access to the module's main tenant breaker and wireway section. (Not shown.)

E. Barrier

A solid metal barrier separates the meter socket section from the tenant breaker in the wireway section. The unmetred vertical bus is enclosed to guard against power theft.

F. Neutral Assembly

Located in the wireway of each module, the assembly permits convenient termination of the neutral conductors.

G. Enclosed Horizontal Bus

Non-removable metal barrier encloses 1200 ampere horizontal bus when passing through the tenant breaker section for added security.

H. Tenant Breaker Range

All modules accept 15 through 225 ampere bolt-on breakers in various AIC ratings. The CHH_X breaker carries a UL listed series rating of 100,000 amperes, which allows you to use standard 10,000 AIC breakers in downstream Cutler-Hammer loadcenters and panelboards by Eaton Corporation.

I. Indoor/Outdoor Construction

Raintight caps, meter covers and lockable raintight tenant breaker covers make it convenient for you to use any of our modules on either NEMA 1 or NEMA 3R applications.

J. Mounting Rail

Rear mounting rail and wall hanger speed and simplify installation. (Mounting rail not shown.)

K. Nameplate and Ratings

The nameplate gives you full rating data: 208Y/120, 3-phase, 4-wire; 240/120, 3-phase, 4-wire Delta (high leg on B-Phase); and 240/120 single-phase. (Not shown.)

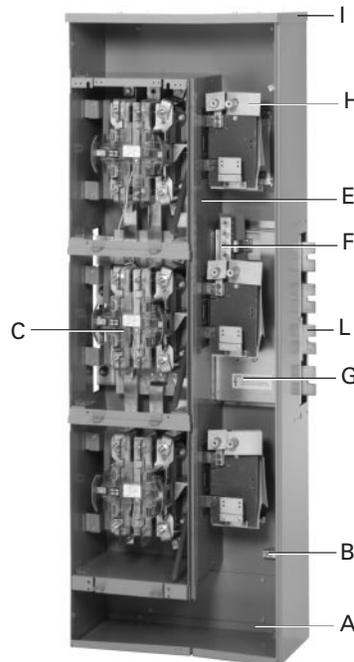
L. Mains and Modules

Slip together quickly, smoothly with front-accessible captive bolts securing the juncture without removing socket interiors or bus access plate. Main bus joint bolts torque to 25 foot pounds.

- Cutler-Hammer 35MM and 37MM modular metering stacks contain meter sockets with built-in manual bypass and jaw release (Non-EUSERC areas).
- Cutler-Hammer 35SS and 37SS stacks utilize meter sockets with test bypass feature (meets EUSERC electrical requirements).
- All commercial modular metering stacks contain four horizontal cross buses.
- Mechanically and electrically built to bolt-up with main service modules and residential modular metering stacks.



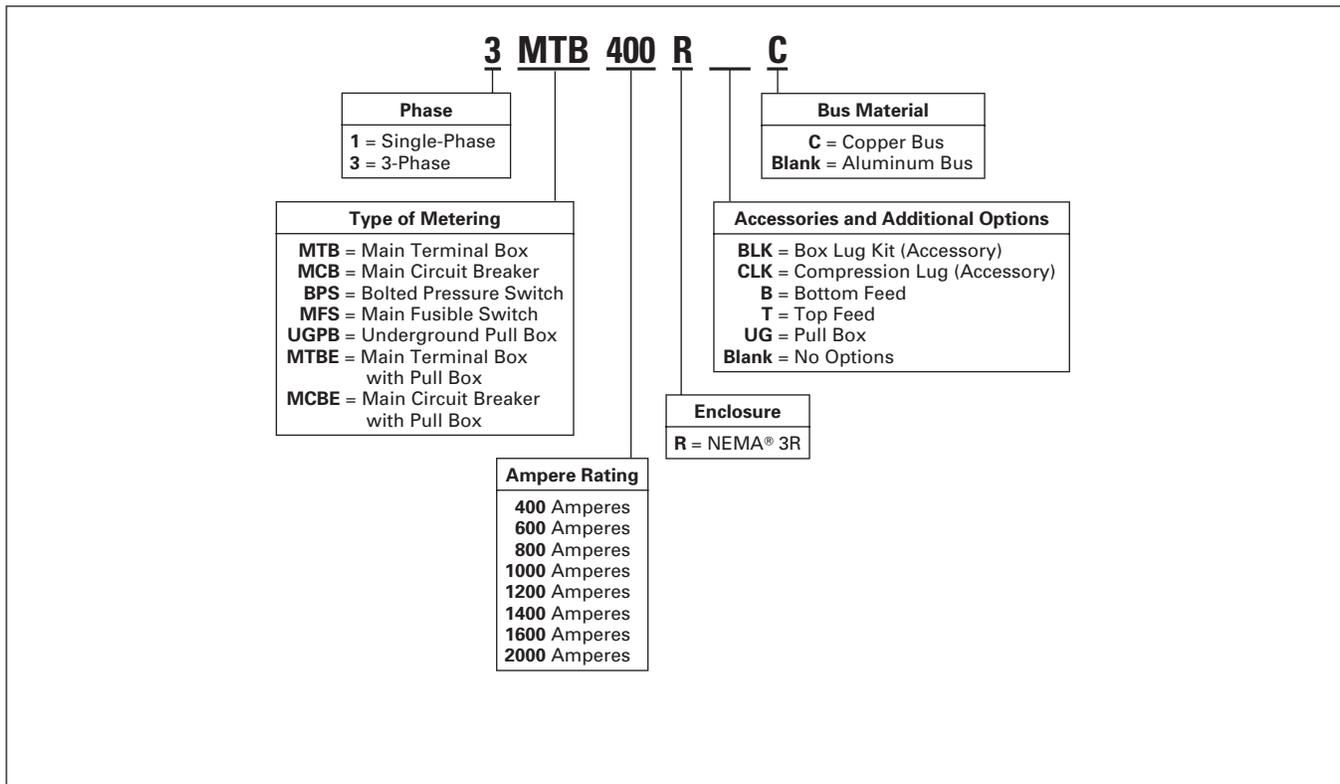
35MM, 37MM, 35SS and 37SS



37MM

Catalog Numbering System

Table 26.1-8. Main Service Modules Catalog Numbering System



When Ordering:

1. Determine catalog number of Main Service Module.
2. Determine catalog number of Meter Stack (Residential or Commercial).
3. Find quantity and catalog numbers for tenant circuit breakers (found on **Page 26.1-25** or **26.1-31**). Order one breaker per socket.
4. If any accessories are needed, order from **Pages 26.1-33** through **26.1-35**.

Main Terminal Box Selections

- Phase and neutral lugs are included.
- Top or bottom feed:
 - For top feed, use Myer type hub
- Indoor or outdoor.
- Terminal box UL listed short circuit rating is the least AIC rating of any installed main tenant breaker — to a maximum of 100,000 rms symmetrical amperes.

Table 26.1-9. Main Terminal Box

Ampere Rating	Line Side Lug and Wire Sizes — Included	Dimensions in Inches			System Voltage	
		Height	Width	Depth	120/240 Vac Single-Phase, 3-Wire	120/208 Vac 3-Phase, 4-Wire
					Catalog Number	Catalog Number
Aluminum Bus						
400	(1) #6 – 600 or (2) 1/0 – 250 kcmil	48.75	13.50	7.00	Use 3-phase	3MTB400R
600	(2) 250 – 500 kcmil ^②	48.75	13.50	7.00	Use 3-phase	3MTB600R
800	(4) 250 – 500 kcmil ^{③⑤}	47.63	20.00	11.75	1MTB800R	3MTB800R
1200 ^①	(4) 250 – 500 kcmil ^{④⑤}	47.63	20.00	11.75	1MTB1200R	3MTB1200R
1600 ^①	(6) 500 kcmil ^⑦	52.13	32.88	11.75	1MTB1600RC	3MTB1600RC
Aluminum Bus (EUSERC)						
400	(1) #6 – 600 or (2) 1/0 – 250 kcmil	48.75	13.50	7.00	1MTBE400R ^⑥	3MTBE400R ^⑥
800	(4) 250 – 500 kcmil ^{③⑤}	48.75	13.50	7.00	1MTBE800R ^⑥	3MTBE800R ^⑥
Copper Bus						
400	(1) #6 – 600 or (2) 1/0 – 250 kcmil	48.75	13.50	7.00	Use 3-phase	3MTB400RC
600	(2) 250 – 500 kcmil ^②	48.75	13.50	7.00	Use 3-phase	3MTB600RC
800	(4) 250 – 500 kcmil ^{③⑤}	47.63	20.00	11.75	1MTB800RC	3MTB800RC
1200 ^①	(4) 250 – 500 kcmil ^{④⑤}	47.63	20.00	11.75	1MTB1200RC	3MTB1200RC
1600 ^①	(6) 500 kcmil ^⑦	52.13	32.88	11.75	1MTB1600RC	3MTB1600RC

^① 120 ampere main devices must be center fed when installing 800 ampere residential meter stacks.

1600 ampere main devices must be center fed when installing 800 – 1200 ampere residential and commercial meter stacks.

^② For compression lug landing kits for 600 ampere units, order **3MTB600CLK**. Kit includes lug landings for 3 phases and neutral.

^③ For 800 ampere units, to obtain (4) 1/0 – 300 kcmil or (2) 1/0 – 750 kcmil cables per phase — order catalog number **3MTB800BLK**, one lug kit per main terminal box ordered (neutral and ground included in kit).

^④ For 1200 ampere units, to obtain (6) 1/0 – 300 kcmil or (3) 750 kcmil cables per phase — order catalog number **3MTB1200BLK**, one lug kit per main terminal box ordered (neutral and ground included in kit).

^⑤ For 800 ampere and 1200 ampere units, for compression lug landing kits, order **3MTB1200CLK**. Kit includes lug landings for 3-phases and neutral.

^⑥ Meets EUSERC electrical requirements and eliminates the need to add additional pull box section.

^⑦ For 1600 ampere units, to obtain (4) 750 kcmil cables per phase — order catalog number **3MTB1600BLK**, one lug kit per main terminal box ordered. For a 1600 ampere compression lug landing kit, order catalog number **3MTB1600CLK**.

Main Circuit Breaker Selections

- Phase and neutral lugs included. If additional neutral lugs are needed, order 1MCB1200NLK for (3) 1/0 – 750 or (6) 1/0 – 300 kcmil.
- For shunt trip mains, order the field installable shunt trip kit.
- For overhead feed, use Myer type hub.
- For compression lugs on 400, 600, 800, 1000 and 1200 ampere units add CL to the end of the part number (includes copper lug pads for lines and neutral).
- 1200 ampere or greater main devices must be center fed when installing 800 ampere residential meter stacks.
- 1400, 1600 and 2000 ampere main devices must be center fed when installing 800 and 1200 ampere residential and commercial meter stacks.

Table 26.1-10. Main Circuit Breaker

Main Ampere Rating	Main Circuit Breaker Type	Feed	kAIC	Line Side Lug and Wire Sizes. Lugs Included with Main Breaker ①	Dimensions in Inches			System Voltage	
					Height	Width	Depth	120/240 Vac Single-Phase, 3-Wire	120/208 Vac 3-Phase, 4-Wire
								Catalog Number	Catalog Number

Aluminum Bus

250	KD HKD	Bottom Bottom	65 100	(2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil (2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB250R 1MHCB250R	3MCB250R 3MHCB250R
300	KD HKD	Bottom Bottom	65 100	(2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil (2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB300R 1MHCB300R	3MCB300R 3MHCB300R
350	KD HKD	Bottom Bottom	65 100	(2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil (2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB350R 1MHCB350R	3MCB350R 3MHCB350R
400	KD HKD	Bottom Bottom	65 100	(2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil (2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB400R ② 1MHCB400R ②	3MCB400R ② 3MHCB400R ②
500	LD HLD	Bottom Bottom	65 100	(2) 400 – 500 kcmil (2) 400 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB500R 1MHCB500R	3MCB500R 3MHCB500R
600	LD HLD	Bottom Bottom	65 100	(2) 400 – 500 kcmil (2) 400 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB600R ② 1MHCB600R ②	3MCB600R ② 3MHCB600R ②
700	MDL HMDL	Bottom Bottom	65 100	(3) 3/0 – 400 kcmil (3) 3/0 – 400 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB700R 1MHCB700R	3MCB700R 3MHCB700R
800	MDL HMDL	Bottom Bottom	65 100	(3) 3/0 – 400 kcmil (3) 3/0 – 400 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB800R ② 1MHCB800R ②	3MCB800R ② 3MHCB800R ②
900	ND HND	Bottom Bottom	65 100	(4) 4/0 – 500 kcmil ③ (4) 4/0 – 500 kcmil ③	47.63 47.63	20.00 20.00	11.75 11.75	1MCB900R ④ 1MHCB900R ④	3MCB900R ④ 3MHCB900R ④
1000	ND HND	Bottom Bottom	65 100	(4) 4/0 – 500 kcmil ③ (4) 4/0 – 500 kcmil ③	47.63 47.63	20.00 20.00	11.75 11.75	1MCB1000R ②④ 1MHCB1000R ②④	3MCB1000R ②④ 3MHCB1000R ②④
1200	ND HND	Bottom Bottom	65 100	(4) 4/0 – 500 kcmil ③ (4) 4/0 – 500 kcmil ③	47.63 47.63	20.00 20.00	11.75 11.75	1MCB1200R ②④ 1MHCB1200R ②④	3MCB1200R ②④ 3MHCB1200R ②④
1400	RD RD	Bottom Top	100 100	(4) 500 – 1000 kcmil ⑤ (4) 500 – 1000 kcmil ⑤	57.13 57.13	24.88 24.88	14.88 14.88	1MCB1400RBC ④⑥ 1MCB1400RT ⑦	3MCB1400RBC ④⑥ 3MHCB1400RT ⑦
1600	RD RD	Bottom Top	100 100	(4) 500 – 1000 kcmil ⑤ (4) 500 – 1000 kcmil ⑤	57.13 57.13	24.88 24.88	14.88 14.88	1MCB1600RBC ⑥⑦ 1MCB1600RT ⑦	3MCB1600RBC ⑥⑦ 3MHCB1600RT ⑦
2000	RD RD	Bottom Top	100 100	(6) #2 – 600 kcmil (6) #2 – 600 kcmil	57.13 57.13	24.88 24.88	14.88 14.88	1MCB2000RBC ⑥⑧ 1MCB2000RT ⑧	3MCB2000RBC ⑥⑧ 3MHCB2000RT ⑧

Aluminum Bus (EUSERC Approved)

400	KD HKD	Bottom Bottom	65 100	(2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil (2) 3/0 – 250 kcmil or (1) 2/0 – 500 kcmil	60.44 60.44	20.01 20.01	11.14 11.14	1MCBE400R 1MHCBE400R	3MCBE400R 3MHCBE400R
600	LD HLD	Bottom Bottom	65 100	(2) 400 – 500 kcmil (2) 400 – 500 kcmil	60.44 60.44	20.01 20.01	11.14 11.14	1MCBE600R 1MHCBE600R	3MCBE600R 3MHCBE600R
800	MDL HMDL	Bottom Bottom	65 100	(3) 3/0 – 400 kcmil (3) 3/0 – 400 kcmil	60.94 60.94	24.88 24.88	11.14 11.14	1MCBE800R 1MHCBE800R	3MCBE800R 3MHCBE800R
1200	ND HND	Bottom Bottom	65 100	(4) 4/0 – 500 kcmil (4) 4/0 – 500 kcmil	61.14 61.14	33.00 33.00	11.32 11.32	1MCBE1200R 1MHCBE1200R	3MCBE1200R 3MHCBE1200R

Copper Bus

400	KD HKD	Bottom Bottom	65 100	(2) 3/0 – 250 kcmil or (1) 2/0-500 kcmil 2/0-500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB400RC ② 1MHCB400RC ②	3MCB400RC ② 3MHCB400RC ②
600	LD HLD	Bottom Bottom	65 100	(2) 300 – 500 kcmil (2) 300 – 500 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB600RC ② 1MHCB600RC ②	3MCB600RC ② 3MHCB600RC ②
800	MDL HMDL	Bottom Bottom	65 100	(3) 3/0 – 400 kcmil (3) 3/0 – 400 kcmil	47.63 47.63	20.00 20.00	11.75 11.75	1MCB800RC ② 1MHCB800RC ②	3MCB800RC ② 3MHCB800RC ②
1000	ND ND	Bottom Bottom	65 100	(4) 4/0 – 500 kcmil ③ (4) 4/0 – 500 kcmil ③	47.63 47.63	20.00 20.00	11.75 11.75	1MCB1000RC ②④ 1MHCB1000RC ②④	3MCB1000RC ②④ 3MHCB1000RC ②④
1200	ND ND	Bottom Bottom	65 100	(4) 4/0 – 500 kcmil ③ (4) 4/0 – 500 kcmil ③	47.63 47.63	20.00 20.00	11.75 11.75	1MCB1200RC ②④ 1MHCB1200RC ②④	3MCB1200RC ②④ 3MHCB1200RC ②④

- ① If additional neutral lugs are needed, order 1MCB1200NLK [(3) 1/0 – 750 kcmil or (6) 1/0 – 300 kcmil].
- ② Add CL to end of catalog number for compression lug pads (includes lug pads for lines and neutral).
- ③ If (3) 500 – 750 kcmil are needed, order TA1201NB1. Order one kit per pole.
- ④ Main devices with a rating greater than 800 ampere can be used with 800 ampere residential modular stacks but only as a center fed main.
- ⑤ If (6) #2 – 600 kcmil lugs are needed, order TA2000RD. Catalog number includes terminals and hardware for 3 poles. If neutral is needed, order TA2000N.
- ⑥ Copper bus.
- ⑦ Main devices with a rating greater than 1200 ampere can be used with residential and commercial modular metering stacks but only as a center fed main.
- ⑧ Only to be used in center feed applications with 1200 ampere meter stacks. Not to be used with 800 ampere stacks.

Main Fusible Switch Selections

- Fuses not included.
- Main lugs and neutral included with device.
- 100 kAIC rating on switches with Class T fuses installed. If converting to Class H, the AIC rating is 10 k and if converted to Class R, the AIC rating is 200 k.
- 800 ampere top and bottom fed units are supplied with Class T fuse clips as standard. The Class T fuse clips are field convertible to Class L by repositioning. No kit is needed.
- Barrier kits available for fusible switches: Bottom feed — **3MFSBBK**, Top feed — **3MFSTBK**.

Note: This is the fuse rating, switch still rated at 100 kAIC.

Table 26.1-11. Main Fusible Switches

Ampere Rating	Feed	Class Fuse Clips (Fuses Not Included)	Line Side Box Lugs and Wire Sizes. Included with Switch.	Dimensions in Inches			System Voltage	
				Height	Width	Depth	120/240 Vac Single-Phase, 3-Wire	120/208 Vac 3-Phase, 4-Wire
							Catalog Number	Catalog Number
Aluminum Bus								
400	Bottom Top	T ① T ①	(2) 1/0 – 300 kcmil or (1) 750 kcmil ④ (2) 1/0 – 300 kcmil or (1) 750 kcmil ⑤	47.63	20.00	11.75	1MFS400RB	3MFS400RB
				47.63	20.00	11.75	1MFS400RT	3MFS400RT
600	Bottom Top	T ② T ②	(2) #2 – 600 kcmil ④ (2) #2 – 600 kcmil ⑤	47.63	20.00	11.75	1MFS600RB	3MFS600RB
				47.63	20.00	11.75	1MFS600RT	3MFS600RT
800	Bottom Top	T ③ T ③	(4) 3/0 – 750 kcmil ④ (4) 3/0 – 750 kcmil ⑤	47.63	20.00	11.75	1MFS800RB	3MFS800RB
				47.63	20.00	11.75	1MFS800RT	3MFS800RT
1200	Bottom	T ③	(4) #2 – 600 kcmil	52.75	33.50	11.88	1MFS1200RB	3MFS1200RB
Copper Bus								
400	Bottom Top	T ① T ①	(2) 1/0 – 300 kcmil or (1) 750 kcmil ④ (2) 1/0 – 300 kcmil or (1) 750 kcmil ⑤	47.63	20.00	11.75	1MFS400RBC	3MFS400RBC
				47.63	20.00	11.75	1MFS400RTC	3MFS400RTC
600	Bottom Top	T ② T ②	(2) #2 – 600 kcmil ④ (2) #2 – 600 kcmil ⑤	47.63	20.00	11.75	1MFS600RBC	3MFS600RBC
				47.63	20.00	11.75	1MFS600RTC	3MFS600RTC
800	Bottom Top	T ③ T ③	(4) 3/0 – 750 kcmil ④ (4) 3/0 – 750 kcmil ⑤	47.63	20.00	11.75	1MFS800RBC	3MFS800RBC
				47.63	20.00	11.75	1MFS800RTC	3MFS800RTC
1200	Bottom	T ③	(4) #2 – 600 kcmil	52.75	33.50	11.88	1MFS1200RBC	3MFS1200RBC

① If Class H fuse clips are needed, use catalog number **WCG3HK400** (order (1) per phase).
If Class R fuse clips are needed, order catalog number **DS56FK** in addition to **WCG3HK400**.
In order to go from T to R, the device must first be converted to H.
All kits are field installable and each **DS56FK** kit will convert 3 poles.

② If Class H fuse clips are needed, use catalog number **WCG3HK600** (order (1) per phase).
If Class R fuse clips are needed, order catalog number **DS66FK** in addition to **WCG3HK600**.
In order to go from T to R, the device must first be converted to H.
All kits are field installable and each **DS66FK** kit will convert 3 poles.

③ Class T fuse clips provided are field convertible to Class L by repositioning. No kit is needed.

④ If compression lugs are being used, order **3MFS800CLK**. This compression lug kit includes four pads (3 poles and neutral).

⑤ If compression lugs are being used, order **3MFS800CLKT**. This compression lug kit includes four pads (3 poles and neutral).

Main Fusible Switch with Pull Box Selections

- Fuses not included.
- Includes lug landing pads on line side and neutral.
- Spacer kit 3MMBSK required when stacks are mounted on right-hand side in EUSERC areas.
- 100 kAIC rating on switches with Class T fuse clips installed.

Table 26.1-12. Main Fusible Switch with Pull Box

Ampere Rating	Feed	Class Fuse Clips ^① (Fuses Not Included)	Line Side Box Lugs and Wire Sizes. Included with Switch	Dimensions in Inches			System Voltage	
				Height	Width	Depth	120/240 Vac Single-Phase, 3-Wire Catalog Number	120/208 Vac 3-Phase, 4-Wire Catalog Number

Aluminum Bus

400	Bottom	T	②	61.00	20.00	11.75	1MFS400RUG	3MFS400RUG
600	Bottom	T	②	61.00	25.00	11.75	1MFS600RUG	3MFS600RUG
800	Bottom	T	②	61.00	25.00	11.75	1MFS800RUG	3MFS800RUG
1200	Bottom	T	②	61.50	33.50	11.88	1MFS1200RUG	3MFS1200RUG

Copper Bus

400	Bottom	T	②	61.00	20.00	11.75	1MFS400RUGC	3MFS400RUGC
600	Bottom	T	②	61.00	25.00	11.75	1MFS600RUGC	3MFS600RUGC
800	Bottom	T	②	61.00	25.00	11.75	1MFS800RUGC	3MFS800RUGC
1200	Bottom	T	②	61.50	33.50	11.88	1MFS1200RUGC	3MFS1200RUGC

① Class T fuse clips are provided. Class L is not available on MFS with pull box units.

② Pull box section includes landing studs for line side compression lugs. Wire sizes refer to fusible switch line side connection.

③ Contact Eaton for price and availability.

Pull Box Selections

- Includes lug landing pads on line side and neutral.
- Requires cable connection in field to main device. Does not include cross bus.

Table 26.1-13. Pull Box

Ampere Rating	Feed	Line Side Lug Information	Load Side Lug Information for Cable Connection to Main Disconnect	Dimensions in Inches			System Voltage	
				Height	Width	Depth	120/240 Vac Single-Phase, 3-Wire Catalog Number	120/208 Vac 3-Phase, 4-Wire Catalog Number

Aluminum Bus

400	Bottom	Pull box section includes landing studs for line side compression lugs.	1/0 – 750 kcmil or (2) 1/0 – 300 kcmil	44.88	16.38	7.88	1UGPB400R	3UGPB400R
800	Bottom		(2) 1/0 – 750 kcmil or (4) 1/0 – 300 kcmil	46.88	24.38	11.88	1UGPB800R	3UGPB800R
1200	Bottom		(4) #2 – 600 kcmil	56.88	32.50	12.00	1UGPB1200R	3UGPB1200R

Copper Bus

400	Bottom	Pull box section includes landing studs for line side compression lugs.	1/0 – 750 kcmil or (2) 1/0 – 300 kcmil	44.88	16.38	7.88	1UGPB400RC	3UGPB400RC
800	Bottom		(2) 1/0 – 750 kcmil or (4) 1/0 – 300 kcmil	46.88	24.38	11.88	1UGPB800RC	3UGPB800RC
1200	Bottom		(4) #2 – 600 kcmil	56.88	32.50	12.00	1UGPB1200RC	3UGPB1200RC

Main Bolted Pressure Contact Switch Selections

- Add suffix ST to catalog number for shunt trip and add \$500 to price U.S. \$. (May need to be loaded on Vista.)
- Fuses not included.
- 100 kAIC rating on switches with Class L fuses installed.

Table 26.1-14. Main Bolted Pressure Contact Switches

Ampere Rating	Feed	Class Fuse Clips (Fuses Not Included)	Line Side Box Lugs and Wire Sizes (Order Separately) ^④	Dimensions in Inches			System Voltage	
				Height	Width	Depth	120/240 Vac Single-Phase, 3-Wire Catalog Number	120/208 Vac 3-Phase, 4-Wire Catalog Number
1200	Bottom Top	L	(4) #4 – 600 kcmil	66.50	36.50	19.50	1BPS1200RB 1BPS1200RT	3BPS1200RB 3BPS1200RT
		L	(4) #4 – 600 kcmil	66.50	36.50	19.50		
1600	Bottom Top	L	(4) #4 – 600 kcmil	66.50	36.50	19.50	Use 3-Phase Use 3-Phase	3BPS1600RB 3BPS1600RT
		L	(4) #4 – 600 kcmil	66.50	36.50	19.50		
2000	Bottom Top	L	(6) #4 – 600 kcmil	66.50	36.50	19.50	Use 3-Phase Use 3-Phase	3BPS2000RB 3BPS2000RT
		L	(4) #4 – 600 kcmil	66.50	36.50	19.50		

④ 1200 ampere lug kit — WCG3BL6012.
2000 ampere lug kit — WCG3BL6020.

Main Service Modules — Dimensions in Inches (mm)

Note: See dimensional data on following page.

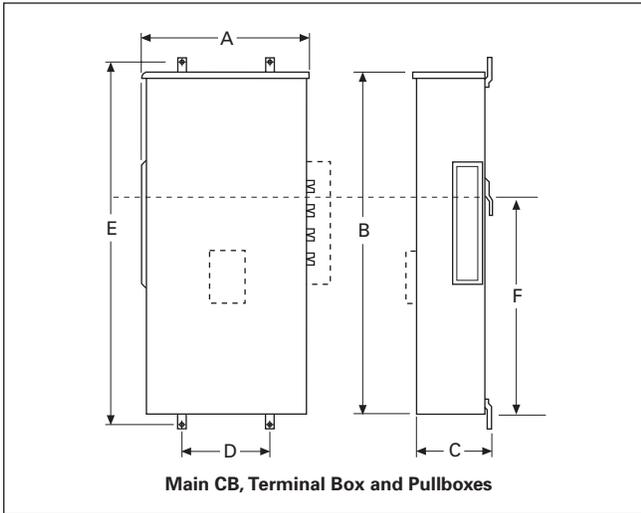


Figure 26.1-4. Main Circuit Breakers, Terminal Boxes and Pull Boxes

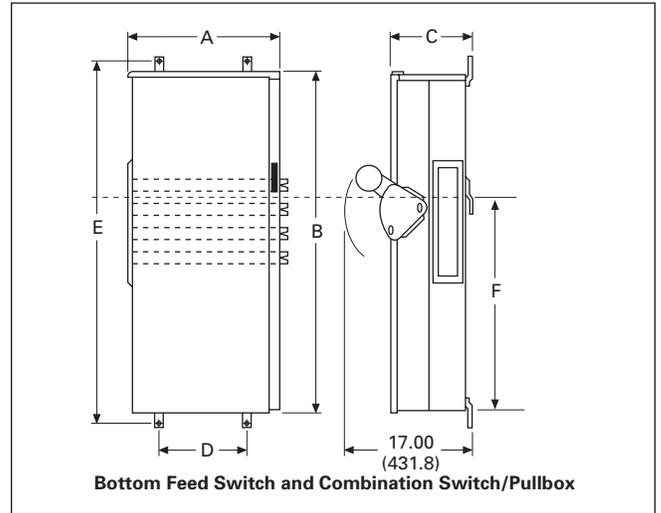


Figure 26.1-6. Bottom Feed Fusible Switch and Combination Fusible Switch with Pull Box

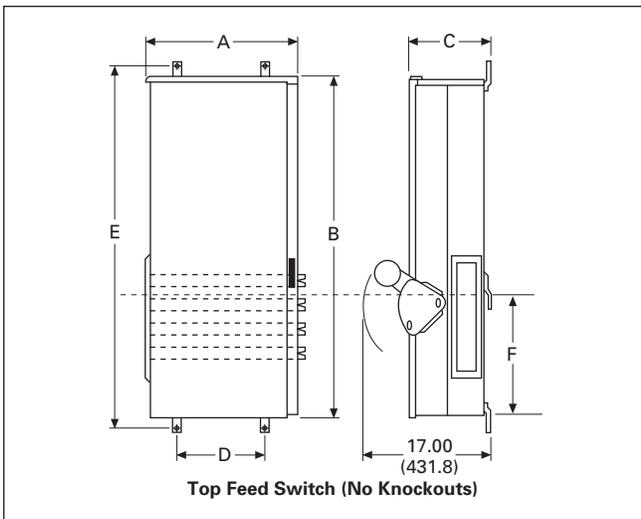


Figure 26.1-5. Top Feed Fusible Switch

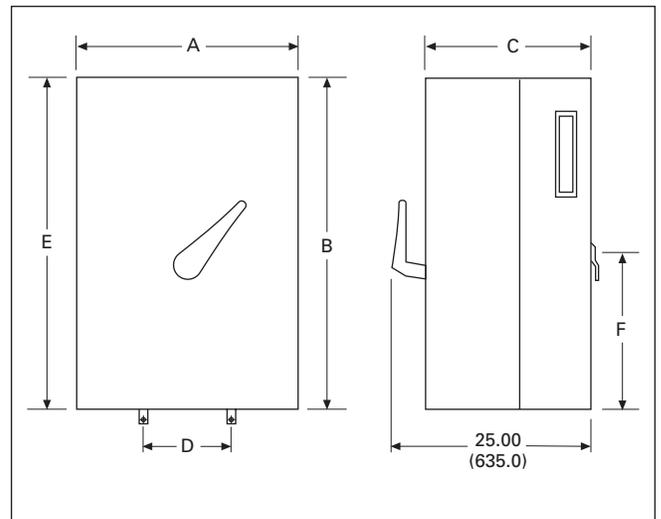


Figure 26.1-7. Bolted Pressure Switch

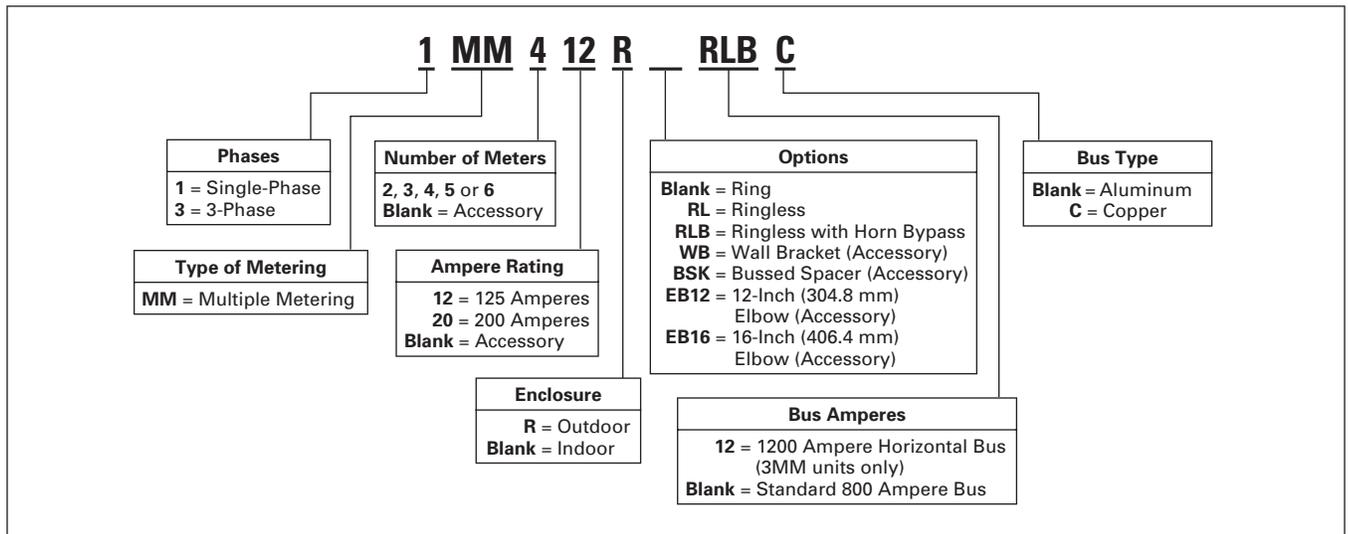
Dimensions — Main Service Modules

Table 26.1-15. Approximate Dimensions (Not to be used for Construction Purposes) — Dimensions in Inches (mm)

Main Device	Width	Height	Depth	Mounting		Center Line of Wall Mounting Bracket
	A	B	C	D	E	
Terminal Box 400 and 600 Ampere	13.50 (342.9)	48.75 (1238.3)	7.00 (177.8)	—	54.00 (1371.6)	30.63 (777.9)
800 and 1200 Ampere	20.00 (508.0)	47.63 (1209.8)	11.75 (298.5)	12.00 (304.8)	51.50 (1308.1)	30.63 (777.9)
1600 Ampere	32.88 (835.2)	52.13 (1324.1)	11.75 (298.5)	16.00 (406.4)	56.25 (1428.8)	31.63 (803.4)
Main Circuit Breaker with Box Lugs 400 – 1200 Ampere	20.00 (508.0)	47.63 (1209.8)	11.75 (298.5)	12.00 (304.8)	51.50 (1308.1)	30.63 (777.9)
Main Circuit Breaker with Box Lugs 1400 – 2000 Ampere	24.88 (632.0)	57.13 (1451.0)	14.88 (378.0)	16.00 (406.4)	57.13 (1451.0)	44.00 (1117.6)
Main Circuit Breaker with Compression Lugs 400 – 1200 Ampere	20.00 (508.0)	61.00 (1549.4)	11.75 (298.5)	12.00 (304.8)	65.00 (1651.0)	44.00 (1117.6)
Main Fusible Switch — Bottom Feed	20.00 (508.0)	47.63 (1209.8)	11.75 (298.5)	12.00 (304.8)	51.50 (1308.1)	30.63 (777.9)
Main Fusible Switch — Top Feed	20.00 (508.0)	47.63 (1209.8)	11.75 (298.5)	12.00 (304.8)	51.50 (1308.1)	18.13 (460.4)
Main Fusible Switch — 1200 Ampere	33.50 (850.9)	52.75 (1339.9)	11.88 (301.8)	16.00 (406.4)	56.25 (1428.8)	30.75 (781.1)
Bolted Pressure Switch	36.50 (927.1)	66.50 (1689.1)	19.50 (495.3)	28.00 (711.2)	60.00 (1524.0)	30.63 (777.9)
Main Fusible Switch with Pull Box 400 Ampere	20.00 (508.0)	61.00 (1549.4)	11.75 (298.5)	12.00 (304.8)	65.00 (1651.0)	44.00 (1117.6)
600 and 800 Ampere (1-Phase)	20.00 (508.0)	61.00 (1549.4)	11.75 (298.5)	12.00 (304.8)	65.00 (1651.0)	44.00 (1117.6)
600 and 800 Ampere (3-Phase)	25.00 (635.0)	61.00 (1549.4)	11.75 (298.5)	12.00 (304.8)	65.00 (1651.0)	44.00 (1117.6)
1200 Ampere	33.50 (850.9)	61.50 (1562.1)	11.88 (301.8)	16.00 (406.4)	65.25 (1657.4)	48.00 (1219.2)
Main Circuit Breaker with Pull Box 400 Ampere	20.01 (508.2)	60.44 (1535.2)	11.14 (283.0)	12.00 (304.8)	65.11 (1653.8)	39.75 (1009.6)
800 Ampere	24.88 (632.0)	60.94 (1547.9)	11.14 (283.0)	17.00 (431.8)	64.88 (1648.0)	39.81 (1011.2)
1200 Ampere	33.00 (838.2)	61.14 (1553.0)	11.32 (287.5)	16.00 (406.4)	65.25 (1657.4)	43.56 (1106.4)
Pull Box 400 Ampere	16.38 (416.1)	44.88 (1140.0)	7.88 (200.2)	8.00 (203.2)	45.75 (1162.1)	28.63 (727.2)
800 Ampere	24.38 (619.3)	46.88 (1190.8)	11.88 (301.8)	12.00 (304.8)	47.75 (1212.9)	32.25 (819.2)
1200 Ampere	32.50 (825.5)	56.88 (1444.8)	12.00 (304.8)	17.75 (450.9)	57.75 (1466.9)	42.25 (1073.2)
EUSERC Bussed Pull Section Single-Phase 400 and 800 Ampere	20.13 (511.3)	61 (1549.4)	11.25 (285.8)	12.00 (304.8)	64.88 (1648.0)	44.00 (1117.6)
Three-Phase 400 and 800 Ampere	25.13 (638.3)	61 (1549.4)	11.88 (301.8)	17.0 (431.8)	64.88 (1648.0)	44.00 (1117.6)

Catalog Numbering System

Table 26.1-16. Residential Meter Stacks Catalog Numbering System



When Ordering:

1. Determine catalog number of Main Service Module.
2. Determine catalog number of Meter Stack (Residential or Commercial).
3. Find quantity and catalog numbers for tenant circuit breakers (found on **Page 26.1-25**). Order one breaker per socket.
4. If any accessories are needed, order from **Pages 26.1-33** and **26.1-35**.

Technical Data — Residential Meter Stacks

1MM and 3MM Residential Meter Stack Modules, Aluminum Bus, 800 A

Note: For 3-phase stacks, please refer to Page 26.1-37 for Phase Balancing instructions.

Table 26.1-17. 800 Ampere Aluminum Bus

Amperes Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Enclosure Type ①	Main Tenant Breaker Type. For Specific Catalog Numbers, Refer to Page 26.1-25	Dimensions	Single-Phase Horizontal Bus (3 Horizontal Bus Bars — A, B, and Neutral) ②	3-Phase Horizontal Bus (4 Horizontal Bus Bars — A, B, C and Neutral)
						Catalog Number	Catalog Number

Ring Style Meter Socket Covers

125 ③	2 ④	800	Indoor/Outdoor	Plug-on Type BR_ BRH_ BRHH_	See Page 26.1-26	Use 3-Phase 1MM312R 1MM412R 1MM512R 1MM612R	3MM212R 3MM312R 3MM412R 3MM512R 3MM612R
	3 ④	800	Indoor/Outdoor				
	4	800	Indoor/Outdoor				
	5	800	Indoor/Outdoor				
	6	800	Indoor/Outdoor				
200 ⑤	2	800	Outdoor	Bolt-on Type CC2_X, CHH2_H2X CHH2_H4X, CHH2_X	See Page 26.1-27	Use 3-Phase 1MM320R 1MM420R	3MM220R 3MM320R 3MM420R
	3	800	Outdoor				
	4	800	Outdoor				

Ringless Style Meter Socket Covers

125	2	800	Outdoor	Plug-on Type BR_ BRH_ BRHH_	See Page 26.1-26	Use 3-Phase 1MM312RRL 1MM412RRL 1MM512RRL 1MM612RRL	3MM212RRL 3MM312RRL 3MM412RRL 3MM512RRL 3MM612RRL
	3	800	Outdoor				
	4	800	Outdoor				
	5	800	Outdoor				
	6	800	Outdoor				
200	2	800	Outdoor	Bolt-on Type CC2_X, CHH2_H2X CHH2_H4X, CHH2_X	See Page 26.1-27	Use 3-Phase 1MM320RRL 1MM420RRL	3MM220RRL 3MM320RRL 3MM420RRL
	3	800	Outdoor				
	4	800	Outdoor				

Ringless Style Covers with Horn Bypass

125	2	800	Outdoor	Plug-on Type BR_ BRH_ BRHH_	See Page 26.1-26	Use 3-Phase 1MM312RRLB 1MM412RRLB 1MM512RRLB 1MM612RRLB	3MM212RRLB 3MM312RRLB 3MM412RRLB 3MM512RRLB 3MM612RRLB
	3	800	Outdoor				
	4	800	Outdoor				
	5	800	Outdoor				
	6	800	Outdoor				
200	2	800	Outdoor	Bolt-on Type CC2_X, CHH2_H2X CHH2_H4X, CHH2_X	See Page 26.1-27	Use 3-Phase 1MM320RRLB 1MM420RRLB	3MM220RRLB 3MM320RRLB 3MM420RRLB
	3	800	Outdoor				
	4	800	Outdoor				

① For indoor applications where a top endwall with knockouts is needed, order (1) of part number **MM12N1WLK** for each 125 ampere stack or **MM20N1WLK** for each 200 ampere stack.

② 1MM units do not come with 5th Jaw.

③ To change in field from ring to ringless — order **1MMRC125**.

④ To change in field from ring to ringless, the top socket in 125 ampere, 2- and 3-high stacks use **1MMRC125T**. Top socket only — other sockets see ③.

⑤ To change in field from ring to ringless — order **1MMRC200**.

Wire Sizes — Neutral and Ground Lugs

- Each stack includes a neutral and ground bar.
- If an extra ground bar is needed, order **1MMGBK**.

Table 26.1-18. Wire Sizes — Neutral and Ground Lugs

Lugs in Meter Socket Modules	Wire Size, Al/Cu
Branch Neutral — 125 ampere socket module	#6 – 2/0 kcmil
Branch Neutral — 200 ampere socket module	#1/0 – 300 kcmil
Equipment Ground Bar, 125 ampere socket module	#14 – #2 kcmil
Equipment Ground Bar, 200 ampere socket module	#14 – 2/0 kcmil
Optional Ground Bar (1MMGBK)	#6 – 2/0 kcmil

1MM and 3MM Residential Meter Stack Modules, Copper Bus, 800 A

Note: For 3-phase stacks, please refer to Page 26.1-37 for Phase Balancing instructions.

Table 26.1-19. 800 Ampere Copper Bus

Amperes Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Enclosure Type ①	Tenant Breaker Type. For Specific Catalog Numbers, Refer to Page 26.1-25	Dimensions	Single-Phase Horizontal Bus (3 Horizontal Bus Bars — A, B, and Neutral) ②	3-Phase Horizontal Bus (4 Horizontal Bus Bars — A, B, C and Neutral)
						Catalog Number	Catalog Number

Ring Style Meter Socket Covers

125 ③	2 ④	800	Outdoor	Plug-on Type	See Page 26.1-26	Use 3-Phase 1MM312RC 1MM412RC 1MM512RC 1MM612RC	3MM212RC 3MM312RC 3MM412RC 3MM512RC 3MM612RC
	3 ④	800	Outdoor	BR_			
	4	800	Outdoor	BRH_			
	5	800	Outdoor	BRHH_			
	6	800	Outdoor	—			
200 ⑤	2	800	Outdoor	Bolt-on Type	See Page 26.1-27	Use 3-Phase 1MM320RC 1MM420RC	3MM220RC 3MM320RC 3MM420RC
	3	800	Outdoor	CC2_X, CHH2_H2X			
	4	800	Outdoor	H4X, CHH2_X			

Ringless Style Meter Socket Covers

125	2	800	Outdoor	Plug-on Type	See Page 26.1-26	Use 3-Phase 1MM312RRLC 1MM412RRLC 1MM512RRLC 1MM612RRLC	3MM212RRLC 3MM312RRLC 3MM412RRLC 3MM512RRLC 3MM612RRLC
	3	800	Outdoor	BR_			
	4	800	Outdoor	BRH_			
	5	800	Outdoor	BRHH_			
	6	800	Outdoor	—			
200	2	800	Outdoor	Bolt-on Type	See Page 26.1-27	Use 3-Phase 1MM320RRLC 1MM420RRLC	3MM220RRLC 3MM320RRLC 3MM420RRLC
	3	800	Outdoor	CC2_X, CHH2_H2X			
	4	800	Outdoor	H4X, CHH2_X			

Ringless Style Covers with Horn Bypass

125	2	800	Outdoor	Plug-on Type	See Page 26.1-26	Use 3-Phase 1MM312RRLBC 1MM412RRLBC 1MM512RRLBC 1MM612RRLBC	3MM212RRLBC 3MM312RRLBC 3MM412RRLBC 3MM512RRLBC 3MM612RRLBC
	3	800	Outdoor	BR_			
	4	800	Outdoor	BRH_			
	5	800	Outdoor	BRHH_			
	6	800	Outdoor	—			
200	2	800	Outdoor	Bolt-on Type	See Page 26.1-27	Use 3-Phase 1MM320RRLBC 1MM420RRLBC	3MM220RRLBC 3MM320RRLBC 3MM420RRLBC
	3	800	Outdoor	CC2_X, CHH2_H2X			
	4	800	Outdoor	H4X, CHH2_X			

① For indoor applications where a top endwall with knockouts is needed, order (1) of part number MM12N1WLK for each 125 ampere stack or MM20N1WLK for each 200 ampere stack.

② 1MM units do not come with 5th Jaw.

③ To change in field from ring to ringless — order 1MMRC125.

④ To change in field from ring to ringless, the top socket in 125 ampere, 2- and 3-high stacks use 1MMRC125T. Top socket only — other sockets see ③.

⑤ To change in field from ring to ringless — order 1MMRC200

Wire Sizes — Neutral and Ground Lugs

- Each stack includes a neutral and ground bar.
- If an extra ground bar is needed, order 1MMGBK.

Table 26.1-20. Wire Sizes — Neutral and Ground Lugs

Lugs in Meter Socket Modules	Wire Size, Al/Cu
Branch Neutral — 125 ampere socket module	#6 – 2/0 kcmil
Branch Neutral — 200 ampere socket module	#1/0 – 300 kcmil
Equipment Ground Bar, 125 ampere socket module	#14 – #2 kcmil
Equipment Ground Bar, 200 ampere socket module	#14 – 2/0 kcmil
Optional Ground Bar (1MMGBK)	#6 – 2/0 kcmil

1MM and 3MM Residential Meter Stack Modules, Copper Bus, 1200 A

Table 26.1-21. 1200 Ampere Horizontal Bus — Copper

Amperes Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Enclosure Type ①	Dimensions	Copper Tenant Breaker Type. For Specific Catalog Numbers, Refer to Page 26.1-25	3-Phase Horizontal Bus (4 Horizontal Bus Bars — A, B, C and Neutral) Catalog Number
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Ring Style Meter Socket Covers

125 ②	2 ③	1200	Indoor/Outdoor	See Page 26.1-26	Plug-on Type BR_ BRH_ BRHH_ —	3MM212R12 3MM312R12 3MM412R12 3MM512R12 3MM612R12
	3 ③	1200	Indoor/Outdoor			
	4	1200	Indoor/Outdoor			
	5	1200	Indoor/Outdoor			
	6	1200	Indoor/Outdoor			
200 ④	2	1200	Outdoor	See Page 26.1-27	Bolt-on Type CC2_X, CHH2_H2X CHH2_H4X, CHH2_X	3MM220R12 3MM320R12 3MM420R12
	3	1200	Outdoor			
	4	1200	Outdoor			

Ringless Style Meter Socket Covers (5th Jaw at 9 o'clock Standard — Field Adjustable to 3 or 6 o'clock)

125	2	1200	Outdoor	See Page 26.1-26	Plug-on Type BR_ BRH_ BRHH_ —	3MM212R12RL 3MM312R12RL 3MM412R12RL 3MM512R12RL 3MM612R12RL
	3	1200	Outdoor			
	4	1200	Outdoor			
	5	1200	Outdoor			
	6	1200	Outdoor			
200	2	1200	Outdoor	See Page 26.1-27	Bolt-on Type CC2_X, CHH2_H2X CHH2_H4X, CHH2_X	3MM220R12RL 3MM320R12RL 3MM420R12RL
	3	1200	Outdoor			
	4	1200	Outdoor			

Ringless Style Covers with Horn Bypass (5th Jaw at 9 o'clock Standard — Field Adjustable to 3 or 6 o'clock)

125	2	1200	Outdoor	See Page 26.1-26	Plug-on Type BR_ BRH_ BRHH_ —	3MM212R12RLB 3MM312R12RLB 3MM412R12RLB 3MM512R12RLB 3MM612R12RLB
	3	1200	Outdoor			
	4	1200	Outdoor			
	5	1200	Outdoor			
	6	1200	Outdoor			
200	2	1200	Outdoor	See Page 26.1-27	Bolt-on Type CC2_X, CHH2_H2X CHH2_H4X, CHH2_X	3MM220R12RLB 3MM320R12RLB 3MM420R12RLB
	3	1200	Outdoor			
	4	1200	Outdoor			

① For indoor applications where a top endwall with knockouts is needed, order (1) of part number MM12N1WLK for each 125 ampere stack or MM20N1WLK for each 200 ampere stack.

② To change in field from ring to ringless — order 1MMRC125.

③ To change in field from ring to ringless, the top socket in 125 ampere, 2- and 3-high stacks use 1MMRC125T. Top socket only — other sockets see ②.

④ To change in field from ring to ringless — order 1MMRC200.

Wire Sizes — Neutral and Ground Lugs

- Each stack includes a neutral and ground bar.
- If an extra ground bar is needed, order 1MMGBK.

Table 26.1-22. Wire Sizes — Neutral and Ground Lugs

Lugs in Meter Socket Modules	Wire Size, Al/Cu
Branch Neutral — 125 ampere socket module	#6 – 2/0 kcmil
Branch Neutral — 200 ampere socket module	#1/0 – 300 kcmil
Equipment Ground Bar, 125 ampere socket module	#14 – #2 kcmil
Equipment Ground Bar, 200 ampere socket module	#14 – 2/0 kcmil
Optional Ground Bar (1MMGBK)	#6 – 2/0 kcmil

1MM and 3MM Meter Stack Tenant Circuit Breakers

- The following breakers are to be used on 1MM and 3MM modular metering stacks.
- Series rating information available on **Pages 26.1-38 through 26.1-40.**
- 120/240 Vac — field installed.



BR2100



CC2200

Tenant Breaker Selections

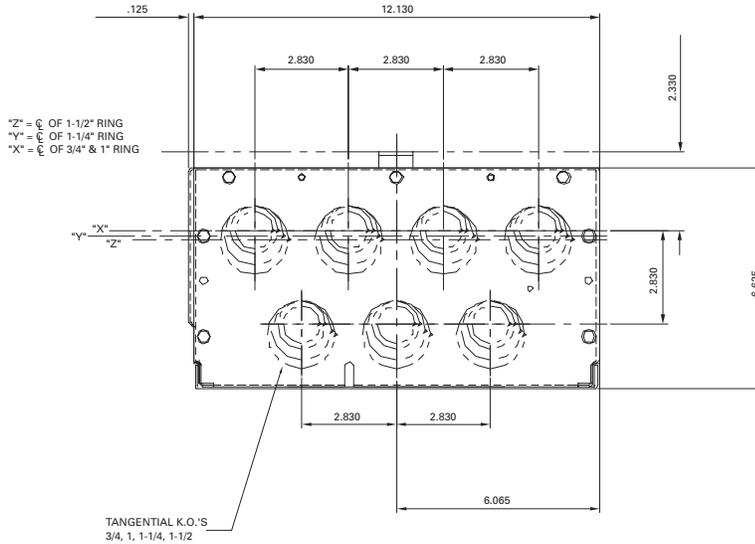
Table 26.1-23. 1MM and 3MM Tenant Circuit Breakers

Description	Number of Poles	Main Tenant Circuit Breaker Ampere Rating	10,000 AIC	22,000 AIC	25,000 AIC	42,000 AIC	100,000 AIC
			Catalog Number				
Plug-on type circuit breakers used with 1MM and 3MM 125 ampere modular metering stacks	2	60	BR260	BRH260	—	BRHH260	—
	2	70	BR270	BRH270	—	BRHH270	—
	2	80	BR280	BRH280	—	BRHH280	—
	2	90	BR290	BRH290	—	BRHH290	—
	2	100	BR2100	BRH2100	—	BRHH2100	—
	2	110	BR2110	BRH2110	—	BRHH2110	—
Bolt-on type circuit breakers used with 1MM and 3MM 200 ampere modular metering stacks	2	125	BR2125	BRH2125	—	BRHH2125	—
	2	60	—	—	CHH2060H2X	CHH2060H4X	CHH2060X
	2	70	—	—	CHH2070H2X	CHH2070H4X	CHH2070X
	2	80	—	—	CHH2080H2X	CHH2080H4X	CHH2080X
	2	90	—	—	CHH2090H2X	CHH2090H4X	CHH2090X
	2	100	CC2100X	—	CHH2100H2X	CHH2100H4X	CHH2100X
	2	125	CC2125X	—	CHH2125H2X	CHH2125H4X	CHH2125X
	2	150	CC2150X	—	CHH2150H2X	CHH2150H4X	CHH2150X
	2	175	CC2175X	—	CHH2175H2X	CHH2175H4X	CHH2175X
	2	200	CC2200X	—	CHH2200H2X	CHH2200H4X	CHH2200X

Dimensions — Residential Meter Stacks, 125 Ampere Maximum Meter Sockets

Dimensions and Knockouts (in Inches) — Modular Metering Stacks — Aluminum and Copper

Note: Dimensions Apply to 800 and 1200 Ampere Horizontal Bus.



TOP END & BOTTOM END VIEW FOR NEMA 1;
BOTTOM END VIEW FOR NEMA 3R

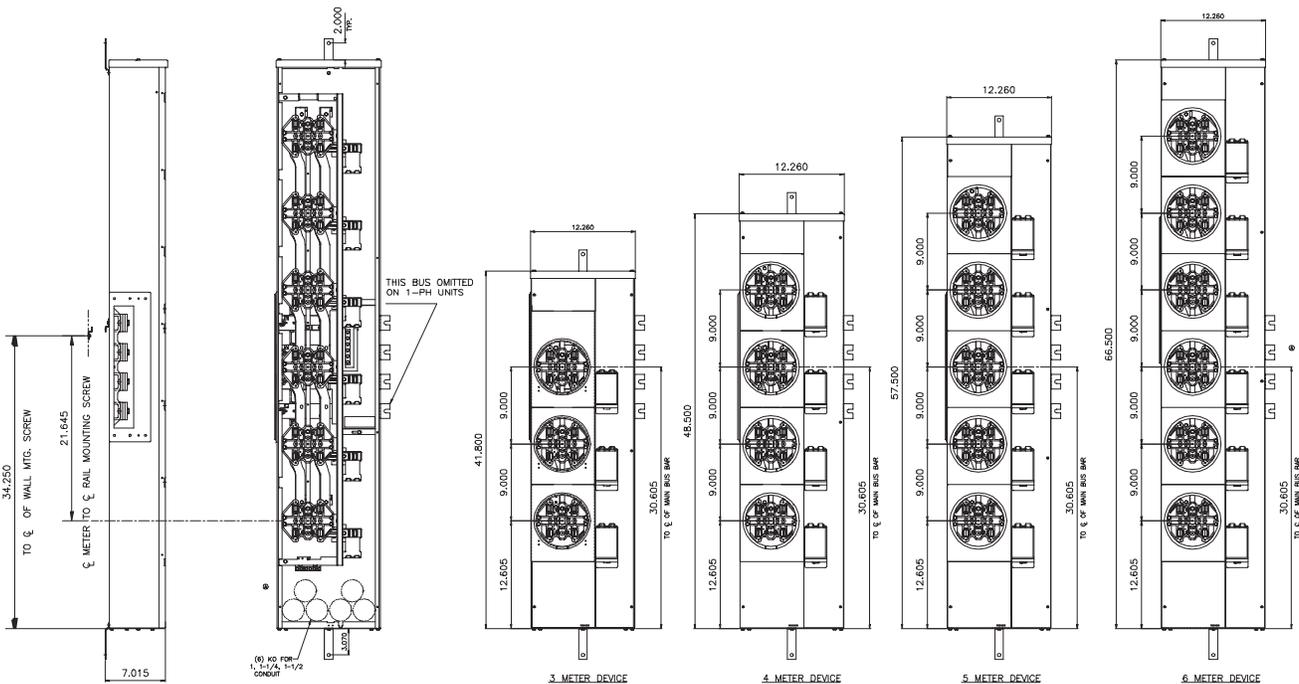
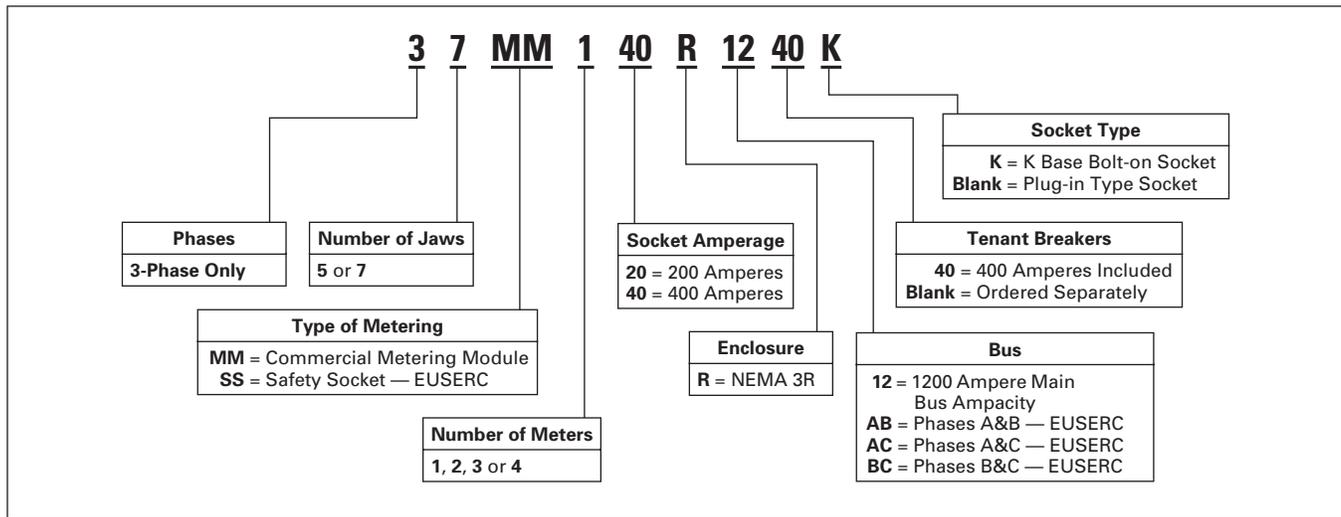


Figure 26.1-8. 1MM, 3MM, 125 Amperes Maximum Meter Sockets

Catalog Numbering System

Table 26.1-24. Commercial Meter Stack Modules Catalog Numbering System



When Ordering:

1. Determine catalog number of Main Service Module.
2. Determine catalog number of Meter Stack (Residential or Commercial).
3. Find quantity and catalog numbers for tenant circuit breakers (found on **Page 26.1-31**). Order one breaker per socket.
4. If any accessories are needed, order from **Page 26.1-33 to 26.1-35**.

35MM, Single-Phase Commercial Meter Stack Modules

- Each socket is a 5 terminal block with lever bypass and jaw release.
- Ringless covers.
- Provision for 2-pole main tenant breakers (circuit breakers not included). For circuit breaker catalog numbers, refer to **Page 26.1-31**.
- Phase balancing kits are included with three high and four high modules. Each individual socket can be phase balanced in the field to the desired lines (A-B, B-C, or A-C). Comes from factory as A-B.
- Indoor/outdoor construction.
- Main tenant feeders can exit top, bottom, or back.
- If being used in outdoor application and exiting the top, mount Myer type hubs on rainproof cap.
- Short circuit ratings up to 100 ampere rms symmetrical depending upon the kAIC rating of installed main tenant circuit breakers and main device.
- Copper horizontal bus supplied as standard.
- Non-EUSERC areas.

Table 26.1-25. 35MM — Single-Phase Commercial Meter Stack Modules

System Voltage	Ampere Rating Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Number of Jaws Per Meter Socket	Tenant Breaker Type (Page 26.1-31)	Dimensions	Catalog Number ①
120/240 volt, Single-phase, 3-wire systems and 208Y/120 volt network metering (Not suitable for use on 3-phase, 4-wire Delta systems)	225	1	1200	5	Bolt-on Type EHD2_②	See Page 26.1-32	35MM120R12 35MM220R12 35MM320R12 35MM420R12
		2	1200	5	CC2_X		
		3	1200	5	CHH2_H2X		
		4	1200	5	CHH2_H4X CHH2_X		
	400	1	1200	5	400 Ampere K-Frame Included		35MM140R1240 ③ 35MM140HR1240 ④
400	2	1200	5	400 Ampere K-Frame Included	35MM240R1240		
400 Continuous	1	1200	5	400 Ampere L-Frame Included	35MM140R1240K ⑤		
400 Continuous	1	1200	5	400 Ampere L-Frame Included	35MM140HR1240K ⑥		

① Add NJ suffix for New Jersey "NJUA" approved units. Same price U.S. \$.
② EHD main tenant breakers require one 37MMCBK kit per breaker.

③ Unit is bottom exit only.
④ Rated at 100 kAIC.
⑤ Rated at 25 kAIC.

⑥ Rated at 35 kAIC.

37MM, Three-Phase Commercial Meter Stack Modules

- Each socket is a 7 terminal block with lever bypass and jaw release.
- Ringless covers.
- Provision for 3-pole main tenant breakers (circuit breakers not included). For circuit breaker catalog numbers, refer to **Page 26.1-31**.
- Indoor/outdoor construction.
- Main tenant breakers can exit top, bottom, or back.
- If being used in outdoor application and exiting the top, mount Myer type hubs on rainproof cap.
- Short circuit ratings up to 100 ampere rms symmetrical depending upon the kAIC rating of installed main tenant circuit breakers and main device.
- Copper horizontal bus supplied as standard.
- Non-EUSERC areas.

Table 26.1-26. 37MM — Three-Phase Commercial Meter Stack Modules

System Voltage	Ampere Rating Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Number of Jaws Per Meter Socket ⑦	Tenant Breaker Type (Page 26.1-31)	Dimensions	Catalog Number
208Y/120 volt, 3-phase, 4-wire 240/120 volt, 3-phase, 4-wire Delta (B-Phase is high leg)	225	1	1200	7	Bolt-on Type EHD3_⑧	See Page 26.1-32	37MM120R12 ⑨ 37MM220R12 ⑨ 37MM320R12 ⑨ 37MM420R12 ⑨ 37MM140R12 ⑩
		2	1200	7	CC3_X		
		3	1200	7	CHH3_H2X		
		4	1200	7	CHH3_H4X CHH3_		
	400	1	1200	7	400 Ampere K-Frame Included		37MM140R1240 ⑪ 37MM140HR1240 ⑫
	400	2	1200	7	400 Ampere K-Frame Included		37MM240R1240
400 Continuous	1	1200	7	400 Ampere L-Frame Included	37MM140R1240K ⑬		
400 Continuous	1	1200	7	400 Ampere L-Frame Included	37MM140HR1240K ⑭		

⑦ If a socket in a 37MM meter stack module needs to be single-phase, order 37MM1CK. This will convert the 3-phase socket to single-phase.
⑧ EHD main tenant breakers require one 37MMCBK kit per breaker.

⑨ Add NJ suffix for New Jersey "NJUA" approved units. Same price U.S. \$.
⑩ 320 ampere continuous rated socket with provisions for two main tenant breakers.
⑪ Unit is bottom exit only.

⑫ Rated at 100 kAIC.
⑬ Rated at 25 kAIC.
⑭ Rated at 35 kAIC.

35SS, Single-Phase Commercial Meter Stack Modules

- Sockets include EUSERC required test-bypass-disconnect feature.
- Ring type covers.
- Single-phase units have provisions for 2-pole main tenant breakers.
- When applying 35SS (single-phase) stacks on 208Y/120 volt, 3-phase, 4-wire and 240/120 volt, 3-phase, 4-wire delta systems, refer to suffixes for proper phase balancing. Each meter stack module is phase balanced at the plant (A-B, B-C, or A-C) and cannot be field modified.
- Indoor/outdoor construction.
- Main tenant breakers can exit top, bottom or back. Removable blank plates are supplied for customer punched service cable exits. If being used in outdoor application and exiting the top, mount Myer type hubs on rainproof cap.
- Short circuit ratings up to 100A rms symmetrical depending upon the kAIC rating of installed main tenant circuit breakers and main device.
- Copper horizontal bus supplied as standard.

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Table 26.1-27. 35SS — Three-Phase Commercial Meter Stack Modules

System Voltage	Ampere Rating Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Number of Jaws Per Meter Socket	Tenant Breaker Type ①	Dimensions	Catalog Number
120/240 volt, Single-phase, 3-wire systems and 208Y/120 volt network metering (Not suitable for use on 3-phase, 4-wire Delta systems)	225	1	1200	5	Bolt-on Type EHD2_② CC2_X CHH2_H2X CHH2_H4X CHH2_X	See Page 26.1-32	35SS120RAB③
		2	1200	5			35SS120RAC③
		3	1200	5			35SS120RBC③
							35SS220RAB③
							35SS220RAC③
							35SS220RBC③
							35SS320RAB③
							35SS320RAC③
							35SS320RBC③

① For specific circuit breaker catalog numbers, refer to Page 26.1-31.
 ② EHD main tenant breakers require one 37MMCBK kit per breaker.
 ③ Last 2 digits of catalog number indicate phase balancing (AB indicates all sockets in this stack are connected to phases A and B only).

37SS, Three-Phase Commercial Meter Stack Modules

- Sockets include EUSERC required test-bypass-disconnect feature.
- Ring type covers.
- Three-phase units have provisions for 3-pole main tenant breaker.
- Copper horizontal bus supplied as standard.

Table 26.1-28. 37SS — Three-Phase Commercial Meter Stack Modules

System Voltage	Ampere Rating Per Meter Socket	Number of Meter Sockets	Bus Ampacity	Number of Jaws Per Meter Socket	Tenant Breaker Type ④	Dimensions	Catalog Number
208Y/120 volt, 3-phase, 4-wire 240/120 volt, 3-phase, 4-wire Delta (B-Phase is high leg)	225	1	1200	7	Bolt-on Type EHD3_⑤ CC3_X CHH3_H2X CHH3_H4X CHH3_	See Page 26.1-32	37SS120R
		2	1200	7			37SS220R
		3	1200	7			37SS320R

④ For specific circuit breaker catalog numbers, refer to Page 26.1-31.
 ⑤ EHD main tenant breakers require one 37MMCBK kit per breaker.

**35MM, 37MM, 35SS and 37SS
Main Tenant Circuit Breakers**

- The following breakers are to be used on 35MM, 37MM, 35SS and 37SS modular metering stacks.
- Series rating information available on **Pages 26.1-38 through 26.1-40.**
- 2-pole breakers are 120/240 Vac:
 - Field Installed
- 3-pole breakers are 208Y/120 Vac:
 - Field Installed



CC2200



EHD2100

Table 26.1-29. 35MM, 37MM, 35SS and 37SS Tenant Circuit Breakers

Description	Number of Poles	Tenant Circuit Breaker Ampere Rating	10,000 AIC	25,000 AIC	42,000 AIC	100,000 AIC
			Catalog Number	Catalog Number	Catalog Number	Catalog Number
Bolt-on type circuit breakers used with 35MM and 35SS (single-phase modular metering stacks) ②	2	15	EHD2015	—	—	—
	2	20	EHD2020	—	—	—
	2	30	EHD2030	—	—	—
	2	40	EHD2040	—	—	—
	2	50	EHD2050	—	—	—
	2	60	EHD2060	CHH2060H2X	CHH2060H4X	CHH2060X
	2	70	EHD2070	CHH2070H2X	CHH2070H4X	CHH2070X
	2	80	EHD2080	CHH2080H2X	CHH2080H4X	CHH2080X
	2	90	EHD2090	CHH2090H2X	CHH2090H4X	CHH2090X
	2	100	CC2100X	CHH2100H2X	CHH2100H4X	CHH2100X
	2	125	CC2125X	CHH2125H2X	CHH2125H4X	CHH2125X
	2	150	CC2150X	CHH2150H2X	CHH2150H4X	CHH2150X
	2	175	CC2175X	CHH2175H2X	CHH2175H4X	CHH2175X
	2	200	CC2200X	CHH2200H2X	CHH2200H4X	CHH2200X
2	225	CC2225X	CHH2225H2X	CHH2225H4X	CHH2225X	
Bolt-on type circuit breakers used with 37MM and 37SS (3-phase modular metering stacks) ②	3	15	EHD3015	—	—	—
	3	20	EHD3020	—	—	—
	3	30	EHD3030	—	—	—
	3	40	EHD3040	—	—	—
	3	50	EHD3050	—	—	—
	3	60	EHD3060	CHH3060H2X	CHH3060H4X	CHH3060
	3	70	EHD3070	CHH3070H2X	CHH3070H4X	CHH3070
	3	80	EHD3080	CHH3080H2X	CHH3080H4X	CHH3080
	3	90	EHD3090	CHH3090H2X	CHH3090H4X	CHH3090
	3	100	CC3100X	CHH3100H2X	CHH3100H4X	CHH3100
	3	125	CC3125X	CHH3125H2X	CHH3125H4X	CHH3125
	3	150	CC3150X	CHH3150H2X	CHH3150H4X	CHH3150
	3	175	CC3175X	CHH3175H2X	CHH3175H4X	CHH3175
	3	200	CC3200X	CHH3200H2X	CHH3200H4X	CHH3200
3	225	CC3225X	CHH3225H2X	CHH3225H4X	CHH3225	

① EHD main tenant circuit breakers require one 37MMCBK kit per breaker.

② Tenant circuit breakers are also available in ratings from 15 to 50 amperes.

Dimensions — Commercial Meter Stacks

Commercial Stacks (35MM, 37MM, 35SS and 37SS) — Dimensions in Inches (mm)

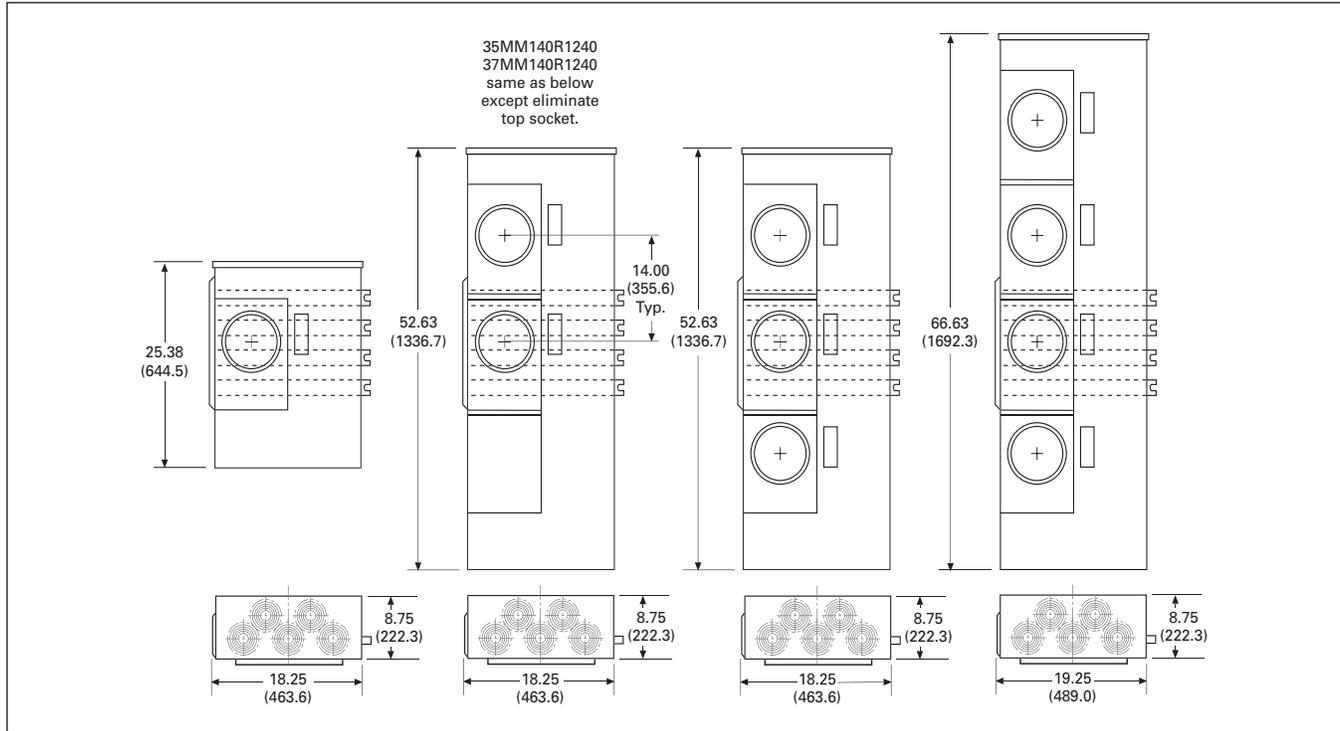


Figure 26.1-10. 35MM and 37MM, 225 A and 400 A Meter Sockets

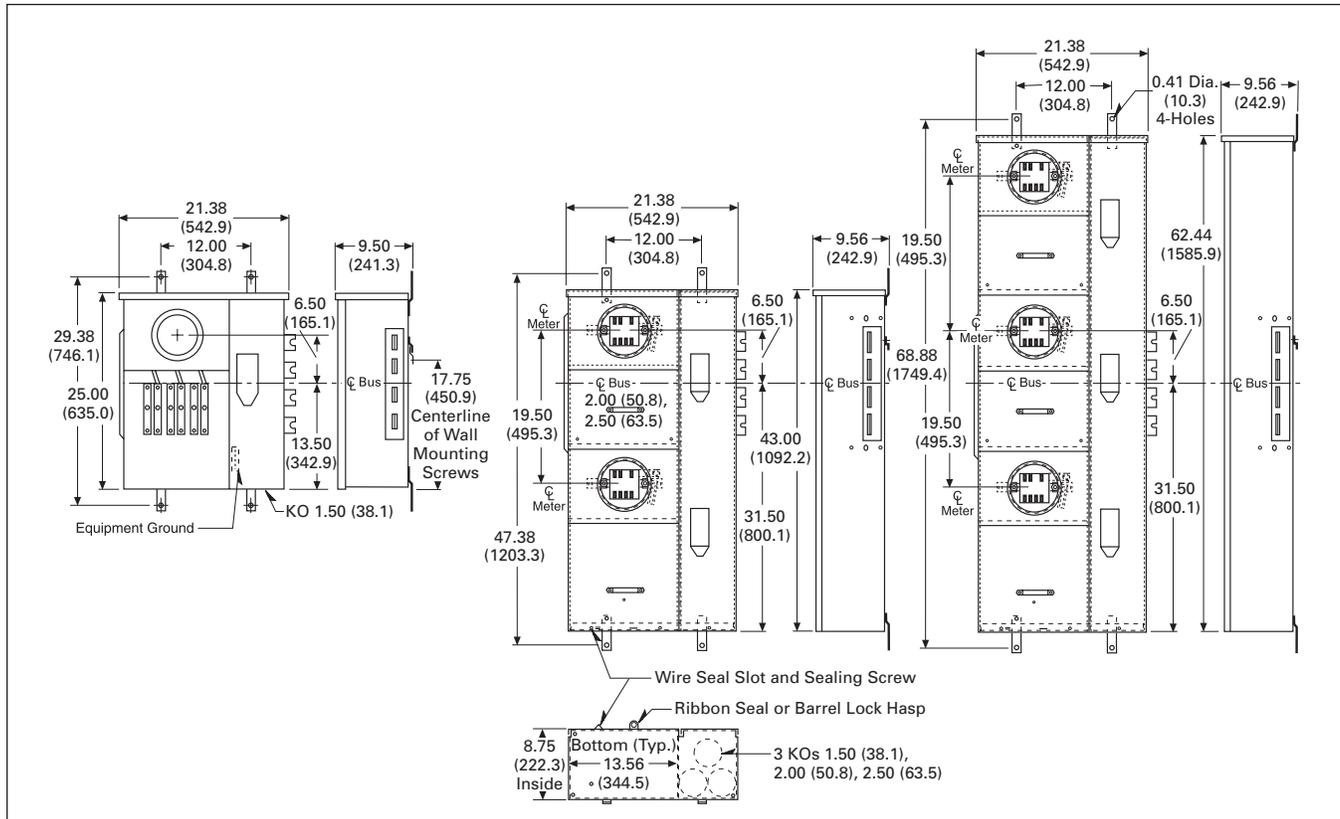


Figure 26.1-11. 35SS and 37SS, 225 A Meter Sockets

Table 26.1-30. Accessories for 1MP, 1MM and 3MM Modular Metering Stacks

Description	Application	Catalog Number
Fifth Jaw Kit	Bolted onto neutral in the 3, 6, or 9 o'clock position. Typically used on network metering systems (3-phase in/single-phase out) or when specified by utility company.	1MM5JK
Isolated Fifth Jaw Kit	Connects to the neutral with an insulated wire.	1MM5JKOP
Manual Bypass Kit (Ring style socket only)	For use with 125 ampere sockets only. (Not top socket.)	1MMBPM125
	For use with 200 ampere sockets only. (Not top socket.)	1MMBPM200
	This kit only to be used for top position of 2 and 3 high 125 ampere 1MM and 3MM stacks and of 2, 3, 5 and 6-position 125 ampere 1MP packs.	1MMBPM125T
	Top 200 ampere socket.	1MMBPM200T
Horn Bypass	Used only on ringless cover stacks, kits can be installed on 125 ampere or 200 ampere sockets. Note: For 1MP2122RRL use:	1MMBPH WCG8HB ①
Meter Bypass Jumper	Installed on 125 ampere or 200 ampere sockets. Jumpers are plugged into jaws. Order lexan cover plate with bypass jumpers to prevent access to meter socket once energized. (Not UL listed.)	1MMBPJ
Lexan Blank Cover	Circular cover mounted on ring or ringless devices preventing access to meter socket while meter is not in place. Includes 4 plastic tabs which plug into each jaw.	1MMPCP
	Same as 1MMPCP minus the tabs located in the back to plug into jaws. This device to be used while meter bypass jumpers are in place (1MMBPJ).	1MMACP
Blank Meter Socket Cover	Used for 125 ampere stacks. Fits bottom socket only. Kit replaces existing meter cover preventing access to meter socket. Includes hasp for seal.	1MMBC125B
	Used on 200 ampere stacks. Fits bottom socket only. Kit replaces existing meter cover preventing access to meter socket. Includes hasp for seal.	1MMBC200B
Wall Mounting Rail	Rails are 4 feet (1.2 m) in length. Bolted on wall for stacks, packs, and mains to be hung.	1MMWB
Bussed Spacer	Bussed spacer 1200 ampere 4-inch (101.6 mm). Required when stacks are mounted on right-hand side in EUSERC areas. (Copper)	3MMBSK ②
Bus Duct Riser/ Meter Center Connection	Available in 400, 600, 800 ampere Main Fusible units only. Contact Product Line for details.	—

① WCG8HB only applies to meter packs built prior to 1998. Current meter packs use 1MMBPH.

② Must be used when mounting MCB main next to an MTB main or another MCB main device.



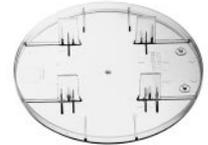
Fifth Jaw Kit



Manual Bypass Kit



Horn Bypass Kit



Lexan Blank Cover



Wall Mounting Rail



Bussed Spacer

Application Data — Accessories

Table 26.1-30. Accessories for 1MP, 1MM and 3MM Modular Metering Stacks (Continued)

Description	Application	Catalog Number
Indoor Corner Elbow (Copper)	12-inch (304.8 mm) indoor corner elbow, 1200 ampere, 3-phase, 4-wire for use with 1MM and 3MM only. Do not use with 35MM, 37MM, 35SS, or 37SS stacks.	3MMEB12
Indoor Corner Elbow (Copper)	16-inch (406.4 mm) indoor corner elbow, 1200 ampere, 3-phase, 4-wire for use with 1MM, 3MM, 35MM, 37MM, 35SS, and 37SS.	3MMEB16
Barrier	Barrier for individual sockets	1MMBK
Meter Jumper and Cover	Combination meter jumper and cover (200 ampere maximum). Used to jumper line and load jaws as well as cover meter socket preventing exposure to current carrying parts.	1MMJCK
Lug Block	125 ampere 2-pole lug block assembly.	BRSF125
Sealing Ring	Standard (included with packs and stacks) ①	1MMSR2
	Stainless steel screw type	1MMSR1
	Stainless steel snap type	1MMSR4
	Aluminum screw type with locking provisions	1MMSR5
Top Endwall	125 ampere, NEMA 1 top end wall with knockouts for 1MM, 3MM meter stacks	MM12N1WLK
	200 ampere, NEMA 1 top end wall for 1MM, 3MM meter stacks	MM20N1WLK

① Aluminum Snap Type.

Table 26.1-31. 1MP, 1MM and 3MM Replacement Parts

Description	Application	Catalog Number
Ringless Cover (Can install this to go from ring to ringless)	Installed on 125 ampere socket for ringless security	1MMRC125
	Installed on 200 ampere socket for ringless security	1MMRC200
	For use with top position of 125 ampere, 2 and 3 position, 1MM and 3MM stacks and 2, 5 and 6 position 1MP packs	1MMRC125T
Ring Cover	Installed on 125 ampere socket for ring security	1MMCP1
	Installed on 200 ampere socket for ring security	1MMCP2
	Top socket ring cover 125 amperes	1MMCP1T
	Top socket ring cover 200 amperes	1MMCP2T
Tenant Breaker Hinged Cover	125 ampere cover	1MMBC1
	200 ampere cover	1MMBC2
Meter Socket ②	125 and 200 amperes	1MMMS

② Meter Packs 1MP2122RRL and 1MP2122RRLB use different meter sockets, see Renewal Parts listing RP.32A.01A.T.E for details.



Indoor Corner Elbow



Standard Sealing Ring



Ringless Cover



Ring Cover



Tenant Breaker Cover



Meter Socket

Table 26.1-32. Accessories for 35MM and 37MM Modular Metering Stacks

Description	Application	Catalog Number
Wall Mounting Rail	Rails are 4 feet (1.2 m) in length. Bolted on wall for stacks, packs, and mains to be hung.	1MMWB
Indoor Corner Elbow (Copper)	16-inch (406.4 mm) indoor corner elbow, 1200 ampere, 3-phase, 4-wire for use with 1MM, 3MM, 35MM, 37MM, 35SS, and 37SS.	3MMEB16
Handle Insulator	Each meter block includes a lever bypass. This kit includes the sleeve which slides onto the lever handle.	37MMHC
Barrel Lock Bracket Kit	Needed when using barrel lock security.	37MMBLK
Totalizing Jumper Kit	Used if one socket is to meter two tenant feeds. When ordering jumper kit, should also order a plastic cover plate (1MMPCP + IMMJCK) preventing access to live parts on unused socket.	37MMTJK
EHD Breaker Mounting Kit	Bolt-on breaker provisions are set up to accept CC/CHH breaker styles. If an EHD breaker is needed, each breaker requires one mounting kit.	37MMCBK
Blank Cover Kit	Kit replaces meter cover preventing access to socket.	37MMCK ①
		37MMCKA ②
Barrier	Barrier for individual sockets	37MMBK
3-Phase to Single-Phase Conversion Kit	This kit will convert one 3-phase meter socket (37MM devices) to a single-phase socket. Only needed if phasing A-C or C-B. If single-phase socket is to be phased A-B, kit is not required for field conversion. (Must use 3-phase breaker.)	37MM1CK
Bus Duct Riser/ Meter Center Connection	Available in 400, 600, 800 ampere Main Fusible units and 400, 600, 800, 1000, 1200 main circuit breaker. Contact product line for details.	—
Anti-inversion Clip	This clip should be inserted into upper right hand jaw of a 320 ampere meter socket. The purpose is prevent a 200 ampere meter from being inserted into a 320 ampere meter socket.	37MMINVCLIP

① For all units made 10/2002 and earlier.

② For all units made after 11/2002.

Table 26.1-33. Replacement Parts

Description	Application	Catalog Number
35MM Replacement Meter Socket	To replace meter socket with lever bypass and jaw release.	MSLMSA1
37MM Replacement Meter Socket	To replace meter socket with lever bypass and jaw release.	MSLMSA2
35SS Replacement Meter Socket	To replace meter socket with test bypass disconnect feature	MSTMSA1
37SS Replacement Meter Socket	To replace meter socket with test bypass disconnect feature	MSTMSA2
Meter Cover Assembly	To replace ringless cover over the meter.	MSTMCVR1
Meter Cover Assembly with NJ Latch	To replace ringless cover over the meter. Includes New Jersey latch requirement.	37MMSKNJ
Tenant Breaker Hinged Cover	To replace cover over tenant breakers.	1MMBC2



Barrel Lock Bracket Kit



Totalizing Jumper Kit



EHD Breaker Mounting Kit



Blank Cover Kit



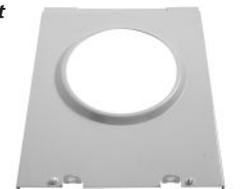
3-Phase to Single-Phase Conversion Kit



35MM Replacement Meter Socket



37SS Replacement Meter Socket



Meter Cover Assembly

Phase Balancing

All 3MM meter modules come factory connected to phase A and B, per Figure A. When connected to a 208Y/120 Vac 3-phase, 4-wire system, field phase balancing of two out of every three stacks is required. One of every three stacks should be phased AC, per Figure B, and one of every three stacks should be phased BC, per Figure C.

Examples:

9 Total Positions — use (3) 3-position stacks and phase one per Figure B (A-C phasing) and one per Figure C (B-C phasing).

16 Total Positions — use (2) 5-position and (2) 3-position stacks. Phase balance (1) 5-position per Figure B (A-C phasing) and (1) 5-position per Figure C (B-C phasing).

19 Total Positions — where 4-position maximum height is allowed by utility. Use (1) 4-position and (5) 3-position stacks per Figure B (A-C phasing) and (2) 3-position stacks per Figure C (B-C phasing).

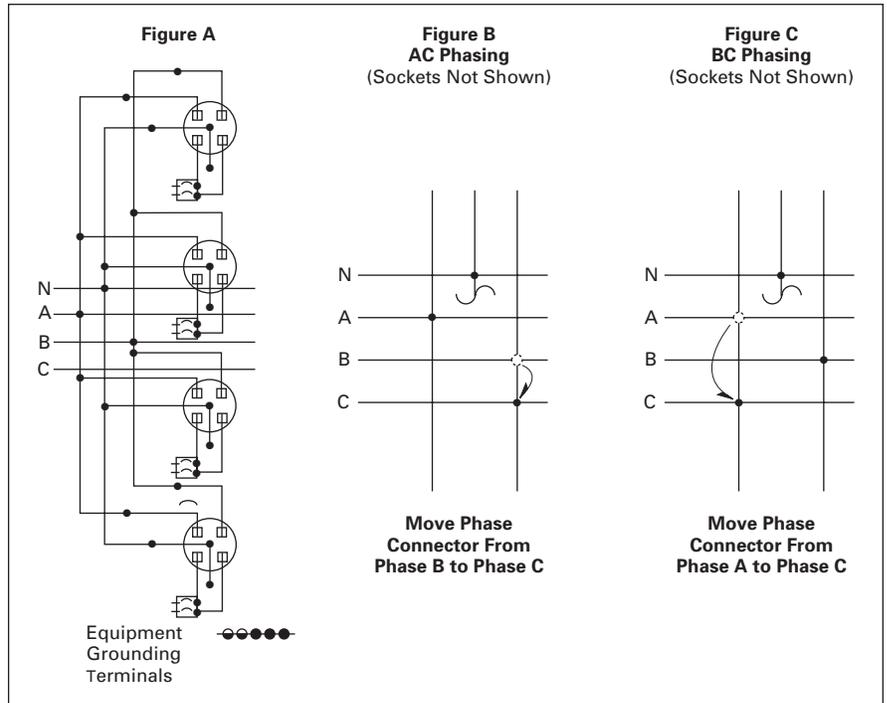


Figure 26.1-13. Phase Balancing

Application Data — Series Combination Short Circuit Ratings

Series Rating Description

When Main Modules and Tenant Breakers are installed in Eaton’s Cutler-Hammer modular metering stack per the table below, the branch breakers installed in Cutler-Hammer downstream panel rated 10,000 AIC or greater are protected to the listed series AIC rating. Refer to the downstream panel marking for the proper series combination short circuit ratings.

Replacement or additional breakers shall be of the same manufacture and type and shall have an interrupting rating equal to or greater than the interrupting rating of any main tenant breaker installed.

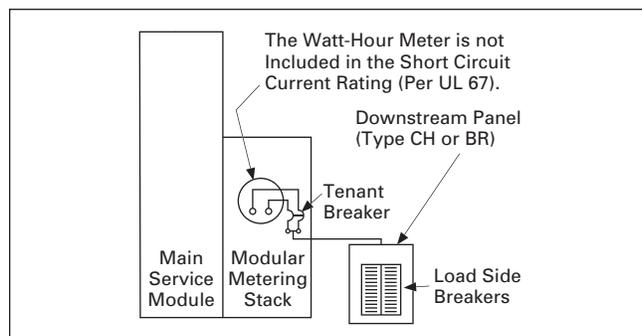


Figure 26.1-14. Series Combination Short Circuit Ratings

Table 26.1-34. Series Combination Short Circuit Ratings — 240 Vac

Main Module Overcurrent Device Breaker Type or Class Fuse	Meter Module Tenant Feeder Breaker Type 1MM, 3MM, 35MM, 37MM, 35SS, 37SS or Loadcenter Main Breaker	Tenant Feeder Breaker Short Circuit Rating	Loadcenter Branch Breaker (1-, 2- or 3-Pole)	System AIC Rating 120/240 Vac Maximum	
None	None	—	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	10,000	
Without Main Disconnect. Cable Tap Box Type 1MTB_, 3MTB_	BR_, CC_, BW_	10,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	10,000	
	BRH_	22,000		22,000	
	BWH_, CHH_H2	25,000		25,000	
	BRHH_, CHH_H4	42,000		42,000	
	CHH_	100,000		100,000	
Main Switch Module Type 1MFS_, 3MFS_ with Class T Fuse, 400 Ampere Maximum	BRH_	22,000	CH, CHT, CH3, CH-GFCI	42,000	
Main Switch Module Type 1MFS_, 3MFS_ with Class T Fuse, 600 Ampere Maximum	BRH_	22,000	BD, BR, BRD, BQ, BQC, GFCB	100,000	
	BRHH_	42,000	CH, CHT, CH3, CH-GFCI	42,000	
Main Switch Module Type 1MFS_, 3MFS_ with Class T Fuse, 800 Ampere Maximum	BR_, CC_, BW_	10,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	10,000	
	BRH_	22,000		22,000	
	BRH_	22,000		BD, BR, BRD, BQ, BQC, GFCB	100,000 ①
	BWH_, CHH_H2	25,000		BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	25,000
	BRHH_, CHH_H4	42,000		BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	42,000
	BRHH_, CHH_H4	42,000		BD, BR, BRD, BQ, BQC, GFCB	100,000 ①
Main Switch Module Type 1MFS_, 3MFS_ with Class T Fuse, 1200 Ampere Maximum	CHH_	100,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	100,000	
	BRHH_	42,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	100,000	
	Main Switch Module Type 1BPS_, 3BPS_ with Class L Fuse, 1200 – 1600 Amperes	BR_, CC_, BW_	10,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	10,000
		BRH_	22,000		22,000
		BWH_, CHH_H2	25,000		25,000
		BRHH_, CHH_H4	42,000		42,000
CHH_		100,000	100,000		
Main Breaker Module Type 1MCB_, 3MCB_ with LC, LD, LSE (600 Ampere Maximum) MC, MA, MDL (800 Ampere Maximum)	BR_, CC_, BW_	10,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	10,000	
	BRH_	22,000		22,000	
	BWH_, CHH_H2	25,000		25,000	
	BRHH_, CHH_H4	42,000		42,000	
Main Breaker Module Type 1MCB_, 3MCB_ with ND 1200 Ampere Maximum	CHH_	100,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	100,000	
	BRHH_	42,000	BD, BR, BRD, BQ, BQC, GFCB	65,000	
Main Breaker Module Type 1MCB_, 3MCB_ with LHE, HLD, LDC (600 Ampere Maximum) HMDL (800 Ampere Maximum) NBY, HND, NDC (1200 Ampere Maximum)	BR_, CC_, BW_	10,000	BD, BR, BRD, BQ, BQC, GFCB, CH, CHT, CH3, CH-GFCI	10,000	
	BRH_	22,000		22,000	
	BWH_, CHH_H2	25,000		25,000	
	BWH_, CHH_H4	42,000		42,000	
	CHH_	100,000		100,000	

① 100,000 with Class T fuse, 600 ampere maximum.

**Series Combination
Short Circuit Rating**

Note: The ratings for both 125 and 200 ampere tenant positions apply to both type BR and CH loadcenters and 10,000 AIC branch breakers.

1MP 125 Ampere Meter Module

This All-in-One Meter Module is UL listed for the short circuit rating at 240 Vac maximum in rms symmetrical amperes per table below.

Table 26.1-35. 1MP 125 Ampere Meter Module

Tenant Breaker Catalog Number 2-Pole	Amperes Maximum	UL Listed Series Short Circuit Rating
BRHH _____	125	42,000 AIC
BRH _____	125	22,000 AIC
BR _____	125	10,000 AIC

When Type BRHH or BRH tenant breakers are installed in this meter module, then Eaton's Cutler-Hammer breakers rated 10,000 AIC or greater installed on the load side of this meter module may be protected for short circuits up to 22,000 AIC with Type BRH breakers or 42,000 AIC with Type BRHH breakers.

See load side breaker panel marking for proper short circuit current rating.

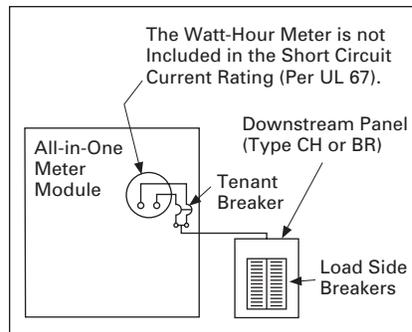


Figure 26.1-15. 1MP 125 Ampere Meter Module

1MP 200 Ampere Meter Module

This All-in-One Meter Module is UL listed for the short circuit rating at 240 Vac maximum in rms symmetrical amperes per table below.

Table 26.1-36. 1MP 200 Ampere Meter Module

Tenant Breaker Catalog Number 2- or 3-Pole	Amperes Maximum	UL Listed Series Short Circuit Rating
CHH _____	200	100,000 AIC
CHH _____ H4	200	42,000 AIC
CHH _____ H2	200	25,000 AIC
CC _____	200	10,000 AIC

When Type CHH tenant breakers are installed in this meter module, then Cutler-Hammer breakers rated 10,000 AIC or greater installed on the load side of this meter module may be protected for short circuits up to 100,000 AIC.

See load side breaker panel marking for proper short circuit current rating.

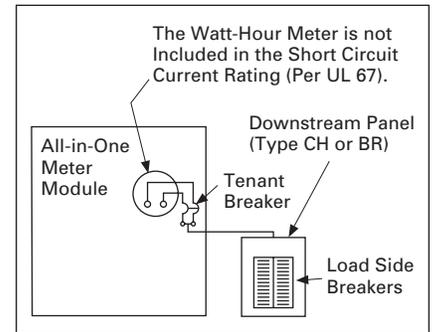


Figure 26.1-16. 1MP 200 Ampere Meter Module

Application Data — Series Combination Short Circuit Ratings

Series Combination Short Circuit Rating

General

When tenant breakers are installed in Eaton's Cutler-Hammer metering modules per the short circuit current ratings below, the branch breakers installed in Cutler-Hammer downstream panel rated 10,000 AIC or greater are protected to the listed series AIC rating. Refer to the downstream panel marking for the proper series combination short circuit ratings. These ratings apply to both loadcenter Types BR and CH.

The short circuit rating is limited to the lowest interrupting rating of any tenant breaker installed or to the lowest marked interrupting rating of the main switch, main breaker, or main lug modules.

Replacement or additional breakers shall be of the same type and manufacturer and shall have an interrupting rating equal to or greater than the interrupting rating of any tenant breaker presently installed in the meter module.

1MM, 3MM 125 Ampere Meter Module

When used with main switch, main breaker, or main lug modules, this meter module is UL listed for the short circuit rating at 240 Vac maximum in rms symmetrical amperes per table below.

Table 26.1-37. 1MM, 3MM 125 Ampere Meter Module

Tenant Breaker Catalog Number 2-Pole	Amperes Maximum	UL Listed Series Short Circuit Rating
BRHH_____	125	42,000 AIC
BRH_____	125	22,000 AIC
BR_____	125	10,000 AIC

When Type BRHH or BRH tenant breakers are installed in this meter module, then Cutler-Hammer breakers rated 10,000 AIC or greater installed on the load side of this meter module may be protected for short circuits up to 22,000 AIC with Type BRH breakers or 42,000 AIC with Type BRHH breakers.

See load side breaker panel marking for proper short circuit current rating.

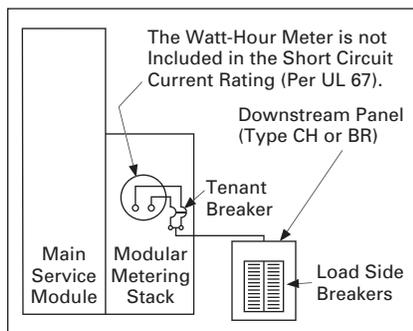


Figure 26.1-17. 1MM, 3MM 125 Ampere Meter Module

1MM, 3MM, 200 Ampere Meter Modules, 35MM, 37MM, 35SS and 37SS 225 Ampere Meter Modules

When used with Main Switch, main breaker, or main lug modules, these meter modules are UL listed for the short circuit rating at 240 Vac maximum in rms symmetrical amperes per table below.

Table 26.1-38. 1MM, 3MM, 200 Ampere Meter Modules, 35MM, 37MM, 35SS and 37SS 225 Ampere Meter Modules

Tenant Breaker Catalog Number 2- or 3-Pole	Amperes Maximum		UL Listed Series Short Circuit Rating
	1MM 3MM 200 A	35MM, 37MM, 35SS, 37SS 225 A	
CHH_____	200	225	100,000 AIC
CHH_____H4	200	225	42,000 AIC
CHH_____H2	200	225	25,000 AIC
CC_____	200	225	10,000 AIC

When Type CHH tenant breakers are installed in these meter modules, then Cutler-Hammer breakers rated 10,000 AIC or greater installed on the load side of these meter modules may be protected for short circuits up to 100,000 AIC.

See load side breaker panel marking for proper short circuit current rating.

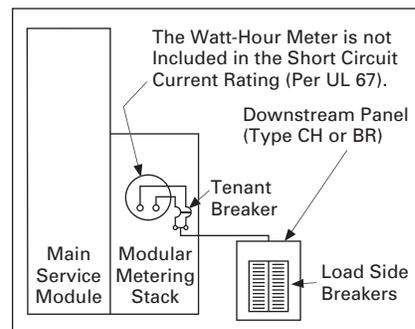


Figure 26.1-18. 1MM, 3MM, 200 Ampere Meter Modules, 35MM, 37MM, 35SS and 37SS 225 Ampere Meter Modules

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General Description

**CH Type Loadcenters
Description**

Loadcenters are enclosures and chassis specifically designed to house the branch circuit breakers and wiring required to distribute power to individual circuits. They contain either a main breaker when used at the service entrance point or a main lug when used as a sub-panel to add circuits to existing service. The main breaker protects the main entire panel and can be used as a service disconnect. The branch breakers protect the wires leading to individual electrical loads such as fixtures and outlets.

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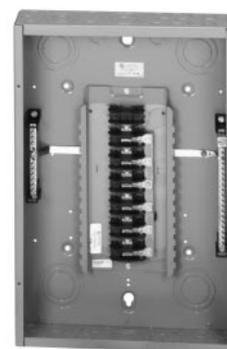
*Single-Phase Main Circuit Breaker —
Top or Bottom Feed — NEMA 1 Enclosure*



Separately Packaged Covers



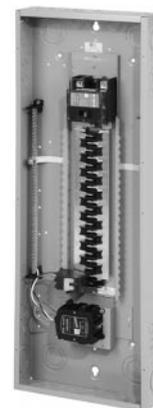
*Three-Phase Main Circuit Breaker —
NEMA 3R Enclosure*



MLO Panel



Cutler-Hammer Type CH Breaker Family



Surge Panel



Cutler-Hammer Type CH Convertible Family



Spa Panel or Ground Fault Protection Kit

General Description

CH Loadcenters Description

Loadcenter Construction

Cutler-Hammer Type CH loadcenters by Eaton Corporation feature silver flash plated copper bus in all interiors. Fingers are rated 200 amperes throughout the CH line. Therefore, the sum of the handle ratings connected to any one stab is limited to 200 amperes maximum. NEMA 1 boxes are manufactured from cold rolled 16 gauge sheet steel. Raintight boxes are manufactured from galvanized steel. All boxes and trims are finished using an electrostatic powder coat, baked urethane paint process.

Neutrals

Cutler-Hammer Type CH loadcenters feature three types of neutrals:

Factory-Bonded Split Neutral

Single-phase main circuit breaker panels are supplied with a factory-bonded twin neutral. When used as a sub-panel, the bonding strap should be removed, and the bonding screw should be reinstalled. The bonded side is now the ground, and the un-bonded side is the neutral. When used as a service entrance panel, the unused neutral holes on either side may be used for terminating ground wires.

Insulated Split Neutral

Most single-phase main lug panels (12 circuits and greater) are supplied with a twin neutral with an insulated cross strap. These panels are shipped in an un-bonded state. For service entrance applications, the neutral must be bonded utilizing the bonding strap supplied with the panel. For sub-feed applications, the panel may be installed as is. Separate ground bars are provided on these panels.

Insulated/Bondable Single Neutral

When a panel is supplied with a single neutral, it arrives from the factory in an "unbonded" state. All that is required to bond the neutral in a service entrance application is to loosen the bonding screw and the neutral screw directly beside it, insert the bonding strap into the neutral bar, and re-tighten both connections. The single neutral can be moved by the contractor to the other side of the panel, if desired. In a service entrance application, where the neutral is bonded, unused neutral connections may be used for the termination of equipment grounds.

Grounds

In service entrance applications where the neutral is bonded, unused neutral holes may be used for terminating ground conductors. In sub-feed panels, the neutral must be isolated (non-bonded), and ground wires must be terminated on a separate ground bar.

The Factory Bonded Split Neutral panels have sufficient terminations for both ground and neutral conductors. The Insulated Split Neutral panels are supplied with a separate factory-installed ground bar. Insulated/Bondable Single Neutral panels are supplied without a ground bar (unless otherwise noted), and ground bar kits if needed must be purchased separately.

Surge Protectors

The CHSURGE Surge Protector has indicating lights that indicate when the units should be replaced. The CHSA01 and CHSA03 Surge Protectors internally short, causing the circuit breaker feeding the surge protector to trip. All but the CHSURGE Surge Protector should be wired to the load side of 15 or 20 ampere feeder circuit breakers mounted adjacent to the main incoming device.

The CHSPULTRA Cutler-Hammer Home Surge Protector is an externally mounted TVSS unit that provides industrial level surge protection in a residential design.

The CHSPULTRA is also available factory installed in the loadcenter and carries a lifetime warranty.

Standards and Certifications

UL Listings

All Cutler-Hammer Type CH loadcenters by are listed under UL File E8741.

Neutral and Ground Terminals

The standard terminals on grounds and neutrals are rated to accept (3) — #14 – #10 Cu/Al or (1) — #14 – 4 wires. For larger cables, add-on neutral lugs may be ordered from the accessories list.

Note: NEC® allows only one current carrying conductor per hole on neutrals unless otherwise noted.

Bottom-Fed Loadcenters

When the power cable is brought into the loadcenter from below the panel; then the main lug panels, and single-phase, 225 amperes and below, loadcenters can be rotated 180 degrees to allow straight-in wiring of power cables to the main terminals. Because the CSR main circuit breaker handle operates horizontally, the orientation of the main circuit breaker handle is consistent with the requirements of NEC® Article 240-81.

Gutter Splicing

Loadcenters are not UL listed as wiring troughs. Therefore, gutter splicing of riser cables to tap off to the main device is not permitted.

Fire Rating

Due to the numerous openings in both loadcenter boxes and trims, they should not be mounted in firewalls. There is no approval method for sealing the enclosures for this application.

General Description

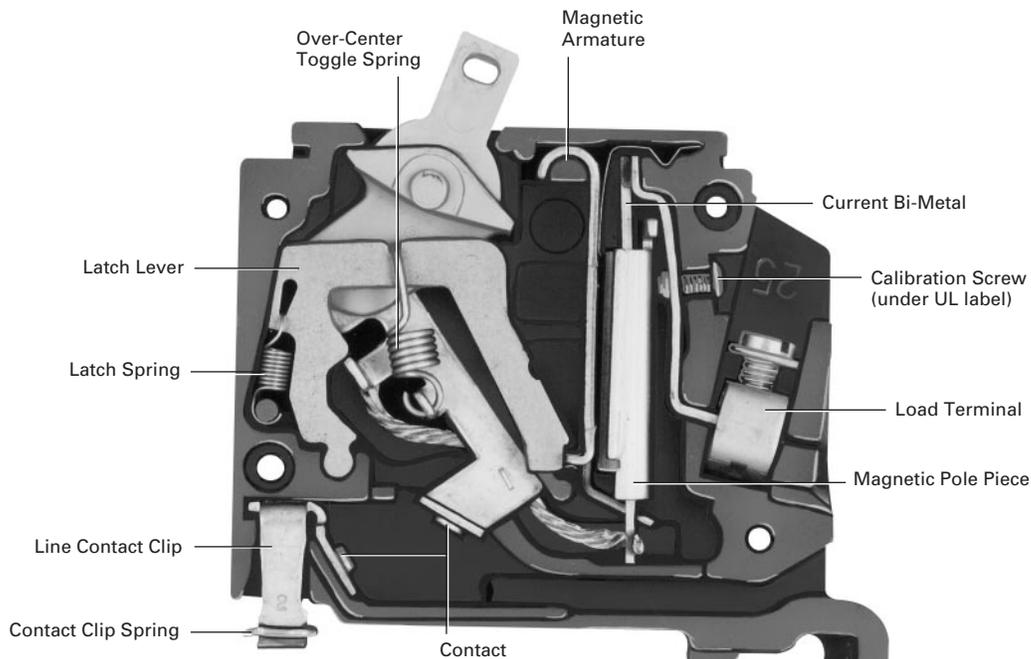
Plug-on Type CH Breakers

Description

Quick-make, quick-break switch mechanism combined with inverse time element tripping operation and trip-free handle design. Type CH circuit breakers trip to the OFF position eliminating nuisance callbacks. The thermal-magnetic trip curve avoids nuisance tripping on mild overloads while reacting almost instantaneously to severe short circuit conditions. Multipole breakers have internal common trip connection to operate all poles simultaneously. Handles are marked with ON-OFF indication and ampere rating of the breaker. Type CH breakers meet UL Standard 489, NEMA standards, and Federal Spec Classification W-C 375 b/Gen. They are UL listed under File Number E11713, E8741, E3624 and E51287; and CSA certified file number LR87196, except Type CHT breakers.

Type CH Circuit Breaker Ratings

Single- and double-pole CH breakers rated 15 and 20 amperes have low instantaneous magnetic trip levels. The 15 and 20 ampere breakers with "HM" suffix have high magnetic trip settings recommended for circuits with inherently high inrush currents. All Type CH breakers are marked for heating, air conditioning and refrigeration (HACR) equipment application. Single-pole 15 – 20 ampere breakers are also suitable for switching duty (SWD). Shunt trip coils operate on 120 Vac and require one additional pole space per breaker.



Plug-on Type CH Breaker

General Description

Type CH Loadcenters Features, Functions and Benefits

Extra 1.5-Inch (38.1 mm) Knockout for Bundling

Provides for easier installation, less installation time.

Top or Bottom Feed

- Straight-in wiring saves labor and material.
- Only one panel for either application — no modifications necessary.

Commercial Grade Main Breaker

- 35 kAIC series rated main breaker in 150 and 200 ampere loadcenters.
- 42 and 100 kAIC series ratings available.

Drywall Marking on Enclosure

Indicates proper mounting depth for flush applications.

One-Piece Silver Flash Plated Copper Bus

Provides superior conductivity throughout the entire product line.

Steel Backpan

- Provides positive, reliable breaker mounting.
- One-piece designed for stability.

Convertible Styles Available

- Uses field installable main breaker or main lug kits.
- Flexible inventory — same breaker is used in loadcenter and circuit breaker enclosures.



“Tangential” Center Knockout
For easier installation

Single Keyhole Mounting
Just one keyhole at top and bottom for easier mounting and leveling.

Unique Sandalwood Finish
Immediately recognizable, esthetically appealing, scratch resistant powder coating.

Separately Packaged Covers

- Full line of “true” surface and combination covers.
- Built-in flush leveling feature.
- Choice of circuit identification by breaker labels or circuit directory.

Neutral Design (For styles as indicated)

- Bonding strap is easily removable for sub-panel applications providing a ground and neutral.
- Factory bonded for service entrance applications providing a split neutral.
- Ample additional 2/0 lugs provided; no kits necessary.
- 200% size neutral.

Improved Endwall Knockouts
Larger KOs are balanced to enhance installed appearance and to ease use of existing wiring.

Type CH Loadcenter

General Description

Type CH Loadcenter — Product Selection

Table 26.2-1. CH Loadcenter Selection Chart

Service	<ul style="list-style-type: none"> Single-phase, three-wire, 120/240 Vac. Three-phase, three-wire, 240 V corner grounded delta. 	<ul style="list-style-type: none"> Three-phase, four-wire, 208Y/120 Vac. Three-phase, three-wire, 240 Vac delta.
Short Circuit Current Rating	<ul style="list-style-type: none"> 10,000 AIC: All single- and three-phase loadcenters 40 through 400 amperes, 2 to 42 circuits except when series ratings are applied. 35,000 AIC: All convertible and factory installed main breakers single-phase loadcenters rated 150 through 225 amperes using Type CSH main breakers. 42,000 and 100,000 are available on some styles: single-phase and three-phase. 	
Main Breaker/Main Lug Loadcenters	Single-Phase <ul style="list-style-type: none"> Main Breaker: 100, 125, 150, 200, 225, 400 amperes. Main Lugs: 40, 70, 125, 150, 200, 225, 400 amperes. 	Three-Phase <ul style="list-style-type: none"> Main Breaker: 150, 200, 225, 300, 400 amperes. Main Lugs: 125, 150, 200, 225, 400 amperes.
Convertible Loadcenters	<ul style="list-style-type: none"> Main Breaker or Main Lugs: single-phase up to 225 amperes 	
Branch Breakers	<ul style="list-style-type: none"> Type CH: 10 to 150 amperes. One-, two-, and three-pole. Selected amperages available in shunt trip, HACR and switching duty. Ground Fault Breakers: 15 to 60 amperes. Type CH-HID: 15 to 30 amperes. One-, two- and three-poles. PMPCI Breakers. CH-HM High Magnetic. CH-M50 High Ambient. 	<ul style="list-style-type: none"> Type CH-AFCI arc fault circuit interrupter. Type CHP: 10 to 125 amperes. One-, two- and three-pole. Three-position commercial trip. Selected amperages available in HACR switching duty. Type CHP-HID: 15 to 30 amperes. One-, two- and three-pole. Type CHP-GFCI: 15 to 30 amperes. One-pole ground fault breakers.
Enclosures	<ul style="list-style-type: none"> NEMA Type 1 indoor. NEMA Type 3R outdoor. 	<ul style="list-style-type: none"> Meets or exceeds UL requirements for indoor or outdoor applications.
Loadcenter and Breaker Accessories	<ul style="list-style-type: none"> Branch Circuit Breaker: Auxiliary components Hold down kits Handle ties Lockoffs Lockdogs Complete Line of Ground Bar Kits 5, 10, 14 and 21 circuits, some with additional #2/0 lugs. Each terminal will accommodate: (3) #14 – #10 Cu/Al or (1) #14 – #4 Cu/Al. Sub-feed Lugs 125, 150 amperes — two- and three-pole. Shunt trips. 	<ul style="list-style-type: none"> Surge Protection: Single-phase whole home surge protector Single-phase plug-on surge protector Single-phase bottle type surge protector Three-phase bottle type surge protector Universal rainproof conduit hubs Group One: 3/4, 1, 1-1/4, 1-1/2, 2 inches (19.1, 25.4, 31.8, 38.1, 50.8 mm). Group Two: 2, 2-1/2, 3 inches (50.8, 63.5, 76.2 mm). Adapter plate.
Bussing	<ul style="list-style-type: none"> Silver Flash Plated Copper Bus is a standard feature. 	

Table 26.2-2. Loadcenters 100 – 225 Amperes and 12 – 42 Circuits Catalog Numbering System

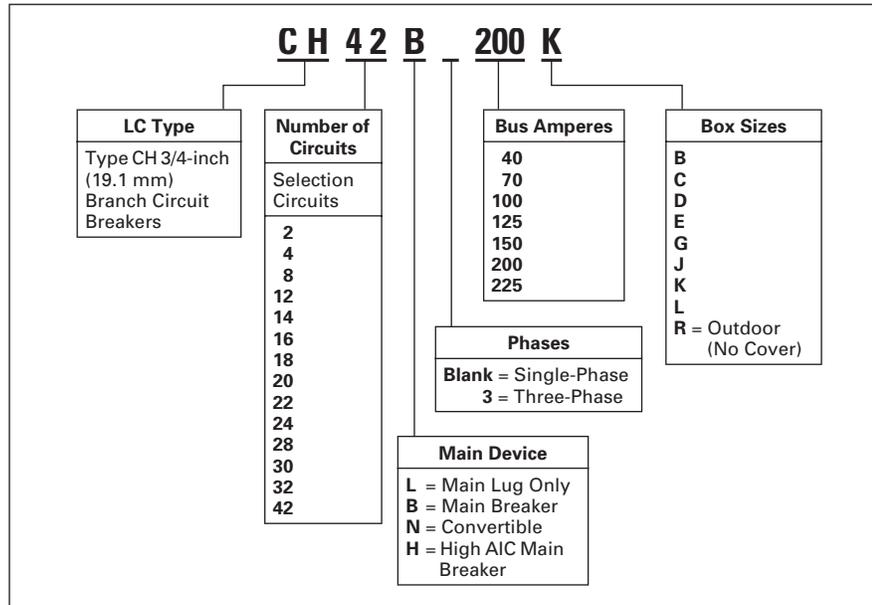
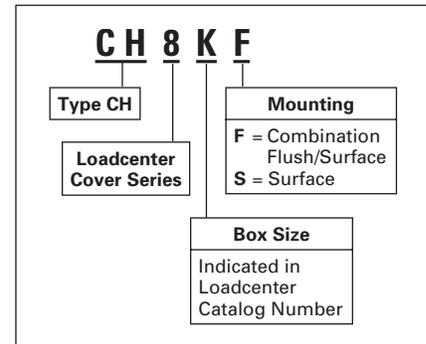


Table 26.2-3. Indoor Covers Ordered Separately



Note: All combinations are not valid, refer to the catalog section.

Technical Data

Single-Phase — Main Lug Loadcenters

Table 26.2-4. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm)		Enclosure Type	Type of Trim (Included)	Box Size	Dimensions in Inches			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number ②
	Space	Poles				Height	Width	Depth		
40	2	4 ①	Indoor	Surface (No Door)	5	9.50	4.50	3.13	#14 – 6	CH2L40SP ③ CH2L40RP ③ CH2L40FP ③
	2	4 ①	Outdoor	—	5R	9.50	4.50	3.13		
	2	4 ①	Indoor	Flush (No Door)	5	9.50	4.50	3.13		
70	2	4 ①	Indoor	Surface (No Door)	5	9.50	4.50	3.13	#14 – 2	CH2L70SP ③ CH2L70RP ③ CH2L70FP ③
	2	4 ①	Outdoor	—	5R	9.50	4.50	3.13		
	2	4 ①	Indoor	Flush (No Door)	5	9.50	4.50	3.13		
125	2	4 ①	Indoor	Surface (No Door)	6	11.38	6.88	3.39	#14 – 1/0	CH2L125SP ③ CH2L125RP ③ CH2L125RSE2P CH2L125FP ③
	2	4 ①	Outdoor	—	6R	11.75	4.50	4.50		
	2	2	Outdoor	—	—	—	—	—		
	2	4 ①	Indoor	Flush (No Door)	6	11.38	6.88	3.39		
	4	8 ①	Indoor	Surface (No Door)	7	13.00	11.00	3.69	#14 – 1/0	CH4L125SP CH4L125RP CH4L125FP
	4	8 ①	Outdoor	—	7R	13.00	11.00	3.69		
	4	8 ①	Indoor	Flush (No Door)	7	13.00	11.00	3.69		
	8	16 ①	Indoor	Surface (No Door)	7	13.00	11.00	3.69	#6 – 1/0	CH8L125SP CH8L125RP CH8L125FP
	8	16 ①	Outdoor	—	7R	13.00	11.00	3.69		
	8	16 ①	Indoor	Flush (No Door)	7	13.00	11.00	3.69		

- ① Requires the use of Type CHNT breakers.
- ② Ground bar kits ordered separately.
 - For 2/4 circuit loadcenters use Type GBK5 or GBK520 ground bar
 - For 4/8 and 8/16 circuit loadcenters use Type GBK10 ground bar
 - Ground bars mount to the left side wall of the enclosure for the 4/8 and 8/16 circuit loadcenters.
- ③ Suitable for use as service equipment when not more than two service disconnecting mains are provided or when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).

Single-Phase — Main Lug Loadcenters

Table 26.2-5. Single-Phase 3-Wire — 120/240 Vac — Twin Neutral — Factory-Installed Ground Bar

Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number	Loadcenter Cover Catalog Number			
				Height	Width	Depth			Combination	Surface		
125	12	Indoor	B	16.75	14.31	3.88	#6 – 2/0	CH12L125B ④	CH8BF	CH8BS		
	12	Outdoor	B	16.75	14.31	5.19		CH12L125R ④⑤	—	—		
	16	Indoor	B	16.75	14.31	3.88		CH16L125B ④	CH8BF	CH8BS		
	16	Outdoor	B	16.75	14.31	5.19		CH16L125R ④⑤	—	—		
	20	Indoor	C	21.00	14.31	3.88		CH20L125C ④	CH8CF	CH8CS		
	20	Outdoor	C	21.00	14.31	5.19		CH20L125R ④⑤	—	—		
	24	Indoor	C	21.00	14.31	3.88		CH24L125C ④	CH8CF	CH8CS		
	24	Outdoor	C	21.00	14.31	5.19		CH24L125R ④⑤	—	—		
	150	24	Indoor	D	29.13	14.31		3.88	#4 – 300 kcmil	CH24L150D ④	CH8DF	CH8DS
		24	Outdoor	D	29.13	14.31		5.19		CH24L150R ⑤⑥	—	—
32		Indoor	D	29.13	14.31	3.88	CH32L150D ④	CH8DF		CH8DS		
32		Outdoor	D	29.13	14.31	5.19	CH32L150R ⑤⑥	—		—		
200	12	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH12L200D ④	CH8DF	CH8DS		
	12	Outdoor	D	29.13	14.31	5.19		CH12L200R ⑤⑥	—	—		
	16	Indoor	D	29.13	14.31	3.88		CH16L200D ④	CH8DF	CH8DS		
	16	Outdoor	D	29.13	14.31	5.19		CH16L200R ⑤⑥	—	—		
225	24	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH24L225D ④	CH8DF	CH8DS		
	24	Outdoor	D	29.13	14.31	5.19		CH24L225R ⑤⑥	—	—		
	32	Indoor	D	29.13	14.31	3.88		CH32L225D ④	CH8DF	CH8DS		
	32	Outdoor	D	29.13	14.31	5.19		CH32L225R ⑤⑥	—	—		
	42	Indoor	G	34.13	14.31	3.88		CH42L225G ⑥	CH8GF	CH8GS		
	42	Outdoor	G	34.13	14.31	5.19		CH42L225R ⑤⑥	—	—		
400	42	Indoor	P	54.38	21.00	6.00	(2) 1/0 – 300 kcmil (1) 750 kcmil	CH42PL400 ⑦	CH7PF ⑧	CH7PS		

- ④ Suitable for use as service equipment when not more than six disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ⑤ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ⑥ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and requires hold-down bracket kit catalog number CH125RB.
- ⑦ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and must be a Type CHB. The breaker cannot be a Type CH.
- ⑧ This cover is for flush application only (not combination).

Technical Data

Single-Phase — Main Circuit Breaker Loadcenters

10,000/35,000 Amperes Interrupting Capacity

Table 26.2-6. Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral (Unless Otherwise Noted)

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type ①	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter ②③ Catalog Number	Loadcenter Cover Catalog Number			
					Height	Width	Depth			Combination ④	Surface		
CH 10 kAIC	100	14	Indoor	B	16.75	14.31	3.88	#6 – 1/0	CH14B100B	CH8BF	CH8BS		
		14	Outdoor	B	16.75	14.31	5.19		CH14B100R	—	—		
		18	Indoor	C	21.00	14.31	3.88		CH18B100C	CH8CF	CH8CS		
		18	Outdoor	C	21.00	14.31	5.19		CH18B100R	—	—		
		22	Indoor	C	21.00	14.31	3.88		CH22B100C	CH8CF	CH8CS		
		22	Outdoor	C	21.00	14.31	5.19		CH22B100R	—	—		
	125	30	Indoor	D	29.13	14.31	3.88	#6 – 1/0	CH30B100D	CH8DF	CH8DS		
		30	Outdoor	D	29.13	14.31	5.19		CH30B100R	—	—		
		22	Indoor	C	21.00	14.31	3.88		CH22B125C	CH8CF	CH8CS		
		22	Outdoor	C	21.00	14.31	5.19		CH22B125R	—	—		
		30	Indoor	D	29.13	14.31	3.88		CH30B125D	CH8DF	CH8DS		
		30	Outdoor	D	29.13	14.31	5.19		CH30B125R	—	—		
CSH 35 kAIC ⑤	150	8	Outdoor	E	29.13	14.31	5.19	#2 – 300 kcmil	CH8B150RF	—	—		
		24	Indoor	E	29.13	14.31	3.88		CH24B150E	CH8EF	CH8ES		
		24	Outdoor	E	29.13	14.31	5.19		CH24B150R	—	—		
		32	Indoor	J	34.13	14.31	3.88		CH32B150J	CH8JF	CH8JS		
		32	Outdoor	J	34.13	14.31	5.19		CH32B150R	—	—		
		200	8	Outdoor	E	29.13	14.31		5.19	#2 – 300 kcmil	CH8B200RF	—	—
	24	Indoor	E	29.13	14.31	3.88	CH24B200E	CH8EF	CH8ES				
	24	Outdoor	E	29.13	14.31	5.19	CH24B200R	—	—				
	32	Indoor	J	34.13	14.31	3.88	CH32B200J	CH8JF	CH8JS				
	32	Outdoor	J	34.13	14.31	5.19	CH32B200R	—	—				
	42	Indoor	K	37.00	14.31	3.88	CH42B200K	CH8KF	CH8KS				
	225	42	Outdoor	K	37.00	14.31	5.19	CH42B200R	—	—			
		32	Indoor	J	34.13	14.31	3.88	#2 – 300 kcmil	CH32B225J	CH8JF	CH8JS		
		32	Outdoor	J	34.13	14.31	5.19		CH32B225R	—	—		
		42	Indoor	K	37.00	14.31	3.88		CH42B225K	CH8KF	CH8KS		
		42	Outdoor	K	37.00	14.31	5.19		CH42B225R	—	—		
		DK 10 kAIC	300	42	Indoor	PM	62.63		21.00	6.00	(2) 3/0 – 250 kcmil	CH42PM300	CH7PMF
	400	42	Indoor	PM	62.63	21.00	6.00		(2) 3/0 – 250 kcmil	CH42PM400	CH7PMF	CH7PMS	

① Outdoor units are furnished with hub closure plates.

② All main circuit breaker loadcenters are listed for use as service entrance equipment.

③ Ground bar kits ordered separately.

④ Combination style covers may be used in surface or flush applications.

⑤ CSH Main and Branch Breaker types CH, CHT and CHP results in a 35 kAIC Series Rating.

Single-Phase — High Interrupting Rated Main Circuit Breaker Loadcenters

42,000/100,000 Amperes Interrupting Capacity

Table 26.2-7. Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral (Unless Otherwise Noted)

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type ⑥	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter ⑦⑧ Catalog Number	Loadcenter Cover Catalog Number	
					Height	Width	Depth			Combination ⑨	Surface
CHB4 42 kAIC ⑩	100	20	Indoor	C	21.00	14.31	3.88	#6 – 1/0	CH20H100C	CH8CF	CH8CS
		20	Outdoor	C	21.00	14.31	5.19		CH20H100R	—	—
		28	Indoor	D	29.13	14.31	3.88		CH28H100D	CH8DF	CH8DS
		28	Outdoor	D	29.13	14.31	5.19		CH28H100R	—	—
		CHH 100 kAIC ⑪	150	32	Indoor	L	39.00		14.31	3.88	#2/0 – 300 kcmil
32	Outdoor	L	39.00	14.31	5.19	CH32H150R	—	—			
200	32	Indoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH32H200L	CH8LF	CH8LS	
	32	Outdoor	L	39.00	14.31	5.19		CH32H200R	—	—	
	42	Indoor	L	39.00	14.31	3.88		CH42H200L	CH8LF	CH8LS	
	42	Outdoor	L	39.00	14.31	5.19		CH42H200R	—	—	
	225	42	Indoor	L	39.00	14.31		3.88	#2/0 – 300 kcmil	CH42H225L	CH8LF
42	Outdoor	L	39.00	14.31	5.19	CH42H225R	—	—			

⑥ Outdoor units are furnished with hub closure plates.

⑦ All main circuit breaker loadcenters are listed for use as service entrance equipment.

⑧ Ground bar kits ordered separately.

⑨ Combination style covers may be used in surface or flush applications.

⑩ CHB4 Main and Branch Breaker types CH, CHT and CHP result in a 42 kAIC Series Rating.

⑪ CHH Main and Branch Breaker types CH, CHT and CHP results in a 100 kAIC Series Rating.

Technical Data

3-Phase — Main Lug Loadcenters

Table 26.2-8. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm)		Enclosure Type	Type of Trim Included	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number
	Spaces	Poles				Height	Width	Depth		
125	6	12 ①	Indoor	Surface No Door	7	13.00	11.00	3.69	#14 – 1/0	CH6L3125SP ②③ CH6L3125RP ②③④ CH6L3125FP ②③
	6	12 ①	Outdoor	—	7R	13.00	11.00	3.69		
	6	12 ①	Indoor	Flush No Door	7	13.00	11.00	3.69		

- ① Requires the use of CHNT breakers.
- ② Suitable for use as service equipment when not more than two service disconnecting means are provided or when not more than six service disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ③ Ground bar kits ordered separately.
 - Use GBK10 ground bar
 - Ground bars mount to the left side wall of the enclosure.
- ④ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to Page 26.2-25.

Table 26.2-9. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number	Loadcenter Cover Catalog Number	
				Height	Width	Depth			Combination	Surface
125	12	Indoor	B	16.75	14.31	3.88	#6 – 2/0	CH12L3125B ⑤⑥	CH8BF	CH8BS
	12		B	16.75	14.31	5.19		CH12L3125R ⑤⑥⑦	—	—
	18	Outdoor	C	21.00	14.31	3.88		CH18L3125C ⑤⑥	CH8CF	CH8CS
	18		C	21.00	14.31	5.19		CH18L3125R ⑤⑥⑧	—	—
	24	Indoor	C	21.00	14.31	3.88		CH24L3125C ⑤⑥	CH8CF	CH8CS
	24		C	21.00	14.31	5.19		CH24L3125R ⑤⑥⑧	—	—
150	30	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH30L3150D ⑤⑥	CH8DF	CH8DS
	30		D	29.13	14.31	5.19		CH30L3150R ⑤⑦⑧	—	—
225	24	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH24L3225D ⑤⑥	CH8DF	CH8DS
	24		D	29.13	14.31	5.19		CH24L3225R ⑤⑦⑧	—	—
	30	Outdoor	D	29.13	14.31	3.88		CH30L3225D ⑤⑥	CH8DF	CH8DS
	30		D	29.13	14.31	5.19		CH30L3225R ⑤⑦⑧	—	—
	42	Indoor	G	34.13	14.31	3.88		CH42L3225G ⑧⑨	CH8GF	CH8GS
	42		G	34.13	14.31	5.19		CH42L3225R ⑦⑧⑨	—	—
400	42	Indoor	P	54.38	21.00	6.00	(2) 1/0 – 300 kcmil (1) 750 kcmil	CH424PL400 ⑩⑪	CH7PF ⑫	CH7PS

- ⑤ Ground bar Type GBK14 is installed.
- ⑥ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and requires hold-down bracket kit catalog number Type CH125RB. Suitable for use as service equipment when not more than six service disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ⑦ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ⑧ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and requires hold-down kit catalog number Type CH125RB.
- ⑨ Ground bar Type GBK21 is installed.
- ⑩ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and must be a Type CHB. **The breaker cannot be a Type CH.**
- ⑪ Ground bar kit ordered separately.
- ⑫ This cover is for flush application only (not combination).

Technical Data

3-Phase — Main Circuit Breaker Loadcenters 10,000 Amperes Interrupting Capacity

Table 26.2-10. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter ^{①②} Catalog Number	Loadcenter Cover Catalog Number	
					Height	Width	Depth			Combination	Surface
CC 10 kAIC	150	30 30	Indoor	L	39.00	14.31	3.88	#1 – 4/0	CH30B3150L CH30B3150R ^③	CH8LF —	CH8LS —
			Outdoor	L	39.00	14.31	5.19				
	200	30 30 42 42	Indoor Outdoor Indoor Outdoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH30B3200L CH30B3200R ^③ CH42B3200L CH42B3200R ^③	CH8LF — CH8LF —	CH8LS — CH8LS —
				L	39.00	14.31	5.19				
				L	39.00	14.31	3.88				
				L	39.00	14.31	5.19				
	225	30 30 42 42	Indoor Outdoor Indoor Outdoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH30B3225L CH30B3225R ^③ CH42B3225L CH42B3225R ^③	CH8LF — CH8LF —	CH8LS — CH8LS —
				L	39.00	14.31	5.19				
				L	39.00	14.31	3.88				
				L	39.00	14.31	5.19				
	400	42	Indoor	PM	62.63	21.00	6.00	(2) 3/0 – 350 kcmil	CH424PM400	CH7PMF ^④	CH7PMS

- ① All main circuit breaker loadcenters are listed for use as service entrance equipment.
- ② Ground bar kits ordered separately.
- ③ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ④ This cover for flush application only (not combination).

3-Phase — High Interrupting Rated Main Circuit Breaker Loadcenters — 100,000 Amperes Interrupting Capacity

Table 26.2-11. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter ^{⑤⑥} Catalog Number	Loadcenter Cover Catalog Number	
					Height	Width	Depth			Combination	Surface
CHH 100 kAIC ^⑦	200	30 30 42 42	Indoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH30H3200L CH30H3200R ^⑧ CH42H3200L CH42H3200R ^⑧	CH8LF — CH8LF —	CH8LS — CH8LS —
			Outdoor	L	39.00	14.31	5.19				
			Indoor	L	39.00	14.31	3.88				
			Outdoor	L	39.00	14.31	5.19				
	225	42 42	Indoor Outdoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH42H3225L CH42H3225R ^⑧	CH8LF —	CH8LS —
				L	39.00	14.31	5.19				

- ⑤ All main circuit breaker loadcenters are listed for use as service entrance equipment.
- ⑥ Ground bar kits priced separately.
- ⑦ 100,000 AIC series combination rating is obtained when Types CH and CHP branch breakers are used with CHH main.
- ⑧ Rainproof loadcenters are furnished with hub closure plates.

Convertible Loadcenters MCB or MLO — Base Units and Main Devices
10,000/35,000 Amperes Interrupting Capacity

Complete assembly consists of: Loadcenter, Cover, and either Main Breaker Kit or Main Lug Kit.

Table 26.2-12. Indoor — Single-Phase — 3-Wire — 120/240 V — Factory Bonded Split Neutral — Top or Bottom Feed

Maximum		Box Size	Dimensions			Loadcenter Box and Panel	Loadcenter Cover		Main Lug Kit		Main Breaker Kit		
Main Ampere Rating	Number of Single Poles		Height	Width	Depth		Catalog Number ①②	Combination	Surface	Wire Size	Catalog Number	kAIC Rating	Wire Size
125	22	C	21.00 21.00	14.31 14.31	3.88 3.88	CH22N125C	CH8CF	CH8CS	#10 – 1/0	CHL125N	10	#10 – 1/0	CH2100N ③ CH2125N ③
200	32	J	34.13 34.13 34.13 34.13	14.31 14.31 14.31 14.31	3.88 3.88 3.88 3.88	CH32N200J	CH8JF	CH8JS	#4 – 300 kcmil	CHL225N	25	#2 – 300 kcmil	CSH2125N ④⑤ CSH2150N ④⑤ CSH2175N ④⑤ CSH2200N ④⑤
225	42	K	37.00 37.00 37.00 37.00	14.31 14.31 14.31 14.31	3.88 3.88 3.88 3.88	CH42N225K	CH8KF	CH8KS	#4 – 300 kcmil	CHL225N	25	#2 – 300 kcmil	CSH2125N ④⑤ CSH2150N ④⑤ CSH2175N ④⑤ CSH2200N ④⑤ CSH2225N ④⑤

- ① Panel does not include main. Order main breaker or main lug kit separately.
 - ② Loadcenters are factory bonded for service entrance applications. Remove bonding strap for separate neutral and ground bars for sub-feed applications.
 - ③ Hold down kit included.
 - ④ 35,000 AIC series combination rating is obtained when Types CH, CHT and CHP branch breakers are used with CSR main.
 - ⑤ CSH breakers include line lugs only as standard.
- Note:** Interrupting rating depends on main circuit breaker selected.

Table 26.2-13. Outdoor — Single-Phase — 3-Wire — 120/240 V — Insulated/Bondable Neutral

Maximum		Box Size	Dimensions			Loadcenter Box and Panel	Main Lug Kit		Main Breaker Kit		
Main Ampere Rating	Number of Single Poles		Height	Width	Depth		Catalog Number ⑥	Wire Size	Catalog Number	kAIC Rating	Wire Size
200	8	E	29.13 29.13 29.13 29.13	14.31 14.31 14.31 14.31	5.19 5.19 5.19 5.19	CH8N200RF ⑦⑧	#4 – 300 kcmil	CHL225N	25	#2 – 300 kcmil	CSH2125N CSH2150N CSH2175N CSH2200N
125	2 2	C	21.00 21.00	14.31 14.31	5.19 5.19	CH22N125R ⑦	#10 – 1/0	CHL125N	10	#10 – 1/0	CH2100N ⑨ CH2125N ⑨
200	3 2	J	34.13 34.13 34.13 34.13	14.31 14.31 14.31 14.31	5.19 5.19 5.19 5.19	CH32N200R ⑦	#4 – 300 kcmil	CHL225N	25	#2 – 300 kcmil	CSH2125N ⑩⑪ CSH2150N ⑩⑪ CSH2175N ⑩⑪ CSH2200N ⑩⑪
225	4 2	K	37.00 37.00 37.00 37.00	14.31 14.31 14.31 14.31	5.19 5.19 5.19 5.19	CH42N225R ⑦	#4 – 300 kcmil	CHL225N	25	#2 – 300 kcmil	CSH2125N ⑩⑪ CSH2150N ⑩⑪ CSH2175N ⑩⑪ CSH2200N ⑩⑪ CSH2225N ⑩⑪

- ⑥ Panel does not include main. Order main breaker or main lug kit separately.
- ⑦ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ⑧ Includes feed-through lugs for both phase and neutral conductors.
- ⑨ Hold down kit included.
- ⑩ 35,000 AIC series combination rating is obtained when Types CH, CHT and CHP branch breakers are used with CSR main.
- ⑪ CSH breakers include line lugs only as standard.

Spa Panels

Table 26.2-14. Spa Panels Single-Phase 3-Wire — 120/240 Vac Insulated/Bondable Neutral — Factory Installed Ground Bar

Main Ampere Rating	Circuit Breaker Included	Enclosure Type	Type of Trim Included	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Catalog Number
					H	W	D		
30	CH230GF	Outdoor	—	5R	9.50	4.50	3.13	#14 – 1/0	CH30SPA ⑫
40	CH240GF	Outdoor	—	5R	9.50	4.50	3.13	#14 – 1/0	CH40SPA ⑬
50	CH250GF	Outdoor	—	5R	9.50	4.50	3.13	#14 – 1/0	CH50SPA ⑭
60	CH260GF	Outdoor	—	5R	9.50	4.50	3.13	#14 – 1/0	CH60SPA ⑮

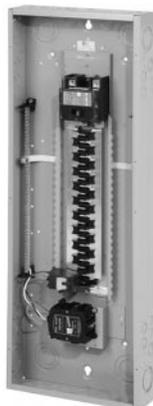
- ⑫ Includes a CH230GFI breaker, factory installed, and 2 extra circuits for convenience.
- ⑬ Includes a CH240GFI breaker, factory installed, and 2 extra circuits for convenience.
- ⑭ Includes a CH250GFI breaker, factory installed, and 2 extra circuits for convenience.
- ⑮ Includes a CH260GFI breaker, factory installed, and 2 extra circuits for convenience.



CH Spa Panel

Technical Data

Type CH Surge Loadcenters



Surge Panel

The Type CH Surge Loadcenter includes a factory-mounted and wired surge suppressor device. There is a knockout in the cover which allows the user to view the status indication lights on the surge suppressor. The CH Surge Loadcenter reduces the surge current, helping protect sensitive home electronic equipment.

Ratings

- Loadcenter
 - 35 kAIC main breaker, main lug only, and convertible main breaker/main lug
 - Factory installed or provision for field installed surge suppressor
 - Top or bottom feed
- Surge Suppressor (CHSPULTRA)
 - Total joules: 3,500 joules
 - Maximum surge current: 175,000 amperes
 - Per phase (L-N/L-G) Surge Current: 75,000 amperes
 - Warranty: Lifetime
 - Connected equipment warranty: \$75,000

Table 26.2-15. Single-Phase Main Circuit Breaker Loadcenters with Factory-Installed Surge Suppression — Indoor Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral

Main Breaker Type	Maximum Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Single Poles	Box Size	Dimensions			Wire Range Size	Loadcenter Catalog Number	Loadcenter Cover	
				Height	Width	Depth			Combination ①	Surface
									Catalog Number	Catalog Number
CSH 35 kAIC	100	24	E	29.13	14.31	3.88	#6 – 4/0	CHSUR24B100E CHSUR32B100K	CHSUR8EF CHSUR8KF	CHSUR8ES CHSUR8KS
		32	K	37.00	14.31	3.88				
	150 200 200	32	K	37.00	14.31	3.88	#2 – 300 kcmil	CHSUR32B150K CHSUR32B200K CHSUR42B200L2	CHSUR8KF CHSUR8KF CHSUR8LF	CHSUR8KS CHSUR8KS CHSUR8LS
		32	K	37.00	14.31	3.88				
	42	L	39.00	14.31	3.88					

① Combination style covers may be used for surface or flushmount applications.

Table 26.2-16. Single-Phase Main Lug Loadcenters with Factory-Installed Surge Suppression — Indoor Single-Phase 3-Wire — 120/240 Vac — Twin Neutral — Factory-Installed Ground Bar

Maximum Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Single Poles	Box Size	Dimensions			Wire Range Size	Loadcenter Catalog Number	Loadcenter Cover		
			Height	Width	Depth			Combination ②	Surface	
									Catalog Number	Catalog Number
125	24	E	29.13	14.31	3.88	#6 – 2/0	CHSUR24L125E	CHSUR8EF	CHSUR8ES	
225	32	K	37.00	14.31	3.88	#2 – 300 kcmil	CHSUR32L225K CHSUR42L225L2	CHSUR8KF CHSUR8LF	CHSUR8KS CHSUR8LS	
	42	L	39.00	14.31	3.88					

② Combination style covers may be used for surface or flushmount applications.

Table 26.2-17. Single-Phase Convertible Loadcenters with Factory-Installed Surge Suppression — Indoor (order main breaker kit separately) Single-Phase 3-Wire — 120/240 Vac — Twin Neutral — Factory-Installed Ground Bar

Maximum Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Single Poles	Box Size	Dimensions			Wire Range Size	Loadcenter Catalog Number	Loadcenter Cover		
			Height	Width	Depth			Combination ③	Surface	
									Catalog Number	Catalog Number
225	32	K	37.00	14.31	3.88	#2 – 300 kcmil	CHSUR32N225K CHSUR42N225L	CHSUR8KF CHSUR8LF	CHSUR8KS CHSUR8LS	
	42	L	39.00	14.31	3.88					

③ Combination style covers may be used for surface or flushmount applications.

Type CH Surge Loadcenters (Continued)

Table 26.2-18. Single-Phase Main Circuit Breaker Loadcenters with Field Installation Provision for Surge Suppression — Indoor Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral

Main Breaker Type	Maximum Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Single Poles	Box Size	Dimensions			Wire Range Size	Loadcenter Catalog Number	Loadcenter Cover	
				Height	Width	Depth			Combination ①	Surface
								Catalog Number	Catalog Number	Catalog Number
CSH 35 kAIC	100	24	E	29.13	14.31	3.88	#6 – 4/0	CHEC24B100E	CHSUR8EF	CHSUR8ES
		32	K	37.00	14.31	3.88		CHEC32B100K	CHSUR8KF	CHSUR8KS
	150 200 200	32	K	37.00	14.31	3.88	#2 – 300 kcmil	CHEC32B150K	CHSUR8KF	CHSUR8KS
		42	L	37.00	14.31	3.88		CHEC32B200K	CHSUR8KF	CHSUR8KS
							CHEC42B200L	CHSUR8LF	CHSUR8LS	

① Combination style covers may be used for surface or flushmount applications.

Table 26.2-19. Single-Phase Main Lug Loadcenters with Field Installation Provision for Surge Suppression — Indoor Single-Phase 3-Wire — 120/240 Vac — Twin Neutral — Factory Installed Ground Bar

Maximum Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Single Poles	Box Size	Dimensions			Wire Range Size	Loadcenter Catalog Number	Loadcenter Cover	
			Height	Width	Depth			Combination ②	Surface
							Catalog Number	Catalog Number	Catalog Number
125	24	E	29.13	14.31	3.88	#6 – 2/0	CHEC24L125E	CHSUR8EF	CHSUR8ES
225	32 42	K	37.00	14.31	3.88	#2 – 300 kcmil	CHEC32L225K	CHSUR8KF	CHSUR8KS
		L	39.00	14.31	3.88		CHEC42L225L	CHSUR8LF	CHSUR8LS

② Combination style covers may be used for surface or flushmount applications.

Table 26.2-20. Single-Phase Convertible Loadcenters with Field Installation Provision for Surge Suppression — Indoor Single-Phase 3-Wire — 120/240 Vac — Twin Neutral — Factory Installed Ground Bar

Maximum Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Single Poles	Box Size	Dimensions			Wire Range Size	Loadcenter Catalog Number	Loadcenter Cover	
			Height	Width	Depth			Combination ③	Surface
							Catalog Number	Catalog Number	Catalog Number
225	32 42	K	37.00	14.31	3.88	#2 – 300 kcmil	CHEC32N225K	CHSUR8KF	CHSUR8KS
		L	39.00	14.31	3.88		CHEC42N225L	CHSUR8LF	CHSUR8LS

③ Combination style covers may be used for surface or flushmount applications.

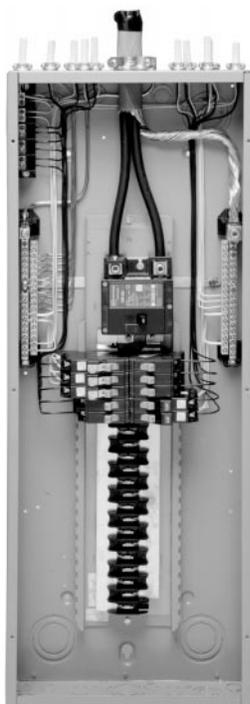
Table 26.2-21. Main Breaker Kits

Maximum Main Ampere Rating	Catalog Number
100	CSH2100N
150	CSH2150N
200	CSH2200N
225	CSH2225N

Table 26.2-22. Main Lug Kits

Maximum Main Ampere Rating	Catalog Number
125	CHL125N
225	CHL225N

Type CH Renovation Loadcenter



Renovation Panel

Product Description

The Cutler-Hammer Renovation Loadcenter by Eaton Corporation is designed for the service contractor. With the addition of a 5-circuit terminal block factory mounted in the top left corner of the loadcenter, the service contractor can terminate short circuit wires instead of having to use expensive wire nuts. Also, the Renovation Loadcenter incorporates a twin stacked neutral design that places the neutral and ground terminations higher in the loadcenter. Both of these features were added without increasing any size from a standard loadcenter. These features will eliminate the need for wire nuts and make for a much neater installation. There is a provision to field mount a second 5-circuit terminal block (RN5TB) in the top right corner of the loadcenter. Choose amongst Cutler-Hammer Type CH breaker family for use in the Renovation Panel.

Single-Phase — Main Circuit Breaker Loadcenters 35,000 Amperes Interrupting Capacity^②

Table 26.2-23. Single-Phase, 3-Wire — 120/240 Vac — Factory Bonded Stacked Split Neutral

Main Breaker Type	Main Ampere Rating	Max. Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60 or 70°C for Main Breakers	Loadcenter Catalog Number	Cover Catalog Number ^①	
					H	W	D			Combination	Surface
CH	100	20	Indoor	C	21.00	14.31	3.88	#6 – 1/0	CH22B100CRN	CH8CFF	CH8CS
CSH	150	32	Indoor	J	34.13	14.31	3.88	#2 – 300 kcmil	CH32B150JRN	CH8JF	CH8JS
CSH	200	32	Indoor	J	34.13	14.31	3.88	#2 – 300 kcmil	CH32B200JRN	CH8JF	CH8JS
CSH	200	42	Indoor	K	37.00	14.31	3.88	#2 – 300 kcmil	CH42B200KRN	CH8KF	CH8KS

① Combination style covers may be used in surface or flush applications.

② 100 ampere main breaker is rated 10 kAIC.

Note: All main circuit breaker loadcenters are listed for use as service entrance equipment. Loadcenters are factory bonded for service entrance applications. Remove bonding strap for separate neutral and ground bars for sub-feed applications.

Table 26.2-24. Renovation Loadcenter Accessories

Description	Catalog Number
5-Circuit Terminal Block Kit Ground Bar Kits	RN5TB (See Table 26.2-25)

Table 26.2-25. Ground Bar Kits

Description (See Legend)	Length Inches (mm)	Ordering Quantity ^③	Catalog Number
●○○○○●	2.54 (64.5)	1	GBK5 ^④
●○○○○●■	3.59 (91.2)	1	GBK520 ^④
●○○○○●○○○○○	4.29 (109.0)	1	GBK10 ^④
●○○○○●○○○○○■	5.34 (135.6)	1	GBK1020 ^④
●○○○○●○○○○○●○○○○○	4.61 (117.1)	1	GBK13 ^④
●○○○○●○○○○○●○○○○○	5.69 (144.5)	1	GBK14 ^④
●○○○○●○○○○○●○○○○○■	6.74 (171.2)	1	GBK1420 ^④
●○○○○●○○○○○●○○○○○●○○○○○	8.14 (206.8)	1	GBK21 ^④
●○○○○●○○○○○●○○○○○●○○○○○■	9.19 (233.4)	1	GBK2120 ^④
■○○○○■○○○○■○○○○■○○○○■	5.78 (146.8)	1	BRGBK39512 ^{⑤⑥}
○○○○	1.84 (46.7)	1	GB4NM ^⑦

③ Must be purchased in multiples of ordering quantities indicated.

④ Distance between mounting holes is 1.75 inches (44.5 mm).

⑤ For single- and 3-phase 400 and 600 ampere applications.

⑥ Distance between mounting holes is 2.34 inches (59.5 mm).

⑦ For non-metallic enclosures. Snaps into molded base.

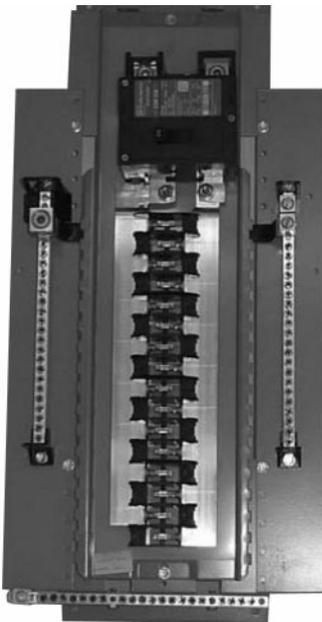
Ground Bar Legend

- (3) #14 – #10 Cu/Al or (1) #14 – #4 Cu/Al
- (1) #6 – 2/0 Cu/Al
- ▣ (1) #14 – #6 Cu/Al or (2) #14 – #12 Cu/Al
- ▢ (1) 1/8 – 14 or (3) #10 – 12 Cu/Al
- (1) #14 – 1/0 Cu/Al or (3) #14 – #10 Cu/Al
- (1) #6 – 14 Cu/Al or (2) #1/0 – 14 Cu/Al
- Mounting Hole

Type CH Retrofit Interior Kits



Retrofit Loadcenter



Interior Chassis

Product Description

Replacing existing loadcenters and panelboards can be a time consuming and expensive job. CH retrofit kits can be the solution to save time and money. The kit consists of a standard trim to fit the interior, a picture frame trim to fit the existing box, and a field adjustable interior assembly which includes neutral and ground bars as well. These are especially applicable when the existing box is flush mounted in drywall, plaster or block wall. The existing box, and many times existing wiring, can remain. Interiors are UL recognized under UL 67, Panelboard standard.

Detailed Product Guide

All standard retrofit kits are suitable for a range of existing box sizes:

- Box width ranging from 14.50 to 22.00 inches (368.3 to 558.8 mm).
- Box depth ranging from 4.25 inches (108.0 mm) for CH to 6.00 inches (152.4 mm).
- Box height ranging from 21.00 to 45.00 inches (533.4 to 1143.0 mm).

For box dimensions outside of these ranges, contact Eaton. Be sure to provide the existing incoming line wire size.

To select the retrofit kit:

1. From the existing box size determine which retrofit groups are suitable (may be more than one).
2. Use type of interior, number of phases, and type of main to find the selection chart.
3. Select part number from chart (if main breaker, replace XXX with specific amp rating).
4. Note that the overlap of the existing wall is the retro cover size minus the existing box size. If specific measurements are needed, communicate that you need a custom trim size.
5. Contact Eaton for pricing, lead-times, and order entry instructions.

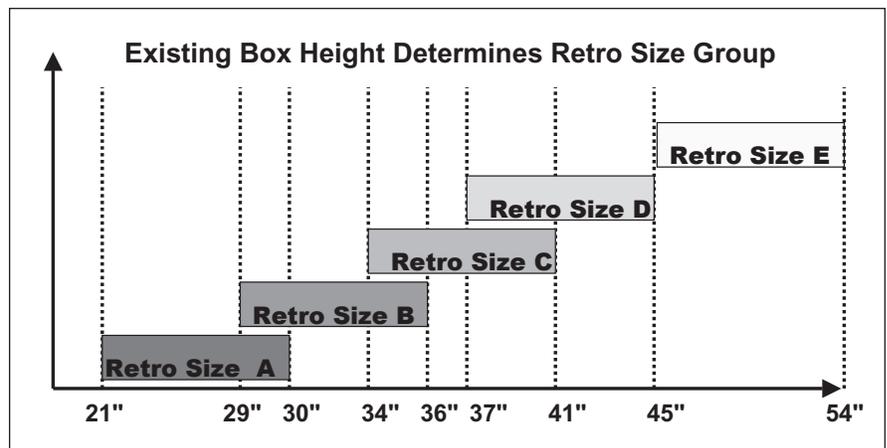


Figure 26.2-1. Retro Size Groups

Technical Data

Selection Tables — Retrofit Interiors

Table 26.2-26. Type CH Interior — Dimensions in Inches (mm)

Main Breaker Rating		Existing Box Height		Wire Size	Number of Circuits	Part Number	Retro Size Group	Retro Cover Size ①	
Amperes	kAIC	Minimum	Maximum					Height	Width
Single-Phase with Main Breaker									
60 – 125	10	21.00 (533.4)	30.00 (762.0)	#2 – 1/0	22	RACH22BXXX ②	A	33.00 (838.2)	24.00 (609.6)
60 – 125	10	29.00 (736.6)	36.00 (914.4)	#2 – 1/0	30	RBCH30BXXX ②	B	40.00 (1016.0)	24.00 (609.6)
100 – 200	25	29.00 (736.6) 30.50 (774.7)	30.00 (762.0) 36.00 (914.4)	#2 – 250 kcmil #2 – 300 kcmil	24	RBCH24BXXX ②			
100 – 225	25	34.00 (863.6)	41.00 (1041.4)	#2 – 300 kcmil	32	RCCH32BXXX ②	C	43.00 (1092.2)	24.00 (609.6)
100 – 225	25 100	37.00 (939.8)	45.00 (1143.0)	#2 – 300 kcmil #4 – 300 kcmil	42	RDCH42BXXX ② RDCH42HXXX ②	D	47.00 (1193.8)	24.00 (609.6)
Three-Phase with Main Breaker									
60 – 125	10	21.00 (533.4)	30.00 (762.0)	#2 – 1/0	18	RACH18B3XXX ②	A	33.00 (838.2)	24.00 (609.6)
100 – 225	10	37.00 (939.8)	45.00 (1143.0)	#2/0 – 300 kcmil	42	RDCH42B3XXX ②	D	47.00 (1193.8)	24.00 (609.6)
	100	37.00 (939.8) 39.00 (990.6)	38.50 (977.9) 45.00 (1143.0)	#2/0 – 250 kcmil #2/0 – 300 kcmil		RDCH42H3XXX ②			

① Specific cover sizes are available. Be sure to specify the custom cover option and provide exact dimensions required.

② XXX is for Main Breaker specific ampere rating.

Table 26.2-27. Type CH Interior — Dimensions in Inches (mm)

Maximum Bus Ampere Rating	Existing Box Height		Wire Size	Number of Circuits	Part Number	Retro Size Group	Retro Cover Size ③	
	Minimum	Maximum					Height	Width
Single-Phase Main Lug Only								
125	21.00 (533.4)	30.00 (762.0)	#4 – 2/0	24	RACH24L125	A	33.00 (838.2)	24.00 (609.6)
125	25.00 (635.0) 26.50 (673.1)	30.00 (762.0) 30.00 (762.0)	#4 – 1	42	RBCH42L125	B	40.00 (1016.0)	24.00 (609.6)
	225	29.00 (736.6)	36.00 (914.4)	#4 – 1/0	32			
225	28.50 (723.9)	36.00 (914.4)	#1 – 300 kcmil	42	RBCH42L225	C	43.00 (1092.2)	24.00 (609.6)
225	34.00 (863.6)	41.00 (1041.4)	#4 – 4/0	42	RCCH42L225			
225	37.00 (939.8)	45.00 (1143.0)	#1 – 300 kcmil	42	RDCH42L225	D	47.00 (1193.8)	24.00 (609.6)
Single-Phase with Sub-Feed Lugs								
225	29.00 (736.6)	31.00 (787.4)	#1 – 300 kcmil	24	RBCH24D225	B	40.00 (1016.0)	24.00 (609.6)
225	31.00 (787.4) 34.00 (863.6)	33.50 (850.9) 36.00 (914.4)	#1 – 300 kcmil #1 – 300 kcmil	30	RBCH30D225			
225	34.00 (863.6)	41.00 (1041.4)	#4 – 4/0	32	RCCH32D225	C	43.00 (1092.2)	24.00 (609.6)
225	37.00 (939.8)	45.00 (1143.0)	#1 – 300 kcmil	42	RDCH42D225	D	47.00 (1193.8)	24.00 (609.6)
Three-Phase Main Lug Only								
125	21.00 (533.4)	30.00 (762.0)	#6 – 2/0	24	RACH24L3125	A	33.00 (838.2)	24.00 (609.6)
125	22.00 (558.8)	30.00 (762.0)	#4 – #1	30	RACH30L3125			
150	22.50 (571.5)	30.00 (762.0)	#4 – 1/0	30	RACH30L3225			
225	24.50 (622.3)	30.00 (762.0)	#4 – 4/0	30	RBCH30L3225	B		
225	29.00 (736.6)	36.00 (914.4)	#4 – 300 kcmil					
125	25.00 (635.0)	28.00 (711.2)	#4 – #1	42	RBCH42L3125	C	43.00 (1092.2)	24.00 (609.6)
225	28.50 (723.9)	36.00 (914.4)	#4 – 4/0	42	RBCH42L3225			
225	34.00 (863.6)	41.00 (1041.4)	#4 – 300 kcmil	42	RCCH42L3225	D	47.00 (1193.8)	24.00 (609.6)
225	37.00 (939.8)	45.00 (1143.0)	#4 – 300 kcmil	42	RDCH42L3225			
Three-Phase with Sub-Feed Lugs								
225	29.00 (736.6)	36.00 (914.4)	#6 – 300 kcmil	24	RBCH24D3225	B	40.00 (1016.0)	24.00 (609.6)
	225	31.00 (787.4) 34.00 (863.6)	33.50 (850.9) 36.00 (914.4)	#6 – 250 kcmil #6 – 300 kcmil	30			
225	34.00 (863.6)	41.00 (1041.4)	#6 – 300 kcmil	30	RCCH30D3225	C	43.00 (1092.2)	24.00 (609.6)
225	37.00 (939.8)	45.00 (1143.0)	#6 – 300 kcmil	42	RDCH42D3225	D	47.00 (1193.8)	24.00 (609.6)

③ Specific cover sizes are available. Be sure to specify the custom cover option and provide exact dimensions required.

Technical Data

**Plug-on Circuit Breakers,
Type CH 10,000 Amperes
Interrupting Capacity 120 Vac,
120/240 Vac and 240 Vac**



Plug-on Circuit Breakers

Table 26.2-28. Type CH Breakers, 3/4-Inch (19.1 mm) per Pole 120, 120/240 or 240 Vac, 10,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	Catalog Number		
		1-Pole 120/240 Vac Requires One 3/4-Inch (19.1 mm) Space	2-Pole 120/240 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces	3-Pole 240 Vac Common Trip Requires Three 3/4-Inch (19.1 mm) Spaces
				
		10 per Shelf Carton	5 per Shelf Carton	5 per Shelf Carton
		10 kAIC	10 kAIC	10 kAIC
10	(1) #14 – 8 ①	CH110	CH210	CH310
15	(2) #14 – 10 ①②	CH115 ⑦⑧	CH215 ⑧	CH315 ⑧
20	(1) #14 – 6 ③	CH120 ⑦⑧	CH220 ⑧	CH320 ⑧
25		CH125 ⑧	CH225 ⑧	CH325 ⑧
30		CH130 ⑧	CH230 ⑧	CH330 ⑧
35	#14 – 2 ① #14 – 6 ③	CH135 ⑧	CH235 ⑧	CH335 ⑧
40	#10 – 1/0 ④	CH140 ⑧	CH240 ⑧	CH340 ⑧
45	#14 – 2 ⑤	CH145 ⑧	CH245 ⑧	CH345 ⑧
50	#3/0 ⑥	CH150 ⑧	CH250 ⑧	CH350 ⑧
60		CH160 ⑧	CH260 ⑧	CH360 ⑧
70		CH170	CH270	CH370
80		—	CH280	CH3080
90		—	CH290	CH3090
100		—	CH2100	CH3100
110		—	CH2110	—
125		—	CH2125	—
150		—	CH2150 ⑨	—

- ① For 1- and 2-pole breakers.
- ② Solid and stranded wire can be used together.
- ③ For 3-pole breakers.
- ④ 1-pole 60 – 70 amperes, 2-pole 80 – 125 amperes, 3-pole 40 – 100 amperes.
- ⑤ 1-pole 40 – 50 amperes, 2-pole 40 – 70 amperes.
- ⑥ 2-pole 150 amperes.
- ⑦ Switching duty rated.
- ⑧ HACR rated.
- ⑨ CH2150 requires 4-pole spaces and is not suitable for use on 3-phase panels, not CSA® certified.

**Plug-on Arc Fault Circuit Breakers, Type CH
10,000 Amperes Interrupting Capacity 120 Vac and 120/240 Vac**



**Type CH 1-Pole
AFCI Circuit Breaker**

An arc fault circuit interrupter is a device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when the arc fault is detected. As of January 1, 2002, the National Electrical Code (NEC) now requires that all branch circuits that supply 125 volt, single-phase, 15 and 20 ampere receptacle outlets installed in dwelling unit bedrooms shall be protected by an Arc Fault Circuit Interrupter(s).

26

Product Selection

Table 26.2-29. Type CH 3/4-Inch (19.1 mm) wide FIRE-GUARD™ AFCI Circuit Breakers

Poles	Ampere Rating	Configuration	Catalog Number
Single-Pole 10 kAIC	15	AFCI AFCI with GFCI AFCI in Clamshell Package	CH115AF CH115AFGF CH115AFCS
	20	AFCI AFCI with GFCI AFCI in Clamshell Package	CH120AF CH120AFGF CH120AFCS
Double-Pole 10 kAIC ①②	15	AFCI Common Trip AFCI Independent Trip AFCI Common Trip with GFCI	CH215AF CH215AFIT CH215AFGF
	20	AFCI Common Trip AFCI Independent Trip AFCI Common Trip with GFCI	CH220AF CH220AFIT CH220AFGF

① Common trip refers to 2-pole 240 volt load application sourced by 120/240 Vac (see Figure 26.2-4).
② Independent trip refers to 2-pole multi-wire, home run or shared neutral circuits (see Figure 26.2-3 and Figure 26.2-5).

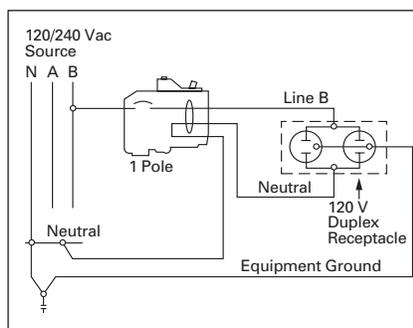


Figure 26.2-2. 1-Pole Single 120 Volt Load Application Sourced by 120/240 Vac

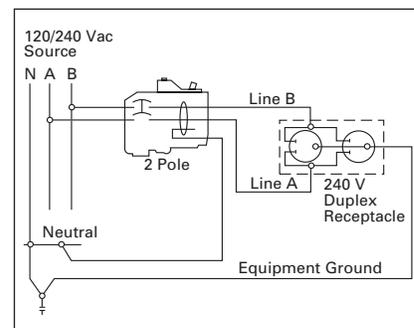


Figure 26.2-4. 2-Pole 240 Volt Load Application Sourced by 120/240 Vac

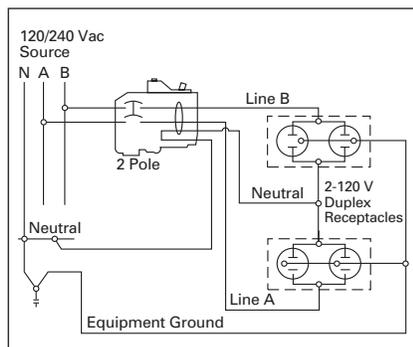


Figure 26.2-3. 1-Pole Shared Neutral with Multi-Duplex Receptacle Application

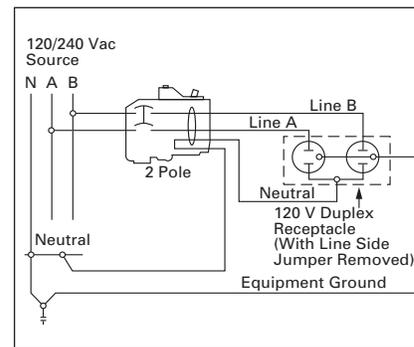


Figure 26.2-5. 2-Pole Shared Neutral with Duplex Receptacle Application

**Plug-on Ground Fault Circuit Breakers, Type CH
10,000 Amperes Interrupting
Capacity 120 Vac and
120/240 Vac**



Type CH 1-Pole

Type CH 2-Pole

Ground Fault Application Notes

Single-pole Type CHGFIs are designed for use in 2-wire, 120 Vac circuits. **Figure 26.2-6** shows a typical wiring configuration.

Two-pole Type CHGFIs are designed for use in 3-wire, 120/240 Vac circuits, 120 Vac multiwire circuits employing common, neutral and 2-wire, 240 Vac circuits obtained from a 120/240 Vac source.

Figure 26.2-7 and **Figure 26.2-8** illustrate typical wiring configurations for 120/240 Vac multiwire circuits.

Figure 26.2-9 depicts a 240 Vac, 2-wire circuit. Note the “panel neutral” conductor connects to the neutral bar, even though the neutral is not included in the load circuit. This connection is necessary to supply a 120 Vac power source to the ground fault sensing circuit.

The figures are shown with a 120/240 Vac, single-phase, 3-wire power source, but are also applicable to a 120/208 Vac, 3-phase, 4-wire power supply. For all figures, the electrical operation of the Type CHGFI is not affected by the equipment ground.

**Table 26.2-30. Type CH Ground Fault Circuit Breakers (5 Milliampere)
3/4-Inch (19.1 mm) per Pole 120 Vac or 120/240 Vac, 10,000 AIC**

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	Catalog Number — 10,000 AIC (1 per Shelf Carton)	
		1-Pole 120 Vac Requires One 3/4-Inch (19.1 mm) Space	2-Pole 120/240 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces
15	#14 – 6 ①	CH115GF	CH215GF
20		CH120GF	CH220GF
25		CH125GF	CH225GF
30		CH130GF	CH230GF
35		—	CH235GF
40		—	CH240GF
45		—	CH245GF
50		—	CH250GF
60		—	CH260GF

① 60 ampere breaker listed for 75°C Cu wire only.

**Table 26.2-31. Type CH Ground Fault Equipment Protectors (30 Milliampere)
3/4-Inch (19.1 mm) per Pole 120 Vac or 120/240 Vac, 10,000 AIC**

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	Catalog Number — 10,000 AIC (1 per Shelf Carton)	
		1-Pole 120 Vac Requires One 3/4-Inch (19.1 mm) Space	2-Pole 120/240 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces
15	#14 – 6 ②	CH115EPD	CH215EPD
20		CH120EPD	CH220EPD
25		CH125EPD	—
30		CH130EPD	CH230EPD
40		—	CH240EPD
50		—	CH250EPD
60		—	CH260EPD

② 60 ampere breaker listed for 75°C Cu wire only.

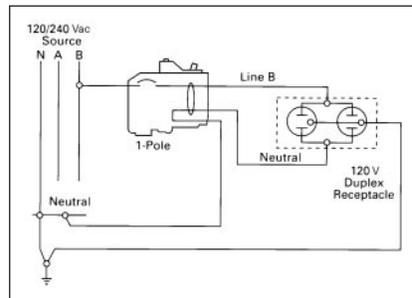


Figure 26.2-6. 1-Pole 120 Volt Duplex Receptacle Application

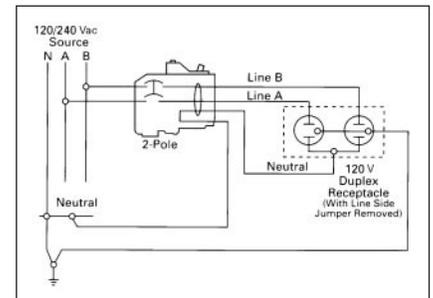


Figure 26.2-8. 2-Pole 120 Volt Duplex Receptacle Application

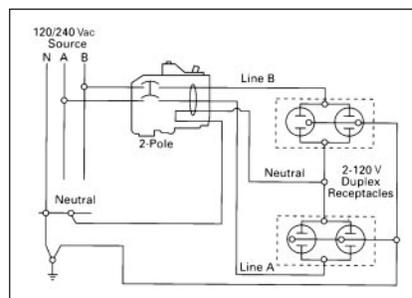


Figure 26.2-7. 2-Pole 120 Volt Multi-Duplex Receptacle Application

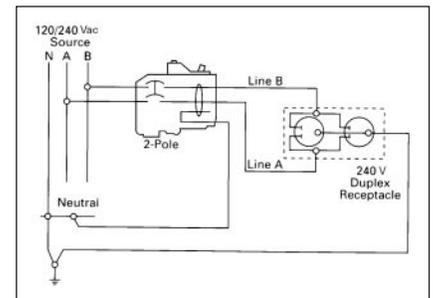


Figure 26.2-9. 2-Pole 240 Volt Duplex Receptacle Application

Technical Data — Special Application Plug-on Circuit Breakers

CH Switching Neutral Breakers — 10,000 Amperes Interrupting Capacity — 120 Vac and 120/240 Vac

Table 26.2-32. Type CH Switching Neutral Breakers, 3/4-Inch (19.1 mm) per Pole 120/240 or 240 Vac, 10,000 AIC

Used to open the neutral along power line(s) for applications of gas pumps.

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	Catalog Number — 10,000 AIC (1 per Shelf Carton)	
		2-Pole 120 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces	3-Pole 120/240 Vac Common Trip Requires Three 3/4-Inch (19.1 mm) Spaces
15	#14 – 8	CH215SW ①	CH315SW ②
20		CH220SW ①	CH320SW ②
30		CH230SW ①	CH330SW ②
40		CH240SW ①	CH340SW ②
50		CH250SW ①	CH350SW ②



CH220SW

① For circuit breakers with shunt trip, add ST suffix. Shunt trip requires one additional pole space.

② Switching duty rated.

CH-HID Circuit Breakers — 10,000 Amperes Interrupting Capacity — 120 Vac, 120/240 and 240 Vac

Table 26.2-33. Type CH-HID Circuit Breakers, 3/4-Inch (19.1 mm) per Pole 120 Vac, 120/240 and 240 Vac, 10,000 AIC

Suitable for use in circuits for fluorescent and High Intensity Discharge lighting. Also suitable for HACR applications.

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°	1-Pole 120/240 Vac	2-Pole 240 Vac	3-Pole 240 Vac
		Requires One 3/4-Inch (19.1 mm) Space	Requires Two 3/4-Inch (19.1 mm) Spaces	Requires Three 3/4-Inch (19.1 mm) Spaces
		10 per Shelf Carton	5 per Shelf Carton	5 per Shelf Carton
		10,000 AIC	10,000 AIC	10,000 AIC
Catalog Number		Catalog Number	Catalog Number	Catalog Number
15	#14 – 8	CH115HID	CH215HID ③	CH315HID
20		CH120HID	CH220HID	CH320HID
30		CH130HID	CH230HID	CH330HID

③ CH215HID is rated for 120/240 volts.

Non-CTL Plug-on Replacement Circuit Breakers, Type CHNT 10,000 Amperes Interrupting Capacity 120/240 Vac

Table 26.2-34. Type CHNT 3/4-Inch (19.1 mm) per Pole 120 Vac, Non-CTL 10,000 AIC
For use as replacement in loadcenters built prior to 1968 and within the current style 2 – 8 circuit loadcenters as indicated in the loadcenter section.

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole
		Requires One 3/4-Inch (19.1 mm) Space
		10 per Shelf Carton
		10,000 AIC
Catalog Number ④⑤		
15 – 15	#14 – 8	CHNT1515
15 – 20		CHNT1520
20 – 20		CHNT2020

④ Switching duty rated.

⑤ HACR rated.

CTL Plug-on Circuit Breakers, Type CHT Twin 10,000 Amperes Interrupting Capacity 120/240 Vac

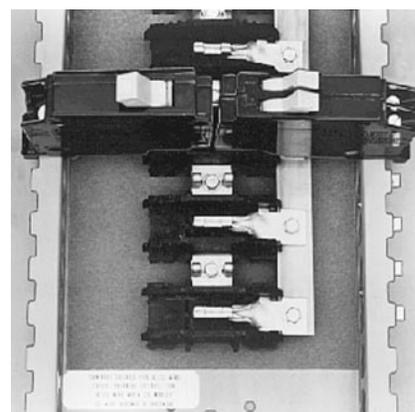
Table 26.2-35. Type CHT Twin (CTL)
3/4-Inch (19.1 mm) per Pole 120 Vac
Class CTL 10,000 AIC

All circuit breakers have rejection feature. Use only with loadcenters marked for use with CHT breakers. See photo to the right.

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole
		Requires One 3/4-Inch (19.1 mm) Space
		10 per Shelf Carton
		10,000 AIC
Catalog Number ⑥⑦		
15 – 15	#14 – 8	CHT1515
15 – 20		CHT1520
20 – 20		CHT2020

⑥ Switching duty rated.

⑦ HACR rated.



Type CH and CHT Circuit Breakers Mounted in Twin Breaker Panel

**CHP Commercial Breakers — 10,000 Amperes Interrupting Capacity
120 Vac, 120/240 Vac and 240 Vac**

Table 26.2-36. Type CHP Breakers, 3/4-Inch (19.1 mm) per Pole 120, 120/240 or 240 Vac, 10,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 Vac	2-Pole 120/240 Vac Common Trip	3-Pole 240 Vac Common Trip
				
		Requires One 3/4-Inch (19.1 mm) Space	Requires Two 3/4-Inch (19.1 mm) Spaces	Requires Three 3/4-Inch (19.1 mm) Spaces
		10 per Shelf Carton	5 per Shelf Carton	5 per Shelf Carton
		10,000 AIC	10,000 AIC	10,000 AIC
		Catalog Number	Catalog Number	Catalog Number
10	(1) #14 – 8 ①	CHP110	CHP210	CHP310
15	(2) #14 – 10 ①②	CHP115 ⑥⑦	CHP215 ⑦	CHP315 ⑦
20	(1) #14 – 6 ③	CHP120 ⑥⑦	CHP220 ⑦	CHP320 ⑦
25		CHP125 ⑦	CHP225 ⑦	CHP325 ⑦
30		CHP130 ⑦	CHP230 ⑦	CHP330 ⑦
35	#14 – 2 ① #14 – 6 ③	CHP135 ⑦	CHP235 ⑦	CHP335 ⑦
40	#10 – 1/0 ④	CHP140 ⑦	CHP240 ⑦	CHP340 ⑦
45	#14 – 2 ⑤	CHP145 ⑦	CHP245 ⑦	CHP345 ⑦
50		CHP150 ⑦	CHP250 ⑦	CHP350 ⑦
60		CHP160 ⑦	CHP260 ⑦	CHP360 ⑦
70		CHP170	CHP270	CHP370
80		—	CHP280	—
90		—	CHP290	—
100		—	CHP2100	CHP3100
110		—	CHP2110	—
125		—	CHP2125	—

- ① For 1- and 2-pole breakers.
- ② Solid and stranded wire can be used together.
- ③ For 3-pole breakers.
- ④ 1-pole 60 – 70 amperes, 2-pole 80 – 125 amperes, 3-pole 40 – 100 amperes.
- ⑤ 1-pole 40 – 50 amperes, 2-pole 40 – 70 amperes.
- ⑥ Switching duty rated.
- ⑦ HACR rated.

Note: CHP Breakers offer on-off and trip positions for commercial applications.

**CHP-GFCI Circuit Breakers — 10,000 Amperes Interrupting Capacity
120 Vac and 120/240 Vac**

Table 26.2-37. Type CHP-GFCI Breakers — 5 Milliampere — 3/4-Inch (19.1 mm) per Pole 120 V and 120/240 Vac, 10,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120 Vac	
		Requires One 3/4-Inch (19.1 mm) Space	
		1 per Individual Carton	
		10,000 AIC	
		Catalog Number	
15	#14 – 6	CHP115GF	
20	#14 – 6	CHP120GF	
30	#14 – 6	CHP130GF	

Note: CHP Breakers offer on-off and trip positions for commercial applications.

Ground Fault Application Notes

Single-pole Type CHPGFI breakers are designed for use in 2-wire, 120 Vac circuits. Figure 26.2-10 shows a typical wiring configuration.

The figure is shown with a 120/240 Vac, single-phase, 3-wire power source, but a 120/208 Vac, 3-phase, 4-wire power supply is also applicable. Electrical operation of the Type CHPGFI is not affected by the equipment ground.

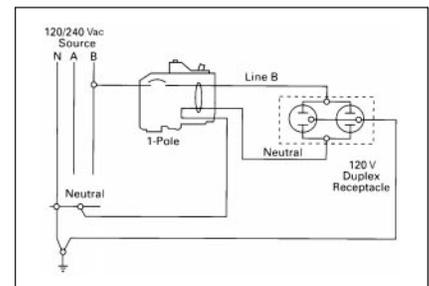


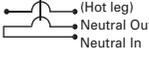
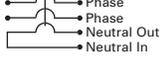
Figure 26.2-10. Typical 1-Pole Wiring Diagram

Technical Data — Special Application Plug-on Circuit Breakers

CHP Neutral Switching Breakers — 10,000 Amperes Interrupting Capacity 120 Vac and 120/240 Vac

Table 26.2-38. Type CHP Neutral Switching Breakers, 3/4-Inch (19.1 mm) per Pole 120 or 120/240 Vac, 10,000 AIC

Used to open the neutral along power line(s) for applications of gas pumps.

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	2-Pole 120 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces		3-Pole 120/240 Vac Common Trip Requires Three 3/4-Inch (19.1 mm) Spaces	
		1 per Shelf Carton	1 per Shelf Carton	10,000 AIC	10,000 AIC
15	#14 – 8	CHP215SW ①		CHP315SW ①②	
20		CHP220SW ①		CHP320SW ①②	

① For circuit breakers with shunt trip, add ST suffix. Shunt trip requires one additional pole space.

② Contact your local Eaton sales office for pricing.

CH-M50 High Ambient Breaker

**Table 26.2-39. Type CH-M50 High Ambient Breakers
3/4-Inch (19.1 mm) per Pole 120 or 120/240 Vac, 10,000 AIC**

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 Vac Requires One 3/4-Inch (19.1 mm) Space		2-Pole 120/240 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces	
		10 per Shelf Carton	5 per Shelf Carton	10,000 AIC	10,000 AIC
15	(1) #14 – 8	CH115M50		CH215M50	
20	(2) #14 – 10	CH120M50		CH220M50	
25		CH125M50		CH225M50	
30		CH130M50		CH230M50	
35		CH135M50		CH235M50	
40		CH140M50		CH240M50	
45		CH145M50		CH245M50	
50		CH150M50		CH250M50	
60		—		CH260M50	
70		—		CH270M50	

CH-HM and CHP-HM High Magnetic Breakers

**Table 26.2-40. Type CH-HM and CHP-HM High Magnetic Breakers
3/4-Inch (19.1 mm) per Pole 120 or 120/240 Vac, 10,000 AIC**

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 Vac Requires One 3/4-Inch (19.1 mm) Space		2-Pole 120/240 Vac Common Trip Requires Two 3/4-Inch (19.1 mm) Spaces	
		10 per Shelf Carton	5 per Shelf Carton	10,000 AIC	10,000 AIC
15	(1) #14 – 8	CH115HM		CH215HM	
20	(2) #14 – 10	CH120HM		CH220HM	
15	(1) #14 – 8	CHP115HM		CHP215HM	
20	(2) #14 – 10	CHP120HM		CHP220HM	

Circuit Breaker Options and Accessories



CH9MB270



CHLO



MCBPL



CHPL



MCBPL (Installed)



CHHT



CHPLGF



CH125RB



CHML

Table 26.2-41. Field Installation Kits and Parts

Description	Ordering Quantity ^①	Catalog Number
Handle Ties ^② Handle tie bar for physically joining the handles of two adjacent 1-pole Type CH Circuit Breakers. (Molded Plastic Handle Cover)	25	CHHT
Handle Lockoffs ^{③④} Padlockable device for locking the handle of 1-, 2- or 3-pole Type CH Circuit Breakers (Escutcheon Mounted) ^⑤ Padlockable device for locking the handle of a 1-, 2- or 3-pole Type CHGFI Circuit Breaker. (Escutcheon Mounted) ^⑤ Padlockable device for locking the handle of main circuit breaker Types CC and CCH into the ON or OFF position. (Screw Mounted) ^⑥ Padlockable device for locking the handle of main breaker Types BW and CSR into the ON or OFF position. (Escutcheon Mounted) ^⑤	1 1 1 1	CHPL CHPLGF CCPL MCBPL
Handle Lockdogs ^{④⑦} Device used to secure handle in ON or OFF position for 1-pole Type CH Circuit Breakers. (Handle Mounted) ^⑧	10	CHLO
Hold-Down Kits ^⑨ Hold-down retainer kit for 1-, 2-, 3-pole Type CH Circuit Breakers. For 6 – 24 circuit 125 ampere single- and 3-phase, 12 – 42 circuit single-phase 225 ampere and 24 – 42 circuit 3-phase 225 ampere MLO Type CH Loadcenters.	1	CH125RB
Hold-Down Kits ^⑨ Hold-down retainer kit for 1-, 2-, 3-pole Type CH Circuit Breakers for 2 – 4 circuit MLO CH Loadcenters.	1	CH125RB24
Mounting Bases Mounting base for 2-pole Type CH Circuit Breaker — 70 ampere maximum.	1	CH9MB270
Main Breaker Lug Kits Types CC and CCH Main Breaker Lug Kit (2) 300 kcmil. Type CSR Main Breaker Lug Kit (2) 300 kcmil.	1 1	CCL300 MCBL300
Mechanical Interlock Type CH for 2-, 3- and 4-pole breakers.	10	CHML

- ① Must be purchased in multiples of ordering quantities indicated.
- ② Handle Ties: Typically used to join two similar independent single-pole breakers to form a 2-pole noncommon trip breaker.
- ③ Handle Lockoffs: Devices that use a padlock to lock the circuit breaker's handle in the ON or OFF position.
- ④ Requires one additional pole space.
- ⑤ Escutcheon Mounted: Device mounted semipermanently to the face of the circuit breaker and secured by the loadcenter dead-front.

- ⑥ Screw Mounted: Device permanently mounted to the face of the circuit breaker by the use of a non-removable screw.
- ⑦ Handle Lockdogs: Devices that are used to secure a circuit breaker's handle in the ON or OFF position. Handle Lockdogs are not padlockable devices.
- ⑧ Handle Mounted: Device mounted above or below handle using spring pressure.
- ⑨ Hold-Down Kits: Devices used to secure the circuit breaker to the loadcenter for back-feed main application. See NEC Article 384-16(g).

Table 26.2-42. Shunt Trip Options

Description		Catalog Number Suffix Adder
Type	Volts	
CSR	12 dc	SR12
CSR	24 dc	SR24
CSR	120 ac	SR01
CH	120 ac	ST ^⑩
CC	12 dc	SR12
CC	24 dc	SR24
CC	120 ac	SR01
CC	208 ac	SR08
CC	240 ac	SR02

^⑩ Requires one additional pole space.

CH Loadcenter Options and Accessories



CHSF2125



CHFP



CHRLS



CHSF3125



BINA



TDL

Table 26.2-43. Field Installation and Parts

Number of Poles	Ampere Rating	Number of 3/4-Inch (19.1 mm) Spaces Needed	Catalog Number
Sub-Feed Lug Blocks			
2	125	2	CHSF2125 CHSF3125
3	125	3	
Neutral/Ground Lug Add-on Neutral or Ground Lug			NL20 NL30 NL300
Filler Plates 3/4-inch (19.1 mm) Space Circuit Breaker Space			CHFP
CSR Main Circuit Breaker Filler Plate (with Hardware)			CSRFP
Door Lock — 12 - 42 Circuits, and 100 - 225 Amperes			TDL
Sandlewood Spray Paint			SPCSW
ANSI-61 Light Gray Touchup Paint for Outdoor Loadcenters			SPC61
Isolated Neutral Assembly (Computer Circuits)			BINA
Circuit Directory — Adhesive Backed			TCD
Cover Screws			LCCS
Cover Replacement Latch 14-5/16 inch (363.55 mm) Wide Loadcenters Only			CHRLS
Circuit Marking Strip (Next to Breakers)			CHMS
Circuit Identification Label (Preprinted Breaker Labels Next to Breakers)			CHBL
Series Rated Caution Label			SRL
Branch Circuit Numbering Strip			CHNS
Bonding Strap with Screw			BSSUSE

CH Loadcenter Options and Accessories (Continued)

Table 26.2-44. Field Installation Rainproof Conduit Hubs

Description	Conduit Size		Catalog Number
	Inches	mm	
Group 1 — For use with 70, 100 and 125 ampere MLO and MCB Loadcenters and Circuit Breaker Enclosures and the following 150 and 200 ampere panels: CH8B150RF, CH8B200RF	.75	19.1	DS075H1
	1.00	25.4	DS100H1
	1.25	31.8	DS125H1
	1.50	38.1	DS150H1
	2.00	50.8	DS200H1
Group 2 — For use with 150, 200 and 225 ampere MLO and MCB Loadcenters and Circuit Breaker Enclosure except for the following 150 and 200 ampere panels: CH8B150RF, CH8B200RF	2.00	50.8	DS200H2
	2.50	63.5	DS250H2
	3.00	76.2	DS300H2
Adapter Kit — Allows Installing a Group 1 Hub on Devices Arranged for Group 2 Hubs	—	—	DS900AP
Group 1 — Small Blank Hub Closure Plate	—	—	DS900CP1
Group 2 — Large Blank Hub Closure Plate	—	—	DS900CP2



DS100H1

① Must be purchased in multiples of ordering quantities indicated.

Table 26.2-45. Ground Bar Kits

Description (See Legend)	Length		Catalog Number
	Inches	mm	
	2.54	64.5	GBK5 ②
	3.59	91.2	GBK520 ②
	4.29	109.0	GBK10 ②
	5.34	135.6	GBK1020 ②
	4.61	117.1	GBK13 ②
	5.69	144.5	GBK14 ②
	6.74	171.2	GBK1420 ②
	8.14	206.8	GBK21 ②
	9.19	233.4	GBK2120 ②
	7.94	201.7	CH9GP21 ③④



GBK14

Ground Bar Legend

- = (3) #14 – #10 Cu/Al or (1) #14 – #4 Cu/Al
- = (1) #6 – 2/0 Cu/Al
- = (1) 1/0 – 14 or (3) #10 – 12 Cu/Al
- ◐ = (1) #14 – 1/0 Cu/Al or (3) #14 – #10 Cu/Al
- = Mounting Hole

② Distance between mounting holes is 1-3/4 inches (44.5 mm).

③ For single- and 3-phase 400 ampere loadcenters.

④ Distance between mounting holes is 2-13/32 inches.

Table 26.2-46. Grounded “B” Phase Adapters

Maximum Amperes	3-Phase Loadcenter Types of Panels	Kit Catalog Number ⑤
125	12 – 32 Circuit Main Lug	CHGRD1
225	Main Lug and CHH Main Breaker Panels CC Main CB Panels	CHGRD2 CHGRD3

⑤ Cannot be used in Safety Breaker Panels. Classic Plus Panels only.

Table 26.2-47. Neutral Bar Accessories

Description	Catalog Number ⑥
Split Neutral Kit for 22 Circuit 125 A Maximum	CHSN125C
Split Neutral Kit for 32 Circuit 200 A Maximum	CHSN225J
Split Neutral Kit for 42 Circuit 200 A Maximum	CHSN225K
Replacement Neutral for all C Type Boxes	CHN125C
Replacement Neutral for all D Type Boxes	CHN125D
Replacement Neutral for all L Type Boxes	CHN225L
Isolated Neutral Assembly (Computer Circuits)	BINA

⑥ Cannot be used in Safety Breaker Panels. Classic Plus Panels only.

CH Loadcenter Options and Accessories (Continued)

Mechanical Interlock Covers

Covers mechanically interlock two breakers. Type A covers interlock two CH breakers mounted across from one another. Type B covers interlock a main Type CSR Breaker with a Type CH.



CH8BRM Type A



CH8EFM Type B

Table 26.2-48. Mechanical Interlocks

Type	Fits Loadcenter Catalog Numbers	Mechanical Interlock Panel Cover	
		Catalog Number	Catalog Number
		Flush	Surface
A	CH12L125B, CH16L125B, CH12L3125B, CH14B100B CH20L125C, CH24L125C, CH18L3125C, CH24L3125C, CH22B100C, CH22N100C CH24L150D, CH32L150D, CH24L3225D, CH30L3150D CH42L225G, CH42L3225G	CH8BFM CH8CFM CH8DFM CH8GFM	CH8BSM CH8CSM CH8DSM CH8GSM
	Inner Cover of Box B Raintight Inner Cover of Box C Raintight	— —	CH8BRM CH8CRM
B	CH24B150E, CH24B200E CH32B150J, CH32B200J, CH324B200J, CH32N200J, CH32B225J CH42B200K, CH42N200K, CH42B225K	CH8EFM CH8JFM CH8KFM	CH8ESM CH8JSM CH8KSM
	CHPC32B150L, CHPC32B200L, CHPC32N200L CHPC42B150L, CHPC42B200L, CHPC42N200L	CHPC8B32LFM CHPC8B42LFM	— —
	CH8B150RF, CH8B200RF, CH8N200RF, CH24B150R, CH24B200R CH32B150R, CH32B200R, CH32N200R, CH32B225R CH42B200R, CH42N200R, CH42B225R	CH3RDF7M CH3RDF9M CH3RDF10M	— — —

Note: For interlock covers for loadcenters not listed in chart, please contact Eaton.

Decorator Cover Accessory

- For easy use with CH Loadcenters mounted in living space.
- Easily wallpapered or painted to match any decor.
- Patented Loadcenter accessory — exclusively from Eaton.

Table 26.2-49. Decorator Cover Accessory

Catalog Number	
Corresponding Cover	Existing CH Loadcenter Cover
CH8BF CH8CF CH8DF/EF CH8GF/JF CH8KF	CH8KDNB CH8KDNC CH8KDND CH8KDNJ CH8KDNK



Now you see it . . .



. . . Now you don't.

CH Loadcenter Options and Accessories (Continued)

Circuit Analyzer



Circuit Analyzer

Product Description

Eaton's Cutler-Hammer Circuit Analyzer provides accurate testing of AFCI and GFCI devices while also testing for faulty wiring conditions.

There are other testing devices on the market but this will be the only one available from an AFCI manufacturer. Eaton has more than 100 years of electrical control and power distribution experience, and a thorough understanding of what arc faults are all about. This experience with AFCI breakers led to developing a patented feature of the analyzer that will save contractors time and aggravation. It allows contractors to verify whether they have a grounded neutral simply by depressing the red Neutral Isolation test button. In this way, they will be able to determine whether they have a grounded neutral or have other neutrals connected before they leave the job site. Additionally, the Circuit Analyzer has a button that tests AFCI and two that test GFCI devices (both 40 mA and 8 mA).

Application Description

The Circuit Analyzer serves as a handy troubleshooting tool for contractors and electrical inspectors. It's a circuit analyzer that provides accurate testing of AFCI and GFCI devices while also testing for faulty wiring conditions.

Features, Functions and Benefits

- All-in-one tester for ground fault, arc fault and faulty wiring conditions.
- Neutral Isolation Test Button is a patented feature that allows the contractor to determine whether they have a grounded neutral or have other neutrals connected before leaving the job.
- Additional test button for AFCI and two that test GFCI devices (40 mA and 8 mA).
- Only product available from an AFCI manufacturer.
- Three standard accessories enhance the usefulness of the Circuit Analyzer:
 - An alligator clip attachment to test hardwired circuits, such as smoke detectors, that lack a receptacle. The clip simply is attached to the smoke alarm's terminals
 - An adapter (3-prong to 2-prong) for testing in older homes that lack 3-prong receptacles
 - Light socket adapter for AFCI testing when no receptacle is available. Examples are ceiling fans that contain sockets and recessed lighting
 - Additionally, the Circuit Analyzer comes with a black carrying case

Technical Data and Specifications

How it Works

1. Plug the tester (or one of the accessories) into the receptacle, light fixture or hardwired terminals to be tested.
2. Check the wiring LEDs on the Circuit Analyzer to determine if the circuit is wired correctly.
3. If the circuit is wired correctly, then proceed to test for Neutral Isolation, Arc Fault or Ground Fault conditions, depending on the breaker or receptacle type that is on the circuit.
4. To perform these tests, press the corresponding button on the Circuit Analyzer and review the results.

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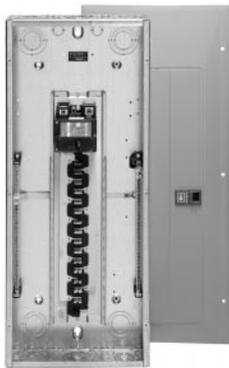
General Description

**BR Type Loadcenter
Description**

Loadcenters are enclosures specifically designed to house the branch circuit breakers and wiring required to distribute power to individual circuits. They contain either a main breaker when used at the service entrance point or a main lug when used as a sub-panel to add circuits to existing service. The main breaker protects the main entire panel and can be used as a service disconnect. The branch breakers protect the wires leading to individual electrical loads such as fixtures and outlets.

26

Single-Phase



Main Circuit Breaker



Riser Panel



Single-Phase Main Lugs

Three-Phase



Main Circuit Breaker



Main Circuit Breaker Commercial



3-Phase Main Lugs

Convertible



Convertible — Outdoor

**Outdoor Circuit Breaker
Unit Enclosures**



ECB Breaker Enclosure

General Description

BR Loadcenter Description**Loadcenter Construction**

Cutler-Hammer Type BR loadcenters by Eaton Corporation have standard tin-plated aluminum bus with a limited availability of copper bus. The sum of the handle ratings connected to any stab is limited to 150 amperes maximum on the 100 and 125 ampere loadcenters, and 200 amperes on loadcenters with 150 ampere or higher main bus. NEMA Type 1 boxes or enclosures are manufactured from galvanized steel. Raintight boxes are manufactured from galvanized steel, then finished using an electrostatic powder coat, baked urethane paint process.

Neutrals

Eaton's Cutler-Hammer Type BR loadcenters have three types of neutrals:

1. Factory Bonded Split Neutral

Certain single-phase main circuit breaker panels are supplied with a factory-bonded twin neutral. When used as a sub panel, the bonding strap should be removed, and the bonding screw should be reinstalled. The bonded side is now the ground, and the un-bonded side is the neutral. When used as a service entrance panel, the unused neutral holes on either side may be used for terminating ground wires.

2. Insulated Split Neutral

Most single-phase panels (12 circuits and greater) are supplied with a twin neutral with an insulated cross strap. These panels are shipped in an un-bonded state. For service entrance applications, the neutral must be bonded utilizing the bonding strap supplied with the panel. For sub-feed applications, the panel may be installed as is. Separate ground bars are provided on these panels.

3. Single Neutral

Single-phase 2 – 8 circuit, three-phase and commercial loadcenters are supplied with a single insulated/bondable neutral. The three-phase loadcenter neutral is movable to the other side if desired. The neutral is bondable in the field by means of a bonding strap that is supplied with each loadcenter. For sub-feed applications, a separate ground bar must be used. In a service entrance application, where the neutral is bonded, unused neutral connections may be used for equipment ground protectors.

Grounds

In service entrance applications where the neutral is bonded, unused neutral holes may be used for terminating ground conductors. In sub-feed panels, the neutral must be isolated (non-bonded), and ground wires must be terminated on a separate ground bar.

The Factory Bonded Split Neutral panels have sufficient terminations for both ground and neutral conductors. The Insulated Split Neutral panels are supplied with a separate factory-installed ground bar if the catalog number contains a "G." If not, a separate ground bar should be installed. Insulated/Bondable Single Neutral panels are supplied without a ground bar (unless otherwise noted), and ground bar kits if needed must be purchased separately.

Neutral and Ground Terminals

The standard terminals on grounds and neutrals are rated to accept (3) — #14 – #10 Cu/Al or (1) — #14 – 4. For larger cables, add-on neutral lugs may be ordered from the accessories list.

Note: NEC allows only one current carrying conductor per hole on neutrals unless otherwise noted.

Bottom Fed Loadcenters

Where power cable is brought into the loadcenter from below the panel, main lug panels, and single-phase, 225 ampere and below loadcenters can be rotated 180 degrees to allow straight-in wiring of power cables to the main terminals. Because the main circuit breaker handle operates horizontally, the orientation of the main circuit breaker handle is consistent with the requirements of NEC Article 240.

Gutter Splicing

Loadcenters are not UL listed as wiring troughs. Therefore, gutter splicing of riser cables to tap off to the main device is not permitted.

Fire Rating

Due to the numerous openings in both loadcenter boxes and trims, they should not be mounted in firewalls. There is no approved method for sealing the enclosures for this application.

Surge Protectors

The BRSURGE Surge Protector has indicating lights that indicate when the units should be replaced. The CHSA01 and CHSA03 Surge Protectors internally short, causing the circuit breaker feeding the surge protector to trip. All but the BRSURGE Surge Protector should be wired to the load side of 15 or 20 ampere feeder circuit breakers mounted adjacent to the main incoming device.

The CHSPULTRA Cutler-Hammer Home Surge Protector is an externally mounted TVSS unit that provides industrial level surge protection in a residential design.

Circuit Breaker Case Interrupting Capacity

- 10,000 AIC.
- 22,000 AIC.

Standards and Certifications**UL Listings**

All Cutler-Hammer Type BR loadcenters are listed under UL File E52977 except the 2 – 8 circuit loadcenters, up through and including 125 amperes, which are listed under UL File E8741.

General Description

Features, Functions and Benefits

Tangential main knockout for easy installation.

Extra 1.50-inch (38.1 mm) knockout for bundling of wires.

Drywall marking on enclosure.

Twin neutral design for easier wiring and balancing of the load, located in wireway, away from circuit breakers.

Maximum wiring gutter space for ease of wiring in compliance with NEC requirements.

One piece roll formed metal backpan with circuit breaker alignment notches ensures accurately aligned breaker and bus stabs.

Six mounting holes (three top, three bottom) for ease of installation.

Standard 14-3/8 inches (365.1 mm) wide enclosures fit snugly between wall studs.

Same size Allen wrench can be used for phase and neutral lugs.

Commercial grade 25 kAIC rated main breaker in 150 A and above loadcenters designed for straight-in wiring that allows for top or bottom feed.

Factory pre-attached neutral bonding strap.

Predrilled mounting holes for ease of installing ground bar kits.

Maximum variety of concentric knockouts, at rear and sides.

Combination trim has sliding latch and adjustable deadfront for neat, clean appearance.



BR4040B200

General Description

Type BR Loadcenter — Product Selections

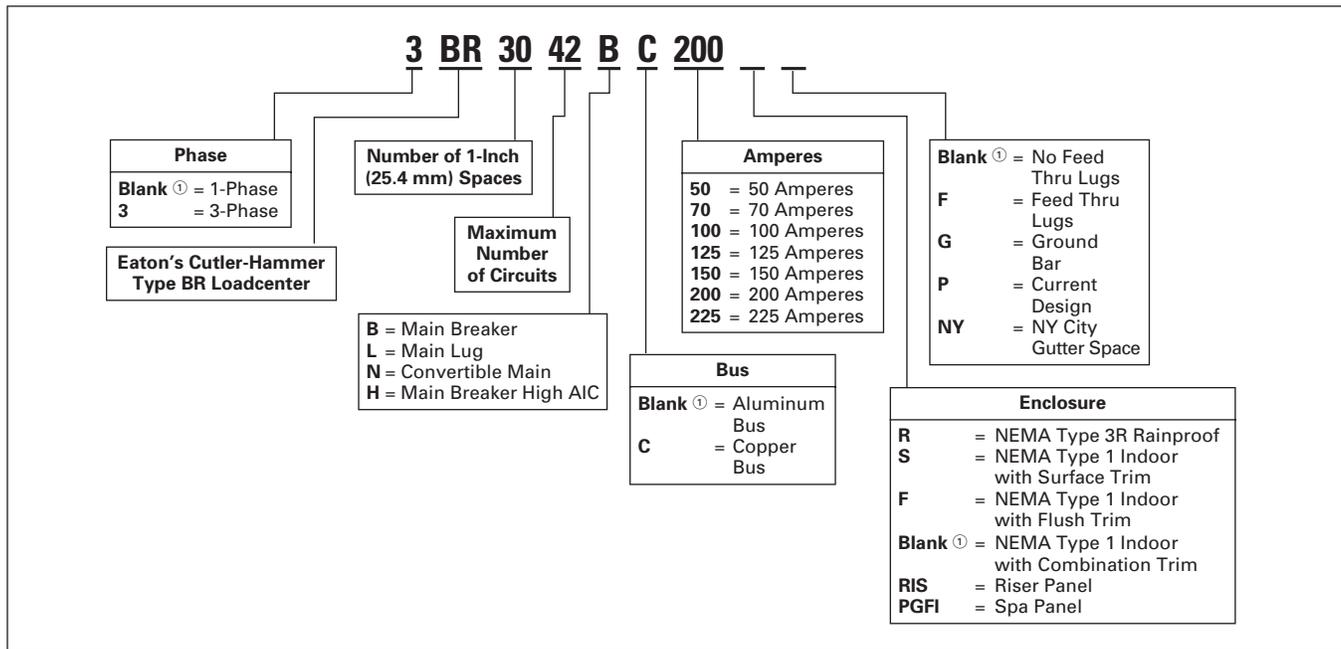
Table 26.3-1. BR Loadcenter Selection Chart

Service	<ul style="list-style-type: none"> ■ Single-phase, three-wire, 120/240 Vac. 	<ul style="list-style-type: none"> ■ Three-phase, four-wire, 208Y/120 Vac. ■ Three-phase, three-wire, 240 Vac delta.
Short Circuit Current Rating	<ul style="list-style-type: none"> ■ 10,000 AIC: All single- and three-phase loadcenters 70 through 225 amperes, 8 to 42 circuits. ■ 22,000 AIC: All convertible loadcenters using 125 amperes rated Type BRH main breakers or selected factory installed 125 ampere rated Type BRH main breaker. 	<ul style="list-style-type: none"> ■ 25,000 AIC: All convertible and factory installed single-phase loadcenters rated 150 and 200 amperes using Type BWH main breakers.
Main Breaker/Main Lug Loadcenters	<p>Single-Phase</p> <ul style="list-style-type: none"> ■ Main Breaker: 100, 125, 150, 200, 225, 400, 600 amperes. ■ Main Lugs: 70, 125, 150, 200, 225, 400, 600 amperes. 	<p>Three-Phase</p> <ul style="list-style-type: none"> ■ Main Breaker: 100, 125, 150, 200, 225, 400, 600 amperes. ■ Main Lugs: 100, 125, 150, 200, 225, 400, 600 amperes.
Convertible Loadcenters	<ul style="list-style-type: none"> ■ Main Breaker: Single-phase up to 200 amperes and three-phase up to 225 amperes. ■ Main Lugs: Single-phase up to 200 amperes and three-phase up to 150 amperes. 	
Branch Breakers	<ul style="list-style-type: none"> ■ Types BR, BRH, and BRH: 10 to 150 amperes. One-, two-, and three-pole. Selected amperages available in switching duty, HACR, shunt trip, and high magnetic setting. ■ Type GFCB: 15 to 50 amperes. One- and two-pole ground fault breakers. ■ Types BJ and BJH: 125 to 225 amperes Two- and three-pole. ■ Type BD Twin: 10 to 50 amperes Two of one-pole. Take one 1-inch (25.4 mm) space. 	<ul style="list-style-type: none"> ■ Type BQ and BQC Multibreaker: 15 to 30 amperes. Two of two-pole or one two-pole and two one-pole. Takes two 1-inch (25.4 mm) spaces. ■ Type BRW: 15 to 30 amperes. Two-pole water heater breakers. ■ Type BRSN: 15 to 30 amperes. Two-pole switching neutral breakers. ■ Type BR 15 to 100 amperes. Two-pole, 240 Vac delta breakers. ■ BR-ACFI arc fault circuit interrupter.
Enclosures	<ul style="list-style-type: none"> ■ NEMA Type 1 indoor. ■ NEMA Type 3R outdoor. 	<ul style="list-style-type: none"> ■ Meets or exceeds UL requirements for indoor or outdoor applications.
Loadcenter and Breaker Accessories	<ul style="list-style-type: none"> ■ Branch Circuit Breaker: Auxiliary components Hold Down Kits Handle ties Lockoffs Lockdogs ■ Complete Line of Ground Bar Kits 5, 10, 14 and 21 circuit, some with additional #2/0 lugs. Each terminal will accommodate: (3) #14 – #10 Cu/Al or (1) #14 – #4 Cu/Al. ■ Main and Sub-feed Lugs 125, 150, 225 amperes — two- and three-pole. ■ Shunt trips. 	<ul style="list-style-type: none"> ■ Surge Protection: Single-phase plug-on surge protector Single-phase bottle type surge protector Three-phase bottle type surge protector Single-phase whole home surge protector ■ Universal Rainproof Conduit Hubs Group One: 3/4, 1, 1-1/4, 1-1/2, 2 inches (19.1, 25.4, 31.8, 38.1, 50.8 mm) Group Two: 2, 2-1/2, 3 inches (50.8, 63.5, 76.2 mm) ■ Adapter plate.
Bussing	<ul style="list-style-type: none"> ■ Tin-plated aluminum as standard. ■ Limited copper bus panels available. 	

General Description

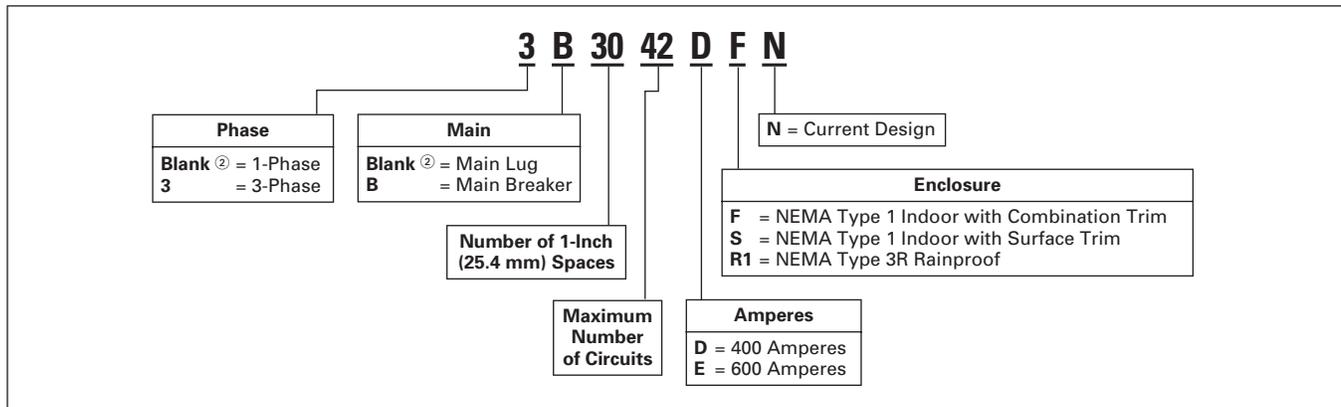
Type BR Loadcenter — Product Selections (Cont.)

Table 26.3-2. Single- and Three-Phase Through 225 Amperes Catalog Numbering System



① No character space used.

Table 26.3-3. Single- and Three-Phase 400 Amperes Through 600 Amperes Catalog Numbering System



② No character space used.

Example No. 1: BR1224L125G

Single-Phase Cutler-Hammer Type BR Loadcenter Rated at 125 Amperes with Main Lugs, 12 Spaces Allowing 24 Poles, Indoor Combination Enclosure, Aluminum Bus and Ground Bar.

Example No. 2: BR24L70RP

Single-Phase Cutler-Hammer Type BR Loadcenter Rated at 70 Amperes with Main Lugs, 2 Spaces Allowing 4 Poles, Rainproof Enclosure with Aluminum Bus.

Example No. 3: 3B4242EFN

3-Phase Cutler-Hammer Type BR Loadcenter Rated at 600 Amperes with Main Breaker, 42 Spaces Allowing 42 Poles, Indoor Combination Enclosure.

Technical Data

Single-Phase — Main Circuit Breaker Loadcenters
10,000/25,000 Amperes Interrupting Capacity

Table 26.3-4. Single-Phase, 3-Wire — 120/240 Vac — Factory Bonded Split Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number with Combination Cover ^①
		Space	Circuits			Height	Width	Depth		
BR 10 kAIC	100	20	20	Indoor	C2	23.00	14.31	3.88	#4 – 1/0	BR2020B100 BR1624B100
	100	16	24	Indoor	C1	21.00	14.31	3.88		
BWH 25 kAIC	150	30	30	Indoor	G1	34.13	14.31	3.88	#2 – 300 kcmil #2 – 300 kcmil	BR3030B150 BR2040B200 BR3040B200 BR4040B200
	200	20	40	Indoor	D1	29.13	14.31	3.88		
	200	30	40	Indoor	G1	34.13	14.31	3.88		
	200	40	40	Indoor	L1	39.00	14.31	3.88		

① Combination style covers may be used in surface or flush applications.

Note: All main circuit breaker loadcenters are listed for use as service entrance equipment. Loadcenters are factory bonded for service entrance applications. Remove bonding strap for separate neutral and ground bars for sub-feed applications

Table 26.3-5. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number with Combination ^② or NEMA Type 3R Cover			
		Spaces	Circuits			Height	Width	Depth					
BR 10 kAIC	100	8	16	Indoor	B1	16.75	14.31	3.88	#4 – 1/0 ^③	BR816B100 BR1020B100S11 BR1020B100F11 BR1020B100RF ^④ BR1212B100 BR1220B100 BR1224B100R BR1616B100 BR1620B100 BR1624B100R BR2024B100R ^⑤			
		10	20	Indoor	A1	15.00	11.25	3.75					
		10	20	Indoor	A1	15.00	11.25	3.75					
		10	20	Outdoor	B2R	18.75	14.31	5.19					
		12	12	Indoor	B2	18.75	14.31	3.88					
		12	20	Indoor	B2	18.75	14.31	3.88					
		12	24	Outdoor	B2R	18.75	14.31	5.19					
		16	16	Indoor	C1	21.00	14.31	3.88					
		16	20	Indoor	C1	21.00	14.31	3.88					
		16	24	Outdoor	C1R	21.00	14.31	5.19					
		20	24	Outdoor	C3R	25.00	14.31	5.19					
		30	30	Indoor	^⑤	—	—	—					
		125	16	24	Indoor	C1	21.00	14.31			3.88	#4 – 2/0	BR1624B125 BR2024B125 BR2024B125R
		20	24	Indoor	C1	21.00	14.31	3.88					
20	24	Outdoor	C3R	25.00	14.31	5.19							
BRH ^⑥ 22 kAIC	100	20	24	Indoor	C2	23.00	14.31	3.88	#2/0 – 300 kcmil	BR2024H100 ^⑥			
BWH ^⑦ 25 kAIC	150	8	16	Outdoor	C3R	25.00	14.31	5.19	#2 – 300 kcmil	BR816B150RF ^④ BR1630B150 BR2030B150 BR2030B150R BR2040B150 BR2040B150R BR2430B150 BR3030B150R BR3040B150			
		16	30	Indoor	C4	27.00	14.31	3.88					
		20	30	Indoor	C4	27.00	14.31	3.88					
		20	30	Outdoor	D1R	29.13	14.31	5.19					
		20	40	Indoor	D1	29.13	14.31	3.88					
		20	40	Outdoor	D1R	29.13	14.31	5.19					
		24	30	Indoor	G1	34.13	14.31	3.88					
		30	30	Outdoor	G1R	34.13	14.31	5.19					
		30	40	Indoor	G1	34.13	14.31	3.88					
		200	4	8	Outdoor	8R	27.00	10.50			4.75	#2 – 300 kcmil	BR48B200RF ^{④⑧⑨} BR816B200RF ^④ BR1632B200 BR2040B200R BR2440B200 BR3040B200R BR4040B200R
	8	16	Outdoor	C3R	25.00	14.31	5.19						
	16	32	Indoor	C4	27.00	14.31	3.88						
	20	40	Outdoor	D1R	29.13	14.31	5.19						
	24	40	Indoor	G1	34.13	14.31	3.88						
	30	40	Outdoor	G1R	34.13	14.31	5.19						
	40	40	Outdoor	L1R	39.00	14.31	5.19						
	225	42	42	Indoor	L2	45.00	14.31	3.88	#1 – 250 kcmil	BR4242B225 BR4242B225R			
		42	42	Outdoor	L2R	45.00	14.31	5.19					

② Combination style covers may be used in surface or flush applications.

③ Wire range size for BR1020B100SP is #6 – #1 Cu/Al.

④ Includes through-feed lugs for both phase and neutral conductors.

⑤ See Copper Bus Offering, Page 26.3-15.

⑥ 22 kAIC series combination rating is obtained when Types BD, BR, BQ, BQC and GFCB 10 kAIC branch breakers are used in series with Type BRH main breaker.

⑦ 25 kAIC series combination rating is obtained when Types BD, BR, BQ, BQC and GFCB 10 kAIC branch circuit breakers are used in series with Type BWH main breaker.

⑧ Supplied with adapter plate to use DS Group1 hubs. If 2.50-inch (63.5 mm) hub is needed, remove adapter and use ARP00007CH25 hub.

⑨ Neutral is bonded — suitable for service entrance only — cannot be converted for sub-feed application.

Note: All main circuit breaker loadcenters are listed for use as service entrance equipment and are shipped with neutral bonding strap preattached. The maximum rating of the panel is the main circuit breaker rating when used as service entrance equipment. Ground bar kits ordered separately.

Technical Data

Main Circuit Breaker Loadcenters

10,000/22,000/25,000 Amperes Interrupting Capacity

Table 26.3-6. Main Circuit Breaker Loadcenters — With Copper Bus — Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number with Combination Cover ^{①②}
		Spaces	Circuits			Height	Width	Depth		
BR 10 kAIC	100	20	20	Indoor	C2	23.00	14.31	3.88	#4 – 1/0	BR2020BC100
		30	30	Indoor	D1	29.13	14.31	3.88	#4 – 1/0	BR3030BC100
BRH 22 kAIC ^③	100	30	30	Indoor	D1	29.13	14.31	3.88	#4 – 1/0	BR3030HC100
BWH 25 kAIC	150	30	30	Indoor	G1	34.13	14.31	3.88	#2 – 300 kcmil	BR3030BC150
		20	40	Indoor	D1	29.13	14.31	3.88	#2 – 300 kcmil	BR2040BC200
		30	40	Indoor	G1	34.13	14.31	3.88	#2 – 300 kcmil	BR3040BC200
		40	40	Indoor	L1	39.00	14.31	3.88	#2 – 300 kcmil	BR4040BC200

① All main circuit breaker loadcenters are listed for use as service entrance equipment and are shipped with neutral bonding strap preattached. The maximum rating of the panel is the main circuit breaker rating when used as service entrance equipment.

② Ground bar kits ordered separately.

③ 22 kAIC series combination rating is obtained when Types BD, BR, BQ, BQC and GFCB 10 kAIC branch breakers are used in series with Type BRH main breaker

Main Circuit Breaker Loadcenters

10,000/22,000 Amperes Interrupting Capacity

Table 26.3-7. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Commercial Loadcenter Catalog Number ^{④⑤⑥}	
		Spaces	Circuits			Height	Width	Depth		With Flush or NEMA Type 3R Cover	With Surface Cover
DK ^⑦	300	42	42	Indoor	24	66.50	16.22	6.31	(2) #3/0 – 250 kcmil	BR304242F	BR304242S
		42	42	Indoor	24	66.50	16.22	6.31	(2) #3/0 – 250 kcmil	B4242DFN	B4242DSN
	42	42	Outdoor	47	66.56	16.31	6.38		B4242DR1N	—	
HLD ^⑧	600	42	42	Indoor	24	66.50	16.22	6.31	(2) #3/0 – 500 kcmil	B4242EFN	B4242ESN

④ Ground bar kits ordered separately.

⑤ The maximum rating of the panel is the main circuit breaker rating when used as service entrance equipment.

⑥ Door lock and key included with loadcenter.

⑦ Type DK main circuit breaker is rated 65 kAIC at 240 Vac and allows a 22 kAIC series rating on the panel when Types BR, BD and BJ branch circuit breakers are used.

⑧ Type HLD main circuit breaker is rated 65 kAIC at 240 Vac. Type HLD circuit breaker is **not** series rated with Types BR, BD and BJ branch circuit breakers.

Technical Data

Single-Phase — Main Lug Loadcenters

Table 26.3-8. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Type of Trim	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number
	Spaces	Circuits				Height	Width	Depth		
70	2	4	Indoor	Surface (No Door)	5	9.44	4.50	3.00	#8 - #2	BR24L70SP ①② BR24L70SGP ②③ BR24L70RP ①②④ BR24L70FP ①② BR24L70FGP ②⑤
	2	4	Indoor	Surface (No Door)	5	9.44	4.50	3.00		
	2	4	Outdoor	—	5R	9.44	4.50	3.00		
	2	4	Indoor	Flush (No Door)	5	9.44	4.50	3.00		
	2	4	Indoor	Flush (No Door)	5	9.44	4.50	3.00		
125	2	4	Indoor	Surface (No Door)	6	12.00	6.88	4.50	#14 - 1/0	BR24L125SP ①② BR24L125RP ①②④ BR24L125RSEP ②⑥⑦⑧ BR24L125RSEP ②⑥⑦⑧ BR24L125FP ①②
	2	4	Outdoor	—	6R	11.75	6.50	4.50		
	2	4	Outdoor	—	6R	11.75	6.50	4.50		
	2	4	Outdoor	—	6R	11.75	6.50	4.50		
	2	4	Indoor	Flush (No Door)	6	12.00	6.88	4.50		
	4	8	Indoor	Surface (No Door)	7	13.00	11.00	3.56	#14 - 1/0	BR48L125SP ① BR48L125SGP ③ BR48L125RP ①④ BR48L125FP ① BR48L125FDP ① BR48L125FGP ③
	4	8	Indoor	Surface (No Door)	7	13.00	11.00	3.56		
	4	8	Outdoor	—	7R	13.00	11.00	3.56		
	4	8	Indoor	Flush (No Door)	7	13.00	11.00	3.56		
	4	8	Indoor	Flush (With Door)	7	13.00	11.00	3.56		
	4	8	Indoor	Flush (No Door)	7	13.00	11.00	3.56		
	6	12	Indoor	Surface (No Door)	7	13.00	11.00	3.56	#14 - #1	BR612L125SP ① BR612L125SGP BR612L125SDP ① BR612L125SDGP BR612L125RP ①④ BR612L125FP ① BR612L125FGP ⑤ BR612L125FDP BR612L125FDGP ⑤
	6	12	Indoor	Surface (No Door)	7	13.00	11.00	3.56		
	6	12	Indoor	Surface (With Door)	7	13.00	11.00	3.56		
	6	12	Indoor	Surface (With Door)	7	13.00	11.00	3.56		
	6	12	Outdoor	—	7R	13.00	11.00	3.56		
	6	12	Indoor	Flush (No Door)	7	13.00	11.00	3.56		
	6	12	Indoor	Flush (No Door)	7	13.00	11.00	3.56		
	6	12	Indoor	Flush (With Door)	7	13.00	11.00	3.56		
	6	12	Indoor	Flush (With Door)	7	13.00	11.00	3.56		
	8	16	Indoor	Surface (No Door)	7	13.00	11.00	3.56		
	8	16	Indoor	Surface (No Door)	7	13.00	11.00	3.56		
	8	16	Indoor	Surface (With Door)	7	13.00	11.00	3.56		
	8	16	Indoor	Surface (With Door)	7	13.00	11.00	3.56		
	8	16	Outdoor	—	7R	13.00	11.00	3.56		
	8	16	Indoor	Flush (No Door)	7	13.00	11.00	3.56		
	8	16	Indoor	Flush (No Door)	7	13.00	11.00	3.56		
	8	16	Indoor	Flush (With Door)	7	13.00	11.00	3.56		
8	16	Indoor	Flush (With Door)	7	13.00	11.00	3.56			
8	16	Indoor	Flush (With Door)	7	13.00	11.00	3.56			

- ① Ground bar kits ordered separately.
 - For 2/4 circuit loadcenters use GBK5 or GBK520 Ground Bar.
 - For 4/8, 6/12 and 8/16 circuit loadcenters use GBK10 Ground Bar.
 - Ground bars mount to the left side wall of the enclosure for the 4/8, 6/12 and 8/16 circuit loadcenters.
- ② Suitable for use as service equipment when not more than two service disconnecting mains are provided or when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ③ Ground bar GBK5 is installed.
- ④ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ⑤ CSA and UL approved.
- ⑥ Neutral/ground holes (6) #14 – 6 and (3) #14 – 2/0 AWG Cu/Al.
- ⑦ For use as service entrance applications only.
- ⑧ Neutral/ground holes (6) #14 – 6 and (3) #14 – 1/0 AWG Cu/Al.

Technical Data

Single-Phase — Main Lug Loadcenters

Table 26.3-9. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral (Continued)

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number with Combination or NEMA Type 3R Cover ①
	Spaces	Circuits			Height	Width	Depth		
125	12	12	Indoor	B1	16.75	14.31	3.88	#6 – 2/0	BR1212L125 ②③④⑤ BR1224L125 ②④⑤ BR1224L125G ②④⑤⑥ BR1224L125DG ②④⑤⑦ BR1224L125R ②⑤⑧ BR1616L125 ②⑤ BR1624L125 ②④ BR1624L125G ②④⑥ BR1624L125R ②⑧ BR2020L125 ②⑤ BR2024L125 ②④ BR2024L125G ②④⑨ BR2024L125R ②⑧ BR2424L125 ②④ BR2424L125G ②④⑨
	12	24	Indoor	B1	16.75	14.31	3.88		
	12	24	Indoor	B1	16.75	14.31	3.88		
	12	24	Indoor	B1	16.75	14.31	3.88		
	12	24	Outdoor	B1R	16.75	14.31	5.19		
	16	16	Indoor	B2	18.75	14.31	3.88		
	16	24	Indoor	B2	18.75	14.31	3.88		
	16	24	Indoor	B2	18.75	14.31	3.88		
	16	24	Outdoor	B2R	18.75	14.31	5.19		
	20	20	Indoor	C1	21.00	14.31	3.88		
	20	24	Indoor	C1	21.00	14.31	3.88		
	20	24	Outdoor	C1R	21.00	14.31	5.19		
	24	24	Indoor	C2	23.00	14.31	3.88		
	24	24	Indoor	C2	23.00	14.31	3.88		
150	16	30	Indoor	C2	23.00	14.31	3.88	#1 – 300 kcmil	BR1630L150 ④⑩ BR2030L150 ④⑩
	20	30	Indoor	C2	23.00	14.31	3.88		
200	8	16	Outdoor	B2R	18.75	14.31	5.19	#1 – 300 kcmil	BR816L200RF ⑤⑥⑩ BR1224L200 ④⑤⑩ BR1224L200R ⑤⑧⑩ BR2040L200 ④⑩ BR2040L200G ④⑨⑩ BR2040L200R ⑧⑩ BR2440L200 ④⑩ BR3040L200 ④⑩ BR3040L200G ④⑨⑩ BR3040L200R ⑧⑩ BR4040L200 ④⑩ BR4040L200G ④⑩ BR4040L200R ⑧⑩
	12	24	Indoor	B2	18.75	14.31	3.88		
	12	24	Outdoor	B2R	18.75	14.31	5.19		
	20	40	Indoor	C2	23.00	14.31	3.88		
	20	40	Indoor	C2	23.00	14.31	3.88		
	20	40	Outdoor	C3R	25.00	14.31	5.19		
	24	40	Indoor	C4	27.00	14.31	3.88		
	30	40	Indoor	D1	29.13	14.31	3.88		
	30	40	Indoor	D1	29.13	14.31	3.88		
	30	40	Outdoor	D1R	29.13	14.31	5.19		
	40	40	Indoor	G1	34.13	14.31	3.88		
	40	40	Indoor	G1	34.13	14.31	3.88		
	40	40	Outdoor	G1R	34.13	14.31	5.19		
	225	42	42	Indoor	L1	39.00	14.31		
42		42	Outdoor	L1R	39.00	14.31	5.19		

- ① Ground bar kits ordered separately unless otherwise noted.
- ② Has notch for BREQS125 hold-down kit.
- ③ Single, movable neutral is provided.
- ④ Combination cover style.
- ⑤ Suitable for use as service equipment when not more than six main disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ⑥ Ground bar GBK10 installed.
- ⑦ Ground bars GBK5 and GBK520 installed.
- ⑧ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ⑨ Ground bar GBK1220 installed.
- ⑩ Has notch for BRHDK125 hold-down kit.
- ⑪ Includes through-feed lugs for both phase and neutral conductors.

Single-Phase — Main Lug Loadcenters, Non-Metallic

Table 26.3-10. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Type of Trim	Box Size	Dimensions			Wiring Diagram Figure Number	Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number
	Spaces	Circuits				Height	Width	Depth			
40 ⑫	⑬	⑭	Indoor	Flush No Door	2	8.63	5.00	3.50	66	⑮	TT120FLGNM ⑯⑰ TT120SLGNM ⑯⑰
			Indoor	Surface No Door	2	8.63	5.00	3.50			
60	2	4	Indoor	Flush No Door	2	8.63	5.00	3.50	1	#14 – 2	2460FNM 2460SNM 2460FGNM ⑱ 2460SGNM ⑱ 2460RNM
			Indoor	Surface No Door	2	8.63	5.00	3.50			
			Indoor	Flush No Door	2	8.63	5.00	3.50			
			Indoor	Surface No Door	2	8.63	5.00	3.50			
			Outdoor	—	⑰	8.63	5.00	3.50			

- ⑫ Suitable for use as service equipment when not more than six main disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ⑬ This device has no main lugs. A Type BR or BD breaker is required to be backfed to supply power to branch breakers. This device is single-phase 120 Vac only. With the use of three Type BR breakers there are two branch circuits available. With the use of three Type BD breakers there are five branch circuits available.
- ⑭ Includes GB4NM ground bar.
- ⑮ 2460 RNM uses the non-metric ACD enclosure.

Technical Data

Single-Phase — Main Lug Loadcenters — 400 and 600 Ampere

Table 26.3-11. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Commercial Loadcenter Catalog Number ^{①②③}	
	Spaces	Circuits			Height	Width	Depth		With Flush or NEMA Type 3R Cover	With Surface Cover
400	12	24	Indoor	19	44.00	16.16	6.25	(1) #4/0 – 750 kcmil or (2) #3/0 – 400 kcmil	—	1224DSN ^⑤
	12	24	Outdoor	42	38.00	16.31	6.38		1224DR1N ^{④⑤}	—
	24	42	Indoor	20	44.00	16.16	6.25		—	2442DSN
	42	42	Indoor	22	54.00	16.22	6.31		4242DFN	4242DSN
	42	42	Outdoor	46	54.00	16.31	6.38		4242DR1N ^④	—
600	42	42	Indoor	22	54.00	16.22	6.31	(2) #2 – 500 kcmil	—	4242ESN

① Ground bar kits ordered separately unless otherwise noted.

② Has notch for BRHDK125 hold-down kit.

③ Ground bar GBK8 installed.

④ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.

⑤ Suitable for use as service equipment when not more than six main disconnecting means are provided and when not used as a lighting and appliance panelboard (see NEC).

Table 26.3-12. Single-Phase 3-Wire — 120/240 Vac — Single Neutral with Copper Bus

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Type of Trim	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number
	Spaces	Circuits				Height	Width	Depth		
125	8	16	Indoor	Surface w/door	7	13.00	11.00	3.56	#14 – 1	BR816LC125SDP BR816LC125FDP
	8	16	Indoor	Flush w/door	7	13.00	11.00	3.56		

Technical Data

**3-Phase — Main Circuit Breaker Loadcenters
10,000 Amperes Interrupting Capacity**

Table 26.3-13. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number ^{①②} (With Combination or NEMA Type 3R Cover)
		Spaces	Circuits			Height	Width	Depth		
BR 10 kAIC	100	12	24	Indoor	C1	21.00	14.31	3.88	#4 – 1/0	3BR1224B100 3BR1224B100R ^③
		12	24	Outdoor	C1R	21.00	14.31	5.19		
CC 10 kAIC	150	30	42	Indoor	L1	39.00	14.31	3.88	#1 – 3/0	3BR3042B150 3BR3042B150R ^③
		30	42	Outdoor	L1R	39.00	14.31	5.19		
	200	30	42	Indoor	L1	39.00	14.31	3.88	#1 – 250 kcmil	3BR3042B200 3BR3042B200R ^③ 3BR4242B200 3BR4242B200R ^③
		30	42	Outdoor	L1R	39.00	14.31	5.19		
		42	42	Indoor	L2	45.00	14.31	3.88		
		42	42	Outdoor	L2R	45.00	14.31	5.19		
	225	42	42	Indoor	L2	45.00	14.31	3.88	#1 – 300 kcmil	3BR4242B225 3BR4242B225R ^③
		42	42	Outdoor	L2R	45.00	14.31	5.19		

① All main circuit breaker loadcenters are listed for use as service entrance equipment and are shipped with a neutral bonding strap pre-attached (commercial loadcenters do not have a pre-attached bonding strip). The maximum main rating of the panel is the main circuit breaker rating when used as service entrance equipment.

② Ground bar kits ordered separately.

③ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.

**3-Phase — Main Circuit Breaker Loadcenters
22,000/65,000 Amperes Interrupting Capacity**

Table 26.3-14. 3-Phase, 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Commercial Loadcenter Catalog Number ^{④⑤⑥} (With Combination or NEMA Type 3R Cover)
		Spaces	Circuits			Height	Width	Depth		
DK ^⑦ 22 kAIC	400	42	42	Indoor	24	66.50	16.22	6.31	(2) #3/0 – 250 kcmil	3B4242DFN 3B4242DR1N ^⑧
		42	42	Outdoor	47	66.56	16.31	6.38		
LD ^⑨	600	42	42	Indoor	24	66.50	16.22	6.31	(2) #3/0 – 500 kcmil	3B4242EFN

④ All main circuit breaker loadcenters are listed for use as service entrance equipment and are shipped with a neutral bonding strap pre-attached (commercial loadcenters do not have a pre-attached bonding strip). The maximum main rating of the panel is the main circuit breaker rating when used as service entrance equipment.

⑤ Ground bar kits ordered separately.

⑥ Door lock and key included with loadcenter.

⑦ Type DK main circuit breaker is rated 65 kAIC at 240 Vac and allows a 22 kAIC series rating on the loadcenter when Types BR, BD and BJ branch circuit breakers are used.

⑧ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.

⑨ The LD main circuit breaker is rated 65 kAIC at 240 Vac. Type LD circuit breaker is **not** series rated with Types BR, BD and BJ branch circuit breakers.

**3-Phase — High Interrupting Rated Main Circuit Breaker Loadcenters
22,000/100,000 Amperes Interrupting Capacity**

Table 26.3-15. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number ^{⑩⑪}	
		Spaces	Poles			Height	Width	Depth		with Combination Cover	with Surface Cover
BRH 22 kAIC ^⑫	100	12	24	Indoor	C1	21.00	14.31	3.88	#4 – 1/0	3BR1224H100	3BR1224H100S
CHH 100 kAIC ^⑬	150	30	42	Indoor	L1	39.00	14.31	3.88	#1 – 250 kcmil	3BR3042H150	3BR3042H150S
CHH 100 kAIC ^⑬	200	30	42	Indoor	L1	39.00	14.31	3.88	#1 – 250 kcmil	3BR3042H200 3BR4242H200	3BR3042H200S 3BR4242H200S
		42	42	Indoor	L2	45.00	14.31	3.88			

⑩ All main circuit breaker loadcenters are listed for use as service entrance equipment and are shipped with a neutral bonding strap pre-attached.

⑪ Ground bar kits ordered separately.

⑫ 22,000 AIC series combination rating is obtained when Types BD, BR, BQ, BQC and GFGB branch breakers are used with BRH main.

⑬ 100,000 AIC series combination rating is obtained when Types BD, BR, BQ, BQC and GFGB branch breakers are used with CHH main.

Technical Data

3-Phase — Main Lug Loadcenters

Table 26.3-16. 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type ③	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number ① (With Combination or NEMA Type 3R Cover)
	Spaces	Circuits			Height	Width	Depth		
100	3	3	Indoor	9	14.50	6.50	3.50	#14 – 1/0	3BR3L100S ② 3BR3L100R
	3	3	Outdoor	9R	14.25	6.50	4.00		
125	12	24	Indoor	C1	21.00	14.31	3.88	#6 – 2/0	3BR1224L125 ④⑤ 3BR1224L125R ④⑤
	12	24	Outdoor	C1R	21.00	14.31	5.19		
150	24	42	Indoor	D1	29.13	14.31	3.88	#1 – 300 kcmil	3BR2442L150 3BR2442L150R
	24	42	Outdoor	D1R	29.13	14.31	5.19		
200	12	24	Indoor	C4	27.00	14.31	3.88	#1 – 300 kcmil	3BR1224L200 ⑥ 3BR1224L200R ⑥ 3BR3042L200 3BR3042L200R 3BR4242L200 3BR4242L200R
	12	24	Outdoor	C3R	25.00	14.31	5.19		
	30	42	Indoor	G1	34.13	14.31	3.88		
	30	42	Outdoor	G1R	34.13	14.31	5.19		
	42	42	Indoor	L1	39.00	14.31	3.88		
	42	42	Outdoor	L1R	39.00	14.31	5.19		
225	42	42	Indoor	L1	39.00	14.31	3.88	#1 – 300 kcmil	3BR4242L225 3BR4242L225R
	42	42	Outdoor	L1R	39.00	14.31	5.19		

① Ground bar kits ordered separately.

② Surface cover only.

③ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.

④ Has notch for BREQS125 hold-down kit.

⑤ Suitable for use as service equipment when not more than six main disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).

⑥ Door lock and key included with loadcenter.

3-Phase — Main Lug Loadcenters

Table 26.3-17. 3-Phase, 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Commercial Loadcenter Catalog Number ⑦	
	Spaces	Circuits			Height	Width	Depth		With Flush or NEMA Type 3R Cover	With Surface Cover
400	18	36	Indoor	19	44.00	16.16	6.25	(1) #4/0 – 750 kcmil or (2) #3/0 – 400 kcmil	—	—
	18	36	Outdoor	43	44.00	16.31	6.38		—	—
	24	42	Indoor	19	44.00	16.16	6.25		—	—
	42	42	Indoor	22	54.00	16.22	6.31		34242DFN	34242DSN
	42	42	Outdoor	46	54.00	16.31	6.38		34242DR1N ⑧	—
600	42	42	Indoor	22	54.00	16.22	6.31	(2) #2 – 500 kcmil	—	34242ESN

⑦ Door lock and key included with loadcenter.

⑧ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.

Technical Data

Convertible Loadcenters MCB or MLO — Base Units and Main Devices
10,000/22,000/25,000 Amperes Interrupting Capacity
Complete Assembly Consists of: Loadcenter and Either Main Breaker Kit or Main Lug Kit

Note: Interrupting rating depends on main circuit breaker selected.

Table 26.3-18. Base Units — Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating ①	Maximum Number 1-Inch (25.4 mm)		Enclosure Type ⑦	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main	Loadcenter Catalog Number With Combination or NEMA Type 3R Cover ②③	
	Spaces	Circuits			Height	Width	Depth			
125 ④	12	24	Indoor	B2	18.75	14.31	3.88	See main breaker and main lug kit tables next page.	BR1224N125 ⑤⑥ BR1224N125R ⑤⑥ BR1624N125 ⑤ BR1624N125R ⑤ BR2024N125 ⑤ BR2024N125R ⑤	
	12	24	Outdoor	B2R	18.75	14.31	5.19			
	16	24	Indoor	C1	21.00	14.31	3.88			
	16	24	Outdoor	C1R	21.00	14.31	5.19			
	20	24	Indoor	C2	23.00	14.31	3.88			
20	24	Outdoor	C3R	25.00	14.31	5.19				
200 ⑧	8	16	Outdoor	C3R	25.00	14.31	5.19			BR816N200RF ⑨⑩ BR1224N200 ⑩ BR1224N200R ⑩ BR1632N200 ⑩ BR2040N200 ⑩ BR2040N200G ⑪ BR2040N200R ⑩ BR2040N200RG ⑪ BR2440N200 ⑩ BR3040N200 ⑩ BR3040N200G ⑪ BR3040N200R ⑩ BR3040N200RG ⑪ BR4040N200 ⑩ BR4040N200G ⑪ BR4040N200R ⑩ BR4040N200RG ⑪
	12	24	Indoor	C4	27.00	14.31	3.88			
	12	24	Outdoor	C3R	25.00	14.31	5.19			
	16	32	Indoor	C4	27.00	14.31	3.88			
	20	40	Indoor	D1	29.13	14.31	3.88			
	20	40	Indoor	D1	29.13	14.31	3.88			
	20	40	Outdoor	D1R	29.13	14.31	5.19			
	20	40	Outdoor	D1R	29.13	14.31	5.19			
	24	40	Indoor	G1	34.13	14.31	3.88			
	30	40	Indoor	G1	34.13	14.31	3.88			
	30	40	Indoor	G1	34.13	14.31	3.88			
	30	40	Outdoor	G1R	34.13	14.31	5.19			
	30	40	Outdoor	G1R	34.13	14.31	5.19			
	40	40	Indoor	L1	39.00	14.31	3.88			
	40	40	Indoor	L1	39.00	14.31	3.88			
40	40	Outdoor	L1R	39.00	14.31	5.19				
40	40	Outdoor	L1R	39.00	14.31	5.19				

- ① The maximum rating of the loadcenter is the main circuit breaker rating when used as service entrance equipment.
- ② 100, 125 and 200 ampere Convertible base unit catalog numbers include interior, box and cover only. Main devices and accessories must be ordered separately for field installation. All Convertible base units are listed as suitable for use as service entrance equipment when used per Article 384 of the NEC.
- ③ Ground bar kits ordered separately except as noted.
- ④ For main breaker, use Type BR. For main lug use Type BRSF.
- ⑤ BREQS125 hold-down screw comes with loadcenter for back-fed Types BR and BRH main circuit breakers.
- ⑥ Convertible to maximum of 100 ampere main circuit breaker and 125 ampere main lug.
- ⑦ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ⑧ For main breaker, use Type BW. For main lug use Type BRL.
- ⑨ Includes through-feed lugs for both phase and neutral conductors.
- ⑩ No hold-down provisions for back-fed Types BR and BRH main circuit breakers.
- ⑪ Includes GBK2120 ground bar.

Table 26.3-19. Base Units — 3-Phase 4-Wire — 208Y/120 Vac or 240 Vac Insulated/Bondable Neutral

Main Ampere Rating ②	Maximum Number 1-Inch (25.4 mm)		Enclosure Type ③	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main	Loadcenter Catalog Number ④⑤ (With Combination or NEMA Type 3R Cover)
	Spaces	Circuits			Height	Width	Depth		
100 ⑥	30	30	Indoor	D1	29.13	14.31	3.88	See main breaker and main lug kit tables next page.	3BR3030N100 ⑦ 3BR3030N100R ⑦
	30	30	Outdoor	D1R	29.13	14.31	5.19		
125 ⑥	12	24	Indoor	C1	21.00	14.31	3.88		3BR1224N125 ⑦⑧ 3BR1224N125R ⑦⑧⑨
	12	24	Outdoor	C1R	21.00	14.31	5.19		

- ② The maximum rating of the loadcenter is the main circuit breaker rating when used as service entrance equipment.
- ③ Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ④ 100, 125 and 200 ampere Convertible base unit catalog numbers include interior, box and cover only. Main devices and accessories must be ordered separately for field installation. All Convertible base units are listed as suitable for use as service entrance equipment when used per Article 384 of the NEC.
- ⑤ Ground bar kits ordered separately.
- ⑥ For main breaker, use Type BR. For main lug use Type BRSF.
- ⑦ BREQS125 hold-down screw comes with loadcenter for back-fed Types BR and BRH main circuit breakers.
- ⑧ Convertible to maximum of 100 ampere main circuit breaker and 125 ampere main lug.
- ⑨ Suitable for use as service equipment when not more than six main disconnecting means are provided and when not used as a lighting and appliance panelboard (see NEC).

Convertible Loadcenters — With Copper Bus 10,000/22,000/25,000 Amperes Interrupting Capacity

Table 26.3-20. Convertible — Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions ①			Wire Size Range Cu/Al 60°C or 75°C for Main	Loadcenter Catalog Number with Combination or NEMA Type 3R Cover ②③④	
	Spaces	Circuits			Height	Width	Depth			
125 10/22 kAIC ⑤⑥	12	24	Indoor	B2	18.75	14.31	3.88	See main breaker and main lug kit tables on Page 26.3-15.	BR1224NC125 ⑧⑨ BR1224NC125R ⑧⑨ BR2024NC125 ⑧ BR2024NC125R ⑧	
	12	24	Outdoor	B2R	18.75	14.31	5.19			
	20	24	Indoor	C2	23.00	14.31	3.88			
	20	24	Outdoor	C3R	25.00	14.31	5.19			
200 10/25 kAIC ⑤⑦	20	40	Indoor	D1	29.13	14.31	3.88			BR2040NC200 BR2040NC200R BR3040NC200 BR3040NC200R BR4040NC200 BR4040NC200R
	20	40	Outdoor	D1R	29.13	14.31	5.19			
	30	40	Indoor	G1	34.13	14.31	3.88			
	30	40	Outdoor	G1R	34.13	14.31	5.19			
	40	40	Indoor	L1	39.00	14.31	3.88			
	40	40	Outdoor	L1R	39.00	14.31	5.19			

- ① Rainproof loadcenters are furnished with hub closure plates. For rainproof hubs, refer to accessories.
- ② All main circuit breaker loadcenters are listed for use as service entrance equipment and are shipped with a neutral bonding strap preattached. The maximum main rating of the loadcenter is the main breaker rating when used as service entrance equipment.
- ③ Ground bar kits ordered separately.
- ④ 100, 125 and 200 ampere Convertible base unit catalog numbers include interior, box and cover only. Main devices must be ordered separately. Accessories must also be ordered separately for field installation. All Convertible base units are listed as suitable for use as service entrance equipment when used per NEC.
- ⑤ Interrupting rating depends on main circuit breaker selected.
- ⑥ For main breaker, use Type BW. For main lug use Type BRL.
- ⑦ For main breaker, use Type BR. For main lug use Type BRSF.
- ⑧ Hold-down screw BREQS125 comes with loadcenter for back-fed Types BR and BRH main circuit breakers.
- ⑨ Suitable for use as service equipment when not more than six main disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).

Convertible Loadcenters MCB or MLO — Base Units and Main Devices

10,000/22,000/25,000 Amperes Interrupting Capacity

Complete Assembly Consists of: Loadcenter and Either Main Breaker Kit or Main Lug Kit

Note: Interrupting rating depends on main circuit breaker selected.

**Table 26.3-21. Main Breakers
2- and 3-Pole Main Circuit Breakers
120/240 Vac or 208Y/120 Vac or 240 Vac**

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	10,000 AIC	22,000/25,000 AIC
		Catalog Number	Catalog Number ⑩
2-Pole			
100	#4 – 1/0	BR2100	BRH2100
110	#4 – 1/0	BR2110	BRH2110
125	#4 – 2/0	BR2125	BRH2125
125	#2 – 300 kcmil	BW2125	BWH2125
150	#2 – 300 kcmil	BW2150	BWH2150
175	#2 – 300 kcmil	BW2175	BWH2175
200	#2 – 300 kcmil	BW2200	BWH2200
3-Pole			
100	#1	BR3100	BRH3100

**Table 26.3-22. Main Lugs
2- and 3-Pole Main Lug Kits
120/240 Vac or 208Y/120 Vac or 240 Vac**

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Catalog Number
2-Pole		
125	#6 – 2/0	BRSF125
150	#1 – 300 kcmil	BRL200
175	#1 – 300 kcmil	BRL200
200	#1 – 300 kcmil	BRL200
3-Pole		
150	#6 – 3/0	3BRSF150

⑩ Series combination rating with Types BD, BR, BQ, BQC and GFCB is 22,000 AIC with BRH main and 25,000 AIC with BWH main.

Spa Panels

Table 26.3-23. Spa Panel

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Catalog Number
	Space	Poles			Height	Width	Depth		
40	—	—	Outdoor	5R	9.44	4.50	3.00	#8 – #2	BR40SPA ⑪
50	—	—	Outdoor	5R	9.44	4.50	3.00	#8 – #2	BR50SPA ⑫

- ⑪ Includes a GFCB240 breaker, factory installed.
- ⑫ Includes a GFCB250 breaker, factory installed.

Technical Data

Commercial Loadcenters — Indoor Enclosures
Main Circuit Breaker, Main Lug and Convertible, New York City Approved
Single-Phase and Three-Phase

Table 26.3-24. Single-Phase Main Circuit Breaker — Factory Installed

Main Breaker Type	Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number	Loadcenter Cover Catalog Number	
		Spaces	Circuits			Height	Width	Depth			Flush	Surface

Single-Phase 3-Wire — 120/240 Vac Insulated/Bondable Neutral

CC 10 kAIC	200	42	42	Indoor	A	38.00	18.13	5.00	#1 – 300 kcmil	BR4242B200NY ①	3BR42FTNY	3BR42STNY
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① Approved for 150 ampere and up for residential services in New York City.

Table 26.3-25. Single-Phase Main Lugs — Factory Installed

Main Lug Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number	Loadcenter Cover Catalog Number	
	Spaces	Circuits			Height	Width	Depth			Flush	Surface

Single-Phase 3-Wire — 120/240 Vac Insulated/Bondable Neutral

225	42	42	Indoor	A	38.00	18.13	5.00	#1 – 300 kcmil	BR4242L225NY ②	3BR42FTNY	3BR42STNY
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② Approved for 150 ampere and up for residential services in New York City.

Table 26.3-26. Three-Phase Convertible Loadcenters

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter Catalog Number	Loadcenter Cover Catalog Number	
	Spaces	Circuits			Height	Width	Depth			Flush	Surface

3-Phase 4-Wire — 120/240 Vac Insulated/Bondable Neutral

225	42	42	Indoor	B	44.00	18.13	5.00	#1 – 300 kcmil	3BR4242N225NY ③④	3BR42FTNY	3BR42STNY
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③ Approved for 150 ampere and up for residential services in New York City.

④ Order main device from Table 26.3-27 and Table 26.3-28 below.

Table 26.3-27. Three-Phase Main Breaker Kits

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	Main Breaker Kit 10 kAIC
150	#4 – 4/0	CC3150N
175	#2/0 – 300 kcmil	CC3175N
200		CC3200N
225		CC3225N

Table 26.3-28. Three-Phase Main Lugs Kit

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	Main Lugs Kit
225	#2/0 – 300 kcmil	3BRL225

BR Type Technical Data

BR Type Riser Panel



Riser Panel

Product Description

The Cutler-Hammer Riser Panel is a loadcenter with an offset interior to allow riser cables to pass through the enlarged gutter. By using lay-in tap lugs, the contractor is able to simply strip off a length of the riser cable's insulation, and tap off to the riser panel's main lugs. These panels are used in the construction of assisted living homes, dormitories, public housing complexes and apartments.

Eaton offers two 125 ampere main lug riser panels, a 12/24 and a 20/24. The panels are convertible to main breaker

by adding the appropriate breaker and a BREQS125 hold-down kit. Additionally, the 12/24 is offered in a bulk-packed version. The bulk-packed product must be ordered in multiples of 16, and consists of a pallet with uncartoned loadcenters on the bottom, and cartoned trims on top. The entire pallet is shrink-wrapped for protection. By supplying the loadcenter without a carton, the contractor is able to save the unpacking time as well as saving on the scrap cardboard on the site.

For applications higher than 125 amperes, or the circuits provided by the panels above, we offer the BRGUTTER. This is essentially a junction box that mounts next to, and assembles to standard BR or CH loadcenters. There is a matching concentric knockout that allows the tapped cables to pass through from the BRGUTTER to the loadcenter. The trims of the loadcenter and the BRGUTTER are designed to allow the two boxes to bolt to one another in a flush application. There is no need to allow for the trim overhang.

Also offered is the GTAP250, which is a set of three lay-in, insulated tap lugs. The maximum wire size for the GTAP250 is 250 kcmil. GTAP250 can be used with either the riser panels, or the BRGUTTER.



BRGUTTER (Shown with Loadcenter)

Table 26.3-31. Riser Panel Accessories

Description	Dimensions		
	Height	Width	Depth
BRGUTTER	23	14.31	3.88
GTAP250	—	—	—

Table 26.3-29. Riser Panel

Main Ampere Rating	Maximum Number 1-Inch (25.4 mm)		Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Catalog Number
	Space	Circuits			Height	Width	Depth		
125	12	24	Indoor	C4	27.00	14.31	3.88	#6 - 2/0	BR1224L125RIS
125	12	24	Indoor	C4	27.00	14.31	3.88	#6 - 2/0	BR1224L125RISBP
125	20	24	Indoor	C4	27.00	14.31	3.88	#6 - 2/0	BR2024L125RIS

Mechanical Interlock Cover

Covers mechanically interlock two breakers — Type BW or BWH main breaker with a Type BR.

Table 26.3-30. Mechanical Interlock Cover

Type	Fits Loadcenter Catalog Numbers	Mechanical Interlock Panel Cover
		Catalog Number
		Flush
B	BR816B200RF BR2040B200R BR3040B200R BR4040B200R	BR3RDF5M BR3RDF11M BR3RDF12M BR3RDF13M
	BR2040B200 BR3040B200 BR4040B200	BRCOV20D1FM BRCOV30G1FM BRCOV40L1FM



Type B

Technical Data

Single-Phase and 3-Phase Circuit Breaker Unit Enclosures — 10,000/25,000 Amperes Interrupting Capacity



Circuit Breaker Unit Enclosures



BWH2200

Table 26.3-32. Type ECB Circuit Breaker Unit Enclosure — Order Type BW and BWH Circuit Breaker Separately — Unit Enclosure Includes Lug Tree Kit

Main Ampere Rating	Unit Enclosure Type	Mounting	Dimensions			Wire Size Range Cu/Al 60°C or 75°C	Catalog Number
			Height	Width	Depth		
Single-Phase 3-Wire — 240 Vac Maximum							
225	Indoor	Flush	23.25	8.88	4.50	①	ECB225F ②③④
225	Indoor	Surface	23.25	8.88	4.50	①	ECB225S ②③④
225	Outdoor	—	23.68	9.31	5.44	①	ECB225R ②③④⑤

- ① Wire size is determined by the circuit breaker installed in enclosure. Maximum wire size and ampere rating is determined by Table 26.3-34.
- ② Order circuit breaker separately.
- ③ One ground lug accepting (1) #14 – #2 is factory installed. Also, there are pre-drilled holes to accept a GBK5 ground bar.
- ④ Approved for service entrance.
- ⑤ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.

Table 26.3-33. Types BW and BWH Circuit Breakers
120/240 Vac — 25,000 AIC for Use in Type ECB Unit Enclosures

Ampere Rating	2-Pole Breakers 10,000 AIC	Wire Size Range Cu/Al 60°C or 75°C for Line Terminals	2-Pole Breakers 25,000 AIC
	Catalog Number		Catalog Number
125	BW2125	#2 – 300 kcmil	BWH2125
150	BW2150		BWH2150
175	BW2175		BWH2175
200	BW2200		BWH2200
225	BW2225		BWH2225

Table 26.3-34. Wire/Application Chart

Wire/Application	Maximum Wire Size	Maximum Ampere Rating
Aluminum — Standard	250 kcmil	200
Aluminum — Service Entrance	250 kcmil	225
Copper — Standard and Service Entrance	250 kcmil	225

Table 26.3-35. BW/BWH Lug Tree Kit for Replacement Purposes Only
for Use in Type ECB Unit Enclosures

Ampere Rating	Description	Wire Size Range Cu/Al 60°C or 75°C for Line Terminals	Catalog Number
225	For use on 125, 150, 175, 200 and 225 Ampere BW and BWH Breakers	#2 – 300 kcmil	MCBK225

Table 26.3-36. Shunt Trips, Auxiliary and Alarm Contacts

Description	Catalog Number Suffix Adder ⑥
Shunt Trip for Types BW/BWH	
12 Volts	SR12 SR24 SR01
24 Volts	
120 Volts	
Auxiliary Contact for Types BW/BWH	
1NO and 1NC	AL1 AL2
2NO and 2NC	
Alarm Contacts for Types BW/BWH	
Types BW/BWH	CR1
Alarm Contacts for Type GFCB (1-Pole)	
Alarm Contact for GFCB (1-Pole) 1NO and 1NC	W1 W2

- ⑥ Add suffix indicated to end of breaker catalog number.
- ⑦ Add amount shown to circuit breaker list price.

Technical Data

Single-Phase and 3-Phase Circuit Breaker Unit Enclosures — 10,000/25,000 Amperes Interrupting Capacity

Table 26.3-37. Type ECC Circuit Breaker Unit Enclosure — Order Type CC Circuit Breaker Separately

Main Ampere Rating	Unit Enclosure Type	Mounting	Catalog Number	Dimensions			Wire Size Range Cu/Al 60°C or 75°C
				Height	Width	Depth	
Single-Phase 3-Wire — 240 Vac Maximum							
225	Indoor	Flush	ECC225F ①②③	23.25	8.88	4.50	⑤
225	Indoor	Surface	ECC225S ①②③	23.25	8.88	4.50	⑤
225	Outdoor	—	ECC225R ①②③④	23.68	9.31	5.44	⑤

- ① Order circuit breaker separately.
- ② One ground lug accepting (1) #14 – #2 is factory installed. Also, there are pre-drilled holes to accept a GBK5 ground bar.
- ③ Approved for service entrance.
- ④ Rainproof panels are furnished with hub closures plates. For rainproof hubs, refer to accessories.
- ⑤ Wire size is determined by the circuit breaker installed in enclosure. Maximum wire size and ampere rating is determined by Table 26.3-39.

Table 26.3-38. Type CC Circuit Breaker
240 Vac — 10 kAIC for Use in Type ECC Unit Enclosures

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C for Line Terminals	Type CC 10 kAIC	Type CC Hi Mag 10 kAIC
		Catalog Number	Catalog Number

2-Pole

100 125 150	#4 – 4/0	CC2100 CC2125 CC2150	CC2100HM CC2125HM CC2150HM
175 200 225	#2/0 – 300 kcmil	CC2175 CC2200 CC2225	CC2175HM CC2200HM CC2225HM

3-Pole

100 125 150	#4 – 4/0	CC3100 CC3125 CC3150	CC3100HM CC3125HM CC3150HM
175 200 225	#2/0 – 300 kcmil	CC3175 CC3200 CC3225	CC3175HM CC3200HM CC3225HM

Table 26.3-39. Wire/Application Chart

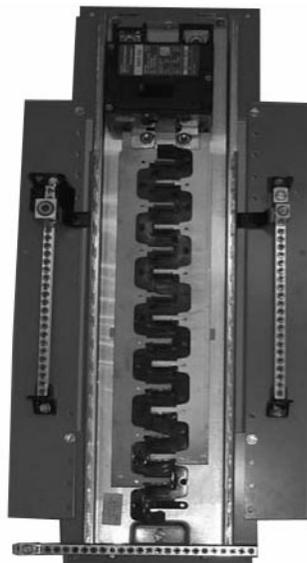
Wire/Application	Maximum Wire Size	Maximum Ampere Rating
Aluminum — Standard	250 kcmil	200
Aluminum — Service Entrance	250 kcmil	225
Copper — Standard and Service Entrance	250 kcmil	225

Table 26.3-40. Shunt Trips and Auxiliary Contacts

Description	Catalog Number Suffix Adder ⑥	
Type	Volts	
Shunt Trip		
CC	12 dc	SR12
CC	24 dc	SR24
CC	120 ac	SR01
CC	208 ac	SR08
CC	240 ac	SR02
Auxiliary Contact		
CC 1NO and 1NC	—	AL1

- ⑥ Add suffix indicated to end of breaker catalog number.

Type BR Retrofit Interior Kits



Type BR Retrofit Interior

Product Description

Replacing existing loadcenters and panelboards can be a time consuming and expensive job. BR retrofit kits can be the solution to save time and money. The kit consists of a standard trim to fit the interior, a picture frame trim to fit the existing box, and a field adjustable interior assembly which includes neutral and ground bars as well. These are especially applicable when the existing box is flush mounted in drywall, plaster or block wall. The existing box, and many times existing wiring, can remain. Interiors are UL recognized under UL 67, Panelboard standard.

Detailed Product Guide

All standard retrofit kits are suitable for a range of existing box sizes:

- Box width ranging from 14.50 to 22.00 inches (368.3 to 558.8 mm).
- Box depth ranging from 4.00 inches (101.6 mm) for BR.
- Box height ranging from 21.00 to 45.00 inches (533.4 to 1143.0 mm).

For box dimensions outside of these ranges contact Eaton. Be sure to provide the existing incoming line wire size.

To select the retrofit kit:

1. From the existing box size determine which retrofit groups are suitable (may be more than one).
2. Use type of interior, number of phases, and type of main to find the selection chart.
3. Select part number from chart (if main breaker, replace XXX with specific amp rating).
4. Note that the overlap of the existing wall is the retro cover size minus the existing box size. If specific measurements are needed, communicate that you need a custom trim size.
5. Contact Eaton for pricing, lead-times, and order entry instructions.

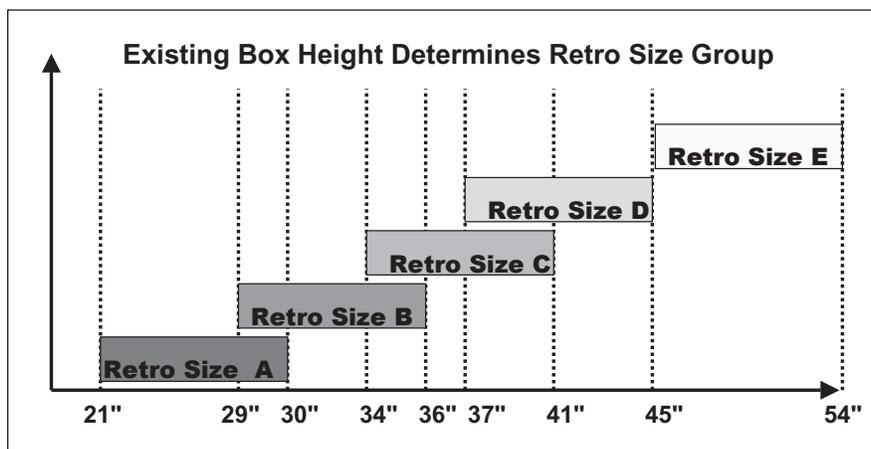


Figure 26.3-1. Retro Size Groups

Product Selection — BR Retrofit Interior Kits

Table 26.3-41. Type BR Interior — Dimensions in Inches (mm)

Main Breaker Rating		Existing Box Height		Wire Size	Number of Circuits	Part Number	Retro Size Group	Retro Cover Size ^①	
Amperes	AIC	Minimum	Maximum					Height	Width
Single-Phase with Main Breaker									
60 – 125	10K 22K	21.00 (533.4)	30.00 (762.0)	#4 – 2/0 #4 – 2/0	20	RABR20BXXX ^② RABR20HXXX ^②	A	33.00 (838.2)	24.00 (609.6)
60 – 125	10K 22K	29.00 (736.6)	36.00 (914.4)	#4 – 1/0 #4 – 1/0	30	RBBR30BCXXX ^② RBBR30HCXXX ^②	B	40.00 (1016.0)	24.00 (609.6)
100 – 200	25K	29.00 (736.6) 31.00 (787.4)	30.50 (774.7) 36.00 (914.4)	#2 – 250 kcmil #2 – 300 kcmil	20	RBBR20HXXX ^②			
100 – 225	25K	34.00 (863.6) 36.00 (914.4)	35.50 (901.7) 41.00 (1041.4)	#2 – 250 kcmil #2 – 300 kcmil	30	RCBR30HXXX ^②	C	43.00 (1092.2)	24.00 (609.6)
100 – 225	25K	37.00 (939.8) 39.00 (990.6) 41.00 (1041.4)	38.50 (977.9) 40.50 (1028.7) 45.00 (1143.0)	#2 – 4/0 #2 – 250 kcmil #2 – 300 kcmil	40	RDBR40HXXX ^②	D	47.00 (1193.8)	24.00 (609.6)
Three-Phase with Main Breaker									
60 – 100	10K 22K	21.00 (533.4)	30.00 (762.0)	#4 – 2/0 #4 – 2/0	12	RABR12B3XXX ^② RABR12H3XXX ^②	A	33.00 (838.2)	24.00 (609.6)
60 – 100	10K 22K	29.00 (736.6)	36.00 (914.4)	#4 – 1/0 #4 – 1/0	30	RBBR30BXXX ^② RBBR30H3XXX ^②	B	40.00 (1016.0)	24.00 (609.6)
100 – 200	10K	37.00 (939.8)	45.00 (1143.0)	2/0 – 300 kcmil	30	RDBR30B3XXX ^②	D	47.00 (1193.8)	24.00 (609.6)
	100K	37.00 (939.8) 39.00 (990.6)	38.50 (977.9) 45.00 (1143.0)	2/0 – 250 kcmil 2/0 – 300 kcmil		RDBR30H3XXX ^②			
100 – 225	10K 100K	34.00 (863.6) 36.00 (914.4)	35.50 (901.7) 41.00 (1041.4)	2/0 – 250 kcmil 2/0 – 300 kcmil	42	REBR42B3XXX ^② REBR42H3XXX ^②	E	56.00 (1422.4)	24.00 (609.6)

^① Specific cover sizes are available. Be sure to specify the custom cover option and provide exact dimensions required.

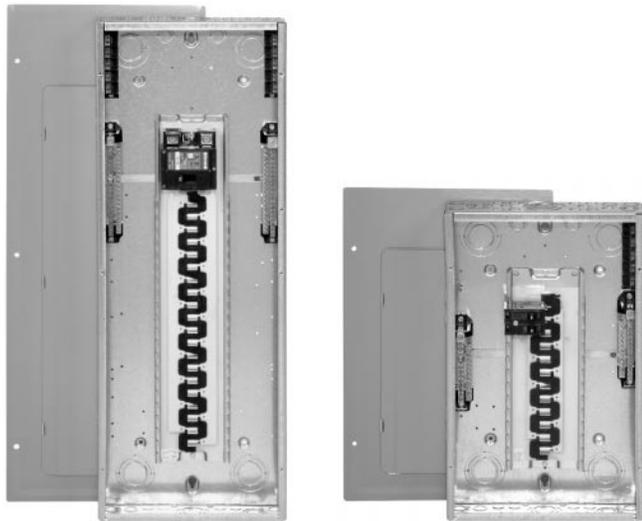
^② XXX is for Main Breaker specific ampere rating.

Table 26.3-42. Type BR Interior — Dimensions in Inches (mm)

Maximum Bus Ampere Rating	Existing Box Height		Wire Size	Number of Circuits	Part Number	Retro Size Group	Retro Cover Size ^③	
	Minimum	Maximum					Height	Width
Single-Phase Main Lug Only								
125	21.00 (533.4)	30.00 (762.0)	#14 – 2/0	24	RABR20L125	A	33.00 (838.2)	24.00 (609.6)
200	29.00 (736.6)	31.50 (800.1)	#1 – 250 kcmil	30	RBBR30L200	B	40.00 (1016.0)	24.00 (609.6)
	32.00 (812.9)	36.00 (914.4)	#1 – 300 kcmil					
200	34.00 (863.6)	36.50 (927.1)	#1 – 250 kcmil	40	RCBR40L200	B	43.00 (1092.2)	24.00 (609.6)
	37.00 (939.8)	41.00 (1041.4)	#1 – 300 kcmil					
200	37.00 (939.8)	38.50 (977.9)	#1 – 250 kcmil	42	RDBR42L225	B	47.00 (1193.8)	24.00 (609.6)
	39.00 (990.6)	45.00 (1143.0)	#1 – 300 kcmil					
Three-Phase Main Lug Only								
125	21.00 (533.4)	30.00 (762.0)	#8 – 2/0	24	RABR12L3125	A	33.00 (838.2)	24.00 (609.6)
100	29.00 (736.6)	36.00 (914.4)	#8 – 2/0	24	RBBR30L3100	B	40.00 (1016.0)	24.00 (609.6)
150			#4 – 4/0	24	RBBR24L3150			
200	34.00 (863.6)	35.50 (901.7)	#4 – 250 kcmil	30	RCBR30L3200	C	43.00 (1092.2)	24.00 (609.6)
	36.00 (914.4)	41.00 (1041.4)	#4 – 300 kcmil					
225	37.00 (939.8)	38.50 (977.9)	#4 – 250 kcmil	42	RDBR42L3225	D	47.00 (1193.8)	24.00 (609.6)
	39.00 (990.6)	45.00 (1143.0)	#4 – 300 kcmil					
225	45.00 (1143.0)	54.00 (1371.6)	#4 – 300 kcmil	42	REBR42L3225	E	56.00 (1422.4)	24.00 (609.6)

^③ Specific cover sizes are available. Be sure to specify the custom cover option and provide exact dimensions required.

BR Renovation Loadcenter Value Packs



BR Renovation Loadcenters

Product Description

- Available in 10, 20, 30 and 40 circuit main breaker styles.
- Designed to replace existing loadcenters and fuse boxes.
- Type BR loadcenter packaged with circuit breakers.
- Factory-installed 5-circuit terminal block(s).
- Twin-stacked neutral design.

Features, Functions & Benefits

- Factory-installed terminal block(s) allows installer to terminate existing short wires without using wire nuts or junction boxes.
- Twin-stacked neutrals are mounted up high in the loadcenter, which allows for all neutral and ground wires to be terminated in the top half of the loadcenter.
- Specifically designed for the service contractor — this is the ONLY renovation line in the industry.
- Single-pole and two-pole breakers included.
- 10-year warranty on loadcenter and breakers.

Product Selection

Table 26.3-43. BR Value Packs

Main Breaker Type	Description	Wire Size Range	Number of 5-Circuit Terminal Blocks	Single-Pole Breakers	Two-Pole Breakers	Catalog Number
BR 10 kAIC	Single-Phase 100 Ampere 10 k Main Breaker 10/20 Circuit Surface-Mount Box is 11.75" Wide x 13" Tall	#6 – 1/0	0	(2) BR115	(1) BR230	BR1020B100S11RN
	Single-Phase 100 Ampere 10 k Main Breaker 10/20 Circuit Flush-Mount Box is 11.75" Wide x 13" Tall		0	(2) BR115	(1) BR230	BR1020B100F11RN
BWH 25 kAIC	Single-Phase 100 Ampere 10 kAIC Main Breaker 20/20 Circuit	#2 – 300 kcmil	1	(5) BR120	(1) BR230	BR2020B100RN
	Single-Phase 200 Ampere 10 kAIC Main Breaker 30/40 Circuit		2	(5) BR115 (5) BR120	(1) BR230 (1) BR250	BR3040B200RN
	Single-Phase 200 Ampere 10 kAIC Main Breaker 40/40 Circuit		2	(6) BR115 (6) BR120	(1) BR230 (1) BR250	BR4040B200RN

Note: Indoor enclosure type.

Plug-on Circuit Breakers, Types BR
10,000/22,000/42,000 Amperes
Interrupting Capacity 120 Vac, 120/240 Vac and 240 Vac



BR120



BR215



BR320

Table 26.3-44. Type BR Breakers, 1-Inch (25.4 mm) per Pole 120/240, 10,000, 22,000 and 42,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 Vac Requires One 1-Inch (25.4 mm) Space 		2-Pole 120/240 Vac Common Trip Requires Two 1-Inch (25.4 mm) Spaces 		
		10 kAIC	22 kAIC	10 kAIC	22 kAIC	42 kAIC
		Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
10	#14 – 4	BR110	—	BR210	—	—
15		BR115 ①②	BRH115	BR215 ③	BRH215	—
20		BR120 ①②	BRH120	BR220 ③	BRH220	—
25		BR125	BRH125	BR225 ③	BRH225	—
30		BR130	BRH130	BR230 ③	BRH230	—
35	#14 – 4	BR135	BRH135	BR235 ③	BRH235	—
40		BR140	BRH140	BR240 ③	BRH240 ③	—
45		—	BRH145	BR245 ③	BRH245	—
50		BR150	BRH150	BR250 ③	BRH250 ③	—
55	#14 – 3	BR150	BRH155	BR255	BRH255	—
60	#4 – 1/0	BR160	BRH160	BR260	BRH260	BRHH260
70		BR170	BRH170	BR270	BRH270	BRHH270
80		—	—	BR280	BRH280	BRHH280
90		—	—	BR290	BRH290	BRHH290
100		—	—	BR2100	BRH2100	BRHH2100
110		—	—	BR2110	BRH2110	BRHH2110
125	#4 – 2/0	—	—	BR2125	BRH2125	BRHH2125
150		—	—	BR2150 ④	—	—

① One pole, 1-inch (25.4 mm) per pole circuit breakers are available with high magnetic setting for switching large tungsten lamp loads. Add suffix H to catalog number.

② Switching duty rated.

③ On the black handle breaker, add suffix “B” to the catalog number to obtain a tapped molded opening for proper use with hold-down kits.

④ For use as a branch circuit breaker in 400 and 600 ampere panels only.

Note: All Type BR 1-, 2-, and 3-pole circuit breakers carry listing for HACR application. For circuit breakers with a shunt trip, add ST suffix.

Technical Data — BR Plug-on Breakers

Table 26.3-45. Type BR Breakers, 1-Inch (25.4 mm) per Pole 240 Vac, 10,000, 22,000 and 42,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	3-Pole 240 Vac Common Trip Requires Three 1-Inch (25.4 mm) Spaces	
		10 kAIC	22 kAIC
		Catalog Number	Catalog Number
10 15 20 25 30	#14 – 4	BR310 BR315 ① BR320 ① BR325 BR330	— BRH315 BRH320 BRH325 BRH330
35 40 45 50	#14 – 4	BR335 BR340 BR345 BR350	BRH335 BRH340 BRH345 BRH350
55	#14 – 3	BR355	BRH355
60 70 80 90 100	#4 – 1/0	BR360 BR370 BR380 BR390 BR3100	BRH360 BRH370 BRH380 BRH390 BRH3100

① One pole, 1-inch (25.4 mm) per pole circuit breakers are available with high magnetic setting for switching large tungsten lamp loads. Add suffix H to catalog number.

Note: All Type BR 1-, 2- and 3-pole circuit breakers carry listing for HACR application. For circuit breakers with a shunt trip, add ST suffix.

Plug-on Arc Fault Circuit Breakers, Type BR
10,000 Amperes
Interrupting Capacity
120 Vac and 120/240 Vac



Type BR AFCI Circuit Breaker

An arc fault circuit interrupter is a device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when the arc fault is detected. As of January 1, 2002, the National Electrical Code (NEC) now requires that all branch circuits that supply 125 volt, single-phase, 15 and 20 ampere receptacle outlets installed in dwelling unit bedrooms shall be protected by an Arc Fault Circuit Interrupter(s).

Product Selection

Table 26.3-46. Type BR, 1-Inch (25.4 mm) wide FIRE-GUARD™ AFCI Circuit Breakers

Poles	Ampere Rating	Configuration	Catalog Number
Single-Pole 10 kAIC	15	AFCI AFCI with GFCI AFCI in Clamshell Package	BR115AF BR115AFGF BR115AFCS
	20	AFCI AFCI with GFCI AFCI in Clamshell Package	BR120AF BR120AFGF BR120AFCS
Double-Pole 10 kAIC ①②	15	AFCI Common Trip AFCI Independent Trip AFCI Common Trip with GFCI	BR215AF BR215AFIT BR215AFGF
	20	AFCI Common Trip AFCI Independent Trip AFCI Common Trip with GFCI	BR220AF BR220AFIT BR220AFGF

- ① Common trip refers to 2-pole 240 volt load application sourced by 120/240 Vac (see Figure 26.3-4).
- ② Independent trip refers to 2-pole multi-wire, home run or shared neutral circuits (see Figure 26.3-3 and Figure 26.3-5).

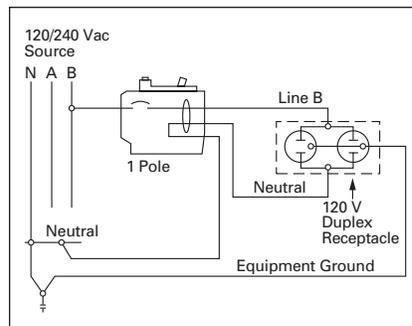


Figure 26.3-2. 1-Pole 120 Volt Load Application Sourced by 120/240 Vac

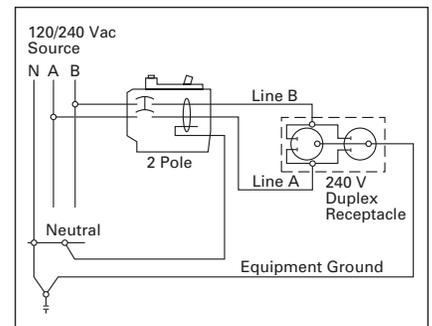


Figure 26.3-4. 2-Pole 240 Volt Load Application Sourced by 120/240 Vac

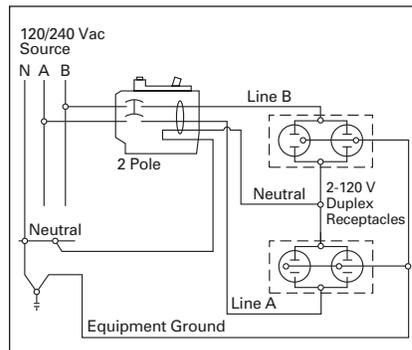


Figure 26.3-3. 1-Pole Shared Neutral with Multi-Duplex Receptacle Application

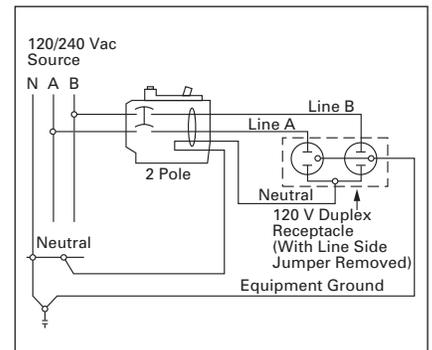
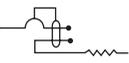
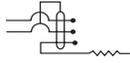


Figure 26.3-5. 2-Pole Shared Neutral with Duplex Receptacle Application

Plug-on Ground Fault Circuit Breakers, Type GFCB and GFEP
10,000/22,000 Amperes Interrupting Capacity
120 Vac and 120/240 Vac

Table 26.3-47. Type GFCB Ground Fault Circuit Breakers — 5 Milliampere —
1-Inch (25.4 mm) per Pole 120 Vac or 120/240 Vac, 10,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120 Vac Requires One 1-Inch (25.4 mm) Space	2-Pole 120/240 Vac Common Trip Requires Two 1-Inch (25.4 mm) Spaces
			
		1 per Shelf Carton	1 per Shelf Carton
		10,000 AIC	10,000 AIC
		Catalog Number ①	Catalog Number
15 20 25 30 40 50	#14 – 4	GFCB115 GFCB120 GFCB125 GFCB130 GFCB140 —	GFCB215 GFCB220 GFCB225 GFCB230 GFCB240 GFCB250 ②

① Available with bell alarm or auxiliary switch. See circuit breaker accessories on Page 26.3-32.

② For use with copper wire only.



Type GFCB 1-Pole



Type GFCB 2-Pole

Table 26.3-48. Type GFCBH Ground Fault Breakers — 5 Milliampere —
1-Inch (25.4 mm) per Pole 120 Vac or 120/240 Vac, 22,000 AIC

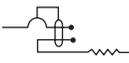
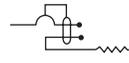
Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120 Vac Requires One 1-Inch (25.4 mm) Space	2-Pole 120/240 Vac Common Trip Requires Two 1-Inch (25.4 mm) Spaces
			
		1 per Shelf Carton	1 per Shelf Carton
		22,000 AIC	22,000 AIC
		Catalog Number	Catalog Number
15 20 25 30	#14 – 4	GFCBH115 GFCBH120 GFCBH125 GFCBH130	GFCBH215 GFCBH220 GFCBH225 GFCBH230

Table 26.3-49. Type GFEP Ground Fault Equipment Protectors — 30 Milliampere —
1-Inch (25.4 mm) per Pole 120 Vac or 120/240 Vac, 10,000 AIC

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120 Vac Requires One 1-Inch Space	2-Pole 120/240 Vac Common Trip Requires Two 1-Inch Spaces
			
		1 per Shelf Carton	1 per Shelf Carton
		10,000 AIC	10,000 AIC
		Catalog Number	Catalog Number
15 20 25 30 40 50	#14 – 4	GFEP115 GFEP120 GFEP125 GFEP130 — —	GFEP215 GFEP220 GFEP225 GFEP230 GFEP240 GFEP250 ③

③ For use with copper wire only.

Ground Fault Application Notes

Single-pole GFCBs are designed for use in 2-wire, 120 Vac circuits.

Figure 26.3-6 shows a typical wiring configuration.

Two-pole GFCBs are designed for use in 3-wire, 120/240 Vac circuits, 120 Vac multiwire circuits employing common, neutral and 2-wire, 240 Vac circuits obtained from a 120/240 Vac source.

Figure 26.3-7 and **Figure 26.3-8** illustrate typical wiring configurations for a 120/240 Vac multiwire circuits.

Figure 26.3-9 depicts a 240 Vac, 2-wire circuit. Note the “panel neutral” conductor connects to the neutral bar, even though the neutral is not included in the load circuit. This connection is necessary to supply a 120 Vac power source to the ground fault sensing circuit.

The figures are shown with a 120/240 Vac, single-phase, 3-wire power source, but are also applicable to a 120/208 Vac, 3-phase, 4-wire power supply. For all figures, the electrical operation of the GFCB is not affected by the equipment ground.

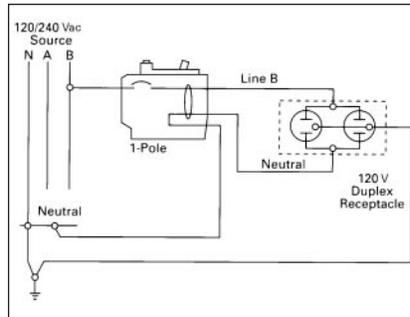


Figure 26.3-6. 1-Pole 120 Volt Duplex Receptacle Application

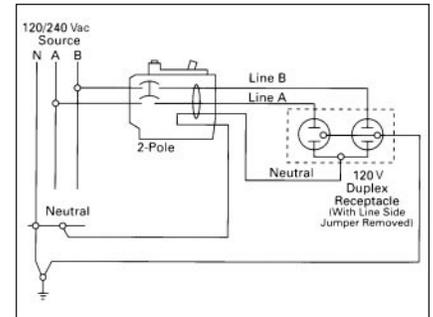


Figure 26.3-8. 2-Pole 120 Volt Duplex Receptacle Application

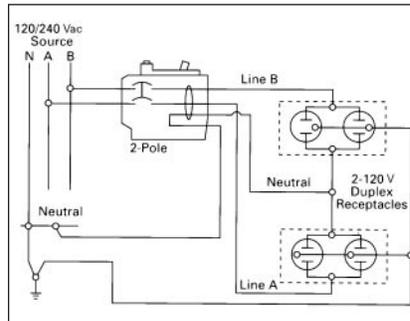


Figure 26.3-7. 2-Pole 120 Volt Multi-Duplex Receptacle Application

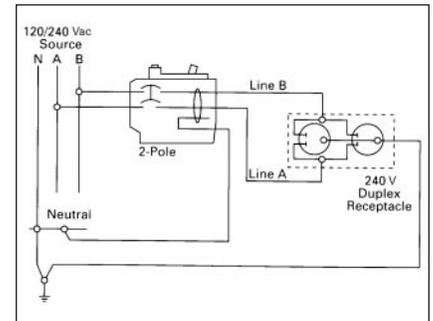


Figure 26.3-9. 2-Pole 240 Volt Duplex Receptacle Application

Technical Data — CTL Duplex and Quadplex Breakers

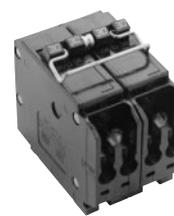
CTL Plug-on Circuit Breakers, Type BD Duplex, BQ and BQC Quadplex
10,000 Amperes Interrupting Capacity 120/240 Vac



BD2020



BQ2302115



BQ230230

Duplex and Independent Trip Quadplex Breakers ①

Table 26.3-50. Class CTL, 1-Inch (25.4 mm) per Pole 10,000 AIC — All Circuit Breakers Have Rejection Tab Feature

Type BD Duplex (UL Type BRD)		Wire Size Range Cu/Al 65°C or 75°C	Type BQ Quadplex Independent Trip (UL Type BRD)				Type BQ Quadplex Independent Trip (UL Type BRD)		
1-Pole ②	2-Pole ③ and 1-Pole ②			Catalog Number	2-Pole				
Requires One 1-Inch (25.4 mm) Space			Requires Two 1-Inch (25.4 mm) Spaces				Requires Two 1-Inch (25.4 mm) Spaces		
10 per Shelf Carton			5 per Shelf Carton				5 per Shelf Carton		
Ampere Rating	10,000 AIC		10,000 AIC				10,000 AIC		
	120 Vac		120 Vac	120/240 Vac	120 Vac	Catalog Number	120/240 Vac		
Catalog Number			Ampere Rating				Ampere Rating		
			Outer Left 1-Pole	Center 2-Poles Independent Trip	Outer Right 1-Pole		Outer 2-Poles Independent Trip	Center 2-Poles Independent Trip	
10 – 10	BD1010	#14 – 4	15	20	15	BQ2202115	15	15	BQ215215
15 – 15	BD1515		20	20	20	BQ2202120	15	20	BQ215220
15 – 20	BD1520		15	30	15	BQ2302115	15	30	BQ215230
15 – 30	BD1530		20	30	20	BQ2302120	15	40	BQ215240
20 – 15	BD2015		15	40	15	BQ2402115	15	50	BQ215250
20 – 20	BD2020		20	40	20	BQ2402120	20	20	BQ220220
20 – 30	BD2030		15	50	15	BQ2502115	20	30	BQ220230
25 – 25	BD2525		20	50	20	BQ2502120	20	40	BQ220240
30 – 15	BD3015		—	—	—	—	20	50	BQ220250
30 – 20	BD3020		—	—	—	—	25	25	BQ225225
30 – 30	BD3030		—	—	—	—	30	30	BQ230230
30 – 40	BD3040		—	—	—	—	30	40	BQ230240
30 – 50	BD3050		—	—	—	—	30	50	BQ230250
50 – 30	BD5030		—	—	—	—	40	40	BQ240240
50 – 50	BD5050		—	—	—	—	40	50	BQ240250
—	—		—	—	—	—	50	50	BQ250250
—	—		—	—	—	—	—	—	—
—	—		—	—	—	—	—	—	—

① Breaker placement restricted — Type BD Duplex, BQ Quadplex and BQC Quadplex (CTL type devices) can only be installed in loadcenter positions that have notched bus stabs. See Page 26.3-29 for more details.
 ② All 15 and 20 ampere single poles are switch-duty rated.
 ③ All Type BD Duplex and BQ Quadplex circuit breakers carry listing for HACR applications.

Common Trip Quadplex Breakers



BQC2302115



BQC230230

Table 26.3-51. Class CTL, 1-Inch (25.4 mm) per Pole 10,000 AIC — All Circuit Breakers Have Rejection Tab Feature

Type BQC Quadplex Common Trip Center Poles (UL Type BRD)				Wire Size Range Cu/Al 65°C or 75°C	Type BQC Quadplex Common Trip Center and Outer Poles (UL Type BRD)			
2-Pole ① and 1-Pole ②					2-Pole ①			
Requires Two 1-Inch (25.4 mm) Spaces					Requires Two 1-Inch (25.4 mm) Spaces			
10,000 AIC					10,000 AIC			
120 Vac	120/240 Vac	120 Vac	Catalog Number ③		120/240 Vac	Catalog Number ③		
Ampere Rating					Ampere Rating			
Outer Left 1-Pole	Center 2-Poles Common Trip	Outer Right 1-Pole			Outer 2-Poles Common Trip			Center 2-Poles Common Trip
15	20	15	BQC2202115		#14 – 4	15		15
15	25	15	BQC2252115	15		20	BQC215220	
15	30	15	BQC2302115	15		30	BQC215230	
15	40	15	BQC2402115	20		15	BQC220215	
15	50	15	BQC2502115	20		20	BQC220220	
—	—	—	—	20	30	BQC220230		
—	—	—	—	20	40	BQC220240		
—	—	—	—	20	50	BQC220250		
20	15	20	BQC2152120	#14 – 4	25	25	BQC225225	
20	20	20	BQC2202120		25	30	BQC225230	
20	25	20	BQC2252120		30	15	BQC230215	
20	30	20	BQC2302120		30	30	BQC230230	
20	40	20	BQC2402120		30	40	BQC230240	
20	50	20	BQC2502120		30	50	BQC230250	
30	50	20	BQC2502030	#14 – 4	40	30	BQC240230	
—	—	—	—		40	40	BQC240240	
—	—	—	—		40	50	BQC240250	
—	—	—	—		50	20	BQC250220	
—	—	—	—		50	50	BQC250250	

① All Type BQC Quadplex circuit breakers carry listing for HACR applications.

② All 15 and 20 ampere single poles are switch-duty rated.

③ Type BD, BQ and BQC Quadplex (CTL) breakers conform to the latest NEC. Install breaker only in loadcenter positions that have notched bus stabs.

Technical Data — Non-CTL Plug-on Breakers

**Non-CTL Plug-on Replacement
Circuit Breakers, Type BRD
10,000 Amperes Interrupting
Capacity 120/240 Vac**

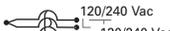
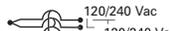
**Non-CTL 10,000 AIC for
Replacement Purposes Only**

For replacement in enclosures manufactured prior to 1968 with unnotched stabs. Circuit breakers do not have rejection tab.



BR1515

Table 26.3-52. Class Non-CTL, 1-Inch (25.4 mm) per Pole 10,000 AIC — Breakers Do Not Have Rejection Tab Feature

Type BR Duplex		Wire Size Range Cu/Al 65°C or 75°C	Type Brand BRD Quadplex Independent Trip			Type BRD Quadplex Common Trip center and Outer Poles		
1-Pole  120/240 Vac 120/240 Vac			2-Pole  120/240 Vac 120/240 Vac			2-Pole  120/240 Vac 120/240 Vac		
Requires One 1-Inch (25.4 mm) Space			Requires Two 1-Inch (25.4 mm) Spaces			Requires Two 1-Inch (25.4 mm) Spaces		
10 per Shelf Carton			5 per Shelf Carton			5 per Shelf Carton		
Ampere Rating	10,000 AIC		10,000 AIC			10,000 AIC		
	120 Vac		120/240 Vac	120/240 Vac	Catalog Number	120/240 Vac	Catalog Number	
10,000 AIC	Catalog Number	Ampere Rating	Outer 2-Poles Independent Trip	Center 2-Poles Independent Trip		Ampere Rating		
			Outer 2-Poles Independent Trip	Center 2-Poles Independent Trip		Outer 2-Poles Common Trip	Center 2-Poles Common Trip	Catalog Number
15 – 15	BR1515	#14 – 4	15	15	BR415	15	15	BRDC215215
15 – 20	BR1520		20	20	BR420	30	30	BRDC230230
20 – 15	BR2015		30	30	BR430	30	40	BRDC230240
20 – 20	BR2020		20	30	BRD220230	30	50	BRDC230250
30 – 30	BR3030		30	40	BRD230240	—	—	—
30 – 50	BR3050		30	50	BRD230250	—	—	—

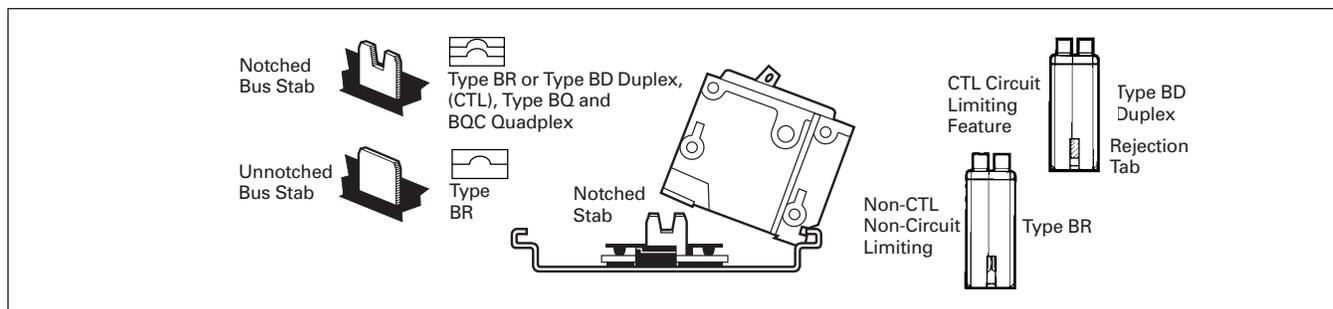


Figure 26.3-10. CTL and Non-CTL Breakers

Note: Type BD Duplex, BQ and BQC Quadplex (CTL) circuit breakers conform to the latest NEC. Install breaker only in panel positions that have notched bus stabs.

Plug-on Circuit Breakers, Types BJ and BJH
10,000/22,000 Amperes Interrupting Capacity
120/240 Vac and 240 Vac

For Use in Single-Phase and 3-Phase Loadcenters
150 Amperes and Above



Type BJ

Table 26.3-53. Types BJ and BJH Breakers, 1-Inch (25.4 mm) per Pole, 120/240 or 240 Vac, 10,000, 22,000 AIC

Ampere Rating	2-Pole 120/240 Vac Common Trip Requires Four 1-Inch (25.4 mm) Spaces ①		Wire Size Range Cu/Al 60°C or 75°C	3-Pole 240 Vac Common Trip Requires Six 1-Inch (25.4 mm) Spaces ②	
	10,000 AIC	22,000 AIC		10,000 AIC	22,000 AIC
	Catalog Number	Catalog Number		Catalog Number	Catalog Number
125	BJ2125	BJH2125	#2 – 300 kcmil	BJ3125	BJH3125
150	BJ2150	BJH2150		BJ3150	BJH3150
175	BJ2175	BJH2175		BJ3175	BJH3175
200	BJ2200	BJH2200		BJ3200	BJH3200
225	BJ2225	BJH2225		BJ3225	BJH3225

① Breaker uses two 1-inch (25.4 mm) pole spaces on left side and two 1-inch (25.4 mm) pole spaces on right side of loadcenter.

② Breaker uses three 1-inch (25.4 mm) pole spaces on left side and three 1-inch (25.4 mm) pole spaces on right side of loadcenter.

Note: If BJ or BJH breakers are used as a main or a back feed device, a hold-down kit is required. See Page 26.3-32.

Plug-on Special Application Circuit Breakers
10,000 Amperes Interrupting Capacity
120 Vac, 120/240 Vac and 240 Vac



BRWH215
Water Heater Breaker



BRSN220
Switching Neutral Breaker

Table 26.3-54. Special Application Circuit Breakers, 1-Inch (25.4 mm) per Pole

Water Heater Breakers		Switching Neutral Breakers		Wire Size Range Cu/Al 60°C or 75°C	240 V Breakers		Non-Automatic Molded Case Switches	
2-Pole 120/240 Vac Common Trip Requires Two 1-Inch (25.4 mm) Spaces		2-Pole 120 Vac Common Trip Requires Two 1-Inch (25.4 mm) Spaces			2-Pole 240 Vac Common Trip Requires Two 1-Inch (25.4 mm) Spaces		2-Pole 240 Vac Requires Two 1-Inch (25.4 mm) Spaces	
With Isolated Line Terminals for Separately Metered Water Heaters		With Switching Neutral Pole for Gasoline Pump Applications		Where Voltage to Ground is 240 Vac		For Use as Disconnect Contains No Magnetic or Thermal Trip Properties		
10,000 AIC		10,000 AIC		10,000 AIC		5,000 AIC		
Ampere Rating	Catalog Number	Ampere Rating	Catalog Number	Ampere Rating	Catalog Number	Ampere Rating	Catalog Number	
15	BRWH215	15	BRSN215	#14 – 4	10	BR210H	—	—
20	BRWH220	20	BRSN220		15	BR215H	—	—
30	BRWH230	25	BRSN225		20	BR220H	—	—
—	—	30	BRSN230		25	BR225H	—	—
—	—	—	—		30	BR230H	—	—
—	—	—	—		35	BR235H	—	—
—	—	—	—		40	BR240H	—	—
—	—	—	—		45	BR245H	—	—
—	—	—	—		50	BR250H	50	BR250NA
—	—	—	—		55	BR255H	—	—
—	—	—	—	#4 – 1/0	60	BR260H	60	BR260NA
—	—	—	—		70	BR270H	—	—
—	—	—	—		80	BR280H	—	—
—	—	—	—		90	BR290H	—	—
—	—	—	—		100	BR2100H	100	BR2100NA

Circuit Breaker Options and Accessories



Table 26.3-55. Field Installation Kits and Parts

Description	Ordering Quantity ^①	Catalog Number
Handle Ties ^② Handle tie bar for physically joining the handles of two adjacent 1-pole Type BR Circuit Breakers. (Metal Cylinder Pin Type)	10	BHT
Handle tie bar for joining two independent outside poles of Types BQ and BQC Quadplex and outside poles of two Type BD Duplex Circuit Breakers.	10	THOW
Handle tie bar for joining two adjacent outside poles of Types BQ and BQC Quadplex and outside poles of two Type BD Duplex Circuit Breakers.	10	THS1
Handle Lockoffs ^{③④} Padlockable device for locking the handle of 1-, 2- or 3-pole Type BR Circuit Breakers and 1-pole of a Type BD Duplex or one independent outside pole of a Type BQ or BQC Quadplex Circuit Breakers. (Escutcheon Mounted) ^⑤	10	BRLW
Padlockable device for locking the handle of a 1-pole Type BR Circuit Breaker. (Handle Mounted) ^⑥	10	BRLW1
Padlockable device for locking the handle of a 2- and 3-pole Type BR Circuit Breaker. (Handle Mounted) ^⑥	10	BRLW2
Padlockable device for locking the handle of a 1-pole Type BD Duplex, BQ or BQC Quadplex Breaker. (Handle Mounted) ^⑥	10	BRDL1
Padlockable device for locking the handle of the two center poles and the two outer poles of a 2-pole Types BQ and BQC Quadplex Circuit Breakers. (Escutcheon Mounted) ^⑤	10	BRQLW
Padlockable device for locking the handle of main circuit breaker Types CC and CHH into the ON or OFF position. (Screw Mounted) ^⑦	1	CCPL
Padlockable device for locking the handle of main breaker Types BW and BWH into the ON or OFF position. (Escutcheon Mounted) ^⑤	1	MCBPL
Handle Lockdogs ^{④⑧} Device used to secure handle in ON or OFF position for 1-, 2- or 3-pole Type BR Circuit Breakers and 1-pole of Type BD Duplex and one independent outside pole of Type BQ or BQC Quadplex Circuit Breakers. (Escutcheon Mounted) ^⑤	10	BHLW
Device used to secure handle in ON or OFF position for 1-pole Type BR Circuit Breakers. (Handle Mounted) ^⑥	10	BHLW1
Device used to secure handle in ON or OFF position for 2- and 3-pole Type BR Circuit Breakers. (Handle Mounted) ^⑥	10	BHLW2
Device used to secure handle in ON or OFF position for 1-pole Type GFBC Ground Fault Circuit Breakers. (Handle Mounted) ^⑥	10	BHGW
Device used to secure handle in ON or OFF position for one independent outside pole of Types BQ and BQC Quadplex or 1-pole Type BD Duplex Circuit Breakers. (Handle Mounted) ^⑥	10	HLW1
Hold-Down Kits ^⑨ Hold-down retainer kit for 3-pole Type BR Circuit Breakers in S3100 and 3100R Loadcenters only.	1	BRHDB
Hold-down screw kit for 2-pole Type BR Circuit Breakers in 1-phase MLO Loadcenters through 125 amperes.	1	BREQS125
Hold-down screw kit for 2-pole Type BR Circuit Breakers in MLO Loadcenters 150 through 225 amperes (1-phase only).	1	BRHDK125
Hold-down screw kit for 2-pole Types BJ and BJH Circuit Breakers in MLO Loadcenters 125 through 225 amperes.	1	BJHDS
Hold-down screw kit for 3-pole Types BJ and BJH Circuit Breakers in MLO Loadcenters 125 through 225 amperes.	1	BJHDS3P
Main Breaker Lug Kits Types CC and CHH Main Breaker Lug Kit (2) 300 kcmil.	1	CCL300
Types BW/BWH Main Breaker Lug Kit (2) 300 kcmil.	1	MCBL300
Mechanical Interlocks Types BR for 2-, 3- and 4-pole breakers.	10	BRML

① Must be purchased in multiples of ordering quantities indicated.
 ② Handle Ties: Typically used to join two similar independent single-pole breakers to form a 2-pole noncommon trip breaker.
 ③ Handle Lockoffs: Devices that use a padlock to lock the circuit breaker's handle in the "On" or "Off" position.
 ④ See Table 26.3-57 for Handle Position Changeability Chart.
 ⑤ Escutcheon Mounted: Device mounted semipermanently to the face of the circuit breaker and secured by the loadcenter deadfront.
 ⑥ Handle Mounted: Device mounted directly to the handle by the use of a set screw.
 ⑦ Screw Mounted: Device permanently mounted to the face of the circuit breaker by the use of a non-removable screw.
 ⑧ Handle Lockdogs: Devices that are used to secure a circuit breaker's handle in the "On" or "Off" position. Handle Lockdogs are not padlockable devices.
 ⑨ Hold-Down Kits: Devices used to secure the circuit breaker to the loadcenter for back-feed main application.

Table 26.3-56. Shunt Trips, Auxiliary and Alarm Contacts

Description	Catalog Number ① Suffix Adder
Shunt Trip for Types BW/BWH	
12 Volts 24 Volts 120 Volts	SR12 SR24 SR01
Shunt Trip for Types BR	
120 Volts	ST
Auxiliary Contact for Types BW/BWH	
1NO and 1NC 2NO and 2NC	AL1 AL2
Alarm Contacts for Types BW/BWH	
Types BW/BWH	CR1
Alarm Contacts for Type GFCB (1-Pole)	
Alarm Contact for GFCB (1-Pole) 1NO and 1NC	W1 W2

① Add suffix indicated to end of breaker catalog number.

Table 26.3-57. Handle Position Changeability Chart

Handle Lockoff and Lockdog Types	To Change Handle Position from "On to "Off," or "Off" to "On" You Must...		
	Remove Padlock	Remove Device	Remove Loadcenter Deadfront
Lockoff Escutcheon Mounted	Remove	—	—
Lockoff Handle Mounted	Remove	Remove	—
Lockoff Screw Mounted	Remove	—	—
Lockdog Escutcheon Mounted	N/A	Remove	Remove
Lockdog Handle Mounted	N/A	Remove	—

Application Data — Replacement Type CHQ Breakers

UL Classified Circuit Breakers

Cutler-Hammer UL classified Replacement Circuit Breakers by Eaton Corporation are available in both 3/4-inch Type CHQ and 1-inch Type CL, 1- and 2-pole configurations. These breakers are classified as direct replacements by Underwriters Laboratories. In addition to a UL listing, they also come with a 15-year warranty.

Specified vs. UL Classified

Specified breakers are listed by the manufacturer of the panelboard for use in a particular panel. This doesn't mean that the panelboard manufacturer produced the specified breaker; it merely means that the panelboard manufacturer has tested the breaker in the panel. In fact, through the years, Eaton has manufactured thousands of breakers for other panelboard manufacturers.

UL classified breakers are produced by one manufacturer for use in place of the breakers specified on the panelboard. Like specified breakers, UL classified breakers have been tested in the panels for which they are approved.

Testing

Classified breakers are tested extensively in numerous GE®, Siemens®, Murray®, Thomas & Betts®, Square D®, and Crouse-Hinds® panels. The tests are conducted with witnesses from Underwriters Laboratories and involve short circuit, temperature, and insertion/withdrawal applications. This level of testing assures that the breakers meet identified standards and have been found suitable by UL for the specified purpose.

Understanding Classified Breaker Terminology

Definitions

Specified Circuit Breaker — Each manufacturer lists the brands of circuit breakers that can be used in their panelboards. Often, manufacturers will not list competitors as specified, even though they are suitable replacements.

Classified Circuit Breaker — A breaker that is considered suitable, by a qualified third party organization, for use in another manufacturer's panelboard.

Listed Breaker — The listing of a circuit breaker is by an independent third party. Cutler-Hammer classified breakers are listed by UL.

Labeled Breaker — A breaker with a label affixed by an independent third party.

Type CHQ Replacement Breakers for Square D Type QO Loadcenters

10,000 Amperes Interrupting Capacity
120 and 120/240 Vac



CHQ120 CHQ230

Table 26.3-58. Type CHQ Classified Breakers 3/4-Inch (19.1 mm) per Pole 120 or 120/240 Vac

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 Vac	2-Pole 120/240 Vac Common Trip
		Requires One 3/4-Inch (19.1 mm) Space	Requires Two 3/4-Inch (19.1 mm) Spaces
		10,000 AIC	10,000 AIC
		Catalog Number	Catalog Number
15	(1) #14 – 8	CHQ115	CHQ215
20	(2) #14 – 10	CHQ120	CHQ220
25		CHQ125	CHQ225
30		CHQ130	CHQ230
35		CHQ135	CHQ235
40		CHQ140	CHQ240
45		CHQ145	CHQ245
50		CHQ150	CHQ250
60		—	CHQ260

Type CHQ Ground Fault and Arc Fault Replacement Breakers for Square D Type QO Loadcenters

10,000 Amperes Interrupting Capacity
120 and 120/240 Vac



CHQ115GF CHQ220GF

Table 26.3-59. Type CHQ Breakers — 5 Milliamperes — 3/4-Inch (19.1 mm) per Pole

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120 Vac	2-Pole 120/240 Vac Common Trip
		Requires One 3/4-Inch (19.1 mm) Space	Requires Two 3/4-Inch (19.1 mm) Spaces
		10,000 AIC	10,000 AIC
		Catalog Number	Catalog Number
Ground Fault			
15	(1) #14 – 8	CHQ115GF	CHQ215GF
20	(2) #14 – 10	CHQ120GF	CHQ220GF
25		CHQ125GF	CHQ225GF
30		CHQ130GF	CHQ230GF
35		—	CHQ235GF
40		—	CHQ240GF
45		—	CHQ245GF
50		—	CHQ250GF
Arc Fault			
15	—	CHQ115AF	—
20	—	CHQ120AF	—
Arc Fault/Ground Fault			
15	#14 – 4	CHQ115AFGF	—
20	—	CHQ120AFGF	—

Table 26.3-60. Type CHQ Surge Arrester

Catalog Number
CHQSA

Table 26.3-61. CHQ Breaker Accessories

Description	Catalog Number
Breaker Handle Lock	CHLO

Application Data — Replacement Type CL Breakers

Type CL Replacement Breakers for Square D HOMELINE, General Electric, Crouse-Hinds, Thomas & Betts, Murray and ITE®/Siemens Loadcenters



CL



CLAF

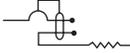


CLR

Table 26.3-62. Type CL Breakers, 1-Inch (25.4 mm) per Pole

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 V Requires One 1-Inch (25.4 mm) Space		2-Pole 120/240 V Common Trip Requires Two 1-Inch (25.4 mm) Spaces	
		10 kAIC	Catalog Number	10 kAIC	Catalog Number
15	#14 – 4	CL115		CL215	
20		CL120		CL220	
25		CL125		CL225	
30		CL130		CL230	
35		CL135		CL235	
40		CL140		CL240	
45	CL145	CL245			
50	CL150	CL250			

Table 26.3-63. Type CL Classified Arc and Ground Fault Breakers (5 Milliampere), 1-Inch (25.4 mm) per Pole

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120/240 V Requires One 1-Inch (25.4 mm) Space	
		10 kAIC	Catalog Number

Arc Fault Breakers

15	#14 – 4	CL115AF
20		CL120AF

Arc Fault/Ground Fault Breakers

15	#14 – 4	CL115AFGF
20		CL120AFGF

Ground Fault Breakers

15	#14 – 4	CL115GF
20		CL120GF
30		CL130GF

Table 26.3-64. Type CL Classified Latching Remote Control Smart Breakers™, 1-Inch (25.4 mm) per Pole

Ampere Rating	Wire Size Range Cu/Al 60°C or 75°C	1-Pole 120 V Requires One 1-Inch (25.4 mm) Space		2-Pole 120/240 V Common Trip Requires Two 1-Inch (25.4 mm) Spaces	
		10 kAIC	Catalog Number	10 kAIC	Catalog Number
15	(2) #14 – 10	CLRP115		CLRP215	
20	(1) #8 – 6	CLRP120		CLRP220	
25		CLRP125		CLRP225	
30		CLRP130		CLRP230	

Application Notes

Arc Fault Application Notes

An arc fault circuit interrupter is a device intended to provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to de-energize the circuit when the arc fault is detected. As of January 1, 2002, the National Electrical Code (NEC) now requires all branch circuits that supply 125 volt, single-phase, 15 and 20 ampere receptacle outlets installed in dwelling unit bedrooms shall be protected by an arc fault circuit interrupter(s). This includes ceiling lighting (recessed, ceiling fans, etc.) as well as smoke detectors and all other bedroom outlets.

26

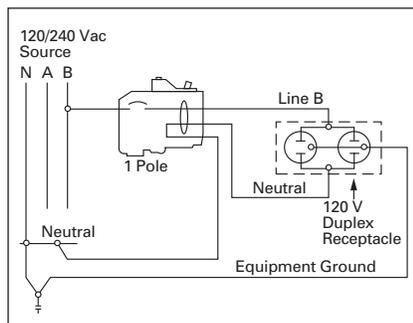


Figure 26.3-11. 1-Pole 120 Volt Load Application Sourced by 120/240 Vac

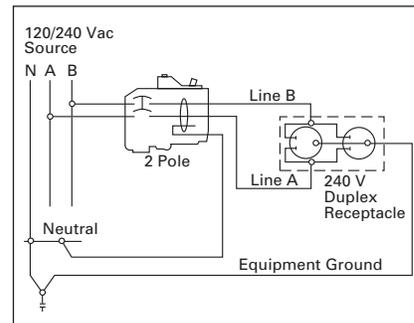


Figure 26.3-15. 2-Pole 240 Volt Load Application Sourced by 120/240 Vac

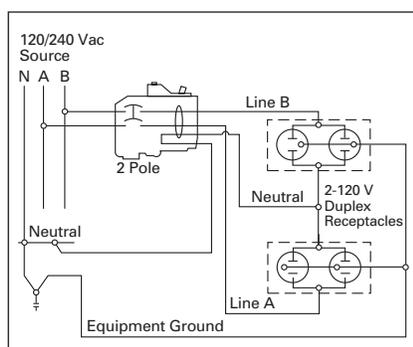


Figure 26.3-12. 2-Pole Shared Neutral with Multi-Duplex Receptacle Application

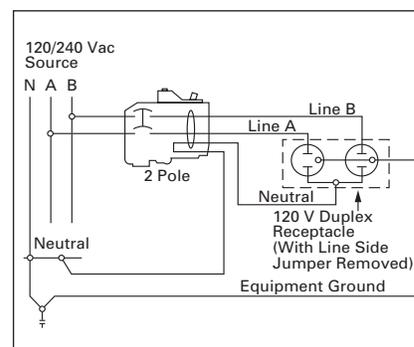


Figure 26.3-16. 2-Pole Shared Neutral with Duplex Receptacle Application

Ground Fault Application Notes

Single-pole GFCBs are designed for use in 2-wire, 120 Vac circuits. **Figure 26.3-13** shows a typical wiring configuration.

Two-pole GFCBs are designed for use in 3-wire, 120/240 Vac circuits, 120 Vac multiwire circuits employing common, neutral and 2-wire, 240 Vac circuits obtained from a 120/240 Vac source.

Figure 26.3-14 and **Figure 26.3-17** illustrate typical wiring configurations for 120/240 Vac multiwire circuits.

Figure 26.3-18 depicts a 240 Vac, 2-wire circuit. Note the "panel neutral" conductor connects to the neutral bar, even though the neutral is not included in the load circuit. This connection is necessary to supply a 120 Vac power source to the ground fault sensing circuit.

The figures are shown with a 120/240 Vac, single-phase, 3-wire power source, but are also applicable to a 120/208 Vac, 3-phase, 4-wire power supply. For all figures, the electrical operation of the GFCB is not affected by the equipment ground.

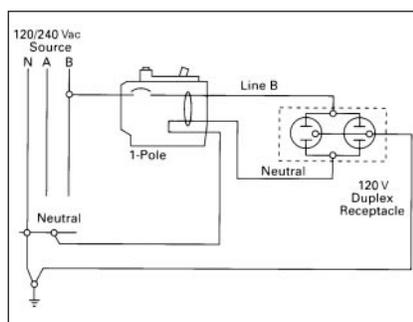


Figure 26.3-13. 1-Pole 120 Volt Duplex Receptacle Application

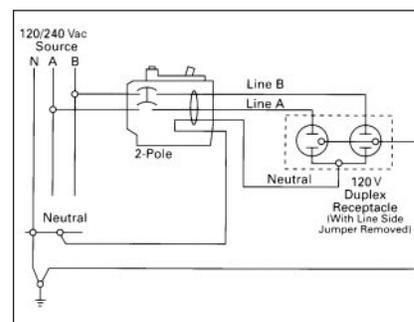


Figure 26.3-17. 2-Pole 120 Volt Duplex Receptacle Application

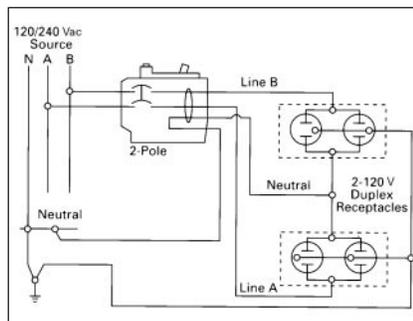


Figure 26.3-14. 2-Pole 120 Volt Multi-Duplex Receptacle Application

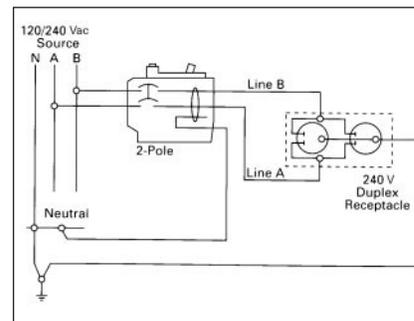


Figure 26.3-18. 2-Pole 240 Volt Duplex Receptacle Application

BR Type Loadcenter Options and Accessories

Table 26.3-65. Field Installation Kits and Parts

Number of Poles	Ampere Rating	Number of 1-Inch (25.4 mm) Spaces Needed	Wire Size Range Cu/Al 60°C or 75°C	Ordering Quantity ①	Catalog Number
Main and Sub-Feed Lug Blocks					
2	125	2	#8 – 2/0	1	BRSF125
	150	2	#8 – 2/0	1	BRSF150
	225	4	#2 – 300 kcmil	1	BRS225
3	150	3	#8 – 2/0	1	3BRSF150
	225	6	#2 – 300 kcmil	1	3BRS225
Main Lugs 2-Pole, 200 Ampere Stud Mounted (Includes Deadfront Filler Plate)			#1 – 300 kcmil	1	BRL200
Neutral/Ground Lug Add-On Neutral or Ground Lug			#2/0 Maximum #3/0 Maximum 300 kcmil Maximum	1 1 1	NL20 NL30 NL300
Filler Plates 1-Inch (25.4 mm) Circuit Breaker Space				25	BRFP
BW Main Circuit Breaker Space (with Hardware)				1	BWFP
Door Lock — 12 through 42 Circuits, and 100 through 225 Amperes				1	TDL
Door Lock — 4 through 8 Circuits, 125 Amperes				1	CH9FL
ANSI-61 Light Gray Touchup Paint for Current Loadcenters				1	SPC61
Isolated Neutral Assembly (Computer Circuits)				1	BINA
Circuit Directory — Adhesive Backed				10	TCD
Cover Screws				25	LCCS
Cover Replacement Latch (Gray) 14-5/16 (363.5 mm) Wide Loadcenters Only				1	BRRL
Circuit Marking Strip (Next to Breaker)				10	BRMS
Circuit Identification Label (Preprinted Breaker Labels)				25	CHBL
Series Rated Caution Label				25	SRL
Bonding Strip with Screw				1	BSSUSE

① Must be purchased in multiples of ordering quantities indicated.

Table 26.3-66. Field Installation Rainproof Conduit Hubs

Description	Conduit Size Inches (mm)	Ordering Quantity ②	Catalog Number
Group 1 — For use with 70, 100 and 125 Ampere MLO and MCB Loadcenters and Circuit Breaker Enclosures and the following 150 and 200 Ampere Panels: BR816B150RF, BR816B200RF	.75 (19.1)	1	DS075H1
	1.00 (25.4)	1	DS100H1
	1.25 (31.8)	1	DS125H1
	1.50 (38.1)	1	DS150H1
	2.00 (50.8)	1	DS200H1
Group 2 — For use with 150, 200 and 225 Ampere MLO and MCB Loadcenters and Circuit Breaker Enclosures except for the following 200 Ampere Loadcenters: BR48B200RF. Also for use with 400 and 600 Ampere Loadcenters and New York City Loadcenters Manufactured after November 1, 2005	2.00 (50.8)	1	DS200H2
	2.50 (63.5)	1	DS250H2
	3.00 (76.2)	1	DS300H2
Type H Conduit Hubs for Loadcenters PL0724R and S3100RN	.75 (19.1)	1	RH75P
	1.00 (25.4)	1	RH100P
	1.25 (31.8)	1	RH125P
	1.50 (38.1)	1	RH150P
Adapter Kit — Allows Installing a Group 1 Hub on Devices Arranged for Group 2 Hubs	—	1	DS900AP
	—	1	DS900CP1
	—	1	DS900CP2

② Must be purchased in multiples of ordering quantities indicated.



BRSF125



3BRS225



BRL200



TDL



DS300H2



Appendix C: Second Means of Egress Approval Letter

NEW JERSEY SCHOOL OF ARCHITECTURE

Richard Garber, AIA
Associate Professor

8 July 2011

Mr. Tom Myers
Colorado Code Consulting – 2011 Solar Decathlon
4610 S Ulster Street, Suite 150
Denver, CO 80237

Dear Tom:

I am writing as Faculty Advisor regarding rescue egress from Team New Jersey's Solar Decathlon house. I recall discussing this issue with you in Orlando in January, and thought we agreed that our rear exterior door would suffice as a means of egress due to its proximity to the bedroom. Based on my understanding of IRC 2009 and the related 2009 New Jersey Edition, and the circumstances surrounding our design decisions for our house, I am writing to you to formally request your consideration in accepting the rear door as a means of exit and safety egress from that room. My reason for this request stems from an alternate way of determining egress requirements for larger buildings designed for maximum allowable occupancies much greater than our maximum occupancy per code, as well as the materials and methods of construction for our house.

First, the maximum diagonal dimension from the southeast to northwest corner of the house is 50'-4". By halving that dimension it seems reasonable to suggest that the maximum dimension of an egress path within the house to an exterior exit is 25'-4".

Next, the doors that allow us to close off the bedroom on either side are ¾" sliding panels that do not have latches, meaning the doors could never be locked into a closed position. Additionally fire resistance ratings exceed IRC requirements due to the house's 100% precast concrete construction and sprinkler system. Finally, I can confirm through our window manufacturer Serious Windows that our 525 Series 48" x 32" Casement Window labeled E7 in the bedroom already qualifies as an egress window as it's dimensions are 47.625" tall by 31.75" wide – I believe minimum requirements are 45.5" x 31". Still it is possible to install a quick release egress hinge in the event of emergency if you feel it is necessary.

Please find further information listed on the following page for your reference. We will also provide a revised egress plan under separate cover to graphically show egress paths. I hope these combined conditions will satisfy any concerns you might have, and I am comfortable that there is no increased safety hazard given our alternative solution to the code.

Egress Tabulation Data – Team New Jersey

1. The Team NJ bedroom is provided with 2 separate means of egress doors. The doors are separated by 14'-10" (C.L. of door) along the east bedroom wall, representing 69% of the overall diagonal of the room, which is 21'-4".
2. The egress travel distance from the center of the bedroom is 36'-1" via exit 1 (the front door) and 25'-1" via exit 2 (the rear door).
3. The Team NJ building is protected with a fire suppression sprinkler system.
4. The Team NJ building is constructed entirely of concrete construction.
5. Window E7 in the bedroom already meets the minimum egress dimensions of 31" x 45.5" – that window is 31.75" wide by 47.625 inches tall, and can be modified to open with quick release by installation of a "egress hinge"

Kindly let me know if you have any questions, and we look forward to seeing you in September.

Sincerely,

A handwritten signature in black ink, appearing to read "Rus J Garber". The signature is fluid and cursive, with a period at the end.

Richard Garber, AIA - NJ License No. 21AI01735200

cc. Urs Gauchat, Clint Andrews, Sal DiCrsitina, Jen Switala, Joseph Simon