10.0

CONSTRUCTION SPECIFICATIONS

DIVISION 1

SECTION 01 54 23 – TEMPORARY SCAFFOLDING AND PLATFORMS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install staging aids and fall protection equipment to withstand structural loads required by OSHA and ANSI Z359.1 standards.

B. Submittals: Product Data. Structural analysis data signed and sealed by a qualified professional engineer registered in the state where project is located

C. Structural and Accessory Components shall conform to the following Standards:

1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: Cold-formed steel tubing, ASTM A 500.
3. Aluminum Extrusions: ASTM B 221.

PART 2 - PRODUCTS

2.01 FALL PROTECTION EQUIPMENT – STANDING SEAM ROOF

A. Manufacturers:

1. Guardian Fall Protection.

B. Models:

1. Standing Seam Roof Clamp, Model #00250.

C. Operation:

1. Portable and reusable anchor for use on standing seam roofs.
2. Seam spacing range: 24" – 36"
3. Retractable Rotation: 360 degrees
4. Self-retracting lifeline adaptable
5. Meets or exceeds all applicable industry standards, including OSHA and ANSI Z359.1.

2.02 FALL PROTECTION EQUIPMENT – SELF-ADHERING SHEET WATERPROOFING

A. Manufacturers:

1. Guardian Fall Protection.

B. Models:

1. CB-12 Roof Anchor, Model #00845.

C. Operation:

DIVISION 1

1. Deck mounted anchor post.
2. Load rating: 5000 lbs.
3. Base and mount plates flashed into roof membrane per manufacturer specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in fall protection and deck eye 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, for permanent installation or duration of use.

C. Fasten fall protection securely in place, with provisions for thermal and structural movement.

D. Correct deficiencies in or remove and reinstall fall protection anchor that do not comply with requirements.

E. Repair, refinish, or replace fall protection anchors and deck eyes damaged during installation, as directed by Architect.

END OF SECTION 01 54 23

DIVISION 4

SECTION 04 20 00 – MASONRY

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Structural Performance: Masonry standard; comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

B. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the contract documents.

B. Defective Units: reference masonry unit manufacturer information, which may allow a certain percentage of chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed work.

C. Fire Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS (CMUs)

A. Subject to compliance with requirements, available products that may be included in the Work include, but are not limited to, the following:

1. CMUs: ASTM C 90.
2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
3. Density Classification: Normal weight.

B. Grout: ASTM C 1107, nonmetallic, shrinkage resistant, factory packaged.

PART 3 - EXECUION

3.01 MASONRY UNITS, GENERAL

A. Prepare ground by cleaning, removing projections, and as otherwise recommended in stand manufacturer's written instructions and DOE Solar Decathlon Building Code foundation provisions.

DIVISION 4

B. Use full size units without cutting if possible. If cutting is required, provide continuous pattern or fit adjoining construction, cut units with motor driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, conceal cut edges.

C. Repair, refinish, or replace products damaged during installation, as directed by Architect.

END OF SECTION 04 20 00

DIVISION 5

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Shop Drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator.

1. Use ASD; data are given at service-load level.

B. Comply with applicable provisions of the following:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

2.02 STRUCTURAL STEEL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. W-Shapes: ASTM A 992/A 992M and ASTM A 572/A 572M, Grade 50 (345) when appropriate.

C. C Channels, Angles: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345) when appropriate.

D. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50 (345) when appropriate.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

2.03 ACCESSORIES

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

B. Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.04 FABRICATION

A. 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 and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

C. Shop Priming: Prepare surfaces according to SSPC-SP 2, "Hand Tool Cleaning"; or SSPC-SP 3, "Power Tool Cleaning." Shop prime steel to a dry film thickness of at least 1.5 mils (0.038 mm). Do not prime surfaces to be embedded in concrete or mortar or to be field welded.

D. Uncoated ferrous metal surfaces indicated as 'weathered steel' shall have all oil removed by application of degreaser as required. No further surface treatment required.

PART 3 - EXECUTION

3.01 ERECTION

A. Structural Steel Frames are built to be transportable.

B. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

C. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

D. 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.

E. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

F. 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.

Joint Type: Snug tightened

G. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

END OF SECTION 05 12 00

DIVISION 5

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

1.02 SECTION REQUIREMENTS

A. Submittals: Shop Drawings.

PART 2 - PRODUCTS

2.01 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.

D. Wire Rod for Bar Grating Crossbars: ASTM A 510 (ASTM A 510M).

E. Rolled Steel Floor Plate: ASTM A 786/A 786M.

F. Steel Tubing: ASTM A 500.

G. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.

H. Slotted Channel Framing: Cold-formed steel channels complying with MFMA-4, 1-5/8 by 1-5/8 inches (41 by 41 mm).

I. Cast Iron: ASTM A 48/A 48M or ASTM A 47/A 47M.

J. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

2.02 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

H. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

I. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

J. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

K. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.03 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 Interior Painting."

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

DIVISION 5

2.04 GROUT

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

2.05 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports at all exterior locations.

D. Prime miscellaneous framing and supports with primer specified in Section 099000 "Painting and Coating".

2.06 DECORATIVE STEEL SHADE SCREENS AND WALLS

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Except where noted as “Custom Pattern Screen,” perforated panels shall be 16 gauge, with 3/16” holes at ¼” staggered centers.

2.07 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. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

C. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use recessed hexagonal flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

D. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

E. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

F. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Form exposed work with accurate angles and surfaces and straight edges.

H. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

I. Fabricate steel pipe columns with 1/2-inch (12-mm) steel base plates and 1/4-inch (6-mm) steel top plates welded to pipe with continuous fillet weld same size as pipe wall thickness. Drill top plates for connection bolts and base plates for 5/8-inch (16-mm) anchor bolts.

J. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

L. Fabricate nosings and ramp transition plates from steel with an integral abrasive finish.

1. Manufacturers: One of the following:

a. American Safety Tread Co., Inc.
b. Balco Inc.
c. Barry Pattern & Foundry Co., Inc.
d. Granite State Casting Co.
e. Safe-T-Metal Company, Inc.
f. Wooster Products Inc.
g. Or Architect approved equal

2.08 STEEL AND IRON FINISHES

A. Hot-dip galvanize steel fabrications at exterior locations where specified in drawings.

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 where specified in drawings.

C. Uncoated ferrous metal surfaces indicated as 'weathered steel' shall have all oil removed by application of degreaser as required. No further surface treatment required.

DIVISION 5

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide anchorage devices and fasteners where needed to secure items to in-place construction.

B. 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.

C. Fit exposed connections accurately together to form hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers.

END OF SECTION 05 50 00

DIVISION 5

SECTION 05 52 00 - METAL RAILINGS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Shop Drawings.

PART 2 - PRODUCTS

2.01 RAILING SYSTEMS

A. Steel Pipe and Tubing Railings

1. Provide railings as indicated in drawings.

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.

2.02 METALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

Primary difference between round steel tubing and steel pipe is in outside dimensions. Pipe sizes are normally indicated by use of nominal pipe size designator and weight class or schedule number; for tubing, OD and wall thickness are used. See Elevations.

C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Plates, Shapes, and Bars: ASTM A 36/A 36M.

DIVISION 5

2.03 Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.04 FASTENERS

A. General: Provide the following:

B. Fasteners for Anchoring Railing to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components.

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

2.05 FABRICATION

A. Assemble railing systems in shop to the greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members by bending or mitering at elbow bends per Drawings.

C. Fabricate railing systems and handrails for connecting members by welding and with concealed mechanical fasteners and fittings as indicated in Drawings.

D. Provide manufacturer's standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

E. Provide wall returns at ends of wall-mounted handrails per Drawings.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.07 STEEL AND IRON FINISHES

A. Railings, railing supports and fastener: Unfinished steel.

PART 3 - EXECUTION

3.01 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 where required as indicated in Drawings.

D. Attach handrails to wall with wall brackets as indicated in Drawings.

END OF SECTION 05 52 00

DIVISION 6

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for wood-preservative treated wood, fire-retardant treated wood, engineered wood products, shear wall panels, and metal framing anchors.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

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

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Engineered wood products shall have allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.02 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

B. Fire-Retardant-Treated Materials: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A unless otherwise indicated.
3. For enclosed roof framing, framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with design adjustment factors of not less than 0.85 for modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
4. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
5. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.

2.03 FRAMING

A. Dimension Lumber:

1. Maximum Moisture Content: 19 percent.
2. Retain one grade requirement and one or more species group in "Non-Load-Bearing Interior Partitions" and "Framing Other Than Non-Load-Bearing Interior Partitions" subparagraphs below depending on availability and suitability for Project. Designate load-bearing walls on Drawings.
3. Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3: Western woods: WCLIB or WWPA.
4. Framing Other Than Non-Load-Bearing Interior Partitions: Douglas fir-larch: WCLIB, or WWPA.
5. 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.
   Species: As specified for framing other than non-load-bearing interior partitions.
   Grade: Select Structural.

B. Laminated-Veneer Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.

1. Manufacturers:

   a. RedBuilt
   b. Or Architect approved equal

2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi (20.0 MPa) for 12-inch nominal- (286-mm actual-) depth members.
3. Modulus of Elasticity, Edgewise: 2,000,000 psi (13 800 MPa).

C. Wood I-Joists: Prefabricated units complying with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. Manufacturers:

   a. RedBuilt
   b. Or Architect approved equal

2. Web Material: Either oriented strand board or plywood, Exposure 1. Install per manufacturer.
3. Structural Properties: Provide units with depths and design values not less than those indicated.
4. Provide units complying with APA PRI-400, factory marked with nominal joist depth, joist class, span ratings, mill identification, and compliance with APA standard.

D. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists.

2. Material: All-veneer product glued-laminated wood or product made from any combination solid lumber, wood strands, and veneers.

3. Thickness: 1 inch (25 mm)

DIVISION 6

2.04 SHEAR WALL PANELS

A. Manufacturer of Insulated Sheathing: See Section 06 16 13– INSULATING SHEATHING (ZIP System R Sheathing)

B. Manufacturers of Standard Sheathing: Any APA Certified PS-1 C-C or C-D Plywood Sheathing Manufacturer

C. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I. Manufactured product as noted above.

D. Allowable Design Loads: Shear wall panels shall have allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.05 MISCELLANEOUS LUMBER

A. Miscellaneous Dimension Lumber: Construction, or No. 2 Standard or Stud grade with 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.06 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, Exterior, AC or C-C Plugged or Exposure 1, C-D Plugged, fire-retardant treated, not less than 1/2-inch (13-mm) nominal thickness.

2.07 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 with hot-dip zinc coating complying with ASTM A 153/A 153M.

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. Manufacturers: Simpson Strong-Tie.

2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Cleveland Steel Specialty Co.
b. KKC Metals Products, Inc.
c. Phoenix Metal Products, Inc.
d. Simpson Strong-Tie Co., Inc.
e. USP Structural Connectors.

3. 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.

4. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Do not splice structural members between supports unless otherwise indicated.

D. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.

2. Published requirements of metal framing anchor manufacturer.

3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

END OF SECTION 06 10 00

DIVISION 6

SECTION 06 15 33 - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install:
   1. Exterior steam/heat treated wood decking.

1.2 RELATED REQUIREMENTS

A. SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedure requirements related to the Owner's sustainability goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.

B. CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood framing and blocking.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. ASTM D1037-12 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
   2. ASTM E84-12a - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. EN 350-2: 1994 – Durability of Wood and Wood-based Products – Natural Durability of Solid Wood: Guide to natural durability and treatability of selected wood species of importance in Europe.
   4. CENS/TS 15083-1 2005 - Durability of wood and wood-based products - Determination of the natural durability of solid wood against wood-destroying fungi, test methods - Part 1: Basidiomycetes.
   5. FS MM-L-736D 2008 - Lumber; Hardwood.
   6. FSC (Forest Stewardship Council): "FSC Certification Program."

1.4 GREEN BUILDING REQUIREMENTS

A. Materials and products within this Section shall contribute to the Project's sustainable design goals. SUSTAINABLE DESIGN REQUIREMENTS.

B. Construction activities to be coordinated with the construction waste requirements of CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 30 00 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for decking installation hardware, adhesives and accessories furnished hereunder.
2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
    a. Submit manufacturer's written certification of the following:
        1) No chemicals are used in the wood treatment process.
        2) Surface Burning characteristics.
        3) Biological durability testing Class.
        4) Peak curing temperature.
    b. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC® standards..
        1) Demonstrate that products are FSC® certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
3. Shop drawings:
    a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing fastening methods; and complete installation details.
4. Verification Samples:
    a. Provide installation hardware samples as requested by Architect for selection of colors and finishes.
    b. Provide 9 inch length samples of decking, pre-grooved and finished.

1.6 QUALITY ASSURANCE

A. Qualifications - Manufacturer: Minimum of 15 years documented experience in steam/heat modification of wood, and demonstrating previously successful work of the type specified herein.

B. Chain of Custody of Wood Products: All wood products furnished under this Specification Section shall be "FSC® certified" according to the rules of the Forest Stewardship Council (FSC®).

1. FSC® Certification includes the following certification bodies of forests and forest products:
    a. Certification Systems.
    b. SmartWood.
    c. SGS Qualifor.
    d. Soil Association.

C. Certifications:

1. Surface Burning characteristics, for North American White Ash, Tested per ASTM E-84: UL Class B finish having maximum flame and smoke developed as follows"
   a. Flame Spread Index (FSI): equals or less than 35.
   b. Smoke Developed Index (SDI):
      1) Board Size, 5/4 by 6 inches: SDI equal to or less than 85.
2. Biological durability testing, tested per European Test Standard CENS/TS 15083-1 2005 having Classified durability as follows:
   a. Thermory® treated Scots Pine: Class 2 (minimum 20 years and over).
3. Chemicals: Use of chemicals is prohibited in the treatment process.
4. Temperature treatment: Peak temperature of not less than 419 degrees F.

1.7 DELIVERY STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
   2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:
   1. Protect decking materials from damage due to moisture and weather elements, sunlight, and damage from construction operations and other causes.
   2. Store and handle materials following manufacturer's recommended procedures.
      a. Store decking in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected location. Keep stored decking protected from water and sunlight at all times, including that within original packaging. Vent stacks to prevent moisture being trapped within coverings.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermory®USA, 1213 Wilmette Avenue, Wilmette, IL 60091, Product: "Thermory® Decking." No substitution will be accepted.

2.2 DESCRIPTION

A. General Description: Wood is factory-treated with heat and steam (no chemicals) in a special, computer controlled, high-temperature kiln. It gives the wood a higher dimensional stability and a lower equilibrium moisture content compared to untreated hardwood flooring, and also causes the color of the wood to darken
   1. Moisture content: Heat/steam treated wood for use shall have a moisture content between 4.5 to 7.5 percent, when delivered to the project.

2. Interlocking end joints, located between framing members shall have point load capacity of over 1900 pounds, as tested per ASTM D1037 on for 0.787 inch (20mm) thickness decking.

B. Sustainability Requirements:

1. Sustainable Forest Certification: All wood shall be "Chain-of-Custody" certified as FSC® Certified.

2.3 WOOD MATERIALS

A. Exterior wood decking: Heat/steam treated clear grade, North American White Ash (Fraxinus Americana) "Thermory®USA Decking," shop-milled with routed-grooving to receive concealed fastening system. Provide boards with end joints, Thermory JEM® Joint, routed interlocking end joints.

1. Board Size: nominal 5/4 by 6 inch, not less than 1.02 inch (26mm) thickness.

2.4 ACCESSORIES

A. Concealed fastening system for decking: Stainless steel mounting clips, type 304 stainless steel, 16 gauge, minimum 0.060 inch thickness. Thermory®USA "HiddenClipSystem."

1. Clip: Thermory® 6" Matte Black Finish Clip.

B. Screws: Self-tapping stainless steel:

1. FixingGroup GmbH, Germany, 4.0 x 40mm terrace screws.
2. Sihga, Austria "GoFix MS II®" 4.0 x 40mm terrace screws.

C. Finishing Materials:

1. Cutek, Australia (North American distributor: Deck Source Inc., Beeton Ontario Canada product "Cutek Extreme Wood Preservative".
2. Duckback Products, Inc., Cleveland OH., product "Superdeck Exotic Hardwood Stain".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adequacy of blocking, backing and support framing for all decking and trim work.

1. Ensure decking supporting joists are spaced not greater than 16 inches on center.

B. Beginning of installation means acceptance of site conditions.

3.2 INSTALLATION

A. General: Decking shall be properly framed, closely fitted and accurately set to the required lines and levels and shall be rigidly secured in place. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces of prefinished boards.

B. Install decking using specified decking clip system in accordance with manufacturer's written instruction. Install "first" board using specified self-tapping stainless steel screws.

1. Face screwing with stainless steel screws using other than the specified self-tapping screws requires predrilling a hole that is 1/32 inch smaller in diameter than the screw and counter-bore for screw head's taper. Utilize depth stop to ensure size of screw head and counter-bore are the same.
2. Minimum screwing distance from edge: 3/4 inch minimum screwing distance from end: 1-1/2 inch. Predrilling is required, even with specified self tapping screws, less than 3 inches from the end of a deck board.

C. Maintain and 1/4 inch for deck boards over 4 inches width. Utilize manufacturer's hidden fasteners clips to automatically provide proper gap between deck boards. Install Thermory® dark colored 6" clips for 1 by 6 and 5/4 by 6 decking. Install clips at each supporting joist, screw fasten each clip with a single stainless steel screw.

D. Install decking with a minimum number of end joints; interlocking end joints (Thermory JEM® Joint) are not required to sit over framing. Stagger joints in adjacent decking boards. Each board must rest on and be fastened to a minimum of two joists.

E. Face screw the outside edges of the first and last decking boards using specified self-tapping stainless steel screws.

3.3 FIELD FINISHING

A. Apply deck finish in accordance with preservative finish manufacturer's written instructions, prior to installation of deck. Apply by brush, roller or spray. If spray applied, use the lowest possible pressure needed for a reasonable spray pattern. Back rolling is suggested when spraying, working the product smoothly and evenly into the wood. This will decrease the possibility of pools or puddles on the surface and ensure a properly penetrated finish.

B. Remove surface contaminants, stains, dirt, mildew, algae, fungus, and failed oxidized stains. Recommended cleaners include the following:

1. Cutek, Australia (North American distributor: Deck Source Inc., Beeton Ontario Canada product "Cutek ProClean".
2. Duckback Products, Inc., Cleveland OH., product "Superdeck® Wood Cleaner". Remove mill glaze with Superdeck® Wood Brightener.

C. Penetrating stain must be applied only at a rate the wood will absorb; do not pool or puddle product on surface. Excess product allowed to sit on surface will result in a tacky finish and extended dry time. Remove tacky finish with mineral spirits within 24 hours of application or with a mild solution of Wood Cleaner after 24 hours. When properly applied, the wood surface will have a positive dry and the wood fibers beneath the surface will maintain excellent lubrication. Thoroughly coat the porous ends of all boards with finishing product.

3.4 TOLERANCES

A. Maximum variation for wood decking from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.

3.5 CLEANING

A. Daily clean work areas by sweeping and disposing of scraps and sawdust.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.6 PROTECTION

A. During the installation of exterior wood decking and finishing, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

END OF SECTION 06 15 33

DIVISION 6

SECTION 06 16 13 – INSULATING SHEATHING (ZIP System R Sheathing)

GENERAL

1.1 SUMMARY

A. Section includes insulating wall sheathing with integral water-resistive barrier and air barrier.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME): www.asme.org

1. ASME B18.6.1 - Wood Screws (Inch Series)

B. ASTM International (ASTM): www.astm.org

1. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
3. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method
4. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics
5. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
6. ASTM E96/E 96M - Test Methods for Water Vapor Transmission of Materials
7. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
8. ASTM E2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies
9. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples
10. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

C. US Department of Commerce (DOC): http://gsi.nist.gov/global/index.cfm/L1-5/l2-44/A-355

1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels

D. International Code Council (ICC): www.iccsafe.org

1. ICC IBC - International Building Code
2. ICC IRC - International Residential Code for One and Two-Family Dwellings

E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org

1. ICC-ES AC12 - Acceptance Criteria For Foam Plastic Insulation
2. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers
3. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes

4. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
5. ICC-ES AC201 - Acceptance Criteria for Staples
6. ICC-ES AC269 - Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials attached to Light-Frame Wall Construction or Code-Complying Sheathing Attached to Light-Framed Walls with Proprietary Fasteners
7. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers
8. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
9. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction

F. Sustainable Forestry Initiative (SFI): www.sfiprogram.org/

1. SFI 2010 - 2014 Standard

1.3 ACTION SUBMITTALS

A. Product Data: For each type of sheathing product specified.

B. Sustainability Submittals:

1. Regional Materials: Certificates verifying that materials were harvested, processed, and manufactured within 500 miles of the Project site.
2. Low-Emitting Materials, Composite Wood and Agrifiber: Product data for composite wood products, indicating that products contain no urea formaldehyde.
3. Material Efficient Framing: Certificates and framing order calculation indicating cost savings associated with reduced framing requirements resulting from use of structural sheathing.
4. Environmentally Preferable Products – Local Production: Certificates verifying that floor, wall, and roof sheathing were harvested, processed, and manufactured within 500 miles of the Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.

B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC-ES AC269 and ICC-ES AC310.

C. Certified Wood Certificates: Certificates indicating that manufacturer is currently certified by an SFI- or FSC- accredited certification body, and chain-of-custody certificates indicating that sheathing products comply with forest certification requirements.

1.5 CLOSEOUT SUBMITTALS

A. Warranty: Executed copy of manufacturer special warranties.

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1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.

B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.

C. Provide wall sheathing products meeting requirements of ICC-ES AC269.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.

1. Warranty Period for Sheathing Products: 30 years following date of Substantial Completion.
2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

PRODUCTS

1.9 MANUFACTURERS

A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com.

1.10 PERFORMANCE REQUIREMENTS

A. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.

B. Water-Vapor Permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.

C. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

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1.11 MATERIALS

A. Certified Wood: Provide sheathing produced from wood obtained from forests certified by an accredited certification body.

B. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

C. Rigid Foam Plastic Insulating Board: Rigid polyisocyanurate foam core complying with ASTM C1289 Type II, Class 2, and ICC-ES AC12, with coated glass fiber facers on both sides, with the following characteristics:

1. Nominal Density: 2.0 pcf (32 kg/cu. m).
2. Compressive Strength, ASTM D1621: Not less than 20 psi (150 kPa).
3. Vapor Permeance, ASTM E96/E96M: Less than 1.0 perm.
4. Edge Configuration: Square finished.

1.12 COMPOSITE INSULATING WALL SHEATHING

A. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch (11.1 mm) thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.

1. Basis-of-Design Product: Provide Huber Engineered Woods LLC; ZIP System R Sheathing.
2. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 Performance Category.
3. Thickness: 1-1/2 inch (38 mm).
4. Thermal Resistivity (R Value): 6.6 deg F x h x sq. ft./Btu x in. at 75 deg F.
5. Edge Profile: Square edge.
6. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with fastener spacing symbols on exterior facer for 24-inch (610 mm) on center spacing, with the following characteristics

    a. Water Resistance of Coatings, ASTM D2247: Pass 14 day exposure test.
    b. Moisture Vapor Transmission, ASTM E96: Not less than 12 perms.
    c. Water Penetration, ASTM E331: Pass at 2.86 lbf/sq. ft. (137 Pa).
    d. Wind Driven Rain, TAS-100: Pass.
    e. Accelerated Weathering, ASTM G154: Pass.

1.13 FASTENERS

A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.

1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M or Type 304 stainless steel.

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B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.

C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.

D. Wood Screws: ASME B18.6.1.

1.14 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIAL

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.

1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape.
2. Thickness: 0.012 inch (0.3 mm).

EXECUTION

1.15 EXAMINATION

A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

1.16 SHEATHING INSTALLATION

A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.

B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.

D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.

E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:

1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
2. IRC: Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments."

F. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

END OF SECTION 06 16 13

DIVISION 6

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Samples for siding, hardwood veneer plywood paneling.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. Softwood Plywood: DOC PS 1.

C. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

D. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.

E. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper.

F. Certified Wood: Wood-based materials produced from tropical forests shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.02 EXTERIOR FINISH CARPENTRY

A. Exterior Lumber Trim and Siding

1. Manufacturers.

a. Centennial Wood
b. Natures Element
c. Or Architect approved equal

2.03 INTERIOR STANDING AND RUNNING TRIM

A. Interior Hardwood Lumber Trim: Clear, kiln-dried, white maple, birch, or honey mesquite per Drawings.

2.04 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock panels complying with HPVA HP-1, made without urea-formaldehyde adhesive.

1. Manufacturers:

   a. Chesapeake Hardwood Products, Inc.
   b. Georgia-Pacific Corp.
   c. Holland Southwest International.
   d. Peterman Lumber
   e. Other manufacturers acceptable.

2. Face Veneer Species: Plain sliced birch per Drawings.
3. Veneer Matching: Slip Match, Random, Balanced.
4. Thickness: 1/2 inch (12.8 mm).
5. All Hardwood Birch Plywood shall meet or exceed Class C flame spread per ASTM E119. Flame spread ASTM E-84 test by HPVA, Hardwood Plywood Veneer Association, ranges between 114 and 127

2.05 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: hot-dip galvanized steel or stainless steel.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer; made with binder containing no urea-formaldehyde resin.

   1. Wood glue shall have a VOC content of 30 g/L or less.

   2. Use waterproof resorcinol glue for interior and exterior applications.

C. Adhesive shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Condition interior finish carpentry in installation areas for 24 hours before installing.

B. Apply clear, matte-finish sealer on both sides of interior finish carpentry per specification section 099000, Painting and Coating; as directed by Architect. Cut to length and seal ends.

C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.

   1. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.

D. Install standing and running trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long except where necessary. Stagger joints in adjacent and related trim. Cope at returns and inside corners and miter at outside corners.

E. Screw siding at each metal furring strip. Do not allow screws to penetrate more than one thickness of metal furring strip, unless otherwise recommended by siding manufacturer. Seal joints at inside and outside corners and at trim locations.

F. Select and arrange paneling for best match of adjacent units. Install with uniform tight joints.

G. Z-Clips for paneling installation shall be attached at 2'-0" on center, or as indicated in Drawings.

END OF SECTION 06 20 00

DIVISION 6

SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Shop Drawings.

B. Grades of interior architectural woodwork shall comply with AWI's "Architectural Woodwork Quality Standards."

PART 2 - PRODUCTS

2.01 ARCHITECTURAL CABINETS

A. Quality Standard: AWI, AWMAC, and WI's "Architectural Woodwork Standards."

B. Certified Wood: Wood-based materials shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

C. Wood Cabinets for Transparent Finish: Custom grade.

1. Type of Construction: Frameless.
2. Cabinet and Door and Drawer Front Interface Style: Flush overlay.
3. Wood Species for Exposed Surfaces: Brown Ash.
4. Cut: Plain sliced/plain sawn.
5. Grain Direction: Vertically for doors and fixed panels, horizontally for drawer fronts, except as noted in Drawings.
6. Matching of Veneer Leaves: Random match.
7. Veneer Matching within Panel Face: Running match.
8. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
9. Drawer Subfronts, Sides, and Backs: Baltic birch plywood.
10. Drawer Bottoms: Baltic birch plywood.

D. Wood Bench and Countertop for Transparent Finish: Custom grade.

1. Type of Construction: As indicated per Drawings.
2. Wood Species for Exposed Surfaces: Teak wood with hand rubbed Tung oil finish or Architect approved equal.

2.02 MATERIALS

A. Wood Moisture Content: 5 to 10 percent.

B. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

C. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde, or Straw-based particleboard complying with requirements of ANSI A208.1, Grade M-2, except for density.

D. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

E. High-Pressure Decorative Laminate: NEMA LD 3.

1. Manufacturers:

a. Abet Laminati, Inc.
b. Formica Corporation.
c. Lamin-Art, Inc.
d. Panolam Industries International, Inc.
e. Wilsonart International; Div. of Premark International, Inc.
f. Or Architect approved equal.

2.03 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100-170 degrees of opening as indicated in Drawings, self-closing.

B. Wire Pulls: Back mounted, solid metal, lengths as indicated in Drawings, 5/16 inch (8 mm) in diameter, and 2-1/2 inches (63.5 mm) deep.

C. Catches: Push-in magnetic catches, BHMA A156.9, B03131 or Roller catches, BHMA A156.9, B03071. Locations as indicated in Drawings.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 or BHMA A156.9, B04102; with shelf brackets, B04112.

E. Shelf Rests: ¼" nickel "L" shelf pin with vinyl; see 4/A522 or BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

F. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

2. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.
3. Keyboard Slides: Grade 1.
4. Trash Bin Slides: Grade 1HD-100.

G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Grommets for Cable Passage through Countertops: 3 inches (75 mm) OD, color as selected, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "XG series" by Doug Mockett & Company, Inc.

K. Exposed Hardware Finishes: Comply with BHMA A156.18 for BHMA code number indicated.

1. Finish: Satin Stainless Steel: BHMA 630.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9

M. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to 15 percent moisture content.

2.05 FABRICATION

A. Complete fabrication to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.06 SHOP FINISHING OF WOOD CABINETS

A. Finishes: Same grades as items to be finished.

B. Finish cabinets at the fabrication shop; defer only final touch up until after installation.

1. Apply one coat of sealer or primer to concealed surfaces of cabinets. Apply two coats to end-grain surfaces.
2. Apply a wash coat sealer to woodwork made from closed-grain wood before staining and finishing.
3. After staining, if any, apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

C. Transparent Finish:

1. Finish: System - 11, catalyzed polyurethane.
2. Staining: Match Architect's sample.
3. Sheen: Satin

PART 3 - EXECUTION

3.01 INSTALLATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Install cabinets to comply with referenced quality standard for grade specified.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Fasten with countersunk concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed attachments, countersunk and filled flush.

F. Install plastic laminate countertops as indicated on drawings.

G. Cabinets: Install so doors and drawers are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips, or as indicated in Drawings.

END OF SECTION 06 41 00

DIVISION 7

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation
2. Glass-fiber blanket insulation
3. Mineral-wool blanket insulation
4. Spray polyurethane foam insulation
5. Spray-applied fire-ignition thermal barrier coating for spray foam insulation
6. Wet-applied cellulous insulation
7. Sill sealer insulation

1.02 SUBMITTALS

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

B. Environmental Quality Submittals:

1. Product Data: For glass-fiber blanket insulation, documentation indicating that product and binder contains no urea formaldehyde.
2. Product Data: For VOC limit of fire-ignition thermal barrier coating. Must comply with SCAQMD and EPA VOC requirements. Documentation including printed statement of VOC content.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fire-ignition thermal barrier coating.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

D. Research/Evaluation Reports: For foam-plastic insulation, from ICC-ES.

E. Research/Evaluation Reports: For fire-ignition thermal barrier coating, from ICC-ES.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by spray-applied polyurethane foam insulation and fire-ignition thermal barrier coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Do not apply spray-applied polyurethane foam insulation and fire-ignition thermal barrier coating when ambient or substrate temperature is 50 deg F (10 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire-ignition thermal barrier coating, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until thermal barrier coating dries thoroughly.

PART 2 - PRODUCTS

2.01 FOAM-PLASTIC BOARD INSULATION

A. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers:

a. Atlas Roofing Corporation.
b. Dow Chemical Company (The).
c. Rmax, Inc.
d. Or Architect approved equal.

2.02 GLASS-FIBER BLANKET INSLULATION

A. Manufacturers:

1. Johns Manville Microlite "L" or Thermal-SHIELD Free.
2. Or Architect approved equal.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Blanket insulation shall be R-11 minimum, unless noted otherwise on drawings.

D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

DIVISION 7

2.03 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers:

a. Demilec (USA) LLC; HeatLoc Soy 200
b. Icynene Inc.; MD-C-200
c. Or Architect approved equal

2. Minimum density of 2.0 lb/cu. ft.

B. Open-Cell Polyurethane Foam Insulation: Spray-applied polyurethane foam using water as a blowing agent, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers:

a. Demilec (USA) LLC; Sealection AgriBalance
b. Icynene Inc.; MD-R-200
c. Or Architect approved equal

2. Minimum density of 0.6 lb/cu. ft.

2.04 SPRAY-APPLIED THERMAL BARRIER COATING FOR SPRAY FOAM INSULATION

A. NFPA 286 and IBC Compliant spray-applied, polymer-based 15 minute thermal barrier coating for Closed-Cell Polyurethane Foam Insulation and Open-Cell Polyurethane Foam Insulation.

1. Manufacturers:

a. Demilec LLC; Blazelok TB 200.
b. Energsmart; Fire-Lok Thermal-Ignition Barrier.
c. Foam It Green; Thermal Barrier.
d. PSI Inc.; Stayflex 2505 Thermal Barrier Coating.
e. SprayFoam; GacoFirestop FireShell Coating.
f. Or Architect approved equal.

2. Applied in accordance with manufacturer's requirements to meet fire resistance requirements of applicable codes.
3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

5. Hardness: Not less than 50, Type D durometer, according to ASTM D 2240.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Non-flat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Under-coaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Fireproofing Exterior Coatings: 350 g/L.

Low-Emitting Materials: Low VOC; not to exceed SCAQMD requirements for indoor environments.

C. Asbestos: Provide products containing no detectable asbestos.

2.05 WET CELLULOUS INSULATION

A. Self-supporting (stabilized) spray applied celulosic thermal insulation in compliance with ASTM C-1149 and ASTM E-84; Products shall also be fungi and insect resistant.

1. Manufacturers:

a. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
b. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
c. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
d. Or Architect approved equal.

2.06 SILL SEALER INSULATION

A. Closed cell polyethylene foam insulation roll stock.

1. Manufacturers:

a. Owens Corning Formular ; 1/4 in. thick x 5 1/2 in. wide
b. Pactiv Green Guard sill sealer; 1/4 in. thick x 5 1/2 in. wide
c. Reflectix, Inc.; 1/4 in. thick x 5 1/2 in. wide
d. Or Architect approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

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

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer. Tape joints as recommended by manufacturer.

C. Glass-Fiber Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically.

D. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

1. Spray-Applied fire-ignition thermal barrier coating shall be applied where indicated over spray-applied insulated surfaces in accordance with manufacturer's requirements to meet fire resistance requirements of applicable codes.

E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

F. Sill sealer insulations. Install below wall sill plates per manufacturer's recommendations.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

Test and inspect fire-ignition thermal barrier coating as required by the IBC, 1704.11.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire-ignition thermal barrier coating for the next area until test results for previously completed applications of fire-ignition thermal barrier coating show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fire-ignition thermal barrier coating will be considered defective if it does not pass tests and inspections.

1. Apply additional fire-ignition thermal barrier coating, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

3.05 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fire-ignition thermal barrier coating, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire-ignition thermal barrier coating will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fire-ignition thermal barrier coating and repair damaged areas and fire-ignition thermal barrier coating removed due to work of other trades.

D. Repair fire-ignition thermal barrier coating damaged by other work before concealing it with other construction.

E. Repair fire-ignition thermal barrier coating by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

F. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

DIVISION 7

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Flexible flashing.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing joint and penetration treatment.

1.02 SUBMITTALS

A. Product Data: For each type of product.

1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

B. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.01 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch (1.0 mm).

1. Products: Subject to compliance with requirements, provide one of the following:

a. As recommended by Water-Resistant Barrier Manufacturer.
b. Or Architect approved equal

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

C. Spray Foams: As recommended by Water-Resistant Barrier Manufacturer.

D. Sealants: As recommended by Water-Resistant Barrier or Flashing Manufacturers.

E. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.01 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at bottom and sides of openings.
4. Lap water-resistive barrier over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates

END OF SECTION 07 25 00

DIVISION 7

SECTION 07 42 13.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

B. Related Sections:

   1. Section 07 61 00 Sheet Metal Roofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   7. Review temporary protection requirements for metal panel assembly during and after installation.
   8. Review of procedures for repair of metal panels damaged after installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 3" = 1'-0" (1:5).

D. Calculations:

1. Include calculations with registered engineer seal, verifying wall panel and attachment method resist wind pressures imposed on it pursuant to applicable building codes.

E. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

1. Include Samples of trim and accessories involving color selection.

F. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Manufacturer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

DIVISION 7

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer Qualifications: Company specializing in Architectural Sheet Metal Products.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal panel assembly as shown on Drawings, including corner, soffits, supports, attachments, and accessories.
2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Remove strippable protective covering on metal panels as panels are being installed. Do not leave the film on installed panels.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

DIVISION 7

1.10 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Galvalume Substrate Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing or perforating.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: 20 years and 6 months from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, chipping, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 29 percent.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/240 of the span.

DIVISION 7

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. V-Groove-Profile, Concealed-Fastener Metal Wall Panels : Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products shown on drawings or comparable product by one of the following:

    a. Berridge Manufacturing Company; Berridge FW Smooth w/ no grooves; 12 inches wide; Color: Lead Coat .
    b. Or Architect approved equal

2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

    a. Nominal Thickness: 0.024 inch (0.61 mm).
    b. Exterior Finish: Two-coat fluoropolymer
    c. Color: As selected by Architect.

3. Panel Coverage: 6 inches (152 mm)
4. Panel Height: 0.625 inch (16 mm)

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils (1.02 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Grace Ultra
    b. Mid-States Asphalt Quick Stick HT Pro
    c. Polyglass Polystick MTS
    d. Soprema Lastobond Shield HT
    e. Tamko TW Underlayment or TW Metal & Tile Underlayment
    f. Or Architect approved equal.

2. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.

3. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

DIVISION 7

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat applied by panel manufacturer

on a continuous coil coating line, with a top side dry film thickness of 0.75± 0.05 mil (0.019± 0.0013 mm) over 0.2± 0.05 mil (0.05± 0.0013 mm) primer coat, to provide a total dry film thickness of 0.95± 0.10 mil (0.024± 0.0025 mm). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.35 mil (0.009 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

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1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use stainless-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Metal Liner Panels: Install panels on exterior side of girts, with girts exposed to the interior.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.13

DIVISION 7

SECTION 07 42 24 - STEAM-CURED WOOD CLADDING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install:
   1. Exterior steam/heat treated wood cladding.

1.2 RELATED REQUIREMENTS

A. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedure requirements related to the Owner's sustainability goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.

B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

C. Section 06 10 00 - ROUGH CARPENTRY: Wood framing and blocking.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
   1. ASTM D1037-12 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
   2. ASTM E84-12a - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. EN 350-2: 1994 – Durability of Wood and Wood-based Products – Natural Durability of Solid Wood: Guide to natural durability and treatability of selected wood species of importance in Europe.
   4. CENS/TS 15083-1 2005 - Durability of wood and wood-based products - Determination of the natural durability of solid wood against wood-destroying fungi, test methods - Part 1: Basidiomycetes.
   5. FS MM-L-736D 2008 - Lumber; Hardwood.
   6. FSC (Forest Stewardship Council): "FSC Certification Program."

1.4 GREEN BUILDING REQUIREMENTS

A. Materials and products within this Section shall contribute to the Project's sustainable design goals . Refer to Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.

B. Construction activities to be coordinated with the construction waste requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

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1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 30 00 - SUBMITTALS:

1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for cladding installation hardware, adhesives and accessories furnished hereunder.
2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
   a. Submit manufacturer's written certification of the following:
      1) No chemicals are used in the wood treatment process.
      2) Surface Burning characteristics.
      3) Biological durability testing Class.
      4) Peak curing temperature.
   b. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC® standards..
      1) Demonstrate that products are FSC® certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
3. Shop drawings:
   a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing fastening methods; and complete installation details.
4. Verification Samples:
   a. Provide installation hardware samples as requested by Architect for selection of colors and finishes.
   b. Provide 9 inch length samples of cladding, pre-grooved and finished.
   c. Provide 9 inch length samples of furring with pre-installed cladding mounting clips (PaCS™).

1.6 QUALITY ASSURANCE

A. Qualifications - Manufacturer: Minimum of 15 years documented experience in steam/heat modification of wood, and demonstrating previously successful work of the type specified herein.

B. Chain of Custody of Wood Products: All wood products furnished under this Specification Section shall be "FSC® certified" according to the rules of the Forest Stewardship Council (FSC®).
   1. FSC® Certification includes the following certification bodies of forests and forest products:
      a. Certification Systems.
      b. SmartWood.
      c. SGS Qualifor.
      d. Soil Association.

C. Certifications:

1. Surface Burning characteristics, for North American White Ash, Tested per ASTM E-84: UL Class B finish having maximum flame and smoke developed as follows"
   a. Flame Spread Index (FSI): equals or less than 35.
   b. Smoke Developed Index (SDI):
      1) Board Size, nominal 1 by 6 inches thickness: SDI equal to or less than 250.
      2) Board Size, 5/4 by 6 inches: SDI equal to or less than 85.
2. Biological durability testing, tested per European Test Standard CENS/TS 15083-1 2005 having Classified durability as follows:
   a. Thermory® treated Scots Pine: Class 2 (minimum 20 years and over).
3. Chemicals: Use of chemicals is prohibited in the treatment process.
4. Temperature treatment: Peak temperature of not less than 419 degrees F.

1.7 DELIVERY STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:

1. Protect cladding materials from damage due to moisture and weather elements, sunlight, and damage from construction operations and other causes.
2. Store and handle materials following manufacturer's recommended procedures.
   a. Store cladding in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected location. Keep stored cladding protected from water and sunlight at all times, including that within original packaging. Vent stacks to prevent moisture being trapped within coverings.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Specified Manufacturer (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermory®USA, 1213 Wilmette Avenue, Wilmette, IL 60091, Product: "Thermory® Cladding." No substitution will be accepted.

2.2 DESCRIPTION

A. General Description: Wood is factory-treated with heat and steam (no chemicals) in a special, computer controlled, high-temperature kiln. It gives the wood a higher dimensional stability and a lower equilibrium moisture content compared to untreated hardwood cladding, and also causes the color of the wood to darken

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1. Moisture content: Heat/steam treated wood for use shall have a moisture content between 4.5 to 7.5 percent, when delivered to the project.
2. Interlocking end joints, located between framing members shall have point load capacity of over 1900 pounds, as tested per ASTM D1037 on for 0.787 inch (20mm) thickness cladding.

B. Sustainability Requirements:

1. Sustainable Forest Certification: All wood shall be "Chain-of-Custody" certified as FSC® Certified.

2.3 WOOD MATERIALS

A. Exterior wood cladding: Heat/steam treated clear grade, Scots Pine (Pinus Sylvestris) "Thermory®USA Cladding," Provide boards with end joints, Thermory JEM® Joint, routed interlocking end joints.

1. Board Size: nominal 1 by 6 inch, not less than 0.787 inch (20mm) thickness.

B. Trim and board accessories:

1. Board Size 1x8, nominal 1 by 8 inch, not less than 0.787 inch (20mm) thickness. In profiles indicated on Drawings.

2.4 ACCESSORIES

A. Screws, self-tapping stainless steel:

1. FixingGroup GmbH, Germany, 4.0 x 60mm terrace screws.
2. Sihga, Austria "GoFix MS II®" 4.0 x 60mm terrace screws.

B. Finishing Materials:

1. Cutek, Australia (North American distributor: Deck Source Inc., Beeton Ontario Canada product "Cutek Extreme Wood Preservative".
2. Duckback Products, Inc., Cleveland OH., product "Superdeck Exotic Hardwood Stain".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify adequacy of blocking, backing and support framing for all cladding and trim work.

1. Ensure cladding support strips are spaced not greater than 16 inches on center.

B. Beginning of installation means acceptance of site conditions.

3.2 INSTALLATION (USING TRADITIONAL BLIND SCREW METHOD)

A. General: Cladding shall be properly framed, closely fitted and accurately set to the required lines and levels and shall be rigidly secured in place.

1. Scribe and cut work to fit adjoining work closely.
2. Refinish cut surfaces of prefinished boards.

B. Install cladding using specified traditional (nailed in place) in accordance with manufacturer's written instructions and as specified herein.

1. Install cladding evenly spaced, make all joints tight.
2. Install with a minimum number of end joints. Stagger vertical joints such that in any given course ends shall not be less than 1-1/2 inches away from vertical joints above and below.
    a. Joints at board ends must sit over furring, except for cladding having interlocking end joints (Thermory JEM® Joint) which is not required to sit over furring.
3. Screw fasten each board independently using specified self-tapping screws. Do not screw through two overlapping pieces of siding. Maximum spacing of screws shall be no greater than 24 inches on center. Screws shall be driven flush and snug without splitting wood cladding
4. Minimum screwing distance from edge: 3/4 inch minimum, screwing distance from end: 1-1/2 inch. Predrilling is required, even with specified self tapping screws, when less than 3 inches from the end of a board.

3.3 FIELD FINISHING

A. Remove surface contaminants, stains, dirt, mildew, algae, fungus, and failed oxidized stains. Recommended cleaners include the following:

1. Cutek, Australia (North American distributor: Deck Source Inc., Beeton Ontario Canada product "Cutek ProClean".
2. Duckback Products, Inc., Cleveland OH., product "Superdeck® Wood Cleaner". Remove mill glaze with Superdeck® Wood Brightener.

B. Apply finish in accordance with preservative finish manufacturer's written instructions, prior to installation of deck. Apply by brush, roller or spray. If spray applied, use the lowest possible pressure needed for a reasonable spray pattern. Back rolling is suggested when spraying, working the product smoothly and evenly into the wood and ensure a properly penetrated finish.

C. Penetrating stain must be applied only at a rate the wood will absorb. Excess product allowed to sit on surface will result in a tacky finish and extended dry time. Remove tacky finish with mineral spirits within 24 hours of application or with a mild solution of Wood Cleaner after 24 hours. When properly applied, the wood surface will have a positive dry and the wood fibers beneath the surface will maintain excellent lubrication. Thoroughly coat the porous ends of all boards with finishing product.

3.4 TOLERANCES

A. Maximum variation for wood cladding from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.

3.5 CLEANING

A. Daily clean work areas by sweeping and disposing of scraps and sawdust.

B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.6 PROTECTION

A. During the installation of exterior wood cladding and finishing, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

END OF SECTION 07 42 24

DIVISION 7

SECTION 07 46 19 STEEL SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Submittals: Product data, Construction drawings

B. Related Sections

1. Section 05 12 13 Structural Steel Framing

1.2 SYSTEM DESCRIPTION

A. Corten corrugated steel siding shall be attached as exterior cladding and shall be let to oxidize to a rusted finish.

B. Performance Requirements: Maximum allowable stress for Grade A (F) = 20,000 PSI for roofs and 26,667 PSI for walls where wind is only load

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Corrugated Metals, Inc., 3575 Morreim Drive, Belvidere, Illinois 61008; tel: (815) 323-1310; fax:
(815) 323-1317; email: info@corrugated-metals.com

2.2 MATERIALS

A. Corten corrugated steel siding, 18 ga ASTM A606 sheets with 93.25" radius

B. 18 ga ASTM A606 flat sheets
1. 2.67" x 7/8"
2. http://www.corrugated-metals.com/267x78_corrugated.html

C. ACCESSORIES
1. Attachment fasteners: 2 ½" stainless steel self-tapping screws and neoprene washers

2.3 QUALITY ASSURANCE

A. Ensure that rolled sections are of correct radius curvature.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installations of corrugated steel should strictly follow drawings for overlap of rolled sections and extension above roof height.

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END OF SECTION 07 46 19

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SECTION 07 46 46 FIBRE CEMENT WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included: The Work of this Section includes Fibre cement panels of the following types:
   1. Through color high density fibre cement EQUITONE [natura pro] panels.
      a. EQUITONE [natura pro] is a through colored base board, with semi-transparent colored finish which results in the structure of fibre cement material shining through. A PU top-coat which is UV hardened is applied to produce a hard surface finish which offers scratch resistant and "anti graffiti" protection.
   2. Fixed with either
      a. Visible EQUITONE rivets colored to match the panel.
      b. Invisible concealed Tergo system
      c. Invisible glue system.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Carefully examine Contract Documents for requirements that affect work of this section.

B. Other specifications sections that directly relate to work of this section include, but are not limited to, the following:

   1. Section 05 40 00 - Cold-Formed Metal Framing.
   2. Section 06 10 00 - Mechanically Graded Lumber.
   3. Section 07 21 00 – Thermal Insulation; exterior insulation, if required for NFPA 285 compliance, is not included in the scope of Section 07450.
   4. Section 07 27 29 - Air Barriers Coatings: Exterior wall air and moisture barrier

1.4 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C 1185 - 08 Standard Test Methods for Sampling and Testing Non-Asbestos Fibre-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.
   2. ASTM C 1186 - 08 Standard Specification for Flat Fibre-Cement Sheets.
   3. ASTM E 84 - Surface Burning Characteristics of Building Materials.

4. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degree C.

B. Materials and Equipment Acceptance (MEA) - New York City Department of Buildings Division.

C. CEN - European Committee For Standardization: EN12467 - Fibre Cement Flat Sheets - Product Specification and Test Methods.

D. CCHD - Coding Center Heidelberg: Performance Test Report.

1.5 SUBMITTALS

A. Products Submittals shall be per Section 01 33 00 – Submittal Procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including, but not limited to:
1. Preparation instructions and recommendations for EQUITONE [natura pro].
2. Storage and handling requirements and recommendations.
3. Installation methods for the supporting framework and the EQUITONE [natura pro] panels.

C. Shop Drawings: Provide detailed drawings of non-standard applications of fibre cement materials which are outside the scope of the standard details and specifications provided by the manufacturer.

D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product.

E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachment system meets the wind load requirements for the project.

F. Selection Samples: For each finish product specified, two complete sets of 5 ¼" x 2 1/2" (160x65mm) color chips representing manufacturer's full range of colors and patterns available in the US shall be provided upon request.

G. Verification Samples: For each finish product specified, two samples, minimum size 12 inches (305 mm) square, representing actual product, color, and patterns.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

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1.6 QUALITY ASSURANCE

A. Installer Qualifications: All products listed in this section are to be installed by a single installer trained and approved by the manufacture or representative.

B. Color Evaluation: No change, 2000 hours of accelerated weathering with color evaluation, CCHD Performance Test Report.

C. Mock-Up: Provide a full size mock-up [minimum ___ by ___] for evaluation of surface preparation techniques and application workmanship. [Mock-up shall include a corner, window sill, jamb and head condition, wall base and wall-roof intersection]

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Moving panels that are stacked on pallets should be done with a forklift or a crane. Ensure the panels are secured to the pallet in a way that will not cause damage. Stacks should be transported under a waterproof cover.

B. All panel materials must be stored flat on pallets, inside and undercover in dry conditions, protected from weather and other trades. Stack the pallets in a way so that the panels are ventilated.

C. Always lift panels off of each other, never slide them over one another, since scratching may occur.

1.8 PROJECT CONDITIONS

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

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. The General Contractor or Installer shall be responsible for existing site dimensions. Recorded measurements shall be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

A. Warranty: At project closeout, provide manufacturer's limited fifteen (15) year warranty covering defects in materials. Warranty is only available when material is installed by an installation contractor trained and approved by the manufacturer's representative.

DIVISION 7

PART 1 - PRODUCTS

2.1 MANUFACTURER

A. As a basis of Design, Fibre Cement Panels shall be manufacturerd by:
EQUITONE Inc
1731 Fred Lawson Drive, Maryville, TN 37801
Tel: +1 865-268-2705. E-mail: info.usa@equitone.com
Web: http://www.equitone.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 WALL PANELS

A. Through Color High Density Fibre Cement Panels:

1. Product: EQUITONE [natura pro] Fibre Cement Panel
   a. Application: Exterior.
   b. Application: Interior.
   c. Thickness: 5/16 inch (8 mm), ½ inch (12mm).
   d. Finish: EQUITONE [natura pro] is a through colored base board, with semi-transparent colored finish which results in the structure of fibre cement material shining through. A PU top-coat which is UV hardened is applied to produce a hard surface finish which offers scratch resistant and "anti graffiti" protection. The finished panel is both weatherproof and UV-stable. Irregularities, differences in shade and traces of the manufacturing process are to be expected. The rear receives a transparent back-sealing coating.
   e. Physical Characteristics: ASTM C1185, ASTM C1186, EN 12467 'Fibre-cement flat sheets'.
      1) Density Dry: Minimum 1.65 kg/m³ (103 lb/ft³)
      2) Bending strength @ ambient, perpendicular: 26.0 N/mm² (3,771 lbf/in²)
      3) Bending strength @ ambient, parallel: 17N/mm². (2,465 lbf/in²)
      4) Modulus of elasticity @ ambient, perpendicular: > 15,000N/mm². (> 2,175,570 lbf/in²)
      5) Hygric movement 0-100%, mean: 1.60 mm/m.
      6) Porosity 0-100%: < 20 %.
      7) Durability classification (EN 12467): Category A.
      8) Strength classification (EN 12467): Class 4.
      9) Fire reaction (EN 13501-1): A2-s1-d0;
         ASTM E84-Zero Flame Spread and smoke development of < 5;
         ASTM E-136 - passed.
      10) Impermeability test: Ok.
      11) Warm water test: Ok.
      12) Soak dry test: Ok.

13)	Freeze thaw test:	Ok.
14)	Thermal conductivity:	0.6 W/mK.

2.3 MISCELLANEOUS CLADDING MATERIALS

A. Perforated Insect/Vermin Screen: Manufacturer's standard.

B. Building Wrap: Approved Building Wrap complying with local codes for product and installation requirements.

C. Aluminum Joint Closures and Decorative Corner Profiles: Manufacturer's standard products as detailed. Maximum thickness of non structural finishing profile to be 0.8 mm or 21 gauge.

D. Panel Fastening Options: [Visible Rivets] [[Tergo Secret Fixing] [Glue Fixing]

DIVISION 7

SECTION 07 61 00 - SHEET METAL ROOFING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

B. Comply with SMACNA's "Architectural Sheet Metal Manual" unless otherwise indicated.

C. Warranties: Provide manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace roofing sheet metal that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

D. Warranties: Standard form in which roofing Installer agrees to repair or replace sheet metal roofing that fails in materials or workmanship within 5 years from date of Substantial Completion.

1.02 PERFORMANCE REQUIREMENTS

A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, battens, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.

B. Fabricate and install roof edges capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

Retain wind zone from four subparagraphs below to suit Project. Wind zones are areas of a roof as they relate to roof slope and design wind speed. See FMG Loss Prevention Data Sheet 1-28, Table 4. Wind Zone 1 is subdivided into two ranges. FMG Loss Prevention Data Sheet 1-49 tabulates a range of metal types and thicknesses that meet Wind Zones 1 and 2 and prescribes minimum anchoring of wood nailers, continuous cleats (hook strips), roof edge flashing, copings, and counterflashing. Wind Zone 3 requires assemblies of special design.

C. Wind Zone and wind loading structural design pressures: As indicated on structural drawings and calculations.

Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.Differential values (for aluminum in particular) in subparagraph below are suitable for most of the U.S.

Temperature Change (Range): [120 deg F (67 deg C), ambient; material surfaces.

PART 2 - PRODUCTS

2.01 ROOFING SHEET METALS

A. Energy Performance of Roofing Sheet Metal: Initial solar reflectance not less than 0.70 and emissivity not less than 0.75 when tested according to CRRC-1.

B. Solar Reflectance Index of Roofing Sheet Metal: Not less than 78 when calculated according to ASTM E 1980.

1. Metallic-Coated Steel Sheet: Galvanized structural-steel sheet, ASTM A 653/A 653M, G90 (Z275), Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); 0.025-inch (0.64-mm) nominal thickness.

2. Manufacturers:
3. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Berridge Manufacturing Co.; Vertical-Rib, Batten Seamed Joint, Standing-seam metal roofing panels, Cee Lock Panels, 16 1/2 inches wide, Color: Lead Coat
b. Or Architect approved equal.

4. Finish: Manufacturer's standard two-coat fluoropolimer finish panels, color as selected by Architect.

2.02 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.

1. Products:

a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High-Temperature Underlayment.
f. Or Architect approved equal.

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

C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.

1. Fasteners for Metallic-Coated Steel Sheet: Hot-dip galvanized steel or Series 300 stainless steel.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Metal Accessories: Matching sheet metal roofing in finish and material required for a complete weathertight roofing system, including clips, flashings, ridge closure strips, trim, copings, fasciae, gutters, and louvers.

2.03 FABRICATION

A. Fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of installation indicated.

1. Flat-Seam Roofing: Form flat-seam pans from metal sheets 20 by 28 inches (510 by 710 mm) with 1/2-inch (13-mm) notched and folded edges.

2. Standing-Seam Roofing: Form standing-seam pans with minimum finished seam height of 1 inch (25 mm).

PART 3 - EXECUTION

3.01 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. Apply self-adhering sheet underlayment at eaves and rakes from edges of roof to at least 24 inches (600 mm) exterior wall line.

C. Apply slip sheet over underlayment before installing metal roof panels.

D. Anchor roofing securely in place, with provisions for thermal and structural movement. Install with concealed fasteners unless otherwise indicated.

E. Separate dissimilar metals with a polymer-modified, bituminous sheet underlayment.

F. Install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges unless otherwise indicated.

1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners to prevent rotation.
2. Screw cleats not more than 12 inches (300 mm) o.c. Bend tabs over nails.
3. Double the number of cleats installed along aoutside four foot perimeter of roof eaves, rakes and ridges to resist wind uplift loads.

G. Seal joints as shown and as required for leakproof construction. Provide low-slope transverse seams using cleats where backup of moisture may occur. Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

1. Do not solder metallic-coated steel

H. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

END OF SECTION 07 61 00

DIVISION 7

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 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.

1.02 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

Retain first paragraph below for roof edge flashing and copings if Project is FMG insured or if FMG requirements will set a minimum quality standard and if delegating design to Contractor. Delete if requirements for copings or roof edge flashing are fully specified and drawn. Minimum thickness of sheet metal may also be governed by fastening patterns, continuous or intermittent cleats, and coping or roof edge flashing profiles. In addition to FMG Loss Prevention Data Sheet 1-49, SMACNA and NRCA offer limited design guidance.

B. Fabricate and install roof edge flashing and trim capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

Retain wind zone from four subparagraphs below to suit Project. Wind zones are areas of a roof as they relate to roof slope and design wind speed. See FMG Loss Prevention Data Sheet 1-28, Table 4. Wind Zone 1 is subdivided into two ranges. FMG Loss Prevention Data Sheet 1-49 tabulates a range of metal types and thicknesses that meet Wind Zones 1 and 2 and prescribes minimum anchoring of wood nailers, continuous cleats (hook strips), roof edge flashing, copings, and counterflashing. Wind Zone 3 requires assemblies of special design.

C. Wind Zone and wind loading structural design pressures: As indicated on structural drawings and calculations.

Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Differential values (for aluminum in particular) in subparagraph below are suitable for most of the U.S.

Temperature Change (Range): [120 deg F (67 deg C), ambient; material surfaces.

PART 2 - PRODUCTS

2.01 SHEET METAL

A. Metallic-Coated Steel Sheet: Galvanized structural-steel sheet, ASTM A 653/A 653M, G90 (Z275), Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); 0.025-inch (0.64-mm) nominal thickness.

1. Finish: Two-coat fluoropolymer to match roofing panels.
2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

2.02 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.

C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.

1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
3. Fasteners for Metallic-Coated Steel Sheet: Hot-dip galvanized steel or Series 300 stainless steel.

D. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 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."

D. Window Sill flashing – fabricated from 26 ga. galvanized steel

E. Window and door head flashing – fabricated from .032 aluminum

F. Clerestory sill flashing – fabricated from 24 ga. galvanized steel or weathered steel as indicated in Drawings.

G. Receiver flashings and counter flashings – fabricated from 26 ga. galvanized steel

H. Module C roof flashings - fabricated from 24 ga. galvanized steel

I. Drip edges - fabricated from 26 ga. galvanized steel

J. Fascia panels - fabricated from 24 ga. galvanized steel or weathered steel as indicated in Drawings.

K. Gutters – fabricated from 24 ga. galvanized steel, profile as shown in Drawings.

L. 4" Round Downspouts - fabricated from 24 ga. galvanized steel

M. Concealed Cleats – fabricated from 24 ga. galvanized steel

2.04 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.

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

1. Do not solder metallic-coated steel sheet.

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

END OF SECTION 07 62 00

DIVISION 7

SECTION 07 84 13 - PENETRATION AND JOINT FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Installer certificates signed by Installer certifying that products have been installed in compliance with requirements.

PART 2 - PRODUCTS

2.01 PENETRATION AND JOINT FIRESTOPPING

A. Manufacturers:One of the following:

1. Grace Construction Products.
2. Hilti, Inc.
3. 3M Fire Protection Products.
4. USG Corporation.

B. Provide penetration and joint firestopping materials that are compatible with one another, substrates, and penetrating items if any.

C. Penetrations and joints in Fire-Resistance-Rated Walls and Horizontal Assemblies: Provide penetration and joint firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

1. F-Rating at Fire-Resistance-Rated Walls: Not less than that of construction penetrated.
2. F-Rating at Horizontal Assemblies: At least 1 hour, but not less than that of construction penetrated.
3. T-Rating at Horizontal Assemblies: At least 1 hour, but not less than the fire-resistance rating of construction penetrated except for penetrations within the cavity of a wall.

D. Penetrations and joints in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

E. VOC Content: Penetration and joint firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Exposed Penetration and Joint Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. Accessories: Provide components for each penetration and joint firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install penetration and joint firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Designation of applicable testing and inspecting agency.
3. Manufacturer's name.
4. Installer's name.

C. Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 07 84 13

DIVISION 7

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and color Samples.

B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).

1.02 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS

A. Low-Emitting Materials: Sealants shall comply with the following limits for VOC content:

1. Architectural Sealants: 250 g/L.
2. Nonmembrane Roof Sealants: 300 g/L.
3. Single-Ply Roof Membrane Sealants: 450 g/L.
4. Other Sealants: 420 g/L.
5. Sealant Primers for Nonporous Substrates: 250 g/L.
6. Sealant Primers for Porous Substrates: 775 g/L.
7. Modified Bituminous Sealant Primers: 500 g/L.
8. Other Sealant Primers: 750 g/L.

B. Low-Emitting Materials:

1. Exterior reactive sealants shall have a VOC content of not more than 50 g/L or 4 percent by weight, whichever is greater.
2. Other exterior caulks and sealants shall have a VOC content of not more than 30 g/L or 2 percent by weight, whichever is greater.

C. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.

D. Sealant for Use in Building Expansion Joints, One of the Following:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 50; for Use NT.

    a. Products:

        i Dow Corning Corporation; 795.

2. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 100/50; for Use NT.

    a. Products:

        i Dow Corning Corporation; 790.

E. Sealant for General Exterior Use Where Another Type Is Not Specified, One of the Following:

1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT.

    a. Products:

        i Dow Corning Corporation; 799.
        ii Dow Corning Coporation; 756 SMS.

F. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and Around Plumbing Fixtures:

1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT; formulated with fungicide.

    a. Products:

        i Dow Corning Corporation; 786 Mildew Resistant.

G. Gap Fillers:

1. Gaps & cracks insulating foam sealant. Single-component, closed cell polyurethane post-expanding foam. UL Classified.

    a. Products:

        i Dow Great Stuff Gaps & Cracks insulating foam sealant.

2. Single-component closed cell polyurethane foam sealant. UL Classified.

    a. Products:

        i Dow Great Stuff Window & Door.

H. Roofing sealants:

1. Butyl rubber sealants.

    a. Products:

i Red Devil Butyl Rubber Sealant.
ii Firestone Water-Block Seal (S-20) Butyl Rubber Sealant.

I. Sealant for Interior Use at Perimeters of Door and Window Frames:

1. Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

a. Products:

i BASF Building Systems; Sonolac.
ii Tremco Incorporated; Tremflex 834.

2.02 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

3.01 INSTALLATION

A. Comply with ASTM C 1193.

B. Install sealant backings to support sealants during application and to produce cross-sectional shapes and depths of installed sealants that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal perimeters, control joints, openings, and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions. Comply with ASTM C 919.

END OF SECTION 07 92 00

DIVISION 8

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Samples for factory-finished doors.

PART 2 - PRODUCTS

2.01 Manufacturers:

A. Algoma Hardwoods, Inc.

B. Ampco, Inc.

C. Buell Door Company Inc.

D. Eggers Industries.

E. Ideal Architectural Doors & Plywood.

F. Marshfield Door Systems, Inc.

G. Mohawk Flush Doors, Inc.; a Masonite company.

H. Vancouver Door Company.

I. or equal approved by custom fabricator

2.02 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: WDMA I.S.1-A.

B. Fire-Rated Wood Doors: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Where indicated provide doors that have a temperature rise rating of 450 deg F (250 deg C).

C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784 and installed in compliance with NFPA 105.

D. Certified Wood: Wood doors shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification.".

E. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

F. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.

G. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated. Provide the following for mineral-core doors:

1. Composite blocking where required to eliminate through-bolting hardware.
2. Laminated-edge construction.
3. Formed-steel edges and astragals for pairs of doors.

2.03 FLUSH WOOD DOORS

A. Doors for Transparent Finish:

1. Exterior Solid-Core Doors: Premium grade, five-ply, structural composite lumber cores.

a. Faces: Grade A plain-sliced select any closed-grain hardwood.
b. Veneer Matching: Slip and running match.
c. Pair matching.

2. Interior Solid-Core Doors: Premium grade, five-ply, particleboard or structural composite lumber cores as indicated in Drawings.

a. Faces: Grade A plain-sliced select white birch.
b. Veneer Matching: Slip and running match.
c. Pair matching and set matching.
d. Continuous matching for doors with transoms.

B. Doors for Opaque Finish:

1. Exterior Solid-Core Doors: Custom grade, five-ply, structural composite lumber cores.

a. Faces: Any closed-grain hardwood.

2. Interior Solid-Core Doors: Custom grade, five-ply, structural composite lumber cores.

a. Faces: Any closed-grain hardwood, Hardboard, or MDF.

2.04 FABRICATION AND FINISHING

A. Factory fit doors to suit frame-opening sizes indicated and to comply with clearances specified.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3.

C. Cut and trim openings to comply with referenced standards.

1. Trim light openings with moldings indicated.
2. Factory install glazing in doors indicated to be factory finished.
3. Factory install louvers in prepared openings.

D. Factory finish doors indicated for transparent finish with manufacturer's standard finish complying with WDMA TR-6, catalyzed polyurethane for grade specified for doors.

1. Sheen: Satin.

E. Factory finish doors indicated for opaque finish with manufacturer's standard finish complying with WDMA OP-6, catalyzed polyurethane for grade specified for doors.

1. Sheen: Satin.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install doors to comply with manufacturer's written instructions and WDMA I.S.1-A, and as indicated.

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

DIVISION 8

SECTION 083323 - OVERHEAD COILING DOORS

Part 1- GENERAL

1.01 DESCRIPTION —

1.01.01 Type: Continuous sheet rolling door Model 650 as manufactured by Janus International Corporation, Temple, GA.

1.01.02. Mounting: To be interior face mounted on a prepared jamb.

1.01.03. Related Work: Preparation of opening, miscellaneous or structural steel, iron work, access panels, master keying cylinders, finish or field painting, electrical wiring, conduit, disconnecting switches are in the scope of the work of other sections or trades.

1.02 QUALITY ASSURANCE — Qualifications of Manufacturer: Products utilized in this section shall be manufactured by an organization who regularly engages in the production of similar products and has a proven history of successful manufactured products acceptable to the Architect, such as Janus International Corporation.

1.03 GUARANTEE — All doors and components specified herein shall be guaranteed to be free of workmanship and defect for a period of 3 years.

Part 2- PRODUCT

2.01 CURTAIN —

2.01.01 Sheets: Continuous 20" corrugated sheets roll formed from 26 gauge ASTM A653 Grade 80 full hard steel and lock seamed
together.

2.01.02 Finish: Galvanized and pre-painted with Super Durable Polyester paint guaranteed with a 40 year film integrity warranty to not crack, peel, flake, split, delaminate or blister. Additional guarantee up to 25 years against fading or changing color based on color chosen.

2.01.03 Bottom Bar: Roll formed clear acrylic coated galvanized steel reinforced with a 1-1/2" x 1-1/2" x 12 gauge galvanized angle that extends fully into the guides. Exterior mounted lift handle(s) and #6 Angola rope attached to interior angle.

2.02 WEATHERSTRIPPING —

2.02.01 Black PVC bulb-type astragal affixed to the bottom bar assembly provides positive contact with the floor.

2.02.02 Polyethylene wear strip furnished on both legs of each guide.

2.02.04 Black flexible neoprene top draft stop with 2" lip attached to curtain.

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2.02.05 4" Header seal attached to header jamb.

2.03 BARREL ASSEMBLY — Galvanized coil steel fabricated in a 9-1/2" diameter spiral formation to enclose spring counterbalance system and provide full span curtain weight support. Attached galvanized drums are furnished with grease-filled, shielded radial ball bearings at rotating points around the axle.

2.04 SPRING COUNTERBALANCE — Factory lubricated, oil tempered, helical torsion springs located inside the barrel and made of wire conforming to ASTM A229. Springs are attached to the steel axle tube by means of a welded spring clip. Axle tube provided is sufficient size to carry curtain load and spring torque.

2.05 SUPPORT BRACKETS — Galvanized and reinforced one-piece 12 gauge formed steel brackets are factory installed to the door assembly.

2.06 SPRING TENSIONER — Left end external mounted ratchet tensioner device allows for field adjustment of spring tension on all springs.

2.07 GUIDE ASSEMBLY — Universal mounted guides roll formed from 18 gauge galvanized steel and fitted with leg wear strips. 1-5/8" guide depth furnished for sufficient curtain engagement. Removable galvanized door stop at top of each guide.

2.08 OPERATION —

2.08.01 Hand operated with #6 Angola rope attaching to the bottom bar assembly.

2.08.02 (Optional) Internal right hand drive electric operator (furnished by vendor).

2.09 LOCKING MECHANISM — Single yellow zinc or optional stainless steel mini latch factory installed on right side of door (outside looking in) with four bolts. Slide exhibits magnetic properties that can activate guide mounted security sensors. Accepts all industry padlocks, including 7/16" diameter shanks. Provisions for cylinder lock included.

2.10 FINISH — Non-galvanized surfaces, excluding axle tube, to consist of shop coat of rust inhibitor primer.

Part 3- EXECUTION

3.01 INSTALLATION— To be performed by an authorized Janus International Corporation representative or professional door installer in accordance with the Janus installation standards, instructions and recommendations.

END OF SECTION 083323

DIVISION 8

SECTION 08 51 18 - ALUMINUM TILT AND TURN WINDOWS, LIFT AND SLIDE DOORS, AND ENTRY DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Section included: Extruded Aluminum windows of the following type (s):
   1. Tilt and Turn windows
   2. Entry Doors
   3. Sliding Doors

1.02 RELATED SECTIONS

A. Section 07 27 00 - Air Barriers: Water-resistant barrier.
B. Section 07 92 00 - Joint Sealants: Sealants and caulking.
C. Section 08 81 00 – Glass and Glazing

1.03 REFERENCES

A. Building Research Institute European Body #1488 – Building Structures Department:

B. Building Structures ITB Department / Building Structures Laboratory confirms ITT window test results in accordance with the product standard EN 14351-1+A1: 2010 clause 4.14, 4.5, 4.2, 4.8 and 4.16

C. Test results are in accordance with the tests report No. LK00-0893/12/R33NK

D. These results refer to tested properties can be used for CE marking, in accordance with the results specified in the product standard PN-EN 14351-1+A1: 2010 – Annexes A, E and F.

1.04 PERFORMANCE REQUIREMENTS

1. Air Permeability - Classification 4 - Test Method PN-EN 1026:2001 – Classification Standard PN12207: 2001
2. Water tightness – Classification E1050 (1050Pa) – Test Method PN-EN 1027:2001 – Classification Standard PN-EN 12208:2001
3. Resistance to Wind Load – Deflection – Classification C5 (2000Pa)/B5 (2000Pa) – Test Method PN-EN12211: 2001 – Classification Standard PN-EN 12210:2001
4. Safety Test – Classification +/- 3000 Pa – Test Method PN-EN12211:2001 – Classification Standard PN-EN 12210:2001
5. Load Bearing Capacity of Safety Devices – Classification Pass – Test Method PN-EN 14351-1+A1: 2010 p. 4.8, PN-EN 14609:2006 – Classification Standard PN-EN 14351-1+A1: 2010
6. Operating Forces – Classification 1 – Test Method – PN-EN 12046-1:2005 – Classification Standard PN-EN 13115: 2002

A. Thermal Performance

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1. Windows shall meet whole-unit U-Value of .20 (A5 Triple Pane Series), according to ISO 9000 and NFRC Thermal Calculations.

1.05 SUBMITTALS

A. Reference Section 01 33 00 – Submittal Procedures; submit following items:

1. Product Data: Submit manufacturer's product data, including installation instructions.

2. Shop Drawings: Include window schedule, window elevations, section details, and multiple window assembly details. Submit full shop drawings as required; include location floor plans or exterior wall elevations showing all window openings, typical unit elevations, and to scale detail sections of every typical aluminum member. Indicate the type of anchors, hardware, operators and other components not included in manufacturer's standard data. Include glazing details and standards for factory glazed units.

3. Samples:
   a. Color samples: Minimum 2 x 1 inch (50 mm x 25 mm) color samples from RAL color matching system.
   b. Glass, showing specified color.

4. Quality Assurance / Control Submittals:
   a. Qualifications: Proof of manufacturers qualifications.
   b. Installation Instructions

B. Closeout Submittals: Reference Section 01 78 00 – Closeout Submittals: submit following items:
1. Maintenance instructions.
2. Special Warranties.

1.06 QUALITY ASSURANCE

A. Overall Standards: These results refer to tested properties can be used for CE marking, in accordance with the rules specified in the product standard PN-EN 14351-1+A1: 2010 – Annexes A, E and F.

B. Qualifications:
1. Manufacturer Qualifications:
   a. Minimum 10 years - experience fabricating aluminum windows.

2. Provide test reports from Building Research Institute – Building Structures Department certifying the performance as specified in section 1.04 of this specification. Valid test reports shall be no more than five years old.

C. Regulatory Requirement: Egress per local code

1.07 DELIVERY, STORAGE, AND HANDLING

Reference Section 01 66 00 – Product Storage and Handling Requirements.

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 an upright position and 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 aluminum window units with glass cups instead of by the frames whenever possible and if unit is over 100 lbs.
2. Protect materials and finish during handling and installation to prevent damage.

1.08 WARRANTY

Warranty:
1. 10 Year Limited Warranty
2. Guarantee windows against defect in materials and workmanship.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Glo European Windows
1001 S 4th St W Suite 1
Missoula MT 59801

Tel: (406) 721-2741

Website: www.glowindows.com

B. Window and Door Series:
A5 Triple Pane Series Aluminum Windows and Doors

C. Substitutions: Substitutions not permitted.

2.02 MATERIALS

A. Frame and Sash: Extruded Aluminum, with powder coat 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 aluminum and of sufficient strength to perform the functions for which they are used.

C. Weather-strip shall meet the requirements of the specifications as detailed in the appropriate test report. All weather-strip 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.

DIVISION 8

2.03 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 aluminum glazing stops. 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.

2.04 INSECT SCREENS

A. Provide tight-fitting screen for operating sash with hardware to allow easy removal.
   1. Screen Cloth: Charcoal colored fiberglass mesh
   2. Frame:
      a. Roll formed or extruded aluminum. (Interior placement)
      b. Rotating Clips for handling

2.05 GLASS AND GLAZING

A. Overall IG thickness: nominally 1-9/16" A5 Triple Pane Series 4mm glass

B. Construction: Individual components shall comply with criteria specified in following paragraphs. Units shall be hermetically sealed.

C. Components

1. Exterior layer [surface #2] to be low-e coated float glass of nominal thickness as required.
2. Exterior glass to be Kind annealed.
3. Middle layer to be float glass of nominal required thickness A5 Triple Pane Series.
4. Middle Glass to be Kind annealed.
5. Interior layer to be clear float glass of nominal thickness as required.
6. Interior glass to be Kind annealed
7. Gas Fill: Each cavity between glass and SCF shall be filled with an inert gas / air mixture containing a minimum of 90% Argon gas
8. Spacers: shall maintain a nominal dimension of 5/8" (16mm) between glass
9. Edge Sealants:
   a. Polyurethane sealant for perimeter moisture barrier
   b. Seal durability: Perimeter seals shall maintain a hermetically sealed, dehydrated condition for the duration of the product warranty.

2.06 FINISH (Exterior / Interior)
A. Frame and Sash colors: RAL Color Chart (300 Colors)
B. Color match screen frame to window frame and sash color

2.07 SOURCE QUALITY CONTROL
A. Windows inspected in accordance with manufacturers Quality Control Program.

2.08 WINDOW AND DOOR TYPES
Tilt and Turn Window, Lift and Slide A5 Triple Pane Series

A. Factory assembled and glazed inward opening aluminum sash
B. Frame:
1. Chambered, foam insulated, extruded aluminum
2. Overall Frame Depth: 3-5/16" (84 mm) A5 Triple Pane Series
C. Sash:
1. Chambered, foam insulated, extruded aluminum
2. Minimum 2-1/4 inch (57 mm) deep, chambered, extruded aluminum profile.
D. Sightlines: edge of frame to tip of glazing tower or glass line 4-3/8" (109 mm) A5 Triple Pane Series
E. Weather-strip:
1. Triple weather-strip
a. Continuous, flexible EPDM type around sash perimeter
b. EPDM frames interior perimeter
c. EPDM around perimeter of frame at sash opening
F. Hardware:
1. Hardware: Tilt and Turn Hardware Mechanism; Siding Door Assembly and Hardware
2. Tilt and Turn Handle and Door Pulls – Brushed Stainless Steel
3. Tilt and Turn Handle mounting height: Not to exceed 48 inches above finish floor.
4. Locking System – Single handle multi-point with positive action (pulls tight).
5. All exposed fasteners- stainless steel

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine openings in which windows will be installed.
1. Field verifies 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.

C. Commencement of work by installer is acceptable of substrate conditions.

3.02 INSTALLATION

A. Install windows in framed walls in accordance with manufacturer's instruction.
B. Install windows in accordance with manufacturer's guideline 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. Integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's instructions.
G. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.
H. Leave windows closed and locked.
I. Do not remove temporary labels.
J. Install insect screens on operable windows.

3.03 FIELD QUALITY CONTROL

A. Optional Field Testing: Test Method

B. Conduct air and water infiltration testing with the window manufacturer, contractor, and owner present.

3.04 CLEANING

A. Reference Section 01 74 00 – Cleaning and Waste Management
B. Clean window frames and glass in accordance with Division 1 requirements.
C. Remove temporary labels and retain for Closeout Submittals.
D. Clean soiled surfaces and glass using a mild detergent and warm water solution with soft, clean cloths.

3.05 PROTECTION

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

3.06 DISPOSAL OF DEBRIS

A. Remove all garbage off-site and legally dispose of existing windows and debris generated from the installation of the new windows.

END OF SECTION 08 52 00

DIVISION 8

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Allowances: Door hardware is included in Hardware Allowance.

B. Submittals: Hardware schedule.

PART 2 - PRODUCTS

2.01 HARDWARE

A. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated. On exit devices provide label indicating "Fire Exit Hardware."

B. Hinges:

1. Manufacturers:

a. Baldwin Hardware Corporation.
b. Hager Companies.
c. IVES Hardware; an Ingersoll-Rand company.
d. McKinney Products Company; an ASSA ABLOY Group company.
e. Trimco.
f. Stanley

2. Stainless-steel hinges with stainless-steel pins.
3. Nonremovable hinge pins for exterior.
4. Ball-bearing hinges for doors with closers and entry doors.
5. Two hinges for 1-3/8-inch- (35-mm-) thick wood doors.
6. Three hinges for 1-3/4-inch- (45-mm-) thick doors 90 inches (2300 mm) or less in height; four hinges for doors more than 90 inches (2300 mm) in height.

C. Locksets and Latchsets:

1. Manufacturers:

a. Accurate Lock & Hardware Co.
b. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
c. Arrow USA; an ASSA ABLOY Group company.
d. Corbin Russwin Architectural Hardware; n ASSA ABLOY Group Company.
e. Falcon Lock; an Ingersoll-Rand Company.
f. Hager Companies.
g. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
h. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
i. Sargent Studio Collection; an ASSA ABLOY Group company.

j. Rockwood, an ASSA ABLOY Group company.
k. Schlage

2. BHMA A156.2, Series 4000, Grade 1 for bored locks and latches.
3. BHMA A156.3, Grade 1 for exit devices.
4. BHMA A156.5, Grade 1 for auxiliary locks.
5. BHMA A156.12, Series 5000, Grade 1 for interconnected locks and latches.
6. BHMA A156.13, Series 1000, Grade 1 for mortise locks and latches.
7. Lever handles on locksets and latchsets.
8. Provide trim on exit devices matching locksets.

D. Key locks to Owner's new master-key system.

1. Cylinders with six-pin tumblers.
2. Provide construction keying.
3. Provide key control system, including cabinet.

E. Provide wall stops or floor stops for doors without closers.

1. Manufacturers:

a. Hager Co.
b. Trimco

F. Hardware Finishes:

1. Hinges: Matching finish of lockset/latchset.
2. Locksets, Latchsets, and Exit Devices: Satin Stainless Steel.
3. Closers: Matching finish of lockset/latchset.
4. Other Hardware: Matching finish of lockset/latchset.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount hardware in locations required to comply with governing regulations and according to SDI A250.8 and DHI WDHS.3.

B. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet.

C. Deliver keys to Owner.

3.02 HARDWARE SCHEDULE

A. Hardware Set No. 1 (Doors #101A): All hardware to be determined and supplied by NanaWall Representative and Architect.

1. Hinges.
2. Entry Lock
3. Floor Stop
4. Threshold

5. Door Bottom
6. Seal

B. Hardware Set No. 2 (Door #107):

1. Hinges: Hager 4-1/2 x 4-1/2" hinges AB800(US32D) (3 per door).
2. Threshold: Pemko or equiv. aluminum plate 3-1/2 x ¼" 14_1
3. Bush Door Shoe: Pemko – 234APK
4. Edge Seal: McKinney adhesive-backed gasket MCKS88BL
5. Lockset: Sargent Metro Elements MI Aventura series cylinder lockset (US32D)
6. Floor Door Stop: Trimco #7280 (US32D)

C. Hardware Set No.3 (Doors #105):

1. Sliding Track: Hafele top-hung system, ALU 40
2. Pulls: Custom pulls per Drawings

D. Hardware Set No. 4 (Doors # 106A, Bedroom Barn Door):

1. Sliding Track: Sugatsune flush mount system, KS-85, Track, KS-3490, Flush, KS-3502
2. Pulls: Custom per Drawings

E. Hardware Set No. 5 (Doors #103A, 106B):

1. All hardware to be determined and supplied by NanaWall Representative and Architect.

F. Hardware Set No. 6 (Doors #108):

1. Hinges: Simonswerk 'Tectus' TE 240 3D-SSL (3 per leaf)
2. Touch Latch: Sugatsune ML-120, white finish, long stroke magnetic touch latch for large doors.
3. Silencer Magnetic Door Hold-Open: Hager 307D, (6) per leaf.

END OF SECTION 08 71 00

DIVISION 8

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.

1. GANA Publications: GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

PART 2 - PRODUCTS

2.01 GLASS, GENERAL

A. Fire-Resistance-Rated Assemblies: Provide products that comply with NFPA 80 and are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for applications indicated.

B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201. Provide safety glazing labeling where safety glass is indicated.

C. Windborne-Debris Resistance: Glazing passes basic protection testing requirements in ASTM E 1996 for Wind Zone 4 when tested according to ASTM E 1886.

2.02 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3.

C. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

2.03 MONOLITHIC-GLASS TYPES

A. Glass Type: Clear heat-strengthened float glass or fully tempered float glass.

1. Thickness: As Required.
2. Provide safety glass.

B. Glass Type: Tinted float glass heat-strengthened float glass or fully tempered float glass.

1. Thickness: As required.
2. Tint Color: Green.
3. Solar Heat Gain Coefficient: 0.28 maximum.
4. Provide safety glass.

2.04 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated insulating glass.

1. Overall Unit Thickness: As Required.

2. Thickness of Each Glass Lite: As Required.
3. Outdoor Lite: Tinted heat-strengthened float glass or fully tempered float glass.
4. Tint Color: Green.
5. Interspace Content: Argon.
6. Indoor Lite: Clear heat-strengthened float glass or fully tempered float glass.
7. Winter Nighttime U-Factor: .20 maximum.
8. Summer Daytime U-Factor: .20 maximum.
9. Solar Heat Gain Coefficient: 0.28 maximum.

2.05 GLAZING SEALANTS

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

1. Products: One of the following:

a. Dow Corning Corporation; 799 or 756 SMS.

B. Low-Emitting Materials: Sealants shall have a VOC content of not more than 250 g/L.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are contained in GANA's "Glazing Manual."

DIVISION 8

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

DIVISION 8

SECTION 08 83 00 - MIRRORS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings.

B. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

PART 2 - PRODUCTS

2.01 MIRRORS, GENERAL

A. Manufacturers:

1. Arch Aluminum & Glass Co., Inc.
2. Avalon Glass and Mirror Company.
3. Guardian Industries.
4. Lenoir Mirror Company.
5. National Glass Industries.
6. Sunshine Mirror; Westshore Glass Corp.
7. Or Architect approved equal.

B. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

C. Safety Glazing Products: Provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

2.02 MATERIALS

A. Clear Glass: Mirror Glazing Quality, 6.0-mm nominal thickness.

B. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; 6.0-mm nominal thickness.

C. Mirror Mastic: An adhesive setting compound, asbestos free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers:
   a. Laurence, C. R. Co., Inc.
   b. Pecora Corporation.
   c. Sommer & Maca Industries, Inc.
   d. Or Architect approved equal.

2. Low-Emitting Materials: Mastic shall have a VOC content of not more than 70 g/L.
3. Low-Emitting Materials: Mastic shall comply with Green Seal's GS-36 and with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

E. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of each mirror in a single piece.

1. Finish: Clear bright anodized.

2.03 FABRICATION

A. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

B. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

B. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points.
2. Mirror Clips: Place a felt or plastic pad between mirror and each clip. Locate clips so they are symmetrically placed and evenly spaced.
3. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

C. Remove nonpermanent labels, and clean surfaces immediately after installation.

DIVISION 8

END OF SECTION 08 83 00

DIVISION 9

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.02 METAL FRAMING AND SUPPORTS

A. Steel Framing Members, General: ASTM C 754.

1. Steel Sheet Components: ASTM C 645. Thickness specified is minimum uncoated base-metal thickness.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.

B. Framing Systems:

1. Studs and Runners: In depth indicated and 0.018 inch (0.45 mm) thick unless otherwise indicated.
2. Flat Strap and Backing: 0.018 inch (0.45 mm) thick.
3. Hat-Shaped, Rigid Furring Channels: In depth indicated and 0.018 inch (0.45 mm) thick.
4. Resilient Furring Channels: 1/2 inch (13 mm) deep, with single- or double-leg configuration.
5. Cold-Rolled Furring Channels: 0.053 inch (1.34 mm) thick, 3/4 inch (19 mm) deep.
6. Z-Furring: In depth required by insulation or as shown, 1-1/4-inch (32-mm) face flange, 7/8-inch (22-mm) wall-attachment flange, and 0.018 inch (0.45 mm) thick.

2.03 ACCESSORIES

A. General: Comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: foam gasket.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install steel framing to comply with ASTM C 754."

1. Gypsum Plaster Assemblies: Also comply with ASTM C 841.
2. Portland Cement Plaster Assemblies: Also comply with ASTM C 1063.
3. Gypsum Veneer Plaster Assemblies: Also comply with ASTM C 844.
4. Gypsum Board Assemblies: Also comply with ASTM C 840.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Isolate steel framing from building structure, except at floor, to prevent transfer of loading imposed by structural movement.

1. Where studs are installed directly against exterior walls, install isolation strip between studs and wall.

D. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

END OF SECTION 09 22 16

DIVISION 9

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.02 PANEL PRODUCTS

A. Provide in maximum lengths available to minimize end-to-end butt joints.

B. Interior Gypsum Board: ASTM C 1396/C 1396M, in thickness indicated, with manufacturer's standard edges. Type X where indicated, type as required for specific fire-resistance-rated assemblies. Sag-resistant type for ceiling surfaces. Other types as indicated on Drawings.

1. Manufacturers:

   a. American Gypsum.
   b. CertainTeed Corp.
   c. Georgia-Pacific Gypsum LLC.
   d. Lafarge North America Inc.
   e. National Gypsum Company.
   f. PABCO Gypsum.
   g. Temple-Inland.
   h. USG Corporation.

C. Glass-Mat, Water-Resistant Gypsum Backing Board: ASTM C 1178/C 1178M, of thickness indicated. Type X where required for fire-resistance-rated assemblies and where indicated.

1. Products: One of the following:

   a. CertainTeed Corp.; GlasRoc Tile Backer.
   b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.

D. Cementitious Backer Units: ANSI A118.9, ASTM C 1288, or ASTM C 1325.

1. Products:

   a. C-Cure; C-Cure Board 990.
   b. CertainTeed Corp.; FiberCement.
   c. Custom Building Products; Wonderboard.
   d. James Hardie Building Products, Inc.; Hardiebacker.
   e. National Gypsum Company, Permabase Cement Board.
   f. USG Corporation; DUROCK Cement Board.

2.03 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet. For exterior trim, use accessories formed from hot-dip galvanized-steel sheet, or rolled zinc.

   1. Provide cornerbead at outside corners unless otherwise indicated.
   2. Provide LC-bead (J-bead) at exposed panel edges.
   3. Provide control joints where indicated.
   4. Provide other trim accessories as indicated in Drawings.

B. Aluminum Accessories: Extruded-aluminum accessories indicated with Class II, clear anodic finish; AA-C12C22A31.

   1. Manufacturers:

      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.

C. Joint-Treatment Materials: ASTM C 475/C 475M.

   1. Joint Tape: Paper unless otherwise recommended by panel manufacturer.
   2. Joint Compounds: Setting-type compounds for fire resistance rated construction and penetrations. Drying-type, ready-mixed, all-purpose compounds for other conditions.
   3. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
   4. Cementitious Backer Unit Joint-Treatment Materials: Products recommended by cementitious backer unit manufacturer.

D. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834.

   1. Sealants shall have a VOC content of 250 g/L or less.
   2. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Sound-Attenuation Blankets: ASTM C 665, Type I (unfaced) and free of formaldehyde.

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PART 3 - EXECUTION

3.01 INSTALLATION

A. Install gypsum board to comply with ASTM C 840.

1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.
3. Multilayer Fastening Methods: Fasten base layers and face layer separately to supports with screws.

B. Install cementitious backer units to comply with ANSI A108.11.

C. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

D. Finishing Gypsum Board: ASTM C 840.

1. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.
2. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
3. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.
4. Where indicated, provide Level 5 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges. Apply skim coat to entire surface.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

END OF SECTION 09 29 00

DIVISION 9

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

B. Obtain tile of each type and color or finish from same production run for each contiguous area

C. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling ceramic tile packages.

PART 2 - PRODUCTS

2.01 CERAMIC TILE

A. Ceramic tile that complies with Standard grade requirements in ANSI A137.1, "Specifications for Ceramic Tile."

B. Tile Type: Factory-mounted unglazed and glazed, impervious natural clay or porcelain cushion-edged ceramic mosaic tile and decorative glass tile.

1. Manufacturers:
2. Basis-of-Design Product: Product indicated on Drawings or a comparable Architect approved product of one of the following:

    a. American Olean; Division of Dal-Tile International Inc.
    b. Crossville, Inc.
    c. Daltile; Division of Dal-Tile International Inc.
    d. Deutsche Steinzeug America, Inc.
    e. Interceramic.
    f. Heath Ceramics.
    g. Imola Ceramic.
    h. Hirsch Glass Corp.

3. Module Size: As indicated on drawings.
4. Surface: Smooth, without abrasive admixture, except where indicated in Drawings.
5. Color and Pattern: As selected.
6. Grout Color: As selected.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile and matching characteristics of adjoining flat tile:

    a. External Corners for Portland Cement Mortar Installations: Glazed edge tile.
    b. External Corners for Thin-Set Mortar Installations: Glazed edge tile.
    c. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

DIVISION 9

2.02 INSTALLATION MATERIALS

A. Low-Emitting Materials: Adhesives and fluid-applied waterproofing membranes shall have a VOC content of 65 g/L or less.

B. Decoupling Membrane: DITRA, by Schluter Systems, ANSI A118.10 1/8" high-density polyethylene membrane with 1/2x1/2" square cavities each cut back in dovetail configuration, and polypropylene anchoring fleece laminated to its underside.

C. Waterproof Membrane: KERDI, by Schluter Systems, ANSI A118.10 0.008" thick, orange polyethylene membrane with polypropylene fleece laminated on both sides. Or Architect approved equal.

D. Shower Waterproofing: KERDI-Drain Shower ST/SC, by Schluter Systems, ANSI A118.10 0.008" thick, orange polyethylene membrane with polypropylene fleece laminated on both sides.

E. Threshold Strips: Metal Edging Strips by Schluter Systems or approved equal, profile as indicated in Drawings.

F. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

G. Setting and Grouting Materials: Comply with material standards in ANSI's "Specifications for the Installation of Ceramic Tile" that apply to materials and methods indicated.

1. Thin-Set Mortar Type for Wood Subfloors: Unmodified thin-set mortar. ANSI A118.1 (per Schulter's recommendation).

   a. Manufacturers:
   b. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

      i Bostik, Inc.
      ii C-Cure.
      iii Custom Building Products.
      iv Laticrete International, Inc.
      v MAPEI Corporation.
      vi TEC; a subsidiary of H. B. Fuller Company.

2. Thick-Set Mortar Type for Wood Subfloors: Unmodified thick-set mortar. ANSI A108.2.

   a. Manufacturers:

   b. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

      i Bostik, Inc.
      ii C-Cure.
      iii Custom Building Products.
      iv Laticrete International, Inc.
      v MAPEI Corporation.
      vi TEC; a subsidiary of H. B. Fuller Company.

3. Grout Type: Grout incompliance with ANSI A118.3, A118.6, A118.7.

    a. Manufacturers:
    b. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

        i Bostik, Inc.
        ii C-Cure.
        iii Custom Building Products.
        iv Laticrete International, Inc.
        v MAPEI Corporation.
        vi TEC; a subsidiary of H. B. Fuller Company.

H. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

1. Products: As recommended by tile and grout manufacturers. Formulated to resist grease, oil, water stains and dirt on porous polished and dense surfaces.

PART 3 -

3.01 INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For installations indicated below, follow procedures in ANSI's "Specifications for the Installation of Ceramic Tile" for providing 95 percent mortar coverage.

    a. Tile floors in wet areas.
    b. Tile floors in laundries.
    c. Tile floors composed of rib-backed tiles.

B. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

C. Lay tile in grid pattern unless otherwise indicated. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.

D. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11.

E. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

F. Install waterproofing to comply with ANSI A108.13.

DIVISION 9

G. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

END OF SECTION 09 30 00

DIVISION 9

SECTION 09 64 00 - WOOD FLOORING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

PART 2 - PRODUCTS

2.01 WOOD FLOORING, GENERAL

A. Hardwood Flooring: Comply with NOFMA grading rules for species, grade, and cut.

1. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

B. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.

1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

C. Softwood Flooring: Comply with WCLIB grading rules for species, grade, and cut.

D. Certified Wood: Wood-based materials shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.02 FIELD-FINISHED WOOD FLOORING

A. Solid-Wood Strip and Plank Flooring: Kiln dried and as follows:

1. Manufacturers:
2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:
   a. Mohawk Group, KH233 Local Legacy Collector's Edition
   b. Or Architect approved equal.
3. Species and Grade: Natural Walnut 04 Finish.
4. Cut: Varies.
5. Thickness: 1/2 inch engineered product.
6. Face Width: 5 inches.
7. Lengths: Random-length strips complying with applicable grading rules.
8. Edge Style: T & G.

B. Urethane Finish System: Complete water-based system of compatible components that is recommended by finish manufacturer for application indicated.

1. VOC Content:

a. Finish Coats and Floor Sealers: Not more than 50 g/L.
b. Stains: Not more than 100 g/L.

2. Stain: Penetrating and nonfading type.

a. Color: As selected.

3. Floor Sealer: Pliable, penetrating type.
4. Finish Coats: Formulated for multicoat application on wood flooring.

C. Wood Filler: Compatible with finish system and recommended by filler and finish manufacturers. If required to match approved samples, provide pigmented filler.

2.03 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6.0 mils (0.15 mm) thick. See SECTION 072100 - THERMAL INSULATION.

B. Asphalt-Saturated Felt: ASTM D 4869, Type II.

C. Wood Flooring Adhesive: Mastic recommended by flooring and adhesive manufacturers for application indicated.

1. Low-Emitting Materials: Adhesives shall have a VOC content of 100 g/L or less.

D. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."

E. Floating Floor Peel and Stick Membrane: Elastilon Strong; 3mm thick. (alternate installation method)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."

B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 1/4 inch (7 mm) or as recommended by wood flooring manufacturer.

C. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:

1. Wood Flooring Nailed to Wood Subfloor: Install flooring over a layer of asphalt-saturated felt.

D. Install Floating Floor Peel and Stick Membrane per manufacturer's recommendations.

3.02 SANDING AND FINISHING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

B. Fill open-grained hardwood.

C. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.

1. Apply stains to achieve an even color distribution matching approved Samples.

END OF SECTION 09 64 00

DIVISION 9

SECTION 09 72 00 –WALL COVERINGS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

B. Extra Materials: Deliver to Owner full-width rolls of wall covering equal to 5 percent of amount of each type installed, packaged with protective covering for storage.

PART 2 - PRODUCTS

2.01 VINYL WALL COVERING

A. Vinyl Wall-Covering Standards: Provide products complying with the following:

1. FS CCC-W-408D and CFFA-W-101-D for Type I, Light Duty products.
2. ASTM F 793 for strippable wall coverings that qualify as Category V, Type II, Commercial Serviceability products.
3. Surface-Burning Characteristics: As follows, per ASTM E 84.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

4. Basis of Design Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:

    a. Maharam Tek-Wall Measure Back #399436.
    b. Maharam Taut #399568.
    c. Maharam Spin #399833.
    d. Or Architect approved equal.

2.02 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer.

1. Low-Emitting Materials. Adhesives shall have a VOC content of 50 g/L or less.

2. Low-Emitting Materials: Primer/sealer shall have a VOC content of 200 g/L or less.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Preparation

1. Clean substrates of substance that could impair wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

2. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.

3. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.

4. Prime new gypsum board.

5. Allow new plaster to cure. Treat areas of high alkalinity.

6. Check painted surfaces for pigment bleeding and treat areas susceptible to pigment bleeding. Snad gloss, semigloss, and eggshell finishes with fine sandpaper.

7. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

B. Install seams vertical and plumb, with no horizontal seams.

C. Match pattern 72 inches (1830 mm) above finish floor.

D. Remove excess adhesive at finished seams, perimeter edges, and adjacent surface using cleaning methods recommended by wall covering manufacturer. Replace strips that cannot be cleaned.

END OF SECTION 09 72 00

DIVISION 9

SECTION 09 90 00 - PAINTING AND COATING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:

1. Product Data. Include printout of MPI's "MPI Approved Products List" with product highlighted.
2. Samples.

B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.

C. Compliance: Interior paints and coatings shall comply with the following limits for VOC content:

1. Flat Paints and Coatings: 50g/L.
2. Nonflat Paints and Coatings: 50g/L.
3. Industrial Maintenance Coatings: 100g/L.
4. Primers, Sealers, and Undercoaters: 100g/L.
5. Pretreatment Wash Primers: 300g/L.
6. Clear Wood Finishes, Varnishes: 350 g/L.
7. Floor Coatings: 100 g/L.
8. Stains: 250 g/L.

D. Extra Materials: Deliver to Owner 1 gal. (3.8 L) of each color and type of finish coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.01 PAINT

A. Manufacturers:

1. Latex Paint MPI #145:

a. Benjamin Moore & Co.: 219 Eco-Spec Zero VOC Interior Semi-Gloss.
b. Sherwin Williams: ProMar 200 Zero VOC Interior Latex Semi-Gloss.
c. Or Architect specified equal.

2. Pigmented Polyurethane Paint: MPI #72

a. Benjamin Moore & Co.: Corotech Aliphatic Acrylic Urethane Gloss V500.
b. Sherwin Williams: Protective & Marine Acrolon 218 HS B65W611/B65V600.
c. Or Architect specified equal.

3. Epoxy Paint: MPI #151:

a. Benjamin Moore & Co.: Product as recommended by manufacturer Benjamin Moore.

b. Sherwin Williams: Pro Industrial Pre-Catalized Water based Epoxy Eg-Shel K45W00151.
c. Or Architect specified equal.

4. Staining and Clear Finishing Materials:

a. Interior finish: Sikkens Cetol water based SRD translucent wood finish or approved equal. 2 coats, Clear Finish No. SIK77000, Color No. 78 Natural.
b. Exterior wood deck finish: Sikkens Cetol water based SRD translucent wood finish or approved equal. 2 coats, Clear Finish No. SIK77000, Color No. 78 Natural.
c. Or Architect approved equal.

B. Material Compatibility: Provide materials that are compatible with one another and with substrates.

1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. Colors: As selected.

PART 3 - EXECUTION

3.01 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.02 APPLICATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paint exposed surfaces, unless otherwise indicated.

1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint the back side of access panels.
4. Color-code mechanical piping in accessible ceiling spaces.
5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

C. Apply paints according to manufacturer's written instructions.

1. Use brushes only for exterior painting and where the use of other applicators is not practical.
2. Use rollers for finish coat on interior walls and ceilings.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

E. Apply stains and transparent finishes to produce surface films without color irregularity, cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other imperfections. Use multiple coats to produce a smooth surface film of even luster.

3.03 INTERIOR PAINT APPLICATION SCHEDULE

A. Gypsum Board:

1. Eggshell Latex System: Two coats over latex primer/sealer.
2. Pigmented Polyurethane System: Two coats over primer/sealer as recommended by manufacturer.
3. Epoxy System: Two coats over primer/sealer as recommended by manufacturer.

3.04 EXTERIOR STAIN AND CLEAR FINISH APPLICATION SCHEDULE

A. Wood, traffic surfaces, including wood decks and ramps.

1. Deck Stain over Wood Preservative: Two coats over preservative: MPI EXT 6.5D.
2. Deck Stain: Two coats: MPI EXT 6.5F.

a. Seal-Once.: Semi-Transparent Tinted Stain
b. Or Architect approved equal.

3.05 INTERIOR STAIN AND CLEAR FINISH APPLICATION SCHEDULE

A. Wood substrates, nontraffic surfaces, including wood trim, architectural woodwork, doors, windows, and wood-based panel products.

1. Semitransparent Stain: Two coats: MPI INT 6.1G
2. Semitransparent Stain: Two coats: MPI INT 6.3C.
3. Satin Water-Based Varnish over Stain: Two coats over stain: MPI INT 6.1R.
4. Satin Water-Based Varnish: Three coats: MPI INT 6.1F.

END OF SECTION 09 90 00

DIVISION 10

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

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 TOILET AND BATH ACCESSORIES

A. Manufacturers:

Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

B. Toilet Tissue Dispenser:

1. Basis-of-Design Product: Kohler K-14377.
2. Type: Single-roll dispenser.
3. Mounting: Surface mounted flanges with concealed fasteners to solid backing.
4. Material and Finish: Chrome plated brass or steel.
5. Operation: Fixed rod, toilet tissue slides onto rod.
6. Or Architect approved equal.

C. Shower Curtain Track:

1. Basis-of-Design Product: Kirsch 9046 or approved equal.
2. Outside Width: 5/8 inch (25.4 mm).
3. Mounting: Per manufacturer's recommendations to solid backing.
4. Material and Finish: Anodized aluminum.
5. Or Architect approved equal.

D. Robe Hook:

1. Basis-of-Design Product: Kohler K-14458-CP.
2. Description: Single-prong unit.
3. Material and Finish: Chrome plated brass or steel.
4. Or Architect approved equal.

E. Towel Bar:

1. Basis-of-Design Product: Kohler K-14451-CP.
2. Mounting: Surfaced mounted flanges with concealed fasteners to solid backing.
3. Material and Finish: Chrome plated brass or steel.
4. Or Architect approved equal.

DIVISION 10

F. Towel Rack:

1. Basis-of-Design Product: Kohler K-14450-CP.
2. Mounting: Surfaced mounted flanges with concealed fasteners to solid backing.
3. Material and Finish: Chrome plated brass and steel.
4. Or Architect approved equal.

G. Grab Bars:

1. Basis-of-Design Product: Kohler Purist.

2. Mounting: Flanges with concealed fasteners.

3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

   a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: 1-1/4 inches (32 mm).

5. Configuration and Length: As indicated on Drawings; 24 inch, 36 inch and 42 inch

2.02 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, ASTM B 16 (ASTM B 16M), or ASTM B 30.

C. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T6 or 6463-T6.

D. Sheet Steel: ASTM A 1008/A 1008M, 0.0359-inch (0.9-mm) minimum nominal thickness.

E. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

F. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

H. Tempered Glass: ASTM C 1048, Kind FT (fully tempered).

I. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

J. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

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

PART 3 - EXECUTION

3.01 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 10 28 00

DIVISION 11

SECTION 11 31 00 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 RESIDENTIAL APPLIANCES

A. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC A117.1.

C. Electric Cooktop: 30-inch, built-in induction cooktop with four heating elements and touch control.

1. Manufacturers:
2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. BOSCH Home Appliances. 500 Series NIT5068UC
b. Or Architect approved equal.

3. Color: Black ceramic glass surface with stainless steel trim.

D. Electric Wall Oven with 1300-3060 watt Bake Broil Oven: Built-in, single, electric, wall European convection oven with convention broil unit.

1. Manufacturers:
2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. BOSCH Home Appliances. HBE5451UC
b. Or Architect approved equal.

3. Color: Stainless steel and clear ceramic glass.

E. Exhaust Hood: 29-inch undercabinet, ventilating exhaust hood.

1. Manufacturers:

2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

    a. BOSCH Home Appliances. DHL755BUC
    b. Or Architect approved equal

3. Color: Silver metallic finish.
4. Fan Control: Hood mounted switch, with separate light switch.
5. Weatherproof through-wall cap with backdraft damper and rodent-proof perforated metal screening as indicated in Drawings.

F. Refrigerator/Freezer: Cabinet-mounted, frost-free, 24 inch Custom Panel refrigerator with bottom-mounted freezer.

1. Manufacturers:

    a. BOSCH Home Appliances. B09IB80NSP
    b. Or Architect approved equal

2. Color: Custom Panel.
3. Fresh Food Compartment and Freezer Compartment Volume: 9.6 cu. ft.
4. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

G. Dishwasher: Built-in, undercounter, automatic dishwasher, sized to replace 24-inch- (407-mm-) base cabinet, six wash cycles with hot-air and heat-off drying cycles, stainless steel tub and door liner, adjustable sliding dish racks.

1. Manufacturers:
2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

    a. BOSCH Home Appliances. SHXM78W55N
    b. Or Architect approved equal.

3. Color: Stainless steel.
4. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

H. Clothes Washer: Freestanding, front-loading, automatic clothes washer with 2.2-cu. ft. capacity stainless-steel tub and 15 wash cycles including regular, delicate, and permanent press.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

    a. BOSCH Home Appliances. Axis Series WAT28402UC
    b. Or Architect approved equal

2. Color: White.
3. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

I. Electric Clothes Dryer: Freestanding, front-loading clothes dryer, 4.0-cu. ft. capacity with stainless-steel interior.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. BOSCH Home Appliances. WTG86402UC
b. Or Architect approved equal.

2. Color: White

J. Built-In Coffee Machine

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. BOSCH Home Appliances. BCM8450UC
b. Or Architect approved equal.

2. Color: Stainless Steel

K. Base Cabinet Lift System

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Freedom Lift Systems: BaseLift 6200 Series
b. Or Architect approved equal.

2. Color: Stainless Steel

L. Ceiling Fan:

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Big Ass Fans, Model #Haiku Bamboo, one unit with light and one unit with light
b. Or Architect approved equal.

2. Color: Motor and Assembly Finishes, black and Airfoil Finishes, Caramel.

PART 3 - EXECUTION

3.01 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 00

DIVISION 12

SECTION 12 22 00 – CURTAINS AND DRAPES

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

PART 2 - PRODUCTS

2.01 DRAPERY TRACKS

A. Manufacturers:

1. Kirsch.
2. Or approved equal.

B. Construction: Kirsch 9046, extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c., and bendable to radii indicated.

C. Finish: Clear anodized.

D. Support Capability: Weight of drapery indicated.

E. Mounting: As indicated on Drawings.
1. Manual Operation: Provide ADA and ANSI A117.1 compliant acrylic drapery rods with open hoop grasp less than 48 inches above finish floor.

F. Draw: As indicated on Drawings.

G. Carriers: Ball bearing rollers with hooks.

2.02 DRAPERIES

A. Provide curtains and drapes passing flame-resistance testing according to NFPA 701.

B. Heading: Flat fold, with grommets.

C. Drapery Fabric:

1. Manufacturer: Marharam Trevira CS.
2. Designation: As indicated on Drawings.
3. Pattern: As indicated on Drawings.
4. Color: As indicated on Drawings.

2.03 DRAPERY FABRICATION

A. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.

1. One-Way-Stacking Draperies: Add 5 inches (127 mm) to overall width for returns.
2. Center-Opening Draperies: Add 10 inches (254 mm) to overall width for overlap.

B. Seams: Join widths so that patterns match and vertical seams lay flat and straight without puckering. Horizontal seams are not acceptable.

C. Side Hems: Double-turned, 1-1/2-inch- (38-mm-) wide, blindstitched hems.

D. Bottom Hems: Double-turned, 3-inch- (76-mm-) wide, weighted and blindstitched hems.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install track systems level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

B. Isolate metal parts of window treatment hardware from concrete or mortar to prevent galvanic action. Use tape or another method recommended by manufacturer.

C. Where draperies abut overhead construction, hang draperies with 1/4-inch (6.4-mm) clearance.

D. Where draperies extend to floor, install with not more than 1-inch (25-mm) and not less than 1/2-inch (13-mm) clearance.

E. Where draperies extend to windowsill, install with not more than 1/2-inch (13-mm) clearance.

END OF SECTION 12 22 00

DIVISION 12

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Motor-operated roller shades with single rollers

B. Related Requirements:

   1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
   2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

   1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

   1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material, signed by product manufacturer.

C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

DIVISION 12

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawingsor comparable product by one of the following:
   1. Corradi USA, Horizon.
   2. Or Architect approved equal.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

   1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Electric Motor: Manufacturer's standardtubular, enclosed in roller.

      a. Electrical Characteristics: Single phase, 110 V, 60 Hz.

   3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for flush mounting. Provide the following for remote-control activation of shades:
      a. Individual/Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for individual and group control.
      b. Sun Sensor Control: Adjustable system consisting of digital displays detecting sun intensity and responding by automatically adjusting shades.
      c. Infrared Control: System consisting of concealed receiver complete with external eye and connecting modular cable and two portable, multiple-channel transmitters with separate buttons to open and close up to 12 individual shades or groups of shades, to open and close shades simultaneously, and to stop shade movement.
      d. Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features; isolated from voltage spikes and surges.
      e. Color: As selected by Architect.

   4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
   5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.

6. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
    b. Capable of interface with audiovisual control system.
    c. Capable of accepting input from building automation control system.
    d. Override switch.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

    1. Roller Drive-End Location: As indicated on Drawings.
    2. Direction of Shadeband Roll: Regular, from back of roller.
    3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

E. Shadebands:

    1. Shadeband Material: Light-filtering fabric.
    2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

        a. Type: Exposed with endcaps.
        b. Color and Finish: As selected by Architect .

F. Installation Accessories:

    1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

        a. Shape: [L-shaped] [Curved] .
        b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open.

    2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

        a. Height: Manufacturer's standard in height required to enclose roller and shadeband when shade is fully open.

    3. Endcap Covers: To cover exposed endcaps.

4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
6. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: [Roller-shade manufacturer] <Insert source for custom fabrics>.
2. Type: [PVC-coated fiberglass] [PVC-coated polyester] [Woven PVC-coated fiberglass and PVC-coated polyester] [Woven polyester and PVC-coated polyester] [Acrylic-coated fiberglass] [PVC-coated fiberglass with silver backing] <Insert description>.
3. Weave: [Mesh] [Basketweave] <Insert description>.
4. Thickness: <Insert thickness>.
5. Weight: <Insert oz./sq. yd. (g/sq. m)>.
6. Roll Width: Sized to fit job conditions.
7. Orientation on Shadeband: [Up the bolt] [Railroaded] [As indicated on Drawings] <Insert requirements>.
8. Openness Factor: [1] [3] [5] [10] [11] [22] <Insert number> percent.
9. Color: Match Architect's sample.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than [1:4] <Insert ratio>, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

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B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

DIVISION 23

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

PART 2 - PRODUCTS

2.01 TUBES AND FITTINGS

A. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B) and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

D. Brazing Filler Metals: AWS A5.8.

2.02 VALVES

A. Thermostatic Expansion Valve: Comply with ARI 750; forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 46 deg F (8 deg C) heating and 71 deg F (22 deg C) cooling suction temperature; 102-411 psig (710-2834 kPa) working pressure, and 240 deg F (116 deg C) operating temperature.

B. Solenoid Valves: Comply with ARI 760; 240 deg F (116 deg C) temperature rating, 400-psig (2760-kPa) working pressure, 240 deg F (116 deg C) operating temperature; and 24-V normally closed holding coil.

2.03 REFRIGERANT PIPING SPECIALTIES

A. Strainers: Welded steel with corrosion-resistant coating and 100-mesh stainless-steel screen with socket ends; 500-psig (3450-kPa) working pressure and 275 deg F (135 deg C) working temperature.

B. Moisture/Liquid Indicators: 500-psig (3450-kPa) operating pressure, 240 deg F (116 deg C) operating temperature; with replaceable, polished, optical viewing window and color-coded moisture indicator.

C. Refrigerant: ASHRAE 34, R-410A.

DIVISION 23

D. Insulation:

1. Conform to ASTEM C534 Grade 1, Type I.
2. Shall have a closed cell structure to prevent moisture from wicking, which makes it an efficient insulation.
3. Shall be manufactured without the use of CFC's, HFC's or HCFC's. It is also formaldehyde free, low VOCs, fiber free, dust free and resists mold and mildew.
4. Shall have a maximum thermal conductivity of 0.27 Btu-in/h-ft^2 F at 75F mean temperature as tested in accordance with ASTM C 177 or ASTM C 518.
5. Shall have a maximum water vapor transmission of 0.08 per-inches when tested in accordance with ASTEm E96, Procedure A.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight.

B. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

C. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

D. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.

E. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.

F. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

G. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected.

H. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.02 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines: Copper, Type L (B), annealed- or drawn-temper tubing and wrought- copper fittings with soldered joints.

END OF SECTION 23 23 00

DIVISION 23

SECTION 23 72 00 – AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Energy recovery ventilator that transfer humidity and recover energy from that humidity, helps maintain a fresh environment even when the heating or cooling system is not operating.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Comply with NFPA 70 and 2011 NEC.

PART 2 - PRODUCTS

2.01 ENERGY RECOVERY VENTILATOR

A. Manufacture: Panasonic.

1. Model #: FV-04VE1.
2. 4" duct.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:

1. ERV Panasonic FV-04VE1 Installation Instructions.

END OF SECTION 23 72 00

DIVISION 23

SECTION 23 81 26 – SPLIT SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Mini-split heat pumps.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 QUALITY ASSURANCE

A. Components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer.

B. Product shall comply with National Electrical Manufacturers Association (NEMA) and UL

PART 2 - PRODUCTS

2.01 OUTDOOR UNIT

A. Manufacture: Mitsubishi.

1. Model #: MUZ-FE09-18NA.

2.02 INDOOR UNIT

A. Manufacture: Mitsubishi.

1. Model #: MSZ-FE09-18NA.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:

1. MUZ-FE09-18NA Outdoor Unit Service Manual.

2. MSZ-FE09-18NA Indoor Unit Service Manual.

3.02 INSTALLATION

A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

B. Handle and install units in accordance with manufacturer's written instructions.

C. Support units rigidly so they remain stationary at all times. Cross bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

D. Locate units to provide proper functioning of volume controls.

END OF SECTION 23 81 26

DIVISION 23

SECTION 23 83 16 - RADIANT-HEATING HYDRONIC PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Radiant floor heating systems for various floor constructions and control strategies, using cross-linked polyethylene (PEX) tubing, manifold for distribution, and applicable fittings.

1.02 SUBMITTALS

A. General: Submit listed submittals .

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Regulatory Requirements and Approvals: Provide a radiant floor heating system that complies with the following requirements.

1. International Code Council (ICC)

a. International Mechanical Code (IMC)
b. International Building Code (IBC)
c. ICC Evaluation Service (ES) Evaluation Report

2. International Association of Plumbing and Mechanical Officials (IAPMO)

a. Uniform Mechanical Code (UMC)

PART 2 - PRODUCTS

2.01 HYDRONIC RADIANT FLOOR HEATING SYSTEM

A. Manufacturer:

1. Uponor, Inc.
5925 148th Street West, Apple Valley, MN 55124;
Telephone: (800) 321-4739, (952) 891-2000;
Fax: (952) 891-1409;
Website: www.uponor-usa.com

B. Tubing

1. hePEX ½"

C. Manifolds (residential and light commercial, valved brass)

1. TruFlOW Jr. with balancing and isolation valves.

D. Fittings

1. ProPEX Fittings and Rings.

E. Supply Water Temperature Control (Single-temperature with Variable-speed Injection)

1. Three Way Mixing Valve

a. Part # A5401112
b. Set to 90 degrees.

2. Thermal Actuators

a. Part # A3030523
b. 24VAC, 167 mA
c. Max 17psi

2.02 HEAT TRANSFER PLATES

A. Joint Trak Plates

1. Part # A5080500

2.03 EXPANSION TANK

A. Manufacturer:

1. Bosch

a. Part #: 7747202342
b. ¾", Male
c. 18 L, 6 bar white
d. Max. operating pressure: 87.02 psi/6 bar

2.04 PIPING, FITTINGS, VALVES AND ACCESSORIES

A. Pressure and Temperature Relief Valve – ¾" stainless steel spring, ASME rate, CSA certified and meet ANSI Z21.22 standard

B. Isolation Valve – ¾" brass ball valve, in line with FNPT

C. Fill/Drain Valve – ¾" hose bib

D. Check Valve – ¾" swing style, brass, NPT

2.05 GAUGES AND INSTRUMENTATION

A. Manufacturer:

1. Omega Engineering, Inc.

2.06 PUMP

A. Manufacturer:

1. Taco
2. Model #: 003-84
3. ¾" SWT

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:

1. Uponor Complete Design Assistance Manual (CDAM)
2. Uponor Radiant Floor Installation Handook
3. Uponor proMIX 201 Installation Manual

3.02 INSTALLATION

A. Above the structural subfloor will be the layer of subflooring specifically for hydronic radiant tubing and plates.

B. Use a round nose router bit with diameter at least ½" and portable electric router to remove wood material where tubing and Joist Track plates are to be layed.

C. Do not exceed 8 inches (203mm) on center. Refer to the submitted radiant floor design.

D. Attach PEX tubing to inverted Joist Trak heat transfer plates by snapping the tube into the channel as they are layed in the routed subfloor grooves.

E. Adhere to the PEX tubing manufacturer's recommendations. Also refer to the Joist Trak Heat Transfer Panel Installation Handbook for additional information.

F. The plate faces should be resting level with the upper surface of the subfloor and the tubing and channel clip should be resting down into the subflooring grooves.

G. Leave a minimum ¼" gap between all plate edges to allow for thermal expansion.

H. Using the pre-punched mounting holes, secure the Joist Trak panels to the uppermost surface of the wood subfloor using screws or nails.

I. Install insulation underneath the structural subflooring and between the joists. Do not allow any air gap between the wood structural subfloor and the top of the insulation.

J. Use the recommended amount of insulation in the joist cavity below the structural subfloor in accordance with the submitted radiant floor design.

K. To compute insulation amount, the base guideline is a minimum of 5:1 ratio in R-value of the joist insulation to upward resistance.

L. Use edge insulation if the heated panel directly contacts an exterior wall or panel.

M. Perform a water pressure test of the system at 100 psi before laying plywood sheathing and finished flooring.

3.03 ADJUSTING

A. Balancing Across the Manifold

1. Balance all loops across each manifold for equal flow resistance based on actual loop lengths and total manifold flow.
2. Balancing is unnecessary when all loop lengths across the manifold are within 3 percent of each other in length. Install the supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.

B. Balancing between manifolds is accomplished with a flow control device installed on the return piping leg from each manifold when direct return piping is used for the supply and return mains.

3.04 CLEANING

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

B. Repair or replace damaged installed products.

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

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

END OF SECTION 23 83 16

DIVISION 22

SECTION 22 11 00 – FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. International Plumbing Code (IPC)

1. ICBO Evaluation Service (ES) Evaluation Report No. 5142
2. SBCCI Standard Plumbing Code (PST and ESI Report No. 9661)

B. Building Officials and Code Administrators International (BOCA)

1. 1993 BOCA National Plumbing Code

C. Uniform Plumbing Code (UPC)

1. IAPMO Files 3558, 3946 and 3960

D. National Standard Plumbing Code (NSPC)

E. HUD Material Release No. 1269

PART 2 - PRODUCTS

2.01 PIPING AND FITTINGS

A. Hard Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Types B and C), water tube, drawn temper with wrought-copper, solder-joint fittings and ProPress fittings.

1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint ends.
2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.

B. PEX

Manufacturer: Uponor, Inc.
5925 148th Street West, Apple Valley, MN 55124
Telephone: (800) 321-4739, (9520 891-2000
Fax: (952) 891-1409
Website: www.uponor-usa.com

1. Tubing:

a. ½" & ¾" AquaPEX White

2. Fittings:

a. ProxPEX adapters with rings
b. EP multi-port tees

C. PVC Pipe: ASTM D 1785, Schedule 40.

1. PVC Fittings: ASTM D 2466, Schedule 40, socket type.

D. Transition Fittings: Manufactured piping coupling or specified piping system fitting.

1. Same size as pipes to be joined and pressure rating at least equal to pipes to be joined.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.
3. All pipe runs shall be laid out to avoid interference with other work.
4. Install union and shut-off valve on pressure piping at connections to equipment.

B. Piping shall conform to the following:

1. Domestic Water:

a. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot water circulating lines with no traps.
b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

C. Soldered Joints:Comply with procedures in ASTM B 828 unless otherwise indicated

D. Uponor Plumbing System:

1. Install the Uponor Plumbing System in accordance with the PEX tubing manufacturer's recommendations and as indicated in the installation handbook.
2. Do not install PEX tubing within 12 inches (305 mm) of any recessed light fixtures.
3. Do not solder within 18 inches (457 mm) of PEX tubing in the same waterline. Make sweat connections prior to making PEX connections.
4. Do not expose PEX tubing to direct sunlight for more than 30 days.
5. Ensure that no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the PEX tubing manufacturer.
6. PEX tubing passing through metal studs shall use grommets or sleeves at the penetration.
7. Protect PEX tubing with sleeves where abrasion may occur.
8. Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.
9. PEX tubing manufacturer supplied bend supports shall be used where bends are less than six times the outside pipe diameter.
10. Tubing shall be supported to structural members using support methods required by local plumbing codes and the PEX tubing manufacturer's installation handbook.
11. Pressurize the plumbing system with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
12. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Water shall not be used to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F (0 degrees C).

3.02 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 by visual inspection of all joints.

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 by flushing out a volume equal to the system volume, then stopping the flow of water for one hour, and then flushing the system.

3.03 PIPING SCHEDULE

A. Aboveground Distribution Piping: PEX

B. Mechanical Room Piping: Copper

C. Landscape: PVC and Poly Tubing

D. Exterior Solar Loop: Flexible stainless steel insulated piping SolarFlex

3.04 VALVE SCHEDULE

A. Valve types:

1. Shutoff Duty: Use dezincification resistant brass ball valve
2. Throttling Duty: Use dezincification resistant brass ball valve
3. Hot-Water-Piping, Balancing Duty
4. Drain Duty: Hose-end drain valves

B. Install 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.

C. PVC ball, butterfly, and check valves may be used in matching piping materials.

D. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

E. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

END OF SECTION 22 11 00

DIVISION 22

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Potable hot and cold water distribution system, using crosslinked polyethylene (PEX) tubing and ASTM F1960 cold expansion fittings.

1.02 REFERENCES

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

B. ASTM International

1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
2. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
3. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing
5. ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
6. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing

C. American National Standards Institute (ANSI)/National Sanitation Foundation (NSF)

1. ANSI/NSF Standard 14 Plastics Piping System Components and Related Materials
2. ANSI/NSF Standard 61 Drinking Water System Components - Health Effects

D. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)

1. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials

E. Canadian Standards Association (CSA)

1. CAN/CSA B137.5: Cross-linked Polyethylene (PEX) Tubing Systems for Pressure applications

F. International Code Council (ICC)

1. International Plumbing Code (IPC)
2. ICC Evaluation Service (ES) Evaluation Report No. ESR 1099

G. Building Officials and Code Administrators International (BOCA)

1. 1993 BOCA National Plumbing Code

H. International Association of Plumbing Officials (IAPMO)

1. Uniform Plumbing Code (UPC)

I. National Association of Plumbing, Heating and Cooling Contractors (NAPHCC)

1. National Standard Plumbing Code (NSPC)

J. U.S. Department of Housing and Urban Development (HUD)

1. HUD Material Release No. 1269

K. Plastics Pipe Institute (PPI)

1. PPI Technical Report TR-4/06

L. Uponor, Inc.

1. Uponor Professional Plumbing Installation Guide, 2006

1.03 SYSTEM DESCRIPTION

A. Design Requirements

1. Standard grade hydrostatic pressure ratings from Plastics Pipe Institute (PPI) in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required.

a. 200°F (93°C) at 80 psi (551 kPa)
b. 180°F (82°C) at 100 psi (689 kPa)
c. 73.4°F (23°C) at 160 psi (1,102 kPa)

2. Certification of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 provided the installation meets one of the following requirements.

a. Tubing spacing is a minimum of 18 inches apart for the following sizes.

i ⅜ inch [9.53mm]
ii ½ inch [12.7mm]
iii ⅝ inch [15.88mm]
iv ¾ inch [19.05mm]

b. Tubing is wrapped with ½" fiberglass insulation with a flame spread of not more than 20 and a smoke-developed rating of not more than 30 and a nominal density of 4.0 to 4.5 pcf. Tubing can run with three tubes separated by zero inches and then 18 inches between the next group of three tubes for the following sizes.

i ⅜ inch [9.53mm]
ii ½ inch [12.7mm]
iii ⅝ inch [15.88mm]
iv ¾ inch [19.05mm]
v 1 inch [25.4mm]
vi 1¼ inch [31.75mm]
vii 1½ inch [38.1mm]

viii 2 inch [50.8mm]

B. Performance Requirements: To provide a PEX tubing hot and cold potable water distribution system, which is manufactured, fabricated and installed to comply with regulatory agencies and to maintain performance criteria stated by the PEX tubing manufacturer without defects, damage or failure.

1. Comply with ANSI/NSF Standard 14.
2. Comply with ANSI/NSF Standard 61.
3. Show compliance with ASTM F877.
4. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings with Underwriters Laboratories, Inc. (UL).

a. UL Design No. L557 — 1 hour wood frame floor/ceiling assemblies
b. UL Design No. K913 — 2 hour concrete floor/ceiling assemblies
c. UL Design No. U372 — 1 hour wood stud/gypsum wallboard wall assemblies
d. UL Design No. V444 — 1 hour steel stud/gypsum wallboard wall assemblies

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

C. Shop Drawings: Provide installation drawings indicating tubing layout, manifold locations, plumbing fixtures supported and schedules with details required for installation of the system.

D. Samples: Submit selection and verification samples of tubing.

E. Quality Assurance/Control Submittals: Submit the following:

1. Test Reports: Upon request, submit test reports from recognized testing laboratories.
2. Certificates: Submit the following:

a. Manufacturer's certificate that products comply with specified requirements.
b. Certificate indicating that the installer is authorized to install the manufacturer's products.

F. Closeout Submittals: Submit the following:

Warranty documents specified herein
Operation and maintenance data

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Use an installer with demonstrated experience on projects of similar size and complexity and possessing documentation proving successful completion of PEX plumbing installation training by the PEX tubing manufacturer.

B. Regulatory Requirements and Approvals: Provide domestic potable system that complies with requirements of the following:

1. International Code Conference (ICC) – International Plumbing Code (IPC)

a. ICC Evaluation Service (ES) Evaluation Report No. ESR 1099

2. Building Officials and Code Administrators International (BOCA)

a. 1993 BOCA National Plumbing Code

3. Uniform Plumbing Code (UPC)

a. IAPMO Files 3558, 3946 and 3960

4. National Standard Plumbing Code (NSPC)

5. HUD Material Release No. 1269

C. Certifications: Provide letters of certification as follows:

1. Installer is trained by the PEX tubing manufacturer to install the PEX potable water distribution system.
2. Installer will use skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed trades professional

D. Pre-installation Meetings: [Specify requirements for meeting.] Verify project timeline requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.06 DELIVERY, STORAGE AND HANDLING

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

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

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

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Store PEX tubing in cartons or under cover to avoid dirt or foreign material from being introduced into the tubing.

2. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, provide cover to portions of tubing exposed to direct sunlight.

1.07 WARRANTY

A. Uponor offers a limited warranty of up to 25 years for its Wirsbo AQUAPEX® tubing and Wirsbo hePEX™ tubing and ProPEX® Fittings when installed by an Uponor-trained contractor and certified plumbing professional. See www.uponor-usa.com for details in the Customer Service section.

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PART 2 - PRODUCTS

2.01 HOT AND COLD POTABLE WATER DISTRIBTUION SYSTEM

A. Manufacturer: Uponor

1. Contact: 5925 148th Street West, Apple Valley, MN 55124; Toll free (800) 321-4739, (952) 891-2000; Fax: (952) 891-2008; website: www.uponor-usa.com

2.02 PRODUCT SUBSTITUTIONS

A. Substitutions: No substitutions permitted.

2.03 MATERIALS

A. Tubing

1. Material: Crosslinked polyethylene (PEX) manufactured by PEX-a or Engel method
2. Type: Wirsbo AQUAPEX
3. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency
4. Standard grade hydrostatic design and pressure ratings from PPI
5. Fire-rated assembly listings in accordance with ANSI/UL 263

    a. UL Design No. L557 — 1-hour wood frame floor/ceiling assemblies
    b. UL Design No. K913 — 2-hour concrete floor/ceiling assemblies
    c. UL Design No. U372 — 1-hour wood stud/gypsum wallboard wall assemblies

6. Minimum Bend Radius (cold bending): No less than six times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
7. Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876 as indicated.

    a. ⅜ inch [9.53mm]
    b. ½ inch [12.7mm]
    c. ¾ inch [19.05mm]
    d. 1 inch [25.4mm]
    e. 1¼ inch [31.75mm]
    f. 1½ inch [38.1mm]
    g. 2 inch [50.8mm]

B. Fittings

1. Material: Fitting assembly is manufactured from material listed in paragraph 5.1 of ASTM F1960.
2. Material Standard: Comply with ASTM F1960.
3. Type: PEX-a cold expansion fitting.

    a. Assembly consists of the appropriate ProPEX insert with a corresponding ProPEX Ring.

C. Manifolds

1. Material

a. Type L copper body with UNS 3600 series brass ProPEX outlet connections
b. Engineered Plastic (EP) body with ProPEX outlet connections

2. Manifold Type

a. Uponor ProPEX 1" Copper Manifold
b. Uponor engineered plastic (EP) Manifold

3. All manifolds manufactured with the appropriate-sized ProPEX fittings on the manifold supply inlets.

D. Accessories

1. Angle stops and straight stops that are compatible with PEX tubing are supplied by the PEX tubing manufacturer.
2. Bend supports designed for maintaining tight radius bends are supplied by the PEX tubing manufacturer.
3. ProPEX expander tool to install the ASTM F1960 compatible fittings are supplied by the PEX tubing manufacturer.
4. The tubing manufacturer provides clips and/or PEX rails for supporting tubing runs.
5. All horizontal tubing hangers and riser clamps are epoxy-coated material.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions, design drawings and the Uponor Professional Plumbing Installation Guide.

3.02 EXAMINATION

A. Site Verification of Conditions:

1. Verify that site conditions are acceptable for installation of the PEX potable water system.
2. Do not proceed with installation of the PEX potable water system until unacceptable conditions are corrected.

3.03 INSTALLATION

A. Wirsbo AQUAPEX Tubing

1. Install Wirsbo AQUAPEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.
2. Do not install PEX tubing within 6 inches [152 mm] of gas appliance vents or within 12 inches [305 mm] of any recessed light fixtures.

3. Do not solder within 18 inches [457 mm] of PEX tubing in the same waterline. Make sweat connections prior to making PEX connections.
4. Do not expose PEX tubing to direct sunlight for more than 30 days.
5. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
6. Use grommets or sleeves at the penetration for PEX tubing passing through metal studs.
7. Protect PEX tubing with sleeves where abrasion may occur.
8. Use strike protectors where PEX tubing penetrates a stud or joist and has the potential for being struck with a screw or nail.
9. Use tubing manufacturer-supplied bend supports where bends are less than six times the outside tubing diameter.
10. Minimum horizontal supports are installed not less than 32 inches between hangers in accordance with model plumbing codes and the installation handbook.
11. PEX riser installations require epoxy-coated riser clamps installed at the base of the ceiling per floor.
12. A mid-story support is required for riser applications.
13. Pressurize Wirsbo AQUAPEX tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
14. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32°F (0°C).

B. Through-penetration Firestop

1. Ensure compliance of one- and two-hour rated through penetration assemblies in accordance with ASTM E814.
2. A list of firestop manufacturers that list PEX tubing with their firestop systems is available from the PEX tubing manufacturer.

C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

3.04 FIELD QUALITY CONTROL

A. Site Tests

1. Specify applicable test requirements to be performed during and after product installation.

B. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

3.05 CLEANING

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

B. Repair or replace damaged installed products.

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

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

3.06 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site

END OF SECTION 22 11 16

DIVISION 22

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. American Society of Sanitary Engineers (ASSE):

1. ANSI/ASSE (Plumbing) 1001-2008: Pipe Applied Atmospheric Type Vacuum Breakers
2. ANSI/ASSE 1010-2004: Water Hammer Arresters
3. ANSI/ASSE (Plumbing) 1020-2004: Pressure Vacuum Breaker Assembly

B. Plumbing and Drainage Institute (PDI):

1. PDI W H-201 2007: Water Hammer Arrestor

PART 2 - PRODUCTS

2.01 DRAINS

A. Manufacturers:

1. Zurn Industries, Inc., www.zurn.com

2.02 CLEANOUTS

A. Manufacturers:

1. Zurn Industries, Inc., www.zurn.com

B. Cleanouts at Exterior Surfaced Areas

1. Round cast nickel bronze access frame and non-skid cover

C. Cleanouts at Interior Finished Wall Areas

1. Line type with lacquered cast iron body and round epoxy coasted gasketed cover, and round stainless steel access cover secured with machine screw.

2.03 HOSE BIBBS

A. Manufacturers:

1. Zurn Industries, Inc., www.zurn.com
2. Watts Regulator Company, www.wattsregulator.com
3. Jay R. Smith Manufacturing Company, www.jayrsmith.com

2.04 BACKFLOW PREVENTERS

A. Manufacturers:

1. Zurn Industries, Inc., www.zurn.com
2. Watts Regulator Company, www.wattsregulator.com
3. Conbraco Industries, www.conbraco.com

2.05 WATER HAMMER ARRESTOR

A. Manufacturers:

1. SharkBite

a. Model #: 22630, Part #: 22630
b. ½" residential water hammer arrestor
c. DZR brass fittings
d. Certified to 200PSI of pressure and 200 degrees Fahrenheit

2.06 BALL VALVES

A. Manufacturers:

1. Milwaukee Valve Company
2. Uponor

2.07 CLOTHES WASHER OUTLET BOX

A. Manufacturers:

1. Uponor

a. Part #: LF5930500
b. High-impact polystyrene
c. 5 year limited warranty
d. Certified to 200PSI of pressure and 200 degrees Fahrenheit
e. Come with ½" lead free brass valves

2.08 SHOWER MIXING VALVE

A. Manufacturers:

1. Kohler

a. Model #: K304-KS-NA

2.09 SHOWER VOLUME CONTROL VALVE

A. Manufacturers:

1. Kohler

a. Model #: K-671-K-NA

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install backflow preventers at each water-supply connection to mechanical equipment and where required by authorities having jurisdiction.

C. Install hose bibs with integral or field-installed vacuum breaker.

D. Install water hammer arrestors at all solenoid valves.

E. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

F. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

G. Valves shall be installed in horizontal piping with stem at or above center of pipe.

H. Valves shall be installed in a position to allow full stem movement.

END OF SECTION 22 11 19

DIVISION 22

SECTION 22 11 23 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Domestic water pressure booster system.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 QUALITY ASSURANCE

A. Components shall be furnished by a single manufacturer and the system shall be the standard cataloged product of the manufacturer.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

PART 2 - PRODUCTS

2.01 DOMESTIC PRESSURE BOOST

A. Manufacturers:

1. Grundfos Pumps Corporation
   17100 W. 118th Terrace, Olathe, KS 66061;
   Telephone: (913) 227-3400
   Fax: (913) 227-3500;
   Website: www.groundfos.com
   a. EZ Booster BMQE Booster Pump
      i Model#:22BMQE 05B-120
   b. Diaphragm Tank
      i 2 U.S. Gallons(8 liter)/130 psi
      ii Material #: 91121984
   c. Controller
      i Material #: 91121987
   d. Pressure Sensor
      i Material #: 96437852

DIVISION 22

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including.

1. EZ Boost Quick Installation Guide

3.02 INSTALLATION

A. Provide mounting brackets for piping and pump support and flex connector between pump and pipe for vibration isolation.

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. Connect piping with valves that are at least the same size as piping connecting to pumps.

F. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

G. Install shutoff valve and strainer on suction side of pumps.

H. Install nonslam check valve and throttling valve on discharge side of pumps.

I. Install thermostats in hot-water return piping.

J. Install test plugs on suction and discharge of each pump. Install at integral pressure gauge tappings where provided.

END OF SECTION 22 11 23

DIVISION 22

SECTION 22 12 19 - FACILITY POTABLE – WATER STORAGE TANKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Water tank for supply and storage of domestic water supply systems and fire sprinkler system, completed, including piping and all accessories.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA):

1. NFPA 22-08: Water Tanks for Private Fire Protection
2. NFPA 25-08: Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems

B. NSF INTERNATIONAL (NSF):

1. NSF/ANSI 61 (2010) Drinking Water System Components -Health Effects

PART 2 - PRODUCTS

2.01 LOW PROFILE WATER TANK

A. Manufacturers:

1. Norwesco, www.norwesco.com
   a. Part #: 41392
   b. Capacity: 1500 gallon
   c. Width 81", Overall height 44", Length 130", Fill Opening 16", Outlet 2"

2.02 ACCESSORIES

A. Manufacturers:

1. Norwesco, www.norwesco.com

DIVISION 22

2.03 PIPING

A. PVC, ASTM D 1785, Schedule 40

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install tank in accordance with NFPA 22.

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. Correct deficiencies in or remove and reinstall products that do not comply with requirements.

END OF SECTION 22 12 19

DIVISION 22

SECTION 22 13 00 – FACILITY SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.01 PIPES AND FITTINGS

A. Pipe and fittings shall be manufactured from ABS compound with a cell class of 42222 for pipe and 32222 for fittings as per ASTM D 3965 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM F 628. Fittings shall conform to ASTM D 2661.

2.02 CLEANOUTS

A. Cleanouts shall be the same size as the pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line

B. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

DIVISION 22

C. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.

B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

D. All pipe runs shall be laid out to avoid interference with other work.

E. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Aboveground ABS piping shall be installed according to ASTM D2661.

G. For ABS piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2235 and ASTM D2661 appendixes.

H. Slope:

1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.02 PIPE SCHEDULE

A. Aboveground Applications: ABS, Schedule 40.

END OF SECTION 22 13 00

DIVISION 22

SECTION 22 13 53 – FACILITY SEPTIC TANKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Grey water and waste receptor and all necessary accessories as designated in this section.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.01 LOW PROFILE HOLDING TANK

A. Manufacturers:

1. Den Hartog
   4010 Hospers Drive S, Box 425, Hospers, Iowa 51238-0421
   www.denhartogindustries.com
   a. Part #: LP0300-RT
   b. Capacity: 300 Gallon
   c. Width 80", overall height 19 1/4", Length 77 3/4", 8" vented lid, 2" outlet

2.02 ACCESSORIES

A. Manufacturers:

1. Den Hartog
   4010 Hospers Drive S, Box 425, Hospers, Iowa 51238-0421
   www.denhartogindustries.com

2.03 PIPING

A. PVC, ASTM D 2665

DIVISION 22

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

C. Correct deficiencies in or remove and reinstall products that do not comply with requirements.

END OF SECTION 22 13 53

DIVISION 22

SECTION 22 33 00 – RESIDENTIAL ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes the requirements for installing a complete electric domestic water heater system ready for operation including the water heaters, thermometers, and all necessary accessories, connections, and equipment.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Electrical components, devices and accessories shall be listed and labeled B as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.

B. Fabricate and label equipment components that will be in contract with potable water to comply with NSF 61, "Drinking Water System Components – Health Effects".

C. UL

PART 2 - PRODUCTS

2.01 TANKLESS ELECTRIC WATER HEATER

A. Manufacturers:

1. Stiebel Eltron Inc.
   17 West Street, West Hatfield MA 01088
   Phone: (413) 247-3380
   Fax: (413) 247-3369
   www.stiebel-eltron-usa.com
   a. Model #: DHC-E 12

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C. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.

B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

D. All pipe runs shall be laid out to avoid interference with other work.

E. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

F. Aboveground ABS piping shall be installed according to ASTM D2661.

G. For ABS piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2235 and ASTM D2661 appendixes.

H. Slope:

1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

J. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.02 PIPE SCHEDULE

A. Aboveground Applications: ABS, Schedule 40.

END OF SECTION 22 13 00

DIVISION 22

SECTION 22 13 53 – FACILITY SEPTIC TANKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Grey water and waste receptor and all necessary accessories as designated in this section.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Comply with NSF 14, "Plastic Piping Components and Related Materials," for plastic piping components.

PART 2 - PRODUCTS

2.01 LOW PROFILE HOLDING TANK

A. Manufacturers:

1. Den Hartog
   4010 Hospers Drive S, Box 425, Hospers, Iowa 51238-0421
   www.denhartogindustries.com
   a. Part #: LP0300-RT
   b. Capacity: 300 Gallon
   c. Width 80", overall height 19 1/4", Length 77 3/4", 8" vented lid, 2" outlet

2.02 ACCESSORIES

A. Manufacturers:

1. Den Hartog
   4010 Hospers Drive S, Box 425, Hospers, Iowa 51238-0421
   www.denhartogindustries.com

2.03 PIPING

A. PVC, ASTM D 2665

DIVISION 22

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

C. Correct deficiencies in or remove and reinstall products that do not comply with requirements.

END OF SECTION 22 13 53

DIVISION 22

SECTION 22 33 00 – RESIDENTIAL ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes the requirements for installing a complete electric domestic water heater system ready for operation including the water heaters, thermometers, and all necessary accessories, connections, and equipment.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. Electrical components, devices and accessories shall be listed and labeled B as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.

B. Fabricate and label equipment components that will be in contract with potable water to comply with NSF 61, "Drinking Water System Components – Health Effects".

C. UL

PART 2 - PRODUCTS

2.01 TANKLESS ELECTRIC WATER HEATER

A. Manufacturers:

1. Stiebel Eltron Inc.
   17 West Street, West Hatfield MA 01088
   Phone: (413) 247-3380
   Fax: (413) 247-3369
   www.stiebel-eltron-usa.com
   a. Model #: DHC-E 12

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PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:

1. DHC-E Operating and Installation

3.02 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

C. Separate dissimilar metals and metal products from contact with wood or cementations materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

D. Correct deficiencies in or remove and reinstall products that do not comply with requirements.

E. Repair, refinish, or replace products damaged during installation, as directed by architect.

F. Adjust operating parts and hardware for smooth, quiet operation

END OF SECTION 22 33 00

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SECTION 22 33 30.00 – SOLAR WATER HEATING EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. A solar energy system arranged for heating or preheating of service domestic hot water using evacuated tube collector array, storage tank, pumps, automatic controls, instrumentation, interconnecting piping and fittings, heat exchanger, expansion tank, and accessories required for the operation of the system.

1.02 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product submittal data and installation instructions.

1.03 COMPLIANCE

A. ASHRAE 93 Methods of testing to determine the thermal performance of solar collectors.

B. ANSI Z21.22/CSA 4.4 Relief valves for hot water supply systems.

C. ASME B40.100 Pressure gauges and gauge attachments.

PART 2 - PRODUCTS

2.01 EVACUATED TUBE COLLECTORS, MANIFOLD, AND FRAME

A. Manufacturers:

1. SolarUS Inc.
   965 West Main Street
   Brandford, CT 06405, USA
   www.solarusmgf.com
   Model #: SL-30

2.02 SOLAR STORAGE TANK

A. Manufacturers:

1. Thermotechnology Corp.
   50 Wentworth Ave
   Londonderry, NH 03053, USA
   Phone: (603) 552-110

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Fax: (603) 965-7568
www.buderus.us
Model #: SM100, vertical dual coil models
Capacity: 103 GALLON, Dry weight 298 lbs
Heat Input to Tank: Upper coil at 97.2 MBH, Lower Coil at 157 MBH, Dual Coil 228.8 MBH
Boiler water flow rate: 11GPM

2.03 EXPANSION TANK

A. Manufacturers:

1. Bosch

a. Part #: 7747202342
b. 3/4", Male
c. 18 liter, 6 bar white
d. Max operating pressure: 87.02 psi/6 bar

2.04 PIPING, FITTINGS, VALVES AND ACCESSORIES

A. Pressure and Temperature Relief Valve – ¾", stainless steel spring, ASME rated, CSA certified and meet ANSI Z21.22 standard

B. Isolation Valve – ¾", brass ball valve, in line with FNPT

C. Fill/Drain Valve – ¾" hose bib

D. Check Valve – ¾" swing style, brass, NPT

2.05 GAUGES AND INSTRUMENTATION

A. Manufacturers:

1. Omega Engineering, Inc.

2.06 PUMPS

A. Manufacturers: Taco

1. Model #: 003-84
2. ¾" SWT

2.07 AUTOMATIC AIR VENT

A. Manufacturers: Bosch

1. Part #: 63015362

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including:

1. Operating and installation instructions" for Single and dual heat exchanger solar storage tanks

3.02 INSTALLATION

A. Install tank in accordance with NFPA 22.

B. Install safety ladders in accordance with NFPA 22 and OSHA requirements.

C. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

D. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

E. 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.

F. Correct deficiencies in or remove and reinstall products that do not comply with requirements.

G. Adjust operating parts and hardware for smooth, quiet operation.

END OF SECTION 22 33 30.00

DIVISION 22

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals:

1. Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.
2. Documentation indicating flow and water consumption requirements.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. 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.

B. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

2.02 WATER CLOSET

A. Vitreous-China Water Closet: Elongated, siphon-jet type, floor-mounted, floor outlet with close-coupled, hydrolic pressurized tank.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. Saile one-piece elongated duel-flush Quiet-Close toilet K-3564-0; with Kohler K-7637-CP angle stop valve.
b. Or Architect approved equal.

2.03 TOILET SEAT

A. Toilet Seat: Elongated, solid plastic closed front with cover with bumpers and hardware, Residential class.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. Included with water closet.

b. Or Architect approved equal.

2.04 LAVATORY

A. Vitreous-China Lavatory: Wall-mounting.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. K-2661-0
b. Or Architect approved equal.

B. Faucets: ASME A112.18.1; solid-brass underbody and chrome cover plate.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. K-T945-4-CP
b. Or Architect approved equal.

2. Type: Counter surface mounted.
3. Finish: Porcelain white.
4. Handle(s): Dual lever.
5. Maximum Flow Rate: 1.0 gpm (3.78 L/min).
6. Aerator: Nigara 1.0 GPM Tamperproof, Male Threaded N3210MT (if needed).

C. Drain & Trap:

Kohler. K-9033-4-CP; trap with slip-joint inlet and wall flange and K-7129-CP drain piece.

D. Angle Stop Valves

Kohler. K-7065-P-CP

E. Supply and Drain Insulation: Soft-plastic covering; removable at stops.

2.05 SHOWER

A. Mixing-Valve Faucet and Miscellaneous Fittings: Single-lever, pressure-balance; maximum 2.5-gpm (0.16-L/s) flow rate.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. K-9059-CP
b. Or Architect approved equal.

2. Shower mixing valve and trim: K-304-KS-NA and K-T950-4-CP.
3. Body Material: Solid-brass underbody and chrome cover plate.
4. Finish: Polished chrome-plate.
5. Hand-held showers: 2.0 GPM Hand-held Shower with hose and slidebar bracket to be included.

B. Drain: Schluter, Chrome-plated-strainer, floor drain by others.

2.06 KITCHEN SINK

A. Stainless-Steel Sink: Undercounter type, 0.063 inch (1.6 mm) thick, one bowl.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. K-3822-3-NA
b. Or Architect approved equal.

B. Faucet: Solid-brass underbody and chrome cover plate. Maximum 2.5-gpm (0.16-L/s) flow rate.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Kohler. K-7547-4-CP
b. Or Architect approved equal.

2. Type: Center set with inlets on 4-inch (102-mm) centers.
3. Finish: Polished chrome-plate.
4. Handle(s): Dual lever.
5. Spout: Non-fixed position gooseneck with 1-1/2-gpm (0.1-L/s) laminar flow or 2-gpm (0.13-L/s) laminar flow.

C. Aerator: Nigara 1.0 GPM Tamperproof, Male Threaded N3210MT.

2.07 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings:

1. Manufacturers:
2. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. B & K Industries, Inc.
b. Brass Craft Mfg. Co.; a Subsidiary of Masco Corporation.
c. Brasstech Inc.; Newport Brass Div.
d. Dearborn Brass; a div. of Moen, Inc.
e. Geberit Manufacturing, Inc.
f. JB Products; a Federal Process Corporation Company.
g. Sioux Chief Manufacturing Company, Inc.
h. Watts Brass & Tubular; a division of Watts Regulator Co.
i. Or Architect approved equal.

3. ASSE 1021, Hose Connections: 5/8-inch- (16-mm-) ID inlet and 7/8-inch- (22-mm-) ID outlet, Capacity: At least 5 gpm (0.32 L/s); at inlet pressure of at least 5 psig (35 kPa) and at temperature of at least 140 deg F (60 deg C), with deck mounting.

2.08 LAUNDRY TRAY

A. Plastic Laundry Trays: Floor-stand type.

1. Basis-of-Design Product: Product indicated on Drawings or a comparable product of one of the following:

a. Crane Plumbing, L.L.C./Fiat Products.
b. Florestone Products Co., Inc.
c. Gerber Plumbing Fixtures LLC.
d. Mustee, E. L. & Sons, Inc.
e. Swan Corporation (The).
f. Zurn Plumbing Products Group; Light Commercial Operation.
g. Or Architect approved equal.

B. Faucet: Solid brass, wall mounting, including swing spout and dual lever or four-arm handles.

C. Drain(s): Manufacturer's standard grid drain with NPS 1-1/2 (DN 40) tubular-brass tailpiece.

PART 3 - EXECUTION

3.01 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.

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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 dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.

P. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.

Q. 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.

R. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

S. Install piping connections between plumbing fixtures and piping systems and plumbing equipment. Install insulation on supplies and drains of fixtures for people with disabilities.

T. Ground equipment.

END OF SECTION 22 40 00

DIVISION 26

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.02 SUBMITTALS

A. Manufacturer's Literature and Data: Showing each cable type and rating.

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA):

1. 70-08 National Electrical Code (NEC)

B. National Electrical Manufacturers Association (NEMA):

1. WC 70-09 Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

C. Underwriters Laboratories, Inc. (UL)

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.

B. Single Conductor:

1. Shall be annealed copper.
2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.

C. Insulation:

1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:

240/120 volt	Split-Phase
Black	Hot

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White	Neutral
Green/Yellow	Ground

2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit hot, neutral, and ground conductors
3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:

    a. Solid color insulation or solid color coating.
    b. Stripes, bands, or hash marks of color specified above.
    c. Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half-overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

2.02 SPLICES AND JOINTS

A. In accordance with UL 486A, C, D, E, and NEC.

B. Aboveground Circuits (No. 10 AWG and smaller):

1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped wires.
3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.

C. Aboveground Circuits (No. 8 AWG and larger):

1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
3. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.03 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.

B. Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.04 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with the NEC, and as specified.

B. Install all wiring in raceway systems.

C. Splice cables and wires only in outlet boxes, junction boxes, pull-boxes, manholes, or handholes.

D. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

E. For panel boards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.

F. Seal cable and wire entering a building from underground between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

G. Wire Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
2. Use nonmetallic ropes for pulling feeders.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the //Resident Engineer// //COTR//.
4. All cables in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

END OF SECTION 26 05 19

DIVISION 26

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.

1.02 SUBMITTALS

A. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA) 70:

1. National Electrical Code B

B. Underwriters Laboratories, Inc. (UL)

PART 2 - PRODUCTS

A. 2/O Type W conductor

PART 3 - EXECUTION

A. Provide conductor from main service equipment to the organizer utility panel.

B. Ensure location of grounding conductors are not a trip hazard.

C. Organizers will bond the dwelling grounding conductor to the organizer grounding electrode.

END OF SECTION 26 05 26

DIVISION 26

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

1.02 SUBMITTALS

A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA):

1. 70-08 National Electrical Code (NEC)

B. Underwriters Laboratories, Inc. (UL)

PART 2 - PRODUCTS

2.01 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown.

B. Conduit:

1. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
2. Flexible galvanized steel conduit: Shall conform to UL 1.
3. Liquid-tight flexible metal conduit: Shall conform to UL 360.

C. Conduit Fittings:

1. Electrical metallic tubing fittings:

a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
b. Only steel or malleable iron materials are acceptable.
c. Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
d. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.

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2. Flexible steel conduit fittings:

    a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
    b. Clamp-type, with insulated throat.

3. Liquid-tight flexible metal conduit fittings:

    a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
    b. Only steel or malleable iron materials are acceptable.
    c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

D. Conduit Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.

E. Outlet, Junction, and Pull Boxes:

1. UL-50 and UL-514A.
2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

PART 3 - EXECUTION

3.01 PENETRATIONS

A. Cutting or Holes: Cut holes in advance where they should be placed in the structural elements, such as ribs or beams.

B. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.02 INSTALLATION

A. In accordance with UL, NEC, as shown, and as specified herein.

B. Install conduit as follows:

1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.

4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 61 00 and Section 07 62 00.
12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

C. Conduit Bends:

1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

D. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences.

3.03 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Bolts supported only by plaster or gypsum wallboard are not acceptable.

F. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

G. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

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3.04 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush-mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1.".

G. On all branch circuit junction box covers, identify the circuits with black marker.

END OF SECTION 26 05 33

DIVISION 26

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of panelboards.

1.02 SUBMITTALS

A. Manuals: Complete maintenance and operating manuals, including technical data sheets and wiring diagrams

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA):

1. 70-2005 National Electrical Code (NEC)
2. 70E-2004 Standard for Electrical Life Safety in the Workplace

B. Underwriters Laboratories, Inc. (UL)

PART 2 - PRODUCTS

2.01 PANELBOARDS

A. Main Panel

Manufacturer: Schneider Electric
Model #: SC2636M200FPV
Semi-flush, 200A

B. Sub Panel

Manufacturer: Schneider Electric
Model #: HOM20L125C
Indoor enclosure, 125A

C. Circuit Breakers

Manufacturer: Schneider Electric
Model #: HOM2000, HOM220, HOM120, HOM120CAFI, HOM230

D. Back-Fed Circuit Breaker Retaining Kit

Manufacturer: Schneider Electric
Model #: PK2SCPV

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PART 3 - EXECUTION

3.01 INSTALLATION.

A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected.

C. Install a printed schedule of circuits in each panelboard. Schedules shall be printed on the panelboard directory cards, installed in the appropriate panelboards, and incorporate all applicable contract changes. Information shall indicate outlets, lights, devices, or other equipment controlled by each circuit, and the final room numbers served by each circuit.

D. Mount the fully-aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78 in [1980 mm]. Mount panelboards that are too high such that the bottom of the cabinets will not be less than 6 in [150 mm] above the finished floor.

END OF SECTION 26 24 16

DIVISION 26

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the furnishing, installation and connection of wiring devices.

1.02 SUBMITTALS

A. Manuals: Technical data sheets and information for ordering replacement units.

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA):

1. 70 National Electrical Code (NEC)

B. Underwriters Laboratories, Inc. (UL)

PART 2 - PRODUCTS

2.01 RECEPTACLES

A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.

B. Duplex Receptacles: The ungrounded pole of each receptacle shall be provided with a separate terminal.

1. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, suitable for mounting in a standard outlet box.

C. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof cover plate. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

D. Cover Plates: White

PART 3 - EXECUTION

3.01 INSTALLATION.

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the green equipment grounding conductor.

C. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

D. Test GFCI devices for tripping values specified in UL 1436 and UL 943.

END OF SECTION 26 27 26

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SECTION 26 31 00 – PHOTOVOLTAIC COLLECTORS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Comply with NFPA 70, "National Electrical Code."

1. Related Sections: 48 19 16 Electrical Power Generation Inverters

PART 2 - PRODUCTS

2.01 MODULES

A. Manufacturer: SunPower.

Model: SPR-225-BLK-U
Mono-crystalline photovoltaic module
25 year limited power warranty

2.02 MOUNTING KIT

A. Manufacturer: S-5!

Model: S-5-U
http://www.s-5.com/common/downloads/S-5-PV_101510.pdf
http://www.s-5.com/clamps/index_927.cfm#1
Stainless steel finishes: No. 6, dull satin

2.03 MICRO - INVERTER

A. Manufacturer: PowerOne Aurora

Model: MICRO-0.25-1-OUTD-US 208/240

PART 3 - EXECUTION

3.01 INSTALLATION

A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in photovoltaic mounting clip manufacturer's written instructions.

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B. Affix S-5! U-Clamps to standing seam metal roof per manufacturer instructions with provisions for thermal and structural movements.

C. Set units level, plumb, and true to line, without warp or rack of frames or panels and anchor securely in place to torque pressures required in manufacturer's specifications.

D. Make connections between S-5! U-Clamps and PV Kit per manufacturer instructions.

E. Correct deficiencies in or remove and reinstall mountings and modules that do not comply with requirements.

F. Repair, refinish, or replace mountings and modules damaged during installation or transit, as directed by Architect.

END OF SECTION 26 31 00

DIVISION 26

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product Data for each luminaire, including lamps.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. 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.

2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Exterior Luminaires: Comply with UL 1598 and listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

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.

2.03 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

A. Recessed Can Light

Manufacturers:

Nora Lighting: NSIC-401QAT, NS-44HZ Finish
Or approved equal.

B. Outdoor Sconce

Manufacturers:

Hevilite: HL-340-2X-xLED, Natural, Stainless, or Anodized Aluminum
Or approved equal.

C. Dining Pendant

Manufacturers:

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Gamalux: G-Beam Series GB35B, Semi-Gloss Satin Aluminum
Or approved equal.

D. Surface Mount Light

Manufacturers:

Skyline: 14-Round
Or approved equal.

E. Under Cabinet Light

Manufacturers:

Diode LED: DI-0255 or DI-0250
Or approved equal.

F. Bath Mirror Light

Manufacturers:

Diode LED: DI-0255
Or approved equal.

G. Patio Downlight

Manufacturers:

Hevilite: HL-336, Anodized Satin Aluminum
Or approved equal.

H. Wall Art Light

Manufacturers:

Feng Shui Lighting: FRM 12X12 AL, Natural Ultimatte Aluminum Finish
Or approved equal.

I. Water Feature Light

Manufacturers:

Diode LED: CASCADE Light Bar
Or approved equal.

J. Deck Accent Light

Manufacturers:

Fiberstars: BritePak
Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.

B. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

C. Comply with NFPA 70 for minimum fixture supports.

D. Seismic Protection: Luminaire attachments to building walls and ceilings shall comply with seismic criteria in applicable electrical code.

E. Suspended Lighting Fixture Support:

Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
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.

F. Adjust aimable lighting fixtures to provide required light intensities.

END OF SECTION 26 50 00

DIVISION 28

SECTION 28 31 00 – FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This specification addresses fire alarm systems installations.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product submittal data and installation instructions ,detailed wiring diagrams

1.03 COMPLIANCE

A. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code
2. NFPA 72 National Fire Alarm Code
3. NFPA 101 Life Safety Code

B. Underwriters Laboratories, Inc. (UL)

PART 2 - PRODUCTS

2.01 SMOKE DETECTORS

A. Combination smoke & carbon monoxide detectors.

2.02 WIRE AND CABLE

A. UL listed and labeled as complying with NFPA 70.

B. Solid copper conductors with 600-V rated, 75 deg C, color-coded insulation. No. 12 AWG or larger as required by local codes.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install and test systems according to NFPA 72.

B. Install wiring in concealed spaces and exposed on ceilings and walls where indicated.

C. Wire devices per manufacturer specifications.

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END OF SECTION 28 31 00

DIVISION 31

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Spray and roll-on wood applied borate treatment for primary termite control.

1.02 SYSTEM DESCRIPTION

A. Performance Requirements: Provides structural termite protection when applied according to the applicable sections of the U.S. Environmental Protection Agency registered label.

1.03 SUBMITTALS

A. Product Data: Submit applicable manufacturer's technical data and application instructions.

1.04 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of structure and application.

B. Engage a professional pest control operator, state licensed in accordance with regulations of governing authorities and trained in the application of wood applied termiticide treatment solution.

1.05 JOB CONDITIONS

A. Restrictions: Treatment will be performed when access to all structural wood members is available. This is normally at the "dried-in" stage of construction when all structural wood and sheathing is in place and prior to installation of drywall, insulation, mechanical systems and electrical wiring.

1.06 SPECIFIC PRODUCT WARRANTY

A. Furnish written warranty certifying that the applied termite treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat structure and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.01 TERMITICIDE, INSECTICIDE, AND FUNGICIDE

A. Preferred Manufacturer: Nisus Corporation, 100 Nisus Drive, Rockford TN 37853, 1-800-264-0870.

B. Product/System: Bora-Care Termiticide, Insecticide and Fungicide.

C. Termiticide requirements:

1. Bora-Care is an EPA-registered primary termiticide treatment that complies with requirements of authorities having jurisdiction over such an application.
2. Bora-Care will be provided in a concentrated formulation that dilutes with water or foaming agent.
3. Bora-Care is registered by label as a primary treatment to prevent termite infestation.
4. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use according to the Bora-Care's EPA registered label.

a. Syngenta; IMPASSE Termite System.

2.02 PRODUCT SUBSTITUTIONS

A. Or Architect approved equal.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product literature, technical bulletins and U.S. EPA registered label.

3.02 APPLICATION

A. Site Preparation: Remove foreign matter that could decrease thoroughness of treatment, such as sawdust, away from treatment surfaces. Move building materials that block or prevent product application to required treatment areas.

B. Application Rates: Apply termite treatment by label directions to include:

1.The treatment of all structural wood and sill plates within 24 inches of contact with the foundation. Apply a second application to wood within treated area when only one or two surfaces are exposed.

2.The treatment of all cellulosic sheathing within 24 inches of the foundation.

3.The treatment of the concrete slab a minimum of 2 inches out from the wooden sill plate.

4.The treatment of open bath traps at 8-16 ounces of treatment solution per square foot of bath trap with the additional treatment of a 12 inch wide band of treatment solution on the slab area surrounding the bath trap.

5.The treatment of all pipe and plumbing penetrations with the treatment solution to a height of two feet and extending at least 6 inches out horizontally from the penetration onto slab surface.

6.The treatment of the inside surface of crawlspace concrete or concrete block walls extending vertically up two feet from the soil.

END OF SECTION 31 31 16

DIVISION 32

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.01 SCOPE

A. This section specification information is for Rain Bird low volume dripline irrigation products including Control Zone Kits, XFS and XFD Dripline and compatible fittings, and Low Volume Emission Devices.

B. Provide labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the drip irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein.

1.02 SUBMITTALS

A. Submittals: Materials list, manufacturer's data, and shop drawings.

1.03 FLUSHING AND TESTING

A. Schedule testing with Owner's Representative a minimum of three (3) days in advance of testing.

B. Provide clean, clear water, pumps, labor, fittings, and equipment necessary to conduct line flushing and testing procedures.

C. Recommended Dripline and Emitter Lateral Flushing Procedures.

1. Flush the system every two weeks for the first six (6) weeks and check the water that is flushed out for cleanliness. Establish a regular system flushing schedule for the future based on results from the initial six-week flushing schedule.

2. Flush the system completely after any repairs are made and monitor system operation closely under regular system flushing schedule.

3. Check the pressure at the supply and flush headers on a regular basis and compare with the pressure readings taken after installation.

D. Recommended Dripline and Emitter Lateral Leakage Testing Procedures.

1. Subject installed dripline tubing and emitter lateral piping to water pressure equal to specified operating pressure for ten (10) minutes. Test with control zone components and dripline flush valve components installed.

2. Partially backfill buried pipe and tubing to prevent movement under pressure. Expose couplings, fittings, and valve components.

3. Visually inspect valve assemblies and fittings for leakage and replace defective pipe, fitting, joint, valve, or appurtenance. Repeat test until test segment is free from leaks. Cement or caulking to seal leaks is prohibited.

E. Recommended Dripline and Emitter Lateral Operational Testing Procedures.

1. Activate each dripline and emitter lateral control zone valve in sequence from controller. Provide either one additional person with radio or use handheld remote to activate remote control valves from controller. Manually activating remote control valve using manual bleed mechanism at remote control valve is not an acceptable method of activation. Owner's Representative will visually observe operation, water application patterns, and leakage.

2. Replace or adjust defective valve, fitting, dripline segment, emitter lateral segment, or appurtenance to correct operational and coverage uniformity deficiencies.

3. Repeat test(s) until each dripline or emitter lateral test segment passes testing procedures. Repeat tests, replace components, and correct deficiencies at no additional cost to Owner and/or Owner's Representative.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Product indicated herein (or on Drawings); or a n approved comparable product of one of the following:

Hunter Industries
Rainbird
Toro
Or Architect approved equal.

2.02 LATERAL PIPE AND FITTINGS

A. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with integral belled end suitable for solvent welding.

B. Use Class 160, SDR-26, rated at 160 PSI (11 bar), conforming to dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 160 in cases where small nominal diameters are not manufactured in Class 160.

(or)

Use Class 200, SDR-21, rated at 200 PSI (13,8 bar), conforming to dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the cases where small nominal diameters are not manufactured in Class 200.

(or)

Use Schedule 40 conforming to dimensions and tolerances established by ASTM Standard D1785; UV radiation resistant.

C. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of type approved by pipe manufacturer.

D. Use PVC Schedule 80 nipples and PVC Schedule 40 or 80 threaded fittings for threaded pipe connections as specified on the drawings and details.

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E. Threaded joint sealant: Use non-hardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by pipe fitting or valve manufacturer.

2.03 DRIP IRRIGATION COMPONENTS

A. Rain Bird Control Zone Kits

1. General Information

a. Provide control zone kits manufactured by Rain Bird as indicated on construction drawings.

b. Control zone kit assemblies for dripline irrigation zones must include control valve, filtration, and pressure regulation components sized to meet the hydraulic demands and flow requirements of the zones that they service.

2. Rain Bird Low Flow Control Zone Kit for dripline zones with flows from 0.2 to 5.0 GPM (0.8 to 18.9 lpm), including low flow valve (LFV) and pressure regulating filter (PRF).

a. Available model numbers:
   1) XCZ-075-PRF [3/4" (19 mm) Low Flow valve and 3/4" (19 mm) PR filter]
   2) XCZ-LF-100-PRF [1" (25 mm) Low Flow valve and 3/4" (19 mm) PR filter]
   3) XACZ-075-PRF [3/4" (19 mm) Low Flow Anti-siphon valve and 3/4" (19 mm) PR filter]

b. Low Flow Valve (LFV) component specifications include:
   1) Valve body and bonnet constructed of high impact, weather-resistant plastic, stainless steel and other chemical/UV resistant materials
   2) Diaphragm with a double-knife seal, constructed of durable Buna-N rubber with a clog-resistant metering orifice
   3) Energy-efficient, low-power encapsulated solenoid with captured plunger and 90 mesh (200 micron) solenoid filter
   4) External bleed for manual system flushing during start-up, internal bleed for manual zone activation during maintenance operations
   5) Inlet pressure rating: 20 to 120 PSI (1,4 to 8,3 bar)
   6) Female threaded inlet and outlet connections
   7) Anti-siphon valve configuration includes listed features and incorporates atmospheric vacuum breaker with I.A.P.M.O and A.S.S.E. listing approval

c. Pressure Regulating Filter (PRF) combines filtration and pressure regulation in one integrated unit for protection of downstream components of drip irrigation system. PRF component specifications include:
   1) Compact "Y" filter body and cap configuration constructed of glass-filled, UV-resistant polypropylene, with 120 PSI (8,3 bar) operating pressure rating. Maximum dimensions of filter body; Height: 4 1/2" (11,4 cm), Length: 5 1/2" (14 cm), Width: 2" (5,1 cm)
   2) Standard 200 mesh (75 micron) filter screen constructed of durable polyester fabric attached to propylene frame. Screen is serviceable for cleaning purposes by unscrewing cap from filter body and removing filter element.
   3) Normally-open pressure regulating device with preset outlet pressure of approximately 30 PSI (2,1 bar). Pressure regulating device allows full flow with minimal pressure loss unless inlet pressure is greater than preset level. As inlet pressure increases above preset level, internal spring compresses to reduce downstream pressure.
   4) Male threaded 3/4" (19 mm) inlet and outlet connections.

(or)

3. Rain Bird Medium Flow Control Zone Kit for dripline zones with flows from 3.0 to 15.0 GPM (11.4 to 56.8 lpm), including Rain Bird DV or ASVF valve and pressure regulating filter (PRF).

   a. Available model numbers:
      1) XCZ-100-PRF [1" (25 mm) DV valve and 1" (25 mm) PR filter]
      2) XACZ-100-PRF [1" (25 mm) Anti-siphon Valve and 1" (25 mm) PR Filter]

   b. DV Valve component specifications include:
      1) Valve body and bonnet constructed of high impact, weather-resistant plastic, stainless steel and other chemical/UV resistant materials
      2) Diaphragm with a double-knife seal, constructed of durable Buna-N rubber with a clog-resistant metering orifice
      3) Energy-efficient, low-power encapsulated solenoid with captured plunger and 90 mesh (200 micron) solenoid filter
      4) External bleed for manual system flushing during start-up, internal bleed for manual zone activation during maintenance operations
      5) Inlet pressure rating: 20 to 120 PSI (1.4 to 8.3 bar)
      6) Female threaded inlet and outlet connections
      7) Anti-siphon valve configuration includes listed features and incorporates atmospheric vacuum breaker with I.A.P.M.O and A.S.S.E. listing approval

   c. Pressure Regulating Filter (PRF) combines filtration and pressure regulation in one integrated unit for protection of downstream components of drip irrigation system. PRF component specifications include:
      1) Compact "Y" filter body and cap configuration constructed of glass-filled, UV-resistant polypropylene, with 120 PSI (8,3 bar) operating pressure rating. Maximum dimensions of filter body; Height: 4 1/2" (11,4 cm), Length: 5 1/2" (14 cm), Width: 2" (5,1 cm)
      2) Standard 200 mesh (75 micron) filter screen constructed of durable polyester fabric attached to propylene frame. Screen is serviceable for cleaning purposes by unscrewing cap from filter body and removing filter element.
      3) Normally-open pressure regulating device with preset outlet pressure of approximately 40 PSI (2,8 bar). Pressure regulating device allows full flow with minimal pressure loss unless inlet pressure is greater than preset level. As inlet pressure increases above preset level, internal spring compresses to reduce downstream pressure.
      4) Male threaded 1" (25 mm) inlet and outlet connections.

(or)

4. Rain Bird Medium Flow Commercial Control Zone Kit for dripline zones with flows from 3.0 to 20.0 GPM (11.4 to 75.7 lpm), including PVC ball valve, Rain Bird PESB valve, and Rain Bird pressure regulating quick-check basket filter.

   a. Available model numbers:
      1) XCZ-100-B-COM [1" (25 mm) PVC ball valve, 1" (25 mm) Rain Bird PESB valve, and 1" (25 mm) PRB-QKCHK pressure regulating basket filter]

   b. PESB valve assembly component specifications include:
      1) 1" (25 mm) PVC full-port ball valve with female threaded inlet and outlet connections

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2) XFDP tubing; purple in color, conforming to an outside diameter (O.D.) of 0.634 inches (16 mm) and an inside diameter (I.D.) of 0.536 inches (13,6 mm) and wall thickness of 0.049 inches (1,2 mm)
3) Factory installed, pressure-compensating, inline emitters welded to the inner circumference of the polyethylene tubing at spacing specified by model number
4) Inline emitters designed to pressure-compensate by lengthening the emitter's turbulent flow path (Rain Bird patent pending)
5) Consistent flow rate from each installed inline emitter when emitter inlet pressure is supplied between recommended operating range of 8.5 to 60 PSI (0,7 to 4,1 bar)
6) Required filtration for XF Series dripline tubing and emitters is 120 mesh (125 micron)

d. Dripline tubing material specifications and features include:
1) XFS tubing; copper in color, conforming to an outside diameter (O.D.) of 0.634 inches (16 mm) and an inside diameter (I.D.) of 0.536 inches (13,6 mm) and wall thickness of 0.049 inches (1,2 mm)
2) XFSP tubing; purple in color, conforming to an outside diameter (O.D.) of 0.634 inches (16 mm) and an inside diameter (I.D.) of 0.536 inches (13,6 mm) and wall thickness of 0.049 inches (1,2 mm)
3) Factory installed, pressure-compensating, inline emitters welded to the inner circumference of the polyethylene tubing at spacing specified by model number
4) Inline XFS Sub-Surface Dripline emitters include Rain Bird's exclusive Copper Shield™ Technology (patent pending), which protects the emitter from root intrusion without requiring EPA-approved handling procedures or supplementary equipment for chemical treatment of water as recommended by some manufacturer's of inline drip equipment.
5) Inline emitters designed to pressure-compensate by lengthening the emitter's turbulent flow path (Rain Bird patent pending)
6) Consistent flow rate from each installed inline emitter when emitter inlet pressure is supplied between recommended operating range of 8.5 to 60 PSI (0,7 to 4,1 bar)
7) Required filtration for XF Series dripline tubing and emitters is 120 mesh (125 micron)

3. Rain Bird XF Series Blank Dripline Tubing

a. Available model numbers for POTABLE water systems:
1) Rain Bird XFD blank tubing, brown in color.

b. Available model numbers for NON-POTABLE water systems:
1) Rain Bird XFDP blank tubing, purple in color.

4. Rain Bird Easy Fit Dripline Tubing Compression Fittings

a. Available model numbers, designed for compatibility with Rain Bird XF Series Dripline Tubing:
1) Tee: MDCFTEE
2) Coupling: MDCFCOUP
3) Elbow: MDCFEL
4) Adapters:
a) 1/2" (13 mm) Male pipe thread adapter: MDCF50MPT
b) 3/4" (19 mm) Male pipe thread adapter: MDCF75MPT
c) 1/2" (13 mm) Female pipe thread adapter: MDCF50FPT
d) 3/4" (19 mm) Female pipe thread adapter: MDCF75FPT
e) 3/4" (19 mm) Female hose thread adapter: MDCF75FHT

5) Flush Cap end closure for POTABLE system: MDCFCAP
6) Flush Cap end closure for NON-POTABLE system: MDCFPCAP

b. Easy Fit compression fitting specifications and features include:
1) Easy Fit directional fittings and flush cap fittings constructed from molded UV-resistant ABS material with Buna-N rubber seal for long-term, leak free connections
2) Easy Fit adapters constructed from UV-resistant ABS materials for use exclusively with Easy Fit Compression Fittings
3) Easy Fit Compression Fittings are intended for use with polyethylene tubing from .630" to .710" (16 mm-18 mm) OD to provide a leak-free compression fit
4) Maximum pressure loss for the Easy Fit adapters estimated to be 0.1 PSI (0,007 bar) per adapter
5) Operating pressure range for Easy Fit compression fittings and adapters is 0 to 60 PSI (0 to 4,1 bar)

(or)

5. Rain Bird XF Series Dripline Tubing Insert Fittings

a. Available model numbers, designed for compatibility with Rain Bird XF Series Dripline Tubing:
1) Tee: XFD-TEE insert tee (17 x17 x 17 mm)
2) Coupling: XFD-COUP insert coupling (17 x 17 mm)
3) Elbow: XFD-ELBOW insert elbow (17 x 17 mm)
4) Cross: XFD-CROSS insert cross (17 x 17 x 17 x 17 mm)
5) Insert Adapters:
a) 1/2" (13 mm) Male pipe thread adapter: XFD-MA-050 [17 mm x 1/2" (13 mm) MPT]
b) 3/4" (19 mm) Male pipe thread adapter: XFD-MA-075 [17 mm x 3/4" (19 mm)MPT]
c) 3/4" (19 mm) Female pipe thread adapter: XFD-FA-075 [17 mm x 3/4" (19 mm)FPT]
d) 1/2" (13 mm) Tee male pipe thread adapter: XFD-TMA-050 [17 mm x 1/2" (13 mm)MPT x 17 mm]
e) 3/4" (19mm) Tee female pipe thread adapter: XFD-TFA-075 [17 mm x 3/4" (19 mm)FPT x 17 mm]

b. XF Series insert fitting specifications and features include:
1) Constructed from black acetyl plastic for long-term, leak free connections
2) Intended for use with polyethylene tubing with ID of 0.536" (13,6 mm), including Rain Bird XF Dripline and XF Series Blank Tubing
3) Operating pressure range is 0 to 50 PSI (0 to 3,5 bar)

6. Rain Bird Air Relief Valves.

a. Available model numbers, designed for compatibility with Rain Bird XF Series Dripline Tubing:
1) ARValve Kit; includes 3/4" (19 mm) air/relief valve, Easy Fit compression tee, and Easy Fit flush cap.
2) ARV12 Air Relief Valve ; includes 1/2" (13 mm) air relief valve.

C. Rain Bird Point Source Irrigation Emission Devices

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1. General Information

   a. Provide low-volume point-source emission devices, manufactured by Rain Bird, to efficiently deliver irrigation water at the plant rootzone as indicated on construction drawings.

2. Rain Bird Single-outlet Xeri-Bug™ Emitters

   a. Available model numbers with self-piercing barb inlet:
      1) XB-05PC (Blue); 0.5 GPH (1,89 lph)
      2) XB-10PC (Black); 1.0 GPH (3,79 lph)
      3) XB-20PC (Red); 2.0 GPH (7,57 lph)

   b. Available model numbers with 10-32 threaded inlet:
      1) XB-05PC-1032 (Blue); 0.5 GPH (1,89 lph)
      2) XB-10PC-1032 (Black); 1.0 GPH (3,79 lph)
      3) XB-20PC-1032 (Red); 2.0 GPH (7,57 lph)

   c. Available model numbers with 1/2" (13 mm) threaded inlet:
      1) XBT-10 (Black); 1.0 GPH (3,79 lph)
      2) XBT-20 (Red); 2.0 GPH (7,57 lph)

   d. Single-outlet Xeri-Bug Emitter specifications and features include:
      1) Available with three inlet options:
         a) Self-piercing barb inlet; Emitters with self-piercing barb inlet permit one-step insertion into 1/2" (13 mm) or 3/4" (19 mm) drip tubing when installed with Rain Bird Xeriman tool.
         b) 10-32 threaded inlet; Emitters with 10-32 threaded inlet allow threaded connection into PolyFlex Riser, 1032 Thread Adapter, or 1800 Xeri-Bubbler Adapter
         c) 1/2" (13 mm) threaded inlet; Emitters with 1/2" (13 mm) threaded inlet allow threaded connection into 1/2" (13 mm) PVC male adapter.
      2) External surfaces constructed from UV resistant acetyl materials
      3) Self-flushing to minimize clogging
      4) Color-coded to identify flow rate;
         a) Blue emitter indicates a flow rate of 0.5 GPH (1,89 lph)
         b) Black emitter indicates a flow rate of 1.0 GPH (3,79 lph)
         c) Red emitter indicates a flow rate of 2.0 GPH (7,57 lph)
      5) Pressure-compensating over the pressure range of 15 to 50 PSI (1,0 to 3,5 bar) with consistent flow rate of [0.5 GPH (1,89 lph)] or [1.0 GPH (3,79 lph)] or [2.0 GPH (7,57 lph)] over this pressure range

3. Rain Bird Single-outlet Pressure-Compensating Modules

   a. Available model numbers with self-piercing inlet barb:
      1) PC-05: light brown, 5 GPH (18,95 lph)
      2) PC-07: violet, 7 GPH (26,53 lph)
      3) PC-10: green, 10 GPH (37,90 lph)
      4) PC-12: dark brown, 12 GPH (45,48 lph)
      5) PC-18: white, 18 GPH (68,22 lph)
      6) PC-24: orange, 24 GPH (90,96 lph)

   b. Available model numbers with 10-32 threaded inlet:
      1) PC-05 10-32: light brown, 5 GPH (18,95 lph)

2) PC-07 10-32: violet, 7 GPH (26,53 lph)
3) PC-10 10-32: green, 10 GPH (37,90 lph)

c. Pressure-Compensating Module specifications and features include:
1) Available with two inlet options:
a) Self-piercing barb inlet; Emitters with self-piercing barb inlet permit one-step insertion into 1/2" (13 mm) or 3/4" (19 mm) drip tubing when installed with Rain Bird Xeriman tool.
b) 10-32 threaded inlet; Emitters with 10-32 threaded inlet allow threaded connection into PolyFlex Riser, 1032 Thread Adapter, or 1800 Xeri-Bubbler Adapter
2) External surfaces constructed from UV resistant acetyl materials
3) Color-coded to identify flow rate;
a) Tan outlet indicates a flow rate of 5 GPH (18,93 lph)
b) Violet outlet indicates a flow rate of 7 GPH (26,50 lph)
c) Green outlet indicates a flow rate of 10 GPH (37,85 lph)
d) Dark brown outlet indicates a flow rate of 12 GPH (45,42 lph)
e) White outlet indicates a flow rate of 18 GPH (68,13 lph)
f) Orange outlet indicates a flow rate of 24 GPH (90,84 lph)
4) Pressure-compensating over the pressure range of 10 to 50 PSI (0.7 to 3,5 bar) with consistent flow rate of [5 GPH (18,93 lph)] or [7 GPH 26,50 lph)] or [10 GPH (37,85 lph)] or [12 GPH (45,42 lph)] or [18 GPH (68,13 lph)] or [24 GPH (90,84 lph)] over this pressure range.

d. Rain Bird PC Diffuser Cap specifications and features include:
1) Available with two color options:
a) PC Diffuser (Black); This Diffuser Cap is to be used for Pressure-Compensating Module zones serviced by a potable water source.
b) PC DIFF-PPL (Purple); This Diffuser Cap is to be used for Pressure-Compensating Module zones serviced by a non-potable water source.
2) Constructed from UV-resistant polyethylene material
3) Capable of snapping onto Rain Bird Pressure-Compensating Modules to create a bubbler effect and prevent wash out

4. Rain Bird Multi-outlet Xeri-Bug Emission Devices

a. Available model numbers with barb inlet:
1) XB-05-6: Blue, 0.5 GPH (1,89 lph/outlet)
2) XB-10-6:Black, 1.0 GPH (3,79 lph/outlet)
3) XB-20-6:Red, 2.0 GPH (7,57 lph/outlet)

b. Available model numbers with 1/2" (13 mm) female threaded inlet:
1) XBT-05-6: Blue, 0.5 GPH (1,89 lph/outlet)
2) XBT-10-6:Black, 1.0 GPH (3,79 lph/outlet)
3) XBT-20-6:Red, 2.0 GPH (7,57 lph/outlet)

c. Multi-outlet Xeri-Bug specifications and features include:
1) Available with two inlet options:
a) Barb inlet; Emitters with barb inlet permit insertion into 1/2" (13 mm) or 3/4" (19 mm) drip tubing
b) 1/2" (13 mm) threaded inlet; Emitters with 1/2" (13 mm) threaded inlet allow threaded connection into 1/2" (13 mm) PVC male adapter.

DIVISION 32

2) Six outlet ports, barbed to retain 1/4" (6,4mm) distribution tubing
3) External surfaces constructed from UV resistant acetyl materials
4) Self-flushing to minimize clogging
5) Color-coded to identify flow rate;
   a) Blue emitter indicates a flow rate of 0.5 GPH (1,89 lph) per outlet
   b) Black emitter indicates a flow rate of 1.0 GPH (3,79 lph) per outlet
   c) Red emitter indicates a flow rate of 2.0 GPH (7,57 lph) per outlet
6) Pressure-compensating over the pressure range of 15 to 50 PSI (1,0 to 3,5 bar) with consistent flow rate of [0.5 GPH (1,89 lph)] or [1.0 GPH (3,79 lph)] or [2.0 GPH (7,57 lph)] GPH over this pressure range

5. Rain Bird 6-outlet Manifold Emission Device

   a. Available model number:
      1) EMT-6XERI

   b. 6-outlet Manifold specifications and features include:
      1) 1/2" (13 mm) female threaded inlet
      2) Six free-flowing outlet ports, barbed to retain 1/4" (6,4 mm) distribution tubing and sealed by manufacturer with durable plastic caps removable with pliers during installation
      3) Recommended operating pressure range between 15 to 50 PSI (1,0 to 3,5 bar)

6. Rain Bird Multi-Outlet Xeri-Bird™ 8 Emission Device

   a. Available model numbers:
      1) XBD-80: Xeri-Bird™ 8 unit (includes seven removable port plugs) with filter
      2) XBD-81: Xeri-Bird™ 8 unit with eight 1 GPH (3,79 lph) Xeri-Bug (XB-10-PC) emitters factory installed and filter

   b. Xeri-Bird™ 8 specifications and features include:
      1) 1/2" (13 mm) threaded device inlet with union base nut to allow removal of the Xeri-Bird 8 body from riser for easy installation and maintenance
      2) Eight independent ports, each capable of accepting a Rain Bird Xeri-Bug™ emitter or Rain Bird PC Module for independent flows from 0.5 to 24 GPH (1,89 to 90,96 lph), or a self-piercing barb connector (SPB-025) for unrestricted flow
      3) Eight barbed outlet ports mounted on bottom of device capable of securely retaining 1/4" (6,4 mm) distribution tubing
      4) 200 mesh (75 micron) filter, easily serviceable from top of unit.
      5) Capable of being used with retrofit pressure regulator (PRS-050-30) when pressure regulation is required at unit

D. Rain Bird Low Volume Broadcast Irrigation Emission Devices

1. General Information

   a. Provide low-volume broadcast emission devices, manufactured by Rain Bird, to efficiently deliver irrigation water in a short-radius wetting pattern to planting areas as indicated on construction drawings.

2. Rain Bird Xeri-Bubbler™

   a. Available model numbers with 1/4" (6,4 mm)barb inlet:

1) SXB-180-025; half-circle, 5 streams
2) SXB-360-025; full-circle, 8 streams
3) UXB-360-025; full-circle, umbrella

b. Available model numbers with 10-32 thread inlet:
1) SXB-180-1032; half-circle, 5 streams
2) SXB-360-1032; full-circle, 8 streams
3) UXB-360-1032; full-circle, umbrella

c. Available model numbers with 5" (12,7 cm) spike inlet:
1) SXB-180-SPYK; half-circle, 5 streams
2) SXB-360-SPYK; full-circle, 8 streams
3) UXB-360-SPYK; full-circle, umbrella

d. Xeri-Bubbler™ specifications and features include:
1) Three inlet connection options:
a) 10-32 self-tapping thread
b) 1/4" (6,4 mm) barb
c) 5" (12,7 cm) spike
2) Three flow pattern options:
a) Half-circle with 5 streams
b) Full-circle with 8 streams
c) Full-circle umbrella pattern
3) Flow and radius adjustment capability by turning outer cap
4) SXB series features flow range of 0 to 13 GPH (0 to 49,2 lph)
5) UXB series features flow range of 0 to 35 GPH (0 to 132,5 lph)
6) Operating pressure range between 15 to 30 PSI (1,0 to 2,1 bar)

3. Rain Bird Xeri-Pop™ Micro-Spray

a. Available model numbers:
1) XP-400X; 4-inch (101,6 mm) pop-up
2) XP-600X; 6-inch (152,4 mm) pop-up
3) XP-1200X; 12-inch (304,8 mm) pop-up

b. Xeri-Pop™ Micro-Spray specifications and features include:
1) 1/4" (6,4 mm) barb inlet located in base of unit for connection to 1/4" (6,4 mm) distribution tubing
2) Three pop-up height options:
a) 4-inch (10,16 cm) pop-up
b) 6-inch (15,24 cm) pop-up
c) 12-inch (30,5 cm) pop-up
3) Compatible with the following Rain Bird nozzles:
a) Multi-port Series nozzles
b) 5-series MPR plastic nozzles
c) 5-series plastic bubbler nozzle (use in conjunction with Rain Bird PCS-series pressure compensating screen)
d) 8-series MPR plastic nozzles
4) External body construction using UV-resistant ABS material
5) Self-flushing, pressure-activated wiper seal
6) Operating pressure range between 20 to 50 PSI (1,4 to 3,5 bar). Optimum performance achieved with 40 PSI (2,8 bar) pressure regulator.

4. Rain Bird Xeri-Sprays™

   a. Available model numbers:
      1) XS-90; Quarter-circle, spray pattern
      2) XS-180; Half-circle, spray pattern
      3) XS-360; Full-circle, stream spray pattern
      4) 360 ADJ Mister

   b. Xeri-Spray™ specifications and features include:
      1) 10-32 self-tapping threaded inlet
      2) Four flow pattern options:
         a) Quarter-circle spray pattern
         b) Half-circle spray pattern
         c) Full-circle spray pattern
         d) Full-circle mister
      3) Operating pressure range between 10 to 30 PSI (0,75 to 2,1 bar)
      4) Adjustable flow and radius with integral ball valve
         a) Flow adjustability between 0 to 31 GPH (0 to 117,3 lph)
         b) Radius adjustability for full-circle sprays between 0 to 13.4 feet (0 to 4,1 m)
         c) Radius adjustability for part-circle sprays between 0 to 10.6 feet (0 to 3,2 m)

E. Rain Bird Drip Irrigation Accessories

1. 1/4" (6,4 mm) Barb Transfer Fittings

   a. Available model numbers:
      1) XBF1CONN:1/4" (6,4 mm) Barb Connector
      2) XBF2EL: 1/4" (6,4 mm) Barb x Barb Elbow
      3) XBFTEE: 1/4" (6,4 mm) Barb x Barb Tee

   b. 1/4" (6,4 mm) Barb Transfer Fittings specifications and features include:
      1) Three fitting configurations:
         a) Connector
         b) Elbow
         c) Tee
      2) Designed for connections of Rain Bird XQ 1/4" (6,4 mm) distribution tubing with an ID of 0.17" (4,3 mm)
      3) Barbed on one end to permit easy insertion into any 1/2" (13 mm) or 3/4" (19 mm) polyethylene tubing using a Rain Bird Xeriman® tool (XM-TOOL)
      4) Constructed from UV resistant acetyl.
      5) Operating pressure range between 0 to 50 PSI (0 to 3.5 bar)

2. Rain Bird Diffuser Bug Cap

   a. Available model numbers:
      1) DBC-025 (Black); for potable water source
      2) DBC-025-PPL (Purple); for non-potable water source

   b. Diffuser Bug Cap specifications and features include:
      1) Barb inlet designed to fit into 1/4" (6,4 mm) distribution tubing with ID of 0.16" (4 mm)
      2) Flanged shield designed to diffuse water to minimize soil erosion at emission point

3) Constructed from polyethylene material
4) Operating pressure range between be 0 to 50 PSI (0 to 3,5 bar)

PART 3 – EXECUTION

3.01 DRIPLINE LAYOUT OF WORK

A. Stake out dripline irrigation system. Items staked include manifold/header pipe and tubing, sleeves, control zone assemblies, flush valves, air relief valves, and check valves.

B. Dripline Irrigation System Layout Review: Dripline irrigation system layout review will occur after staking has been completed. Notify Owner's Representative one week in advance of review. Modifications will be identified by Owner's Representative at this review.

C. General:

1. Keep pipe free from dirt and debris. Cut pipe ends square, debur and clean as recommended by pipe manufacturer.

2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.

D. PVC Pipe and Fittings:

1. Use only strap-type friction wrenches for threaded plastic pipe.

2. PVC Solvent Weld Pipe and Fittings:

a. Use appropriate primer and solvent cement. Join pipe in manner recommended by pipe and fitting manufacturers and in accordance with accepted industry practices.

b. Cure for thirty (30) minutes before handling and twenty-four (24) hours before pressurizing or installing with vibratory plow.

c. Snake pipe from side to side within trench.

3. PVC Threaded Connections:

a. Use only factory-formed threads. Field-cut threads are not permitted.

b. Apply thread sealant in manner recommended by component, pipe and sealant manufacturers and in accordance with accepted industry practices.

E. Dripline Tubing and Fittings:

1. Use only Rain Bird XF-Series Insert Fittings or Rain Bird Easy Fit Compression Fittings for Rain Bird XF-Series dripline tubing connections or transitions as recommended by the Manufacturer's representative for the specific site and system conditions.

2. Dripline Insert Fittings:

a. Install dripline tubing and fittings in manner recommended by manufacturer and in accordance with accepted industry practices.

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3. Dripline Compression Fittings:

    a. Install dripline tubing and fittings in manner recommended by manufacturer and in accordance with accepted industry practices.

3.02 INSTALLATION OF DRIPLINE IRRIGATION COMPONENTS

A. Control Zone Kit Assembly:

1. Flush mainline pipe before installing Control Zone Kit assembly.

2. Locate where shown on drawings. Connect control wires to remote control valve wires using specified wire connectors and waterproof sealant. Provide connectors and sealant per manufacturer's recommendations.

3. Install a maximum of four (4) Low Flow or Medium Flow Control Zone Kits per standard rectangular valve box. Install a maximum of one (1) Medium Flow Commercial Control Zone Kits per standard rectangular valve box. Install a maximum of one High Flow Commercial Control Zone Kits per jumbo rectangular valve box.

    a. Locate valve boxes at least 12" (30,5 cm) from, and align with, nearby walls or edges of paved areas.

    b. Group Control Zone Kit assemblies together where practical. Align grouped valve boxes in uniform patterns. Allow at least 12" (30,5 cm) between valve boxes.

    c. Brand controller letter and station numbers on valve box lid in 2" (50 mm) high letters.

B. Lateral Piping and Dripline Tubing:

1. Install lateral piping and dripline tubing at locations and in grid patterns as indicated on drawings and installation details, and in strict accordance with manufacturer recommendations.

2. Thoroughly flush PVC lateral piping, supply headers, and dripline tubing immediately upon installation.

C. Air Relief Valve Kit Assembly: Install at all high points in dripline tubing grid as shown and directed on drawings and installation details.

D. Flush Point Assembly: Install in flush header or at ends of each dripline zone segment as shown and directed on drawings and installation details. Install at least 12-inches from and align with adjacent walls or edges of paved areas.

END OF SECTION 32 84 00

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SECTION 32 93 00 – PLANTS

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

A. Submittals: Product data and certificates.

PART 2 - PRODUCTS

2.01 PLANTING MATERIALS

A. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

B. Tree and Shrub Material: Nursery grown, with healthy root systems, well-shaped, fully branched, healthy, and free of insects, eggs, larvae, defects, and disfigurement.

C. Ground Covers and Plants: Established and well rooted in pots or similar containers.

2.02 MISCELLANEOUS

A. Edgings: Weathered stell not less than 4 inches deep, with accessories and stakes.

1. Manufacturers:
2. Basis-of-Design Product: [Product indicated on Drawings] <Insert manufacturer's name; product name or designation> or a comparable product of one of the following:

a. Border Concepts, Inc.
b. Collier Metal Specialties, Inc.
c. Curv-Rite, Inc.
d. Oly-Ola Edgings, Inc.
e. Permaloc Corporation.
f. Russell, J. D. Company (The).
g. Sure-Loc Edging Corporation.
h. Russell, J. D. Company (The).
i. Sure-Loc Edging Corporation.
j. Valley View Industries.
k. Or Architect approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Trees and Shrubs: All trees and shrubs are to remain in their containers for this is not a permanent structure.

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3.02 MAINTENANCE

A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, adjusting and repairing, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Maintain trees and shrubs until established, but not less than six months.

C. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

D. Maintain ground covers and plants until established, but not less than six months.

END OF SECTION 32 93 00

APPENDIX I
STRUCTURAL CUTSHEETS

Hanger Options

FACE-MOUNT HANGER OPTION MATRIX

SIMPSON Strong-Tie®

BASE MODEL SERIES	HANGER MODIFICATION OPTIONS						APPLICATIONS	HANGER OPTION PAGE(S)
	SKEWED SEAT							
	ALLOWABLE SKEW	SQUARE CUT JOIST ALLOWED	SLOPED SEAT	SKEWED & SLOPED SEAT	CONCEALED FLANGE(S)	ALTERNATE WIDTHS	UPLIFT WELDABILITY	
	Skewable	Butt Cut	Slopeable	Slopeable& Skewable	Concealed		Uplift / Weldable	
FACE MOUNT HANGERS								
HGU	≤ 45°	See Note 4			O	●	U	243
HGUM	≤ 45°	See Note 4			●	●	U	243
HGUQ							U	—
HGUS	≤ 45°	O					U	237
HHGU					●	●	U	243
HHUS	≤ 45°		≤ 45°	●			U	237
HSUL/HSUR	45° Std.	●			O		U	—
HSULC/HSURC	45° Std.	●			Std.		U	—
HTU	≤ 67½°	●					U	237
HU	≤ 67½°	●	≤ 45°	●	O	O	U, W	236
HUC	≤ 45°	●	≤ 45°		Std.		U, W	236
HUCQ					Std.		U	—
HUSC					Std.		U	—
IUS							U	—
LGU	≤ 45°	●			●	●	U	243
LGUM	≤ 45°	See Note 4					U	243
LSU/LSSU	Field skewable and slopeable to 45° available for some models						U	—
LTHJA							U	—
LTHMA							U	—
LU							U	—
LUC					Std.		U	—
LUS							U	—
MGU	≤ 45°	See Note 4			O	●	U	243
MIU							U	—
MUS							U	—
SUL/SUR	45° Std.	●					U	—
SULC/SURC	45° Std.	●			Std.		U	—
THGB/THGBH/ THGBV/THGBHV	≤ 45°	See Note 4					U	238
THGQH	45°	●					U	238
THJA							U	—
THJU						●	U	237
U	≤ 67½°	●	≤ 45°	●			U	236

1. Refer to the specific product pages for uplift, nailer, and weld information.
2. Refer to the listed pages for each model series for restrictions, required load reductions, and additional information regarding the hanger modifications.
3. HUC less than 3¼" wide cannot be skewed 45°. See page 236 for allowable skews for narrower widths.
4. Square cut allowed for beams up to 5½" and 4-ply trusses.

● = Available for all models O = Available for some models **Std.** = Available with standard model *(no modification required)*

Engineered Wood & Structural Composite Lumber Connectors

FACE MOUNT HANGERS U/HU/HUC/HUCQ *I-Joist & Structural Composite Lumber Hangers*

SIMPSON Strong-Tie®

See Hanger tables on pages 112-116. See Hanger Options on pages 233-243 for hanger modifications, which may result in reduced loads.

U—The standard U hanger provides flexibility of joist to header installation. Versatile fastener selection with tested allowable loads.

HU/HUC—Most models have triangle and round holes. To achieve maximum loads, fill both round and triangle holes with common nails. These heavy-duty connectors are designed for schools and other structures requiring additional strength, longevity and safety factors.

HUCQ—Features concealed flanges so it can be installed close to the end of the supporting beam or on a post. They install with Simpson Strong-Tie® Strong-Drive® SDS Heavy-Duty Connector screws *(supplied with the hanger)* for high capacity and ease of installation.

MATERIAL: See tables on pages 112-116. **FINISH**: Galvanized

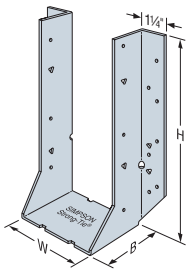
INSTALLATION: • Use all specified fasteners. See General Notes.

- HU/HUC—can be installed filling round holes only, or filling round and triangle holes for maximum values.
- HUCQ—When using structural composite lumber columns, the capacities shown in the tables are for fasteners applied to the wide face of the column.
- Web Stiffeners are required for all I-joists usedwith these hangers.
- For installation to masonry or concrete, see page 175.
- HU/HUC hangers can be welded to a steel member. Allowable loads are the lesser of the values in the Hanger tables on pages 112-116 or the weld capacity – refer to technical bulletin T-HUHUC-W.

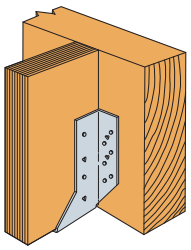
OPTIONS: • HU is available with one flange concealed when the W dimension is less than 2⁵⁄₁₆" at 100% of the table load. Order HUC hanger.

- **Sloped, Skewed and Sloped/Skewed:**
  - For low-cost, code-listed 45° skews, see SUR/SUL and HSUR/HSUL. See also LSU/LSSU connectors.
  - U/HU may be skewed to a maximum of 45° and sloped to a maximum of 45°. Hangers 5½" or less in width may be skewed to 67½°. Hangers skewed 51°- 67½° require a square cut.
  - For all options, uplift loads are 0.75 of table loads.
  - For skewed hangers 3⁹⁄₁₆" and less in width, the allowable download is 100% of the table load. For skewed hangers over 3⁹⁄₁₆" in width the allowable download is 80% of the table load. For slope only, the allowable download is 100% of the table load.
  - For combined slopes and skews, the maximum allowable download is 0.80 of the table load.
- For sloped and skewed hangers, the flange on the acute side flange can be concealed at 0.80 of the table load. Contact Simpson Strong-Tie for skew limitations.
- See Hanger Options on pages 233-243 for additional information.
- See also HUS series.
- HUCQ cannot be modified.

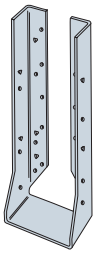
Model configurations may differ from those shown. Some HU models do not have triangle holes. Contact Simpson Strong-Tie for details.



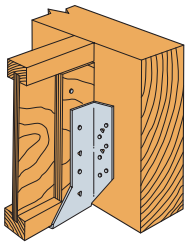
HU410



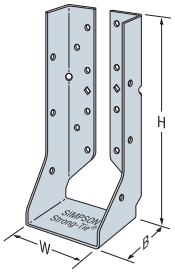
Typical HU7 Installation



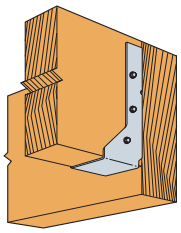
HUC412 Concealed Flanges



Typical HU7 Installation



HUCQ



Typical HUCQ Installed on End of a Beam

FACE MOUNT HANGERS HUS/HHUS/HGUS *Double Shear SCL Hangers*

See Hanger tables on pages 122-126. See Hanger Options on pages 233-243 for hanger modifications, which may result in reduced loads.

These hangers are designed for applications where higher loads are needed *(also see HUC and HUCQ)*.

All hangers in this series have double shear nailing. This patented innovation distributes the load through two points on each joist nail for greater strength. It also allows the use of fewer nails, faster installation, and the use of common nails for all connections. *(Do not bend or remove tabs)*

MATERIAL: See tables on pages 122-126.

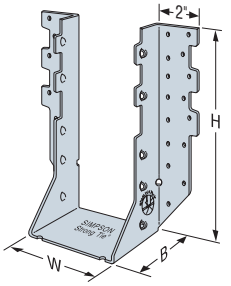
FINISH: Galvanized. Some products available in stainless steel or ZMAX®; see Corrosion Information, pages 13-15.

INSTALLATION • Use all specified fasteners. See General Notes.

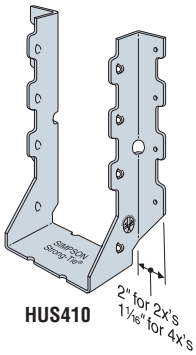
- Do not use double shear hangers with I-joists.
- Nails must be driven at an angle through the joist or truss into the header to achieve the table loads.
- Not designed for welded or nailer applications.
- 16d sinkers (0.148" dia. x 3¼" long) may be used where 10d commons are specified with no reduction in load. Where 16d commons are specified, 10d commons or 16d sinkers (0.148" dia. x 3¼" long) may be used at 0.85 of the table load.
- With 3x carrying members, use 16dx2½" *(Simpson Strong-Tie® N16)* nails into the header and 16d commons into the joist with no load reduction. With 2x carrying members, use 10dx1½" nails into the header and 10d commons into the joist, and reduce the load to 0.64 of the table value.

OPTIONS: • HUS hangers available with the header flanges turned in for 3½" wide joist only, with no load reduction. See HUSC Concealed Flange illustration.

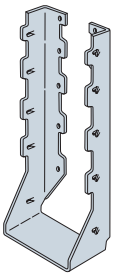
- Concealed flanges are not available for HGUS, HUS1.81/10 and HHUS.
- See Hanger Options, pages 233-243, for sloped and/or skewed HHUS and HGUS models.
- Other sizes available; contact Simpson Strong-Tie for details.



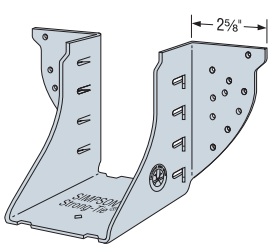
HHUS410



HUS410



HUSC Concealed Flanges *(not available for HHUS, HGUS and HUS1.81/10)*



HGUS46

Glulam Beam Connectors

FACE MOUNT HANGERS HU/HUC/HUCQ/HGUS *Glulam Beam & Double Shear Joist Hangers*

SIMPSON Strong-Tie®

See Hanger Options on pages 233-243 for hanger modifications, which may result in reduced loads.

HU/HUC—Most models have triangle and round holes. To achieve maximum loads, fill both round and triangle holes with common nails.

HGUS—Face mount hanger used for high load applications. All hangers in this series have double shear nailing. This innovation distributes the load through two points on each joist nail for greater strength. It also allows the use of fewer nails, faster installation, and the use of common nails for all connections.

HUCQ—Heavy duty joist hangers that incorporate Simpson Strong-Tie® Strong Drive® SDS Heavy-Duty Connector screws.

MATERIAL: See tables **FINISH**: Galvanized. Some products available in ZMAX® or HDG coating; see Corrosion Information, pages 13-15.

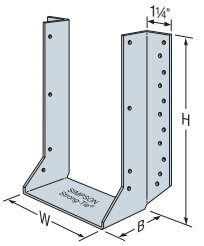
INSTALLATION: • Use all specified fasteners. See General Notes.

- HU/HUC—can be installed filling round holes only, or filling round and triangle holes for maximum values.
- HGUS—Nails must be driven at an angle through the joist or truss into the header to achieve the table loads.
- HUCQ—Install ¼"x2½" Strong-Drive SDS Heavy-Duty Connector screws *(provided)* in all round holes. Lag screws will not achieve the same load.
- With 3x carrying members, use 16dx2½" (0.162" dia. x 2½" long) nails into the header and 16d commons into the joist with no load reduction. With 2x carrying members, use 10dx1½" (0.148" dia. x 1½" long) nails into the header and 10d commons into the joist, and reduce the load to 0.64 of the table value.
- For installations to masonry or concrete, see page 175.

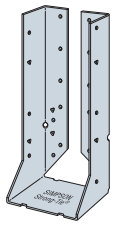
OPTIONS: • HU hangers available with the header flanges turned in for 2⅝" and larger widths, with no load reduction—order HUC hanger.

- See Hanger Options on pages 233-243, for sloped and/or skewed HU models, and HUC *(concealed flange)* models.
- Concealed flanges are not available for HGUS.
- HGUS may be skewed only up to a maximum of 45°. See Hanger Options page 237 for load reductions.
- Other sizes available; contact Simpson Strong-Tie.
- See also HUS series.
- HUCQ hangers cannot be modified.

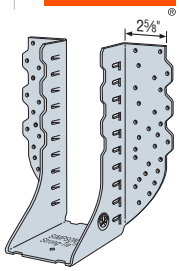
CODES: See page 12 for Code Reference Key Chart.



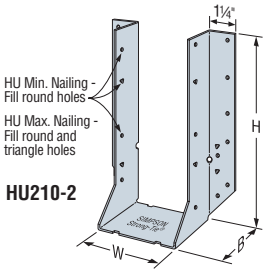
HU5.125/12



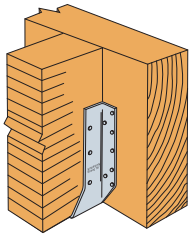
HUC210-2
Concealed Flanges
(HUCQ similar)



HGUS3.25/12



HU210-2



Typical HU Installation

Double-Shear Nailing Top View

Double-Shear Nailing Side View Do not bend tab

Dome Double-Shear Nailing Side View *(available on some models)*

U.S. Patent 5,603,580

Projection seat on most models for maximum bearing and section economy.

Model configurations may differ from those shown. Some HU models do not have triangle holes. Contact Simpson Strong-Tie for details.

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Carried Member Width	Model No.	Ga	Dimensions (in.) W	H	B	Min/ Max	Fasteners Face	Joist	Allowable Loads DF/SP Species Header Uplift (160)	Floor (100)	Snow (115)	Roof (125)	SPF/HF Species Header Floor (100)	Snow (115)	Roof (125)	Code Ref.
3⅛ GLULAM	HU210-2/HUC210-2	14	3⅛	8 13/16	2½	Min	14-16d	6-10d	1135	2085	2350	2530	1795	2025	2180	I9, F6, L17, L12
			3⅛	8 13/16	2½	Max	18-16d	10-10d	1895	2680	3020	3250	2305	2605	2800	
	HU212-2/HUC212-2		3⅛	10 9/16	2½	Min	16-16d	6-10d	1135	2380	2685	2890	2050	2315	2490	
			3⅛	10 9/16	2½	Max	22-16d	10-10d	1895	3275	3695	3970	2820	3180	3425	
	HU3.25/10.5/HUC3.25/10.5		3¼	10¼	2½	—	22-16d	10-10d	1895	3275	3695	3970	2820	3180	3425	I9, L12
	HU3.25/12/HUC3.25/12		3¼	11¾	2½	—	24-16d	12-10d	2015	3570	4030	4335	3075	3470	3735	
	HU216-2/HUC216-2		3⅛	13⅞	2½	Min	20-16d	8-10d	1515	2975	3360	3610	2565	2895	3110	I9, F6, L17, L12
			3⅛	13⅞	2½	Max	26-16d	12-10d	2015	3870	4365	4695	3330	3760	4045	
	HU3.25/16/HUC3.25/16		3¼	13 13/16	2½	Min	20-16d	8-10d	1515	2975	3360	3610	2560	2890	3105	I9, L12
			3¼	13 13/16	2½	Max	26-16d	12-10d	2015	3870	4365	4695	3330	3755	4040	
	HUCQ210-2-SDS		3¼	9	3	—	12-SDS¼x2½	6-SDS¼x2½	2510	4680	4955	4955	3370	3570	3570	
	HGUS3.25/10	12	3¼	8⅝	4	—	46-16d	16-16d	4095	9100	9100	9100	7825	7825	7825	I9, F23, L12
	HGUS3.25/12		3¼	10⅜	4	—	56-16d	20-16d	5045	9600	9600	9600	8255	8255	8255	
3½ GLULAM	HU410	14	3 9/16	8⅝	2½	Max	18-16d	10-10d	1895	2680	3020	3250	2305	2605	2800	I7, I9, F8, L12
	HU414		3 9/16	12⅝	2½	Max	24-16d	12-10d	2015	3570	4030	4335	3075	3470	3735	
	HUCQ410-SDS		3 9/16	9	3	—	12-SDS¼x2½	6-SDS¼x2½	2510	4680	4955	4955	3370	3570	3570	I9, F24, L12
	HUCQ412-SDS		3 9/16	11	3	—	14-SDS¼x2½	6-SDS¼x2½	2510	5460	5560	5560	3930	4005	4005	I9, F25, L12
	HHUS410		3⅝	9	3	—	30-16d	10-16d	3735	5635	6380	6880	4835	5480	5910	
	HGUS410	12	3⅝	9 1/16	4	—	46-16d	16-16d	4095	9100	9100	9100	7825	7825	7825	I7, I9, F8, L12
	HGUS414		3⅝	12 7/16	4	—	66-16d	22-16d	5515	10100	10100	10100	8685	8685	8685	
5⅛ GLULAM	HU310-2/HUC310-2	14	5⅛	8⅞	2½	—	14-16d	6-10d	1135	2085	2350	2530	1795	2025	2180	I9, F6, L17, L12
	HU5.125/12/HUC5.125/12		5¼	10¼	2½	—	22-16d	8-16d	1795	3275	3695	3970	2820	3180	3425	I9, L12
	HU5.125/13.5/HUC5.125/13.5		5¼	13¼	2½	—	26-16d	12-16d	2695	3870	4365	4695	3330	3760	4045	
	HU5.125/16/HUC5.125/16		5¼	13⅞	2½	—	26-16d	12-16d	2695	3870	4365	4695	3330	3760	4045	
	HUCQ5.25/9-SDS		5¼	9	3	—	12-SDS¼x2½	6-SDS¼x2½	2510	4680	4955	4955	3370	3570	3570	I9, F23, L12
	HUCQ5.25/11-SDS		5¼	11	3	—	14-SDS¼x2½	6-SDS¼x2½	2510	5460	5560	5560	3930	4000	4000	
	HGUS5.25/10	12	5¼	9 1/16	4	—	46-16d	16-16d	4095	9100	9100	9100	7825	7825	7825	
	HGUS5.25/12		5¼	10⅜	4	—	56-16d	20-16d	5045	9600	9600	9600	8255	8255	8255	
5½ GLULAM	HUCQ610-SDS	14	5½	9	3	—	12-SDS¼x2½	6-SDS¼x2½	2520	4680	5380	5715	3370	3875	4115	I9, F27, L12
	HUCQ612-SDS		5½	11	3	—	14-SDS¼x2½	6-SDS¼x2½	2520	5315	5315	5315	3825	3825	3825	
	HHUS5.50/10	12	5½	9	3	—	30-16d	10-16d	3735	5635	6380	6880	4835	5480	5910	I9, F23, L12
	HGUS5.50/10		5½	8 5/16	4	—	46-16d	16-16d	4095	9100	9100	9100	7825	7825	7825	
	HGUS5.50/14		5½	12½	4	—	66-16d	22-16d	5515	10100	10100	10100	8685	8685	8685	
6¾ GLULAM	HGUS6.88/10	12	6⅞	8 13/16	4	—	46-16d	16-16d	4095	9100	9100	9100	7825	7825	7825	
	HGUS6.88/12		6⅞	10 13/16	4	—	54-16d	20-16d	5045	9600	9600	9600	8255	8255	8255	
	HGUS6.88/14		6⅞	12 13/16	4	—	66-16d	22-16d	5515	10100	10100	10100	8685	8685	8685	
7 GLULAM	**See HHUS and HGUS in 7" Structural Composite Lumber section, page 116 or GU series on page 117.**															
8¾ GLULAM	**See HGU and HHGU on page 102.**															

1. Uplift loads based on Douglas Fir and have been increased 60% for wind or earthquake loading with no further increase allowed. Reduce where other loads govern.
2. MIN nailing quantity and load values—fill all round holes; MAX nailing quantity and load values—fill all round and triangle holes.
3. For SPF/HF uplift, use 0.86 x DF/SP uplift load for products requiring nails and 0.72 for products requiring screws.
4. **NAILS:** 16d = 0.162" dia. x 3½" long, 10d = 0.148" dia. x 3" long. See pages 22-23 for other nail sizes and information.

Solid Sawn Joist Hangers

FACE MOUNT HANGERS – SOLID SAWN LUMBER (SPF/HF)

SIMPSON Strong-Tie®

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

These products are approved for installation with the Strong-Drive® SD Connector screw. See page 27 for more information.

Joist Size	Model No.	Ga	Dimensions (in.) W	H	B	Min/ Max	Fasteners Header	Joist	SPF/HF Allowable Loads Uplift (160)	Floor (100)	Snow (115)	Roof (125)
SAWN LUMBER SIZES												
2x4	LU24	20	1 9/16	3 1/8	1 1/2	—	4-16d	2-10dx1 1/2	230	475	545	590
	LUS24	18	1 9/16	3 1/8	1 3/4	—	4-10d	2-10d	420	575	655	705
	U24	16	1 9/16	3 1/8	1 1/2	—	4-16d	2-10dx1 1/2	230	495	560	605
	HU26	14	1 9/16	3 1/16	2 1/4	—	4-16d	2-10dx1 1/2	290	515	580	620
DBL 2x4	LUS24-2	18	3 1/8	3 1/8	2	—	4-16d	2-16d	380	680	780	845
	U24-2	16	3 1/8	3	2	—	4-16d	2-10d	320	495	560	605
	HU24-2	14	3 1/8	3 1/16	2 1/2	—	4-16d	2-10d	325	515	580	620
2x6	LUS26	18	1 9/16	4 3/4	1 3/4	—	4-10d	4-10d	1005	740	845	915
	LU26	20	1 9/16	4 3/4	1 1/2	—	6-16d	4-10dx1 1/2	490	715	815	885
	U26	16	1 9/16	4 3/4	2	—	6-16d	4-10dx1 1/2	500	745	845	910
	LUC26Z	18	1 9/16	4 3/4	1 3/4	—	6-16d	4-10dx1 1/2	630	725	825	895
	HU26	14	1 9/16	3 1/16	2 1/4	—	4-16d	2-10dx1 1/2	290	515	580	620
	HUS26	16	1 5/8	5 1/8	3	—	14-16d	6-16d	1335	2330	2650	2820
DBL 2x6	LUS26-2	18	3 1/8	4 7/8	2	—	4-16d	4-16d	1000	880	1010	1090
	U26-2	16	3 1/8	5	2	—	8-16d	4-10d	640	990	1125	1210
	HUS26-2/HUSC26-2	14	3 1/8	5 3/16	2	—	4-16d	4-16d	1060	910	1035	1120
	HU26-2/HUC26-2	14	3 1/8	5 3/8	2 1/2	Min	8-16d	4-10d	655	1025	1155	1245
		14	3 1/8	5 3/8	2 1/2	Max	12-16d	6-10d	980	1540	1735	1865
TPL 2x6	LUS26-3	18	4 5/8	4 1/8	2	—	4-16d	4-16d	1000	880	1010	1090
	U26-3	16	4 5/8	4 1/4	2	—	8-16d	4-10d	640	990	1125	1210
	HU26-3/HUC26-3	14	4 11/16	5 1/2	2 1/2	Min	8-16d	4-10d	655	1025	1155	1245
		14	4 11/16	5 1/2	2 1/2	Max	12-16d	6-10d	980	1540	1735	1865
2x8	LUS26	18	1 9/16	4 3/4	1 3/4	—	4-10d	4-10d	1005	740	845	915
	LU26	20	1 9/16	4 3/4	1 1/2	—	6-16d	4-10dx1 1/2	490	715	815	885
	LUS28	18	1 9/16	6 5/8	1 3/4	—	6-10d	4-10d	1005	940	1075	1165
	LU28	20	1 9/16	6 3/8	1 1/2	—	8-16d	6-10dx1 1/2	730	950	1085	1145
	U26	16	1 9/16	4 3/4	2	—	6-16d	4-10dx1 1/2	500	745	845	910
	LUC26Z	18	1 9/16	4 3/4	1 3/4	—	6-16d	4-10dx1 1/2	630	725	825	895
	HU28	14	1 9/16	5 1/4	2 1/4	—	6-16d	4-10dx1 1/2	525	770	870	935
	HUS26	16	1 5/8	5 1/8	3	—	14-16d	6-16d	1335	2330	2650	2820
	HUS28	16	1 5/8	7	3	—	22-16d	8-16d	1720	2905	3035	3125
DBL 2x8	LUS26-2	18	3 1/8	4 7/8	2	—	4-16d	4-16d	1000	880	1010	1090
	LUS28-2	18	3 1/8	7	2	—	6-16d	4-16d	1000	1125	1285	1390
	U26-2	16	3 1/8	5	2	—	8-16d	4-10d	640	990	1125	1210
	HUS28-2/HUSC28-2	14	3 1/8	7 3/16	2	—	6-16d	6-16d	1335	1365	1555	1680
	HU28-2/HUC28-2	14	3 1/8	7	2 1/2	Min	10-16d	4-10d	655	1280	1445	1555
		14	3 1/8	7	2 1/2	Max	14-16d	6-10d	980	1795	2025	2180
TPL 2x8	LUS28-3	18	4 5/8	6 1/4	2	—	6-16d	4-16d	1000	1125	1285	1390
	U26-3	16	4 5/8	4 1/4	2	—	8-16d	4-10d	640	990	1125	1210
	HU26-3/HUC26-3	14	4 11/16	5 1/4	2 1/2	Min	8-16d	4-10d	655	1025	1155	1245
		14	4 11/16	5 1/4	2 1/2	Max	12-16d	6-10d	980	1540	1735	1865
QUAD 2x8	HU28-4/HUC28-4	14	6 1/8	6 5/8	2 1/2	Min	10-16d	4-16d	775	1280	1445	1555
		14	6 1/8	6 5/8	2 1/2	Max	14-16d	6-16d	1160	1795	2025	2180
2x10	LUS28	18	1 9/16	6 5/8	1 3/4	—	6-10d	4-10d	1005	940	1075	1165
	LU28	20	1 9/16	6 3/8	1 1/2	—	8-16d	6-10dx1 1/2	730	950	1085	1145
	LUS210	18	1 9/16	7 13/16	1 3/4	—	8-10d	4-10d	1005	1145	1305	1415
	LU210	20	1 9/16	7 13/16	1 1/2	—	10-16d	6-10dx1 1/2	730	1190	1360	1470
	U210	16	1 9/16	7 13/16	2	—	10-16d	6-10dx1 1/2	960	1240	1405	1445
	LUC210Z	18	1 9/16	7 3/4	1 3/4	—	10-16d	6-10dx1 1/2	945	1210	1380	1490
	HU210	14	1 9/16	7 1/8	2 1/4	—	8-16d	4-10dx1 1/2	525	1025	1155	1245
	HUS210	16	1 5/8	9	3	—	30-16d	10-16d	2580	3150	3315	3425
DBL 2x10	LUS28-2	18	3 1/8	7	2	—	6-16d	4-16d	1000	1125	1285	1390
	LUS210-2	18	3 1/8	9	2	—	8-16d	6-16d	1500	1565	1785	1935
	U210-2	16	3 1/8	8 1/2	2	—	14-16d	6-10d	960	1735	1965	2120
	HUS210-2	14	3 1/8	9 3/16	2	—	8-16d	8-16d	2820	1820	2070	2240
	HU210-2/HUC210-2	14	3 1/8	8 13/16	2 1/2	Min	14-16d	6-10d	980	1795	2025	2180
		14	3 1/8	8 13/16	2 1/2	Max	18-16d	10-10d	1635	2305	2605	2800
	HHUS210-2/HUSC210-2	14	3 5/16	8 7/8	3	—	30-16d	10-16d	3525	4835	5270	5380
	HUCQ310-SDS	14	2 5/16	9	3	—	8-1/4"x2 1/2" SDS	4-1/4"x2 1/2" SDS	985	2245	2585	2810
TPL 2x10	LUS28-3	18	4 5/8	6 1/4	2	—	6-16d	4-16d	1000	1125	1285	1390
	LUS210-3	18	4 5/8	8 3/16	2	—	8-16d	6-16d	1500	1565	1785	1935
	U210-3	16	4 5/8	7 3/4	2	—	14-16d	6-10d	960	1735	1965	2120
	HU210-3/HUC210-3	14	4 11/16	8 9/16	2 1/2	Min	14-16d	6-10d	980	1795	2025	2180
		14	4 11/16	8 9/16	2 1/2	Max	18-16d	10-10d	1635	2305	2605	2800
	HHUS210-3	14	4 11/16	8 7/8	3	—	30-16d	10-16d	3525	4835	5480	5910
	HUCQ210-3-SDS	14	4 5/8	9	3	—	12-1/4"x2 1/2" SDS	6-1/4"x2 1/2" SDS	1805	3370	3570	3570
QUAD 2x10	HU210-4/HUC210-4	14	6 1/8	8 3/8	2 1/2	Min	14-16d	6-16d	1160	1795	2025	2180
		14	6 1/8	8 3/8	2 1/2	Max	18-16d	8-16d	1550	2305	2605	2800
	HHUS210-4	14	6 1/8	8 7/8	3	—	30-16d	10-16d	3525	4835	5480	5910

See footnotes on page 82.

Strong-Wall® Wood Shearwalls

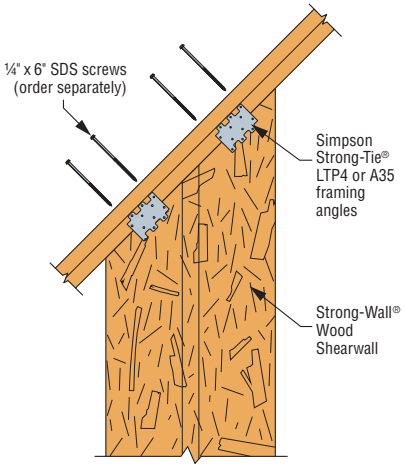
Standard and Balloon Framing on Concrete Foundations

SIMPSON Strong-Tie®

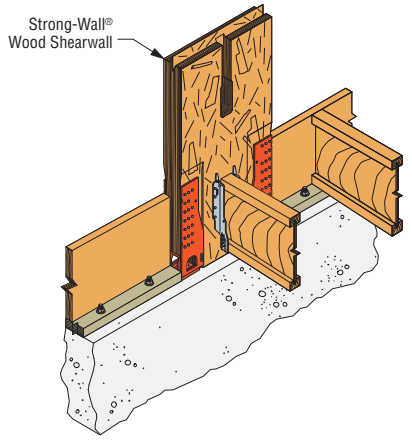
Strong-Wall® Wood Shearwall Product Data

Model No.	W (in.)	H (in.)	Anchor Bolts		Total Wall Weight (lb.)
			Quantity	Diameter (in.)	
WSW12x7	12	78	2	⅞	100
WSW18x7	18	78	2	⅞	145
WSW12x7.5	12	85½	2	⅞	110
WSW18x7.5	18	85½	2	⅞	155
WSW12x8	12	93¼	2	⅞	115
WSW18x8	18	93¼	2	⅞	165
WSW24x8	24	93¼	2	1	225
WSW12x9	12	105¼	2	⅞	130
WSW18x9	18	105¼	2	⅞	185
WSW24x9	24	105¼	2	1	245
WSW12x10	12	117¼	2	⅞	140
WSW18x10	18	117¼	2	⅞	205
WSW24x10	24	117¼	2	1	270
WSW12x11	12	129¼	2	⅞	150
WSW18x11	18	129¼	2	⅞	220
WSW24x11	24	129¼	2	1	295
WSW12x12	12	141¼	2	⅞	165
WSW18x12	18	141¼	2	⅞	240
WSW24x12	24	141¼	2	1	320
WSW18x13	18	153¼	2	⅞	255
WSW24x13	24	153¼	2	1	345
WSW24x14	24	168	2	1	375
WSW24x16	24	192	2	1	425
WSW18x20	18	240	2	⅞	385
WSW24x20	24	240	2	1	520

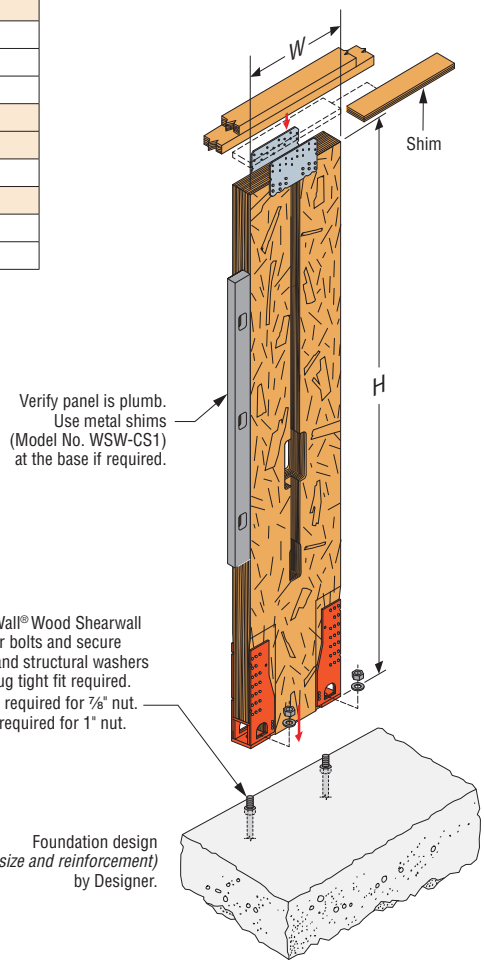
1. For heights not listed, order the next tallest panel and trim to fit. Minimum trimmed height for all panels is 74½".
2. All panels come with two pre-attached holdowns, two standard hex nuts, two flat washers, two WSW-TOW top-connection plates (width based on panel model), and installation instructions.
3. All panels are 3½" thick.



Rake Wall Application

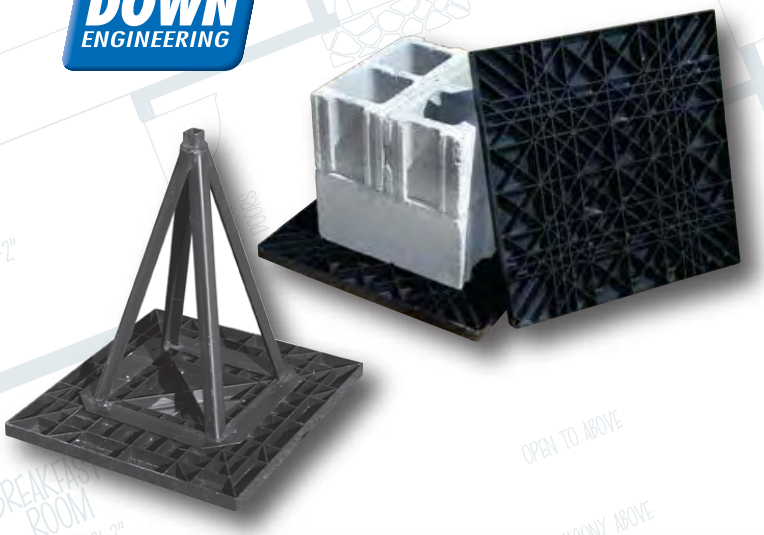


First-Story Installation with Wood Floor System
Specify panel height from top of foundation to underside of the top plates or beam.



Standard Installation

ABS Foundation Pads by TIE DOWN ENGINEERING



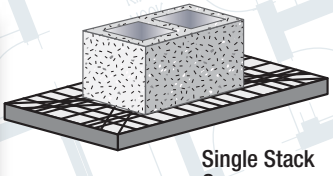
- **Lighter than concrete, saves on labor.**
- **Larger pads to increase spacing, saving time and material.**
- **Made from recycled materials.**
- **Easily stackable for larger pad area and wider pier spacing.**
- **Multi stack for 5 sq. ft. & 6 sq. ft.**

Pad Bearing Capacity

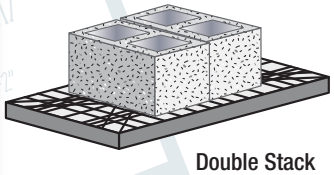
ABS Pad Size	Part#	1000 lbs. Soil	1500 lbs. Soil	2000 lbs. Soil	3000 lbs. Soil
16" x 18"- 2 Sq. Ft. 288 Sq. In.	59300	2,000 lbs.	3,000 lbs.	4,000 lbs.	6,000 lbs.
16" x 22.5" - 2.5 Sq. Ft. 360 Sq. In.	59301	2,500 lbs.	3,750 lbs.	5,000 lbs.	7,500 lbs.
17" x 25"- 3 Sq. Ft. 432 Sq. In.	59302	3,000 lbs.	4,500 lbs.	6,000 lbs.	N/A
24" x 24" - 4 Sq. Ft. 576 Sq. In.	59303	4,000 lbs.	6,000 lbs.	8,000 lbs.	N/A
Multi Pad Layout					
32" X 22.5" (See 1 below) 5 Sq. Ft. - 720 Sq. In.	3 X 59301	5,000 Lbs.	7,500 lbs.	10,000 Lbs.*	
34.4 X 25.2 (See 2 below) 6 Sq. Ft. - 864 Sq. In.	3 X 59302	6,000 Lbs.	9,000 lbs.	12,000 Lbs.*	

* Concrete Block rated @ 8000 lbs. Double block any higher loads.

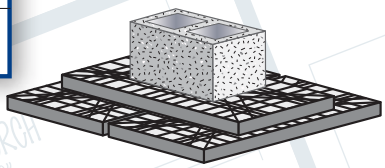
1. The 32 X 22.5 Pyramid configuration uses 2 - 16 X 22.5 pads placed side by side with 1 – 16 X 22.5 pad on top in the opposite direction.
2. The 34.4 X 25.4 Pyramid configuration uses 2 – 17.2 X 25.2 placed side by side with 1 – 17.2 X 25.2 Pad on top in the opposite direction.



Single Stack Course



Double Stack Course

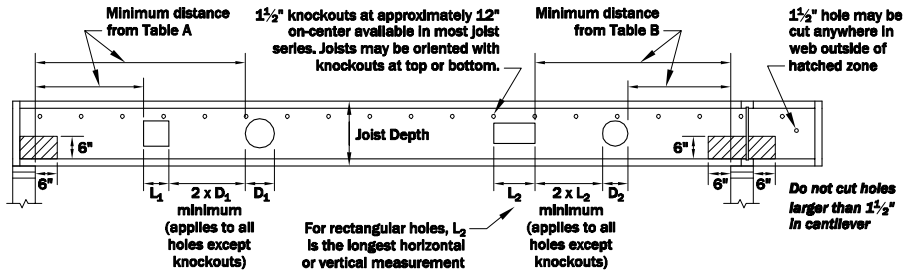


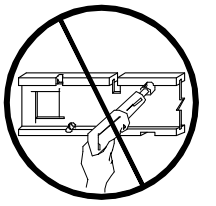
Multi Pad Layout

TIE DOWN ENGINEERING • 255 Villanova Drive SW • Atlanta, GA 30336
www.tiedown.com (404) 344-0000 Fax (404) 349-0401

110215.D1236

8 ALLOWABLE HOLES





DO NOT cut, drill, or notch flanges

Table A - End Support

Minimum distance from edge of hole to inside face of nearest end support

Joist Depth	Joist Series	Round Hole Size									
		2"	4"	6"	8"	10"	12"	14"	16"	18"	20"
		Square or Rectangular Hole Size									
		1.25"	2.5"	4"	5"	6"	7"	8.5"	9.5"	10.5"	13"
9½"	I45 / I65	1'-6"	***3'-0"***	***5'-0"***	-	-	-	-	-	-	-
	I90	2'-0"	3'-6"	***5'-6"***	-	-	-	-	-	-	-
11⅞"	I45 / I65	1'-6"	2'-6"	***4'-0"***	***5'-6"***	-	-	-	-	-	-
	I90 / I90H	1'-6"	3'-6"	5'-6"	***7'-0"***	-	-	-	-	-	-
	I90HS	2'-0"	4'-0"	6'-6"	-	-	-	-	-	-	-
14"	I45 / I65	1'-0"	2'-0"	3'-6"	***4'-6"***	***6'-6"***	-	-	-	-	-
	I90 / I90H	1'-0"	3'-0"	5'-0"	6'-6"	***9'-0"***	-	-	-	-	-
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	-	-	-	-	-	-
16"	I45 / I65	1'-0"	1'-6"	3'-0"	4'-0"	***5'-0"***	***8'-0"***	-	-	-	-
	I90 / I90H	1'-0"	2'-0"	4'-0"	6'-0"	8'-6"	***10'-6"***	-	-	-	-
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	-	-	-	-	-
18"	I45 / I65	1'-0"	1'-0"	2'-6"	3'-6"	4'-6"	***6'-0"***	***9'-0"***	-	-	-
	I90 / I90H	1'-0"	1'-0"	2'-6"	5'-0"	7'-0"	9'-6"	***12'-6"***	-	-	-
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	-	-	-	-
20"	I45 / I65	1'-0"	1'-0"	2'-0"	3'-0"	4'-0"	5'-0"	***7'-0"***	***10'-6"***	-	-
	I90 / I90H	1'-0"	1'-0"	2'-0"	4'-0"	6'-0"	8'-0"	11'-0"	***14'-0"***	-	-
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	9'-6"	11'-6"	14'-0"	-	-	-
22"	I65	1'-0"	1'-0"	1'-6"	2'-6"	3'-6"	4'-6"	5'-6"	7'-6"	***11'-6"***	-
	I90 / I90H	1'-0"	1'-0"	1'-0"	3'-0"	5'-0"	7'-0"	9'-0"	12'-6"	***16'-0"***	-
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	9'-6"	11'-6"	13'-6"	16'-0"	-	-
24" to 26"	I65	1'-0"	1'-6"	2'-6"	3'-6"	4'-0"	5'-0"	6'-0"	7'-6"	***10'-0"***	-
	I90 / I90H	1'-0"	1'-0"	2'-0"	3'-6"	5'-0"	6'-6"	8'-6"	10'-6"	14'-6"	***18'-6"***
	I90HS	2'-0"	4'-0"	6'-0"	7'-6"	9'-6"	11'-6"	13'-6"	15'-0"	18'-0"	-
28" to 32"	I65	1'-0"	2'-0"	2'-6"	3'-6"	4'-0"	5'-0"	6'-0"	7'-0"	8'-0"	10'-6"
	I90 / I90H	1'-0"	1'-6"	2'-6"	4'-0"	5'-6"	6'-6"	8'-0"	9'-6"	11'-6"	14'-6"
	I90HS	2'-0"	3'-6"	5'-0"	7'-0"	8'-6"	10'-0"	12'-0"	13'-6"	16'-0"	18'-6"

Table B - Intermediate or Cantilever Support

Minimum distance from edge of hole to inside face of nearest intermediate or cantilever support

Joist Depth	Joist Series	Round Hole Size									
		2"	4"	6"	8"	10"	12"	14"	16"	18"	20"
		Square or Rectangular Hole Size									
		1.25"	2.5"	4"	5"	6"	7"	8.5"	9.5"	10.5"	13"
9½"	I45 / I65	1'-6"	***4'-0"***	***6'-6"***	-	-	-	-	-	-	-
	I90	3'-0"	5'-6"	***8'-0"***	-	-	-	-	-	-	-
11⅞"	I45 / I65	1'-0"	2'-0"	***4'-6"***	***7'-0"***	-	-	-	-	-	-
	I90 / I90H	2'-0"	4'-6"	7'-6"	***10'-0"***	-	-	-	-	-	-
	I90HS	3'-6"	6'-0"	9'-0"	-	-	-	-	-	-	-
14"	I45 / I65	1'-0"	1'-0"	3'-6"	***5'-6"***	***8'-6"***	-	-	-	-	-
	I90 / I90H	1'-0"	3'-6"	6'-0"	9'-0"	***12'-6"***	-	-	-	-	-
	I90HS	4'-0"	6'-6"	9'-0"	11'-6"	-	-	-	-	-	-
16"	I45 / I65	1'-0"	1'-0"	2'-0"	***4'-0"***	***6'-6"***	***10'-0"***	-	-	-	-
	I90 / I90H	1'-0"	1'-6"	4'-6"	8'-0"	11'-0"	***14'-6"***	-	-	-	-
	I90HS	3'-0"	6'-0"	8'-6"	11'-6"	14'-0"	-	-	-	-	-
18"	I45 / I65	1'-0"	1'-0"	1'-0"	2'-6"	***5'-0"***	***8'-0"***	***12'-0"***	-	-	-
	I90 / I90H	1'-0"	1'-0"	2'-6"	5'-6"	9'-0"	12'-6"	***17'-0"***	-	-	-
	I90HS	2'-6"	5'-6"	8'-0"	11'-0"	13'-6"	16'-6"	-	-	-	-
20"	I45 / I65	1'-0"	1'-0"	1'-0"	1'-0"	3'-6"	***6'-0"***	***9'-0"***	***13'-6"***	-	-
	I90 / I90H	1'-0"	1'-0"	1'-0"	3'-6"	7'-0"	10'-6"	14'-6"	***19'-6"***	-	-
	I90HS	2'-0"	5'-0"	7'-6"	10'-6"	13'-6"	16'-0"	19'-6"	-	-	-
22"	I65	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	4'-6"	7'-0"	10'-0"	***15'-0"***	-
	I90 / I90H	1'-0"	1'-0"	1'-6"	4'-0"	6'-6"	9'-6"	12'-0"	16'-0"	-	-
	I90HS	1'-0"	3'-0"	6'-0"	9'-0"	12'-6"	15'-6"	18'-6"	22'-0"	-	-
24" to 26"	I65	1'-0"	1'-0"	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	10'-0"	***13'-6"***	-
	I90 / I90H	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	9'-0"	11'-0"	14'-0"	***18'-6"***	-
	I90HS	1'-6"	4'-0"	6'-6"	9'-0"	11'-6"	14'-0"	17'-0"	20'-0"	23'-0"	-
28" to 32"	I65	1'-0"	1'-0"	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	9'-0"	11'-0"	***13'-6"***
	I90 / I90H	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	9'-0"	11'-0"	12'-6"	15'-6"	18'-6"
	I90HS	1'-0"	2'-6"	4'-6"	7'-0"	9'-6"	12'-0"	14'-6"	17'-0"	19'-6"	21'-6"

General Notes

- Tables are based on maximum allowable uniform loads. ***Bold italic*** cells indicate 2000 lb. concentrated load spread over two joists has not been considered, use RedSpec™ software or contact your RedBuilt™ technical representative if concentrated load check is required.
- For other hole sizes, hole locations, or loads, use RedSpec™ software or contact your RedBuilt™ technical representative
- Holes may be located vertically anywhere in the web. Leave ⅛" of web (minimum) at top and bottom of hole. DO NOT cut joist flanges.
- Knockouts are located in web at approximately 12" on-center; they do not affect hole placement.
- Do not cut holes in cantilever without consulting your RedBuilt™ representative.

How to use Tables A and B

1. Determine the hole shape and size. For rectangular holes, use the largest dimension of the rectangle. Sizes given in the table are hole sizes, not duct sizes.
2. Determine the Red-I™ joist series and depth.
3. Determine the type of support on each side of the hole. If the Red-I™ joist is continuous over a support, use both tables. Use Table A if the joist terminates at both supports.
4. Find the table cell at the intersection of the Red-I™ joist and the hole.
5. The measurement shown is the minimum distance from the edge of the hole to the inside face of the support.
6. Maintain the minimum required distance from both supports.
7. It is permissible to interpolate between hole sizes shown in the tables.

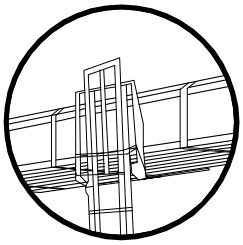
RedBUILT™
Engineered Wood Products

I-JOIST INSTALLATION INFORMATION

ATTENTION BUILDER
Enclosed is IMPORTANT information on how to safely and properly install RedBuilt™ Joists.
Personal injury or death may result from failure to read and follow this information.

1 PRODUCT HANDLING

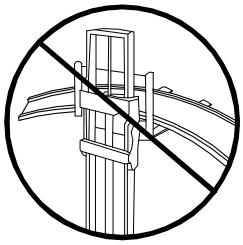
THIS



Lift I-joists from underside only.
DO NOT dump or drop from truck.

NOT THIS

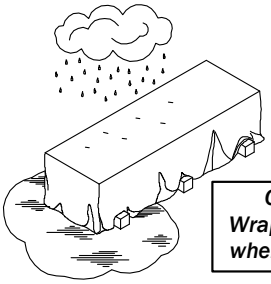
DO NOT lift I-joists by top flange



DO NOT lift I-joists in the flat orientation

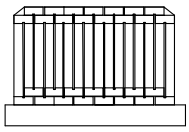
2 PRODUCT STORAGE

THIS



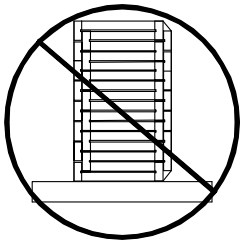
CAUTION
Wrap is slippery when wet or icy.

- Protect products from sun and water.
- Use support blocks at 10' on-center to keep products out of mud and water.



Store and handle joists in vertical orientation. Leave joists banded together until ready to install.

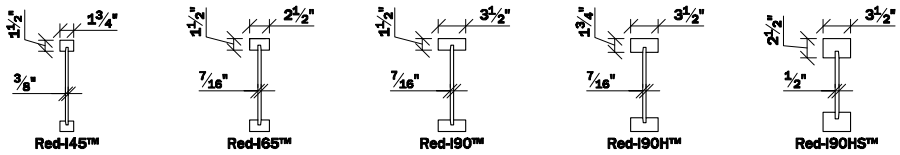
NOT THIS



DO NOT store I-joists in the flat orientation

WARNING
Workers should stay clear when cutting the banding to avoid possible injury from flying banding or toppling joists.

RedBuilt™ Red-I® Product Sections Refer to plan for series and depth



For allowable holes and fasteners information please scan the QR code or use the link below to access page number 3 of sprinkler system installation guide

http://www.redbuilt.com/images/docs/RedBuilt%20Sprinkler%20Guide.pdf

If you have questions or concerns:
Call your RedBuilt™ Representative directly, or for general customer service call
(866) 859-6757 Sheet __ of __

RedBUILT™

Red-I™ Joists

Including Red-I45,™ Red-I65,™ Red-I90,™ Red-I90H,™ and Red-I90HS™ Joists

- Lightweight for Fast Installation
- Resists Bowing, Twisting, and Shrinking
- Available in Long Lengths
- FSC Chain-of-Custody Now Available
- Compatible with Standard Framing
- Works with Multiple Spans
- Limited Product Warranty

RedSPEC™ Product Sizing Software

Download your free copy at RedBuilt.com.

Specify Red-I™ Joists for your next project using RedSpec™ single-member sizing software.

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Welcome to RedBuilt

RedBuilt is an exciting business offering building solutions for a broad range of commercial and custom residential applications. In addition to pioneering unique manufacturing technologies, RedBuilt provides world-class service and technical support for architects, specifiers and builders.

RedBuilt gives you access to reliable, innovative products, including RedBuilt™ open web trusses, Red-I™ joists, and RedLam™ LVL beams and headers. And we keep things simple: You'll work with just one service-oriented supplier to get all these products—plus the support you need to build smarter.

RedBuilt: A family of brand-name building products... a source for innovative ideas and solutions... a supplier that's simpler to do business with.

The RedBuilt™ Red-I™ Joist Advantage

Red-I™ joists are lightweight joists suitable for use in roofs and floors in custom residential, multifamily, institutional, and commercial applications. This product is available in multiple series so you can design the most cost-effective system. Other Red-I™ joist benefits include:

- **Dependable Delivery**—RedBuilt plants are located in key market areas, enabling us to deliver materials quickly. Each plant is staffed with experienced personnel who can help solve problems and talk with you about any special project requirements.
- **Minimum Waste**—Red-I™ joists are manufactured to resist twisting and shrinking, and they can be cut to size at the factory so there's virtually no time or material waste prior to installation.
- **Compatibility**—All Red-I™ joists fit into wood frame, masonry, or steel construction, and they can accommodate a wide variety of decking and ceiling materials—including wood, plywood, steel, and gypsum.
- **Easy Mechanical Access**—Knockout holes for ventilation and flexible conduit are provided in the web of the Red-I™ joists. The web can also be cut or drilled to accommodate larger ductwork (see page 19), so costly suspended ceilings can often be eliminated.

ABOUT THIS GUIDE

The RedBuilt™ Red-I45,™ I65,™ I90,™ I90H,™ and I90HS™ Joist Specifier's Guide is one of several guides that offer technical information and design recommendations for RedBuilt™ products. This guide provides architects, designers, and engineers with information regarding Red-I™ joists for commercial and custom residential applications.

FEATURES AND BENEFITS

Product Selection

This guide provides specifiers with technical information about the RedBuilt™ Red-I™ joist product line. However, complex or custom applications can often make specifying the the right products in the right places a challenge—especially when you have factors such as span, wind, load-carrying capacity and other design constraints to consider. But whatever your project entails, RedBuilt is here to help. Your local RedBuilt technical representative, along with our Design Center team, can assist you in choosing the best products and designing the best system for your specific application.

Contact us for help with any of the following:

- Product selection
- Building department calculations
- Complete cost analysis
- System selection (system packages can include horizontal framing, load-carrying beams, headers, wall framing, mansard framing, and accessories)

Products for Every Application

In addition to Red-I™ joists, RedBuilt™ offers a variety of other engineered lumber products that are ideal for use in commercial and custom residential projects. For more information, contact your RedBuilt technical representative or visit www.RedBuilt.com to download literature for products such as tapered Red-I™ joists, open-web trusses, and RedLam™ LVL.

Our network of technical representatives offers a wide range of services to help guide your projects through planning and construction.

Unsurpassed Technical Support

RedBuilt has one of the largest networks of technical representatives in the business. Their services include consultation, computer-assisted design and layout, delivery coordination, and installation review. They can suggest cost-reduction techniques and check special application requirements. In addition, they're backed by a staff of professional engineers who provide comprehensive technical support when needed. Special requests are accommodated wherever practical, and they offer cost analysis, engineering analysis, assistance with building code approvals—even the creation of special product applications for more creative designs. The goal of RedBuilt technical support is to help architects and engineers achieve quality design applications with the most cost-efficient product selection possible.

Resource Efficiency

Consider all the positive attributes of wood when selecting your building material of choice. In addition to its structural properties, high strength-to-weight ratio, and ease of construction, wood is a naturally occurring, renewable resource that requires less energy to produce than steel or concrete. And it sequesters carbon—whether on the stump or in your structure.

Our Red-I™ joists, as well as other RedBuilt™ products, are now available with FSC credits. Whether you're looking for LEED certification or simply want to ensure efficient use of raw materials, we can help. By making better use of every tree, RedBuilt produces cost-effective, consistently available engineered wood products that reduce environmental impact. The result is a quality wood product that offers superior strength and reliable performance.

FSC
www.fsc.org
FSC® C002542

The mark of responsible forest management

DESIGN CENTER SERVICES

Upon request, RedBuilt can provide the following services for the products described in this Red-I™ Joist Specifier's Guide:

- A complete design package including layout drawings (placement diagrams) and detailed design calculations.
- Review and analysis of the application.
- Drawings and/or calculations sealed by a professional engineer.

Our technical support team offers professional capabilities in the design and application of all RedBuilt™ products.

Installation Review

Although responsibility for proper installation lies with the contractor-builder, RedBuilt provides detailed suggestions and guidelines for installation. If requested, a RedBuilt representative will visit the site to verify the contractor's understanding of proper installation. RedBuilt professional engineers also are available to help solve jobsite application problems.

Engineering Responsibility Position Statement

RedBuilt is a manufacturer of proprietary structural components.

It employs a staff of professional engineers to aid in the development, manufacture, and marketing of its products. RedBuilt does not replace or accept the responsibility of the design professional of record for any structure.

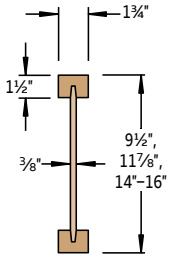
RedBuilt accepts the delegation of engineering responsibility only for the products it manufactures, provided that the application conditions are specified by the design professional of record, or other responsible party when a design professional is not engaged. RedBuilt provides engineering in the design of its products and does not displace the need on any project for a design professional of record.

RED-I™ JOIST DESCRIPTIONS

This guide covers five series of joists: Red-I45,™ Red-I65,™ Red-I90,™ Red-I90H,™ and Red-I90HS™. These joists are primarily intended for commercial applications such as retail stores, office buildings, schools, restaurants, multi-family, hotels, warehouses, and nursing homes. They are typically designed, manufactured, and sold by RedBuilt for each specific job. Contact your RedBuilt representative for more information.

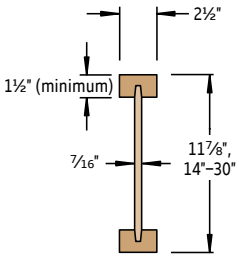
Some series of Red-I™ joists are available with tapered profiles for use in certain roof applications. Contact your RedBuilt representative for determining availability and for application assistance.

Red-I™ joists are normally produced without camber. However, camber is available at 2,250' radius as a special order for I45,™ I65,™ I90,™ and I90H™ series joists. Camber is not recommended for floors, or for multiple-span or cantilever applications.



Red-I45™

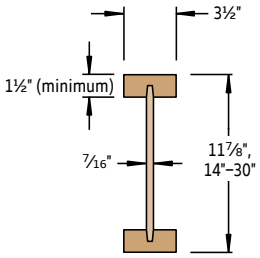
Top and bottom flanges of 1½" x 1¾" RedLam™ LVL with ⅜" OSB web.



Red-I65™

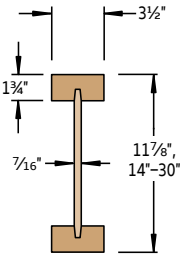
Top and bottom flanges of 1½" (minimum) x 2½" RedLam™ LVL with 7⁄16" OSB web.

- *Also available in a tapered profile (Red-I65T™). Check with your technical representative for availability.*



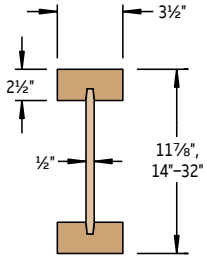
Red-I90™

Top and bottom flanges of 1½" (minimum) x 3½" RedLam™ LVL with 7⁄16" OSB web.



Red-I90H™

Top and bottom flanges of 1¾" x 3½" RedLam™ LVL with 7⁄16" OSB web.



Red-I90HS™

Top and bottom flanges of 2½" x 3½" RedLam™ LVL with ½" OSB web.

- *For heavy loads and 8' on-center roof systems*
- *Provides increased bending strength and stiffness.*

Joist depths from 14" to 32" are available in 2" increments.

Building Codes and Product Acceptance: See ICC-ES ESR-2993, ICC-ES ESR-2994, L.A. City RR #25832 and #25833, DSA IR 23-9

DESIGN PROPERTIES

Joist Depth	Joist Weight (lbs/ft)	Reference Design Values												
							End Reaction (lbs)[4][5]				Intermediate Reaction (lbs)[4][5]			
							1¾"[6] Bearing		3½" Bearing		3½" Bearing		5¼" Bearing	
							Web Stiffeners[7]		Web Stiffeners[7]		Web Stiffeners[7]		Web Stiffeners[7]	
		Moment[1] M_r (ft-lbs)	Shear[2] V_r (lbs)	EI x 10^6 (in.^{2}-lbs)	EI[3] x 10^6 Red-I™ Joist with Nailed Floor Sheathing (in.^{2}-lbs)	EI[3] x 10^6 Red-I™ Joist with Glue-Nailed Floor Sheathing (in.^{2}-lbs)	No	Yes	No	Yes	No	Yes	No	Yes
Red-I45™ Joist														
9½"	2.2	3,620	1,590	185	221	250	1,015	NA	1,560	NA	2,025	NA	2,575	NA
11⅞"	2.5	4,685	1,785	319	375	420	1,015	1,225	1,560	1,785	2,025	2,385	2,575	2,930
14"	2.8	5,570	1,960	474	553	615	1,015	1,225	1,560	1,915	2,025	2,385	2,575	2,930
16"	3.0	6,390	2,120	653	756	839	1,015	1,225	1,560	1,915	2,025	2,385	2,575	2,930
Red-I65™ Joist														
11⅞"	3.6	6,750	2,255	450	512	561	1,375	1,745	1,885	2,255	2,745	3,120	3,365	3,735
14"	3.9	8,030	2,540	666	752	821	1,375	1,750	1,885	2,505	2,745	3,365	3,365	3,985
16"	4.2	9,210	2,810	913	1,025	1,116	1,375	1,750	1,885	2,625	2,745	3,490	3,365	4,105
18"	4.4	10,380	3,080	1,205	1,348	1,462	1,375	1,750	1,885	2,750	2,745	3,615	3,365	4,230
20"	4.7	11,540	3,345	1,545	1,722	1,864	NA	1,750	NA	2,875	NA	3,740	NA	4,355
22"	5.0	12,690	3,615	1,934	2,149	2,322	NA	1,750	NA	3,000	NA	3,860	NA	4,480
24"	5.3	13,830	3,200	2,374	2,632	2,838	NA	1,750	NA	3,125	NA	3,875	NA	4,605
26"	5.5	14,960	3,200	2,868	3,172	3,416	NA	1,750	NA	3,200	NA	4,725[8]	NA	5,345[9]
28"	5.8	16,085	3,200	3,417	3,772	4,056	NA	1,750	NA	3,200	NA	4,850[8]	NA	5,470[9]
30"	6.1	17,205	3,200	4,025	4,434	4,762	NA	1,750	NA	3,200	NA	4,975[8]	NA	5,590[9]
Red-I90™ Joist														
11⅞"	4.6	9,605	2,255	621	687	741	1,400	1,715	1,885	2,200	3,350	3,665	3,965	4,285
14"	4.9	11,430	2,540	913	1,005	1,079	1,400	1,875	1,885	2,355	3,350	3,825	3,965	4,440
16"	5.2	13,115	2,810	1,246	1,366	1,462	1,400	2,030	1,885	2,515	3,350	3,980	3,965	4,600
18"	5.4	14,785	3,080	1,635	1,786	1,908	1,400	2,030	1,885	2,515	3,350	3,980	3,965	4,600
20"	5.7	16,435	3,345	2,085	2,272	2,422	NA	2,190	NA	2,675	NA	4,140	NA	4,755
22"	6.0	18,075	3,615	2,597	2,824	3,006	NA	2,345	NA	2,830	NA	5,090	NA	5,705
24"	6.3	19,700	3,400	3,172	3,442	3,659	NA	2,345	NA	2,830	NA	5,405	NA	6,020
26"	6.5	21,315	3,400	3,814	4,132	4,387	NA	2,450	NA	2,990	NA	6,180[8]	NA	6,795[9]
28"	6.8	22,915	3,400	4,525	4,895	5,191	NA	2,450	NA	3,145	NA	6,335[8]	NA	6,800[9]
30"	7.1	24,510	3,400	5,306	5,732	6,073	NA	2,450	NA	3,145	NA	6,655[8]	NA	6,800[9]
Red-I90H™ Joist														
11⅞"	4.6	10,960	2,300	687	755	810	1,400	1,715	1,885	2,200	3,495	3,810	4,100	4,420
14"	4.9	13,090	2,600	1,015	1,109	1,185	1,400	1,875	1,885	2,355	3,495	3,970	4,100	4,575
16"	5.2	15,065	2,880	1,389	1,512	1,610	1,400	2,030	1,885	2,515	3,495	4,130	4,100	4,735
18"	5.4	17,010	3,160	1,827	1,982	2,106	1,400	2,030	1,885	2,515	3,495	4,130	4,100	4,735
20"	5.7	18,945	3,445	2,331	2,522	2,676	NA	2,190	NA	2,675	NA	4,285	NA	4,890
22"	6.0	20,855	3,725	2,904	3,136	3,321	NA	2,345	NA	2,830	NA	5,235	NA	5,840
24"	6.3	22,755	3,800	3,549	3,825	4,046	NA	2,345	NA	2,830	NA	5,425	NA	6,155
26"	6.5	24,645	3,800	4,266	4,590	4,850	NA	2,450	NA	2,990	NA	6,315[8]	NA	6,920[9]
28"	6.8	26,520	3,800	5,059	5,436	5,737	NA	2,450	NA	3,145	NA	6,470[8]	NA	7,080[9]
30"	7.1	28,380	3,800	5,930	6,363	6,710	NA	2,450	NA	3,145	NA	6,790[8]	NA	7,395[9]
Red-I90HS™ Joist														
11⅞"	6.0	16,050	2,320	900	974	1,034	1,835	2,320	2,150	2,320	3,995	4,650	4,690	5,345
14"	6.3	19,425	2,565	1,355	1,457	1,538	1,835	2,565	2,150	2,565	3,995	4,980	4,690	5,670
16"	6.6	22,550	2,790	1,876	2,008	2,113	1,835	2,790	2,150	2,790	3,995	4,980	4,690	5,670
18"	7.0	25,640	3,020	2,488	2,654	2,787	1,835	3,020	2,150	3,020	3,995	5,310	4,690	6,000
20"	7.3	28,695	3,250	3,195	3,399	3,562	NA	3,250	NA	3,250	NA	5,425	NA	6,330
22"	7.6	31,725	3,480	3,998	4,244	4,442	NA	3,475	NA	3,480	NA	5,425	NA	6,330
24"	7.9	34,730	3,710	4,901	5,194	5,428	NA	3,500	NA	3,710	NA	5,425	NA	6,655
26"	8.2	37,715	3,940	5,905	6,249	6,523	NA	3,500	NA	3,940	NA	6,985[8]	NA	7,675[9]
28"	8.5	40,680	4,165	7,014	7,412	7,730	NA	3,500	NA	4,165	NA	6,985[8]	NA	7,675[9]
30"	8.8	43,630	4,375	8,230	8,687	9,052	NA	3,500	NA	4,375	NA	7,310[8]	NA	8,005[9]
32"	9.1	46,560	4,375	9,555	10,075	10,490	NA	3,500	NA	4,375	NA	7,640[8]	NA	8,335[9]

(1) Do not increase joist resistive moment properties by a repetitive-member-use factor.
(2) For possible increases in shear capacity see shear design information at right.
(3) For deflection calculation only. Assumes 24" joist spacing with a 24" span-rated panel.
(4) Interpolation between bearing lengths is permitted for allowable design reactions.
(5) Reaction capacity has been determined based on RedBuilt™ products. Allowable bearing on supporting members shall be checked.
(6) For Red-I90HS™, use a bearing length of 2½".
(7) Refer to page 16 for web stiffener details.
(8) 5¼" bearing length is required at intermediate reactions.
(9) 7" bearing length is required at intermediate reactions.

- The stated allowable design properties are for loads of normal duration. Adjustments to the allowable design values shall be in accordance with the applicable code.

Red-I™ Joist Shear Design

When joists are used as simple span members, the design shear is equal to the shear at the face of the support.

When joists **up to 24" in depth** are used as multiple-span members, the design shear is the calculated shear at the interior support reduced by the following:

$$R = \frac{W}{\left(\frac{V_{12}}{100}\right)} \leq 18\%$$

Where: R is the percent reduction
W is the uniform load in plf
V_{12} is the reference design shear for an 11⅞" deep joist (lbs.)

LOAD TABLES

Instructions for Load Tables on pages 7–9

To size floor joists:

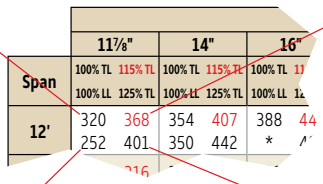
- Calculate total load and live load in pounds per linear foot (plf).
- Check both total load (100% TL) and live load (100% LL). Live load (100% LL) values may be increased with a glue-nailed floor system; contact your RedBuilt representative for assistance.

To size roof joists:

- Calculate total load in pounds per linear foot (plf).
- Check the appropriate snow load area (115% TL) value or non-snow load area (125% TL) value to determine the maximum allowable total load.

100% TL (Total Load)

Use this and the 100% LL to select floor member. This is the maximum allowable total load in pounds per linear foot of joist. Values are limited by deflection equal to L/240 at total load.



	11⅞"		14"		16"	
Span	100% TL	115% TL	100% TL	115% TL	100% TL	11
	100% LL	125% TL	100% LL	125% TL	100% LL	12
12'	320	368	354	407	388	44
	252	401	350	442	*	*

115% TL (Total Load)

Use this to select roof member in snow load areas. This is the maximum allowable total load in pounds per linear foot of joist. Values are limited by deflection equal to L/180 at total load.

100% LL (Live Load)

Use this and the 100% TL to select floor member. This number is the maximum allowable live load capacity in pounds per linear foot of joist. Value is based on the **Commercial Floor Deflection Limit** shown on page 20.

125% TL (Total Load)

Use this to select roof member in non-snow load areas. This is the maximum allowable total load in pounds per linear foot of joist. Values are limited by deflection equal to L/180 at total load.

Consult local codes to verify deflection limits required for specific applications.

General Notes for Load Tables on pages 7–9

- Values shown are maximum allowable load capacities based on the following assumptions:
  - Simple span; horizontal clear distance between supports.
  - Uniformly loaded conditions with 2½" bearing length. Web stiffeners are assumed for joist depths greater than 9½". Other capacities may be possible with different criteria; contact your RedBuilt representative.
  - Positive drainage in roof applications (¼" per foot slope minimum).
  - Composite action is not considered for deflection.
  - **Floor Total Load** deflection limit is L/240.
  - **Floor Live Load** deflection limit is based on commercial deflection criteria shown on page 20.
  - **Roof Total Load** deflection limit is L/180.
- Camber (2,250' radius) is available for simple-span applications only (not available for Red-I90HS™). **Contact your RedBuilt representative for availability.**
- For span or loading conditions not covered by these tables (such as multiple spans or concentrated loads), contact your RedBuilt representative for assistance.

Visit www.RedBuilt.com to find your local representative.

LOAD TABLES

Red-I45™ Joist Allowable Uniform Load (PLF)

Span	Depth							
	9½"		11⅞"		14"		16"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
10'	245 / 160	282 / 307	288 / 257	331 / 360	299 / *	344 / 373	299 / *	344 / 373
12'	195 / 98	224 / 244	240 / 162	276 / 301	249 / 230	287 / 312	249 / *	287 / 312
14'	129 / 64	165 / 173	186 / 107	214 / 233	214 / 154	246 / 268	214 / 205	246 / 268
16'	89 / 44	119 / 119	143 / 74	164 / 179	170 / 106	196 / 213	188 / 143	216 / 235
18'	64 / 28	85 / 85	107 / 47	130 / 141	135 / 69	155 / 168	154 / 92	178 / 193
20'		63 / 63	80 / 30	105 / 106	109 / 46	126 / 136	125 / 63	144 / 157
22'		48 / 48		81 / 81	89 / 35	104 / 113	104 / 48	119 / 130

Table Footnotes

* Indicates total load (TL) value controls.

• Red numbers refer to 115% total load (TL).

See Load Table Instructions and General Notes on page 6.

Red-I65™ Joist Allowable Uniform Load (PLF)

Span	Depth																			
	11⅞"		14"		16"		18"		20"		22"		24"		26"		28"		30"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
10'	386 / 347	444 / 482	407 / *	469 / 509	418 / *	480 / 522	428 / *	492 / 535	439 / *	504 / 548	449 / *	517 / 562	460 / *	529 / 575	466 / *	536 / 583	466 / *	536 / 583	466 / *	536 / 583
12'	322 / 220	371 / 403	340 / 310	391 / 426	349 / *	401 / 436	358 / *	411 / 447	366 / *	421 / 458	375 / *	432 / 469	384 / *	442 / 480	389 / *	448 / 487	389 / *	448 / 487	389 / *	448 / 487
14'	269 / 147	309 / 336	292 / 210	336 / 365	300 / 277	345 / 375	307 / *	353 / 384	315 / *	362 / 393	322 / *	371 / 403	330 / *	379 / 412	334 / *	385 / 418	334 / *	385 / 418	334 / *	385 / 418
16'	206 / 102	237 / 258	245 / 146	282 / 307	262 / 194	302 / 328	269 / 249	309 / 336	276 / *	317 / 345	282 / *	325 / 353	289 / *	332 / 361	293 / *	337 / 366	293 / *	337 / 366	293 / *	337 / 366
18'	149 / 65	188 / 199	194 / 94	223 / 243	223 / 126	256 / 279	239 / 163	275 / 299	245 / 204	282 / 307	251 / 248	289 / 314	257 / *	296 / 321	261 / *	300 / 326	261 / *	300 / 326	261 / *	300 / 326
20'	111 / 44	148 / 148	157 / 64	181 / 197	181 / 86	208 / 226	204 / 112	234 / 255	221 / 140	254 / 276	226 / 172	260 / 283	231 / 206	266 / 289	235 / *	270 / 293	235 / *	270 / 293	235 / *	270 / 293
22'	85 / 34	113 / 113	123 / 49	150 / 163	149 / 66	172 / 187	168 / 86	194 / 211	187 / 108	216 / 234	206 / 133	237 / 257	211 / 161	242 / 263	213 / 190	246 / 267	213 / *	246 / 267	213 / *	246 / 267
24'		88 / 88	96 / 38	126 / 129	126 / 52	145 / 157	142 / 68	163 / 177	158 / 85	181 / 197	173 / 105	199 / 217	189 / 127	217 / 236	196 / 151	225 / 245	196 / 177	225 / 245	196 / *	225 / 245
26'		70 / 70	77 / 30	102 / 102	104 / 41	123 / 134	121 / 54	139 / 151	134 / 68	155 / 168	148 / 84	170 / 185	161 / 102	185 / 201	174 / 122	201 / 218	181 / 143	208 / 226	181 / 166	208 / 226
28'		56 / 56		83 / 83	84 / 33	106 / 112	104 / 44	120 / 130	116 / 55	133 / 145	127 / 69	147 / 159	139 / 83	160 / 174	150 / 100	173 / 188	162 / 117	186 / 202	168 / 136	193 / 210
30'		46 / 46		68 / 68		92 / 92	90 / 36	104 / 114	101 / 46	116 / 126	111 / 57	128 / 139	121 / 69	139 / 151	131 / 82	151 / 164	141 / 97	162 / 176	151 / 113	173 / 189
32'		38 / 38		56 / 56		77 / 77	75 / 30	92 / 100	89 / 38	102 / 111	98 / 47	112 / 122	106 / 57	122 / 133	115 / 69	133 / 144	124 / 81	143 / 155	133 / 95	152 / 166
34'		32 / 32		47 / 47		64 / 64		81 / 84	79 / 32	90 / 98	86 / 40	100 / 108	94 / 48	108 / 118	102 / 58	117 / 128	110 / 68	126 / 137	117 / 80	135 / 147
36'				40 / 40		54 / 54		71 / 71		81 / 88	77 / 34	89 / 97	84 / 41	97 / 105	91 / 49	105 / 114	98 / 58	113 / 122	105 / 68	121 / 131
38'				34 / 34		46 / 46		61 / 61		72 / 78	69 / 29	80 / 87	75 / 35	87 / 94	82 / 42	94 / 102	88 / 50	101 / 110	94 / 58	108 / 118
40'				29 / 29		40 / 40		52 / 52		65 / 67		72 / 78	68 / 30	78 / 85	74 / 36	85 / 92	79 / 43	91 / 99	85 / 50	98 / 106

LOAD TABLES

Red-I90™ Joist Allowable Uniform Load (PLF)

Span	Depth																					
	11⅞"		14"		16"		18"		20"		22"		24"		26"		28"		30"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
14'	271 192	312 339	293 268	337 367	315 *	363 394	315 *	363 394	338 *	389 423	360 *	414 450	360 *	414 450	378 *	435 473	387 *	446 484	387 *	446 484
16'	237 134	273 297	257 189	296 321	276 249	318 346	276 *	318 346	296 *	341 370	315 *	363 394	315 *	363 394	331 *	381 414	339 *	390 424	339 *	390 424
18'	198 87	243 264	229 124	263 286	246 164	283 307	246 209	283 307	263 258	303 329	281 *	323 351	281 *	323 351	295 *	339 369	302 *	347 378	302 *	347 378
20'	148 59	198 198	206 85	237 257	221 113	255 277	221 144	255 277	237 179	273 297	253 217	291 316	253 *	291 316	265 *	305 332	272 *	313 340	272 *	313 340
22'	114 45	152 152	164 65	214 219	201 87	232 252	201 112	232 252	216 140	248 270	230 170	264 287	230 203	264 287	241 239	278 302	247 *	285 309	247 *	285 309
24'	89 35	119 119	129 51	172 172	172 69	206 224	185 89	212 231	198 111	228 248	211 135	242 264	211 162	242 264	221 191	255 277	227 222	261 284	227 *	261 284
26'	71 28	95 95	103 41	137 137	138 55	176 184	171 71	196 213	183 89	210 229	195 109	224 243	195 131	224 243	204 155	235 256	210 181	241 262	210 208	241 262
28'		77 77	83 33	111 111	112 45	150 150	145 58	171 186	165 73	190 207	181 89	208 226	181 108	208 226	190 127	218 237	195 149	224 243	195 172	224 243
30'		63 63		91 91	92 37	123 123	120 48	149 160	144 60	166 180	158 74	182 198	169 89	194 211	177 106	204 222	182 124	209 227	182 143	209 227
32'		52 52		76 76	77 30	103 103	100 40	131 133	126 50	146 158	139 62	160 174	152 75	175 190	164 89	189 206	170 104	196 213	170 120	196 213
34'		44 44		64 64		86 86	84 33	112 112	106 42	129 140	123 52	142 154	135 63	155 168	146 75	167 182	157 88	180 196	160 102	184 201
36'		37 37		54 54		73 73	71 28	95 95	90 36	115 120	110 44	127 138	120 54	138 150	130 64	149 162	140 75	161 175	149 87	172 187
38'		31 31		46 46		63 63		82 82	77 31	103 103	95 38	114 124	108 46	124 135	117 55	134 146	125 65	144 157	134 75	154 168
40'				40 40		54 54		70 70		89 89	82 33	103 110	97 40	112 122	105 47	121 132	113 56	130 142	121 65	139 151
42'				34 34		47 47		61 61		77 77	72 28	93 96	87 34	101 110	95 41	110 119	103 49	118 128	110 57	126 137

Table Footnotes

* Indicates total load (TL) value controls.

• Red numbers refer to 115% total load (TL).

See Load Table Instructions and General Notes on page 6.

Red-I90H™ Joist Allowable Uniform Load (PLF)

Span	Depth																					
	11⅞"		14"		16"		18"		20"		22"		24"		26"		28"		30"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
14'	271 208	312 339	293 290	337 367	315 *	363 394	315 *	363 394	338 *	389 423	360 *	414 450	360 *	414 450	378 *	435 473	387 *	446 484	387 *	446 484
16'	237 146	273 297	257 206	296 321	276 270	318 346	276 *	318 346	296 *	341 370	315 *	363 394	315 *	363 394	331 *	381 414	339 *	390 424	339 *	390 424
18'	211 95	243 264	229 135	263 286	246 179	283 307	246 227	283 307	263 *	303 329	281 *	323 351	281 *	323 351	295 *	339 369	302 *	347 378	302 *	347 378
20'	162 65	217 217	206 93	237 257	221 123	255 277	221 158	255 277	237 196	273 297	253 237	291 316	253 *	291 316	265 *	305 332	272 *	313 340	272 *	313 340
22'	125 50	167 167	180 72	215 234	201 96	232 252	201 123	232 252	216 153	248 270	230 186	264 287	230 222	264 287	241 *	278 302	247 *	285 309	247 *	285 309
24'	98 39	131 131	142 56	189 189	185 76	212 231	185 97	212 231	198 122	228 248	211 149	242 264	211 178	242 264	221 209	255 277	227 *	261 284	227 *	261 284
26'	78 31	104 104	113 45	151 151	152 61	196 203	171 78	196 213	183 98	210 229	195 120	224 243	195 144	224 243	204 170	235 256	210 198	241 262	210 *	241 262
28'		84 84	92 36	123 123	124 49	165 165	158 64	182 198	170 80	195 212	181 98	208 226	181 118	208 226	190 140	218 237	195 163	224 243	195 188	224 243
30'		69 69	76 30	101 101	102 41	136 136	132 53	170 177	158 66	182 198	169 82	194 211	169 98	194 211	177 116	204 222	182 136	209 227	182 157	209 227
32'		57 57		84 84	85 34	114 114	111 44	148 148	139 55	168 183	158 68	182 198	158 82	182 198	166 98	191 208	170 114	196 213	170 132	196 213
34'		48 48		70 70	71 28	95 95	93 37	124 124	118 47	149 157	142 58	164 178	149 70	171 186	156 83	180 196	160 97	184 201	160 112	184 201
36'		41 41		60 60		81 81	79 31	106 106	100 40	133 133	123 49	146 159	139 59	160 173	148 71	170 185	151 83	174 189	151 96	174 189
38'		35 35		51 51		69 69		90 90	86 34	114 114	106 42	131 141	124 51	143 156	135 61	155 169	143 71	165 179	143 83	165 179
40'		30 30		44 44		60 60		78 78	74 29	99 99	92 36	118 122	111 44	129 141	122 53	140 152	131 62	151 164	136 72	157 171
42'				38 38		52 52		68 68		86 86	80 32	106 106	97 38	117 127	110 46	127 138	119 54	137 149	127 63	146 159

LOAD TABLES

Red-I90HS™ Joist Allowable Uniform Load (PLF)

Span	Depth																					
	11⅞"		14"		16"		18"		20"		22"		24"		26"		28"		30"		32"	
	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL	100% TL / 100% LL	115% TL / 125% TL
14'	327 / 263	376 / 409	362 / *	416 / 452	393 / *	452 / 492	426 / *	490 / 532	458 / *	527 / 573	490 / *	564 / 613	494 / *	568 / 617	494 / *	568 / 617	494 / *	568 / 617	494 / *	568 / 617	494 / *	568 / 617
16'	287 / 186	330 / 358	317 / 265	364 / 396	345 / *	396 / 431	373 / *	429 / 467	402 / *	462 / 502	429 / *	494 / 537	432 / *	497 / 541	432 / *	497 / 541	432 / *	497 / 541	432 / *	497 / 541	432 / *	497 / 541
18'	255 / 121	293 / 319	282 / 175	324 / 352	307 / 232	353 / 383	332 / 295	382 / 415	357 / *	411 / 447	382 / *	439 / 478	385 / *	443 / 481	385 / *	443 / 481	385 / *	443 / 481	385 / *	443 / 481	385 / *	443 / 481
20'	209 / 83	264 / 278	254 / 121	292 / 317	276 / 161	318 / 345	299 / 207	344 / 374	322 / 256	370 / 402	344 / 310	396 / 430	347 / *	399 / 433	347 / *	399 / 433	347 / *	399 / 433	347 / *	399 / 433	347 / *	399 / 433
22'	161 / 64	215 / 215	231 / 94	266 / 289	251 / 126	289 / 314	272 / 162	313 / 340	293 / 202	337 / 366	313 / 245	360 / 391	315 / 292	363 / 394	315 / *	363 / 394	315 / *	363 / 394	315 / *	363 / 394	315 / *	363 / 394
24'	127 / 50	169 / 169	185 / 74	244 / 247	230 / 100	265 / 288	249 / 129	287 / 312	268 / 161	309 / 336	287 / 197	330 / 359	289 / 235	333 / 362	289 / 276	333 / 362	289 / *	333 / 362	289 / *	333 / 362	289 / *	333 / 362
26'	101 / 40	135 / 135	149 / 59	199 / 199	201 / 80	245 / 266	230 / 104	265 / 288	248 / 131	285 / 310	265 / 160	305 / 332	267 / 192	307 / 334	267 / 226	307 / 334	267 / 262	307 / 334	267 / *	307 / 334	267 / *	307 / 334
28'	82 / 32	109 / 109	121 / 48	162 / 162	164 / 65	219 / 219	214 / 85	246 / 268	230 / 107	265 / 288	246 / 132	283 / 308	248 / 158	285 / 310	248 / 187	285 / 310	248 / 217	285 / 310	248 / *	285 / 310	248 / *	285 / 310
30'		90 / 90	100 / 40	133 / 133	136 / 54	181 / 181	177 / 70	230 / 236	215 / 89	247 / 269	230 / 109	264 / 287	232 / 132	266 / 290	232 / 156	266 / 290	232 / 182	266 / 290	232 / 210	266 / 290	232 / *	266 / 290
32'		75 / 75	83 / 33	111 / 111	113 / 45	151 / 151	148 / 59	197 / 197	187 / 75	232 / 250	216 / 92	248 / 270	217 / 111	250 / 272	217 / 131	250 / 272	217 / 154	250 / 272	217 / 177	250 / 272	217 / 203	250 / 272
34'		63 / 63	70 / 28	93 / 93	95 / 38	127 / 127	125 / 50	167 / 167	158 / 63	211 / 211	195 / 78	233 / 254	204 / 94	235 / 256	204 / 112	235 / 256	204 / 131	235 / 256	204 / 151	235 / 256	204 / 173	235 / 256
36'		53 / 53		79 / 79	81 / 32	108 / 108	106 / 42	142 / 142	135 / 54	180 / 180	167 / 66	220 / 222	193 / 80	222 / 241	193 / 96	222 / 241	193 / 112	222 / 241	193 / 130	222 / 241	193 / 149	222 / 241
38'		45 / 45		68 / 68		93 / 93	91 / 36	122 / 122	116 / 46	155 / 155	143 / 57	191 / 191	174 / 69	210 / 229	183 / 82	210 / 229	183 / 97	210 / 229	183 / 112	210 / 229	183 / 129	210 / 229
40'		39 / 39		58 / 58		80 / 80	79 / 31	105 / 105	100 / 40	134 / 134	124 / 49	166 / 166	151 / 60	198 / 201	174 / 71	200 / 217	174 / 84	200 / 217	174 / 98	200 / 217	174 / 112	200 / 217
42'		34 / 34		51 / 51		70 / 70		91 / 91	87 / 35	116 / 116	108 / 43	144 / 144	131 / 52	175 / 175	157 / 62	190 / 207	166 / 73	190 / 207	166 / 85	190 / 207	166 / 98	190 / 207
44'		29 / 29		44 / 44		61 / 61		80 / 80	76 / 30	102 / 102	95 / 38	126 / 126	115 / 46	154 / 154	138 / 55	177 / 184	158 / 64	182 / 198	158 / 75	182 / 198	158 / 86	182 / 198
46'				39 / 39		53 / 53		70 / 70		90 / 90	83 / 33	111 / 111	101 / 40	135 / 135	121 / 48	162 / 162	143 / 57	174 / 189	151 / 66	174 / 189	151 / 76	174 / 189
48'				34 / 34		47 / 47		62 / 62		79 / 79	74 / 29	99 / 99	90 / 36	120 / 120	108 / 43	144 / 144	127 / 50	161 / 169	145 / 59	167 / 181	145 / 68	167 / 181
50'				30 / 30		42 / 42		55 / 55		70 / 70		88 / 88	80 / 32	107 / 107	96 / 38	128 / 128	113 / 45	148 / 151	132 / 52	159 / 173	139 / 60	160 / 174

Table Footnotes

* Indicates total load (TL) value controls.

• Red numbers refer to 115% total load (TL).

See Load Table Instructions and General Notes on page 6.

8' ON-CENTER ROOF SPAN TABLE

Red-I90HS™ Joist, 8' On-Center Roof Span

Red-I90HS™ Joist Depth	12 PSF Dead Load	14 PSF Dead Load	16 PSF Dead Load
16"	27'- 0"	26'- 0"	24'- 5"
18"	29'- 9"	28'- 5"	26'- 7"
20"	32'- 7"	31'- 0"	28'- 11"
22"	35'- 3"	33'- 7"	31'- 4"
24"	38'- 0"	36'- 3"	33'- 9"
26"	40'- 2"	38'- 9"	36'- 3"
28"	41'- 11"	40'- 4"	37'- 10"
30"	43'- 7"	42'- 0"	39'- 0"
32"	45'- 3"	***42'- 2"***	***39'- 0"***

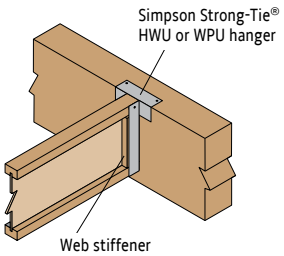


Table is based on:

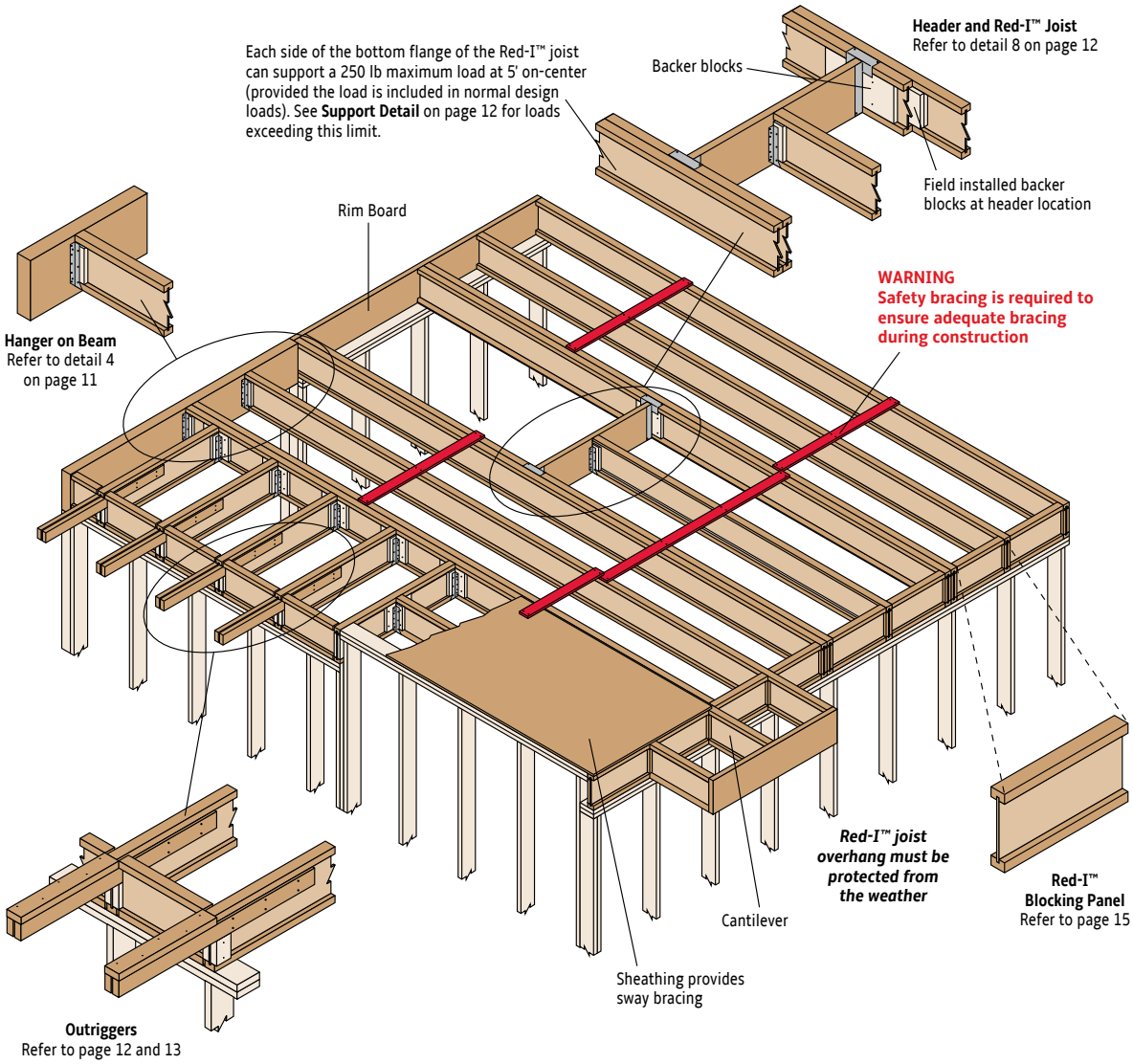
- Uniformly loaded, simple-span joists
- Red-I™ joists spaced at 8' on-center
- Spans limited by total load deflection of L/180
- Spans reflect 125% duration of load adjustment
- Roof live load of 20 psf with live load reductions applied per 2012 IBC Section 1607.12.2
- Roof slopes of ¼" per foot

General Notes

- Span is defined as horizontal clear distance between inside face of beam/wall supports.
- Reaction based on 3" minimum bearing length and web stiffeners. See web stiffener information on page 16.
- ***Bold italic*** numbers indicate span may be increased by one foot when HWU hanger is used.
- Fill all nail holes in hanger. Use 10d (3") common nails into joists and 16d (3½") common nails into header.

FLOOR DETAILS

Typical Floor System



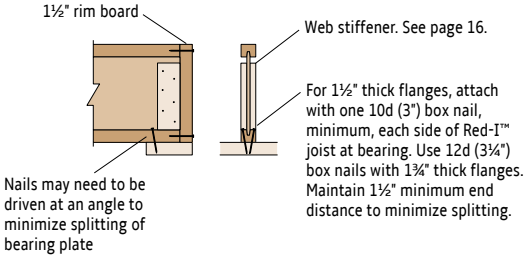
General Notes

- Details shown on pages 10–14 are conceptual. Attachments and connections shall be made to the supporting structure in accordance with the specific design requirements.
- Rim board or Red-I™ blocking panels (or an equivalent alternative) must always be used to prevent rollover and to provide structural attachment of the deck sheathing to the supporting structure in accordance with the specific design requirements.

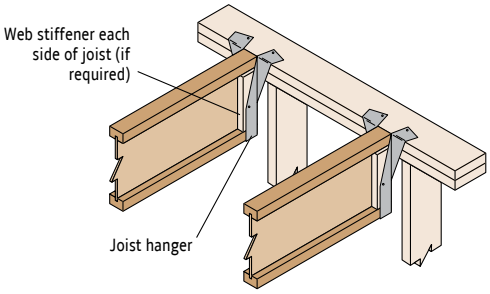
See Red-I™ Joist Installation Guide (available online at www.RedBuilt.com) for additional installation guidelines.

FLOOR DETAILS

1 Nailing Red-I™ Joist to Bearing Plate

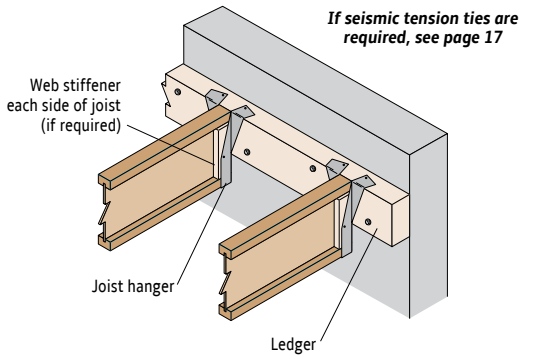


2 Hanger on Stud Wall

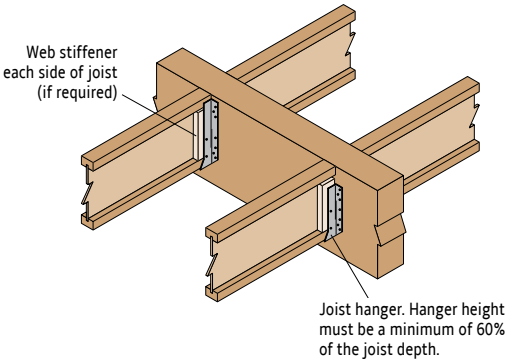


The potential for top plate rotation may reduce hanger capacities. Contact RedBuilt for assistance.

3 Hanger on Ledger

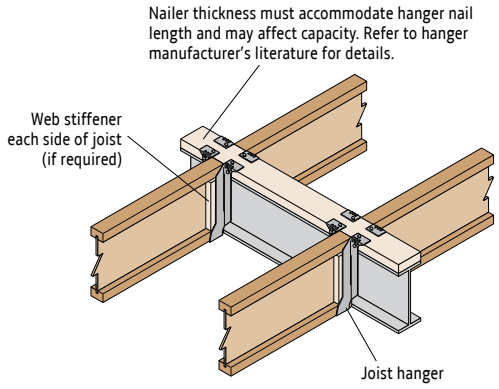


4 Hanger on Beam

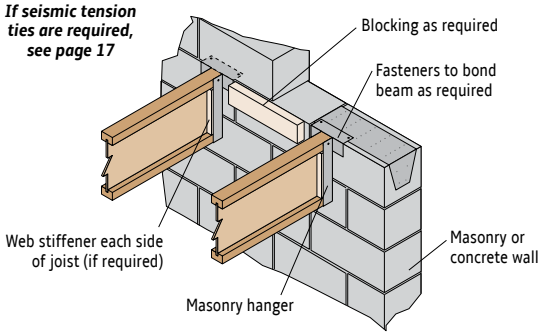


Web stiffeners are required if the sides of the hanger do not laterally support at least ⅜" of the Red-I™ joist top flange.

5 Hanger on Steel Beam



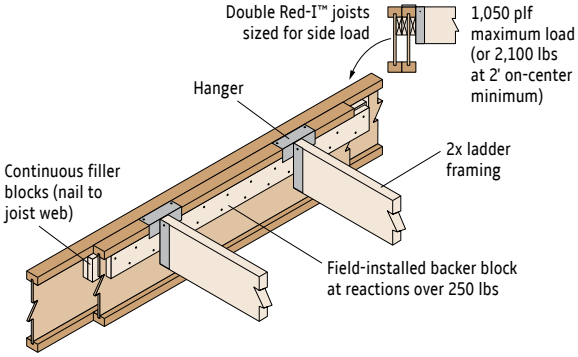
6 Hanger on Masonry Wall



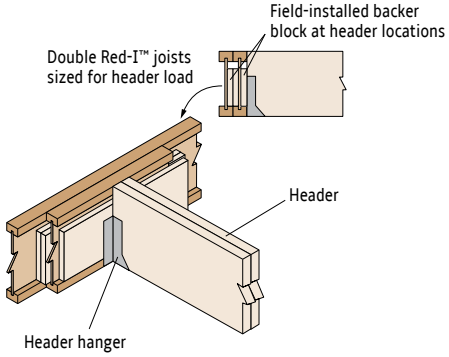
Traditional masonry hangers will not support construction loads without a minimum amount of cured masonry construction above hanger level. Refer to hanger manufacturer's literature for information on the correct installation and use of masonry hangers.

FLOOR DETAILS

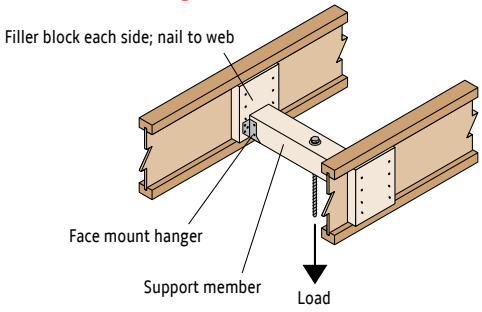
7 Side-Loaded Double Joist
(Ladder Framing)



8 Side-Loaded Double Joist
(Header Location)



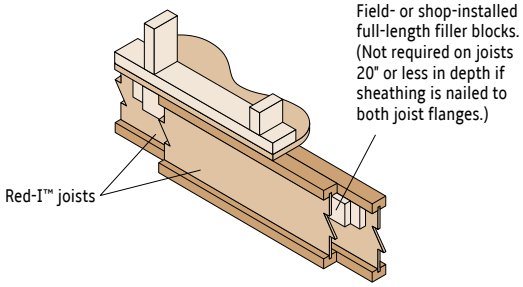
9 Support Detail
(For Loads Exceeding 250 lbs)



Each side of the bottom flange of the Red-I™ joist can support a 250 lb maximum load at 5' on-center (provided the load is included in normal design loads). Use the detail above for loads exceeding this limit.

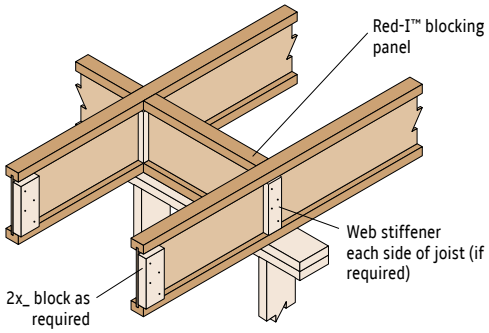
For additional information on supporting hanging loads and sprinkler systems, see the RedBuilt Sprinkler System Installation Guide (available online at www.RedBuilt.com).

10 Top-Loaded Double Joist



CANTILEVERS AND OUTRIGGERS

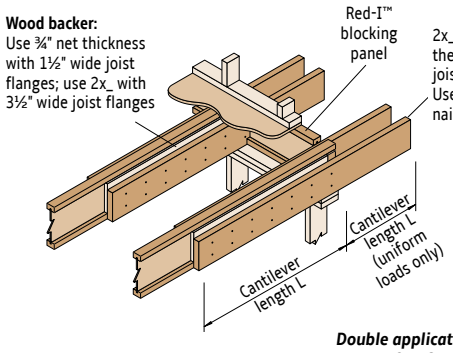
11 Red-I™ Joist Cantilever



Red-I™ joists are intended for dry-use applications.

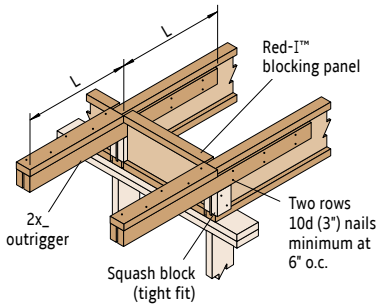
CANTILEVERS AND OUTRIGGERS

12a Cantilevers (Field Assembled Only)



Red-I™ joists and cantilevers/outriggers are intended for dry-use applications.

12b Outriggers (Available as Plant Assembled)



Double application shown in detail 12. Single application is similar. See General Notes below regarding allowable loads.

Double 2x_ Cantilever/Outrigger — Allowable Uniform Loads (PLF)

Cantilever/ Outrigger Length L	Solid Sawn Lumber														
	Two 2x4			Two 2x6			Two 2x8			Two 2x10			Two 2x12		
	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof
24"	342	393	427	393	451	491	393	451	491	393	451	491	393	451	491
30"	219	251	273	384	441	***480***	384	441	***480***	384	441	***480***	384	441	***480***
36"	152	174	189	323	371	***403***	***378***	***435***	***473***	***378***	***435***	***473***	***378***	***435***	***473***
42"	111	128	139	237	272	295	***374***	***430***	***467***	***374***	***430***	***467***	***374***	***430***	***467***
48"	77	97	106	181	208	225	289	***330***	***358***	***371***	***426***	***463***	***371***	***426***	***463***
54"	54	77	83	143	163	177	227	260	***281***	***337***	***384***	***414***	***368***	***424***	***460***
60"		62	63	115	132	143	183	209	227	***271***	***308***	***332***	***362***	***410***	***441***
66"			47	95	109	118	151	172	186	***222***	***252***	***271***	***296***	***335***	***359***
72"				79	91	99	126	144	156	186	***210***	***226***	***246***	***277***	***295***
78"				68	77	84	107	122	132	157	178	***190***	***207***	***232***	***246***
84"				56	66	72	92	105	113	135	152	162	***177***	***197***	***208***
90"					57	62	80	91	97	116	131	139	153	***169***	***178***
96"					50	54	70	79	85	102	114	121	133	146	***153***

Cantilever/ Outrigger Length L	RedLam™ LVL														
	Two 2x4			Two 2x6			Two 2x8			Two 2x10			Two 2x12		
	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof	Floor	Snow Roof	Non-Snow Roof
24"	393	451	491	393	451	491	393	451	491	393	451	491	393	451	491
30"	292	441	***467***	384	441	***480***	384	441	***480***	384	441	***480***	384	441	***480***
36"	173	277	277	***378***	***435***	***473***	***378***	***435***	***473***	***378***	***435***	***473***	***378***	***435***	***473***
42"	110	177	177	***374***	***430***	***467***	***374***	***430***	***467***	***374***	***430***	***467***	***374***	***430***	***467***
48"	74	119	119	***277***	***417***	***444***	***371***	***426***	***463***	***371***	***426***	***463***	***371***	***426***	***463***
54"	53	84	84	***198***	***317***	***317***	***368***	***424***	***460***	***368***	***424***	***460***	***368***	***424***	***460***
60"		62	62	146	***233***	***233***	***322***	***421***	***456***	***366***	***421***	***458***	***366***	***421***	***458***
66"		46	46	110	177	***177***	***246***	***348***	***371***	***365***	***419***	***456***	***365***	***419***	***456***
72"		36	36	85	137	137	***191***	***288***	***306***	***363***	***410***	***425***	***363***	***418***	***454***
78"				67	108	108	***152***	***242***	***243***	***306***	***339***	***350***	***362***	***417***	***425***
84"				54	87	87	***122***	***196***	***196***	***247***	***283***	***291***	***334***	***346***	***351***
90"					71	71	100	***160***	***160***	***203***	***238***	***244***	***281***	***289***	***293***
96"					58	58	83	***132***	***132***	***168***	***202***	***206***	***238***	***245***	***247***

Table is based on:

Solid Sawn

F_v = 175 psi
F_b = 900 psi[(1)]
E = 1.6 x 10^6 psi

RedLam™ LVL

F_v = 285 psi
F_b = 2140 psi[(2)]
E = 1.6 x 10^6 psi

Cantilever/Outrigger Deflection

- 2L/480 at floor live load (live load = 0.80 x total load)
- 2L/240 at roof total load

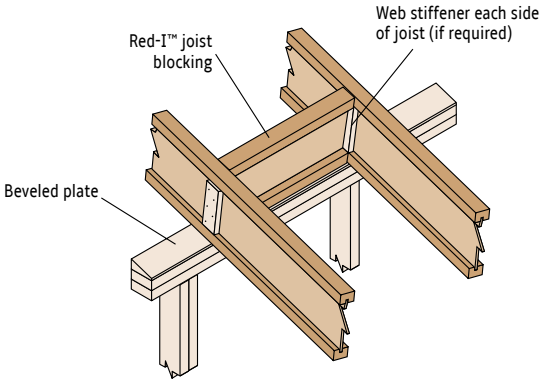
General Notes

- ***Bold Italic*** cells indicate a single 2x can be used; use half of the allowable load shown for double 2x members. For all other cells single 2x members are not permitted.
- Members have been evaluated for 300 lb. point load.

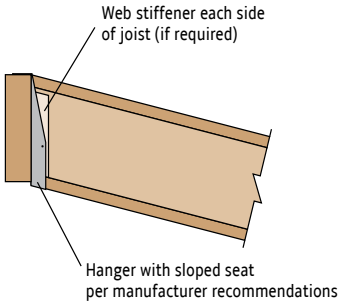
(1) Size Factor, C_F, per NDS® Table 4A may be applied
(2) For 12" depth; for other depths, multiply by $(12/d)^{0.136}$

ROOF DETAILS

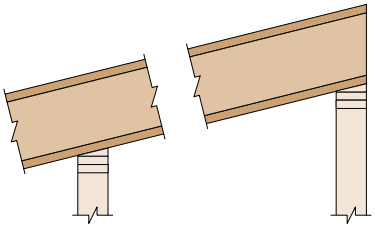
13 Slope Detail



14 Slope Detail at High End

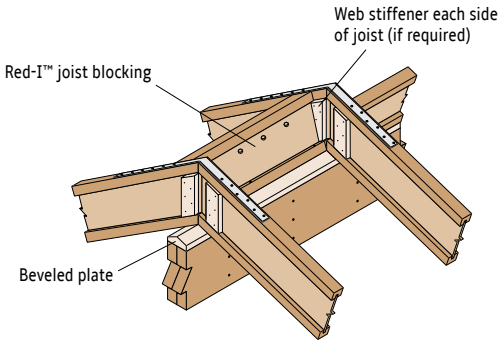


15 Beveled Plate Requirements



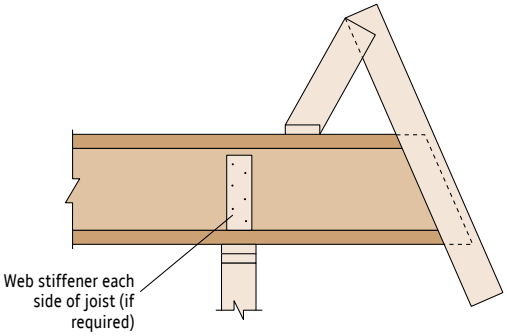
Required Bearing Length	Maximum Slope Without Beveled Plate
1¾"	½" in 12"
3½"	¼" in 12"
5½"	⅛" in 12"

16 Ridge Detail

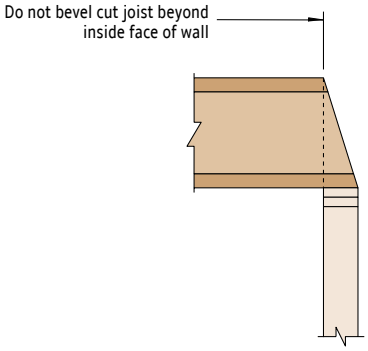


A strap and alternating blocking panels, or two rows of blocking panels, are required for lateral stability.

17 Cantilever with Mansard Framing



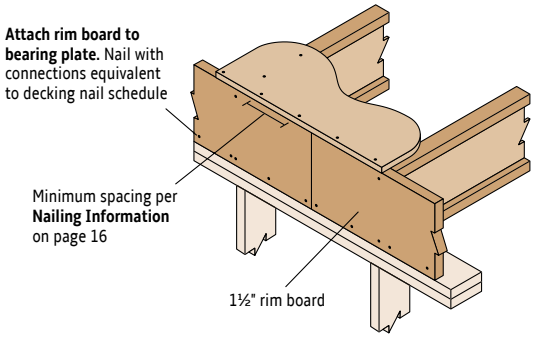
18 Bevel Cut or Fire Cut



RIM BOARD

Rim board (up to 24" in depth) is available from RedBuilt and may be used for:

- Shear transfer (nailing must be established by design).
- Vertical load transfer.
- General closure.
- Helping to prevent rollover during joist installation.



RED-I™ BLOCKING PANELS

Red-I™ blocking panels are available from RedBuilt and may be used for:

- Vertical load transfer.
- General closure.
- Helping to prevent rollover during joist installation.
- Shear transfer (nailing must be established by design).

  Shear transfer capacity for each joist is:
  1,785 plf for Red-I45™ joists;
  2,255 plf for Red-I65™ and Red-I90™ joists;
  2,300 plf for Red-I90H™ joists;
  2,320 plf for Red-I90HS™ joists.

When Red-I™ blocking panels are used for vertical load transfer, values shown in the following table may be used:

Allowable Uniform Vertical Load Transfer (PLF)

Red-I™ Joist Series	Red-I™ Blocking Panel Depth				
I45	9½"	11⅞"–14"	16"	–	–
	2,100	2,100	2,100	–	–
I65, I90, I90H and I90HS	9½"	11⅞"–14"	16"–20"	22"–24"	26"–30"
	–	3,050	2,450	1,850	1,200

- Loads are for Red-I™ blocking panels or Red-I™ joists as rim board.
- Loads shown may not be increased for duration of load.

Concentrated Vertical Loads

The allowable concentrated vertical loads on Red-I™ blocking panels or rim joist can be determined by using the equation provided below. Loads exceeding the calculated value should be supported by squash blocks.

$$P_{allow} = W_{allow}\left[\frac{L_c + 2t_s + 2t_f}{12}\right]$$

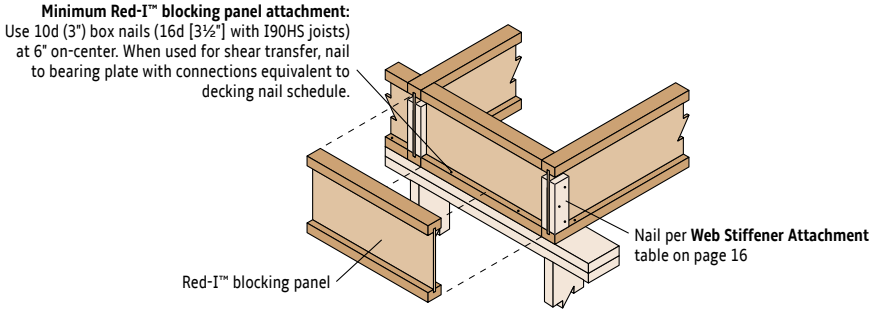
Where:

P_{allow} = Allowable concentrated vertical load (lbs)
W_{allow} = Allowable uniform vertical load for blocking panel (plf)
L_c = Bearing length of column on blocking panel (in.)
t_s = Sheathing thickness (in.)
t_f = Effective flange thickness:
⅞" for Red-I45™, Red-I65™ and Red-I90™ joists;
1⅛" for Red-I90H™ joists;
1¼" for Red-I90HS™ joists

Example Calculation

4x4 post applied to 20" Red-I65™ joist through $^{23}/_{32}$" sheathing.

$$P_{allow} = 2{,}450\left[\frac{3.5 + 2(^{23}/_{32}) + 2(^{7}/_{8})}{12}\right] = 1{,}365 \text{ lbs}$$



WEB STIFFENERS

The Importance of Web Stiffeners

Web stiffeners are available from RedBuilt in pre-cut sizes and can be installed at the plant on one or both ends upon request. Web stiffeners are an important part of almost all Red-I™ joist installations because they will:

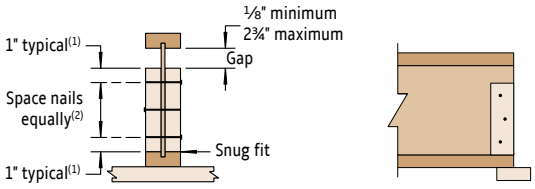
- Stiffen the Red-I™ joist web material and prevent buckling.
- Minimize the bearing length required for the Red-I™ joist.
- Help transfer reaction loads into the Red-I™ joist web.
- Provide stabilization in hangers.

Proper Installation Ensures System Performance

- Web stiffeners must be installed at bearing points as shown in the details below and at points of concentrated loads exceeding 1,500 lbs.
- Web stiffeners are required on joists 20" and greater in depth.
- Web stiffeners are available from RedBuilt and typically have the maximum gap shown below. Verify that hanger nails adequately engage the web stiffener.
- Gap must be at top for all bearing conditions. For concentrated loads, the gap must be at the bottom (see details below).

Web Stiffener Attachment — Nail Quantities

Joist Depth	Red-I45™	Red-I65™	Red-I90™ and Red-I90H™		Red-I90HS™
	8d (0.113" x 2½") Nails		16d (0.135" x 3½") Nails		
	End or Intermediate	End or Intermediate	End	Intermediate	End or Intermediate
9½"	3	–	–	–	–
11⅞"	3	3	3	3	4
14"	3	5	3	3	6
16"	3	6	4	4	6
18"	–	7	4	4	8
20"	–	8	5	5	10
22"	–	9	6	11	10
24"	–	10	6	13	12
26"	–	11	7	14	14
28"	–	12	8	15	14
30"	–	13	8	17	16
32"	–	–	–	–	18



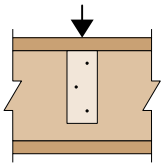
(1) 1½" (typical) with 2x4 solid sawn lumber web stiffeners.
(2) Nails may be driven from one side only.

Web Stiffener Size and Material

Flange Width	Minimum Web Stiffener Size	Web Stiffener Material
1¾"	⅝" x 2⁵⁄₁₆"	Sheathing (with face grain vertical) that meets the requirements of PS1 or PS2
2½"	1" x 2⁵⁄₁₆"	Sheathing (with face grain vertical) that meets the requirements of PS1 or PS2
3½"	2x4	Construction grade or better

Concentrated Load (No Bearing Wall Below)

If concentrated loads from above exceed 1,500 lbs, install web stiffeners tight to Red-I™ joist top flange. See tables at left for nailing and material requirements.



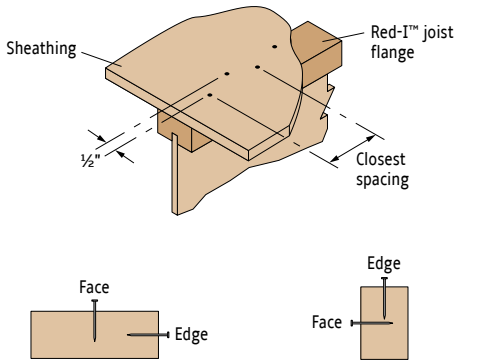
NAILING INFORMATION

Minimum Nail Spacing

Nail Type		Nail Size	RedLam™ LVL			Sawn Lumber	
			Face	Edge		Face	Edge
				Joist Flange	Rim Board, Header, Beam		
8d(1)	Box	0.113" x 2½"	2"	4"	3"	4"	2"
	Common	0.131" x 2½"	2"	6"	3"	6"	2"
10d	Box	0.128" x 3"	2"	6"	3"	6"	2"
	Common	0.148" x 3"	3"	6"	4"	6"	2½"
12d	Box	0.128" x 3¼"	2"	6"	3"	6"	2"
	Common	0.148" x 3¼"	3"	6"	4"	6"	2½"
16d	Box	0.135" x 3½"	3"	6"	4"	6"	2½"
	Sinker	0.148" x 3¼"	3"	6"	4"	6"	2½"
	Common	0.162" x 3½"	4"	8"	8"	8"	4"

(1) 14 gauge staples may be a direct substitute for 8d nails if a minimum penetration of 1" into the flange is maintained.

- If more than one row of nails is used, offset rows at least ½" and stagger. Use 10d (3") common nails, maximum, and maintain ⅜" minimum edge distance. **Exception: Wind/Seismic Connections** (see page 17).
- Nailing pattern to be per plans and specifications, and nail spacing should comply with criteria listed on this page.
- For member stability, nail sheathing to the full length of the member (24" on-center, maximum).



Flatwise orientation
(typical with Red-I™ joists and plywood edge blocking)

Edgewise orientation
(typical with rim board, beams, and headers)

WIND OR SEISMIC CONNECTIONS

Strap Tension Tie Nailing and Capacities—Allowable Tension Loads*

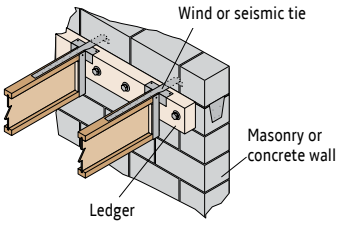
Design Category	Maximum Ledger Size	Model No.	Strap Length	Embed. Length, l_e		Non-Cracked Concrete			Cracked Concrete			CMU Wall			Max. Allowable Strap Tensile Capacity (lbs)
				Concrete	CMU	Nail Qty.	Nail Size	Tension (lbs)	Nail Qty.	Nail Size	Tension (lbs)	Nail Qty.	Nail Size	Tension (lbs)	
Wind and SDC A–B	4x	PAI18	18½"	4"	6"	9	10d x 1½"	1,820	9	10d x 1½"	1,820	9	10d x 1½"	1,055	NA
		PAI23	23¾"	4"	6"	14	10d x 1½"	2,835	12	10d x 1½"	2,360	14	10d x 1½"	1,805	NA
		PAI28	29"	4"	6"	16	10d x 1½"	3,370	12	10d x 1½"	2,360	16	10d x 1½"	2,705	NA
		PAI35	35"	4"	6"	18	10d x 1½"	3,370	12	10d x 1½"	2,360	18	10d x 1½"	2,815	NA
		MPAI32	32"	5½"	5½"	16	10d x 1½"	2,355	–	–	–	16	10d x 1½"	2,355	–
		MPAI44	44"	5½"	5½"	24	10d x 1½"	2,865	–	–	–	24	10d x 1½"	2,865	–
SDC C–F	4x	PAI18	18½"	4"	6"	9	10d x 1½"	1,820	9	10d x 1½"	1,820	9	10d x 1½"	1,055	4,180
		PAI23	23¾"	4"	6"	14	10d x 1½"	2,830	10	10d x 1½"	1,980	14	10d x 1½"	1,805	4,180
		PAI28	29"	4"	6"	20	10d x 1½"	2,830	10	10d x 1½"	1,980	16	10d x 1½"	2,705	5,070
		PAI35	35"	4"	6"	26	10d x 1½"	2,830	10	10d x 1½"	1,980	18	10d x 1½"	2,815	5,070
		MPAI32	32"	5½"	5½"	–	–	–	–	–	–	16	10d x 1½"	2,355	–
		MPAI44	44"	5½"	5½"	–	–	–	–	–	–	24	10d x 1½"	2,865	–

- Allowable loads have been increased for earthquake or wind load durations with no further increases allowed.
- Deflection at highest allowable loads for standard installation are as follows: PAI18 = 0.10", PAI23 = 0.158", PAI28 = 0.167", and PAI35 = 0.13".
- Multiply seismic and wind ASD load values by 1.4 or 1.6, respectively, to obtain LRFD capacities.
- Minimum center-to-center spacing is three times the required embedment for PA/HPA's acting in tension simultaneously, where l_e = embedment depth. Standard installation is based on minmum 5" end distance.
- For wall anchorage systems in SDC C–F, the maximum allowable strap tensile capacity shall not be less than 1.4 times the ASD anchor design load.
- Nail quantities are based on Douglas fir (DF) or equivalent specific gravity of 0.50 or better. For use on spruce-pine-fir (SPF) or hem fir (HF), nail quantities must be increased by 1.15 to achieve allowable loads.
- Structural composite lumber beams have sides that show either the wide face or the lumber strands/veneers. Values in tables reflect installation in the wide face.
- Concrete shall have a minimum concrete strength (f'_c) of 3,000 psi. Minimum f'_m is 1,500 psi for masonry.
- Use 10d x 1½" nails when installing directly to framing. When installing over wood structural panel sheathing, use 2⅛" minimum nail lengths for ½" nominal sheathing.
- **Nails:** 10d nails = 0.148" diameter by 3" long; 10d x 1½" nails = 0.148" diameter by 1½" long.
- MPAI straps require 3½" flanges, PAI straps require 2½" flanges.
- See hanger manufacturer for installation information.

* Information adapted from Simpson Strong-Tie® catalog Wood Construction Connectors 2013-2014, p.127.

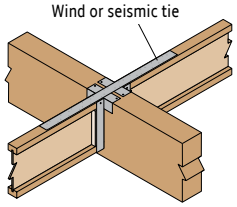
19 Wall Tension Tie With Straps

For 2½" or wider Red-I™ joists.



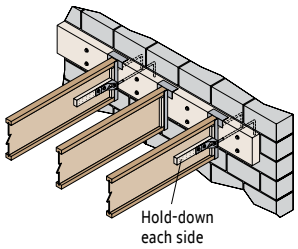
20 Wind or Seismic Tie at Butting Joists

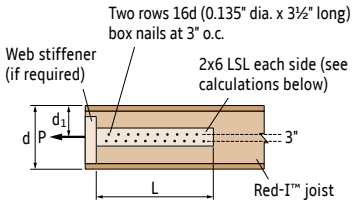
Tension straps must have a minimum nail spacing of 3" on-center per row, with a minimum of ⅜" between rows and maximum nail diameter of 0.148" (10d common).



See strap manufacturer's literature for allowable loads.

21 Wall Tension Tie — HD Connections





To calculate the length of the LSL block (to transfer shear to joist flange):

1. Find $L_1 = \left[\frac{0.75\,(KP)d_1}{C_D V_A - [V_{DL} + (0.75V_{LL})]}\right]$
2. Find $L_2 = ⅔\,(n) + 3$, where $n = \frac{P}{V_n C_D}$
3. Compare L_1 and L_2. Use maximum of the two values for the length of the the LSL block.

C_D = Load duration factor
d_1 = Distance to axial load (in.) from top of joist
L_1, L_2 = Length of block (in.)
K = 0.6 for wind; 0.7 for seismic (accounts for strength-based load)
n = Number of nails
P = Axial load (lbs)
V_A = Allowable shear load (lbs) for Red-I™ joist (see page 5)
V_{DL} = Shear load due to gravity dead load (lbs)
V_{LL} = Shear load due to gravity live load (lbs)
V_n = Nail shear capacity; see table below

16d Nail Shear Capacity

Red-I™ Web Thickness	V_n (100%) in lbs
⅜"	107
7/16"	124
½"	142

FIRE AND SOUND

Fire Assembly Details

For Fire Assemblies and other construction-related fire information, please refer to resources on our website at www.RedBuilt.com.

Sound Assemblies and Noise Measurement

The ability of a wall or floor/ceiling system to reduce airborne sound transmission is measured using ASTM E90, and reported using the ASTM E413 Sound Transmission Class (STC) rating system. The ratings listed below—originally developed by the Acoustical and Insulation Materials Association and now considered a standard throughout the industry—are a practical reference for a range of STC numbers. In general, the higher the number, the better the acoustical performance. It is important to note that this table is valid only for a given level of background noise and should be used only for generalized comparisons.

Floor/ceiling systems can also be rated for impact noise transmitted through an assembly. Ratings are determined using the ASTM E492 Impact Insulation Class (IIC) system, and like STC ratings, a high IIC rating indicates significantly reduced impact noise.

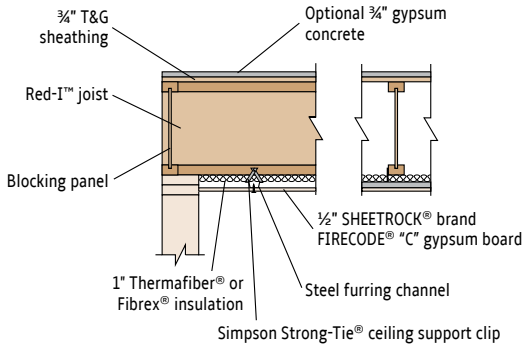
STC Ratings

25	Normal speech can be understood quite clearly
30	Loud speech can be understood fairly well
35	Loud speech audible but not intelligible
42	Loud speech audible as a murmur
45	Must strain to hear loud speech
48	Some loud speech barely audible
50	Loud speech not audible

Testing

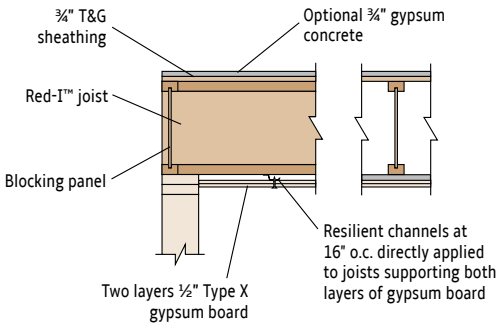
The acoustical assemblies provided below have been tested and rated by recognized acoustical laboratories, and the ratings shown are well within the acceptable range for multi-family buildings. However, in order to achieve these ratings, precautions should be taken to prevent flanking noise and sound leaks, and to ensure that actual construction conforms to the assembly shown.

22



Without Gypsum Concrete	With Gypsum Concrete
STC = 47	STC = 59
Pad and carpet IIC = 54	Pad and carpet IIC = 54
Cushioned vinyl IIC = 43	Cushioned vinyl IIC = 43

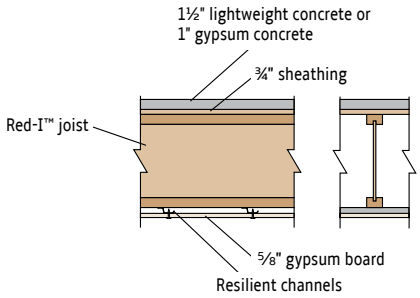
23



Without Gypsum Concrete	With Gypsum Concrete
STC = 50	STC = 58
Pad and carpet IIC = 60	Pad and carpet IIC = 54
Cushioned vinyl IIC = 45	Cushioned vinyl IIC = 46
Granit Acoustiflor® IIC = 51(1)	Granit Acoustiflor® IIC = 54(1)

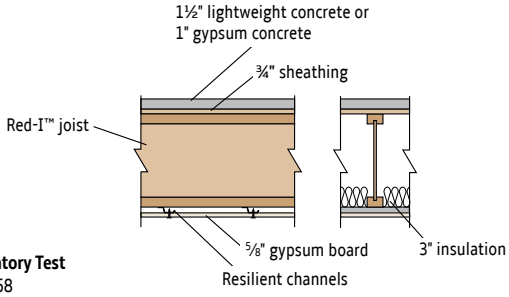
(1) Requires two layers of ⅝" Type X gypsum board with one layer of 3½" thick batt insulation.

24



Laboratory Test
STC = 57
G&H No. USDA-11xST

25



Laboratory Test
STC = 58
With pad and carpet IIC = 77
With vinyl tile IIC = 50
G&H No. USDA-11xST

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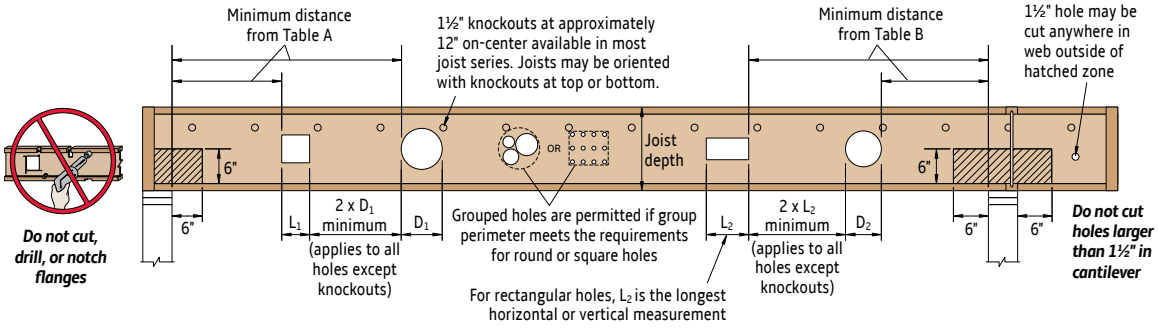
RED-I JOIST™ ALLOWABLE HOLES



Joist Depth	Joist Series	TABLE A: End Support or Simple Span — Minimum distance from edge of hole to inside face of nearest support										TABLE B: Intermediate or Cantilever Support — Minimum distance from edge of hole to inside face of nearest intermediate or cantilever support									
		Round Hole Size										Round Hole Size									
		2"	4"	6"	8"	10"	12"	14"	16"	18"	20"	2"	4"	6"	8"	10"	12"	14"	16"	18"	20"
		Square or Rectangular Hole Size										Square or Rectangular Hole Size									
		1.25"	2.5"	4"	5"	6"	7"	8.5"	9.5"	10.5"	13"	1.25"	2.5"	4"	5"	6"	7"	8.5"	9.5"	10.5"	13"
9½"	I45	1'-0"	***2'-6"***	***4'-0"***	–	–	–	–	–	–	–	1'-0"	***2'-6"***	***5'-0"***	–	–	–	–	–	–	–
	I65	1'-6"	***3'-0"***	***5'-0"***	–	–	–	–	–	–	–	1'-6"	***4'-0"***	***6'-6"***	–	–	–	–	–	–	–
	I90	2'-0"	3'-6"	***5'-6"***	–	–	–	–	–	–	–	3'-0"	5'-6"	***8'-0"***	–	–	–	–	–	–	–
11⅞"	I45	1'-0"	2'-0"	***3'-6"***	***5'-0"***	–	–	–	–	–	–	1'-0"	***2'-0"***	***4'-0"***	***6'-6"***	–	–	–	–	–	–
	I65	1'-6"	3'-0"	***4'-6"***	***6'-6"***	–	–	–	–	–	–	1'-0"	3'-0"	***5'-6"***	***8'-6"***	–	–	–	–	–	–
	I90 / I90H	1'-6"	3'-6"	5'-6"	***7'-0"***	–	–	–	–	–	–	2'-0"	4'-6"	7'-6"	***10'-0"***	–	–	–	–	–	–
	I90HS	2'-0"	4'-0"	6'-6"	–	–	–	–	–	–	–	3'-6"	6'-0"	9'-0"	–	–	–	–	–	–	–
14"	I45	1'-0"	2'-0"	3'-0"	***4'-0"***	***6'-0"***	–	–	–	–	–	1'-0"	1'-0"	3'-0"	***5'-0"***	***7'-6"***	–	–	–	–	–
	I65	1'-0"	2'-6"	4'-0"	***5'-6"***	***8'-0"***	–	–	–	–	–	1'-0"	1'-6"	4'-0"	***7'-0"***	***10'-6"***	–	–	–	–	–
	I90 / I90H	1'-0"	3'-0"	5'-0"	6'-6"	***9'-0"***	–	–	–	–	–	1'-0"	3'-6"	6'-0"	9'-0"	***12'-6"***	–	–	–	–	–
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	–	–	–	–	–	4'-0"	6'-6"	9'-0"	11'-6"	–	–	–	–	–	–
16"	I45 / I65	1'-0"	1'-6"	3'-0"	4'-0"	***5'-0"***	***8'-0"***	–	–	–	–	1'-0"	1'-0"	2'-0"	***4'-0"***	***6'-6"***	***10'-0"***	–	–	–	–
	I90 / I90H	1'-0"	2'-0"	4'-0"	6'-0"	8'-6"	***10'-6"***	–	–	–	–	1'-0"	1'-6"	4'-6"	8'-0"	11'-0"	***14'-6"***	–	–	–	–
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	–	–	–	–	–	3'-0"	6'-0"	8'-6"	11'-6"	14'-0"	–	–	–	–	–
18"	I45 / I65	1'-0"	1'-0"	2'-6"	3'-6"	4'-6"	***6'-0"***	***9'-0"***	–	–	–	1'-0"	1'-0"	1'-0"	2'-6"	***5'-0"***	***8'-0"***	***12'-0"***	–	–	–
	I90 / I90H	1'-0"	1'-0"	2'-6"	5'-0"	7'-0"	9'-6"	***12'-6"***	–	–	–	1'-0"	1'-0"	2'-6"	5'-6"	9'-0"	12'-6"	***17'-0"***	–	–	–
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	–	–	–	–	2'-6"	5'-6"	8'-0"	11'-0"	13'-6"	16'-6"	–	–	–	–
20"	I45 / I65	1'-0"	1'-0"	2'-0"	3'-0"	4'-0"	5'-0"	***7'-0"***	***10'-6"***	–	–	1'-0"	1'-0"	1'-0"	1'-0"	3'-6"	***6'-0"***	***9'-0"***	***13'-6"***	–	–
	I90 / I90H	1'-0"	1'-0"	2'-0"	4'-0"	6'-0"	8'-0"	11'-0"	***14'-0"***	–	–	1'-0"	1'-0"	1'-0"	3'-6"	7'-0"	10'-6"	14'-6"	***19'-6"***	–	–
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	9'-6"	11'-6"	14'-0"	–	–	–	2'-0"	5'-0"	7'-6"	10'-6"	13'-6"	16'-0"	19'-6"	–	–	–
22"	I65	1'-0"	1'-0"	1'-6"	2'-6"	3'-6"	4'-6"	5'-6"	7'-6"	***11'-6"***	–	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	4'-6"	7'-0"	10'-0"	***15'-0"***	–
	I90 / I90H	1'-0"	1'-0"	1'-0"	3'-0"	5'-0"	7'-0"	9'-0"	12'-6"	***16'-0"***	–	1'-0"	1'-0"	1'-6"	4'-0"	6'-6"	9'-6"	12'-0"	16'-0"	–	–
	I90HS	2'-0"	4'-0"	6'-0"	8'-0"	9'-6"	11'-6"	13'-6"	16'-0"	–	–	1'-0"	3'-0"	6'-0"	9'-0"	12'-6"	15'-6"	18'-6"	22'-0"	–	–
24"–26"	I65	1'-0"	1'-6"	2'-6"	3'-6"	4'-0"	5'-0"	6'-0"	7'-6"	***10'-0"***	–	1'-0"	1'-0"	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	10'-0"	***13'-6"***	–
	I90 / I90H	1'-0"	1'-0"	2'-0"	3'-6"	5'-0"	6'-6"	8'-6"	10'-6"	14'-6"	***18'-6"***	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	9'-0"	11'-0"	14'-0"	***18'-6"***	–
	I90HS	2'-0"	4'-0"	6'-0"	7'-6"	9'-6"	11'-6"	13'-6"	15'-0"	18'-0"	–	1'-6"	4'-0"	6'-6"	9'-0"	11'-6"	14'-0"	17'-0"	20'-0"	23'-0"	–
28"–32"	I65	1'-0"	2'-0"	2'-6"	3'-6"	4'-0"	5'-0"	6'-0"	7'-0"	8'-0"	10'-6"	1'-0"	1'-0"	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	9'-0"	11'-0"	***13'-6"***
	I90 / I90H	1'-0"	1'-6"	2'-6"	4'-0"	5'-6"	6'-6"	8'-0"	9'-6"	11'-6"	14'-6"	1'-6"	3'-0"	4'-6"	6'-0"	7'-6"	9'-0"	11'-0"	12'-6"	15'-6"	18'-6"
	I90HS	2'-0"	3'-6"	5'-0"	7'-0"	8'-6"	10'-0"	12'-0"	13'-6"	16'-0"	18'-6"	1'-0"	2'-6"	4'-6"	7'-0"	9'-6"	12'-0"	14'-6"	17'-0"	19'-6"	21'-6"

General Notes

- Tables are based on maximum allowable uniform loads. ***Bold italic*** cells indicate 2000 lb. concentrated load spread over two joists has not been considered. Use RedSpec™ software or contact your RedBuilt technical representative if concentrated load check is required.
- Holes may be located vertically anywhere in the web. Leave ⅛" of web (minimum) at top and bottom of hole. **DO NOT cut joist flanges.**
- **Do not cut holes in cantilever without consulting your RedBuilt representative.**
- Knockouts are located in web at approximately 12" on-center; they do not affect hole placement.
- Interpolation between holes sizes shown in the tables is allowed.

***WARNING:** Drilling, sawing, sanding or machining wood products generates wood dust, a substance known to the State of California to cause cancer.*

How to Use Tables A and B

1. Determine the hole shape and size. For rectangular holes, use the largest dimension. Sizes shown in the tables are hole sizes, not duct sizes.
2. Determine the Red-I™ joist series and depth.
3. Determine the type of support on each side of the hole. If the Red-I™ joist is continuous over a support, use both tables.
4. Find the table cell at the intersection of the Red-I™ joist and the hole.
5. The measurement shown is the minimum distance from the edge of the hole to the inside face of the support.
6. Maintain the minimum required distance from **both** supports.

For other hole sizes, hole locations, or loads, use RedSpec™ software or contact your RedBuilt technical representative.

DEFLECTION CRITERIA

RedBuilt™ Recommended Deflection Criteria

Full-scale tests have shown repeatedly that RedBuilt™ products have deflection characteristics that are consistently predictable by calculation, with minimal set after load withdrawal.

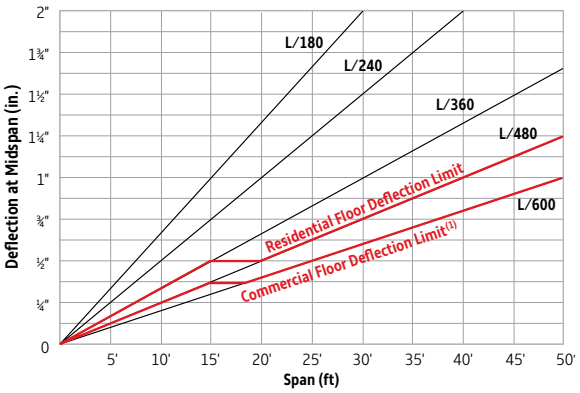
The graph below shows that the RedBuilt recommended deflection limit for residential and commercial floors is more restrictive than the minimum of L/360 required by building codes. The floor load portions of the tables shown on pages 7–9 were developed based on the **Commercial Floor Deflection Limit** shown in the graph.

Floors:

- Maximum deflection at live load limited as indicated below
- Movable partition loads need not be considered

Roofs:

- Sloped Roofs—¼" to 12" per foot, maximum deflection L/180 at total load
- Plaster Ceilings—Also check L/360 at live load



(1) For live load applications greater than 50 psf, check the L/600 deflection limit using a 50 psf live load, and check the code-prescribed deflection limit using the full live load.

Deflection criteria will vary by application. In a roof system, excessive deflection would be unsightly and could cause ceiling cracks and/or drainage problems. Floor systems, however, have entirely different—and usually much more restrictive—deflection requirements due to an occupant's perception of floor performance and feel.

Deflection Calculations

The deflection characteristics of Red-I™ joists can be closely approximated by analyzing beams using the EI values for flexural deflections shown in the **Design Properties** table on page 5. The EI values selected from the **Design Properties** table must be determined by application (i.e., for roof applications use the EI for joists; for floor applications use the EI for nailed panels or glue-nailed panels).

For uniformly loaded simple spans, the mid-span deflection (in inches) can be calculated as shown below:

Joist Series	Mid-span Deflection Calculation*
Red-I45™	$\Delta = \frac{22.5wL^4}{EI} + \frac{2.67wL^2}{d \times 10^5}$
Red-I65™, I90™, and I90H™	$\Delta = \frac{22.5wL^4}{EI} + \frac{2.26wL^2}{d \times 10^5}$
Red-I90HS™	$\Delta = \frac{22.5wL^4}{EI} + \frac{2.00wL^2}{d \times 10^5}$

* The second function is shear deflection.

Where:

w = Uniform load in plf
L = Span in feet
d = Depth of Red-I™ joist in inches
EI = Value from the proper column in the **Design Properties** table (page 5)

Example Calculation

Condition:

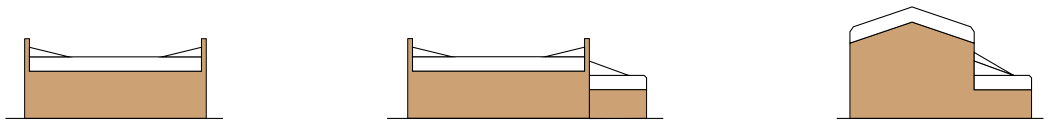
- 14" Red-I65™ floor joist
- Nailed floor sheathing
- 20' span floor
- 100 plf uniform load

$$\Delta = \frac{22.5 \times 100 \times 20^4}{752 \times 10^6} + \frac{2.26 \times 100 \times 20^2}{14 \times 10^5} = 0.54"$$

In this same example, if the deck was glue-nailed to the Red-I™ joists the deflection would reduce to:

$$\Delta = \frac{22.5 \times 100 \times 20^4}{821 \times 10^6} + \frac{2.26 \times 100 \times 20^2}{14 \times 10^5} = 0.50"$$

SNOWDRIFT LOADING



Wind direction, site exposure, and roof type and shape are some of the factors that can dramatically influence the accumulation of snow on a roof structure. ASCE 7 (*Minimum Design Loads for Buildings and Other Structures*) and the applicable building code, as well as other local state and regional codes, provide guidelines for calculating snowdrift loadings on all types of building construction.

Drifts usually occur at locations of discontinuity in a roof, such as at parapet walls, valleys, or where a high roof meets a low roof. Closer on-center spacing or additional support may be required at these locations.

The examples above illustrate potential snowdrift conditions. The project design professional is responsible for determining any additional loads due to snow drifting.

TECHNICAL SUPPORT AND ANALYSIS

Technical Support Organization and Functions

RedBuilt has four strategically located Design Centers staffed by professional engineers and designers. Their role is to provide technical support and service to our RedBuilt representatives, the professional design community, and the manufacturing plants. Design Center personnel have access to extensive test data, production standards, building code product acceptance criteria, and the most current computer design software.

The Design Centers work closely with our RedBuilt representatives and can provide the following services:

- Review and analysis of potential applications submitted by our RedBuilt representatives
- Drawings showing placement, bearing conditions, dimensions, and installation suggestions
- Custom design of the product
- Assistance in resolving field problems should they arise

This design guide contains technical data and design information frequently required by the design professional when using our products. Because of the variety of possible conditions, the design professional is strongly encouraged to request support from RedBuilt Design Centers through one of our representatives.

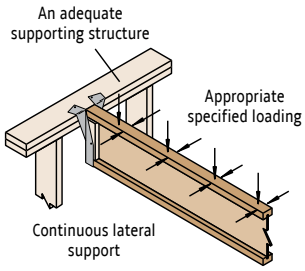
Product Application Assumptions

Our warranty is subject to an adequate supporting structure for our products. The design of the entire structure is not the role of RedBuilt, nor can we assume accountability for the full function of the roof or floor system. We can only be responsible for the internal design integrity of our own products, which are structural components of roof and floor systems that are necessarily designed by others.

Our warranty is also subject to continuous lateral support to the compression flange of our products unless specific design provisions account for other lateral support conditions. Continuous lateral support is provided by 8d (2½") nails at 24" on-center (minimum) for Red-I™ joists that are connected to an adequate diaphragm or total lateral strength system.

The magnitude, direction, and location of all design loads are as specified by the building designer. The review of this loading by our personnel is only for purposes of designing our product.

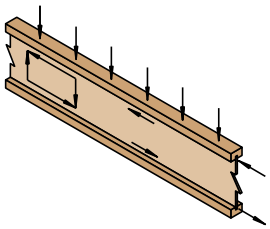
Other application assumptions are referenced on the terms and conditions of our purchase agreement contract.



Analysis Procedure—Red-I™ Joists

Using the allowable stresses found in our code approvals, Red-I™ joists are analyzed according to the procedures outlined in ASTM D5055. Bending capacity is determined using the net area of the flanges (rout area deducted) as sole flexural strength, while stiffness considers the contributions of the web material as well. Shear and reaction capacity have been established through product tests, and properties are routinely confirmed through ongoing quality-control testing. Local web buckling in high shear locations, as well as bearing load transfer to the web, may require reinforcement of the web (usually by use of web stiffeners). Web stiffener requirements and fastening details have been established by testing.

The composite nature of the Red-I™ joist results in multiple control mechanisms—all of which are accounted for in testing but are generally unrelated to the shear mechanics of solid joists and timbers. For this reason, ignoring loads near supports is not generally appropriate, and the basic design shear is the vertical shear at the face of the support. In some cases, web confinement and inelastic beam behavior are observed to cause increases in shear strength during testing of members that are continuous over a support. Deflection of Red-I™ joists is closely predicted through flexural and shear deflection analysis, using composite action with the sheathing for nailed or glue-nailed attachments.



Concentrated and Non-Uniform Loads

For the most efficient use of RedBuilt™ Commercial products resisting concentrated loads, non-uniform loads, and/or in conditions other than simple spans, consult your RedBuilt representative for precise sizing. As a general rule, extra members should be added to the system to carry concentrated loads such as bearing partitions, air conditioners, and other mechanical equipment. Handling concentrated loads in this manner usually provides the most economical system and also helps ensure more uniform deflection.

Q & A

Q1: What type of certification and quality assurance do Red-I™ joists have?

A1: RedBuilt™ Red-I™ joists are manufactured in accordance with rigorous standards and are monitored by a third party quality control agency (PFS® Corporation). These standards are documented in current evaluation reports in major model building codes, which are also referenced in this guide.

Q2: What types of adhesives are used in Red-I™ joists, and are they waterproof?

A2: Red-I™ joists are manufactured using waterproof, thermoset adhesives such as resorcinol and phenol formaldehyde. These adhesives meet the requirements of ASTM standard D2559.

Q3: What is the level of formaldehyde emissions from the adhesives in your Red-I™ joists?

A3: It is less than 0.10 parts per million (ppm).

Independent third-party testing[1][2] shows that products manufactured with these adhesives do not emit significant amounts of formaldehyde. When tested in accordance with the ASTM large-chamber test[3], the formaldehyde emissions of these products were below 0.10 ppm, which is below even the most stringent regulatory requirements. In many cases, emissions were so low that they could not be distinguished from background levels of formaldehyde in the fresh air used during testing[4].

Q4: Are tapered and cambered Red-I™ joists available?

A4: Yes. RedBuilt offers the Red-I65T™ series joist in a single slope, tapered profile to provide minimum roof slopes for drainage. For more details, refer to our *Tapered Joist Design Guide* (available at www.RedBuilt.com). A nominal camber can also be built into some Red-I™ joist products (see **Red-I™ Joist Descriptions** on page 4). Contact your RedBuilt representative for more information.

Q5: Do Red-I™ joists meet the requirements set forth in the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) standard?

A5: LEED – NC (new construction) is a commonly used building rating system designed to accelerate the development of green building practice. While products such as Red-I™ joists are not LEED certified on an individual basis, they may contribute to point totals for a "whole building" certification. For example, the following items may be viewed as contributors toward points in the LEED rating system:

- RedBuilt offers FSC credits for our Red-I™ joist products as well as other products we manufacture or distribute. Consult your local RedBuilt technical representative for availability.
- The **Low Emitting Materials** section (EQ 4.4) recognizes composite wood that is free from urea-formaldehyde resins. RedBuilt does not use urea-formaldehyde resins in any of its engineered lumber products. Material Safety Data Sheets (MSDS) are available at www.RedBuilt.com.
- RedBuilt™ products may qualify for Regional Materials (MR 5.1 & 5.2) for projects located within a 500 mile radius of Portland, OR.
- Hardware accessories to Red-I™ joists, such as Simpson Strong-Tie® hangers, may qualify for Recycled Content (RC 4.1 & 4.2). For more information visit Simpson's website at www.strongtie.com.

Q6: Are repetitive-member increases allowed in Red-I™ joist design?

A6: No. The product qualification model in ASTM D5055 modifies the resistive-moment values so they closely model wood I-joist moment capacity. However, that procedure does not use a repetitive-member increase, so an increase to the Red-I™ joist moment values shown in this design guide is not applicable.

Q7: Are there special considerations for shear design in Red-I™ joists?

A7: Yes. In wood design, it is common practice to neglect all uniform loads within a distance equal to the joist depth; however, that does not apply to Red-I™ joists at end bearing locations. In addition, it is critical that Red-I™ joists be designed for both reaction and shear at supports.

References:
(1) Structural Board Association Technical Bulletin, TB102 <www.osbguide.com/osbliterature.html>
(2) APA — The Engineered Wood Association <www.apawood.org>
(3) *Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.* ASTM E1333
(4) *Technical Report: Structural Wood Panels and Formaldehyde.* APA — The Engineered Wood Association

Q & A

Q8: What are the deflection criteria most commonly used when selecting Red-I™ joists?

A8: Red-I™ joist deflections must meet all applicable building codes and any criteria specified by the building designer. But as the graph on page 20 shows, the RedBuilt recommended deflection limits for residential and commercial floors are more restrictive than the minimums required by typical building codes.

It is important to note that designing a floor around a deflection limit is often not enough to ensure good floor performance. Individual perceptions of floor vibration vary, and they are influenced by a variety of factors associated with floor construction.

Q9: Are there special considerations when using double Red-I™ joists?

A9: Yes. With double Red-I™ joists, if a load is applied to the side of one member, you must connect the two Red-I™ joists together at the loading point to transfer the load equally into both members. For more specific information, see detail 7 on page 12.

Typically, sheathing is not nailed to both Red-I™ joists, which leaves one joist with an unbraced compression flange. To ensure the lateral stability of both joists when loads are applied from above, the Red-I™ joists must be connected as shown in detail 9 on page 12. Often, a rectangular member may be the simplest option.

Q10: Is the 1½"-thick flange on commercial Red-I™ joists sufficient for the nail penetration required by building code diaphragm tables?

A10: Yes. A 1½"-thick (or thicker) flange meets the fastener penetration requirements stated in building code diaphragm tables such as IBC Table 2306.3.1. For other building codes, calculations per the *2008 AWC Special Design Provisions for Wind and Seismic* consider fastener penetration into the main member and show that a 1½" penetration does not reduce the lateral nail capacity.

Q11: How do I account for snowdrift loading on Red-I™ joists?

A11: Snowdrift loading should be considered by the designer in any snow load area where roof projections and/or changes in roof elevations could allow snow to accumulate. Specific design criteria falls under the jurisdiction of local building codes.

Q12: Does RedBuilt provide guidelines for the installation of Red-I™ joists?

A12: Yes. Installation guides are provided with every Red-I™ joist delivery. Typical construction applications and details can be found in the guide, and particular attention should be given to the handling, storage, safety bracing, and installation instructions. Shop drawings showing job-specific information are also furnished upon request. A copy of our *Red-I™ Joist Installation Guide* can also be downloaded from www.RedBuilt.com.

Q13: Are your Red-I™ joists covered by a warranty?

A13: Yes. RedBuilt warrants that its products will be free from manufacturing errors or defects in workmanship and material. In addition, provided the product is correctly installed and used, the company warrants the adequacy of its design for the normal and expected life of the building. A copy of our Product Warranty can be found on the back cover of this guide or on our website at www.RedBuilt.com.

Q14: Does RedBuilt provide any fire-rated assembly details?

A14: Yes. RedBuilt provides a number of fire assembly details, which can be downloaded from our website at www. RedBuilt. com.

Q15: How can I contact a RedBuilt representative?

A15: You can find your local RedBuilt representative by calling 1-866-859-6757 or through the **FIND A REP** locator on our website at www.RedBuilt.com.

RED-I™ JOIST SPECIFICATIONS

1.0 General

1.1 Scope
This work includes the complete furnishings and installation of all Red-I™ joists, as shown on the drawings herein specified and necessary to complete the work.

1.2 Code Approvals
These products shall be designed and manufactured to the standards set forth in the International Code Council Report No. ESR-2994.

1.3 Related Work Specified Elsewhere
A. Carpentry and millwork
B. Glu-laminated members

1.4 Design
A. Products: RedBuilt™ products shall be designed to fit the dimensions and loads indicated on the plans.

B. Design Calculations: When requested, a complete set of design calculations shall be prepared by RedBuilt.

1.5 Submittals
A. Drawings: Drawings showing layout and detail necessary for determining fit and placement in the building shall be provided by RedBuilt.

B. Production: Fabrication and/or cutting shall not proceed until the architect and/or engineer have approved the submittal package.

2.0 Products

2.1 Materials
Flange members, web members and adhesives shall conform to the provisions of ICC-ES Report No. ESR-2994.

2.2 Fabrication
Red-I™ joists shall be manufactured by RedBuilt in a plant listed in the report referred to above and under the supervision of an approved third-party inspection agency.

2.3 Tolerances
Depth: ± 1/16"
Flange Width: ± 1/16"

2.4 Identification
Each of the joists shall be identified by a stamp indicating the joist series, ICC-ES report number, manufacturer's name, plant number, date of fabrication, and the independent inspection agency's logo.

2.5 Hardware
Not applicable.

3.0 Execution

3.1 Installation
Red-I™ joists, if stored prior to installation, shall be protected from the weather. They shall be handled with care so they are not damaged. Red-I™ joists shall be installed in accordance with the plans, and any RedBuilt drawings and installation suggestions. Temporary construction loads that cause stresses beyond design limits are not permitted. Safety bracing is to be provided by the installer to keep the Red-I™ joists straight and plumb as required, and to ensure adequate lateral support for the individual Red-I™ joist members and the entire system until the sheathing material is applied.

3.2 Installation Review
Prior to enclosing the Red-I™ joists, the Contractor shall give notification to the RedBuilt representative to provide an opportunity for review of the installation.

3.3 Performance Standards
Products shall be proven by testing and evaluation in accordance with the provisions of ASTM D5055.

3.4 Fire Rating/Sound Rating
Fire and sound ratings are to be established in accordance with the assemblies detailed in ICC-ES Report No. ESR-2994, or the *Directory of Listed Products* published by Intertek Testing Services.

3.5 Warranty
The products delivered shall be free from manufacturing errors or defects in workmanship and material. The products, when correctly installed and maintained, shall be warranted to perform as designed for the normal and expected life of the building.

4.0 Alternates and/or Equals

4.1 Base Bid
Due to the customized detailing and engineering characteristics of the roof and/or floor framing assembly, it is a requirement that Red-I™ joists be used in the base bid.

4.2 Alternate Manufacturers
Other manufacturers' bids are to be listed in the alternate section of your proposal. All framing plans, detailing, and calculations for the alternate bids will be reviewed by the owner, architect, and engineer for structural performance, possible conflicts with related trades, and compatibility with the overall building requirements and building code.

4.3 Alternate Products
Alternate products will only be permitted if written approval and acceptance is obtained by both architect and owner at least seven days prior to the bid date. Any monetary savings that may be realized by using an alternate product shall be forwarded to the owner.

4.4 Acceptable Alternatives
At the discretion of the specifier of record, accepted alternates will be listed on the final addendum prior to the bid date.

MATERIAL WEIGHTS

Refer to local building codes for live load design requirements.

Composition Roofing

2–15 and 1–90 lb ..... 1.7 psf
3–15 and 1–90 lb ..... 2.2 psf
3-ply and gravel ..... 5.6 psf
4-ply and gravel ..... 6.0 psf
5-ply and gravel ..... 6.5 psf
Insulated Roof Membrane Assembly (IRMA)
  2" thick ..... 13.0 psf
Single-ply roofs (insulation not included)
  Ballasted system ..... 13.0 psf
  Mechanically fastened ..... 2.0 psf
  Fully adhered ..... 2.0 psf

Douglas Fir Sheathing*

(Based on 36 pcf for plywood, 40 pcf for OSB)

½" plywood ..... 1.5 psf
⅝" plywood ..... 1.8 psf
¾" plywood ..... 2.3 psf
1⅛" plywood ..... 3.4 psf
½" OSB ..... 1.7 psf
⅝" OSB ..... 2.0 psf
¾" OSB ..... 2.5 psf
⅞" OSB ..... 2.9 psf
1⅛" OSB ..... 3.7 psf

* For southern pine weights, increase Douglas fir weights by 10%.

Miscellaneous Roofing Materials

Corrugated galvanized steel
  16 ga. ..... 2.9 psf
  20 ga. ..... 1.8 psf
  22 ga. ..... 1.5 psf
  24 ga. ..... 1.3 psf
Asphalt shingles ..... 2.5 psf
Wood shingles ..... 3.0 psf
Clay tile ..... 9.0 to 14.0 psf
Slate (⅜" thick) ..... 15.0 psf

Rigid Insulation (1" thick)

Hemlock ..... 1.2 psf
Cork ..... 0.7 psf
Gold bond ..... 1.5 psf
Polystyrene foam ..... 0.2 psf
Foamglass ..... 0.8 psf
Rigid fiberglass ..... 1.5 psf

Roll or Batt Insulation (1" thick)

Rock wool ..... 0.2 psf
Glass wool ..... 0.1 psf

Floors

Hardwood (nominal 1") ..... 4.0 psf
Concrete (1" thick)
  Regular ..... 12.0 psf
  Lightweight ..... 8.0 to 10.0 psf
Gypsum concrete (¾" thick) ..... 6.5 psf
Sheet vinyl ..... 0.5 psf
Carpet and pad ..... 1.0 psf
¾" ceramic or quarry tile ..... 10.0 psf

Ceilings

Acoustical fiber tile ..... 1.0 psf
½" gypsum board ..... 2.2 psf
⅝" gypsum board ..... 2.8 psf
Plaster (1" thick) ..... 8.0 psf
Metal suspension system (including tile) ..... 1.8 psf

To calculate total dead load, use a minimum of 1.5 psf for "miscellaneous" with all dead loads.

Weights of Douglas Fir Framing Members

Nominal Size (in.)	Joist Spacing		
	12"	16"	24"
2x4	1.4 psf	1.1 psf	0.7 psf
2x6	2.2 psf	1.7 psf	1.1 psf
2x8	2.9 psf	2.2 psf	1.5 psf
2x10	3.7 psf	2.8 psf	1.9 psf
2x12	4.4 psf	3.3 psf	2.2 psf
3x6	3.6 plf		
4x6	5.0 plf		
4x8	6.8 plf		
4x10	8.6 plf		
4x12	10.4 plf		

- For southern pine weights, increase Douglas fir weights by 10%

Weights of Sprinkler Lines

Size of Pipe	Schedule 40, Standard Pipe		Schedule 10, Thin Wall Pipe	
	Dry (plf)	Wet (plf)	Dry (plf)	Wet (plf)
1"	1.7	2.1	1.4	1.8
1¼"	2.3	3.0	1.8	2.5
1½"	2.7	3.6	2.1	3.1
2"	3.7	5.2	2.7	4.2
2½"	5.8	7.9	3.6	5.9
3"	7.6	10.8	4.3	8.0
3½"	9.2	13.5	5.0	9.8
4"	10.9	16.4	5.6	11.8
5"	14.8	23.5	7.8	17.3
6"	19.2	31.7	9.3	23.1
8"	28.6	50.8	16.9	40.1
10"	40.5	74.6		

- For additional information on sprinkler systems, see RedBuilt's *Sprinkler System Installation Guide* (available online at www.RedBuilt.com)

Approximate Weights of RedBuilt™ Products

	Series	PLF Weight
Trusses	Red-L™, Red-LT™	3.75–4.25
	Red-W™	4.50–5.25
	Red-S™	4.75–5.75
	Red-M™	8.00–9.00
	Red-H™	10.00–12.00
Joists	Red-I45™	2.2–3.5
	Red-I65™	3.0–5.8
	Red-I90™	4.2–6.6
	Red-I90H™	4.6–7.1
	Red-I90HS™	6.0–9.1

Structural Composite Lumber	Density (pcf)
2.0E RedLam™ LVL	42
LSL	45

- PLF Unit Weight = (density) x (width) x (depth)

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2.0E RedLam™ LVL

Beams, Headers & Columns

Laminated Veneer Lumber

- Engineered to project specifications
- Consistent strength
- Consistent quality
- Finished lengths up to 80 feet

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2.0E REDLAM™ LAMINATED VENEER LUMBER

RedLam™ LVL can be used as main carrying beams, flush beams, headers and wall framing. The RedLam™ LVL manufacturing process removes and disperses the natural defects inherent in wood and produces a product that is strong, dimensionally stable and very reliable.

STRONGER THAN NATURE

Our production process creates wood members with structural qualities equal to or greater than equivalent sizes of dimensional lumber and most glulam beams.

SIZES FOR EVERY NEED

RedLam™ LVL is manufactured in standard widths from 1½" – 3½", in lengths up to 80 feet, with depths of 9½" – 24" including wall framing in 2x and 3x sizes from 3½" – 11¼".

REDLAM™ LVL BEAMS AND HEADERS

RedLam™ LVL beams work well in applications all over the structure. No matter where they're used, they install quickly with little or no waste. RedLam™ LVL is very stable and resists warping, splitting and shrinking.

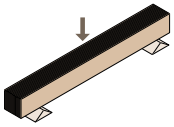
RedLam™ LVL rim board is available in sizes that match Red-I™ joists up to 24" deep. See the RedBuilt™ LVL Rim Board Product Memo at www.RedBuilt.com

2.0E RedLam™ LVL Available Sizes

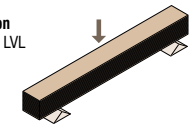
Available Width	Depth												
	3½"	5½"	7¼"	9¼"	9½"	11¼"	11⅞"	14"	16"	18"	20"	22"	24"
1½"	x	x	x	x		x							
1¾"	x	x	x	x	x	x	x	x	x	x			
2½"	x	x	x	x		x							
3½"	x	x	x	x	x	x	x	x	x	x	x	x	x
5¼"		x	x		x		x	x	x	x	x	x	x
7"			x		x		x	x	x	x	x	x	x

Beam, Plank and Column Orientation Diagrams

Beam Orientation
Load RedLam™ LVL parallel to glue line.



Plank Orientation
Load RedLam™ LVL perpendicular to glue line.



Column Orientation

Resource Efficiency

Consider all of the positive attributes of wood when selecting your building material of choice. In addition to its structural properties, high strength-to-weight ratio, and ease of construction, wood is a naturally occurring, renewable resource that requires less energy to produce than steel or concrete. And it sequesters carbon–whether on the stump or in your structure.

Our RedLam™ LVL, as well as other RedBuilt™ products, are now available with FSC credits. Whether you're looking for LEED certification or simply because you want to ensure efficient use of raw materials, we can help. By making better use of every tree, RedBuilt™ produces cost-effective, consistently available engineered wood products that reduce environmental impact. The result is a quality wood product that offers superior strength and reliable performance.

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www.fsc.org
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The mark of responsible forest management

BEAM DESIGN STRESSES

Orientation		RedLam™ LVL Beam/Joist	RedLam™ LVL Plank (5)
Grade		2.0E	2.0E
Shear modulus of elasticity	G =	125,000 psi	125,000 psi
Modulus of elasticity	E =	2.0 x 10^6 psi	2.0 x 10^6 psi
Minimum Modulus of elasticity	E_{min} =	1.0 x 10^6 psi (1)	1.0 x 10^6 psi (1)
Flexural stress	F_b =	2,900 psi (2)	3,430 psi
Tension stress	F_t =	1,660 psi (3)	1,660 psi (3)
Compression perpendicular to grain	$F_{c\perp}$ =	750 psi (4)	480 psi (4)
Compression parallel to grain	$F_{c\parallel}$ =	2,635 psi	2,635 psi
Horizontal shear parallel to grain	F_v =	285 psi	190 psi
Equivalent specific gravity	SG =	0.50	0.50

(1) E_{min} is the reference modulus of elasticity for beam stability and column stability calculations.
(2) For 12" depth. For other depths, multiply F_b by $\left[\frac{12}{d}\right]^{0.136}$
(3) F_t is adjusted for volume effects for a range of common conditions.
(4) $F_{c\perp}$ may not be increased for duration of load.
(5) Values shown are for thickness up to 3½".

For uniformly loaded simple span beams, deflection is calculated as follows:

$$\Delta = \frac{270wL^4}{Ebd^3} + \frac{28.8wL^2}{Ebd}$$

Where: Δ = Deflection, inches; w = Uniform load in plf; L = Span, feet; E = Modulus of Elasticity, psi; b = Beam width, inches; d = Beam depth, inches

RedLam™ LVL is intended for dry-use, untreated applications

Code Evaluations: See ICC ESR-2993

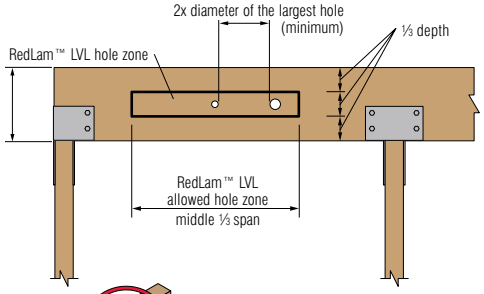
For RedLam™ LVL rim board properties see the RedBuilt™ LVL Rim Board Product Memo available at www.RedBuilt.com.

BEAM DESIGN PROPERTIES

100% Load Duration

Width (in)	Depth (in)	Weight (plf)	Shear (lbs)	Moment (ft-lbs)	I (in^4)	EIx10^6 (in^2-lbs)
1.75	9.5	4.8	3,160	6,600	125	250
	11.875	6.1	3,950	10,000	244	490
	14	7.1	4,660	13,500	400	800
	16	8.2	5,320	17,400	597	1,190
	18	9.2	5,990	21,600	851	1,700
3.5	9.5	9.7	6,320	13,100	250	500
	11.875	12.1	7,900	19,900	488	980
	14	14.3	9,310	27,100	800	1,600
	16	16.3	10,640	34,700	1,195	2,390
	18	18.4	11,970	43,200	1,701	3,400
	20	20.4	13,300	52,600	2,333	4,670
	22	22.5	14,630	62,800	3,106	6,210
	24	24.5	15,960	73,900	4,032	8,060
5.25	9.5	14.5	9,480	19,700	375	750
	11.875	18.2	11,850	29,900	733	1,470
	14	21.4	13,970	40,600	1,201	2,400
	16	24.5	15,960	52,100	1,792	3,580
	18	27.6	17,960	64,800	2,552	5,100
	20	30.6	19,950	78,900	3,500	7,000
	22	33.7	21,950	94,200	4,659	9,320
	24	36.8	23,940	110,800	6,048	12,100
7	9.5	19.4	12,640	26,300	500	1,000
	11.875	24.2	15,790	39,800	977	1,950
	14	28.6	18,620	54,100	1,601	3,200
	16	32.7	21,280	69,400	2,389	4,780
	18	36.8	23,940	86,400	3,402	6,800
	20	40.8	26,600	105,200	4,667	9,330
	22	44.9	29,260	125,700	6,211	12,420
	24	49.0	31,920	147,800	8,064	16,130

HEADERS AND BEAMS



DO NOT cut, notch, or drill holes in headers or beams except as indicated in the illustrations and tables

General Notes

- Allowed hole zone suitable for headers and beams with uniform loads only.
- Round holes only.
- No holes in cantilevers.
- No holes in headers or beams in plank orientation.

Header or Beam Depth	Maximum Round Hole Size
5½"	1¾"
7¼" – 20"	2"

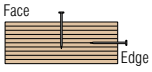
- See illustration for allowed hole zone.

NAILING INFORMATION

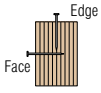
Minimum Nail Spacing

Nail Type		Nail Size	RedLam™ LVL Face	RedLam™ LVL Edge(1)
8d	Box	0.113" x 2½"	2"	3"
	Common	0.131" x 2½"	2"	3"
10d	Box	0.128" x 3"	2"	3"
	Common	0.148" x 3"	3"	4" (2)
12d	Box	0.128" x 3¼"	2"	3"
	Common	0.148" x 3¼"	3"	4" (2)
16d	Box	0.135" x 3½"	3"	4"
	Sinker	0.148" x 3¼"	3"	4" (2)
	Common	0.162" x 3½"	4"	8" (3)

(1) For headers and beams. For Red-I™ joists and open-web trusses, see the nailing criteria in the respective specifier's guide.
(2) Minimum spacing must be 5" for 4 rows of nails.
(3) Spacing may be reduced to 5" where nail penetration does not exceed 1⅜".



Flatwise orientation
(typical with Red-I™ joists and plywood edge blocking)



Edgewise orientation
(typical with rim board, beams, and headers)

- If more than one row of nails is used, offset rows at least ½" and stagger. Maintain ⅜" minimum edge distance.
- Nailing pattern to be per plans and specifications, and nail spacing should comply with criteria listed on this page.

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REPRESENTATIVE INFORMATION

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ESR-3373

Reissued 06/2015
This report is subject to renewal 06/2017.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 12 00—STRUCTURAL PANELS
SECTION: 06 16 00—SHEATHING
DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
SECTION: 07 21 00—THERMAL INSULATION
SECTION: 07 25 00—WATER-RESISTIVE BARRIERS/WEATHER BARRIERS
SECTION 07 27 00—AIR BARRIERS

REPORT HOLDER:

HUBER ENGINEERED WOODS, LLC

ONE RESOURCE SQUARE
10925 DAVID TAYLOR DRIVE, SUITE 300
CHARLOTTE, NORTH CAROLINA 28262

EVALUATION SUBJECT:

ZIP SYSTEM® R-SHEATHING (INSULATING SHEATHING)

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ESR-3373

Reissued June 2015
Corrected June 6, 2016
This report is subject to renewal June 2017.

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 12 00—Structural Panels
Section: 06 16 00—Sheathing

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 21 00—Thermal Insulation
Section: 07 25 00—Water-Resistive Barriers/Weather Barriers
Section: 07 27 00—Air Barriers

REPORT HOLDER:

HUBER ENGINEERED WOODS, LLC
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CHARLOTTE, NORTH CAROLINA 28262
(800) 933-9220
www.huberwood.com

EVALUATION SUBJECT:

ZIP SYSTEM® R-SHEATHING (INSULATING SHEATHING)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2015, 2012 and 2009 *International Residential Code®* (IRC)
- 2015, 2012 and 2009 *International Energy Conservation Code®* (IECC)

Properties evaluated:

- Structural
- Thermal resistance
- Air leakage
- Weather resistance

2.0 USES

ZIP System® R-Sheathing panels are used as combination wall sheathing and continuous insulation in conventional light wood-framed walls of Type V construction (IBC) and dwellings constructed in accordance with the IRC. R-Sheathing is used to resist transverse loads in accordance with the PS-2 span rating shown on the panels. The panels are used to satisfy the continuous insulation and insulated sheathing allowances of 2015 IRC Table N1102.1.2, 2012 IRC Table N1102.1.1 or 2009 IRC Table N1102.1.2 and 2015 IECC Tables R402.1.2 and C402.1.3, 2012 IECC Tables R402. 1.1 and C402.2, or 2009 IECC Tables 402.1.1 and 502.2(1), as applicable. When installed with ZIP System™ Flexible Flashing seam tape, R-Sheathing may be used as an alternative to the water-resistive barrier required by IBC Section 1404.2 and IRC Section R703, and to address air leakage in the building envelope as required by Sections R402.4 and C402.5 of the 2015 IECC, Sections R402.4 and C402.4 of the 2012 IECC or Sections 402.4.1 and 502.4.3 of the 2009 IECC.

ZIP System R-Sheathing panels may be used as intermittent wall bracing panels within designated braced wall lines (2009 IRC only) in accordance with Section 4.5, and as shear wall panels in accordance with Section 4.6, of this report.

3.0 DESCRIPTION

ZIP System® R-Sheathing is an insulated sheathing made by combining $^{7}/_{16}$-inch-thick ZIP System® Wall Sheathing recognized in ESR-1474 with a layer of maximum 2-inch-thick (25.4 mm) rigid foam plastic insulation laminated to its interior face using polyvinyl alcohol (PVA) adhesive. The ZIP System® Wall Sheathing is OSB complying with U.S. DOC PS 2 for wood structural panels as Exposure 1 with a 24/0, 24/16, or Wall 24 span rating, and is overlaid on the exterior side with a Grade D water-resistive barrier. The rigid foam plastic insulation is Rboard® recognized in ESR-1375 which complies with the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12). The foam plastic insulation boards have a nominal density of 2.0 pcf, compressive strength of 20 psi (138 kPa), vapor permeance of less than 1.0 perm, a flame-spread index of 75 or less and a smoke-developed index of 450 or less. The ZIP System® R-Sheathing panels are nominally 4 feet wide by 8, 9, 10, 11 or 12 feet long and have a square-finished-edge or machined-edge profile.

4.0 INSTALLATION

4.1 General:

ZIP System® R-Sheathing panels must be installed over wood-framed walls with minimum nominally "2-by" framing spaced at a maximum of 24 inches (406 mm) on center. In accordance with the manufacturer's published installation instructions, it is recommended that the square edges of the panels be installed with a gap between adjacent panels and that the panels be separated from

dissimilar materials. ZIP System® R-Sheathing panels may be installed vertically or horizontally. When use is in the construction of braced wall panels in accordance with Section 4.5, or as wood shear walls in accordance with Section 4.6, all joints and panel edges must be backed by framing.

When the panels are used as wall bracing panels or shearwall panels, fastening must be as described in Tables 1 or Table 2. ZIP System® R-Sheathing panels that are not used for structural bracing or shearwalls must be installed with minimum 8d common nails (or equivalent) at a maximum spacing of 6 inches on center on panel edges and 12 inches on center in the field. Nails must have a minimum 1-inch embedment into framing.

4.2 Water-resistive Barrier:

To qualify as a water-resistive barrier, ZIP System® R-Sheathing panels must be installed with the polymer-modified sheet overlay facing the exterior and all panel seams must be sufficiently sealed with ZIP System™ Flexible Flashing Tape in accordance with ESR-1474. All overlay surfaces must be dry and free of sawdust and dirt prior to application of the ZIP System™ seam tape. The seam tape must extend a minimum of 1 inch (25.4 mm) past the panel edge T-joint intersections and must be centered, within $^1/_2$ inch (12.7 mm), over the middle of panel seams. The tape must be pressed firmly to adhere to the surfaces and seal the seams. Wrinkles in the ZIP System™ seam tape are acceptable unless they create a leak path to the panel seam.

Flashing complying with the applicable code must be installed at the perimeter of door and window assemblies, penetrations and terminations of exterior wall assemblies, exterior wall intersections with roofs, chimneys, porches, decks, balconies, and similar projections, and at built-in gutters and similar locations where moisture could enter the wall. An adhesive-backed flashing tape that complies with the ICC-ES Acceptance Criteria for Flashing Materials (AC148) must be installed to seal all ZIP System® R-Sheathing flashing joints. Penetration items must be sealed to the panels. The adhesive-backed flashing tape must be installed in accordance with the manufacturer's published installation instructions.

4.3 Air Barrier:

ZIP System® R-Sheathing fastened to maximum 24-inch-on-center (610 mm) wood wall framing, using 8d nails spaced at 6 inches (152 mm) around panel edges and at 12 inches (305 mm) in the field, leaving a $^1/_8$-inch (3.18 mm) gap between panels, forms an air barrier assembly when the gaps between panels and the perimeter of penetrations are sealed with ZIP System™ seam tape recognized in ESR-2227. The assembly has demonstrated a maximum air leakage of 0.0072 cfm/ft^2 [0.037 L/(s•m^2)] infiltration and 0.0023 cfm/ft^2 [0.012 L/(s•m^2)] exfiltration at a pressure differential of 1.57 psf (75 Pa).

4.4 Thermal Resistance:

ZIP System® R-Sheathing panels have nominal thermal resistance in accordance with the R-Sheathing Type shown in Tables 1 or 2.

4.5 Braced Wall Panels in Accordance with the 2009 IRC:

ZIP System® R-Sheathing panels are recognized for use in intermittent braced wall panel construction in accordance with 2009 IRC Section R602.10.2 when installed in accordance with Table 1. The panels are recognized as equivalent to wood structural panels used in Bracing Method WSP and may be used with amounts of bracing (lengths) specified in 2009 IRC Table R602.10.1.2(1), entitled "Bracing Requirements Based on Wind Speed," The minimum effective braced wall panel length must be 48 inches (1219 mm) for wall heights up to 10 feet (3048 mm), 4 feet 5 inches (1346 mm) for walls not exceeding 11 feet (3352 mm) in height, and 4 feet 10 inches (1473 mm) for walls not exceeding 12 feet (3658 mm) in height. For prescriptive wall bracing under this section (Section 4.5), recognition is limited to use in areas where the design wind speed is less than 110 mph and in Seismic Design Categories (SDC) A, B, and C (Exception: SDC A and B only for townhouses); use of the sheathing in other conditions is outside the scope of this report. Holes and notches in wood framing are permitted in accordance with 2009 IRC Section R602.6.

4.6 Wood Framed Shear Walls in accordance with the 2015, 2012, and 2009 IBC and IRC:

ZIP System® R-Sheathing panels may be used in the construction of wood shear walls when the design is in accordance with Table 2 and 2015, 2012, or 2009 IBC Sections 2305 and 2306, as applicable. The Allowable Shear Capacity values in Table 2 must be used in lieu of the values shown in the code. Under this section (Section 4.6), recognition is limited to resisting in-plane wind loads and to use in Seismic Design Categories (SDC) A, B, and C, with earthquake load resistance determined using the maximum values of R = 2.0, Ωo = 2.5, and Cd = 2.0. Holes and notches in the framing are permitted in accordance with the applicable code, code-referenced documents, and engineered design.

Shearwalls using ZIP System® R-Sheathing panels installed in accordance with this report may be used under the 2015, 2012, and 2009 IRC when an engineered design is submitted in accordance with 2015, 2012, and 2009 IRC Section R301.1.3, as applicable.

5.0 CONDITIONS OF USE

The ZIP System® R-Sheathing panels described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The ZIP System® R-Sheathing panels must be manufactured, identified and installed in accordance with this report and the manufacturer's published installation instructions. In the event of a conflict between the instructions and this report, this report governs.

5.2 When required by the code official, this evaluation report and the manufacturer's published installation instructions must be submitted at the time of permit application.

5.3 Walls sheathed with the panels must not be used to resist in-plane horizontal loads from concrete or masonry walls.

5.4 The ZIP System® R-Sheathing panels must be covered with a code-complying exterior wall covering or one that is recognized in a current ICC-ES evaluation report.

5.5 Siding installed over R-Sheathing must be installed in accordance with code and with the siding manufacturer's recommendations. Siding installers must account for any extra fastener length required to attach siding through the foam backed panel and into framing.

5.6 Where foam plastic is used in areas where the probability of termite infestation is "very heavy," safeguards must be followed in accordance with the protection against subterranean termite provisions in Chapter 26 of the IBC or Chapter 3 of the IRC, as applicable.

5.7 Fire-resistance-rated construction is outside the scope of this report.

5.8 Under the 2015 IBC, special inspection must be provided in accordance with IBC Sections 1704.3 and 1705.11 for sheathing installed in shear walls on buildings in Exposure B locations where V_{ASD} is 120 mph (53.6 m/s) or greater and in Exposures C and D locations where V_{ASD} is 110 mph (49.2 m/s) or greater. Under the 2012 IBC, special inspection must be provided in accordance with IBC Sections 1704.3 and 1705.10 for sheathing installed in shear walls on buildings in Exposure B locations where V_{ASD} is 120 mph (53.6 m/s) or greater and in Exposures C and D locations where V_{ASD} is 110 mph (49.2 m/s) or greater. Under the 2009 IBC, special inspection must be provided in accordance with IBC Sections 1705.1, 1705.2 and 1705.4 for sheathing installed in shear walls on buildings in Exposure B locations where the basic wind speed is 120 mph (53.6 m/s) or greater and in Exposures C and D locations where the basic wind speed is 110 mph (49.2 m/s) or greater. A statement of special inspections complying with 2015 or 2012 IBC Section 1704.3 or 2009 IBC Section 1705 (as applicable) must be provided to the code official (this includes addressing requirements in 2015 IBC Sections 1704.3.3 and 1705.11 or 2012 IBC Sections 1704.3.3 and 1705.10 or 2009 IBC Sections 1705.4.1 and 1705.4.2, as applicable).

5.9 Cutting openings and penetrations in designated braced wall panels is not permitted.

5.10 Gypsum wallboard is required to be installed on the side of the wall opposite the proprietary sheathing in accordance with 2009 IRC Section R602.10.2.1.

5.11 Use of ZIP System® R-Sheathing panels to resist combined wind uplift and shear must be approved by the code official.

5.12 ZIP System® R-Sheathing panels are laminated at facilities located in Camp Hill, Pennsylvania, Diboll, Texas, Crystal Hill, Virginia, Broken Bow, Oklahoma, and East Moline, Illinois, under a quality-control program with inspections provided by ICC-ES.

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Water-resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-resistive Barriers (AC310), dated May 2008 (editorially revised, August 2015).

6.2 For recognition under the 2015, 2012 and 2009 IBC and IRC for use in shear walls, data in accordance with the ICC-ES Acceptance Criteria for Proprietary Sheathing Jobsite-attached to Wood Light-frame Wall Construction Used as Shear Walls (AC269.2), dated October 2013 (editorially revised, February 2016).

6.3 For recognition under the 2009 IRC for use as an alternative to prescriptive intermittent braced wall panels, data in accordance with the ICC-ES Acceptance Criteria for Proprietary Sheathing Attached to Wood Light-frame Wall Construction Used as Braced Wall Panels under the IRC (AC269.1), dated February 2013 (editorially revised, February 2014).

6.4 Air leakage data in accordance with ASTM E2357.

7.0 IDENTIFICATION

Each ZIP System® R-Sheathing panel described in this report must bear a label that includes the manufacturer's name (Huber Engineered Woods, LLC) and address, the product name, the R-Sheathing type, the date of manufacture or a tracking number, the manufacturing plant identifier, and the evaluation report number (ESR-3373).

PRESCRIPTIVE METHOD (INTERMITTENT WALL BRACING)

TABLE 1—FASTENING REQUIREMENTS FOR ZIP SYSTEM® R-SHEATHING WITH FRAMING OF DOUGLAS FIR-LARCH FOR WIND OR SEISMIC LOADING UNDER THE 2009 IRC (WSP METHOD)

R-SHEATHING TYPE[3] (R-Value of foam)	FRAMING[1]		FASTENING REQUIREMENT		
	Nominal Stud Size (min.)	Maximum Stud Spacing (inches)	Fastener Specifications[2]	Edge/Field Spacing (inches)	Minimum Penetration into Framing (inches)
R-3	2-by-4	24	0.131-inch shank nails	4/12	1.5
R-3	2-by-4	16	16ga staples, 7/16-inch crown, 2-inch length	3/6	1.0
R-6	2-by-4	24	0.131-inch shank nails	4/12	1.5
			15ga staples, 7/16-inch crown, 2.5-inch length	3/6	1.0
R-9	2-by-4	24	0.131-inch shank nails	3/12	1.5
R-12	2-by-4	24	0.131-inch shank nails	3/12	1.5

For **SI:** 1 inch = 25.4 mm

[1]All fasteners must be located a minimum of 3/8 inch from panel edges.
[2]Fasteners must be common nails or equivalent, or staples, of a type generally used to attach wood sheathing.
[3]Type R-12 R-Sheathing panels have a foam plastic insulation thickness of 2.0 inch. Type R-9 R-Sheathing panels have a foam plastic insulation thickness of 1.5 inch. Type R-6 R-Sheathing panels have a foam plastic insulation thickness of 1.0 inch. Type R-3 R-Sheathing panels have a foam plastic insulation thickness of 0.5 inch.
[4]All panel edges must be backed by framing.

ENGINEERED METHOD (SHEARWALL PANELS)

TABLE 2—FASTENING REQUIREMENTS AND ALLOWABLE SHEAR CAPACITY FOR ZIP SYSTEM® R-SHEATHING WITH FRAMING OF DOUGLAS FIR-LARCH[2] FOR WIND OR SEISMIC LOADING UNDER THE 2015, 2012 AND 2009 IBC

R-SHEATHING TYPE[4] (R-Value of foam)	FRAMING		FASTENING REQUIREMENT			ALLOWABLE SHEAR CAPACITY[5,6,7] (plf)
	Nominal Stud Size (min.)	Maximum Stud Spacing (inches)	Fastener Specifications[3]	Edge/Field Spacing (inches)	Minimum Penetration into Framing (inches)	
R-3	2-by-4	24	0.131-inch shank nails	4/12	1.5	245
R-3	2-by-4	24	0.131-inch shank nails	3/12	1.5	280
R-3	2-by-4	16	16ga staples, 7/16-inch crown, 2-inch length	3/6	1.0	210
R-6	2-by-4	24	0.131-inch shank nails	4/12	1.5	230
R-6	2-by-4	24	0.131-inch shank nails	3/12	1.5	255
R-9	2-by-4	24	0.131-inch shank nails	3/12	1.5	240
R-12	2-by-4	24	0.131-inch shank nails	3/12	1.5	215

For **SI:** 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

[1]All fasteners must be located a minimum of 3/8 inch from panel edges.
[2]For framing of other species, the shear value above must be multiplied by the Specific Gravity Adjustment Factor = [1- (0.50 – SG)], where SG is the specific gravity of the framing lumber in accordance with the AWC NDS. This adjustment factor must not be greater than 1.
[3]Fasteners must be common nails or equivalent, or staples, of a type generally used to attach wood sheathing.
[4]Type R-6 R-Sheathing panels have a foam plastic insulation thickness of 1.0 inch. Type R-3 R-Sheathing panels have a foam plastic insulation thickness of 0.5 inch.
[5]The maximum height-to-width aspect ratio of shear walls is 2:1.
[6]The allowable shear capacity may be increased by 40% for wind in Allowable Stress Design in accordance with Section 2306.3 of the 2015, 2012 and 2009 IBC.
[7]All panel edges must be backed by framing.

ZIPsystem™ SHEATHING & TAPE

HUBER ENGINEERED WOODS

ZIP SYSTEM® R-SHEATHING

MANUFACTURER

Huber Engineered Woods LLC
10925 David Taylor Drive, Suite 300, Charlotte, NC 28262
800.933.9220 • Technical Service: 800.933.9220 x2716
ZIPSystem.com • HuberArchitectLibrary.com

BASIC USE AND APPLICATIONS

ZIP System R-Sheathing insulating sheathing is a one-of-a-kind layered product engineered to insulate and protect wall assemblies in a single application. ZIP System R-Sheathing combines the strength, weather-resistive, and air barrier qualities of ZIP System Sheathing with the thermal resistance of polyisocyanurate foam insulation.

ZIP System R-Sheathing provides a combined R-value of 3.6, 6.6, 9.6 or 12.6 on the outside of wall framing in addition to wall cavity insulation. One panel delivers thermal, air, and moisture resistance, while providing strength and durability. ZIP System R-Sheathing, with its built-in protective overlay eliminates the need for building wrap. Install the panels, tape the seams with ZIP System tape, and the building is rough-dried in. A wide range of wall claddings install directly over ZIP System R-Sheathing to finish the exterior.

ZIP System R-Sheathing uses a tough, phenolic resin-impregnated overlay to provide permanent weather resistance along with a proprietary seam tape that is extensively tested for long-term adhesion and flexibility.

This material combination meets performance requirements for Grade D weather-resistive barriers in accordance with ICC Acceptance Criteria AC38. ZIP System R-Sheathing may be used for walls on buildings of Type V construction and other construction permitted under the International Residential Code.

AVAILABLE SIZES

ZIP System R-Sheathing panels are available in nominal 4' x 8' sheets. The wood structural panel layer is approximately 47-15/16" x 95-7/8", while the polisocyanurate foam bonded to the structural panel layer is sized at a full 48" x 96". This allows for proper gapping between the wood panels, with a 1/16" to 1/8" foam overhang located on two of four panel edges to ensure tightly fitted insulation. Panels are available in the following thicknesses:

- Nominal 1" thick: 7/16" thick ZIP System panel plus 1/2" thick foam with a combined R-value of 3.6
- Nominal 1-1/2" thick: 7/16" thick ZIP System panel plus 1" thick foam with a combined R-value of 6.6
- Nominal 2" thick: 7/16" thick ZIP System panel plus 1-1/2" thick foam with a combined R-value of 9.6
- Nominal 2-1/2" thick: 7/16" thick ZIP System panel plus 2" thick foam with a combined R-value of 12.6

ZIP System Benefits	
Structure and Durability	•Nail-able wood base •Can be used to resist shear (see ESR-3373 for conditions)
Built-in Water Resistive Barrier	•Eliminates costly rework •Instant rough dry-in
Continuous Air Barrier	•Reduces air leakage, protecting the R-value of the insulation
Continuous Exterior Insulation	•Increases thermal performance •Controls thermal bridging
Ease of Installation	•All-in-one product eliminates multiple installations

SUSTAINABLE DESIGN CONTRIBUTIONS

- Low-Emitting Material: No added urea formaldehyde
- Sustainable Forestry Initiative Certified Wood: Harvested, transported, manufactured, and distributed utilizing sustainable practices
- Renewable Forest Resources: Composed of primarily young growth bio-based resources
- Regional Materials: Made in the United Sates at one of our 4 regional manufacturing facilities: Commerce, GA; Broken Bow, OK; Crystal Hill, VA; and Easton, ME

Third party independent compliance testing of ZIP System R Sheathing is by Timberco, Inc. (TECO).

800.933.9220 | ZIPsystem.com

SUBSTRATE
Before beginning installation, verify wood wall framing is properly spaced and aligned to continuously support panel edges.

PANEL INSTALLATION
Install ZIP System R-Sheathing in accordance with:

- ZIP System R-Sheathing Installation Manual
- ICC-ES ESR-3373
- Additional requirements of code official

Install panels with moisture barrier surface facing out. Panels may be oriented vertically or horizontally. Refer to ZIP System R-Sheathing Installation Manual.

TAPE INSTALLATION
Install ZIP System tape in accordance with all manufacturer's written instructions at panel seams, openings, and penetrations.

Install windows and associated window flashings in accordance with all window manufacturer's instructions. Details of installation recommendations are available in AutoCAD and PDF formats at ZIPSystem.com or HuberArchitectLibrary.com.

STORAGE AND HANDLING
Store and handle products according to manufacturer's written recommendations. Support panel bundles off the ground. Cover stored panels with weatherproof protective material; allow sides of protective material to remain loose to assure adequate air circulation. In high-moisture conditions, cut bundle banding to prevent edge damage to panels. Factory applied packaging is intended only for protection during transit. Packaged units must be stored indoors or within a covered structure. Do not stack more than three units high.

AVAILABILITY
Huber Engineered Wood's ZIP System R-Sheathing panels are manufactured at multiple locations in the U.S. They are available through distributors nationwide. Visit ZIPSystem.com or contact Huber Engineered Woods for a retailer near you.

WARRANTY
ZIP System R-Sheathing is furnished with a 30-year system warranty as well as a 30-year warranty against delamination and manufacturing defects, subject to published standard terms and condition.

NOTES AND LIMITATIONS
ZIP System R-Sheathing should be covered with a code-complying exterior wall cladding within 180 days of installation. ZIP System R-Sheathing can only be used structurally with wood framed construction.

DO NOT use in roofs or structurally over light gauge metal framing. For systems requiring multiple layers of water-resistive barriers, ZIP System R-Sheathing is intended to replace only the first layer.

ZIP System R-Sheathing should not be used with adhesively attached EIFS, but can be used with mechanically attached EIFS.

TECHNICAL SERVICE
Detailed information including specifications, product literature, test reports, installation instructions, and special applications is available through Huber Engineered Woods. Please visit ZIPSystem.com or call 800.933.9220 EXT 2716 to speak to a technical representative.

AVAILABLE RESOURCES
Section 06 16 13 INSULATING SHEATHING guide specifications for ZIP System R-Sheathing products in CSI 3-part format is available at ZIPSystem.com or HuberArchitectLibrary.com.

ZIP System R Sheathing Foam Insulation Properties		
Dimensional Stability	ASTM D2126	<2%
Compressive Strength	ASTM D1621	20-25 psi
Water Absorption	ASTM C209 ASTM D2842	< 1% < 3.5%
Water Vapor Transmission	ASTM E96	< 1.0perm
Flame Spread	ASTM E84	40-60
Smoke Developed	ASTM E84	50-170

ZIP System R Sheathing Performance Properties		
Thermal Resistance (R-value)	ASTM C1289*	3.6@1" 6.6@1-1/2" 9.6@2" 12.6@2-1/2"
Water Resistance of Coatings	ASTM D2247 (for 14 day)	Passed
Water Vapor Transmission Panel Overlay	ASTM E96	12-16 perms
Water Penetration	ASTM E331	Passed
Air Barrier Assembly	ASTM E2357	0.037 L/(s*m2)
Air Barrier Material	ASTM E2176	-0.0016 L/(s*m2)
Wind Driven Rain	TAS 100 (at 100 mph)	Passed
Accelerated Weathering	ASTM G154	Passed

*LTTR for foam, with R-value of 7/16" OSB per ASHRAE Handbook-Fundamentals. For additional performance and installation information: Refer to ZIP System R-Sheathing ICC-ES ESR-3373.

APPENDIX II
ARCHITECTURAL CUTSHEETS

S-5!®

The Right Way!

Now Listed to UL-2703

UL LISTED

INTERTEK ETL LISTED c US

S-5-PV Kit

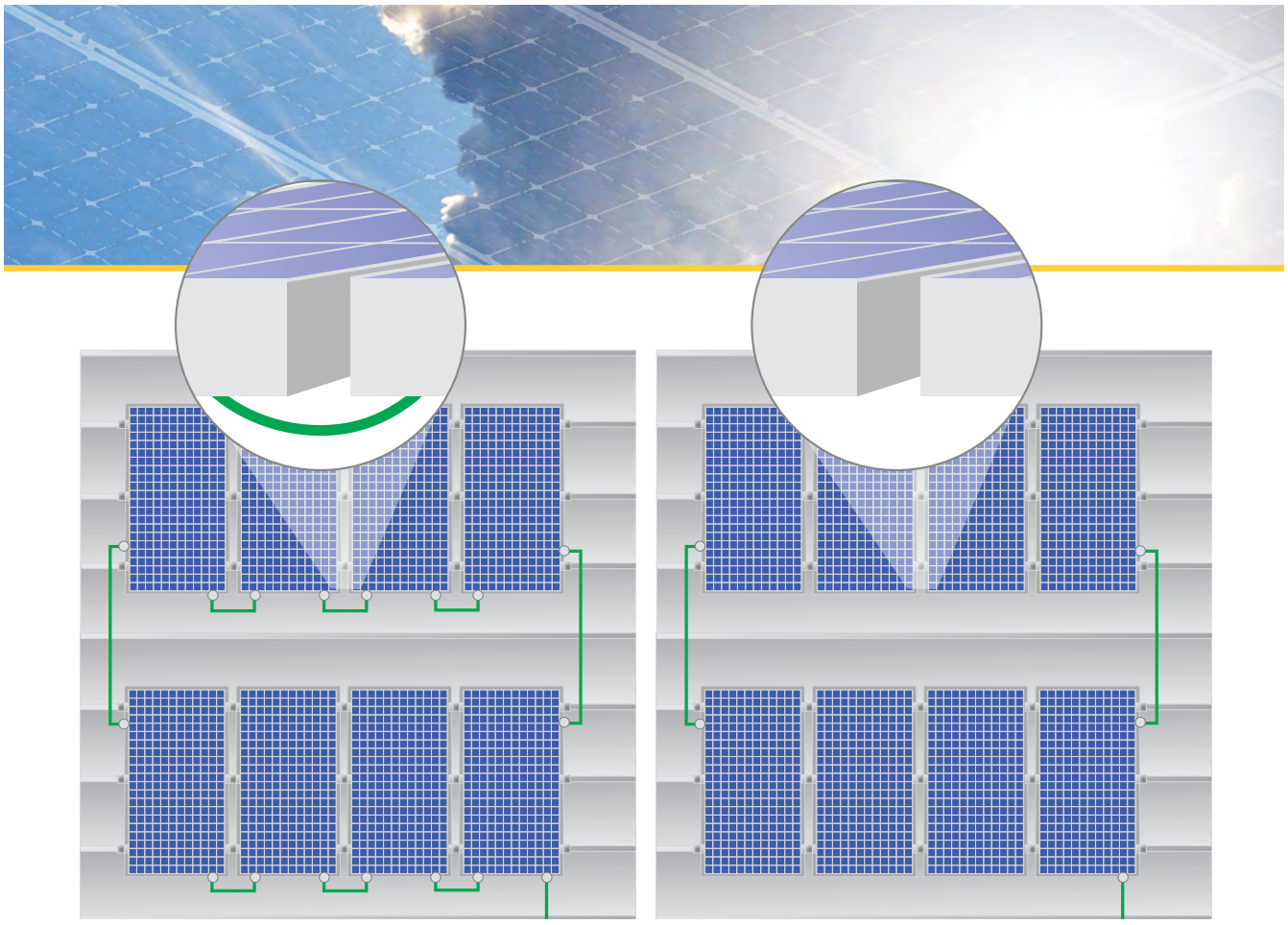
Now Available!

The Newly Redesigned S-5-PV Kit

- Groundbreaking new mounting disk: twelve nodes designed to ensure module-to-module conductivity
- Simply anchor the module with the S-5-PV Kit and it's automatically bonded
- No lugs/wire required, except to connect one string of modules to another and to ground the system
- In most cases, this connection detail represents a savings of $6-$12 per unit and is sufficient to pay for the entire S-5-PV Kit and clamp setup!
- Listed to the new UL subject 2703, a standard that covers both bonding and mounting
- ETL Listed to UL 1703
- The stainless steel mounting disk is able to withstand severe conditions and is compatible with brass

The S-5-PV Kit uses an innovative cost-cutting method that in most cases pays for itself and the S-5!® clamps.

(800) 284-1412 | www.lmcurbs.com



Without the S-5-PV Kit, lugs or copper wires are required to bond PV panels within a string of modules.

Using the S-5-PV Kit, wires and lugs are no longer needed from module-to-module, but will still be needed to bond strings together and to ground the system.

The new stainless steel mounting disk is designed to ensure conductivity with anodized aluminum module frames.

Because of this, the new S-5-PV Kit will further reduce installation costs. The new disk provides module-to-module electrical continuity (called “bonding” within the industry). Previously, this was accomplished by connecting modules with ground lugs and copper wire; this connection detail represents installed electrical costs of $6-$12 per unit. With the new S-5-PV Kit, the module is simply anchored with the S-5-PV Kit and is automatically bonded. No lugs or wires are required from module-to-module, but will still be needed to bond strings together and to ground the system. In most cases, the savings pays for the entire S-5-PV Kit and S-5!® clamp setup. Additionally, the stainless steel mounting disk withstands weathering and facilitates use with brass clamps.

S-5!®

The Right Way!

S-5-PV Kit

LISTED

S-5-PV Kit

The concept of combining photovoltaic arrays with standing seam metal roofing is growing—and for good reasons. A standing seam metal roof has a life expectancy consistent with that of framed PV modules. A 30-year power source on a 40-year roof, along with zero-penetration technology creates the most sustainable roof system available with alternative power generation, all without compromising the roof's warranty!

The new S-5-PV Kit boasts an important breakthrough in PV mounting technology. It is one of the first solar module mounting solutions in the industry to be listed to the new UL subject 2703, a standard that covers both bonding and mounting. Furthermore, the S-5-PV Kit has gained an ETL Listing to UL 1703.

The S-5-PV Kit features a groundbreaking new stainless steel mounting disk with twelve nodes designed to ensure the module-to-module conductivity of anodized aluminum module frames. This means the module is simply anchored with the kit and is automatically bonded. No lugs or wire required except to connect one string of modules to another and to ground the system. This connection detail represents installed electrical cost savings of $6-$12 per unit. In most cases, the savings in time and materials is sufficient to pay for the entire S-5-PV Kit and clamp setup.

The right way to attach almost anything to metal roofs!

800-284-1412 | www.lmcurbs.com

S-5!®
The Right Way!

The S-5-PV Kit is a revolutionary new solution to attach solar PV panels to standing seam metal roofs!

The **S-5-PV Kits** are furnished with the hardware shown at right, excluding the attachment clamp, which is supplied separately. Additional nuts will need to be ordered for use on end applications. S-5-PV Kits are compatible with most common metal roofing materials, including brass. Providing flexibility, S-5! offers one kit to accommodate all PV frame thicknesses from 1.3" (33 mm) to 2.5" (64 mm).

The embossed panel guide makes the module placement easier. The mounting disk is multi-directional and rails are not required. Flat mounting disks are available for use with the S-5! VersaBracket for exposed-fastened trapezoidal profiles.

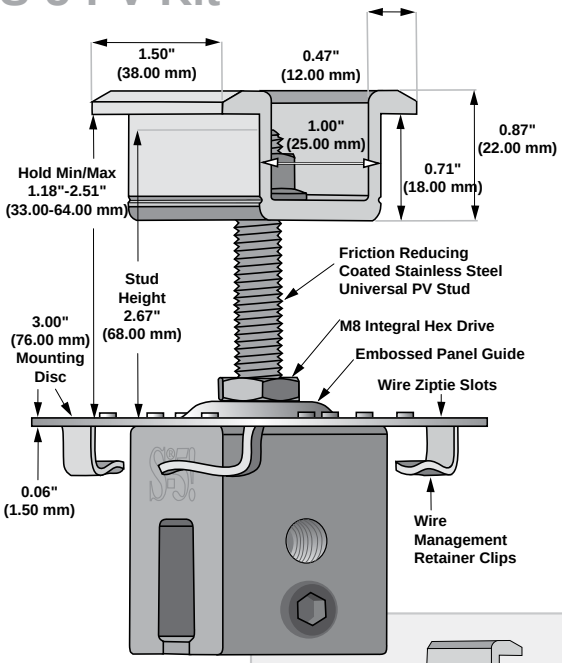
Four strategically placed under-disk hooks assist in wire management. The PV grab ears that hold the solar panel in place are broader to allow for ease of installation and precise module engagement.

The S-5-PV Kit fits the majority of solar panels on the market. Using the S-5! mini clamps, it also fits the majority of metal roofs on the market, including exposed fastened and corrugated. It is designed to universally fit both field (two adjacent panels) and end conditions.

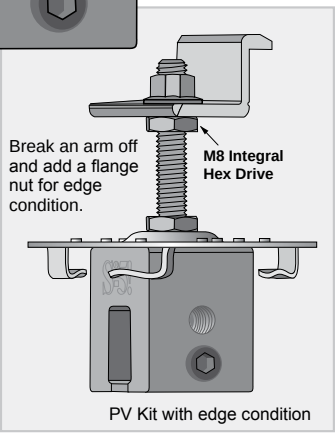
The S-5-PV Kit continues to be the easiest, most cost-effective way to install solar panels directly to standing seam metal roofs, remaining the most popular choice worldwide.

Wind dynamics are complex, thus, each system should be reviewed by a qualified licensed professional who under-stands wind effects on metal roof design and construction prior to purchase and installation. For more detailed information including specifications, installation instructions and CAD drawings, visit **www.lmcurbs.com** or your S-5-PV Kit distributor.

S-5-PV Kit



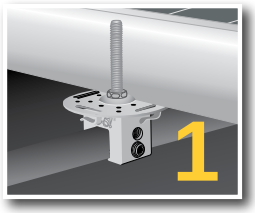
Please note: All measurements are rounded to the second decimal place.

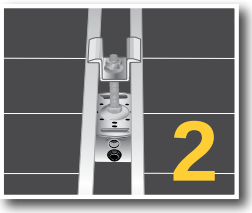


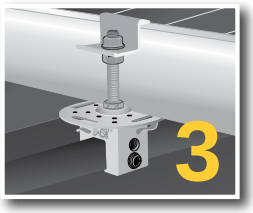
PV Kit with edge condition

LISTED

Listed to UL subject 2703.
ETL Listed to UL 1703.







Patents pending.
Due to the variety of attachment needs, S-5-PV Kits are sold separately from S-5! mini clamps. The S-5-PV Kit fits only S-5! mini clamps, NOT standard clamps.

S-5!® Warning! Please use this product responsibly!

Products are protected by multiple U.S. and foreign patents. Visit the website at www.S-5.com for complete information on patents and trademarks. For maximum holding strength, setscrews should be tensioned and re-tensioned as the seam material compresses. Clamp setscrew tension should be verified using a calibrated torque wrench between 160 and 180 inch pounds when used on 22ga steel, and between 130 and 150 inch pounds for all other metals and thinner gauges of steel. Consult the S-5! website at www.S-5.com for published data regarding holding strength.

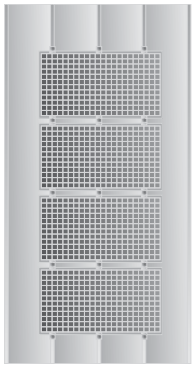
Distributed by

S-5!® suggestions for spacing of S-5! mini clamps for PV arrays.

The following suggestions assume that determination has been made that the roof to which the S-5! ® mini clamps will be attached is structurally adequate. Any loads imposed on the S-5! mini clamps will be transferred to the panels. Panel seams must have sufficient flexural strength to carry these loads. Panels must also be adequately attached to the building structure, and the structure must be sufficient to carry these loads. The makers of S-5! mini clamps make no representations with respect to these variables. It is the responsibility of the user to verify this information, or seek assistance from a qualified design professional if necessary.

The key to frequency and spacing of attachment points for PV frames utilizing the S-5-PV Kit is to distribute loads to the metal standing seam panels in a manner that is consistent with the intended distribution of loads from the roof panels into the building structure. With very few exceptions, the attachment of a single S-5! mini clamp to the seam will be stronger than a single point of attachment of the seam to the building structure. Hence the "weak link" is not the S-5! mini clamp but the attachment clips that hold the metal panels to the building structure, or the beam strength of the roof panel seam itself.

The most conservative approach to the spacing/frequency of PV frame attachment to the roof is to determine the spacing/frequency of the roof's attachment to the building structure, then duplicate it at minimum. Determining panel attachment spacing in one axis is very simple. Standing seam panels' attachment will be made using concealed hold-down clips within the seam area of the panel. So, in that axis, the clip spacing is the same as the seam spacing. The location of the clips along the seam (in the other axis) can be determined by a) consultation with the roof system manufacturer or installer, b) checking from the underside or, c) close examination from the topside along the seam. There will usually be a slight, but detectable, deformation of the seam at the clip location visible from the roof's topside. Many standing seam roof systems are installed on "pre-engineered" steel buildings. The attachment spacing in that industry is typically 5'-0" and is readily apparent by inspecting the spacing of the structural purlins to which the panel clips are attached from the roof underside (interior of the building).



If, for instance, the panel clips are spaced 5'-0" on center along the seam, then use the 5'-0" dimension as a maximum spacing for the S-5! mini clamps. (S-5! mini clamps may also be spaced at closer centers, but not wider.) When modules are direct attached without racking in the landscape orientation, this spacing dimension is dictated by the smallest dimension of the PV frame. Using the roof panel clip spacing as a maximum spacing template for S-5! mini clamps is a sound practice, whether the PV modules are attached direct to S-5! mini clamp or to a racking system and then to the S-5! mini clamp (and panel seams). To evenly distribute loads, it is also necessary that each seam be involved in the finished assembly. Thus, every time a seam is traversed, it should be attached. Such an attachment scheme should evenly distribute wind loads into the building structure through the panels and their attachment, as was intended in the original roof construction assembly.

Please note these are only suggestions. Wind dynamics are complex, and S-5! advises review of the planned PV frame attachment design by a qualified professional who understands wind effects and metal roof design and construction. In certain solar installations a design professional may determine that seams can be skipped as points of attachment, but this determination must be made on a job-specific basis.

These instructions for use by those experienced in the craft. Always follow appropriate safety precautions and use appropriate tools.

S-5!®
The Right Way!

These instructions for use by those experienced in the craft.
Always follow appropriate safety precautions and use appropriate tools.

Installation Instructions

S-5!® Warning! Please use these products responsibly! Visit our website or contact your S-5! distributor for detailed installation instructions and available load test results. The user and/or the installer of these parts is responsible for all necessary engineering and design for the intended use of these parts in an assembly or application. Note that a continuous ground must be followed in accordance with National Electric Code (NEC), ANSI/ NFPA 70. Installation in Canada must be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1. For use with PV Modules having a maximum fuse rating of 15A or less. Prior to installation contact the local code Authority Having Jurisdiction (AHJ) to determine the proper grounding requirements.

Install S-5! mini clamp. See mini clamp installation instructions.

1) Place mounting disc on the S-5! mini clamp. Secure Universal PV stud through the mounting disc into the S-5! mini clamp. Using a 13 mm deepwell socket, tighten universal PV stud to 140–160 inch pounds.

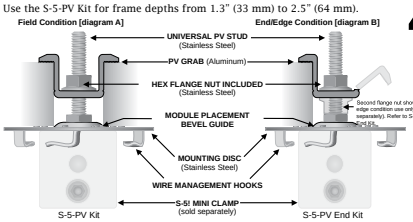
2)-3) Install PV frames on top of the mounting disc utilizing the module placement bevel guide to ensure proper placement.

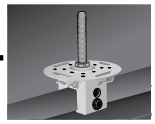
4) Install the universal PV anchor grab to the universal PV stud, with the flanged nut to secure the two PV frames (See diagram A). Tighten flange nut to 100–120 inch pounds.

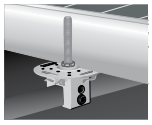
5) For end/edge condition use two flange nuts (one sold separately). Install the first flange nut flange side up, and then install the PV anchor grab on top of the first flange nut. Ensure the arm of the PV grab fully engages module frame. Then install the second flange nut on the stud. Tighten top flange nut to 100 to 120 inch pounds and verify proper torque is achieved. Using locking pliers break off extra PV anchor grab arm by bending toward module frame and then back (see diagram B).

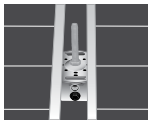
Note: An electric tool can be utilized for ease of installation provided proper torque is achieved.

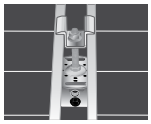
Use the S-5-PV Kit for frame depths from 1.3" (33 mm) to 2.5" (64 mm).

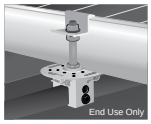












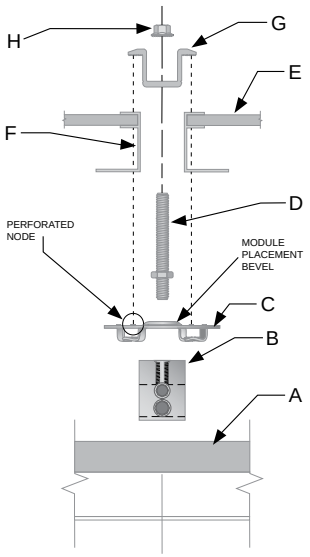
S-5-PV Kit Install

These instructions for use by those experienced in the craft. Always follow appropriate safety precautions and use appropriate tools.

The right way to attach almost anything to metal roofs!

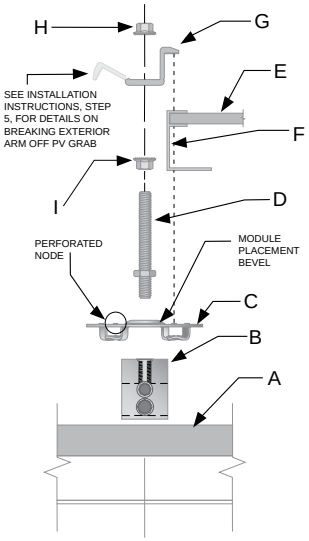
800-284-1412 www.lmcurbs.com

PV Mounting Assembly
Field Condition



A. STANDING SEAM METAL ROOF
B. S-5! MINI CLAMP (Sold separately)
C. STAINLESS STEEL MOUNTING DISC
D. STAINLESS STEEL M8--1.25x68 mm UNIVERSAL PV STUD (Tensioned between 140 and 160 inch pounds)
E. GLASS
F. MODULE FRAME CROSS SECTION (Frame thickness from 1.3" [33 mm] to 2.5" [64 mm])
G. PV GRAB
H. STAINLESS STEEL M8-1.25 HEX FLANGE NUT (Tensioned between 100 and 120 inch pounds)

PV Mounting Assembly
Edge Condition



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S-5!®
The Right Way!

The right way to attach almost anything to metal roofs!

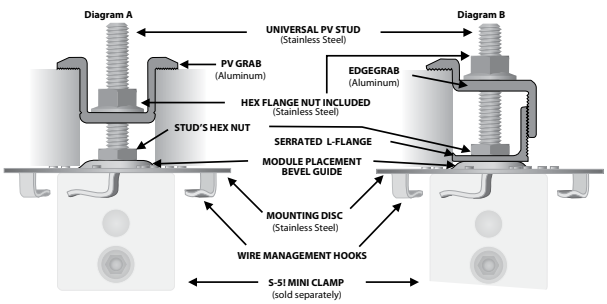
Installation Instructions

S-5!® Warning! Please use these products responsibly! Visit our website or contact your S-5! distributor for detailed installation instructions and available load test results. The user and/or the installer of these parts is responsible for all necessary engineering and design for the intended use of these parts in an assembly or application. Note that a continuous ground must be followed in accordance with National Electric Code (NEC), ANSI/NFPA 70. Installation in Canada must be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1. For UL Subject 2703 Listed assemblies use with PV Modules having a maximum fuse rating of 25A or less. For ETL UL-1703 Listed Model Number MD40-B-300S use with PV Modules having a maximum fuse rating of 15A or less. Prior to installation, contact the local code Authority Having Jurisdiction (AHJ) to determine the proper grounding requirements.

Install S-5! mini clamp. See mini clamp installation instructions.

1. Place mounting disc on the S-5! mini clamp. Secure Universal PV stud through the mounting disc into the S-5! mini clamp. Using a 13 mm deep-well socket on the PV stud's hex nut, tighten universal PV stud to 140–160 inch pounds. Install one PV frame on top of the mounting disc utilizing the module placement bevel guide to ensure proper placement.
2. Install a second PV frame on top of the mounting disc again utilizing the module placement bevel guide to ensure proper placement.
3. Install the universal PV anchor grab to the universal PV stud, with the flanged nut to secure the two PV frames (see Diagram A). Tighten flange nut to 100–120 inch pounds.
4. For end/edge conditions, use the EdgeGrab™. There are two assembly options for the EdgeGrab, dependent upon the PV frame thickness. For frame thicknesses 30–48 mm, install the EdgeGrab by placing the serrated L-flange on top of the mounting disk (see Diagram B). Then, drive the universal PV stud through the serrated L-flange and the mounting disk, and into the S-5 mini clamp. The serrated L-flange will be positioned beneath the stud's hex nut. Using a 13 mm deep-well socket, tighten the universal PV stud to 140–160 inch pounds. Next, set the PV module atop the mounting disk, making the thin edge of the serrated L-flange flush against the PV frame. Slide the top component of the EdgeGrab onto the stud, allowing the serrated sides to interlock at the appropriate height. Add the flange nut to the stud to secure the PV frame. Tighten flange nut to 100–120 inch pounds.
5. For frame thicknesses 34–51 mm, position the serrated L-flange stud's hex nut. Proceed with the remainder of Step 4.

Note: When ProteaBracket™ is used in conjunction with the S-5-PV Kit, an additional nut is required during installation to secure the universal PV stud and mounting disk to ProteaBracket's slotted L-flange.



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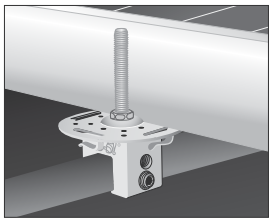

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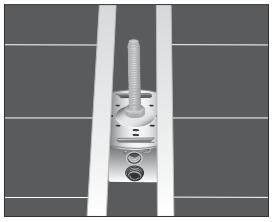

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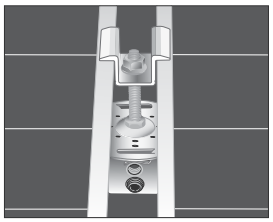

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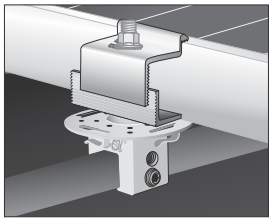

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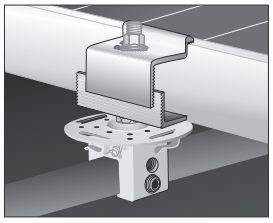

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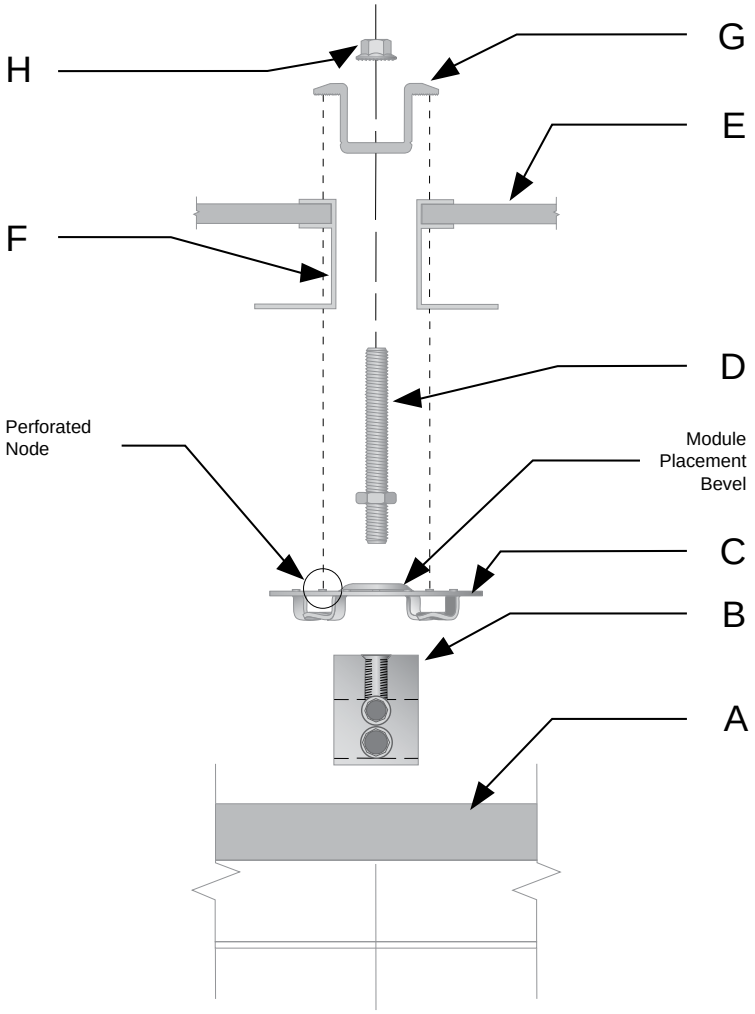
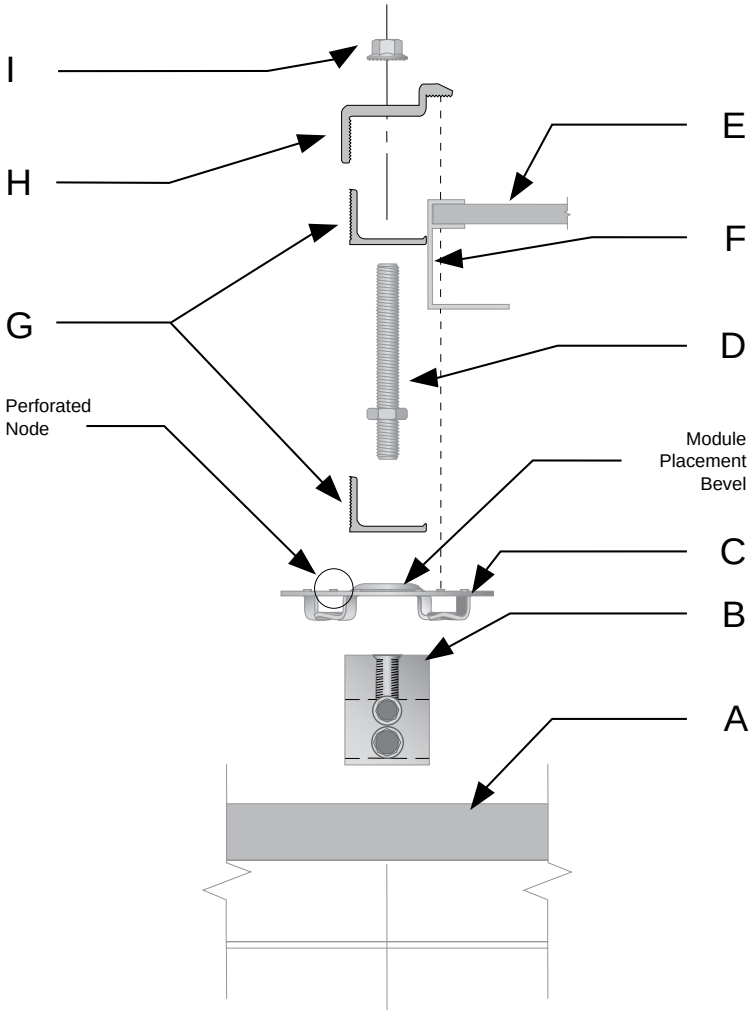
PV Mounting Assembly

Field Condition



A. Standing Seam Metal Roof
B. S-5!® Mini Clamp (Sold separately)
C. Stainless Steel Mounting Disc
D. Stainless Steel M8–1.25x68 mm Universal PV Stud w/hex nut (Tensioned between 140 and 160 inch pounds)
E. Glass
F. Module Frame Cross Section (Frame thickness from 1.3" [33 mm] to 2.5" [64 mm])
G. Universal PV Grab
H. Stainless Steel M8–1.25 Hex Flange Nut (Tensioned between 100 and 120 inch pounds)

EdgeGrab™
Edge Condition

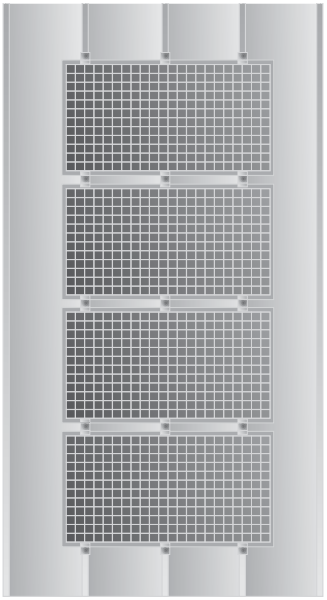


A. Standing Seam Metal Roof
B. S-5!® Mini Clamp (Sold separately)
C. Stainless Steel Mounting Disc
D. Stainless Steel M8–1.25x68 mm Universal PV Stud w/hex nut (Tensioned between 140 and 160 inch pounds)
E. Glass
F. Module Frame Cross Section (Frame thickness from 1.3" [33 mm] to 2.5" [64 mm])
G. EdgeGrab™ Serrated L-Flange (See installation instructions, Steps 4 and 5, for details on EdgeGrab)
H. EdgeGrab Serrated Top Component (See installation instructions, Steps 4 and 5, for details on EdgeGrab)
I. Stainless Steel M8–1.25 Hex Flange Nut (Tensioned between 100 and 120 inch pounds)

S-5!® suggestions for spacing of S-5! mini clamps for PV arrays.

The following suggestions assume that determination has been made that the roof to which the S-5!® mini clamps will be attached is structurally adequate. Any loads imposed on the S-5! mini clamps will be transferred to the panels. Panel seams must have sufficient flexural strength to carry these loads. Panels must also be adequately attached to the building structure, and the structure must be sufficient to carry these loads. The makers of S-5! mini clamps make no representations with respect to these variables. It is the responsibility of the user to verify this information, or seek assistance from a qualified design professional if necessary.

The key to frequency and spacing of attachment points for PV frames utilizing the S-5-PV Kit is to distribute loads to the metal standing seam panels in a manner that is consistent with the intended distribution of loads from the roof panels into the building structure. With very few exceptions, the attachment of a single S-5! mini clamp to the seam will be stronger than a single point of attachment of the seam to the building structure. Hence the "weak link" is not the S-5! mini clamp but the attachment clips that hold the metal panels to the building structure, or the beam strength of the roof panel seam itself.



The most conservative approach to the spacing/frequency of PV frame attachment to the roof is to determine the spacing/frequency of the roof's attachment to the building structure, then duplicate it at minimum. Determining panel attachment spacing in one axis is very simple. Standing seam panels' attachment will be made using concealed hold-down clips within the seam area of the panel. So, in that axis, the clip spacing is the same as the seam spacing. The location of the clips along the seam (in the other axis) can be determined by a) consultation with the roof system manufacturer or installer, b) checking from the underside or, c) close examination from the topside along the seam.

There will usually be a slight, but detectable, deformation of the seam at the clip location visible from the roof's topside. Many standing seam roof systems are installed on "pre-engineered" steel buildings. The attachment spacing in that industry is typically 5'-0" and is readily apparent by inspecting the spacing of the structural purlins to which the panel clips are attached from the roof underside (interior of the building).

If, for instance, the panel clips are spaced 5'-0" on center along the seam, then use the 5'-0" dimension as a maximum spacing for the S-5! mini clamps. (S-5! mini clamps may also be spaced at closer centers, but not wider.) When modules are attached directly without racking in the landscape orientation, this spacing dimension is dictated by the smallest dimension of the PV frame. Using the roof panel clip spacing as a maximum spacing template for S-5! mini clamps is a sound practice, whether the PV modules are attached directly to S-5! mini clamps, or to a racking system and then to the S-5! mini clamp (and panel seams). To evenly distribute loads, it is also necessary that each seam be involved in the finished assembly. Thus, every time a seam is traversed, it should be attached. Such an attachment scheme should evenly distribute wind loads into the building structure through the panels and their attachment, as was intended in the original roof construction assembly.

Please note these are only suggestions. Wind dynamics are complex, and S-5! advises review of the planned PV frame attachment design by a qualified professional who understands wind effects and metal roof design and construction. In certain solar installations, a design professional may determine that seams can be skipped as points of attachment, but this determination must be made on a job-specific basis.

S-5!® Warning! Please use this product responsibly!

PVKAI-V1.0-0915

S-5!®

The Right Way!

S-5-Z Clamp

The S-5-Z clamp is specially developed to fit profiles having a round "bulb" seam configuration. Its two-piece design allows it to be easily installed anywhere along the length of the rib. The S-5-Z is perfect for use with S-5!® ColorGard® snow retention system and other heavy-duty applications.

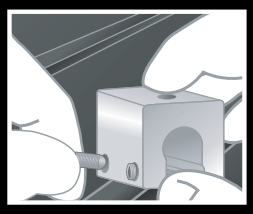
Installation is as simple as placing the clamp on the seam, positioning the insert piece, and tightening the patented round-point setscrews to the specified tension. Then, affix ancillary items using the bolt provided. Go to www.S-5.com/tools for information and tools available for properly attaching and tensioning S-5! clamps.

S-5-Z Mini Clamp

The S-5-Z Mini is a medium-duty, non-penetrating seam clamp and is a bit shorter than the S-5-Z and has one setscrew rather than two. The mini is the choice for attaching all kinds of rooftop accessories: signs, walkways, satellite dishes, antennas, rooftop lighting, lightning protection systems, solar arrays, exhaust stack bracing, conduit, condensate lines, mechanical equipment—just about anything!*

*S-5! mini clamps are not compatible with, and should not be used with, S-5! SnoRail™/SnoFence™ or ColorGard® snow retention systems.

1



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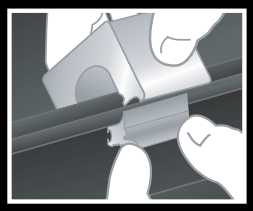

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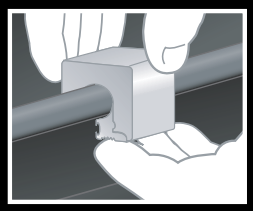

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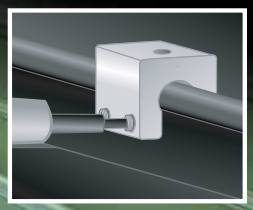

S-5-Z and S-5-Z Mini

The S-5-Z clamp is specially developed to fit profiles having a round "bulb" seam configuration.

The right way to attach almost anything to metal roofs!

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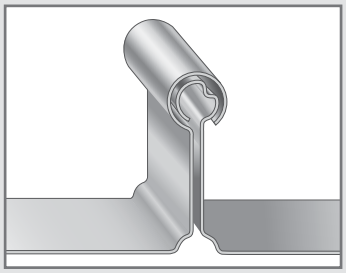
S-5!®
The Right Way!

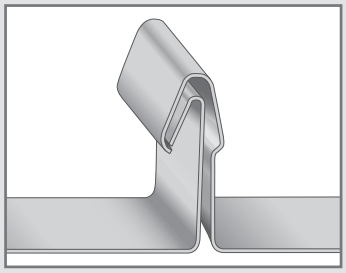
The strength of the S-5-Z clamp is in its simple design. The patented setscrews will slightly dimple the metal seam material but will not puncture it—leaving roof warranties intact.

The **S-5-Z and S-5-Z Mini clamps** are each furnished with the hardware shown to the right. Each box also includes a bit tip for tightening setscrews using an electric screw gun. A structural aluminum attachment clamp, the S-5-Z is compatible with most common metal roofing materials excluding copper. All included hardware is stainless steel. Please visit **www.S-5.com** for more information including CAD details, metallurgical compatibilities, and specifications.

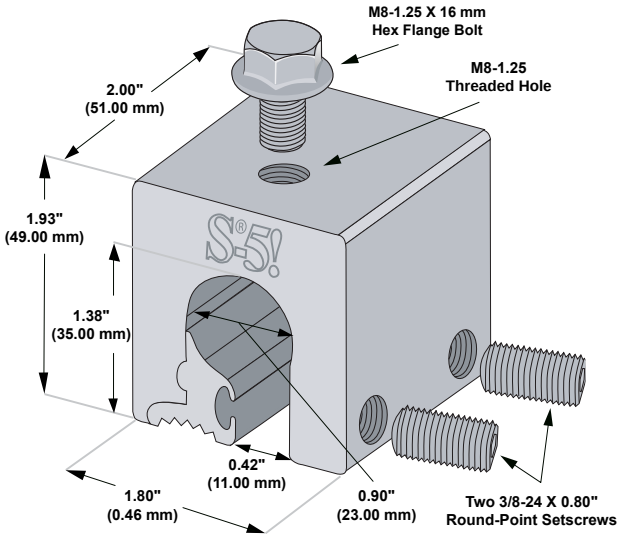
The S-5-Z clamp has been tested for load-to-failure results on a variety of bulb shaped standing seam roof profiles from leading manufacturers of panels. The independent lab test reports found on our website at www.S-5.com prove that S-5!® holding strength is unmatched in the industry.

Example Profiles

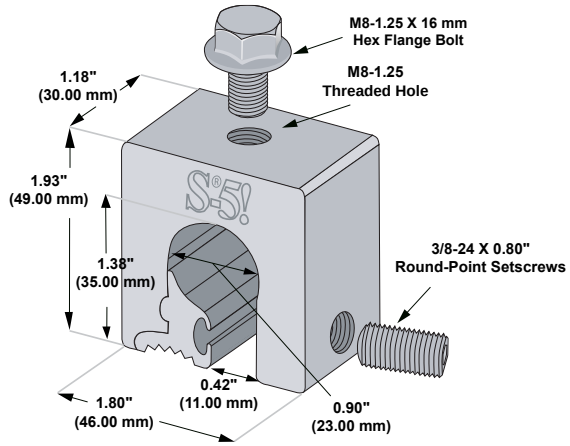




S-5-Z Clamp



S-5-Z Mini Clamp



Please note: All measurements are rounded to the second decimal place.

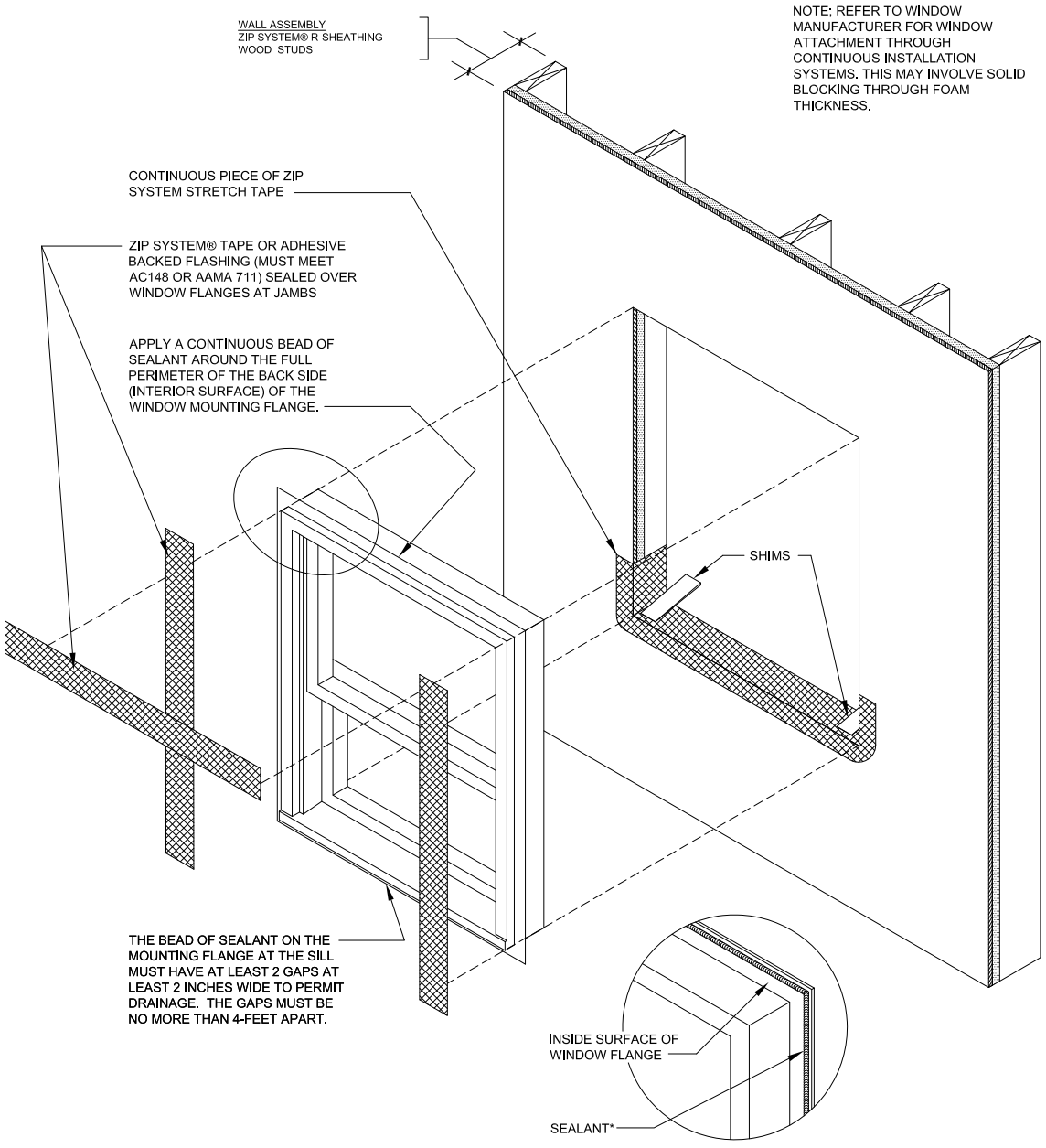
S-5!® Warning! Please use this product responsibly!

Products are protected by multiple U.S. and foreign patents. Visit the website at www.S-5.com for complete information on patents and trademarks. For maximum holding strength, setscrews should be tensioned and re-tensioned as the seam material compresses. Clamp setscrew tension should be verified using a calibrated torque wrench between 160 and 180 inch pounds when used on 22ga steel, and between 130 and 150 inch pounds for all other metals and thinner gauges of steel. Consult the S-5! website at www.S-5.com for published data regarding holding strength.

Distributed by

ZIP SYSTEM® R-SHEATHING - TYPICAL FLANGED WINDOW - OPTION A (1 OF 2)

RW-1



*WHEN USING ZIP SYSTEM TAPE, BUTYL, 100% SILICONE OR POLYURETHANE SEALANTS ARE ACCEPTABLE. DO NOT USE LATEX SEALANTS WITH ZIP SYSTEM TAPE. IF USING ANOTHER FLASHING TAPE, FOLLOW THE FLASHING MANUFACTURER'S RECOMMENDATION IN SELECTING A SEALANT COMPATIBLE WITH THE FLASHING .

DRAWING NOT TO SCALE

08-10-2015

ZIPsystem™ SHEATHING & TAPE

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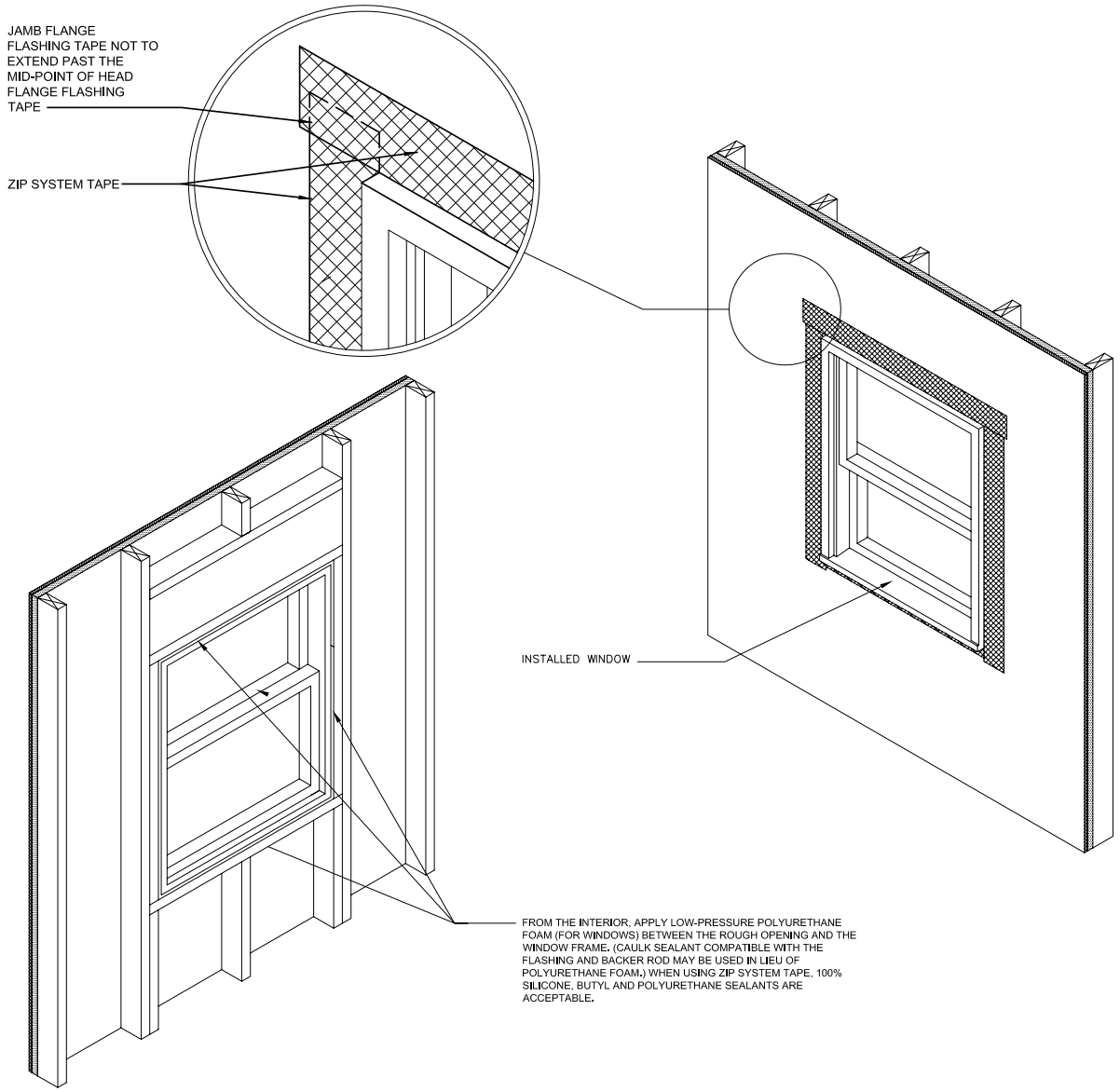
ZIP SYSTEM® R-SHEATHING - TYPICAL FLANGED WINDOW - OPTION A (2 OF 2)

RW-1



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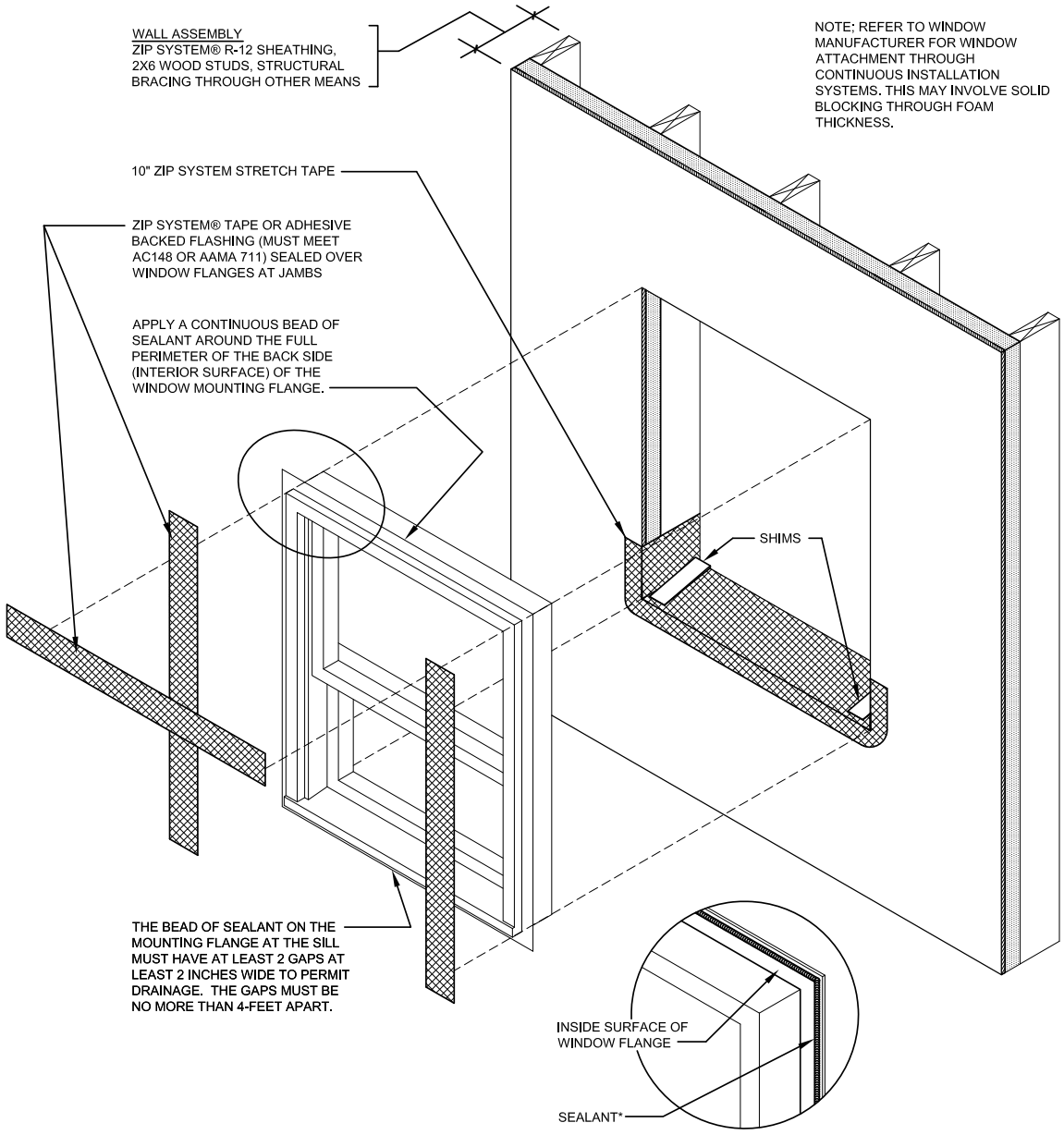
ZIP SYSTEM® R-SHEATHING - TYPICAL FLANGED WINDOW 10-INCH STRETCH TAPE (1 OF 2)

RW-2



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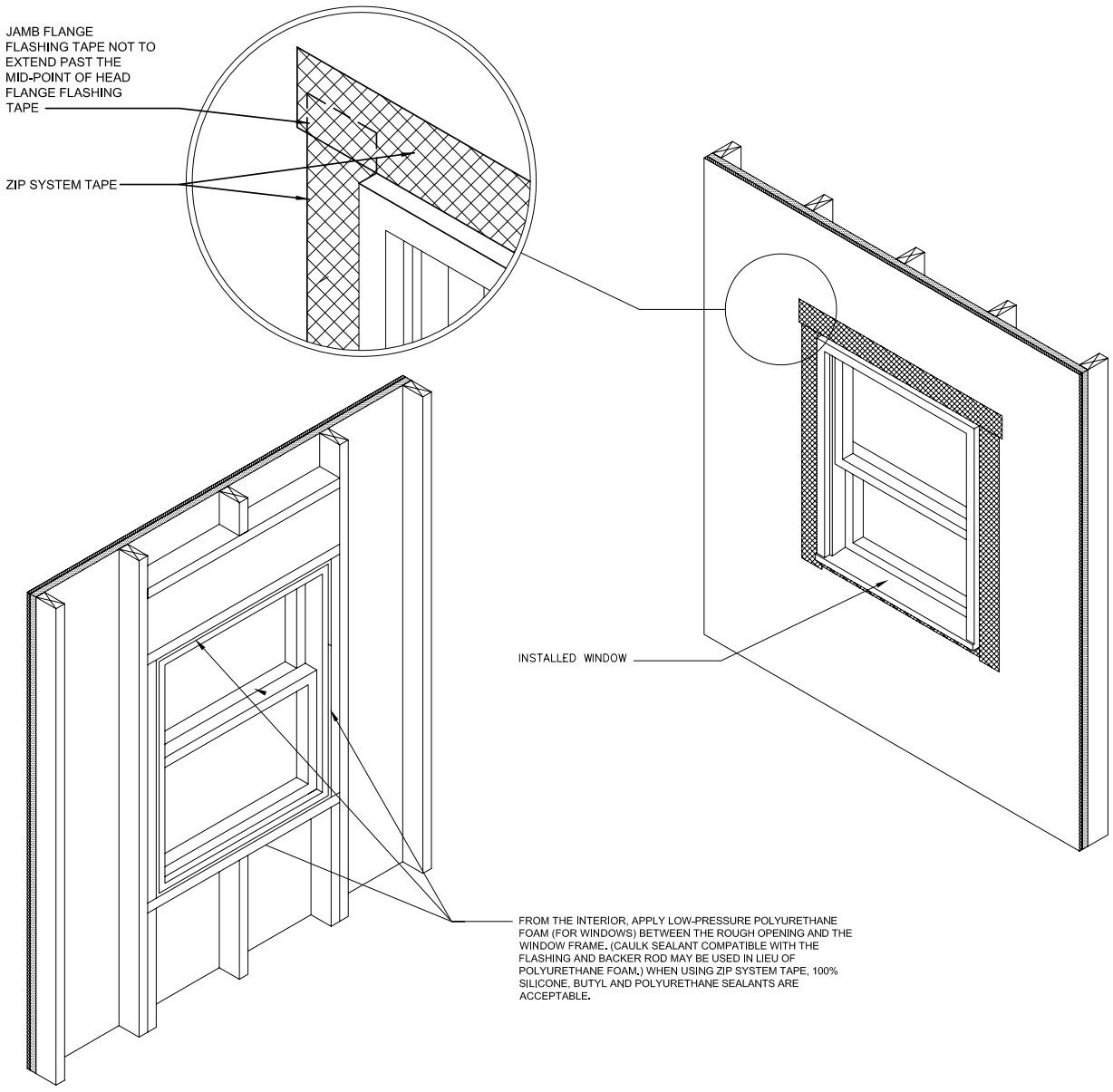
ZIP SYSTEM® R-SHEATHING - TYPICAL FLANGED WINDOW 10-INCH STRETCH TAPE (2 OF 2)

RW-2



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ZIPsystem™ SHEATHING & TAPE

HUBER ENGINEERED WOODS

ZIP SYSTEM™ STRETCH TAPE

MANUFACTURER

Huber Engineered Woods LLC
10925 David Taylor Drive, Suite 300, Charlotte, NC 28262
800.933.9220 • Technical Service: 800.933.9220 x2716
ZIPSystem.com • HuberArchitectLibrary.com

BASIC USE AND APPLICATIONS

ZIP System™ stretch tape is a code-recognized flashing tape that stretches and forms around irregular and difficult to seal areas like window rough openings, curved window heads, and wall and roof penetrations. It is UV radiation resistant and highly effective at sealing up the exterior building envelope. Unlike most other flashing tapes, ZIP System stretch tape is compatible with flexible PVC windows.

ZIP System stretch tape easily stretches to fit difficult to flash areas with a single piece without having to piece tape segments together. This avoids tape seams or joints. ZIP System stretch tape is made of a high-performance composite acrylic adhesive and a strong, yet stretchable, acrylic foam core. The tape conforms to challenging applications and locks out moisture over mismatched surfaces when correctly applied. ZIP System stretch tape can be pulled up and reapplied for easy, fast, and hassle-free installation that provides a tight seal against weather intrusion.

ZIP System stretch tape can be used for a wide range of applications including:

- Window rough opening sill pans.
- Wall penetrations
- Curved window heads
- Cantilevered beams

ADVANTAGES

ZIP System stretch tape is a multi-purpose acrylic tape with a robust and aggressive acrylic adhesive. The intertwined polymer chains provide excellent internal strength and durability. The tape's advanced acrylic adhesive is made of highly polar molecules; the resulting attraction pulls the tape to the ZIP System® panel. This helps the tape wet out and flow into panel ridges and produce a weather tight seal. The strong, yet stretchable, acrylic foam core allows for continuous single-piece flashing around pipes, beams, rough openings and other difficult to flash applications. The ZIP System stretch tape satisfies the requirements of AC148 and AAMA 711-13 as represented in IAPMO ER-365.

The use of ZIP System stretch tape as flashing material is recognized for use on Type V construction under the IBC and non-fire-resistance-rated construction under the IBC and IRC.

ZIP System™ Stretch Tape	
Maximum Exposure Time	180 Days
Adhesive Type	Acrylic
Installation Temperature Range	20 °F – 120 °F
Compatibility	Compatible with flexible PVC used in vinyl windows
Tensile Strength	225 psi
Elongation	800-1200%
Code Acceptance	IRC and IBC compliance recognized by IAPMO ER-365
Performance Standard	AAMA 711-13 compliant

SIZE

ZIP System stretch tape is available in 75 ft (22.8 m) long rolls in a 6-inch (152 mm) and 10-inch (254 mm) roll width, is 42 mils thick and is packaged with a release liner.

SUBSTRATE

Prior to application, ensure that the surface to be taped is dry and free of frost, dust, dirt, loose fasteners, and other protrusions. Apply tape when ambient air and substrate are above 20 °F (-6 °C).

TAPE INSTALLATION

Refer to installation instructions on huberwood.com or huberarchitectlibrary.com for detailed instructions and illustrations for application of ZIP System Stretch Tape to sheathing, flanged windows, brick mould windows, penetrations, and openings. Apply tape as additionally prescribed in IAPMO ER-365. Tape should be covered with a code-compliant roof or wall covering within 180 days of installation. ZIP System stretch tape is a pressure sensitive tape that must be rolled in (ZIP System Tape roller or similar) to achieve maximum bond to the panel.

800.933.9220 | ZIPsystem.com

WINDOWS AND PENETRATIONS

Apply tape at wall openings and sheathing penetrations in manner described in window or door manufacturer's written instructions. Details of installation recommendations are available in AutoCAD or PDF formats at ZIPSystem.com or HuberArchitectLibrary.com

STORAGE AND HANDLING

Store ZIP System stretch tape in the original packaging at a temperature not to exceed 90 °F (32 °C). Store in a clean, dry place.

When stored as recommended in its original unopened container the typical shelf life for ZIP System stretch tape is 9 months from the date of manufacture.

WARRANTY

ZIP System stretch tape is furnished with a 30-year limited system warranty when used with ZIP System Sheathing. See ZIPSystem.com for details.

AVAILABILITY

Huber Engineered Wood's ZIP System stretch tape is available through a vast network of distributors. Visit ZIPSystem.com or contact Huber Engineered Woods for a retailer near you.

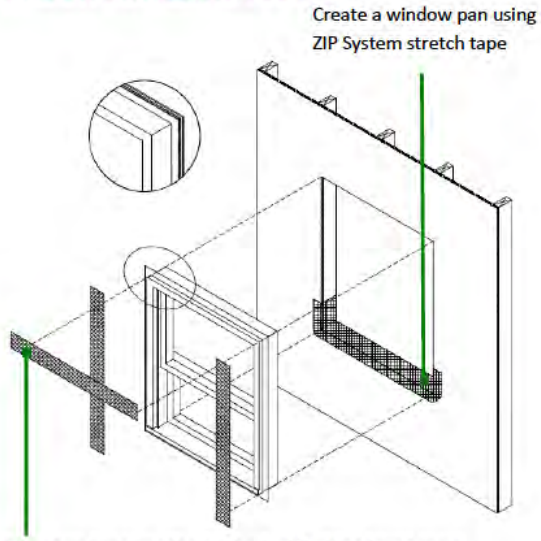
TECHNICAL SERVICE

Detailed information including specifications, product literature, test reports, installation instructions, and special applications are available through Huber Engineered Woods. Please visit ZIPSystem.com or call 800.933.9220 x2716 to speak to a technical representative.

AVAILABLE RESOURCES

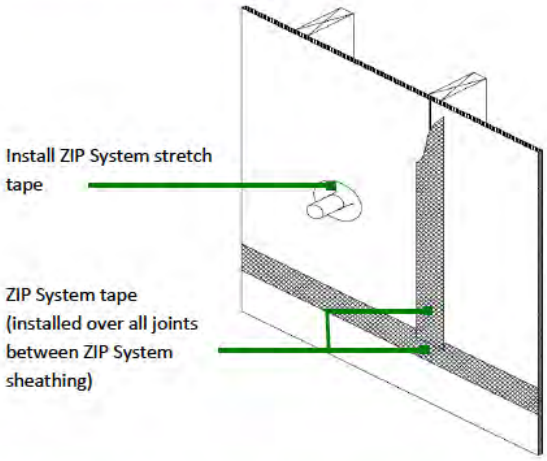
Section 06 16 00 SHEATHING for ZIP System Roof and Wall Sheathing products in CSI 3-part format is available at ZIPSystem.com or HuberArchitectLibrary.com.

WINDOW INSTALLATION DETAIL

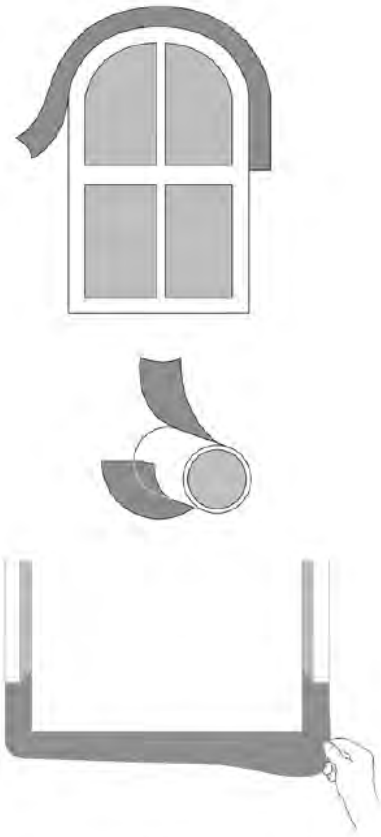


ZIP System tape or adhesive backed flashing (must meet AAMA 711 or AC148) sealed over window flanges. jambs

ROUND PENETRATION DETAIL



MULTIPLE USES FOR ZIP SYSTEM STRETCH TAPE



ZIPsystem™ R-SHEATHING

INSTALLATION MANUAL

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FROM THE CREATORS OF AdvanTech

another innovation from HUBER ENGINEERED WOODS

ZIP System® R-Sheathing

2

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08 ZIP System® R-Sheathing – Exterior Cladding Installation: Lap Siding
09 ZIP System® R-Sheathing – Exterior Cladding Installation: Anchored Masonry Brick Veneer

ATTENTION: This installation guide is intended to provide general information for the designer and end user. The following guidelines will help you properly install the ZIP System® R-Sheathing. We urge anyone installing this product to read these guidelines in order to minimize the risk of safety hazards and to prevent voiding any applicable warranties. This manual is a general installation guide and does not cover every installation condition. Proper installation shall be deemed to mean the most restrictive requirement specified by Huber Engineered Woods (HEW), local building code, engineer or architect of record or other authority having jurisdiction. Please acknowledge that it is solely your obligation for all safety requirements and code compliance. For additional information, contact Huber Engineered Woods LLC.

ZIP System® R-Sheathing Safety Guidelines

- Follow all OSHA regulations and any other safety guidelines and safety practices.
- Use approved safety belts and/or harnesses or other fall protection equipment.
- Install ZIP System® R-Sheathing and ZIP System™ tape only in dry conditions and on dry surfaces. Do not install in rain, snow, frost or other slippery conditions.
- Do not apply flame directly to foam layer. Foam will burn and smoke if exposed to an ignition source of sufficient heat and intensity or open flame, such as a welder's torch.

What is ZIP System® R-Sheathing?

ZIP System® R-Sheathing panels consist of an oriented strand board panel laminated with a water-resistive facer on the exterior and a rigid foam insulation panel bonded on the opposite (interior) face. When properly installed and taped, ZIP System R-Sheathing provides a water-resistive barrier, air barrier and exterior insulation in one product. It may also be used in the construction of braced wall panels or shear walls in certain conditions. See the Structural Bracing to Resist Lateral Forces section of this installation manual for more information.

The OSB substrate complies with Voluntary Product Standard PS2 for wood structural panels and the water-resistive barrier complies as an alternate to the water-resistive barrier prescribed in the code. ZIP System® R-Sheathing is available with a 1/2-inch, 1-inch, 1-1/2-inch and 2-inch foam insulation panel.

ZIP System® R-Sheathing Includes:

- ZIP System® wall sheathing panels with built-in water-resistive barrier and preprinted fastening and tape guides.
- Foam insulation panel.
- ZIP System™ tape.

Storage and Handling

- Set panel stack on three supports (stickers) to keep a minimum of 4 inches of clearance above ground level.
- Outdoors, cover panels loosely with a waterproof protective material such as a tarpaulin.
- Anchor covers on top of the stack, but keep away from sides and bottom to assure good air circulation.
- In high moisture environments, cut banding on the panel stack to prevent edge damage.
- Factory applied packaging is intended only for protection during transit.
- Packaged units must be stored indoors or within a covered structure.
- For temporary job-site storage, units should be stacked on pallets at least three inches above ground level and completely covered with a weatherproof covering such as a tarpaulin.
- The temporary factory-applied packaging should be slit or removed to prevent accumulation of condensation.
- Do not stack more than three units high.

ZIP System® R-Sheathing Notes and Limitations

- ZIP System® R-Sheathing is approved for wall use only. Do not use on roofs.
- Do not use abutted against stone or masonry without providing a minimum of a 1/2-inch gap.
- Do not install ZIP System™ tape in temperatures less than 20° F.
- ZIP System R-Sheathing products are not approved for manufactured housing applications that are built under a federal building code administered by the U.S. Department of Housing and Urban Development (HUD).
- Not intended to replace traditional wood structural panels in applications where the wall sheathing is designed to resist combined wind uplift and shear.
- Do not use in fire-rated assemblies in lieu of a required "wood structural panel."
- Do not apply secondary coatings to the overlay on ZIP System R-Sheathing.
- Minimum 1/2-inch gypsum wall board must be installed on the interior side of the wood wall studs as a thermal barrier using code-recognized fasteners per IRC or IBC requirements.
- Only use in buildings of Type V construction or construction permitted under the International Residential Code.
- In areas where the probability of termite infestation is "very heavy" the clearance between ZIP System R-Sheathing and finished grade shall be no less than 6-inches.

Note: In cladding systems requiring multiple layers of water-resistive barriers, like traditional hard-coat stucco and adhered stone veneers, ZIP System® R-Sheathing is intended only to replace the first layer.

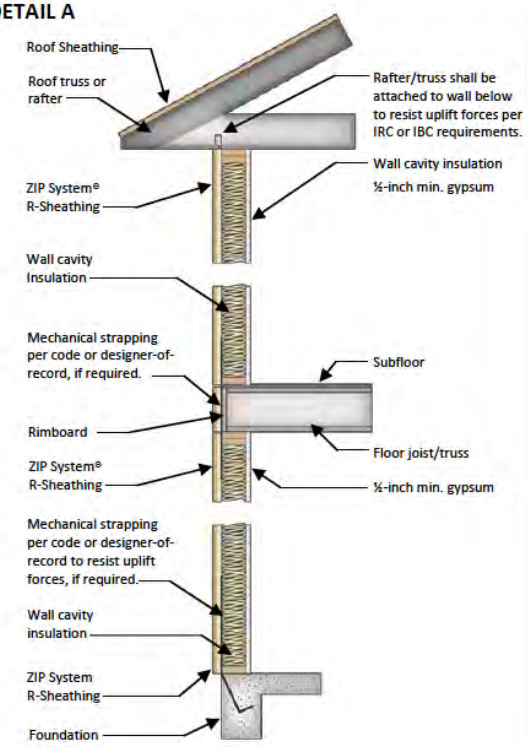
ZIP System® R-Sheathing Installation

Overview: ZIP System® R-Sheathing is composed of ZIP System® wall sheathing panels, laminated exterior foam panel insulation and ZIP System™ seam sealing tape. ZIP System R-Sheathing panels should be fully installed before the seam sealing tape is applied. The following manufacturer installation steps and recommendations are presented as a general outline of the installation process. You are fully and solely responsible for all safety requirements. Good construction practices should be followed at all times.

Step 1. Install any necessary mechanical strapping directly to framing. Any metal straps, ties or other connectors designed to resist uplift, shear or diaphragm loading must be installed prior to ZIP System® R-Sheathing installation. The requirement for mechanical uplift connections shall be determined by the designer-of-record, local building codes or authority having jurisdiction. Detail A should not be considered typical and only applies when mechanical uplift connections are specified.

Straps, ties and connectors installed on the exterior face of stud will not be visible after ZIP System® R-Sheathing panels are installed. Schedule any necessary anchor or nailing inspections accordingly.

DETAIL A



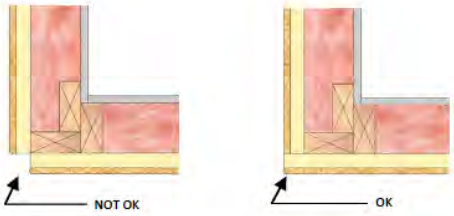
Step 2. Install ZIP System® R-Sheathing panels positioned with the water-resistive barrier facing out. The panels may be installed with the long side of the panel oriented either horizontally or vertically to the framing members. Wall panels that are designed to resist lateral shear forces should have solid framing or blocking behind all panel edges. Foam insulation is oversized on one 4-ft and one 8-ft. edge relative to the ZIP System R-Sheathing face to accommodate proper gapping of panels. Panels should be installed with foam edges touching. Please coordinate panel field placement and orientation in order to take advantage of this gapping feature.

ZIP System® R-Sheathing Installation

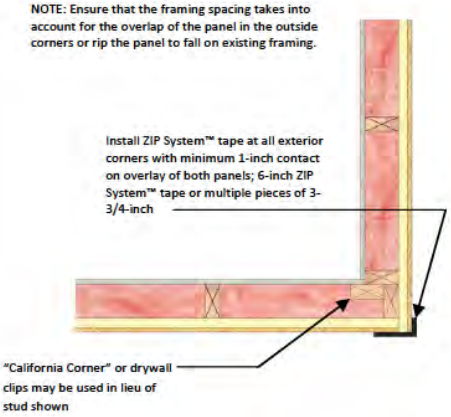
Step 3. Fasten the panels to the framing members with code approved fasteners. When used to resist lateral forces, nail fastener penetration into the wood wall stud should be a minimum of 1 1/2-inches. If staples are used (R3 and R6 only), fasteners must penetrate a minimum 1-inch into the framing. See, Structural Bracing to Resist Lateral Forces, on page 5, for fastener and fastener spacing options. It is the responsibility of the general contractor to ensure correct fastener type and spacing prior to installation. Apply fasteners 3/8 inch from panel edge.

ZIP System® R-Sheathing thickness may influence building interior and exterior dimensions, framing layout or foundation design for anchored veneers. For example: Foundation brick ledges may need to be wider when using ZIP System R-Sheathing (See DETAIL G on page 9), or wall stud placement may need to be adjusted from building corners to allow for sheathing thickness. Designer and general contractor should make necessary adjustments (if any) to the design and/or construction methods to accommodate these changes.

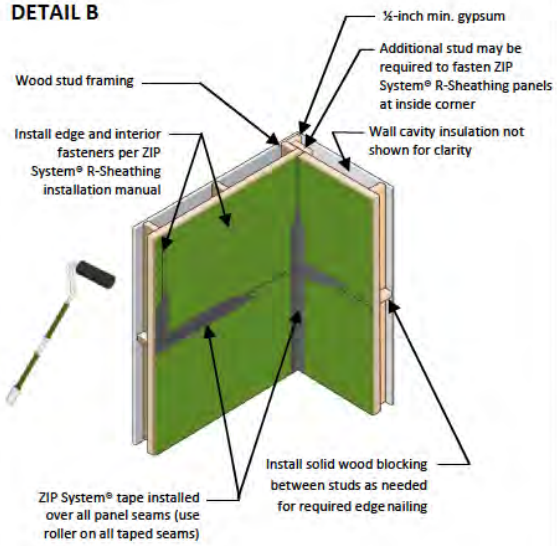
ZIP System® tape must be installed using a roller to apply pressure to the pressure sensitive adhesive layer of the tape.



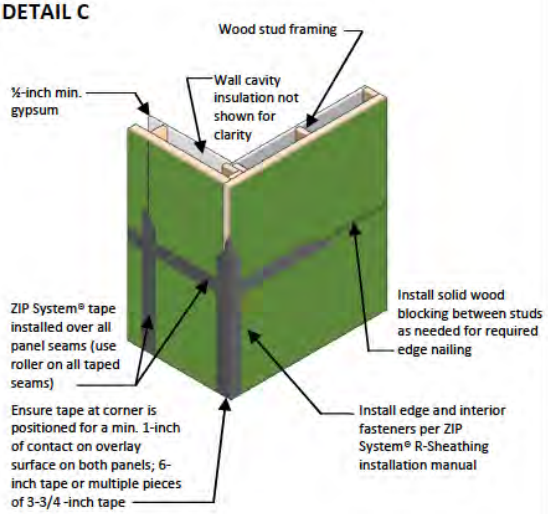
NOTE: Ensure that the framing spacing takes into account for the overlap of the panel in the outside corners or rip the panel to fall on existing framing.



DETAIL B



DETAIL C



Structural Bracing to Resist Lateral Forces

ZIP System® R-Sheathing wood-framed walls may be designed to resist lateral shear forces by prescriptive or engineered methods in accordance with the International Building and Residential Codes (See Table 1 and Table 2 below). All seams between panels used to resist lateral loads must be backed by solid wood framing. If the panel is not required for structural bracing, the panels should be installed with a minimum 0.131" shank diameter nails (minimum 1-inch embedment into wood studs) spaced at 6 inches on center on panel edges and 12 inches on center in the field of the panel. Minimum 1/2-inch thick gypsum wallboard must be installed as a thermal barrier in accordance with Chapter 26 of the IBC or Chapter 3 of the IRC.

Installation When Not Part of Lateral Force Resisting System
ZIP System® R-Sheathing that is not intended to resist wind or seismic loads may be attached to framing using 0.131" diameter shank nails. Nails must penetrate the studs at least 1 inch.

Installation When used in Wall Bracing or Shear Walls
ZIP System® R-Sheathing may be used in the construction of braced wall panels in accordance with WSP bracing method (2009 IRC) as an equivalent alternative to the prescribed wood structural panels ONLY if installed per Table 1 below. All requirements, restrictions and limitations listed in the IRC regarding the applicability and use of prescriptive wall bracing methods still apply.

TABLE 1
PRESCRIPTIVE METHOD: FASTENING REQUIREMENTS FOR ZIP SYSTEM® R-SHEATHING WITH FRAMING OF DOUGLAS FIR-LARCH FOR WIND OR SEISMIC LOADING UNDER THE 2009 IRC (WSP METHOD)

R-SHEATHING TYPE[3] (R-Value of foam)	FRAMING[4]		FASTENERS		
	Nominal Stud Size (Min.)	Maximum Stud Space (inches)	Fastener Specifications[2]	Maximum Edge/Field Spacing (inches)	Minimum Penetration into Framing (inches)
R-3	2-by-4	24	0.131-inch shank nails	4/12	1.5
R-3	2-by-4	16	16ga staples, 7/16-inch crown, 2-inch length	3/6	1.0
R-6	2-by-4	24	0.131-inch shank nails	4/12	1.5
			15ga staples, 7/16-inch crown, 2-inch length	3/6	1.0
R-9	2-by-4	24	0.131-inch shank nails	3/12	1.5
R-12	2-by-4	24	0.131-inch shank nails	3/12	1.5

1. All fasteners must be located a minimum of 3/8 inch from panel edges.
2. Fasteners must be common nails or equivalent, or staples, of a type generally used to attach wood sheathing.
3. R-12 R-Sheathing panels have a foam plastic insulation thickness of 2.0 inch. R-9 R-Sheathing panels have a foam plastic insulation thickness of 1.5 inch. R-6 R-Sheathing panels have a foam plastic insulation thickness of 1.0 inch. R-3 R-Sheathing panels have a foam plastic insulation thickness of 0.5 inch.
4. All panel edges must be backed by framing.

Designers may use ZIP System® R-Sheathing as an alternate to wood structural panels in the construction of wood shear walls when designed in accordance with 2012 or 2009 IBC Sections 2305 and 2306 (as applicable). The allowable shear loads are listed in Table 2.

TABLE 2
ENGINEERED METHOD: FASTENING REQUIREMENTS AND ALLOWABLE SHEAR CAPACITY FOR ZIP SYSTEM® R-SHEATHING WITH FRAMING OF DOUGLAS FIR-LARCH[2] FOR WIND OR SEISMIC LOADING UNDER THE 2009, 2012 AND 2015 IBC.

R-SHEATHING TYPE[4] (R-Value of foam)	FRAMING		FASTENERS			ALLOWABLE SHEAR CAPACITY[5,6,7] (plf)
	Nominal Stud Size (Min.)	Maximum Stud Space (inches)	Fastener Specifications[3]	Edge/Field Spacing (inches)	Minimum Penetration into Framing (inches)	
R-3	2-by-4	24	0.131-inch shank nails	4/12	1.5	245
R-3	2-by-4	24	0.131-inch shank nails	3/12	1.5	280
R-3	2-by-4	16	16ga staples, 7/16-inch crown, 2-inch length	3/6	1.0	210
R-6	2-by-4	24	0.131-inch shank nails	4/12	1.5	230
R-6	2-by-4		0.131-inch shank nails	3/12	1.5	255
R-9	2-by-4	24	0.131-inch shank nails	3/12	1.5	240
R-12	2-by-4	24	0.131-inch shank nails	3/12	1.5	215

For SI: 1 inch = 25.4 mm; 1 pound per foot (ppf) = 14.59 N/m.

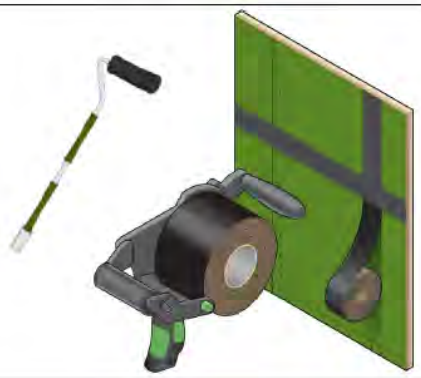
1. All fasteners must be located a minimum of 3/8 inch from panel edges.
2. For framing of other species, the shear value above must be multiplied by the Specific Gravity Adjustment Factor = [1- (0.50 – SG)], where SG = Specific Gravity of the framing lumber in accordance with the AF&PA NDS. This adjustment factor must not be greater than 1.
3. Fasteners must be common nails or equivalent, or staples, of a type generally used to attach wood sheathing to wood framing.
4. R-12 R-Sheathing panels have a foam plastic insulation thickness of 2.0 inch. R-9 R-Sheathing panels have a foam plastic insulation thickness of 1.5 inch. R-6 R-Sheathing panels have a foam plastic insulation thickness of 1.0 inch. R-3 R-Sheathing panels have a foam plastic insulation thickness of 0.5 inch.
5. The maximum height-to-width aspect ratio of 2:1.
6. The allowable shear capacity may be increased by 40% for wind in Allowable Stress Design in accordance with Section 2306.3 of the 2015, 2012 and 2009 IBC.
7. All panel edges must be backed by framing.

ZIP System® R-Sheathing – Tape Installation

Apply ZIP System™ tape after ZIP System® R-Sheathing panels are fully fastened to wall framing. Only ZIP System tape should be used to seal the seams of ZIP System R-Sheathing. Make sure that the panel surface is dry and free of sawdust and dirt prior to taping. ZIP System tape is a contact tape that requires application pressure for an adequate seal.

Step 1. Tape all seams using ZIP System™ tape. Center the tape over the seam within +/- 1/2 inch to provide adequate coverage and reduce wrinkles in tape.

Use the ZIP System™ tape gun or ZIP System® roller to apply pressure to the tape and smooth out any wrinkles.

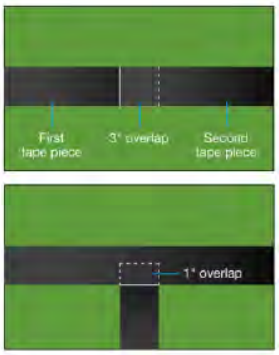


Step 2. Wherever tape splices occur at a horizontal or vertical seam, create an overlapping splice of at least 3 inches.

At T-joints, the tape pieces should overlap by at least 1 inch. Apply pressure onto the surface of the tape to ensure a secure bond between the panel and the tape.

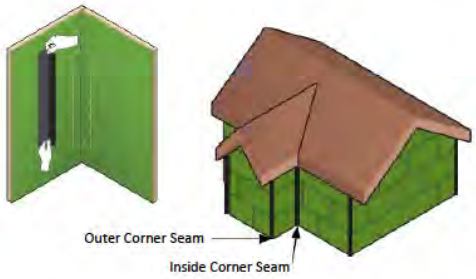
Use the ZIP System™ tape gun or ZIP System® roller to apply pressure to the tape and smooth out any wrinkles.

Take special care to remove any voids and/or trapped air at splice areas and T-joints.



Step 3. Tape inside and outside corner seams.

Tip: When taping inside corner seams, it is helpful to cut a manageable length of ZIP System™ tape and hold the ends in the middle using only your index fingers and thumbs. Slightly pulling both ends of the tape causes the tape edges to naturally curl inward. With the tape in tension, place it in the inside corner. Repeat as you go up the full height of the wall.

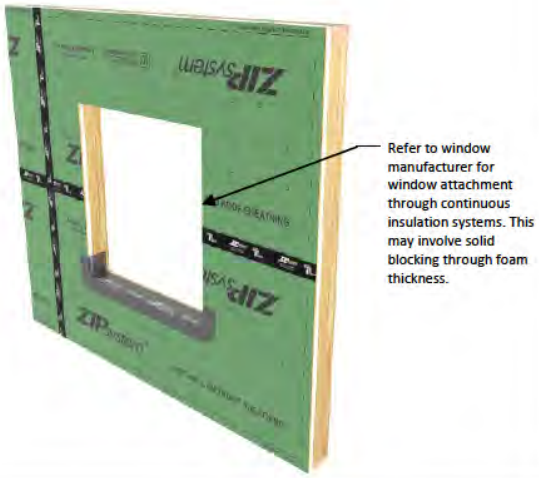


ZIP System® R-Sheathing – Window Installation

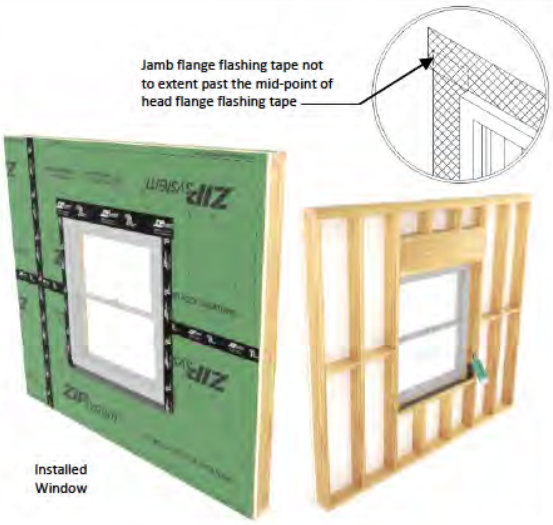
DISCLAIMER: Please defer to/consult the installation instructions of your window manufacturer as well as local code requirements. It is the responsibility of the general contractor to coordinate rough opening dimensions with window dimensions and install any necessary extensions or solid blocking as needed.

Step 1. Install sill/pan flashing that satisfies the requirements of ASTM E 2112 and AAMA 711into the rough opening. ZIP System™ tape or ZIP System™ stretch tape may be used as pan flashing. Other adhesive-based flashing tapes may be used if they satisfy ICC-ES AC-148 or AAMA 711.

DETAIL D



Step 2. From the interior of the rough opening, apply low-pressure polyurethane foam (for windows) between the rough opening and the window frame. (Caulk sealant compatible with the flashing and backer rod may be used in lieu of polyurethane foam.) When using ZIP System™ tape, 100% silicone, butyl and polyurethane sealants are acceptable.

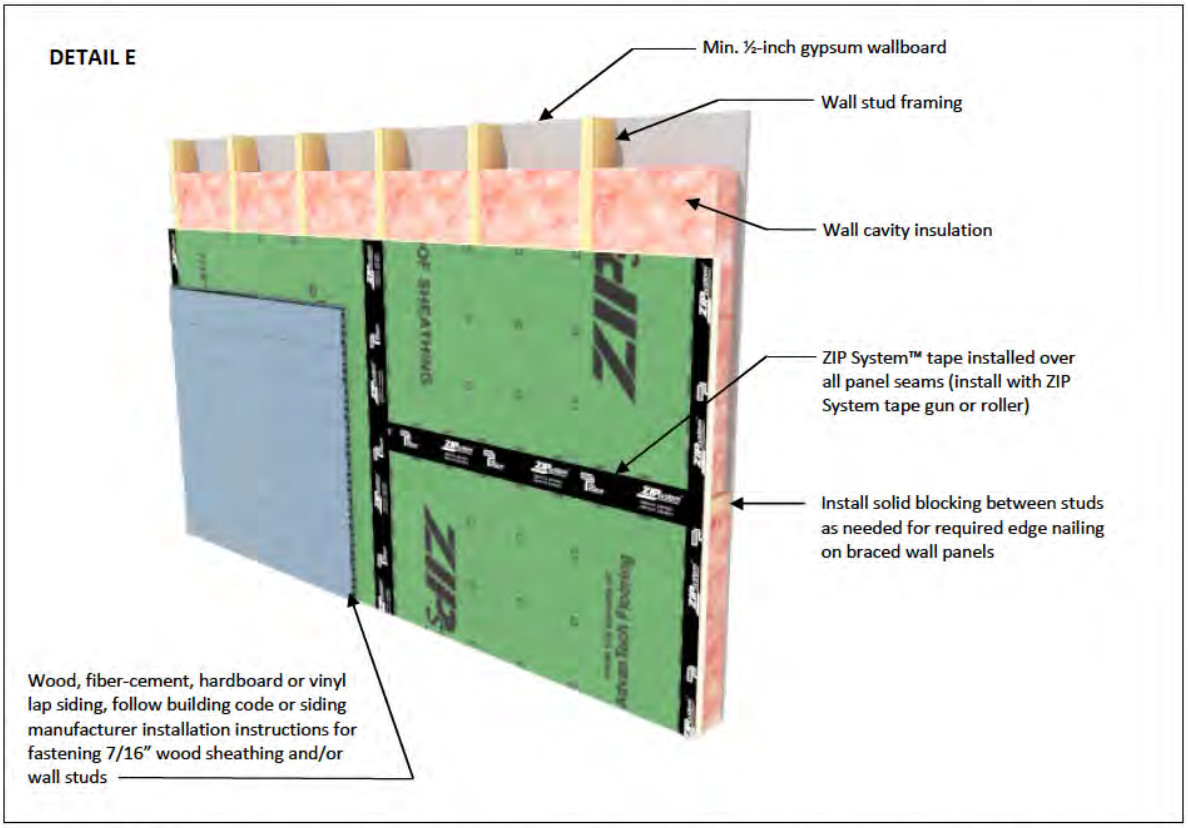


ZIP System® R-Sheathing – Exterior Cladding Installation

The outside layer of ZIP System® R -Sheathing consists of a 7/16" wood structural panel that can be used as a nailbase for finished exterior cladding that does not require direct attachment to structural framing. For finished wall cladding requiring fasteners to penetrate into the structural framing we recommend following the finished cladding manufacturer's installation recommendations. The maximum allowable cladding weights and cladding fastener schedules are listed in Table R703.15.1 of the 2015 IRC.

DISCLAIMER: The following steps represent a general overview of exterior cladding installation. Please defer to/consult the installation instructions of your cladding manufacturer as well as local code requirements.

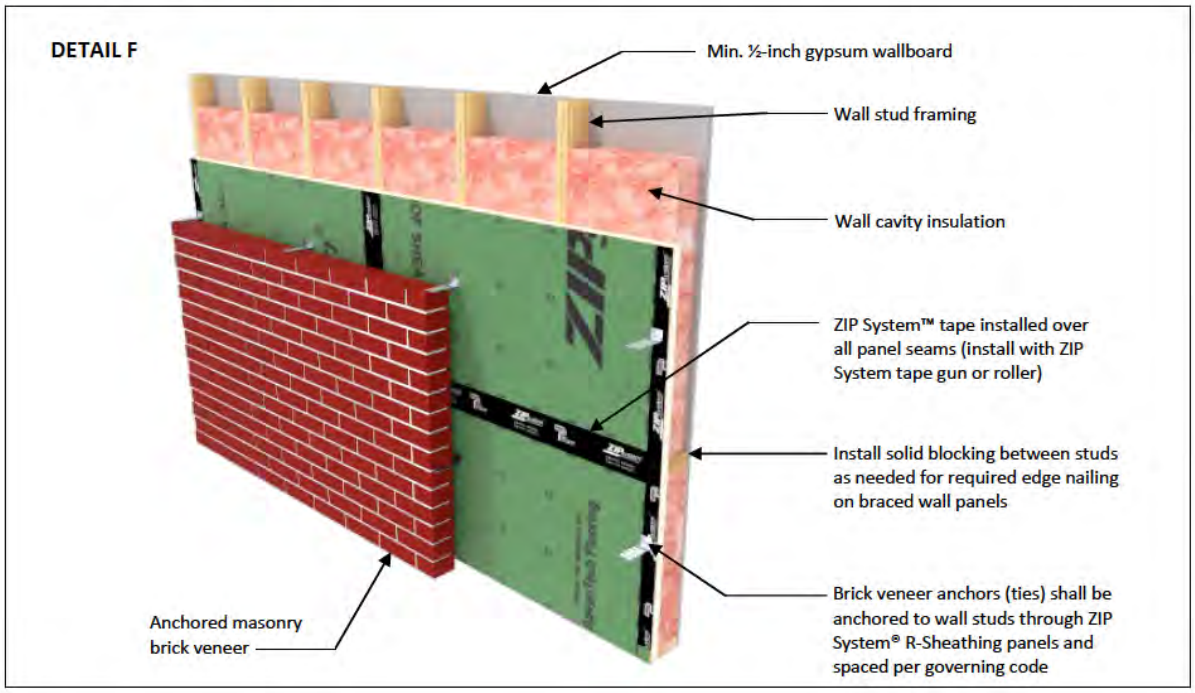
Lap Siding

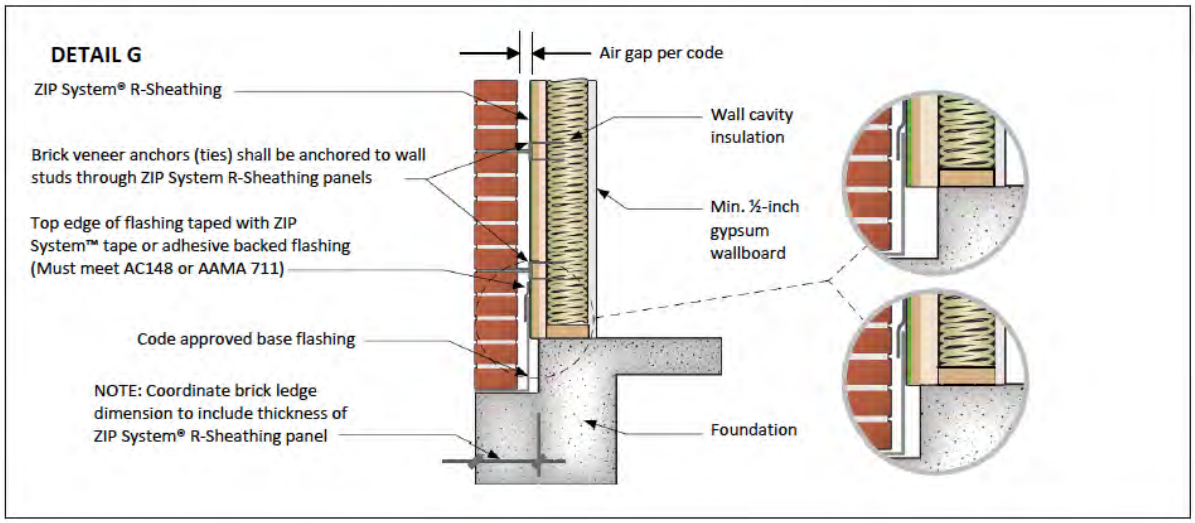


It is the responsibility of the general contractor to ensure that fasteners used to install lap siding are of adequate length to satisfy the requirements of governing building codes and siding manufacturer's installation instructions.

ZIP System® R-Sheathing – Exterior Cladding Installation

Anchored Masonry Brick Veneer





It is the responsibility of the general contractor to ensure that fasteners used to install brick veneer anchors (ties) are of adequate length to satisfy the requirements of governing building codes.

To learn more about our ZIP system® R-sheathing call 1.800.933.9220 or visit ZIPsystem.com. HUB-3021 07/16

LT50 Altus® RTS

Star Head and Round Head Motors

506S2	1032500	**535A2**	1037509	**506S2 RH**	1037519
510S2	1037501	**540R2**	1037510	**510S2 RH**	1037521
525A2	1043287	**550R2**	1037511		
530R2	1037507				

Radio Technology Somfy® (RTS) allows for wireless radio control of motorized window coverings via the RTS family of controls.

Technical Features

Voltage Supply 120V AC, 60Hz

Index Protection Rating IP 44

Limit Switch Type Electronic RTS

Limit Switch Capacity 250 Turns

(Round Head limited to 3 minutes of rotation without stop)

Temperature Working Range

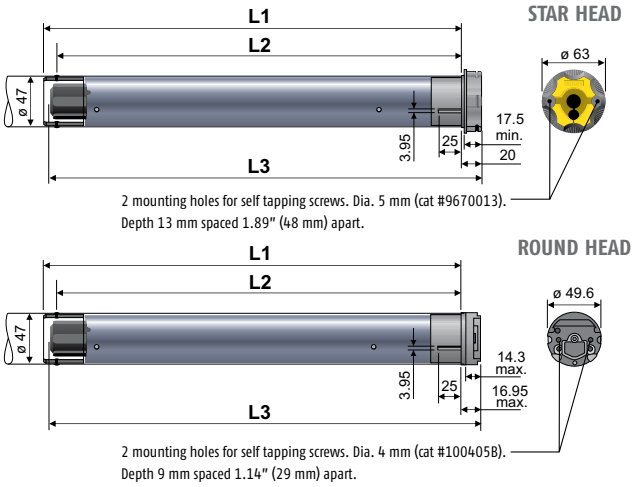
Star Head
14°F to 104°F (-10°C to 40°C)

Round Head
32°F to 140°F (0°C to 60°C)

Insulation Class Class 1 for 120V AC

Antenna Integrated into power cord. Must be at least 12 inches and must not come in contact with metal

Dimensions



Dimensions	506	510	525	530	535	540	550
L1	23.82 in (605 mm)	25.79 in (655 mm)	25.79 in (655 mm)	25.79 in (655 mm)	26.57 in (605 mm)	26.57 in (605 mm)	26.57 in (605 mm)
L2	23.23 in (590 mm)	25.20 in (640 mm)	25.20 in (640 mm)	25.20 in (640 mm)	25.98 in (660 mm)	25.98 in (660 mm)	25.98 in (660 mm)
L3	SH 24.13 in (613 mm) RH 24.02 in (610 mm)	SH 26.10 in (663mm) RH 25.98 in (660mm)	26.10 in (663 mm)	26.10 in (663 mm)	26.89 in (683 mm)	26.89 in (683 mm)	26.89 in (683 mm)
Cable Length	6.5 ft (2 m)	6.5 ft (2 m)	12.3 ft (3.75 m)	6.5 ft (2 m)	12.3 ft (3.75 m)	6.5 ft (2 m)	6.5 ft (2 m)

Optional cables with NEMA plugs available in 3ft, 6ft, 12ft, 18ft, 24ft.

Specifications

	506	510	525	530	535	540	550
Torque	6 Nm	10 Nm	25 Nm	30 Nm	35 Nm	40 Nm	50 Nm
Nominal Voltage	120V/60Hz						
Rated Current	1.1A	1.3A	1.6A	1.5A	2.1A	1.8A	2.1A
Speed	38 rpm	38 rpm	20 rpm	14 rpm	20 rpm	14 rpm	14 rpm
Thermal Protection	5 minutes						
Radio Frequency	433.42 MHz	433.42 MHz	433.42 MHz	433.42 MHz	433.42 MHz	433.42 MHz	433.42 MHz

Type of power cable

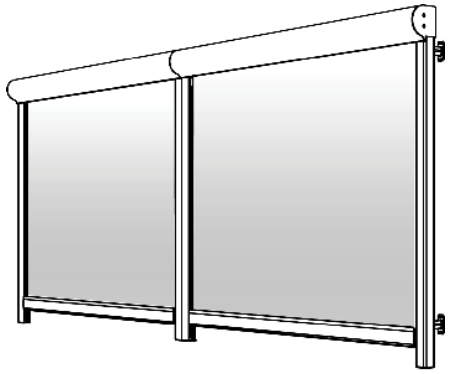
RTS 120V AC / 60 Hz 3 conductor cable

14

HORIZON Features

HORIZON

Designed for interior and exterior skylight shading, as well as mounting to existing structures for patio areas, the Horizon is a unique answer to controlling the sun's harsh U.V. rays.



MAXIMUM DIMENSIONS

Width	*Projection*
60"-180"	60"-180"

The Horizon is capable of up to 195 square feet of coverage per individual unit. The systems can also be installed side by side together for even greater coverage. It can also be used for larger bottom-up applications. It can be used with solar screening materials or solid awning fabrics. The Horizon's constant tensioning design will give years of maintenance free sun control.

**The Horizon is strictly designed for sun control and is not intended to protect from rain.*

Base Model - The base model comes in white only, motorized, with tracks specifically used for the Horizon.

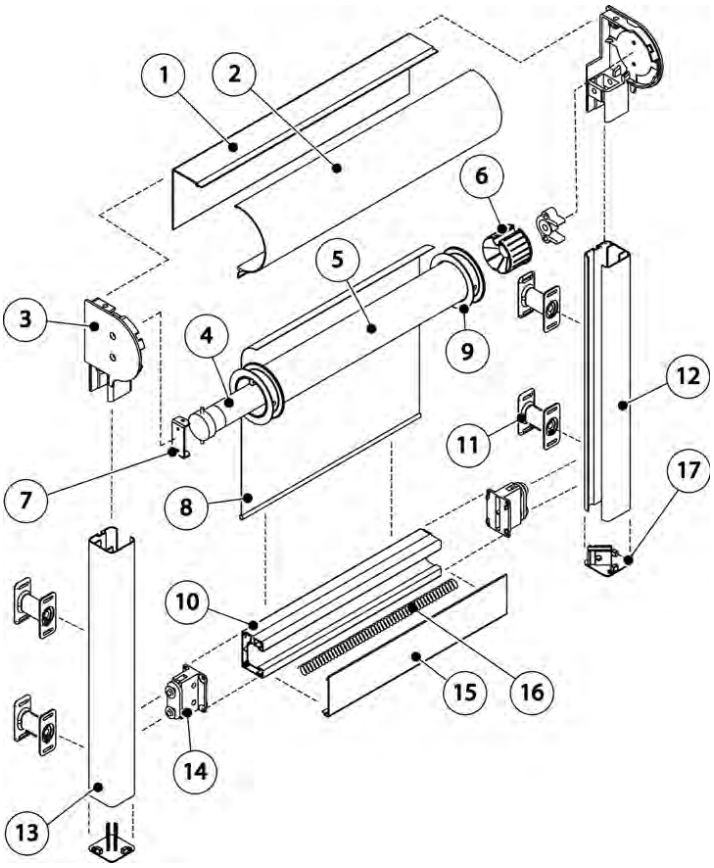
The Horizon is Motorized Only - The Horizon is available with several motor configurations including a wired switch controlled motor or wireless remote controlled motor. Corradi offers the latest motors from Nice motors and Somfy motors.

Sensors - The wireless options can be used with a sun, wind, or a sun & wind sensor to automatically operate under specific conditions.

Brackets - The Horizon is delivered ready to install with options to use L-Brackets or Stand-off Brackets.

Installation - SEE PAGE 45

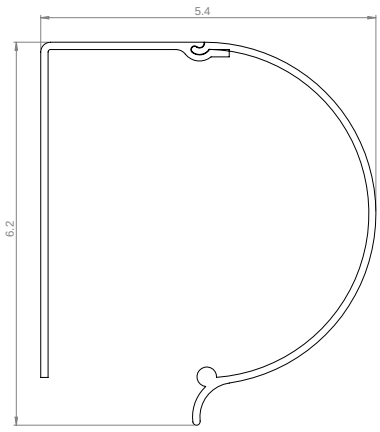
HORIZON Exploded Drawing



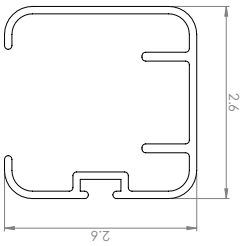
1	FIXED CASSETTE COVER
2	REMOVABLE CASSETTE
3	ENDCAP (DIE CAST ALUMINUM)
4	MOTOR
5	ROLL TUBE
6	IDLE ROLL TUBE ENDCAP
7	MOTOR BRACKET
8	FABRIC
9	CABLE WINDER FOR PULLEYS
10	BOTTOM BAR
11	MOUNTING BRACKETS
12	RIGHT FABRIC GUIDE
13	LEFT FABRIC GUIDE
14	BOTTOM BAR ENDCAP
15	BOTTOM BAR COVER
16	FABRIC TENSIONING SPRING
17	GUIDE ENDCAP

HORIZON Dimensions

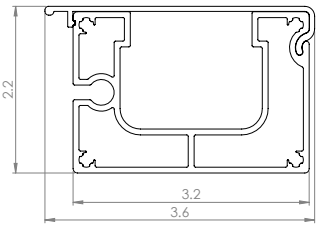
PROFILE SECTIONS



CASSETTE



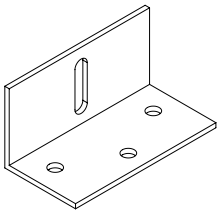
TRACK



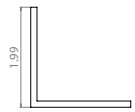
BOTTOM BAR

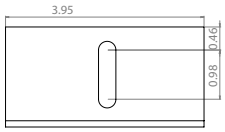
HORIZON Brackets

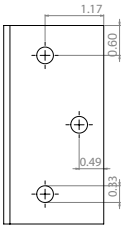
L-BRACKETS



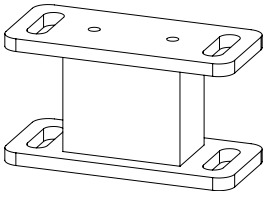
The L-Bracket is used for mounting the Horizon inbetween walls (side-mounting).



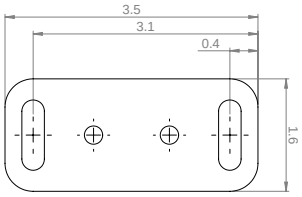


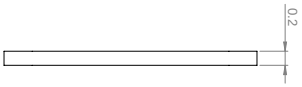


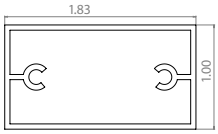
STAND-OFF BRACKETS

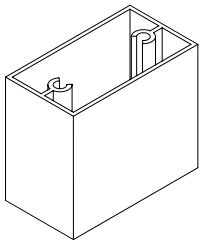


The Stand-Off Bracket is used in situations where the Horizon must be installed on top or bottom of existing structure. The height can be customized at a minimum of 2" and a maximum of 12".









URTSI – Universal RTS Interface

Part #1810872

Overview:

The URTSI is an integration device that allows third party systems to control Radio Technology Somfy® motorized applications. The URTSI can control up to 16 RTS channels individually and/or as a group through RS232, RS485 and IR. Multiple URTSIs can be cascaded to control up to 256 channels, using the RS485 expansion port. This ensures optimal coverage of the RTS signal. Its simple design allows you to quickly duplicate programming from existing RTS transmitters and easily locate it within the space without a need for line of sight to the motorized window coverings.

Features Summary:

- 16 channels of RTS control per URTSI
- Communicates with:
  - RS232
  - RS485
  - IR
- Using RS485
  - Control up to 16 URTSIs together for 256 channels in a system
  - Cascade up to 16 URTSIs with one wire
  - Power up to 16 URTSIs with one power supply in a system

Technical Specifications:

- Power Input: 9 V DC, 200mA–UL approved
- Power Consumption: 20 mA
- Material: ABS
- Dimensions: 3" L x 4" W x 1.75" H
- Maximum Range: 65 feet radius (under optimal conditions)
- Operating Temperature Range: Ambient temperature
- Shipping Weight: 1 lb.
- LED: Bi-color
- Frequency: 433.42 Mhz

What's in the Box:

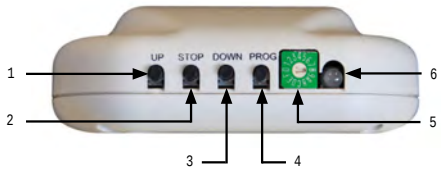
- URTSI
- Antenna
- Power Supply
- DB9 to RJ45 for RS232
- Instructions

Optional Accessories:

IR Receiver	#9015078
IR Transmitter	#1810498
DB9 to RJ45 for RS232	#9015028
DB9 to RJ45 for RS485	#9015029
RS232 to RS485 Converter	#1810496

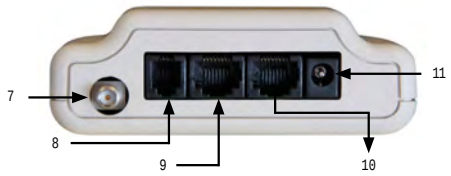
Connections and Indicators:

Front View



	ELEMENT	FUNCTION
1	**Up Button**	RTS (Test) Up directional button
2	**Stop Button**	RTS (Test) Stop directional button
3	**Down Button**	RTS (Test) Down directional button
4	**Programming Button**	RTS Programming button
5	**Rotary Dial**	**Programming:** RTS Channel selector **Operation:** URTSI Address selector (RS485) (A-0 = CH 10-16)
6	**Bi-Color LED**	Green = Power; Red Flash = RTS Transmission

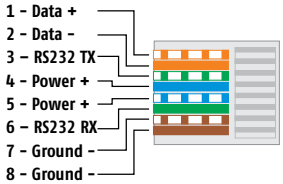
Back View



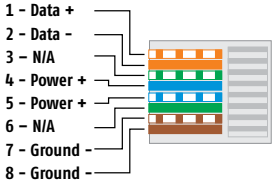
	ELEMENT	FUNCTION
7	**Antenna**	RTS antenna
8	**IR Sensor Input**	RJ9 port for Somfy's IR receiver (9015078)
9	**RS232 or RS485 Input**	RJ45 for RS232 or RS485 serial input
10	**RS485 Expansion**	RJ45 for RS485 expansion
11	**Power**	3.5mm jack for included power supply (9V DC 200mA)

Cable Pinouts:

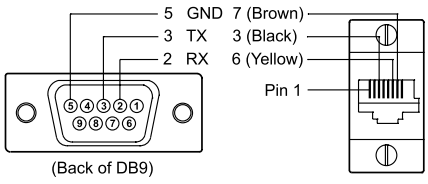
RS232 input or RS485 input



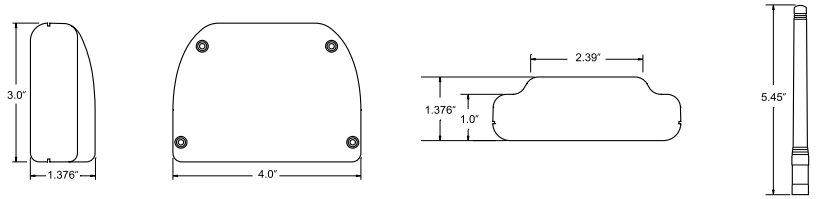
RS485 expansion



RJ45 to DB9 RS232



Dimensions:

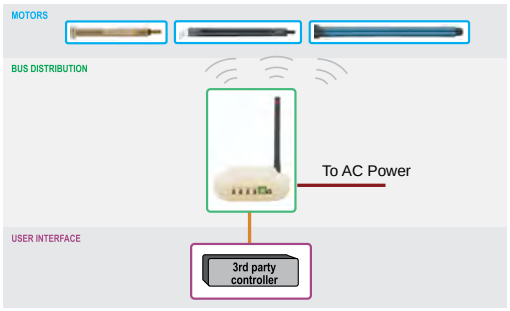


Wiring Best Practice:

- Somfy recommends placing the URTSI in a central location and that each channel is tested to ensure proper communication between the URTSI and motorized window covering prior to integration.
- Somfy recommends using specified adapters and cables. Making your own cable is not recommended.

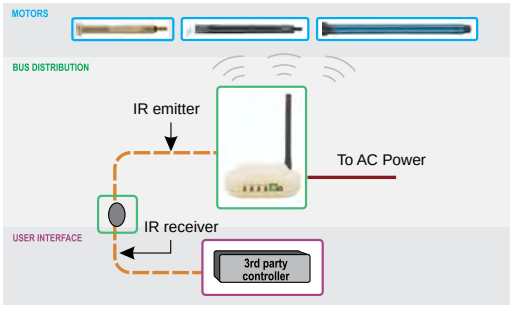
RS232

- Somfy recommends using a DB9 to RJ45 adapter.
- Set the rotary dial arrow back to 1, this will ensure proper commands to be sent to the unit.



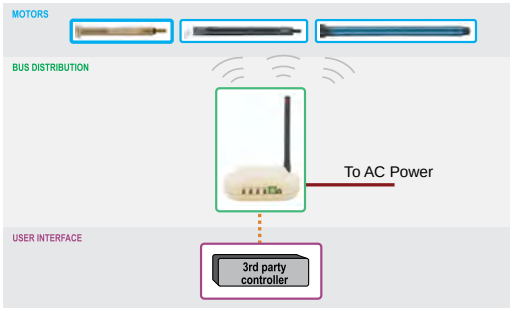
IR

- When connecting to the URTSI using IR please use the Somfy branded IR Receiver (9015078) and attach an IR emitter from the control system.
- The learnable codes come from the Somfy multichannel IR transmitter.
- Making your own cable and trying to hardwire into the URTSI is NOT recommended.



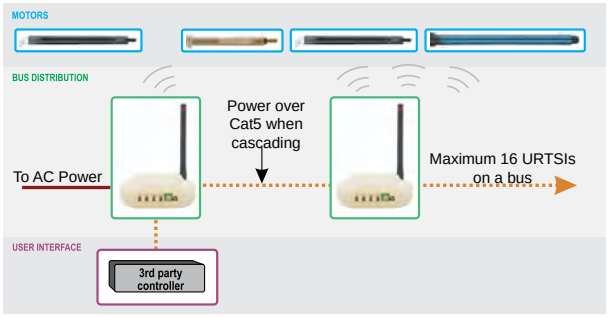
RS485 Single

- Somfy recommends using a a DB9 to RJ45adapter.
- DO NOT USE the DB9 to RJ45adapter that was included in the box (it is pinned out for RS232).
- Set the rotary dial arrow back to 1, this will ensure proper commands to be sent to the unit.



RS485 Multiple

- Somfy recommends using a DB9 to RJ45adapter.
- DO NOT USE the DB9 to RJ45adapter that was included in the box (it is pinned out for RS232).
- Set the rotary dial to the appropriate address.
- You can cascade a total of 16 URTSIs on 1 bus line for a total of 256 available RTS channels.
- When cascading URTSIs together on a bus line, you only need to power one of the units.



Wiring Connection Types

Wireless	Third Party	Power
RTS	RS232 - 50' max	110V AC
WiFi	RS485 - 4K' max	24V DC
Z-Wave®	IR	12V DC
ZigBee®	Ethernet	9V DC
		5V DC

somfy

D-0004

Berridge FW-1025 & FW-12 Panel

Wall, Liner or Soffit Panels. Versatile, maintenance-free, prefinished metal wall panels for open spans.

- **Available in 24 & 22 gauge steel or 0.032 & 0.040 aluminum**
- **Concealed fasteners**
- **Optional vee-grooves**
- **Seam lock feature (optional)**
- **Striated profile (optional)**
- **Optional stucco embossed texture**
- **Panel may be vented**
- **Soffit and vertical wall applications**
- **Open framing or solid sheathing**
- **ASTM air & water resistance tested***
- **ASTM E-1592***
- **Florida Product Approval***
- **Miami-Dade Approved**
- **Texas Department of Insurance Listed***

Optional seam lock feature.

Unless otherwise noted, all testing is for steel only.
*Approved for steel and aluminum

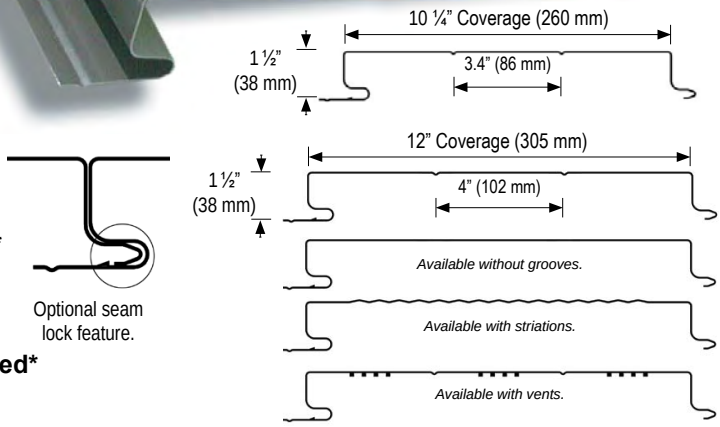
With a 12" coverage, Berridge FW-12 panel is ideal for large soffit and ceiling applications.

Berridge FW-12 is a multipurpose wall and soffit panel as shown above.

Berridge FW-1025 & FW-12 Panels can be vented for soffit applications.

Vented FW-12 & FW-1025 Panels provide 7.79 square inches of Net Free Vent Area (NFVA) per lineal foot of panel. Note: Berridge Manufacturing Company does not recommend this product in applications subject to aggressive atmospheres, marine environments or high humidity due to the corrosive nature of these environments on raw edges of steel.

Berridge Manufacturing Company
6515 Fratt Road
San Antonio, Texas 78218
(800) 669-0009 • www.berridge.com



24GA, FW-12, RECOMMENDED DESIGN LOAD IN PSF, PANEL WT = 1.40 PSF			
SPAN (FT)	POSITIVE WIND LOAD (PSF)		
	1-SPAN	2-SPAN	3-SPAN
4'	94	86	100
5'	48d	55	64

24GA, FW-12, RECOMMENDED DESIGN LOAD IN PSF, PANEL WT = 1.40 PSF	
SPAN (FT)	NEGATIVE WIND LOAD (PSF) WITH OPTIONAL SEAM-LOCK
	24-Gauge
2'	67.57
2.5'	61.51
3'	55.45
3.5'	49.38
4'	43.32
4.5'	37.26
5'	31.20

NOTES:
1. 22-Gauge, FW-12 Negative Wind Load with Optional Seam-Lock is 83 PSF at 2' span.
2. All loads meet L/240 Deflection Criteria. (d) Deflection governs allowables.
3. Positive values based on 1996 edition of AISI and good engineering practices.
4. Negative values based on ASTM E1592 load testing.

SPECIFICATIONS

(Complete specifications available at www.berridge.com)

PRODUCT:
Furnish and install Berridge [FW-1025] or [FW-12] wall and soffit system as manufactured by Berridge Manufacturing Company, San Antonio, Texas.

MANUFACTURE:
[FW-1025] or [FW-12] provides a [12"] or [10 ¼"] coverage and a panel depth of 1½". Panels are available from the factory in continuous lengths to a maximum of 40'-0". Panel is available with optional vee grooves spaced at [3.4"] or [4"] o.c., optional stucco embossing, optional striations, or optional vented profile for soffit applications.

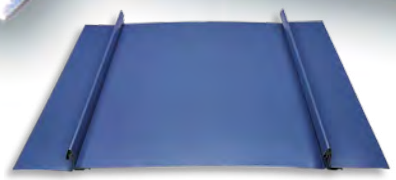
ENGINEERING:
Acceptable installation design over engineered framing or solid structural sheathing. Approved underlayment to cover sheathing (run horizontally starting at the sill and run up the wall, review Berridge underlayment details for complete installation instructions).

MATERIALS, FINISH INFORMATION & CONSTRUCTION DETAILS:
Reference web site: www.berridge.com

Printed in the USA - January 2017- 500 K

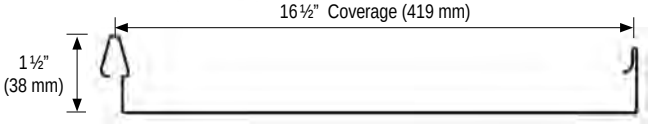
Berridge Cee-Lock Panel

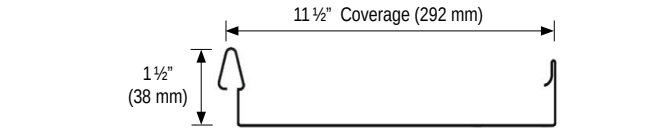
Metal Standing Seam with exclusive vinyl weatherseal as an integral part of Snap-Lock Seam. Residential and commercial construction with solid sheathing.



- **Available in 24 & 22 gauge steel & 0.032 aluminum**
- **Extruded vinyl weatherseal (optional)**
- **Concealed fasteners**
- **Integral snap-lock seam**
- **Striated profile is available on 16 ½" Coverage**
- **UL 580 tested***
- **UL 90 wind uplift***
- **UL fire resistance listed***
- **UL 1897 tested***
- **ASTM air & water resistance tested**
- **ASTM E-1592 tested**
- **Class 4 hail resistance tested***
- **Florida Product Approval***
- **Miami-Dade approved**
- **Texas Department of Insurance Listed***
- **ICC-ES Report ESR-3486**
- **May be site-formed in continuous lengths with Berridge CL-21 portable roll former**

Unless otherwise noted, all testing is for steel only
*Approved for steel and aluminum





See www.berridge.com for Details and Specifications

Vinyl Weatherseal: US Patent No. 4641475

SPECIFICATIONS

(Complete specifications available at www.berridge.com)

PRODUCT:
Furnish and install Berridge Cee-Lock Standing Seam System as manufactured by Berridge Manufacturing Company, San Antonio, Texas.

MANUFACTURE:
Cee-Lock provides a 16-½" or 11-½" coverage with a 1-½" seam height (a factory or field applied vinyl weatherseal insert is available in panel seam). Panel is available from the factory in continuous lengths to a maximum of 40'-0". Panel may be field roll formed to virtually unlimited lengths with Berridge CL-21 Portable Roll Former.

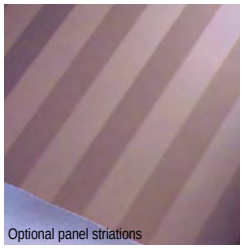
WEATHERTIGHTNESS:
Certification from independent testing laboratory indicating no measurable air or water penetration through the seam in accordance with ASTM E 1680 and E 1646 is required for use with continuous rib.

ENGINEERING:
Roof deck shall be of solid structural sheathing and free of all objects which may puncture underlayment, (entire roof area must be covered with a minimum of number thirty roof felt run horizontally starting at the eave, review Berridge underlayment details for complete installation instructions). Where required, panel assemblies can be constructed to meet Underwriter's Laboratory UL90 pursuant to Construction Numbers 334, 381, 404 and 474 for Galvalume products; 689 and 690 for Aluminum. Additional UL fire rated assemblies reference Berridge website.

MATERIALS, FINISH INFORMATION & CONSTRUCTION DETAILS:
Reference web site: www.berridge.com

CEE-LOCK SECTION PROPERTIES BASED ON 24 GA 40 K.S.I.			
CEE-LOCK	I_x (in⁴/ft)	M_A (ft·lbs/ft)	V_A (lbs/ft)
Positive Bending	0.0567	87.0	610
Negative Bending	0.0286	61.9	610

NOTES: Cee-Lock Panel with continuous 24 GA Cee-Rib.
Values based on 1996 edition of AISI and good engineering practice.



Optional panel striations

Berridge Manufacturing Company
6515 Fratt Road
San Antonio, Texas 78218
(800) 669-0009 • www.berridge.com

Printed in the USA
January 2017 - 500 K

Specifications
Air by Kvadrat
281830

maharam

Application
Windows

Characteristics
Content: 100% Trevira CS Polyester
Finish: None
Backing: None
Width: 118" (300cm)
Bolt Size: 66 yards (60 m)
Weight: 7.1 oz/ly (220 gr/lm)
Maintenance: Machine wash to 140°F (60°C). Air or cabinet dry only. Do not tumble dry.
Country of Origin: Switzerland
Note: Shown railroaded.

Price
$42.00 / C$64.50 (FOB Kitchener)

Performance
Flammability: This textile meets all appropriate flammability requirements for windows. See flame certificate for test results.
Lightfastness: 60+ Hours

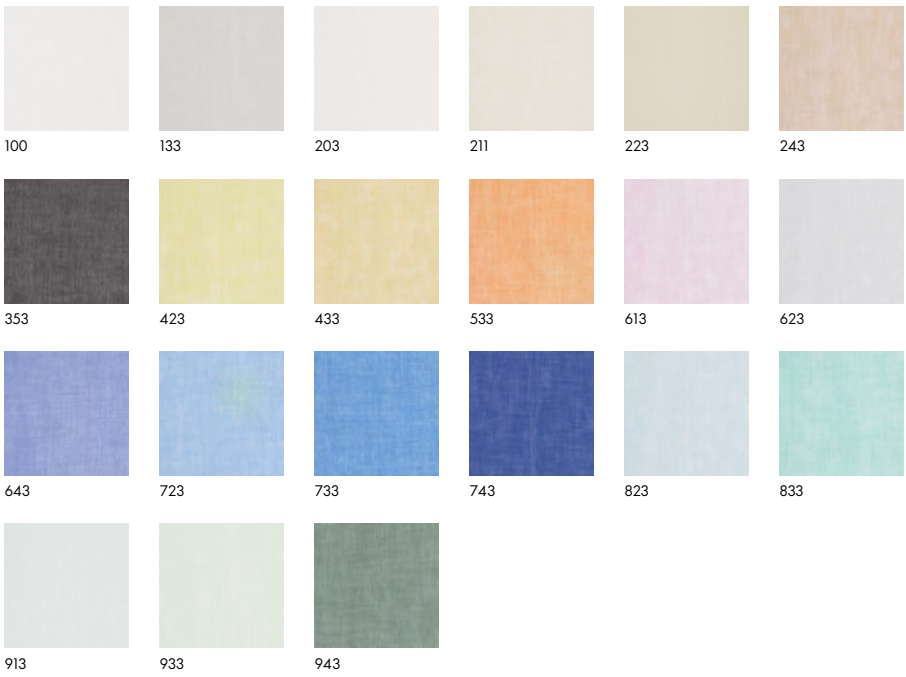
Environmental
Greenguard and Greenguard Gold Certified
Oeko-Tex Certified
Contains A Non-Halogenated/Non-Brominated Flame Retardant

Warranty
1 year.

Complete product information at maharam.com
800.645.3943

Specifications
Air by Kvadrat
281830

maharam



Specifications
Vellum
283775

maharam

Application
Windows

Characteristics
Content: 100% Trevira CS Polyester
Finish: None
Backing: None
Width: 122" (310cm)
Repeat: 9 ½" V (24cm V)
Railroaded Repeat: 9 ½" H (24cm H)
Bolt Size: 66 yards (60 m)
Weight: 6.1 oz/ly (189 gr/lm)
Maintenance: Dry clean only.
Country of Origin: Germany
Note: Shown railroaded.

Price
$65.00 / C$90.25 (FOB destination) / C$86.75 (FOB origin)

Performance
Flammability: This textile meets all appropriate flammability requirements for windows. See flame certificate for test results.
Lightfastness: 60+ Hours

Environmental
Greenguard and Greenguard Gold Certified
Contains A Non-Halogenated/Non-Brominated Flame Retardant

Warranty
1 year.

Complete product information at maharam.com
800.645.3943

001 Pristine

002 Altitude

003 Fade


004 Swell

Living > Sofas > Costura Sectional with Chaise





Costura Sectional with Chaise

Designed by Jon Gasca for Stua

~~$5,290.00~~
$4,496.50
DWR Exclusive

Select your Upholstery and Color

Boucle - **Poppy**

Swatch Details

Ducale Wool

Linen Weave

Price:	~~$5,290.00~~ $4,496.50
Item Number:	9192687
Availability:	This item is currently out of stock. Order it now and we'll ship it to you as soon as it's available.

Living > Lounge Chairs > Costura Armchair





Costura Armchair

Designed by Jon Gasca for Stua

~~$1,890.00~~
$1,606.50
DWR Exclusive

Select your Upholstery and Color

Boucle - **Poppy**

Swatch Details

Ducale Wool

Linen Weave

Price:	~~$1,890.00~~ $1,606.50
Item Number:	9190971
Availability:	In stock and ready to ship!

QTY 1 ADD TO CART


75"
43.5"
29"
CONAN
Retail $950
$599
you save $351
In stock
Buy Now
Dispatched in 2 to 5 days
Dimensions


26.5"
21.5"
19.5"
30"
23"
ZOLA
Retail $260
$169
you save $91
In stock
Buy Now
Dispatched in 2 to 5 days
Available In
Dimensions

Genio T - Twin Wall Bed with Table

Brand: MULTIMO
Product Code: A200WLW
Availability: Pre-Order (30 days)

~~$3,927.00~~ $2,799.00

* Color

Cabinets
Enter desired quantity before clicking 'Add to Cart' button

Cross Module (Set of 2) ~~$840.00~~ $624.00

* Color

0

Single Bookcase ~~$717.50~~ $533.00

Møller Model 63A Bench

Designed by Niels Otto Møller, produced by J.L. Møllers Møbelfabrik

$990.00 - $1,750.00

Step 1: Select your Frame

Step 2: Select your Seat and Color
Hallingdal in Grey Brown

Hallingdal - **Grey Brown**

Leather

Woven

Price:	$990.00 - $1,750.00
Item Number:	5782
Availability:	Please make selections

Dining > Chairs | Stools > Møller Model 80A Stool

Møller Model 80A Stool

Designed by Niels Otto Møller, produced by J.L. Møllers Møbelfabrik

$520.00 - $960.00

Step 1: Select your Frame

Step 2: Select your Seat

HALLINGDAL | LEATHER | WOVEN

Step 3: Select your Color

Price:	$520.00 - $960.00
Item Number:	6429
Availability:	Please make selections

Dining › Chairs | Stools › Møller Model 57 Armchair

Møller Model 57 Armchair

Designed by Niels Otto Møller, produced by J.L. Møllers Møbelfabrik

$1,150.00 - $1,550.00

Step 1: Select your Frame

Step 2: Select your Seat and Color

Hallingdal

Leather

Woven

Price:	$1,150.00 - $1,550.00
Item Number:	6291
Availability:	Please make selections

QTY 1 ADD TO CART

Workspace > Chairs > Sayl® Task Chair, Adjustable Arms and Seat

Sayl® Task Chair, Adjustable Arms and Seat

Designed by Yves Béhar for Herman Miller®

$649.00 - $729.00

Step 1: Select your Color

White / Fog

Step 2: Select your Adjustment

ADJUSTABLE ARMS AND SEAT

Price:	$649.00 - $729.00
Item Number:	7288
Availability:	Please make selections

QTY 1 ADD TO CART

ref. 26740
CENTRE TABLE
Jasper Morrison / KETTAL RIVA

Dimensions

Standard finishes

Characteristics

U.B.: 1 - **W:** 25 Kg / 55,11 Lbs
V: 0,36 m³ / 12,71 cft.

Materials

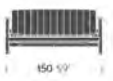
Teak
Teak A-Grade, Eco Friendly Oeko-Tek

Fabric
Warp & Weft Count Nm 2/34 - Nm 6/34, Weight 400 g/m3, Abrasion test 30000 cycles, 22,500 Wyzenbeek Double Rubs, Fire retardand NFPA 260, Finish Teflon, anti-mold

KETTAL

ref. 26400
2-SEATER SOFA
Jasper Morrison / KETTAL RIVA

Dimensions



Materials

Teak
Teak A-Grade, Eco Friendly Oeko-Tek

Fabric
Warp & Weft Count Nm 2/34 - Nm 6/34, Weight 400 g/m3, Abrasion test 30000 cycles, 22,500 Wyzenbeek Double Rubs, Fire retardand NFPA 260, Finish Teflon, anti-mold

Standard finishes


Teak

Ash Rose Laminate
294

Characteristics

FRAME
U.B.: 1 - **W:** 40 Kg / 88,18 Lbs
V: 1 m³ / 35,31 cft.

SEAT BACK CUSHION
U.B.: 1 - **W:** 10 Kg / 22,04 Lbs
V: 0,23m³ / 8,12 cft.
130 x 60 x 15 / 51,1 x 23,6 x 5,9" **C.O.M.:** 7,1 ml

Optional Colours

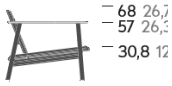
Terrain Fabrics, Laminate Terrain Fabrics

KETTAL

ref. 26370
1-SEATER SOFA
Jasper Morrison / KETTAL RIVA

Dimensions

75,6 29,7"



78 30,7"

Materials

Teak
Teak A-Grade, Eco Friendly Oeko-Tek

Fabric
Warp & Weft Count Nm 2/34 - Nm 6/34, Weight 400 g/m3, Abrasion test 30000 cycles, 22,500 Wyzenbeek Double Rubs, Fire retardand NFPA 260, Finish Teflon, anti-mold

Standard finishes

Teak

Ash Rose Laminate
294

Characteristics

FRAME
U.B.: 1 - **W:** 14,5 Kg / 31,9 Lbs
V: 0,05 m^3 / 1,76 cft. **C.O.M.:** 2,7 m^2
48 x 55 x 5 / 18,8 x 21,6 x 1,96" **C.O.M.:** 1,9 ml

SEAT / BACK CUSHION
U.B.: 1 - **W:** 3 Kg / 6,61 Lbs
V: 0,05 m^3 / 1,76 cft. **C.O.M.:** 2,7 m^2
48 x 55 x 5 / 18,8 x 21,6 x 1,96" **C.O.M.:** 1,9 ml

Optional Colours

Terrain Fabrics, Laminate Terrain Fabrics

KETTAL

KOHLER®

Purist®
36" Grab Bar
K-11895

Features
- KOHLER finishes resist corrosion and tarnish.
- 36- inch bar.
- Contemporary styling matches any decor.
- Coordinates with other products in the Purist® collection.
- ADA compliant when installed per ADA guidelines.
- 38-7/16" (976 mm) x 2-3/4" (70 mm) x 2-7/16" (62 mm)

Material
- Premium metal construction.

Components
Additional included component/s: Installation hardware.

ADA	CSA B651	OBC

Codes/Standards
ADA
ICC/ANSI A117.1
CSA B651
OBC

KOHLER® Faucet Lifetime Limited Warranty
See website for detailed warranty information.

Available Color/Finishes
Color tiles intended for reference only.

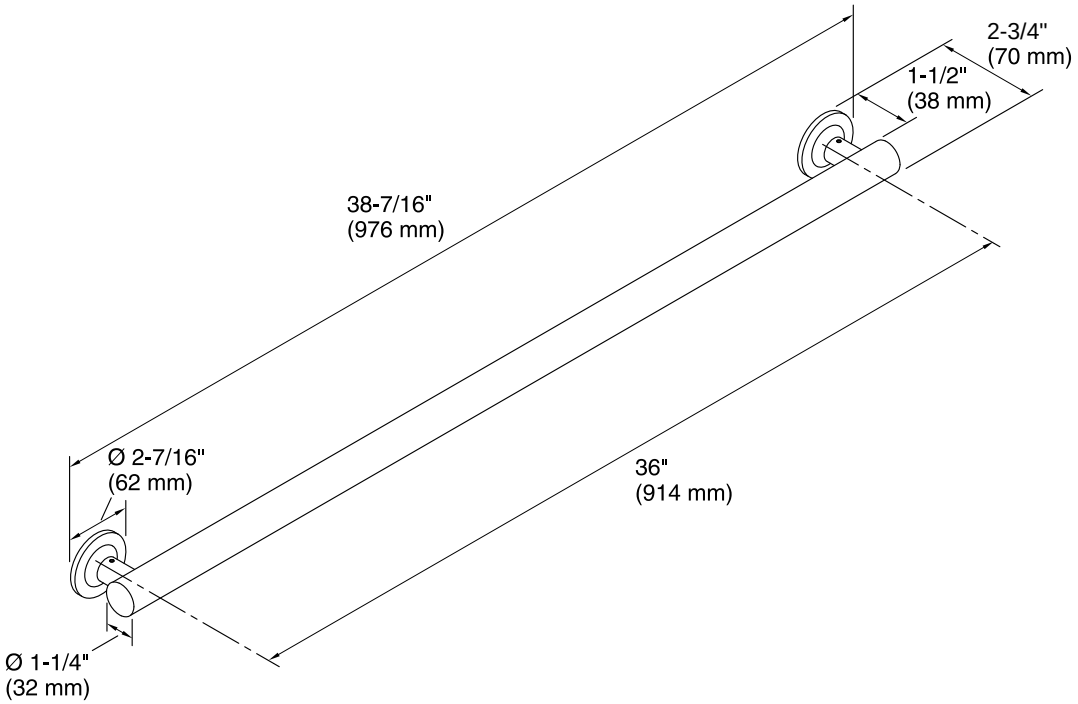
Color	Code	Description
	S	Polished Stainless
	SN	Vibrant® Polished Nickel
	BN	Vibrant® Brushed Nickel
	BS	Brushed Stainless
	BV	Vibrant® Brushed Bronze
	TT	Titanium

KOHLER®

Purist®

36" Grab Bar

K-11895



Technical Information

All product dimensions are nominal.

Notes

Measure your actual product for roughing-in details.

WARNING: Risk of personal injury. The wall plates on the grab bar must be mounted to a brace between the wall studs. This will ensure that the weight of the user is adequately supported.

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

KOHLER®

Purist®

42" Grab Bar

K-11896

Features

- KOHLER finishes resist corrosion and tarnish.
- 42- inch bar.
- Contemporary styling matches any decor.
- Coordinates with other products in the Purist® collection.
- ADA compliant when installed per ADA guidelines.
- 44-7/16" (1129 mm) x 2-3/4" (70 mm) x 2-7/16" (62 mm)

Material

- Premium metal construction.

Components

Additional included component/s: Installation hardware.

ADA | **CSA B651** | **OBC**

Codes/Standards

ADA
ICC/ANSI A117.1
CSA B651
OBC

KOHLER® Faucet Lifetime Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

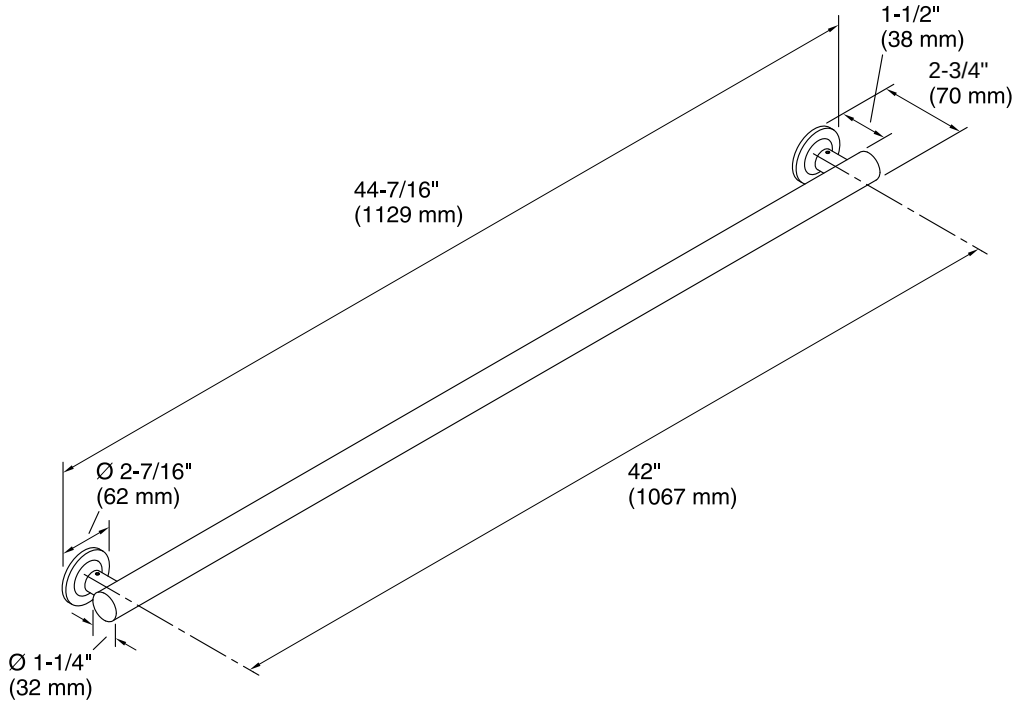
Color	Code	Description
	S	Polished Stainless
	SN	Vibrant® Polished Nickel
	BN	Vibrant® Brushed Nickel
	BS	Brushed Stainless
	BV	Vibrant® Brushed Bronze

KOHLER®

Purist®

42" Grab Bar

K-11896



Technical Information

All product dimensions are nominal.

Notes

Measure your actual product for roughing-in details.

WARNING: Risk of personal injury. The wall plates on the grab bar must be mounted to a brace between the wall studs. This will ensure that the weight of the user is adequately supported.

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

KOHLER®

Purist®
24" Grab Bar
K-11893

Features
- KOHLER finishes resist corrosion and tarnish.
- 24- inch bar.
- Contemporary styling matches any decor.
- Coordinates with other products in the Purist® collection.
- ADA compliant when installed per ADA guidelines.
- 26-7/16" (672 mm) x 2-3/4" (70 mm) x 2-7/16" (62 mm)

Material
- Premium metal construction.

Components
Additional included component/s: Installation hardware.

ADA | **CSA B651** | **OBC**

Codes/Standards
ADA
ICC/ANSI A117.1
CSA B651
OBC

KOHLER® Faucet Lifetime Limited Warranty
See website for detailed warranty information.

Available Color/Finishes
Color tiles intended for reference only.

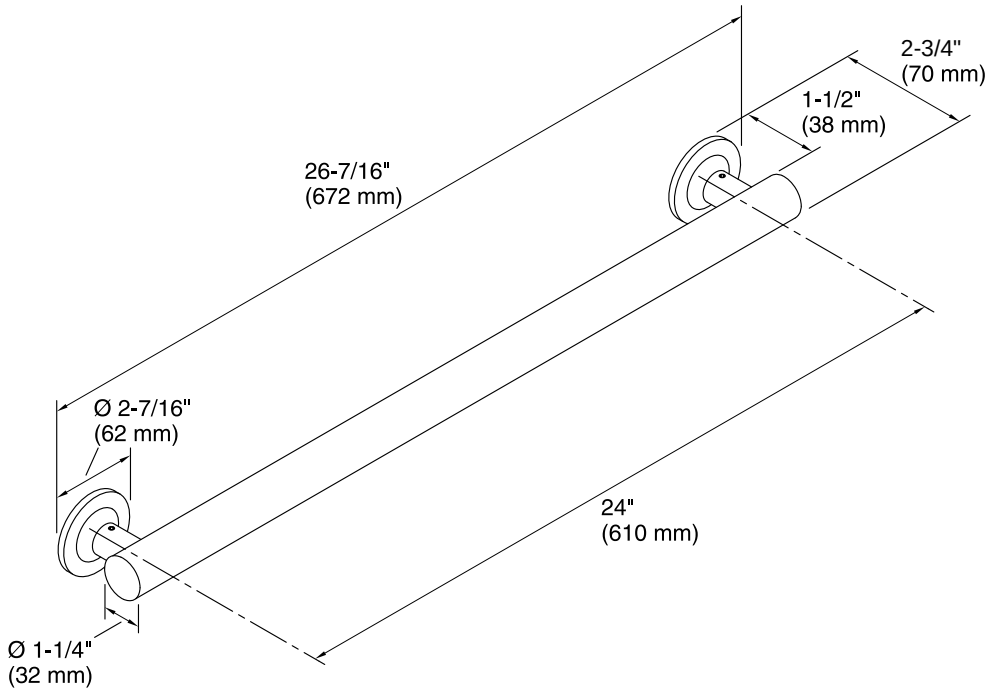
Color	Code	Description
	S	Polished Stainless
	SN	Vibrant® Polished Nickel
	BN	Vibrant® Brushed Nickel
	BS	Brushed Stainless
	BV	Vibrant® Brushed Bronze
	TT	Titanium

KOHLER®

Purist®

24" Grab Bar

K-11893



Technical Information

All product dimensions are nominal.

Notes

Measure your actual product for roughing-in details.

WARNING: Risk of personal injury. The wall plates on the grab bar must be mounted to a brace between the wall studs. This will ensure that the weight of the user is adequately supported.

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

KOHLER®

Purist®

Toilet Tissue Holder

K-14377

Features

- KOHLER finishes resist corrosion and tarnish.
- Coordinates with other products in the Purist collection.
- 8-3/16" (208 mm) x 3-1/8" (79 mm) x 1-7/8" (48 mm)

Material

- Premium metal construction.

Components

Additional included component/s: Installation hardware.

Codes/Standards

None Applicable

KOHLER® Faucet Lifetime Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

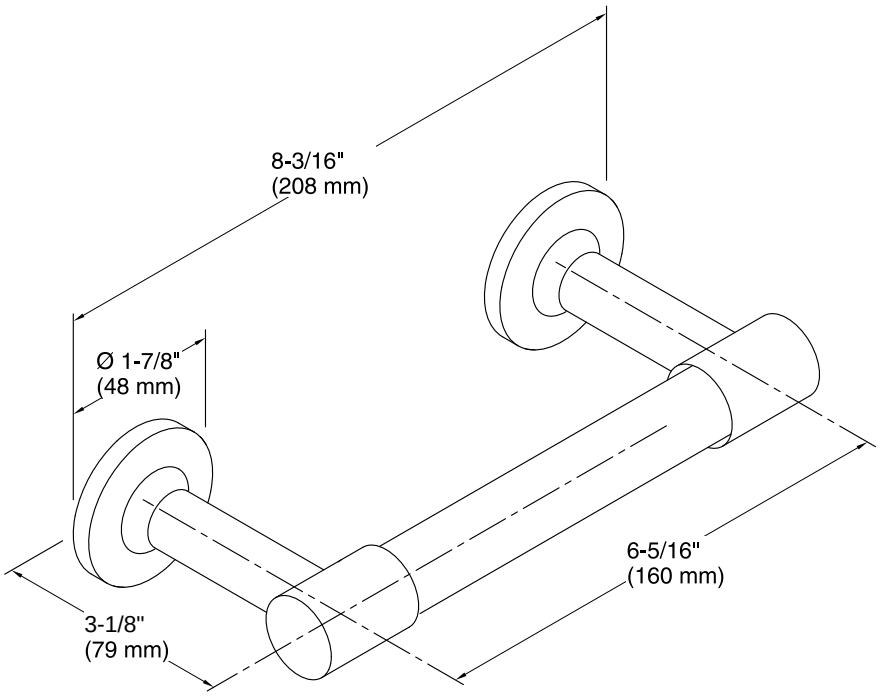
Color	Code	Description
	CP	Polished Chrome
	SN	Vibrant® Polished Nickel
	BGD	Vibrant® Moderne Brushed Gold
	BN	Vibrant® Brushed Nickel
	BV	Vibrant® Brushed Bronze

KOHLER®

Purist®

Toilet Tissue Holder

K-14377



Technical Information

All product dimensions are nominal.

Notes

Install this product according to the installation guide.

CAUTION: Risk of personal injury. Do not install these products in any area where they are likely to be used inadvertently as a grab bar or support bar. These products are not designed or intended for use as a grab bar or support bar.

BeveLED 2.1

PROJECT INFORMATION

PROJECT _____

_____

DATE _____

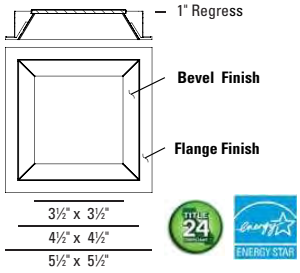
TYPE _____

3110
DOWNLIGHT

BeveLED 2.1 Recessed Downlight - BeveLED 2.1 is the most complete recessed LED downlight product family available from USAI Lighting, now with more BeveLED trim finishes, LED classic white color temperatures, innovative housing styles, and dimming driver options than before. With industry-leading performance, BeveLED 2.1 can provide a solution for any project - commercial, corporate and residential installations.

1" REGRESS DOWNLIGHT

1" Regress



DELIVERED PERFORMANCE

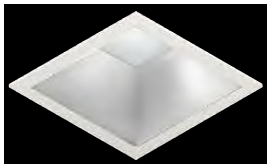
BeveLED 2.1 1" REGRESS DOWNLIGHT	9 Watts		12 Watts		16 Watts		24 Watts		33 Watts		37 Watts	
Color Rendering Index	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI
Lumens per Watt	100	74	93	73	93	72	86	67	77	62	81	64
Source Lumens	1150	900	1300	1025	1725	1350	2400	1875	3025	2350	3775	2950
Delivered Lumens	**850**	**675**	**1125**	**875**	**1475**	**1150**	**2050**	**1600**	**2600**	**2025**	**3000**	**2350**
Color Consistency	2-Step MacAdam Ellipse											

Performance based on 3000K

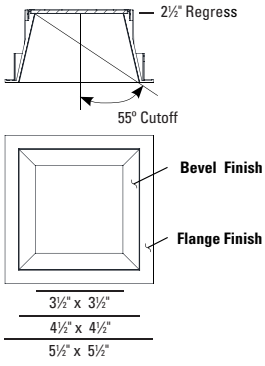
CCT MULTIPLIER	2200K	2700K		3000K		3500K	4000K
Color Rendering Index	80+ CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	80+ CRI
Multiplier for Lumen Output	0.72	0.94	0.78	1.00	.78	1.00	1.06

90+ CRI is not available for 2200K, 3500K, or 4000K

DEEP REGRESS DOWNLIGHT



Deep Regress



DELIVERED PERFORMANCE

BeveLED 2.1 DEEP REGRESS DOWNLIGHT	9 Watts		12 Watts		16 Watts		24 Watts		33 Watts		37 Watts	
Color Rendering Index	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI
Lumens per Watt	76	60	75	58	74	58	68	53	63	49	65	51
Source Lumens	1150	900	1300	1025	1725	1350	2400	1875	3025	2350	3775	2950
Delivered Lumens	**675**	**550**	**900**	**700**	**1175**	**925**	**1650**	**1275**	**2075**	**1625**	**2400**	**1875**
Color Consistency	2-Step MacAdam Ellipse											

Performance based on 3000K

CCT MULTIPLIER	2200K	2700K		3000K		3500K	4000K
Color Rendering Index	80+ CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	80+ CRI
Multiplier for Lumen Output	0.72	0.94	0.78	1.00	.78	1.00	1.06

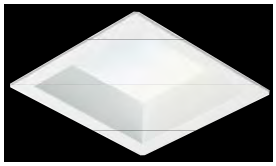
90+ CRI is not available for 2200K, 3500K, or 4000K

USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

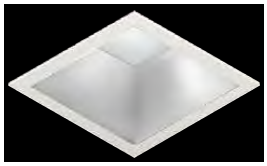
BeveLED 2.1

ORDERING INFORMATION

3110
DOWNLIGHT



1"REGRESS



DEEP REGRESS

HOW TO SPECIFY

Ordering Example: Specify trim code and housing code to order: **3110W - B1- S - 10 - LSTD4 - 9012 - C3 - 27KS - 50 - NC - 277V - DIML2 - CB27**

TRIM ORDERING INFORMATION

TRIM: 3110 | OPTION: _____ - BEVEL STYLE: _____ - LENS: _____ - FLANGE FINISH: _____

1" REGRESS DOWNLIGHT

3110 Square Downlight 1" Regress	**W** Wet location [1] **EML** Integral Emergency Test Switch [2] **TZ** 6" TechZone ceiling compatible (NCSM only) N/A with 01 or 02 flange finishes.	**B1** 1" Regress Bevel, Painted Die Cast Matches Flange Finish **AB1** 1" Regress Bevel, Black Anodized **AC1** 1" Regress Bevel, Clear Matte Anodized	**S** Solite (provided standard) **F** Frosted	**01** Clear Matte (AC Bevel only) **02** Black Anodized (AB Bevel Only) **10** White **13** Statuary Bronze **21** Black **28** Metalized Grey **RAL** Custom Color (specify RAL #)

DEEP REGRESS DOWNLIGHT

3110 Square Downlight Deep Regress	**W** Wet location [1] **EML** Integral Emergency Test Switch [2]	**B2** 2-1/2" Regress Bevel, Painted Die Cast Matches Flange Finish **AB2** 2-1/2" Regress Bevel, Black Anodized **AC2** 2-1/2" Regress Bevel, Clear Matte Anodized

[1] Wet location, use with B1 and B2 trims only.

[2] See table on page 3.

HOUSING ORDERING INFORMATION

HOUSING CODE: LSTD4 - WATTAGE: _____ - ENGINE CODE: _____ - COLOR: _____ - REFLECTOR: _____ - HOUSING TYPE: _____ - SELECT ONE VOLTAGE: _____ - DIMMING DRIVER OPTIONS: _____ - ACCESSORIES: _____

HOUSING CODE	WATTAGE	ENGINE CODE	COLOR
LSTD4	**9009** 9W LED **9012** 12W LED **9016** 16W LED **9024** 24W LED **9033** 33W LED **9037** 37W LED See performance chart for precise lumen information.	**C3** **E1**	**22KS** 2200K, 80+ CRI [3] **27KS** 2700K, 80+ CRI **30KS** 3000K, 80+ CRI **35KS** 3500K, 80+ CRI **40KS** 4000K, 80+ CRI **27KH** 2700K, 90+ CRI **30KH** 3000K, 90+ CRI 2 Step MacAdam ellipse is standard for all [3] Not available with E1 light engine

1" REGRESS DOWNLIGHT		REFLECTOR	HOUSING TYPE
	25 25° beam **50** 50° beam **90** 90° beam	**FT** Flat Housing New Construction (FT is IC-rated up to 16W maximum) **NCSM** New Construction Narrow Width **NC** New Construction, all in one **CP** Chicago Plenum **IC** Insulation-Contact Rated / Airtight [4]
DEEP REGRESS DOWNLIGHT			
	C25 25° beam Comfort Cutoff **C40** 40° beam Comfort Cutoff **C70** 70° beam Comfort Cutoff	**NC** New Construction, all in one **CP** Chicago Plenum **IC** Insulation-Contact Rated / Airtight [4] See emergency solutions chart for EM options with these housings [4] Not available with E1 light engine

SELECT ONE VOLTAGE	DIMMING DRIVER OPTIONS
120V **277V**	**For use with 120V or 277V** **DIML2** 0-10V dim, 10% (provided standard) **DIML4** Lutron A 3-wire/ECO, 1% **DIML4E** Lutron 5 ECO, 5% [5,8] **DIML4H** Lutron H ECO, 1% Fade [5] **DIML6A** EldoLED 0-10V, 0.1%, logarithmic / Lutron controls **DIML6B** EldoLED 0-10V Linear, 0.1%, linear controls **DIML6E** EldoLED 0-10V, 1%, logarithmic/Lutron controls **DIML6F** EldoLED 0-10V, 1%, linear controls **DIML7** EldoLED DALI, 0.1% **DIML8** EldoLED DMX, 0.1% [6,7]
120V	**For use with 120V only** **DIML3** Lutron A 2-wire, 1% 120V only **DIML19** Phase 2-wire dimming, 1% 120V only [5,6,8]
347V	**For use with 347V only** **DIML15** 0-10V dim, 1% 347 only

[5] N/A with 9W
[6] N/A with 33W
[7] N/A with FT housing
[8] N/A with E1 light engine

1" REGRESS DOWNLIGHT	DEEP REGRESS DOWNLIGHT	ACCESSORIES
CB27 27" C-Channel Bars **CB52** 52" C-Channel Bars **EML** Emergency battery [9] **EMLW** Emergency battery, wet location [9] **TZ** 6" TechZone ceiling compatible [10]	**CB27** 27" C-Channel Bars **CB52** 52" C-Channel Bars **EML** Emergency battery [9] **EMLW** Emergency battery, wet location [9]	[9] See emergency solutions chart for more details on EM options. Not available with 347V [10] With NCSM housing only

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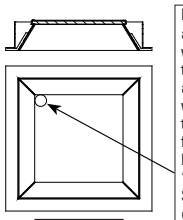
3110
DOWNLIGHT

TRIM INFORMATION

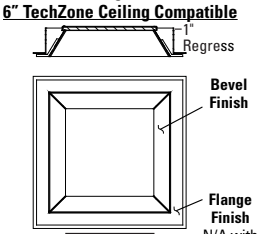
1" REGRESS DOWNLIGHT TRIMS

1" Regress



EM fixtures that are provided with an integral test switch are shipped with a hole in the glass lens for access. Refer to "EMERGENCY SOLUTIONS" chart to find out which fixtures have an integral test switch.

1" Regress - 6" TechZone Ceiling Compatible



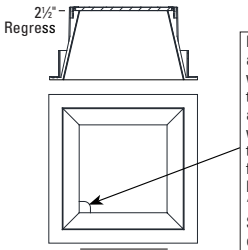
3110 - 1" Regress Emergency Solutions

Housing	EM SERVICE	Integral Test Switch	Remote Test Switch	Inverter By Others
FT	N/A			X
NCSM*	Above ceiling access required		X	X
NC	Through aperture	X		X
NC Wet Location	Through aperture		X	X
CP	N/A			X
IC	N/A			X

* NCSM + DIML8 cannot be offered with EM, 347V cannot be offered with EM

DEEP REGRESS DOWNLIGHT TRIM

Deep Regress



EM fixtures that are provided with an integral test switch are shipped with a hole in the glass lens for access. Refer to "EMERGENCY SOLUTIONS" chart to find out which fixtures have an integral test switch.

3110 - Deep Regress Emergency Solutions

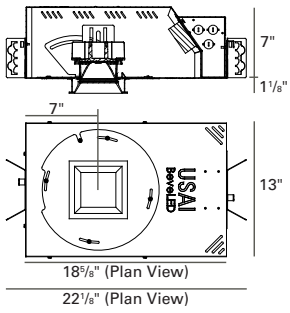
Housing	EM SERVICE	Integral Test Switch	Remote Test Switch	Inverter By Others
NC	Through aperture	X		X
NC Wet Location	Through aperture		X	X
CP	N/A			X
IC	N/A			X

* 347V cannot be offered with EM

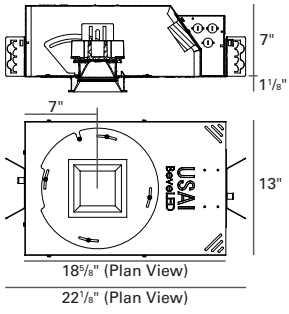
HOUSING INFORMATION

NC, IC AND CP HOUSINGS BELOW ARE FOR USE WITH 1" REGRESS TRIMS & DEEP REGRESS TRIMS

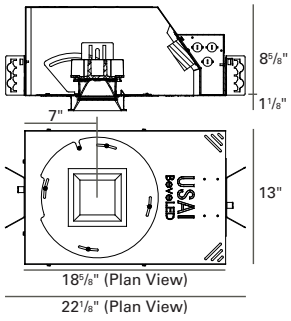
New Construction
Universal Style Housing - NC



Chicago Plenum (24W and less) - CP
IC / Airtight (24W and less) - IC

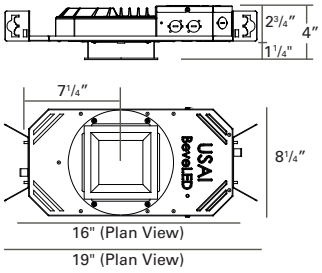


Chicago Plenum (33W) - CP
IC / Airtight (33W) - IC (not available with E1 light engine)

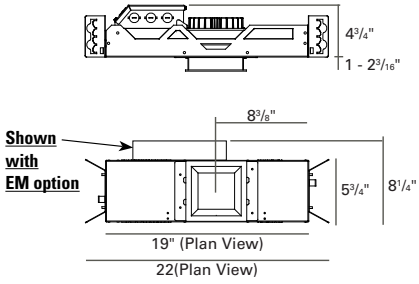


HOUSINGS BELOW ARE FOR USE WITH 1" REGRESS TRIMS ONLY (FT AND NCSM ARE NOT AVAILABLE FOR USE WITH DEEP REGRESS)

New Construction
Flat Housing - FT (Not for use with deep regress trims)
FT housing is IC-rated up to 16W maximum.



New Construction - Narrow Width - NCSM
(Not for use with deep regress trims)



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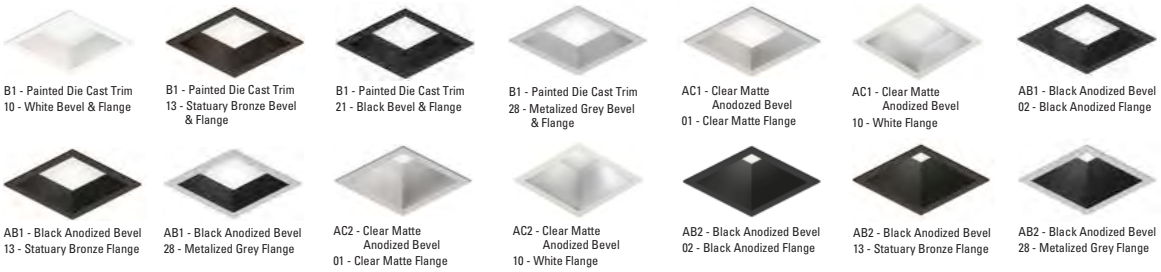
3110
DOWNLIGHT

SPECIFICATIONS

TRIM: 4-1/2" square aperture with a 1" regress or deep regress bevel and 1/2" flange, retained by two mounting clips. Die cast aluminum bevel is available in white, statuary bronze, black, and metalized gray painted finishes, with flange painted to match. Also available in black or clear matte anodized finishes, with self-finish or contrasting painted flange. Custom colors are available (provide RAL#). Trim is shipped with a solite lens provided standard.

Some examples of standard trim finish options for 3110 are shown below:



FIELD REPLACEABLE LED LIGHT ENGINE: is serviceable through the aperture without tools. All USAI Lighting Classic White light engines feature industry leading color consistency within a 2-Step MacAdam's ellipse. 2200K is not available with E1 light engine.

FIELD REPLACEABLE DIMMING DRIVER: 0-10V, 100%-10% solid state electronic constant current DIML2 dimming driver with a high power factor provided standard and sources 2mA. Specify 120V or 277V. Driver complies with IEEEC62.41 surge protection. Multiple dimming driver options are available; some on-time delay may be experienced, depending on control system used.

EMERGENCY: Fixtures provided with an integral test switch are provided with a hole in the glass lens as per drawing. Fixtures provided with a remote test switch are provided with a 24" lead length for location of the test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. SPECIAL NOTE FOR NCSM HOUSING: DIML8 cannot be combined with EM options in NCSM housing. See emergency solutions chart for more information on EM test switches and servicing.

HOUSING: 1" regress fixture housing options are NC, IC, CP, FT, and NCSM. DEEP regress fixture housing options are NC, IC, and CP only. FT and NCSM housings are not available with DEEP regress trims. All-Ways Square® (covered by US Pat. No: US 7,832,889) housing allows alignment of square aperture (up to 20° rotation) after housing installation and prior to finish ceiling installation. Fabricated of 20 ga. galvanized steel with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. FT housing is IC-rated up to 16W maximum. IC-rated housings for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 or less. IC rated housing is Not available with E1 light engine. NCSM with TZ option is compatible with 6" TechZone ceiling systems. When using DIML8, NCSM housing can NOT be used with thru-branch circuit wiring.

MOUNTING: Butterfly brackets and adjustable nailer bars with integral nails provided. Nailer bars are extendible from 14" to 24" centers. C-channel bars are optionally available for acoustical ceiling applications.

MAXIMUM CEILING THICKNESS: As noted on housing drawings.

CEILING CUT OUT: 5-1/16" x 5-1/16"

WARRANTY: Based on IESNA LM80-2008, BeveLED 2.1 has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment.

LISTINGS: Dry/Damp. Wet location option available with B1 trim only. NRTL/CSA-US tested to UL standards. IBEW union made. Energy Star Qualified under Luminaires Specification V2.0. Please see Energy Star website for exact model #s included in the listing. Please note that the following options are not Energy Star qualified: 22KS, 27KH, and 30KH light engines; E1 light engines; B-13, B-21, and AB trim styles; Frosted lens and EM options. CEC/ Title 24 Compliant up to 16W maximum. See CEC website for exact models included.

NOTES:

- Not for use in corrosive environment.
- Use of pressure washer voids warranty.

PHOTOMETRICS: Consult factory or website for IES files. Tested in accordance with IESNA LM79.

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DOWNLIGHT 3110

DELIVERED PERFORMANCE

3110 / 3311 16W 30KS 25° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.08	1.06	1.11	1.08	1.06	.94	1.04	1.02	1.01	1.01	.99	.98	.97	.96	.95	.93
2	1.08	1.03	.99	.95	1.05	1.01	.97	.87	.98	.95	.92	.95	.92	.90	.92	.90	.88	.86
3	1.02	.96	.91	.87	1.00	.94	.90	.81	.92	.88	.84	.89	.86	.83	.87	.84	.82	.80
4	.97	.89	.84	.80	.95	.88	.83	.76	.86	.82	.78	.84	.80	.77	.82	.79	.76	.75
5	.92	.84	.78	.74	.91	.83	.77	.71	.81	.76	.73	.79	.75	.72	.78	.74	.71	.70
6	.88	.79	.73	.69	.86	.78	.72	.67	.76	.72	.68	.75	.71	.67	.74	.70	.67	.65
7	.84	.74	.68	.64	.82	.74	.68	.63	.72	.67	.64	.71	.67	.63	.70	.66	.63	.62
8	.80	.70	.64	.60	.78	.70	.64	.59	.69	.63	.60	.68	.63	.60	.67	.62	.59	.58
9	.76	.67	.61	.57	.75	.66	.60	.56	.65	.60	.56	.64	.60	.56	.63	.59	.56	.55
10	.73	.63	.58	.54	.72	.63	.57	.53	.62	.57	.53	.61	.57	.53	.60	.56	.53	.52

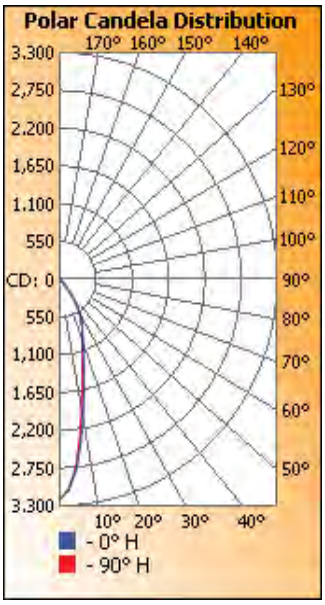
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,001.9	67.6%
0-40	1,309.7	88.3%
0-60	1,450.7	97.9%
60-90	31.7	2.1%
70-100	12.1	0.8%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	804.4 fc	0.9 ft	0.9 ft
4.0ft	201.1 fc	1.9 ft	1.7 ft
6.0ft	89.4 fc	2.8 ft	2.6 ft
8.0ft	50.3 fc	3.8 ft	3.5 ft
10.0ft	32.2 fc	4.7 ft	4.3 ft
12.0ft	22.3 fc	5.6 ft	5.2 ft
14.0ft	16.4 fc	6.6 ft	6.1 ft
16.0ft	12.6 fc	7.5 ft	6.9 ft

Vert. Spread: 26.4°
Horiz. Spread: 24.5°



3110 / 3311 33W 30KS 25° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.08	1.06	1.11	1.08	1.06	.94	1.04	1.02	1.01	1.01	.99	.98	.97	.96	.95	.93
2	1.08	1.03	.99	.95	1.05	1.01	.97	.87	.98	.95	.92	.95	.92	.90	.92	.90	.88	.86
3	1.02	.96	.91	.87	1.00	.94	.90	.81	.92	.88	.84	.89	.86	.83	.87	.84	.82	.80
4	.97	.89	.84	.80	.95	.88	.83	.76	.86	.82	.78	.84	.80	.77	.82	.79	.76	.75
5	.92	.84	.78	.74	.91	.83	.77	.71	.81	.76	.73	.79	.75	.72	.78	.74	.71	.70
6	.88	.79	.73	.69	.86	.78	.72	.67	.76	.72	.68	.75	.71	.67	.74	.70	.67	.65
7	.84	.74	.68	.64	.82	.74	.68	.63	.72	.67	.64	.71	.67	.63	.70	.66	.63	.62
8	.80	.70	.64	.60	.78	.70	.64	.59	.69	.63	.60	.68	.63	.60	.67	.62	.59	.58
9	.76	.67	.61	.57	.75	.66	.60	.56	.65	.60	.56	.64	.60	.56	.63	.59	.56	.55
10	.73	.63	.58	.54	.72	.63	.57	.53	.62	.57	.53	.61	.57	.53	.60	.56	.53	.52

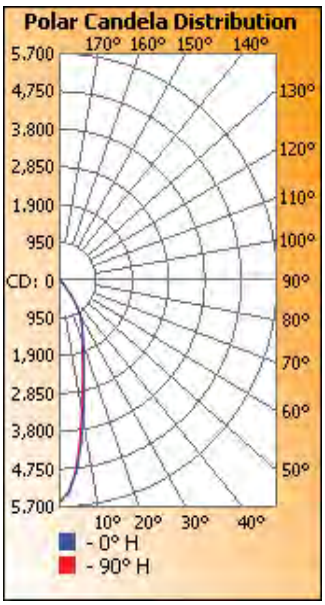
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,745.5	67.6%
0-40	2,281.6	88.3%
0-60	2,527.3	97.9%
60-90	55.3	2.1%
70-100	21.0	0.8%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	1,401.4 fc	0.9 ft	0.9 ft
4.0ft	350.4 fc	1.9 ft	1.7 ft
6.0ft	155.7 fc	2.8 ft	2.6 ft
8.0ft	87.6 fc	3.8 ft	3.5 ft
10.0ft	56.1 fc	4.7 ft	4.3 ft
12.0ft	38.9 fc	5.6 ft	5.2 ft
14.0ft	28.6 fc	6.6 ft	6.1 ft
16.0ft	21.9 fc	7.5 ft	6.9 ft

Vert. Spread: 26.4°
Horiz. Spread: 24.5°



BeveLED 2.1

DOWNLIGHT 3110

DELIVERED PERFORMANCE

3110 / 3311 16W 30KS 50° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.07	1.05	1.11	1.08	1.06	.93	1.04	1.02	1.00	1.00	.99	.97	.97	.96	.94	.93
2	1.07	1.02	.98	.94	1.05	1.00	.96	.86	.97	.94	.91	.94	.91	.89	.91	.89	.87	.85
3	1.01	.94	.89	.85	.99	.93	.88	.80	.90	.86	.83	.88	.84	.82	.86	.83	.80	.79
4	.96	.88	.82	.78	.94	.87	.81	.74	.84	.80	.76	.82	.78	.75	.81	.77	.74	.73
5	.91	.82	.76	.71	.89	.81	.75	.69	.79	.74	.70	.77	.73	.70	.76	.72	.69	.67
6	.86	.77	.70	.66	.84	.76	.70	.64	.74	.69	.65	.73	.68	.65	.71	.67	.64	.63
7	.82	.72	.66	.61	.80	.71	.65	.60	.70	.65	.61	.69	.64	.60	.67	.63	.60	.58
8	.77	.68	.61	.57	.76	.67	.61	.56	.66	.60	.57	.65	.60	.56	.64	.59	.56	.55
9	.74	.64	.57	.53	.72	.63	.57	.53	.62	.57	.53	.61	.56	.53	.60	.56	.53	.51
10	.70	.60	.54	.50	.69	.60	.54	.49	.59	.54	.50	.58	.53	.50	.57	.53	.50	.48

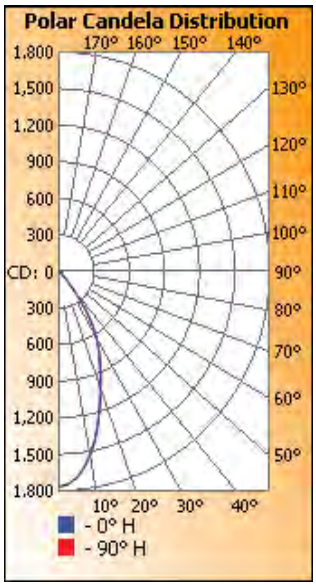
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	927.0	64.5%
0-40	1,252.7	87.2%
0-60	1,402.0	97.6%
60-90	34.9	2.4%
70-100	13.1	0.9%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	443.6 fc	1.7 ft	1.8 ft
4.0ft	110.9 fc	3.5 ft	3.5 ft
6.0ft	49.3 fc	5.2 ft	5.3 ft
8.0ft	27.7 fc	6.9 ft	7.1 ft
10.0ft	17.7 fc	8.6 ft	8.9 ft
12.0ft	12.3 fc	10.4 ft	10.6 ft
14.0ft	9.1 fc	12.1 ft	12.4 ft
16.0ft	6.9 fc	13.8 ft	14.2 ft

Vert. Spread: 46.7°
Horiz. Spread: 47.8°



3110 / 3311 33W 30KS 50° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.07	1.05	1.11	1.08	1.06	.93	1.04	1.02	1.00	1.00	.99	.97	.97	.96	.94	.93
2	1.07	1.02	.98	.94	1.05	1.00	.96	.86	.97	.94	.91	.94	.91	.89	.91	.89	.87	.85
3	1.01	.94	.89	.85	.99	.93	.88	.80	.90	.86	.83	.88	.84	.82	.86	.83	.80	.79
4	.96	.88	.82	.78	.94	.87	.81	.74	.84	.80	.76	.82	.78	.75	.81	.77	.74	.73
5	.91	.82	.76	.71	.89	.81	.75	.69	.79	.74	.70	.77	.73	.70	.76	.72	.69	.67
6	.86	.77	.70	.66	.84	.76	.70	.64	.74	.69	.65	.73	.68	.65	.71	.67	.64	.63
7	.82	.72	.66	.61	.80	.71	.65	.60	.70	.65	.61	.69	.64	.60	.67	.63	.60	.58
8	.77	.68	.61	.57	.76	.67	.61	.56	.66	.60	.57	.65	.60	.56	.64	.59	.56	.55
9	.74	.64	.57	.53	.72	.63	.57	.53	.62	.57	.53	.61	.56	.53	.60	.56	.53	.51
10	.70	.60	.54	.50	.69	.60	.54	.49	.59	.54	.50	.58	.53	.50	.57	.53	.50	.48

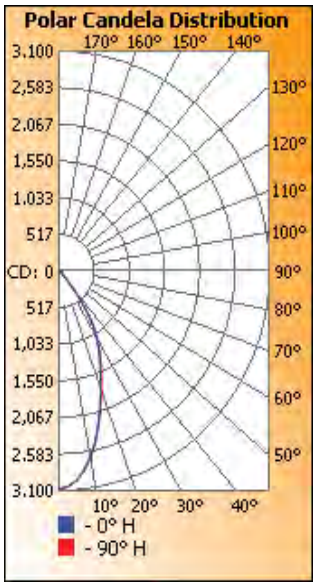
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,615.0	64.5%
0-40	2,182.4	87.2%
0-60	2,442.6	97.6%
60-90	60.8	2.4%
70-100	22.8	0.9%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	772.8 fc	1.7 ft	1.8 ft
4.0ft	193.2 fc	3.5 ft	3.5 ft
6.0ft	85.9 fc	5.2 ft	5.3 ft
8.0ft	48.3 fc	6.9 ft	7.1 ft
10.0ft	30.9 fc	8.6 ft	8.9 ft
12.0ft	21.5 fc	10.4 ft	10.6 ft
14.0ft	15.8 fc	12.1 ft	12.4 ft
16.0ft	12.1 fc	13.8 ft	14.2 ft

Vert. Spread: 46.7°
Horiz. Spread: 47.8°



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BeveLED 2.1

DOWNLIGHT 3110

DELIVERED PERFORMANCE

3110 / 3311 16W 30KS 90° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.11	1.07	1.04	1.01	1.09	1.05	1.02	.89	1.01	.99	.96	.97	.95	.93	.94	.92	.91	.89
2	1.03	.96	.91	.86	1.01	.95	.89	.79	.91	.87	.83	.88	.84	.81	.85	.82	.80	.78
3	.95	.87	.80	.74	.93	.85	.79	.69	.82	.77	.72	.80	.75	.71	.77	.73	.70	.68
4	.88	.78	.71	.65	.86	.77	.70	.62	.74	.68	.64	.72	.67	.63	.70	.66	.62	.60
5	.82	.71	.63	.57	.80	.70	.62	.55	.68	.61	.56	.66	.60	.56	.64	.59	.55	.53
6	.76	.64	.56	.51	.74	.63	.56	.49	.62	.55	.50	.60	.54	.50	.59	.53	.49	.47
7	.71	.59	.51	.45	.69	.58	.51	.44	.57	.50	.45	.55	.49	.45	.54	.48	.44	.43
8	.66	.54	.46	.41	.65	.53	.46	.40	.52	.45	.41	.51	.45	.40	.50	.44	.40	.38
9	.62	.50	.42	.37	.61	.49	.42	.36	.48	.41	.37	.47	.41	.37	.46	.41	.36	.35
10	.58	.46	.39	.34	.57	.46	.39	.33	.45	.38	.34	.44	.38	.33	.43	.37	.33	.32

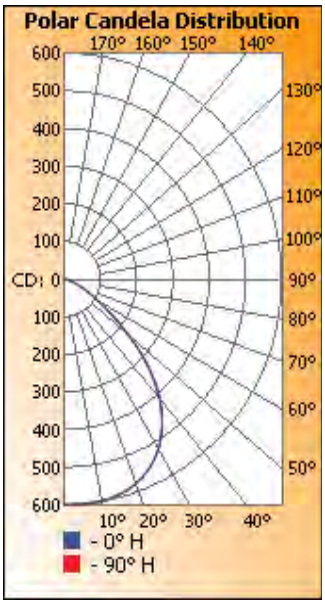
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	480.2	37.3%
0-40	779.3	60.5%
0-60	1,198.0	92.9%
60-90	91.0	7.1%
70-100	28.0	2.2%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	148.9 fc	4.3 ft	4.2 ft
4.0ft	37.2 fc	8.5 ft	8.4 ft
6.0ft	16.5 fc	12.8 ft	12.6 ft
8.0ft	9.3 fc	17.0 ft	16.8 ft
10.0ft	6.0 fc	21.3 ft	21.0 ft
12.0ft	4.1 fc	25.6 ft	25.2 ft
14.0ft	3.0 fc	29.8 ft	29.4 ft
16.0ft	2.3 fc	34.1 ft	33.6 ft

Vert. Spread: 93.6°
Horiz. Spread: 92.8°



3110 / 3311 33W 30KS 90° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.11	1.07	1.04	1.01	1.09	1.05	1.02	.89	1.01	.99	.96	.97	.95	.93	.94	.92	.91	.89
2	1.03	.96	.91	.86	1.01	.95	.89	.79	.91	.87	.83	.88	.84	.81	.85	.82	.80	.78
3	.95	.87	.80	.74	.93	.85	.79	.69	.82	.77	.72	.80	.75	.71	.77	.73	.70	.68
4	.88	.78	.71	.65	.86	.77	.70	.62	.74	.68	.64	.72	.67	.63	.70	.66	.62	.60
5	.82	.71	.63	.57	.80	.70	.62	.55	.68	.61	.56	.66	.60	.56	.64	.59	.55	.53
6	.76	.64	.56	.51	.74	.63	.56	.49	.62	.55	.50	.60	.54	.50	.59	.53	.49	.47
7	.71	.59	.51	.45	.69	.58	.51	.44	.57	.50	.45	.55	.49	.45	.54	.48	.44	.43
8	.66	.54	.46	.41	.65	.53	.46	.40	.52	.45	.41	.51	.45	.40	.50	.44	.40	.38
9	.62	.50	.42	.37	.61	.49	.42	.36	.48	.41	.37	.47	.41	.37	.46	.41	.36	.35
10	.58	.46	.39	.34	.57	.46	.39	.33	.45	.38	.34	.44	.38	.33	.43	.37	.33	.32

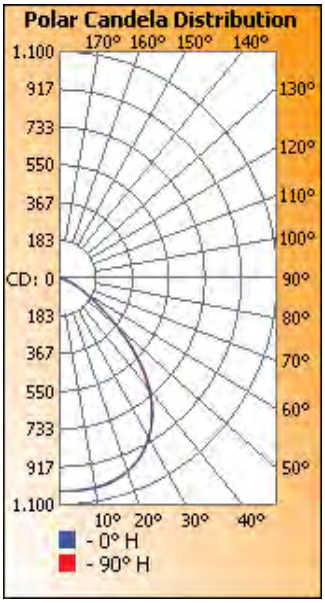
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	836.5	37.3%
0-40	1,357.7	60.5%
0-60	2,087.1	92.9%
60-90	158.6	7.1%
70-100	48.8	2.2%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	259.4 fc	4.3 ft	4.2 ft
4.0ft	64.9 fc	8.5 ft	8.4 ft
6.0ft	28.8 fc	12.8 ft	12.6 ft
8.0ft	16.2 fc	17.0 ft	16.8 ft
10.0ft	10.4 fc	21.3 ft	21.0 ft
12.0ft	7.2 fc	25.6 ft	25.2 ft
14.0ft	5.3 fc	29.8 ft	29.4 ft
16.0ft	4.1 fc	34.1 ft	33.6 ft

Vert. Spread: 93.6°
Horiz. Spread: 92.8°



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML2

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

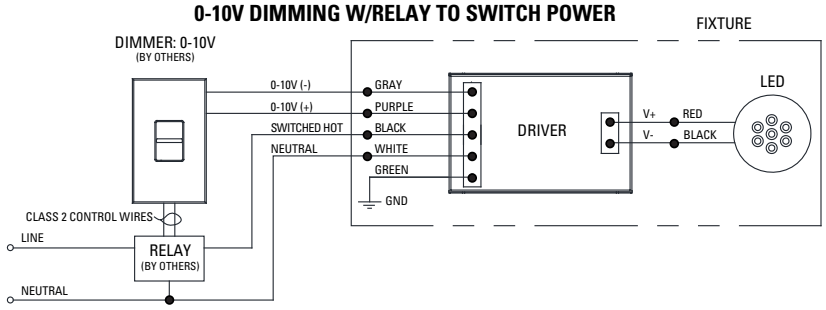
DIML2 LED: 0-10V Dimming Driver Wiring (Dims down to 10%)

DIML2 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
120V / 277V				Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Crestron	iLux dimmer expansion module	CLS-EXP-DIMFLV	100% - 10%	
Crestron	DIN Rail dimmer	DIN-4DIMFLV4	100% - 10%	
Crestron	DIN Rail analog output module	DIN-A08	100% - 10%	
Crestron	8 Channel dimmer module	GLX-DIMFLV8	100% - 10%	
Crestron	8 Channel dimmer module	GLXP-DIMFLV8	100% - 10%	
Leviton	IllumaTech dimmer	IP710-DLX	100% - 10%	
Lightolier (Philips)	Vega	V2000FAMU	100% - 10%	
Lutron	Diva	DVTV-XX	100% - 10%	

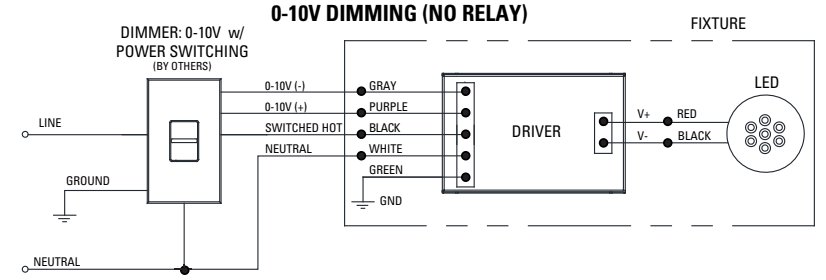
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML2
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

DIML2
0-10V DIMMING (NO RELAY)



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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I2-264-2 Revised 02/15/2016

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

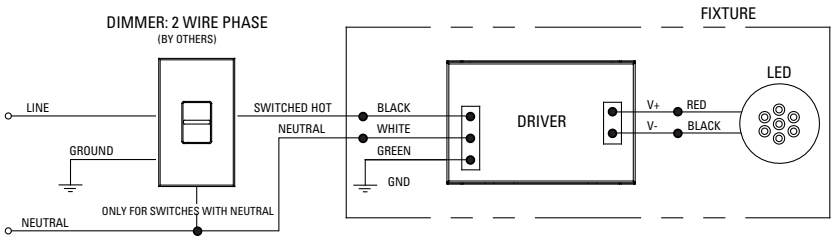
DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V only.

DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML3
2 WIRE PHASE DIMMING



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML4

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 wiring diagrams continued on next page

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4 Continued

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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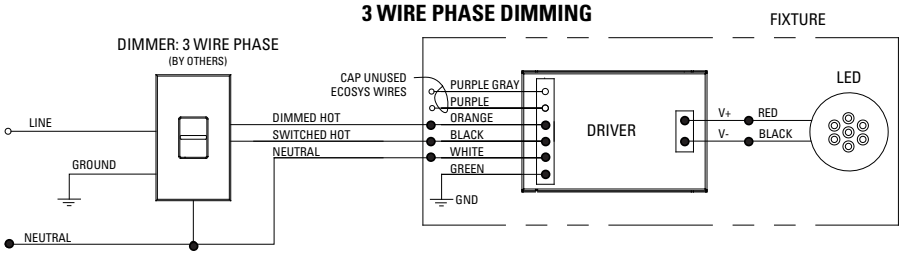
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4
3 WIRE PHASE DIMMING



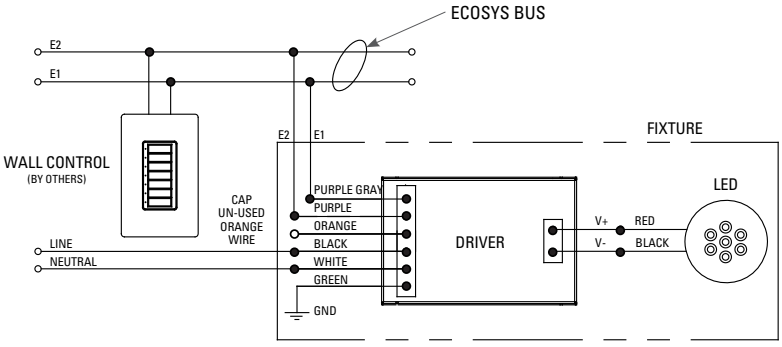
DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4
EcoSystem CONTROLS



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4E and DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4E LED: Lutron 5 Series EcoSystem LED Driver / LED Dimming Driver Wiring (Dims down to 5%)

DIML4E EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–5%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–5%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–5%	1–64	1 – 32
Lutron	Quantum	Various	100%–5%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

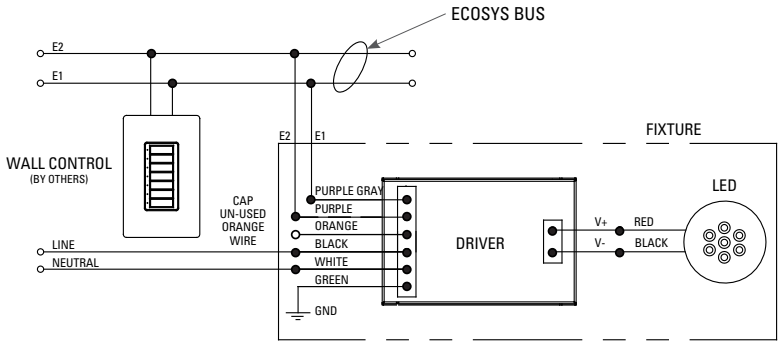
DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

DIML4E EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4E and DIML 4H
EcoSystem CONTROLS



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I2-264-4EH Revised 02/15/2016

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML6A, 6E
DIML6B, 6F

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML6A and DIML6E LED Dimming Compatibility Table

DIML6A and DIML6E are linearly programmed dimming drivers for use with logarithmic-style dimming controls (e.g., Lutron and others listed in the table below)
DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6A and DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6A		6E	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV/NTFTV with PP-20	99% -	0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML6B and DIML6F LED Dimming Compatibility Table

DIML6B and DIML6F are logarithmic-programmed dimming drivers for use with linear-style dimming controls (e.g., Crestron, non-Lutron and others listed in the table below)
DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6B and DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6B		6F	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	
Leviton	IllumaTech dimmer	IP710-DLX	100% -	0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

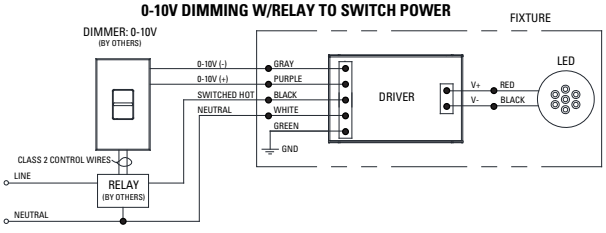
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIMMING DRIVER WIRING SCHEMES:

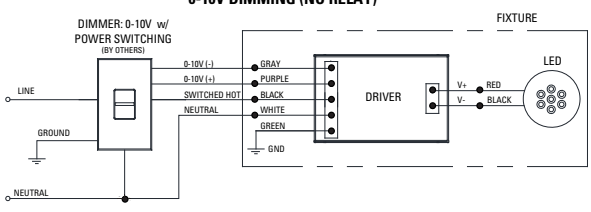
NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



DIML6
0-10V DIMMING (NO RELAY)



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML7

DIMMING DRIVER WIRING SCHEMES:

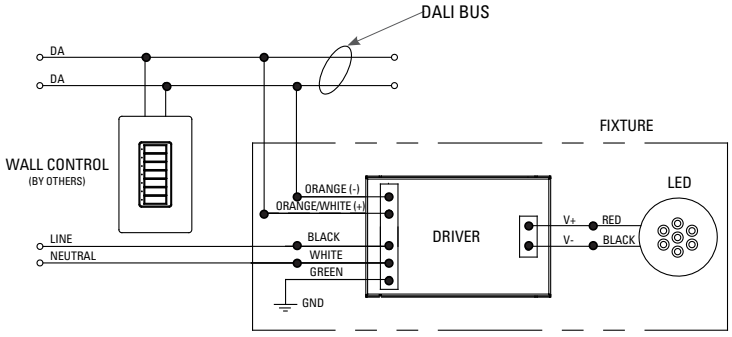
NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML7 LED: EldoLED DALI Dimming Driver Wiring (Dims down to 0.1%)

DIML7
DALI CONTROLS



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML8

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

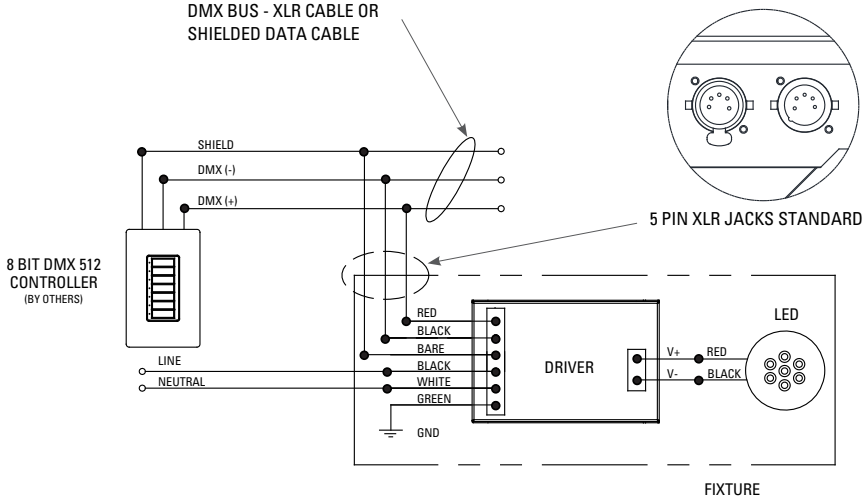
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML8 LED: EldoLED DMX Dimming Driver Wiring (Dims down to 0.1%)

DMX BUS - XLR CABLE OR
SHIELDED DATA CABLE

The data cable used must meet the following requirements:
- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device (by others) should be used on last fixture in line on a circuit to avoid signal loss.



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

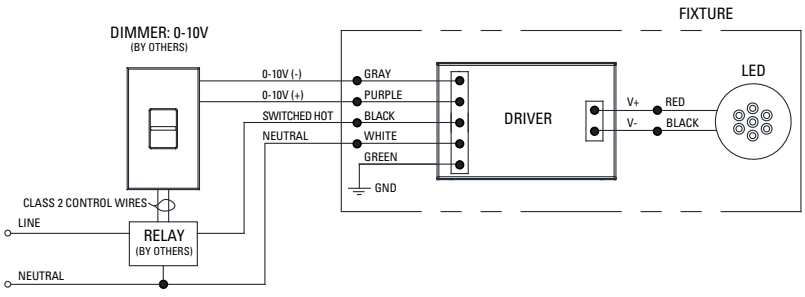
DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

DIML15 Dimmer Compatibility Chart

Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML19

DIMMING DRIVER WIRING SCHEMES:

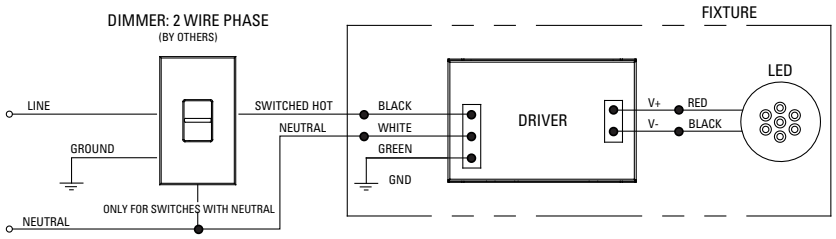
NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML19 LED: Hatch XTC series or equivalent - Forward and Reverse Phase Dimming Driver. Dims down to 1% contingent upon dimmer specification and load. 120V only.

DIML19
2 WIRE PHASE DIMMING



DIML19 Dimmer Compatibility Chart

120V ONLY		
Forward Phase / TRIAC Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	IPL06-10Z	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	6613-xxx	
Lutron	S-600P	
	S-603P	
	DV-600P	
	DV-603P	
	DVSC-603P	
	CT-600P	
	CT-603P	
120V ONLY		
Reverse Phase / ELV Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	6615	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	IPE04-xxx	
Lutron	NTELV-300	
	NTELV-600	
	SELV-300P	
	SELV-303P	
	DVELV-300P	
	DVELV-303P	

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BeveLED®2.1

PROJECT INFORMATION

PROJECT _____

_____

DATE _____

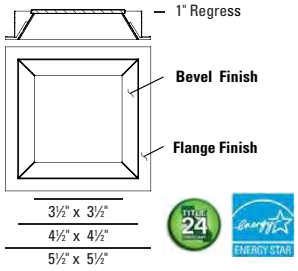
TYPE _____

3110
DOWNLIGHT

BeveLED 2.1 Recessed Downlight - BeveLED 2.1 is the most complete recessed LED downlight product family available from USAI Lighting, now with more BeveLED trim finishes, LED classic white color temperatures, innovative housing styles, and dimming driver options than before. With industry-leading performance, BeveLED 2.1 can provide a solution for any project - commercial, corporate and residential installations.

1" REGRESS DOWNLIGHT

1" Regress



DELIVERED PERFORMANCE

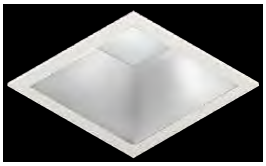
BeveLED 2.1 1" REGRESS DOWNLIGHT	9 Watts		12 Watts		16 Watts		24 Watts		33 Watts		37 Watts	
Color Rendering Index	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI
Lumens per Watt	100	74	93	73	93	72	86	67	77	62	81	64
Source Lumens	1150	900	1300	1025	1725	1350	2400	1875	3025	2350	3775	2950
Delivered Lumens	**850**	**675**	**1125**	**875**	**1475**	**1150**	**2050**	**1600**	**2600**	**2025**	**3000**	**2350**
Color Consistency	2-Step MacAdam Ellipse											

Performance based on 3000K

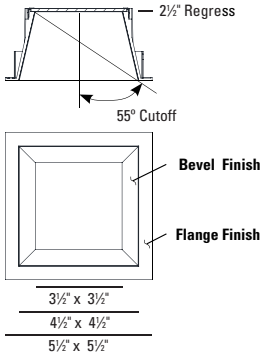
CCT MULTIPLIER	2200K	2700K		3000K		3500K	4000K
Color Rendering Index	80+ CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	80+ CRI
Multiplier for Lumen Output	0.72	0.94	0.78	1.00	.78	1.00	1.06

90+ CRI is not available for 2200K, 3500K, or 4000K

DEEP REGRESS DOWNLIGHT



Deep Regress



DELIVERED PERFORMANCE

BeveLED 2.1 DEEP REGRESS DOWNLIGHT	9 Watts		12 Watts		16 Watts		24 Watts		33 Watts		37 Watts	
Color Rendering Index	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI
Lumens per Watt	76	60	75	58	74	58	68	53	63	49	65	51
Source Lumens	1150	900	1300	1025	1725	1350	2400	1875	3025	2350	3775	2950
Delivered Lumens	**675**	**550**	**900**	**700**	**1175**	**925**	**1650**	**1275**	**2075**	**1625**	**2400**	**1875**
Color Consistency	2-Step MacAdam Ellipse											

Performance based on 3000K

CCT MULTIPLIER	2200K	2700K		3000K		3500K	4000K
Color Rendering Index	80+ CRI	80+ CRI	90+ HIGH CRI	80+ CRI	90+ HIGH CRI	80+ CRI	80+ CRI
Multiplier for Lumen Output	0.72	0.94	0.78	1.00	.78	1.00	1.06

90+ CRI is not available for 2200K, 3500K, or 4000K

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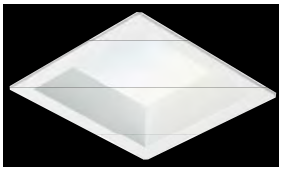
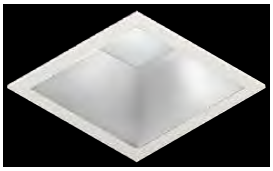
BeveLED 2.1

ORDERING INFORMATION

3110
DOWNLIGHT



1"REGRESS



DEEP REGRESS

HOW TO SPECIFY

Ordering Example: Specify trim code and housing code to order: **3110W - B1- S - 10 - LSTD4 - 9012 - C3 - 27KS - 50 - NC - 277V - DIML2 - CB27**

TRIM ORDERING INFORMATION

TRIM: 3110 | OPTION: _____ - BEVEL STYLE: _____ - LENS: _____ - FLANGE FINISH: _____

1" REGRESS DOWNLIGHT

3110 Square Downlight 1" Regress	**W** Wet location [1] **EML** Integral Emergency Test Switch [2] **TZ** 6" TechZone ceiling compatible (NCSM only) N/A with 01 or 02 flange finishes.	**B1** 1" Regress Bevel, Painted Die Cast Matches Flange Finish **AB1** 1" Regress Bevel, Black Anodized **AC1** 1" Regress Bevel, Clear Matte Anodized	**S** Solite (provided standard) **F** Frosted	**01** Clear Matte (AC Bevel only) **02** Black Anodized (AB Bevel Only) **10** White **13** Statuary Bronze **21** Black **28** Metalized Grey **RAL** Custom Color (specify RAL #)	

DEEP REGRESS DOWNLIGHT

3110 Square Downlight Deep Regress	**W** Wet location [1] **EML** Integral Emergency Test Switch [2]	**B2** 2-1/2" Regress Bevel, Painted Die Cast Matches Flange Finish **AB2** 2-1/2" Regress Bevel, Black Anodized **AC2** 2-1/2" Regress Bevel, Clear Matte Anodized			

[1] Wet location, use with B1 and B2 trims only.

[2] See table on page 3.

HOUSING ORDERING INFORMATION

HOUSING CODE: LSTD4 - WATTAGE: _____ - ENGINE CODE: _____ - COLOR: _____ - REFLECTOR: _____ - HOUSING TYPE: _____ - SELECT ONE VOLTAGE: _____ - DIMMING DRIVER OPTIONS: _____ - ACCESSORIES: _____

HOUSING CODE	WATTAGE	ENGINE CODE	COLOR
LSTD4	**9009** 9W LED **9012** 12W LED **9016** 16W LED **9024** 24W LED **9033** 33W LED **9037** 37W LED See performance chart for precise lumen information.	**C3** **E1**	**22KS** 2200K, 80+ CRI [3] **27KS** 2700K, 80+ CRI **30KS** 3000K, 80+ CRI **35KS** 3500K, 80+ CRI **40KS** 4000K, 80+ CRI **27KH** 2700K, 90+ CRI **30KH** 3000K, 90+ CRI 2 Step MacAdam ellipse is standard for all [3] Not available with E1 light engine

1" REGRESS DOWNLIGHT		REFLECTOR
	25 25° beam	**FT** Flat Housing New Construction (FT is IC-rated up to 16W maximum)
	50 50° beam	**NCSM** New Construction Narrow Width
	90 90° beam	**NC** New Construction, all in one
		CP Chicago Plenum
		IC Insulation-Contact Rated / Airtight [4]

DEEP REGRESS DOWNLIGHT	REFLECTOR
C25 25° beam Comfort Cutoff	**NC** New Construction, all in one
C40 40° beam Comfort Cutoff	**CP** Chicago Plenum
C70 70° beam Comfort Cutoff	**IC** Insulation-Contact Rated / Airtight [4]
	See emergency solutions chart for EM options with these housings
	[4] Not available with E1 light engine

SELECT ONE VOLTAGE	DIMMING DRIVER OPTIONS
120V	**For use with 120V or 277V**
277V	**DIML2** 0-10V dim, 10% (provided standard)
	DIML4 Lutron A 3-wire/ECO, 1%
	DIML4E Lutron 5 ECO, 5% [5,8]
	DIML4H Lutron H ECO, 1% Fade [5]
	DIML6A EldoLED 0-10V, 0.1%, logarithmic / Lutron controls
	DIML6B EldoLED 0-10V Linear, 0.1%, linear controls
	DIML6E EldoLED 0-10V, 1%, logarithmic/Lutron controls
	DIML6F EldoLED 0-10V, 1%, linear controls
	DIML7 EldoLED DALI, 0.1%
	DIML8 EldoLED DMX, 0.1% [6,7]
120V	**For use with 120V only**
	DIML3 Lutron A 2-wire, 1% 120V only
	DIML19 Phase 2-wire dimming, 1% 120V only [5,6,8]
347V	**For use with 347V only**
	DIML15 0-10V dim, 1% 347 only

[5] N/A with 9W
[6] N/A with 33W
[7] N/A with FT housing
[8] N/A with E1 light engine

1" REGRESS DOWNLIGHT	ACCESSORIES
	CB27 27" C-Channel Bars
	CB52 52" C-Channel Bars
	EML Emergency battery [9]
	EMLW Emergency battery, wet location [9]
	TZ 6" TechZone ceiling compatible [10]

DEEP REGRESS DOWNLIGHT	ACCESSORIES
	CB27 27" C-Channel Bars
	CB52 52" C-Channel Bars
	EML Emergency battery [9]
	EMLW Emergency battery, wet location [9]

[9] See emergency solutions chart for more details on EM options. Not available with 347V

[10] With NCSM housing only

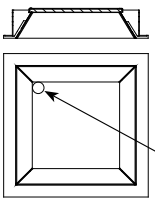
BeveLED 2.1

3110
DOWNLIGHT

TRIM INFORMATION

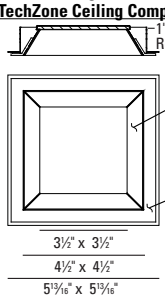
1" REGRESS DOWNLIGHT TRIMS

1" Regress



EM fixtures that are provided with an integral test switch are shipped with a hole in the glass lens for access. Refer to "EMERGENCY SOLUTIONS" chart to find out which fixtures have an integral test switch.

1" Regress - 6" TechZone Ceiling Compatible



N/A with 01 or 02 flange finish

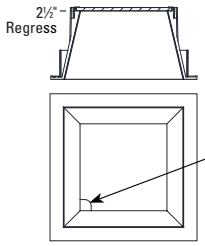
3110 - 1" Regress Emergency Solutions

Housing	EM SERVICE	Integral Test Switch	Remote Test Switch	Inverter By Others
FT	N/A			X
NCSM*	Above ceiling access required		X	X
NC	Through aperture	X		X
NC Wet Location	Through aperture		X	X
CP	N/A			X
IC	N/A			X

* NCSM + DIML8 cannot be offered with EM, 347V cannot be offered with EM

DEEP REGRESS DOWNLIGHT TRIM

Deep Regress



EM fixtures that are provided with an integral test switch are shipped with a hole in the glass lens for access. Refer to "EMERGENCY SOLUTIONS" chart to find out which fixtures have an integral test switch.

3110 - Deep Regress Emergency Solutions

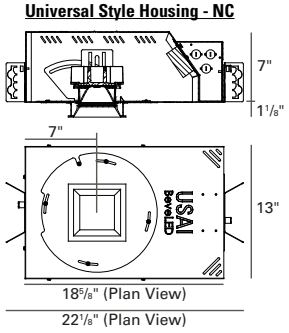
Housing	EM SERVICE	Integral Test Switch	Remote Test Switch	Inverter By Others
NC	Through aperture	X		X
NC Wet Location	Through aperture		X	X
CP	N/A			X
IC	N/A			X

* 347V cannot be offered with EM

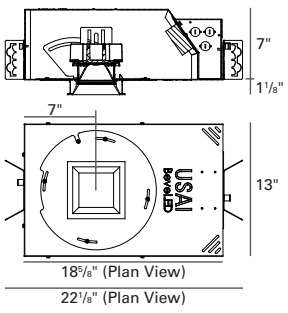
HOUSING INFORMATION

NC, IC AND CP HOUSINGS BELOW ARE FOR USE WITH 1" REGRESS TRIMS & DEEP REGRESS TRIMS

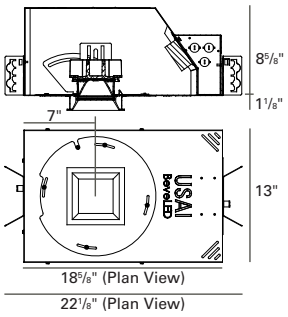
New Construction Universal Style Housing - NC



Chicago Plenum (24W and less) - CP
IC / Airtight (24W and less) - IC

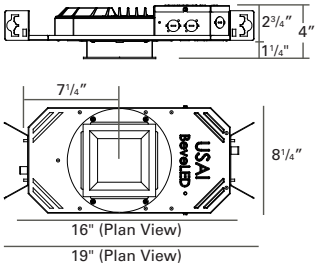


Chicago Plenum (33W) - CP
IC / Airtight (33W) - IC (not available with E1 light engine)

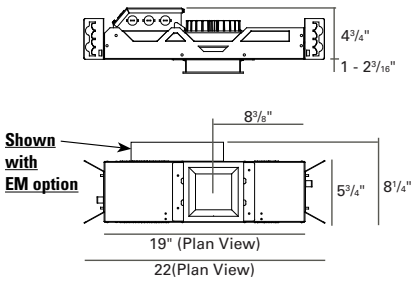


HOUSINGS BELOW ARE FOR USE WITH 1" REGRESS TRIMS ONLY (FT AND NCSM ARE NOT AVAILABLE FOR USE WITH DEEP REGRESS)

New Construction
Flat Housing - FT (Not for use with deep regress trims)
FT housing is IC-rated up to 16W maximum.



New Construction - Narrow Width - NCSM
(Not for use with deep regress trims)



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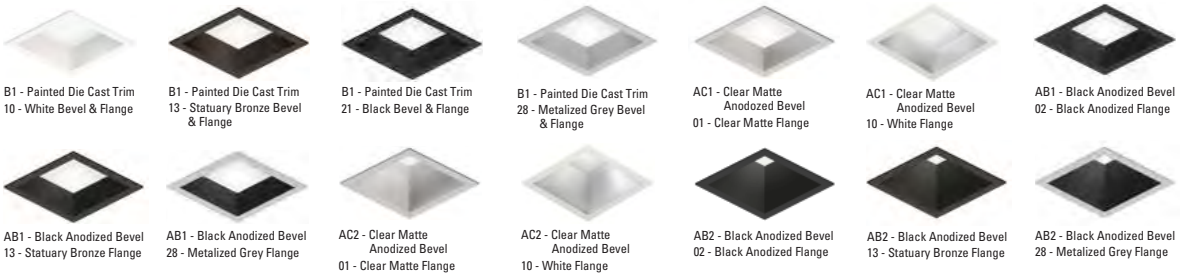
BeveLED 2.1

3110
DOWNLIGHT

SPECIFICATIONS

TRIM: 4-1/2" square aperture with a 1" regress or deep regress bevel and 1/2" flange, retained by two mounting clips. Die cast aluminum bevel is available in white, statuary bronze, black, and metalized gray painted finishes, with flange painted to match. Also available in black or clear matte anodized finishes, with self-finish or contrasting painted flange. Custom colors are available (provide RAL#). Trim is shipped with a solite lens provided standard.

Some examples of standard trim finish options for 3110 are shown below:



B1 - Painted Die Cast Trim
10 - White Bevel & Flange

B1 - Painted Die Cast Trim
13 - Statuary Bronze Bevel & Flange

B1 - Painted Die Cast Trim
21 - Black Bevel & Flange

B1 - Painted Die Cast Trim
28 - Metalized Grey Bevel & Flange

AC1 - Clear Matte Anodozed Bevel
01 - Clear Matte Flange

AC1 - Clear Matte Anodized Bevel
10 - White Flange

AB1 - Black Anodized Bevel
02 - Black Anodized Flange

AB1 - Black Anodized Bevel
13 - Statuary Bronze Flange

AB1 - Black Anodized Bevel
28 - Metalized Grey Flange

AC2 - Clear Matte Anodized Bevel
01 - Clear Matte Flange

AC2 - Clear Matte Anodized Bevel
10 - White Flange

AB2 - Black Anodized Bevel
02 - Black Anodized Flange

AB2 - Black Anodized Bevel
13 - Statuary Bronze Flange

AB2 - Black Anodized Bevel
28 - Metalized Grey Flange

FIELD REPLACEABLE LED LIGHT ENGINE: is serviceable through the aperture without tools. All USAI Lighting Classic White light engines feature industry leading color consistency within a 2-Step MacAdam's ellipse. 2200K is not available with E1 light engine.

FIELD REPLACEABLE DIMMING DRIVER: 0-10V, 100%-10% solid state electronic constant current DIML2 dimming driver with a high power factor provided standard and sources 2mA. Specify 120V or 277V. Driver complies with IEEEC62.41 surge protection. Multiple dimming driver options are available; some on-time delay may be experienced, depending on control system used.

EMERGENCY: Fixtures provided with an integral test switch are provided with a hole in the glass lens as per drawing. Fixtures provided with a remote test switch are provided with a 24" lead length for location of the test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. SPECIAL NOTE FOR NCSM HOUSING: DIML8 cannot be combined with EM options in NCSM housing. See emergency solutions chart for more information on EM test switches and servicing.

HOUSING: 1" regress fixture housing options are NC, IC, CP, FT, and NCSM. DEEP regress fixture housing options are NC, IC, and CP only. FT and NCSM housings are not available with DEEP regress trims. All-Ways Square® (covered by US Pat. No: US 7,832,889) housing allows alignment of square aperture (up to 20° rotation) after housing installation and prior to finish ceiling installation. Fabricated of 20 ga. galvanized steel with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. FT housing is IC-rated up to 16W maximum. IC-rated housings for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 or less. IC rated housing is Not available with E1 light engine. NCSM with TZ option is compatible with 6" TechZone ceiling systems. When using DIML8, NCSM housing can NOT be used with thru-branch circuit wiring.

MOUNTING: Butterfly brackets and adjustable nailer bars with integral nails provided. Nailer bars are extendible from 14" to 24" centers. C-channel bars are optionally available for acoustical ceiling applications.

MAXIMUM CEILING THICKNESS: As noted on housing drawings.

CEILING CUT OUT: 5-1/16" x 5-1/16"

WARRANTY: Based on IESNA LM80-2008, BeveLED 2.1 has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment.

LISTINGS: Dry/Damp. Wet location option available with B1 trim only. NRTL/CSA-US tested to UL standards. IBEW union made. Energy Star Qualified under Luminaires Specification V2.0. Please see Energy Star website for exact model #s included in the listing. Please note that the following options are not Energy Star qualified: 22KS, 27KH, and 30KH light engines; E1 light engines; B-13, B-21, and AB trim styles; Frosted lens and EM options. CEC/ Title 24 Compliant up to 16W maximum. See CEC website for exact models included.

NOTES:

- Not for use in corrosive environment.
- Use of pressure washer voids warranty.

PHOTOMETRICS: Consult factory or website for IES files. Tested in accordance with IESNA LM79.

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BeveLED2.1

DOWNLIGHT 3110

DELIVERED PERFORMANCE

3110 / 3311 16W 30KS 25° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.08	1.06	1.11	1.08	1.06	.94	1.04	1.02	1.01	1.01	.99	.98	.97	.96	.95	.93
2	1.08	1.03	.99	.95	1.05	1.01	.97	.87	.98	.95	.92	.95	.92	.90	.92	.90	.88	.86
3	1.02	.96	.91	.87	1.00	.94	.90	.81	.92	.88	.84	.89	.86	.83	.87	.84	.82	.80
4	.97	.89	.84	.80	.95	.88	.83	.76	.86	.82	.78	.84	.80	.77	.82	.79	.76	.75
5	.92	.84	.78	.74	.91	.83	.77	.71	.81	.76	.73	.79	.75	.72	.78	.74	.71	.70
6	.88	.79	.73	.69	.86	.78	.72	.67	.76	.72	.68	.75	.71	.67	.74	.70	.67	.65
7	.84	.74	.68	.64	.82	.74	.68	.63	.72	.67	.64	.71	.67	.63	.70	.66	.63	.62
8	.80	.70	.64	.60	.78	.70	.64	.59	.69	.63	.60	.68	.63	.60	.67	.62	.59	.58
9	.76	.67	.61	.57	.75	.66	.60	.56	.65	.60	.56	.64	.60	.56	.63	.59	.56	.55
10	.73	.63	.58	.54	.72	.63	.57	.53	.62	.57	.53	.61	.57	.53	.60	.56	.53	.52

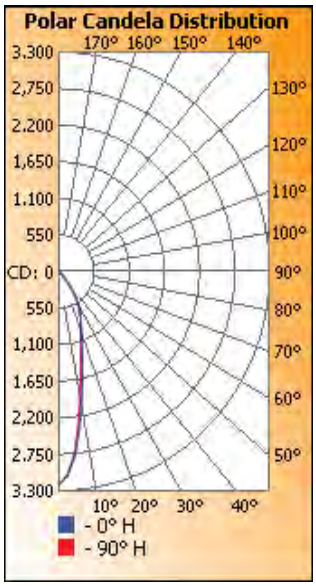
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,001.9	67.6%
0-40	1,309.7	88.3%
0-60	1,450.7	97.9%
60-90	31.7	2.1%
70-100	12.1	0.8%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	804.4 fc	0.9 ft	0.9 ft
4.0ft	201.1 fc	1.9 ft	1.7 ft
6.0ft	89.4 fc	2.8 ft	2.6 ft
8.0ft	50.3 fc	3.8 ft	3.5 ft
10.0ft	32.2 fc	4.7 ft	4.3 ft
12.0ft	22.3 fc	5.6 ft	5.2 ft
14.0ft	16.4 fc	6.6 ft	6.1 ft
16.0ft	12.6 fc	7.5 ft	6.9 ft

Vert. Spread: 26.4°
Horiz. Spread: 24.5°



3110 / 3311 33W 30KS 25° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.08	1.06	1.11	1.08	1.06	.94	1.04	1.02	1.01	1.01	.99	.98	.97	.96	.95	.93
2	1.08	1.03	.99	.95	1.05	1.01	.97	.87	.98	.95	.92	.95	.92	.90	.92	.90	.88	.86
3	1.02	.96	.91	.87	1.00	.94	.90	.81	.92	.88	.84	.89	.86	.83	.87	.84	.82	.80
4	.97	.89	.84	.80	.95	.88	.83	.76	.86	.82	.78	.84	.80	.77	.82	.79	.76	.75
5	.92	.84	.78	.74	.91	.83	.77	.71	.81	.76	.73	.79	.75	.72	.78	.74	.71	.70
6	.88	.79	.73	.69	.86	.78	.72	.67	.76	.72	.68	.75	.71	.67	.74	.70	.67	.65
7	.84	.74	.68	.64	.82	.74	.68	.63	.72	.67	.64	.71	.67	.63	.70	.66	.63	.62
8	.80	.70	.64	.60	.78	.70	.64	.59	.69	.63	.60	.68	.63	.60	.67	.62	.59	.58
9	.76	.67	.61	.57	.75	.66	.60	.56	.65	.60	.56	.64	.60	.56	.63	.59	.56	.55
10	.73	.63	.58	.54	.72	.63	.57	.53	.62	.57	.53	.61	.57	.53	.60	.56	.53	.52

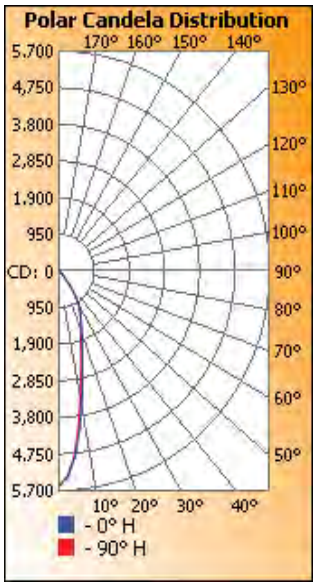
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,745.5	67.6%
0-40	2,281.6	88.3%
0-60	2,527.3	97.9%
60-90	55.3	2.1%
70-100	21.0	0.8%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	1,401.4 fc	0.9 ft	0.9 ft
4.0ft	350.4 fc	1.9 ft	1.7 ft
6.0ft	155.7 fc	2.8 ft	2.6 ft
8.0ft	87.6 fc	3.8 ft	3.5 ft
10.0ft	56.1 fc	4.7 ft	4.3 ft
12.0ft	38.9 fc	5.6 ft	5.2 ft
14.0ft	28.6 fc	6.6 ft	6.1 ft
16.0ft	21.9 fc	7.5 ft	6.9 ft

Vert. Spread: 26.4°
Horiz. Spread: 24.5°



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DOWNLIGHT 3110

DELIVERED PERFORMANCE

3110 / 3311 16W 30KS 50° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.07	1.05	1.11	1.08	1.06	.93	1.04	1.02	1.00	1.00	.99	.97	.97	.96	.94	.93
2	1.07	1.02	.98	.94	1.05	1.00	.96	.86	.97	.94	.91	.94	.91	.89	.91	.89	.87	.85
3	1.01	.94	.89	.85	.99	.93	.88	.80	.90	.86	.83	.88	.84	.82	.86	.83	.80	.79
4	.96	.88	.82	.78	.94	.87	.81	.74	.84	.80	.76	.82	.78	.75	.81	.77	.74	.73
5	.91	.82	.76	.71	.89	.81	.75	.69	.79	.74	.70	.77	.73	.70	.76	.72	.69	.67
6	.86	.77	.70	.66	.84	.76	.70	.64	.74	.69	.65	.73	.68	.65	.71	.67	.64	.63
7	.82	.72	.66	.61	.80	.71	.65	.60	.70	.65	.61	.69	.64	.60	.67	.63	.60	.58
8	.77	.68	.61	.57	.76	.67	.61	.56	.66	.60	.57	.65	.60	.56	.64	.59	.56	.55
9	.74	.64	.57	.53	.72	.63	.57	.53	.62	.57	.53	.61	.56	.53	.60	.56	.53	.51
10	.70	.60	.54	.50	.69	.60	.54	.49	.59	.54	.50	.58	.53	.50	.57	.53	.50	.48

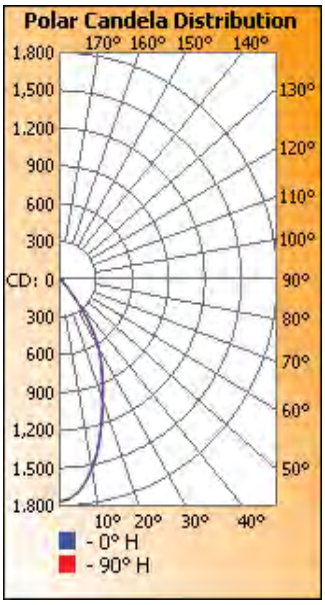
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	927.0	64.5%
0-40	1,252.7	87.2%
0-60	1,402.0	97.6%
60-90	34.9	2.4%
70-100	13.1	0.9%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	443.6 fc	1.7 ft	1.8 ft
4.0ft	110.9 fc	3.5 ft	3.5 ft
6.0ft	49.3 fc	5.2 ft	5.3 ft
8.0ft	27.7 fc	6.9 ft	7.1 ft
10.0ft	17.7 fc	8.6 ft	8.9 ft
12.0ft	12.3 fc	10.4 ft	10.6 ft
14.0ft	9.1 fc	12.1 ft	12.4 ft
16.0ft	6.9 fc	13.8 ft	14.2 ft

Vert. Spread: 46.7°
Horiz. Spread: 47.8°



3110 / 3311 33W 30KS 50° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.13	1.10	1.07	1.05	1.11	1.08	1.06	.93	1.04	1.02	1.00	1.00	.99	.97	.97	.96	.94	.93
2	1.07	1.02	.98	.94	1.05	1.00	.96	.86	.97	.94	.91	.94	.91	.89	.91	.89	.87	.85
3	1.01	.94	.89	.85	.99	.93	.88	.80	.90	.86	.83	.88	.84	.82	.86	.83	.80	.79
4	.96	.88	.82	.78	.94	.87	.81	.74	.84	.80	.76	.82	.78	.75	.81	.77	.74	.73
5	.91	.82	.76	.71	.89	.81	.75	.69	.79	.74	.70	.77	.73	.70	.76	.72	.69	.67
6	.86	.77	.70	.66	.84	.76	.70	.64	.74	.69	.65	.73	.68	.65	.71	.67	.64	.63
7	.82	.72	.66	.61	.80	.71	.65	.60	.70	.65	.61	.69	.64	.60	.67	.63	.60	.58
8	.77	.68	.61	.57	.76	.67	.61	.56	.66	.60	.57	.65	.60	.56	.64	.59	.56	.55
9	.74	.64	.57	.53	.72	.63	.57	.53	.62	.57	.53	.61	.56	.53	.60	.56	.53	.51
10	.70	.60	.54	.50	.69	.60	.54	.49	.59	.54	.50	.58	.53	.50	.57	.53	.50	.48

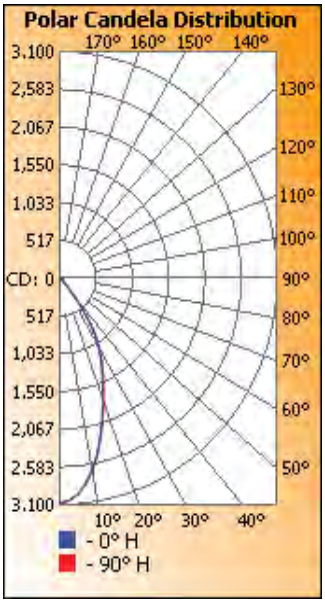
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	1,615.0	64.5%
0-40	2,182.4	87.2%
0-60	2,442.6	97.6%
60-90	60.8	2.4%
70-100	22.8	0.9%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	772.8 fc	1.7 ft	1.8 ft
4.0ft	193.2 fc	3.5 ft	3.5 ft
6.0ft	85.9 fc	5.2 ft	5.3 ft
8.0ft	48.3 fc	6.9 ft	7.1 ft
10.0ft	30.9 fc	8.6 ft	8.9 ft
12.0ft	21.5 fc	10.4 ft	10.6 ft
14.0ft	15.8 fc	12.1 ft	12.4 ft
16.0ft	12.1 fc	13.8 ft	14.2 ft

Vert. Spread: 46.7°
Horiz. Spread: 47.8°



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BeveLED2.1

DOWNLIGHT 3110

DELIVERED PERFORMANCE

3110 / 3311 16W 30KS 90° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.11	1.07	1.04	1.01	1.09	1.05	1.02	.89	1.01	.99	.96	.97	.95	.93	.94	.92	.91	.89
2	1.03	.96	.91	.86	1.01	.95	.89	.79	.91	.87	.83	.88	.84	.81	.85	.82	.80	.78
3	.95	.87	.80	.74	.93	.85	.79	.69	.82	.77	.72	.80	.75	.71	.77	.73	.70	.68
4	.88	.78	.71	.65	.86	.77	.70	.62	.74	.68	.64	.72	.67	.63	.70	.66	.62	.60
5	.82	.71	.63	.57	.80	.70	.62	.55	.68	.61	.56	.66	.60	.56	.64	.59	.55	.53
6	.76	.64	.56	.51	.74	.63	.56	.49	.62	.55	.50	.60	.54	.50	.59	.53	.49	.47
7	.71	.59	.51	.45	.69	.58	.51	.44	.57	.50	.45	.55	.49	.45	.54	.48	.44	.43
8	.66	.54	.46	.41	.65	.53	.46	.40	.52	.45	.41	.51	.45	.40	.50	.44	.40	.38
9	.62	.50	.42	.37	.61	.49	.42	.36	.48	.41	.37	.47	.41	.37	.46	.41	.36	.35
10	.58	.46	.39	.34	.57	.46	.39	.33	.45	.38	.34	.44	.38	.33	.43	.37	.33	.32

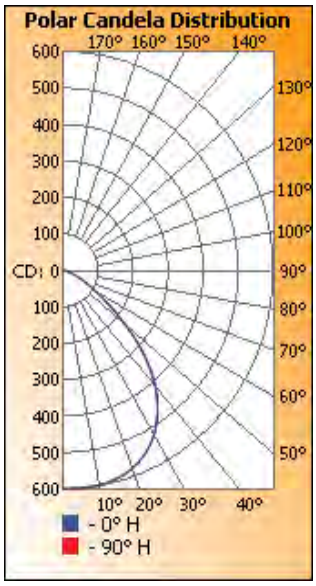
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	480.2	37.3%
0-40	779.3	60.5%
0-60	1,198.0	92.9%
60-90	91.0	7.1%
70-100	28.0	2.2%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	148.9 fc	4.3 ft	4.2 ft
4.0ft	37.2 fc	8.5 ft	8.4 ft
6.0ft	16.5 fc	12.8 ft	12.6 ft
8.0ft	9.3 fc	17.0 ft	16.8 ft
10.0ft	6.0 fc	21.3 ft	21.0 ft
12.0ft	4.1 fc	25.6 ft	25.2 ft
14.0ft	3.0 fc	29.8 ft	29.4 ft
16.0ft	2.3 fc	34.1 ft	33.6 ft

Vert. Spread: 93.6°
Horiz. Spread: 92.8°



3110 / 3311 33W 30KS 90° 1" Regress

Coefficients Of Utilization - Zonal Cavity Method

Effective Floor Cavity Reflectance: 20%

RCC %:	80				70				50			30			10			0
RW %:	70	50	30	0	70	50	30	0	50	30	20	50	30	20	50	30	20	0
RCR: 0	1.19	1.19	1.19	1.19	1.16	1.16	1.16	1.00	1.11	1.11	1.11	1.06	1.06	1.06	1.02	1.02	1.02	1.00
1	1.11	1.07	1.04	1.01	1.09	1.05	1.02	.89	1.01	.99	.96	.97	.95	.93	.94	.92	.91	.89
2	1.03	.96	.91	.86	1.01	.95	.89	.79	.91	.87	.83	.88	.84	.81	.85	.82	.80	.78
3	.95	.87	.80	.74	.93	.85	.79	.69	.82	.77	.72	.80	.75	.71	.77	.73	.70	.68
4	.88	.78	.71	.65	.86	.77	.70	.62	.74	.68	.64	.72	.67	.63	.70	.66	.62	.60
5	.82	.71	.63	.57	.80	.70	.62	.55	.68	.61	.56	.66	.60	.56	.64	.59	.55	.53
6	.76	.64	.56	.51	.74	.63	.56	.49	.62	.55	.50	.60	.54	.50	.59	.53	.49	.47
7	.71	.59	.51	.45	.69	.58	.51	.44	.57	.50	.45	.55	.49	.45	.54	.48	.44	.43
8	.66	.54	.46	.41	.65	.53	.46	.40	.52	.45	.41	.51	.45	.40	.50	.44	.40	.38
9	.62	.50	.42	.37	.61	.49	.42	.36	.48	.41	.37	.47	.41	.37	.46	.41	.36	.35
10	.58	.46	.39	.34	.57	.46	.39	.33	.45	.38	.34	.44	.38	.33	.43	.37	.33	.32

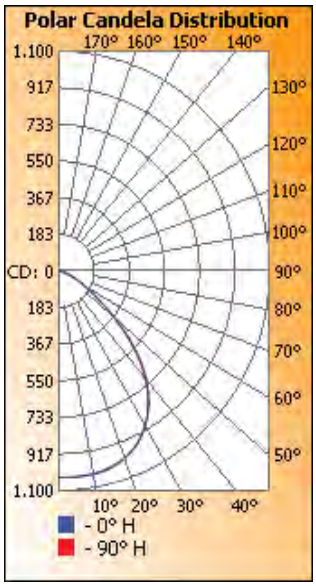
Zonal Lumen Summary

Zone	Lumens	% Luminaire
0-30	836.5	37.3%
0-40	1,357.7	60.5%
0-60	2,087.1	92.9%
60-90	158.6	7.1%
70-100	48.8	2.2%
90-120	0	0%

Illuminance at a Distance

	Center Beam fc	Beam Width	
2.0ft	259.4 fc	4.3 ft	4.2 ft
4.0ft	64.9 fc	8.5 ft	8.4 ft
6.0ft	28.8 fc	12.8 ft	12.6 ft
8.0ft	16.2 fc	17.0 ft	16.8 ft
10.0ft	10.4 fc	21.3 ft	21.0 ft
12.0ft	7.2 fc	25.6 ft	25.2 ft
14.0ft	5.3 fc	29.8 ft	29.4 ft
16.0ft	4.1 fc	34.1 ft	33.6 ft

Vert. Spread: 93.6°
Horiz. Spread: 92.8°



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML2

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

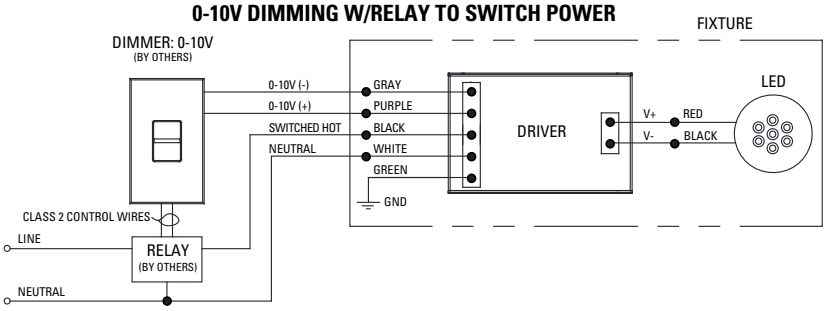
DIML2 LED: 0-10V Dimming Driver Wiring (Dims down to 10%)

DIML2 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
120V / 277V				Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Crestron	iLux dimmer expansion module	CLS-EXP-DIMFLV	100% - 10%	
Crestron	DIN Rail dimmer	DIN-4DIMFLV4	100% - 10%	
Crestron	DIN Rail analog output module	DIN-A08	100% - 10%	
Crestron	8 Channel dimmer module	GLX-DIMFLV8	100% - 10%	
Crestron	8 Channel dimmer module	GLXP-DIMFLV8	100% - 10%	
Leviton	IllumaTech dimmer	IP710-DLX	100% - 10%	
Lightolier (Philips)	Vega	V2000FAMU	100% - 10%	
Lutron	Diva	DVTV-XX	100% - 10%	

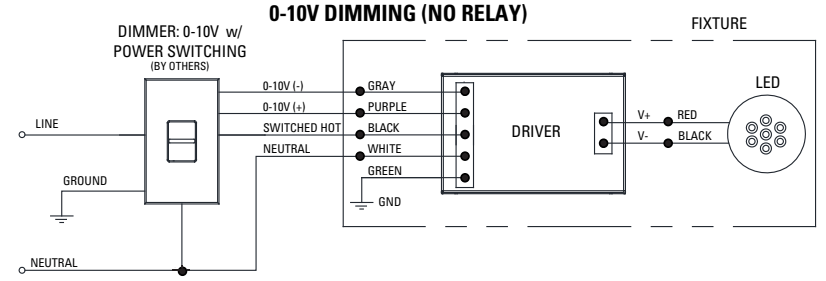
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML2
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

DIML2
0-10V DIMMING (NO RELAY)



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

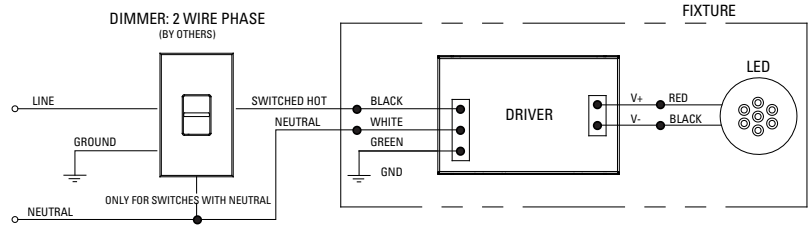
DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V only.

DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML3
2 WIRE PHASE DIMMING



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML4

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 wiring diagrams continued on next page

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4 Continued

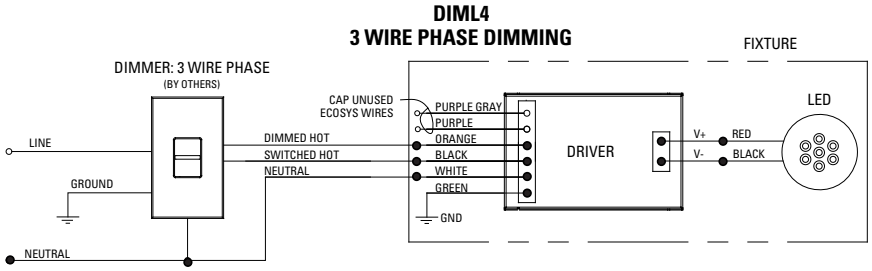
DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

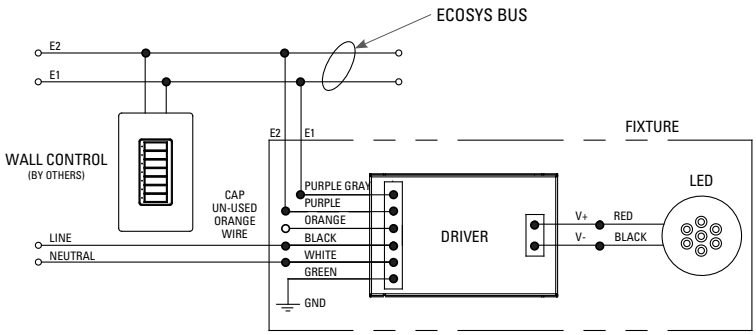


DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to 1%)

DIML4 EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1–16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1–32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1–32
Lutron	Quantum	Various	100%–1%	1–64	1–32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 EcoSystem CONTROLS



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML4E and DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
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5. Cap any wires not used separately (not together).

DIML4E LED: Lutron 5 Series EcoSystem LED Driver / LED Dimming Driver Wiring (Dims down to 5%)

DIML4E EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–5%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–5%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–5%	1–64	1 – 32
Lutron	Quantum	Various	100%–5%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

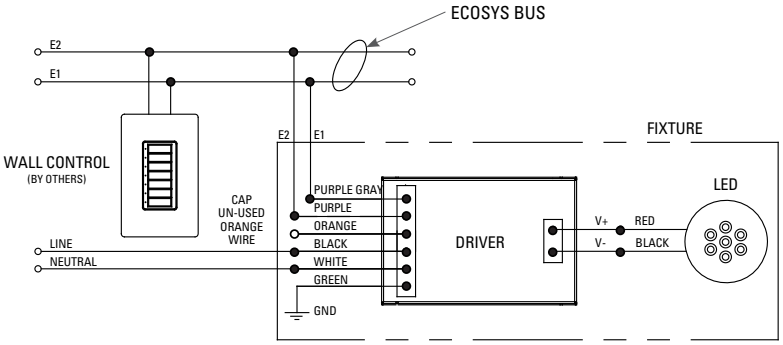
DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

DIML4E EcoSystem Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4E and DIML 4H EcoSystem CONTROLS



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I2-264-4EH Revised 02/15/2016

USAI Lighting

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML6A, 6E
DIML6B, 6F

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML6A and DIML6E LED Dimming Compatibility Table

DIML6A and DIML6E are linearly programmed dimming drivers for use with logarithmic-style dimming controls (e.g., Lutron and others listed in the table below)
DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6A and DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range		Qty Fixtures Per Dimmer*
120V & 277V			DIML6A	6E	Refer to manufacturer's
Lutron	Diva	DVTV/NFTV/NTFTV with PP-20	99% - 0.1%	1%	dimmer load rating for
Lutron	Energi Savr Node	QSN-4T16-S	100% - 0.1%	1%	maximum and minimum
Lutron	GP Dimming Panels	TVM2 Module	99% - 0.1%	1%	fixture quantities per
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% - 0.1%	1%	dimmer.
Sensor Switch	nIO	nIO EZ	100% - 0.1%	1%	Enlighted compatible.
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML6B and DIML6F LED Dimming Compatibility Table

DIML6B and DIML6F are logarithmic-programmed dimming drivers for use with linear-style dimming controls (e.g., Crestron, non-Lutron and others listed in the table below)
DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

DIML6B and DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range		Qty Fixtures Per Dimmer*
120V & 277V			DIML6B	6F	Refer to
Bush-Jaeger	Electronic potentiometer	2112U-101	100% - 0.1%	1%	manufacturer's
Jung	Electronic potentiometer	240-10	100% - 0.1%	1%	dimmer load
Leviton	IllumaTech dimmer	IP710-DLX	100% - 0.1%	1%	rating for
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% - 0.1%	1%	maximum and
Merten	Electronic potentiometer	5729	100% - 0.1%	1%	minimum fixture
Pass & Seymour	Titan	CD4FB-W	100% - 0.1%	1%	quantities per
Watt Stopper	Miro	DCLV1	100% - 0.1%	1%	dimmer.
Synergy	Wallbox Dimmers	ISD BC	100% - 0.1%	1%	Enlighted
ABB	i-bus	SD/S 2.16.1	100% - 0.1%	1%	compatible.
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% - 0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% - 0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% - 0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% - 0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% - 0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

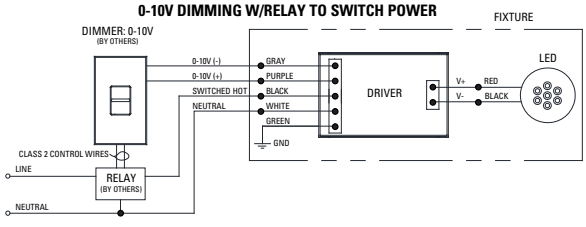
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIMMING DRIVER WIRING SCHEMES:

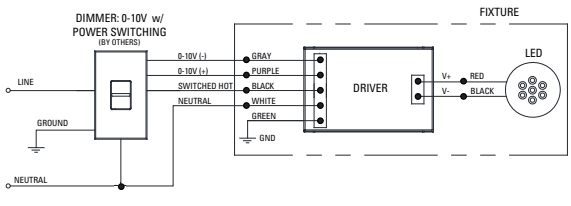
NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



DIML6
0-10V DIMMING (NO RELAY)



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I2-264-6 Revised 08/19/2016

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML7

DIMMING DRIVER WIRING SCHEMES:

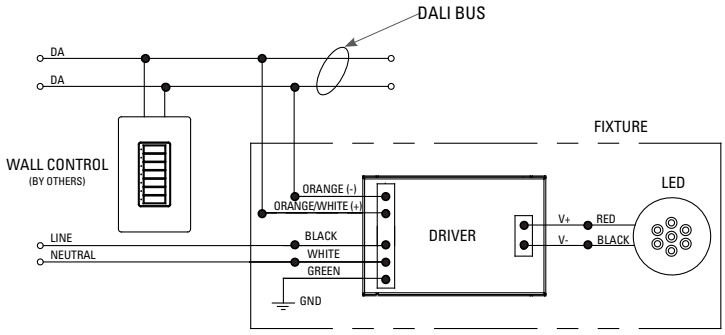
NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML7 LED: EldoLED DALI Dimming Driver Wiring (Dims down to 0.1%)

DIML7
DALI CONTROLS



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML8

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

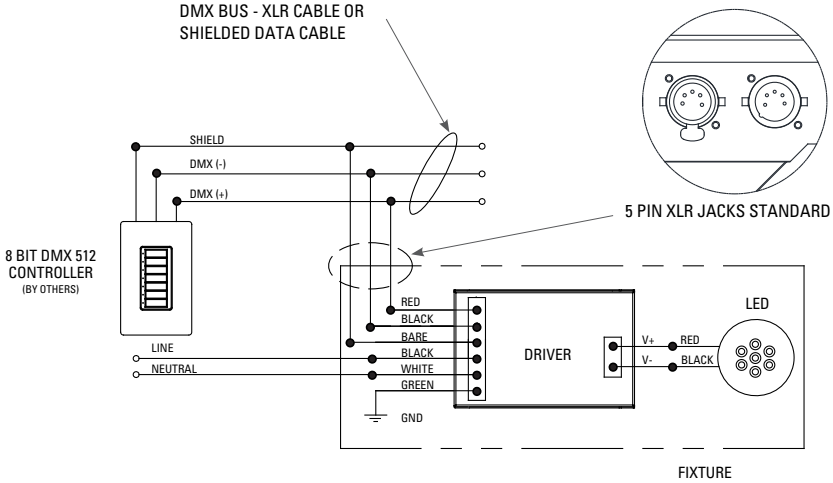
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML8 LED: EldoLED DMX Dimming Driver Wiring (Dims down to 0.1%)

DMX BUS - XLR CABLE OR
SHIELDED DATA CABLE

The data cable used must meet the following requirements:
- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device (by others) should be used on last fixture in line on a circuit to avoid signal loss.



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

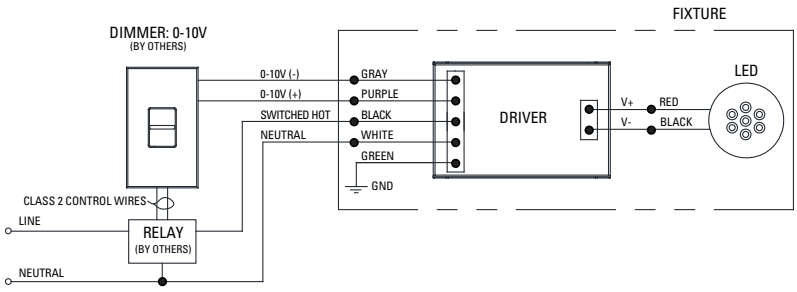
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

DIML15 Dimmer Compatibility Chart			
Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML19

DIMMING DRIVER WIRING SCHEMES:

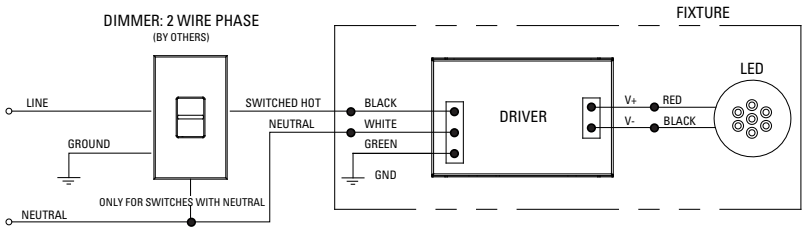
NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

DIML19 LED: Hatch XTC series or equivalent - Forward and Reverse Phase Dimming Driver. Dims down to 1% contingent upon dimmer specification and load. 120V only.

DIML19
2 WIRE PHASE DIMMING



DIML19 Dimmer Compatibility Chart

120V ONLY		
Forward Phase / TRIAC Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	IPL06-10Z	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	6613-xxx	
Lutron	S-600P	
	S-603P	
	DV-600P	
	DV-603P	
	DVSC-603P	
	CT-600P	
	CT-603P	
120V ONLY		
Reverse Phase / ELV Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	6615	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	IPE04-xxx	
Lutron	NTELV-300	
	NTELV-600	
	SELV-300P	
	SELV-303P	
	DVELV-300P	
	DVELV-303P	

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I2-264-19 Revised 07/29/2016

auroralight™

TYPE:
CAT. #: LSL6

LSL6 CYCLOPS

Flush Mount
BR-FM-BLP

Surface Mount
BR-SM-BLP

Male Thread
BR-1/2-BLP
(Actual Size)

Auroralight's new **LSL6** is a Micro-Directional X-Platform IP67 luminaire that features a Thermally Integrated™ and Field Serviceable LED module. The machined ball and socket design incorporates a remarkably small yet capable Cree® powered light engine. The easily replaceable, self-contained ball fits snugly into a precision machined socket for exceptional heat dissipation allowing this tiny luminaire to operate at 3 watts. Offered in 4 unique configurations, a multitude of finishes and 4 interchangeable optics; it is both inconspicuous and versatile.

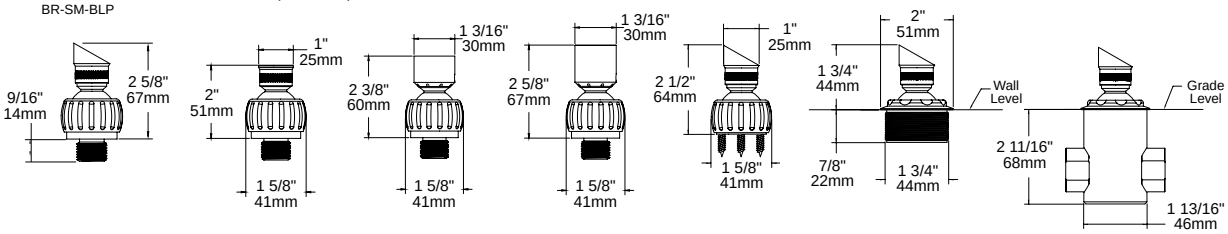
Features include:

- 3 Watts
- Cree XLAMP® High Density (XP-L) LED
- 2700, 3000K or 4500 (CRI 80 typ.)
- Thermally Integrated™, Field Serviceable LED Module
- TRIAC Dimming to <10% typ.
- 12 VAC Electronic or Magnetic Source Compatible
- Solid Copper and Brass Construction
- Patent Pending

Powered by CREE LEDs

LED

12V



Male Thread
60° Angled Shroud

Male Thread
No Shroud

Male Thread
90° Shroud (Short)

Male Thread
90° Shroud (Long)

Surface Mount
60° Angled Shroud

Flush Mount
60° Angled Shroud

Flush Mount with Micro J-Box
60° Angled Shroud

ORDERING GUIDE LSL6: L (LED) SL (SPOTLIGHT) 6 (SERIES)

RED INDICATES REQUIRED FIELD

MATERIAL
[BR] Brass
[CU] Copper*

*Shroud, ball and base remains Brass

SHROUD
[60] 60° Angled
[NS] No Shroud
[S90] 90° Short
[L90] 90° Long

OPTIC
[N] 15° Narrow
[M] 25° Medium
[W] 40° Wide
[EL] Elliptical

LED
[27D] 2700K
[30D] 3000K
[45D] 4500K

[D] = Dimmable

CONFIGURATION
[SM] Surface Mount
[1/2] Male Thread
[FM] Flush Mount

MOUNT
1/2: MALE THREAD OPTIONS
[G/S] Ground Stake
[D/S] Deluxe Spike (9")
[9x18] Telescopic Riser
(Specify 5x10, 7x14, 9x18 or 11x22)
[T/S-L] Tree Strap (Light Duty)
[CP4] 4" Cover Plate
[SM3] 3" Surface Mount

FM: FLUSH MOUNT OPTION
[MJB] Micro J-Box

[X] = Specify Length

FINISH
[NAT] Natural
[BLP] Bronze Living Patina
[BLP-XD] BLP Extra Dark
[PNI] Polished Nickel
[BNI] Brushed Nickel
[PAU] PVD Gold
[BLK] PVD Black
[PCR] PVD Chrome

1/2 OPTIONS

G/S D/S 9x18 T/S-L CP4 SM3

FM OPTION

MJB
Provides 3 ports for multi-conduit entries

FINISH OPTIONS

BR-BLP PNI BNI PAU BLK PCR

MADE IN THE USA

CARLSBAD, CA | PHONE 877 942 1179 | FAX 760 931 2916 | E-MAIL SALES@AURORALIGHT.COM | AURORALIGHT.COM

Haiku L Series Fans | TECHNICAL SPECIFICATIONS

Haiku's signature design elements, energy efficiency, and effectiveness at a more accessible price point.

THE CEILING FAN, REINVENTED

- **Airfoils** — Hybrid resin construction available in black, white, caramel, or cocoa finishes
- **Mounting** — Universal mount for flat or sloped ceilings 8 feet (2.4 meters) and taller
- **Integrated LED Light** — Settings include on/off, Sleep mode, and 16 dimmable light levels; life expectancy of 50,000 hours
- **Fan Settings** — Whoosh® mode, Sleep mode, timer, and on/off
- **Motor** — EC motor with digital inverter drive
- **Controls** — Handheld remote control, Haiku Wall Control (optional), or Amazon Echo (with addition of Wi-Fi module)
- **Environment** — Indoor or covered outdoor use[2]
- **Accessories** — Haiku Wall Control (enables SenseME® Technology[1] features, including motion sensing and Smart Mode settings). See respective spec sheet for details.

Handheld Remote

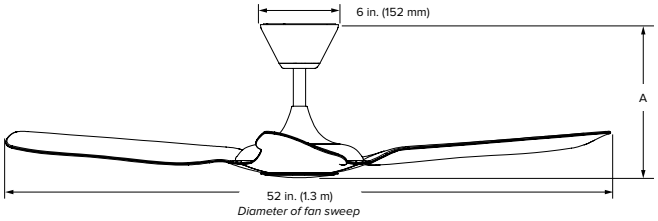
Black Finish with Smoky Lens

Airfoil Finishes

Black | White | Caramel | Cocoa

Technical Specifications		
Model number[3]	120 V: L3127-X5-XX-XX-00-E	240 V: L3127-X6-XX-XX-00-E
Operating voltage	100–120 VAC, 1 Φ, 50/60 Hz	200–240 VAC, 1 Φ, 50/60 Hz
Amps (min/max)	0.037/0.42 A	0.033/0.16 A
Fan watts (min/max)	2.5/17.7 W	4.1/18.6 W
Light watts (max)	20 W	
Light output (max)	988 lumens	
Light color temperature	2700 K	
Light color rendering index	82 CRI	
Standard fan heights (A)	11.4 in. (289 mm) 16.4 in. (417 mm)	
Optional extended fan heights (A)[4]	28.4 in. (721 mm) 41.1 in. (1044 mm) 57.1 in. (1450 mm) 69.1 in. (1755 mm)	
Weight[5]	11 lb (5 kg)	
Fan speed (min/max)	7 speeds (60/182 RPM)	
Sound level at max speed[6]	< 35 dBA	

[1] SenseME Technology and the Haiku Home app are supported by Android™ and iOS®. The Haiku Wall Control must be purchased to enable SenseME Technology.
[2] 100–125 V model certified by Intertek/ETL to UL 507 damp rated applications. 200–240 V model certified by TÜV SÜD to the CB scheme including T mark for Tropical applications.
[3] "X" indicates a placeholder number, which varies depending on finish options, where the fan is installed, and other factors.
[4] Extended length extension tubes are packaged separately.
[5] The actual, precise fan weight will vary based on individual component weights and finishing.
[6] Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.



Diameter of fan sweep

Lead times may vary.
See warranty for coverage information.
Specifications subject to change without notice.

HAIKU BY BIG ASS SOLUTIONS

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855-694-2458

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844-924-4277

AUSTRALIA
HAIKUHOME.COM/AU
1-300-244-277

HONG KONG
HAIKUHOME.COM/HK
+852 2836 5808

SINGAPORE
HAIKUHOME.COM/SG
+65 6709 8500

MALAYSIA
+603 5565 0888

NIVEOUS – model: PD-51310, PD-52313

dwelLED™ LED Pendants

WAC LIGHTING
Responsible Lighting®

Fixture Type: _____

Catalog Number: _____

Project: _____

Location: _____

PRODUCT DESCRIPTION

Optimized light distribution deploying multiple mid-powered LEDs to achieve an evenly lit globe, providing beautiful ambient illumination.

FEATURES

- Mouth blown etched triplex glass
- Integral swivel for sloped ceilings
- Three 12 inch and one 6 inch rods included (additional extension rods available)
- Supplied with 10 feet of wire
- Meets 2013 California Title 24 Efficiency
- Smooth and continuous ELV dimming
- ETL & cETL damp location listed
- Driver located in J box
- 70,000 hour rated life
- 90 CRI
- 277V available (special order)

SPECIFICATIONS

Construction: Mouth blown etched triplex glass

ORDERING NUMBER

Model#	Color Temp	Watt	LED Lumens	Delivered Lumens	Finish
PD-52310	*2700K*	*14W*	*906*	*685*	**BN** *Brushed Nickel* **WT** *White*
PD-52313	*2700K*	*14W*	*906*	*715*	

_____ - ____

Example: **PD-52310-WT**

For 277V, add an "F" before the finish: **PD-52310F-WT**

WAC Lighting
www.waclighting.com
Phone (800) 526.2588 • Fax (800) 526.2585

Headquarters/Eastern Distribution Center
44 Harbor Park Drive • Port Washington, NY 11050
Phone (516) 515.5000 • Fax (516) 515.5050

Western Distribution Center
168 Brea Canyon Road • City of Industry, CA 91789
Phone (800) 526.2588 • Fax (800) 526.2585

moda LIGHT®

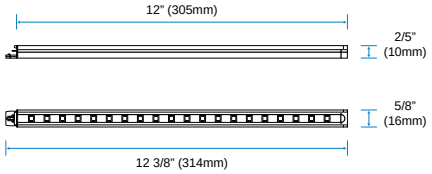
ZILVA 3000k

SPECIFICATION

Dimmable Linear LED Fixture:

Low profile, commercial grade, rigid linear fixture. This efficient, cool running solid state fixture is designed with easy modular connections that can be linked in distances of up to 30 feet. Constructed with an anodized aluminum body to conceal the PCB. Simple installation using the integral hidden mounting clips. Dimmable with MODA drivers.

Dimensions:



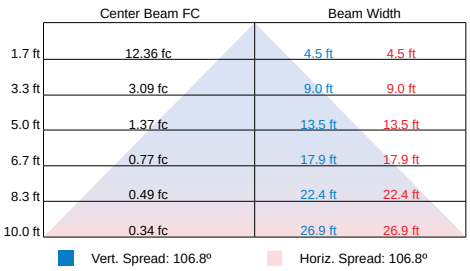
LED Spacing: 2/5" (10mm)
Max Continuous Length: 30' (9.14m)

Output:

Delivered Lumens	91.80 lm / ft
CCT	3000k
Chromaticity Ordinates	x: 0.44 y: 0.416 Typical
Color Bin Tolerance	+ 3% / - 3%
Efficacy (lm/w)	57.38
CRI	82
Lumen Maintenance	70,000 Hours L70 @ 25°C : 90,000 Hours L50 @ 25°C 50,000 Hours L70 @ 50°C : 70,000 Hours L50 @ 50°C
Testing Data	Light Data LM-79-08 & LM-80-08

Illuminance at a Distance: Data Shown for 110º

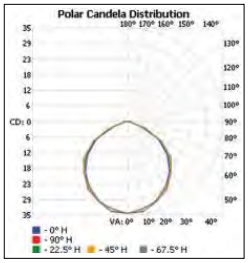
(For lux multiply fc by 10.7)



Electrical:

Input Voltage	24v DC
Power Consumption	1.6w (0.02A) - Varies based on length of run & driver
Power Factor	≤ 1
Dimming	100-277v 0-10v & Magnetic Low Voltage
Emergency	N/A

Polar Candela Distribution:
Data Shown for 110º



Lumens per Zone:

Zone	Lumens	% Total
0-10	3.20	3.50%
10-20	9.10	10.00%
20-30	13.80	15.00%
30-40	16.70	18.20%
40-50	17.50	19.00%
50-60	15.40	16.70%
60-70	10.00	10.90%
70-80	4.10	4.50%
80-90	1.40	1.50%
90-100	0.60	0.60%

Physical:

Applications	Cove, Cabinet, Low Profile Installations, Furniture, and Signage
Dimensions	Length 11 4/5" (299mm) Width 3/5" (16mm) Height 2/5" (10mm)
Weight	2.3 oz (65.2g)
Construction	High Quality Anodized Aluminum
Thermal Management	MODA Aluminum Heat Sink
Optics	N/A
Fixture Connections	Modular Connectors
Operating Temperature	-22ºF ~ 122ºF (-30ºC ~ 70ºC)
Storage Temperature	-40ºF ~ 176ºF (-40ºC ~ 80ºC)
Humidity	0-95% Non Condensing

Project Name:				
Notes:				

VDC20162402

S P E C I F I C A T I O N

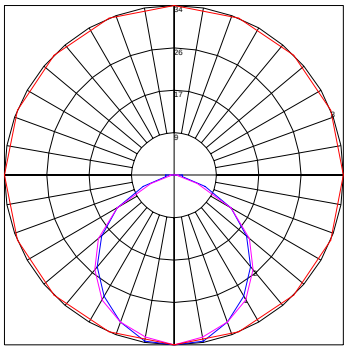
Zonal Lumen Summary:

Zone	Lumens	% Lamp	% Fixt
0-30	26.20	N.A.	28.50%
0-40	42.80	N.A.	46.60%
0-60	75.60	N.A.	82.40%
60-90	15.60	N.A.	17.00%
0-90	91.20	N.A.	99.40%
90-180	0.60	N.A.	0.60%
0-180	91.80	N.A.	100%

Luminance Data (cd/sq.m):

Angle in Degrees	Average 0-Deg	Average 45-Deg	Average 90-Deg
45	16792	17761	17437
55	15526	16919	15924
65	12967	14318	11887
75	8823	9705	6176
85	10482	10482	5244

Polar Graph: Data Shown for 110º



Candela Tabulation:

	0	22.5	45	67.5	90
0	34.334	34.334	34.334	34.334	34.334
10	34.126	33.293	33.293	32.877	33.293
20	31.629	31.213	31.629	31.629	31.629
30	28.299	27.883	28.299	28.715	29.132
40	24.138	24.970	24.970	24.970	24.970
50	19.144	19.976	20.809	21.225	19.976
60	13.317	13.734	14.566	14.566	13.318
70	6.659	7.075	7.491	4.994	4.994
80	1.665	1.665	1.665	1.665	0.833
90	1.665	0.416	1.665	0.833	0.833

Coefficients of Utilization - Zonal Cavity Method:

RC RW	80 70 50 30 10	70 70 50 30 10	50 50 30 10	30 50 30 10	10 50 30 10	0 0
0	119 119 119 119	116 116 116 116	111 111 111	106 106 106	102 102 102	100
1	110 105 101 97	107 103 99 96	98 95 93	94 92 90	91 89 87	85
2	100 92 86 80	97 90 84 79	87 81 77	83 79 75	80 77 74	71
3	91 81 73 67	89 80 72 66	77 70 65	75 68 64	71 67 63	61
4	84 72 63 57	81 71 63 57	68 61 56	66 60 55	64 58 54	52
5	77 64 56 49	75 63 55 49	61 54 48	59 53 48	57 52 47	45
6	71 58 49 43	69 57 49 43	55 48 42	53 47 42	52 46 41	39
7	66 53 44 38	64 52 44 38	50 43 37	49 42 37	47 41 37	35
8	61 48 40 34	60 47 39 34	46 39 33	45 38 33	43 37 33	31
9	57 44 36 30	56 43 36 30	42 35 30	41 35 30	40 34 30	28
10	54 41 33 28	52 40 33 27	39 32 37	38 32 27	37 31 27	25

Effective Floor Cavity Reflectance 0.20

Accessories:

		
MCLA04 6' 6" Leader Cable for ZILVA	**MCLA03** Male / Female Flexible Connector for 90º Bends	**MCLA06** End Cap
Connects ZILVA to Power Supply	Connects Two ZILVA And Allows for 90º Sharp Corner Bends	Plugs Into ZILVA To Terminate Power Running Through Series
Connector Dim. L: 3/5" (16mm) W: 3/5" (16mm) H: 2/5" (10mm)	Connector Dim. L: 2 1/5" (56mm) W: 3/5" (16mm) H: 2/5" (10mm)	L: 1/2" (13mm) W: 3/5" (15mm) H: 1/5" (5mm)

Standards and Certifications:

Certification	Tested to UL & CSA by ETL For Use in USA & CANADA, Complies with California Title 24 Requirements, Lighting Facts. Exceeds ANSI C78.377A, CE & RoHS Compliant.
Class	Class 3
Environment	Dry Location - IP20
Warranty	5 Year Limited Warranty

Ordering:

SKU: ZILVA-3000K

moda LIGHT®

SPECIFICATION

24v DRIVERS

Non Dimming		Voltage Range	Wattage	IP Rating	Dimension
MP17		100-277v AC	150w	IP67	8 7/10" x 2 7/10" 1 1/2" (222mm x 68mm x 39mm)

0-10v Dimming		Voltage Range	Wattage	IP Rating	Dimension
MP06		347v AC	60w	IP66	9 2/5" x 1 7/10" x 1 3/10" (240mm x 43mm x 32mm)
MP19N		100-277v AC	60w	IP66	9 2/5" x 1 7/10" x 1 3/10" (240mm x 43mm x 32mm)
MP87		100-277v AC	100w	IP66	9 1/2" x 2 3/10" x 1 1/2" (241mm x 58mm x 37mm)
MP89		100-277v AC	150w	IP66	9 1/2" x 2 3/5" x 1 3/5" (241mm x 67mm x 40.5mm)

Ordering:

Sample SKU:	MP19N

modaLIGHT® SPECIFICATION

MODA MINI COVE® INTERIOR SO 2700K HCRI 1FT

Miniature Line Voltage Cove Fixture.
MODA MINI COVE INTERIOR features smooth flicker free ELV dimming down to 0%. Specialized Light Chamber delivers a light bending 200 degree beam perfect for cove illumination. Integral self locking bracket which slides into any position and turns 170 degrees. Lightweight aluminum construction for durability and excellent thermal characteristics. Available in 6", 1ft, 4ft, and 8ft Lengths for rapid installation saving expensive labour installation costs.

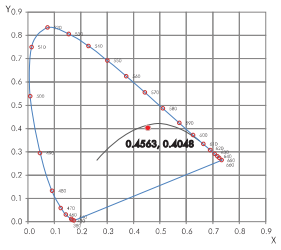
OUTPUT

Delivered Lumens	447.40
CCT & SDMC	2700K - 2 Step MacAdam Ellipse
Chromaticity Coordinates	x: 0.4563 y: 0.4048 u: 0.2628 v: 0.5246
Color Bin Tolerance	Single Bin
Efficacy (lm/w)	89.48 (120v) / 68.83 (277v)
CRI	98
Lumen Maintenance	70,000 Hours L70 @ 25°C 90,000 Hours L50 @ 25°C 50,000 Hours L70 @ 50°C 70,000 Hours L50 @ 50°C
Testing Data	Light Data LM-79-08 & LM-80-08

ELECTRICAL

Input Voltage	100-277v AC 50Hz/60Hz
Power Consumption	120v - 5w (0.04A) 277v - 6.5w (0.02A)
Power Factor	≥ 0.98
Dimming	Electronic Low Voltage Reverse Phase Trailing Edge
Emergency	N/A

CIE 1931 CHROMATICITY DIAGRAM



R VALUES

R1	R2	R3	R4	R5
99	99	97	99	99
R6	**R7**	**R8**	**R9**	**R10**
97	97	95	93	98
R11	**R12**	**R13**	**R14**	**R15**
97	87	99	97	98

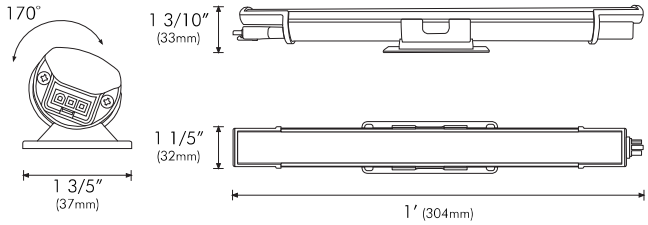
Project Name:

Notes:

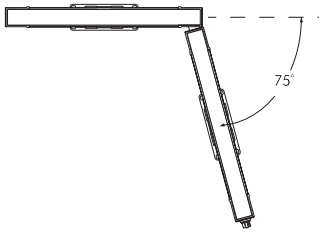
PHYSICAL

Applications	Cove, Accent & Indirect General Illumination
Dimensions	Length 1' (304mm) Width 1 3/5" (37mm) Height 1 3/10" (33mm)
Weight	6.1oz (173g)
Construction	Pure Aluminum Body, Polycarbonate Mounting Bracket and Lens
Thermal Management	MODA Aluminum Heat Sink
Optics	N/A
Fixture Connections	Integral Male & Female Connectors
Operating Temperature	-4°F ~ 104°F (-20°C ~ 40°C)
Storage Temperature	-40°F ~ 176°F (-40°C ~ 80°C)
Humidity	0-95% Non Condensing

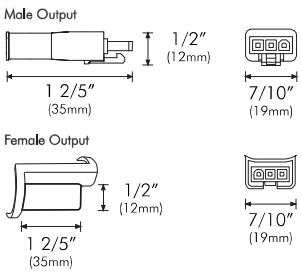
DIMENSIONS



ANGLE ADJUSTMENT



CONNECTOR DIMENSIONS



MODA TECHNOLOGY

- modaBIN™
- modaCOMMUNICATE™
- modaCUE™
- modaDRIVER™
- modaHIGH CRI
- modaKWIK CONNECT™
- modaLOCK™
- modaPHOSPHOR™
- modaSOFT™

STANDARDS & CERTIFICATIONS

ETL CE RoHS APPROVED ONE BIN

LM 79 LM 80 5 YEAR WARRANTY

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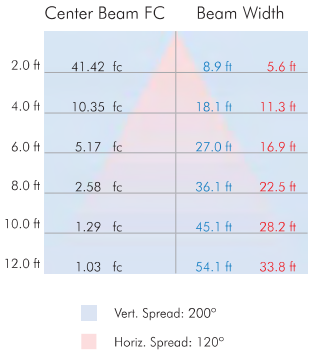
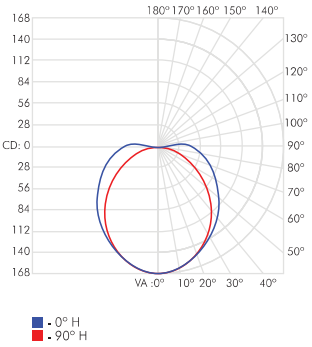
modaLIGHT®
SPECIFICATION

MODA MINI COVE® INTERIOR SO 2700K HCRI 1FT

ILLUMINANCE AT A DISTANCE



POLAR CANDELA DISTRIBUTION



ZONAL LUMEN SUMMARY

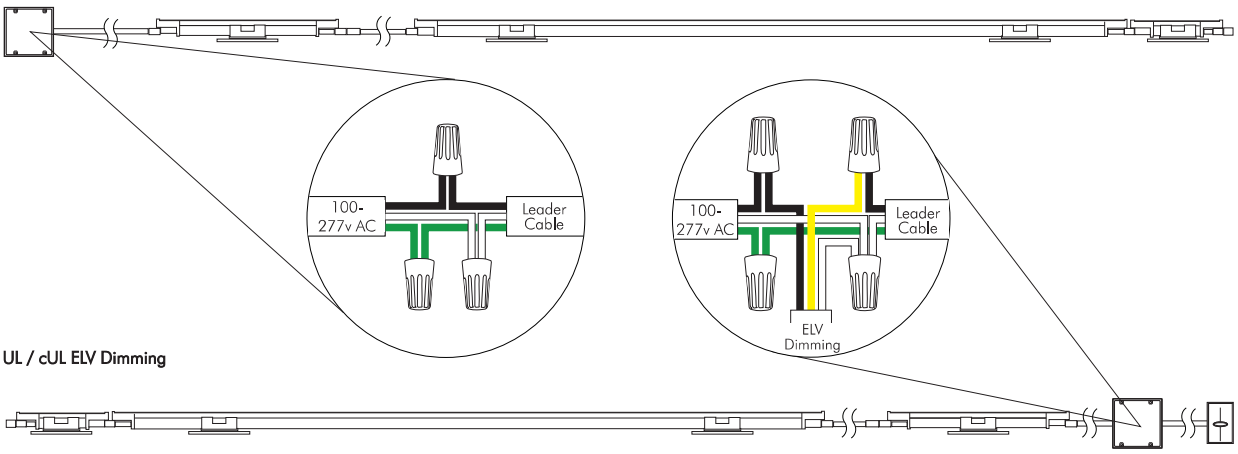
Zone	Lumens	% Lamp	% Fixt
0-30	128.40	N.A.	28.70%
0-40	209.83	N.A.	46.90%
0-60	367.32	N.A.	82.10%
60-90	79.64	N.A.	17.80%
0-90	446.95	N.A.	99.90%
90-180	0.45	N.A.	0.10%
0-180	447.40	N.A.	100%

LUMENS PER ZONE

Zone	Lumens	% Total
0-10	15.65	3.50%
10-20	44.74	10.00%
20-30	68.00	15.20%
30-40	81.43	18.20%
40-50	83.66	18.70%
50-60	73.82	16.50%
60-70	51.90	11.60%
70-80	23.71	5.30%
80-90	4.03	0.90%
90-100	3.40	0.76%

WIRING

UL / cUL Non-dimming



UL / cUL ELV Dimming

WIRING LEGEND

	UL/cUL	CE/PSE*
Ground	Green	Yellow/Green
Live 100-277v	Black	Brown
Neutral	White	Blue
Data	Yellow	

*not illustrated

COMPATIBLE DIMMERS

Lutron MAELV-600 (600W)
Lutron Skylark SELV-300P (300W)
Leviton MNE04 (400W)
Lutron DIVA DVELV-300P (300W)
Lutron DIVA DVELV-300P (300W) ADJUSTED

MAX RUN LENGTHS

1ft using 120v AC	120pcs
1ft using 277v AC	240pcs

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moda LIGHT®
SPECIFICATION

MODA MINI COVE® INTERIOR SO 2700K HCRI 1FT

ACCESSORIES

MODA-MINI-COVE-GRAZE-INT-10FT-LEADER-CABLE-W

Power to First Fixture of Run

Leader Cable	Male Connector
L: 10' (3.05m)	L: 1 2/5" (35mm) W: 7/10" (19mm) H: 1/2" (12mm)

MODA-MINI-COVE-GRAZE-INT-25FT-LEADER-CABLE-W

Power to First Fixture of Run

Leader Cable	Male Connector
L: 25' (7.62m)	L: 1 2/5" (35mm) W: 7/10" (19mm) H: 1/2" (12mm)

MODA-MINI-COVE-GRAZE-INT-1FT-JUMPER-CABLE-W

Connection Between Fixtures

Jumper Cable
L: 1' (304.80mm)

Male Connector	Female Connector
L: 1 2/5" (35mm) W: 7/10" (19mm) H: 1/2" (12mm)	L: 1 2/5" (35mm) W: 7/10" (19mm) H: 1/2" (12mm)

MODA-MINI-COVE-GRAZE-INT-4FT-JUMPER-CABLE-W

Connection Between Fixtures

Jumper Cable
L: 4' (1.2m)

Male Connector	Female Connector
L: 1 2/5" (35mm) W: 7/10" (19mm) H: 1/2" (12mm)	L: 1 2/5" (35mm) W: 7/10" (19mm) H: 1/2" (12mm)

MODA-MINI-COVE-GRAZE-INT-TERMINATOR-W

Must be Fixed to Last Fixture for Safety

L: 1 1/2" (39mm)
W: 4/5" (22mm)
H: 3/5" (17mm)

MODA-MINI-COVE-GRAZE-20FT-MOUNTING-TRACK-G

Allows User to Install Fixtures in a Continuous Linear Position.

5 Pieces (20ft)	Each Piece
	4' (1.2m)

MODA-BRIDGE[1]

Allows User to Convert a 0-10v Dimming Signal into an ELV Dimming Signal that Dims Down to 0%

L: 7 3/4" (196.85mm)
W: 4 2/10" (107mm)
H:1 8/10" (47mm)

STANDARDS & CERTIFICATIONS

Certification	Tested to UL & CSA by Intertek For Use in USA & CANADA. Exceeds ANSI C78.377-2015, CE & RoHS Compliant.
Class	1
Environment	Dry/Damp Location - IP52
Warranty	5 Year Limited Warranty

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modaLIGHT® SPECIFICATION

SKU GUIDE: MODA-MINI-COVE-INTERIOR-**B**-C-D-**E**-**F**-G-**H**-I

MODA - MINI - COVE - INTERIOR - ____ - S1 - S - ____ - ____ - HCRI - ____

COMPLETE SAMPLE SKU: MODA-MINI-COVE-INTERIOR-SO-S1-S-ELV-2700K-HCRI-1FT

A - FIXTURE

COVE	—	Fixture with no optic option

INTERIOR - LOCATION

INTERIOR	—	Fixture for dry location use

B - LIGHT OUTPUT

SO	—	Standard Output
HO	—	High Output

C - SERIES NUMBER

S1	—	Series 1

D - PRODUCT FINISH

S	—	Silver

E - DIMMING

ELV	—	Electronic Low Voltage
0-10v	—	DC voltage ranging from 0 to 10 volts*

*Available only in 1ft and 4ft.

F - LED COLOR

22K	—	2200K
27K	—	2700K
3K	—	3000K
35K	—	3500K
4K	—	4000K

G - COLOR RENDERING INDEX (CRI)

HCRI	—	High CRI

H - LENGTH

6"	—	6 inches
1FT	—	1 foot
4FT	—	4 feet
8FT	—	8 feet

I - OPTIC

Available only for Moda Mini Graze.

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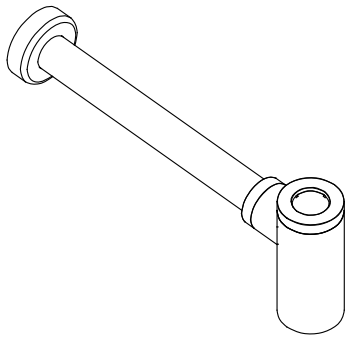
KOHLER® FAUCETS

Features

- *Metal construction*
- *Intended for console table and vessel installations*
- *1-1/4″ diameter slip-fit inlet*
- *Removable trap eye for easy cleaning*
- *Contemporary design*
- *Includes 12″ (305 mm) extension tube*

BOTTLE TRAP
K-9033



Codes/Standards Applicable

Specified model meets or exceeds the following:

- *ASME A112.18.2/CSA B125.2*

Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes	
K-9033	Bottle trap	☐ CP	☐ Other_____

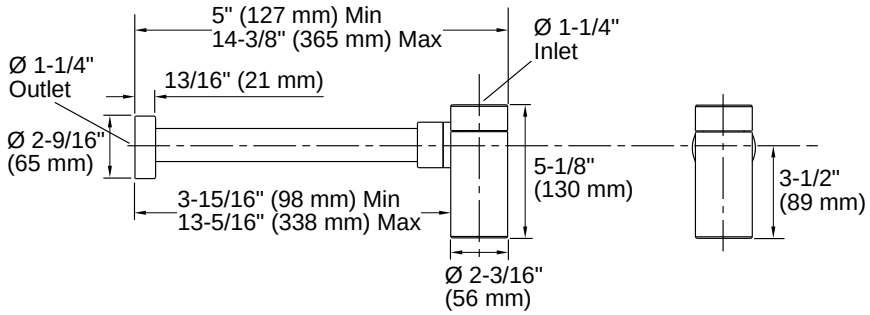
PRODUCT SPECIFICATION

Bottle trap shall be made of metal construction. Product shall be for console table and vessel installations. Product shall include a 12″ (305 mm) extension tube, 1-1/4″ diameter slip-fit inlet, and removable trap eye for easy cleaning. Product shall have a contemporary design. Product shall be Kohler Model K-9033-____.

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

Installation Notes

Install this product according to the installation guide.



Product Diagram

BOTTLE TRAP
Page 2 of 2
1108185-4-**C**

THE BOLD LOOK OF KOHLER®

KOHLER®

Cimarron®

Comfort Height® Toilet

K-3887

Features

- Vitreous china.
- Two-piece toilet.
- Comfort Height® round-front bowl.
- AquaPiston® flushing system.
- Includes left-hand polished chrome trip lever.
- 1.28 gpf (4.8 lpf).
- 2-1/8" (54 mm) fully glazed trapway.
- 12" (305 mm) rough-in.
- Less seat and supply.
- 11-1/2" (292 mm) x 9-1/4" (235 mm) water area.
- 27-1/4" 692 mm) x 17-5/8" (448 mm) x 30-1/2" (775 mm).
- Floor mount / Floor outlet.

Optional Accessories

K-9466-L Left-hand Trip Lever
K-9470-L Left-hand Trip Lever
K-7637 Angle Supply with Stop (single)

Components

Product includes:

K-4347 Comfort Height® Round-front Bowl
K-4166 Toilet Tank
Additional included component/s: Tank cover, Trip lever, Bolt cap accessory pack, and Tank accessory pack.

ADA

Codes/Standards

ASME A112.19.2/CSA B45.1
DOE - Energy Policy Act 1992
EPA WaterSense®
California Energy Commission (CEC)
ADA
ICC/ANSI A117.1

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

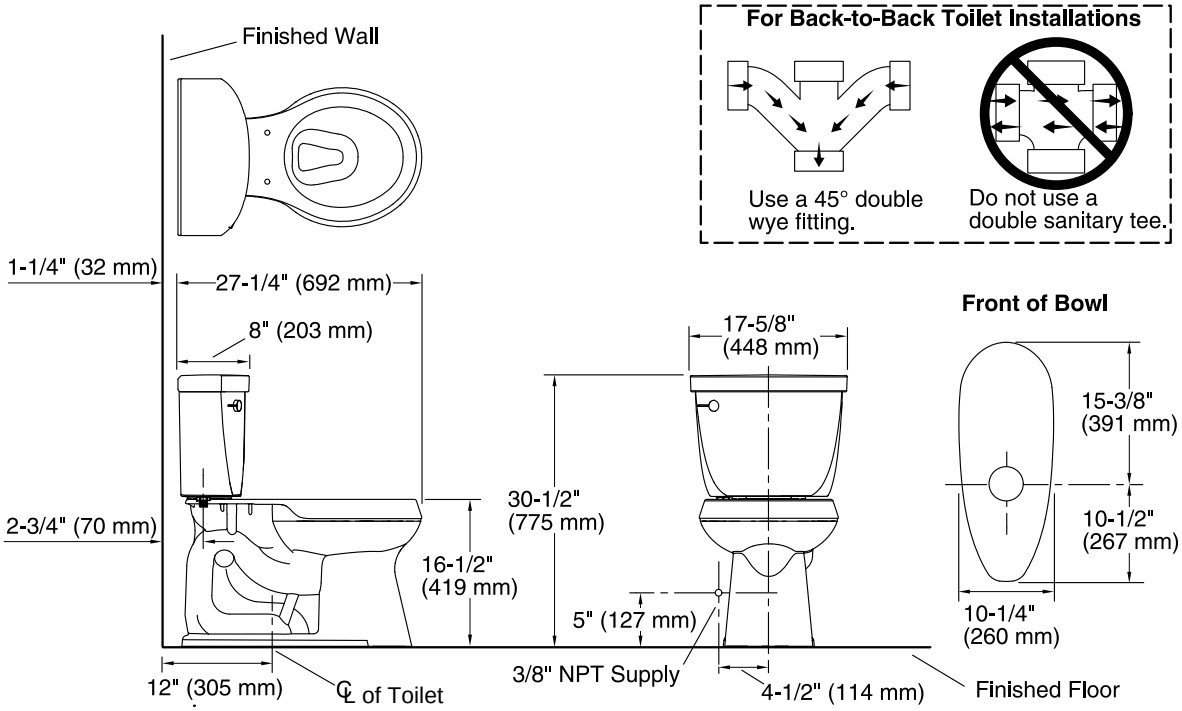
Color	Code	Description
	0	White
	96	Biscuit
	47	Almond
	NY	Dune
	95	Ice™ Grey
	G9	Sandbar
	7	Black Black™

KOHLER®

Cimarron®

Comfort Height® Toilet

K-3887



Technical Information

All product dimensions are nominal.

Toilet type:	Two-piece, Floor-mount
Waste Outlet:	Floor
Bowl shape:	Round front
Flush type:	AquaPiston
Trap passageway:	2-1/8" (54 mm)
Water Consumption	
Full:	1.28 gpf (4.8 lpf)
Water surface size:	11" x 9-1/4" (279 mm x 235 mm)
Rim to water surface:	5-1/4" (133 mm)
Rough-in:	12" (305 mm)
Seat-mounting holes:	5-1/2" (140 mm)

Notes

Install this product according to the installation instructions.

For back-to-back toilet installations: Use only a 45° double wye fitting.

The Model Plumbing Codes require elongated toilets for public bathrooms.

ADA compliant when installed to the specific requirements of these regulations.

The Model Plumbing Codes require the installation of elongated open-front toilet seats on public bathrooms.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
12-20-2016 05:26

THE BOLD LOOK OF KOHLER®

KOHLER®

Chord®

Wading Pool® Bathroom Sink

K-2331-8

Features

- Vitreous china.
- Above-counter.
- Unique shallow basin.
- Without overflow.
- 8-inch centers.
- 18-5/8" (473 mm) x 16-13/16" (427)

Required Accessories

7710
7715

Recommended Accessories

K-9018 P-Trap
K-942-4 Widespread Bathroom Sink Faucet
14406

Codes/Standards

ASME A112.19.2/CSA B45.1

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color	Code	Description
	0	White
	96	Biscuit
	47	Almond

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
12-20-2016 04:45

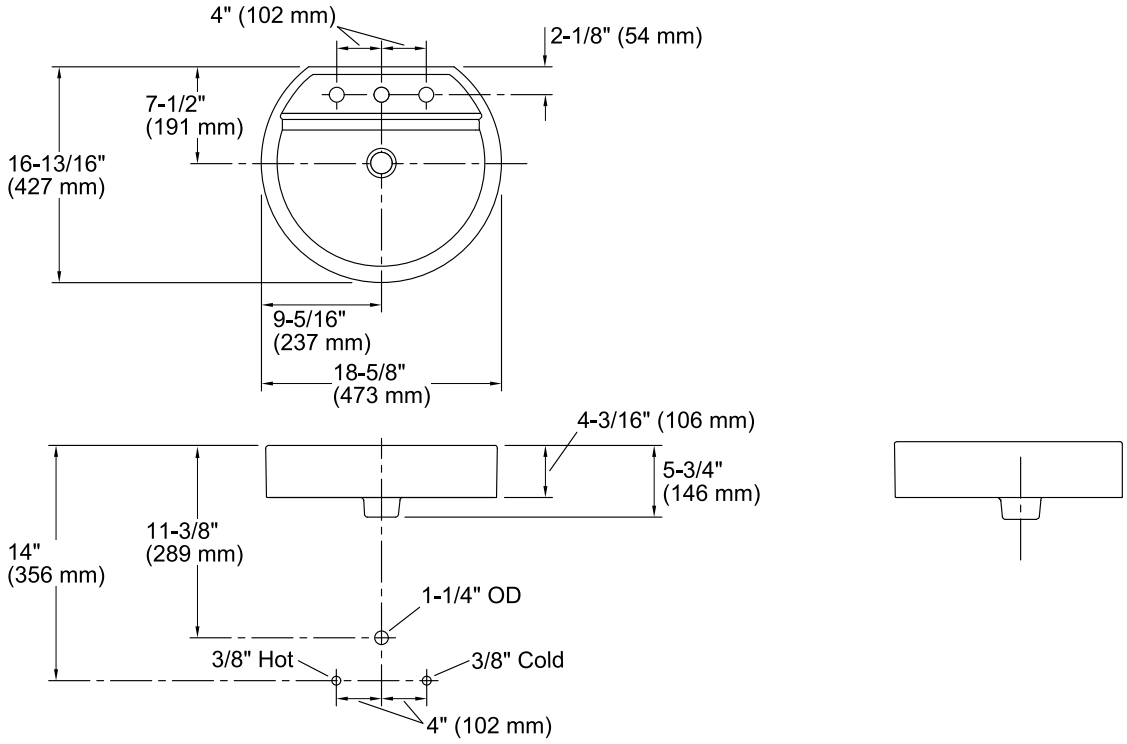
THE BOLD LOOK OF KOHLER®

KOHLER®

Chord®

Wading Pool® Bathroom Sink

K-2331-8



Technical Information

All product dimensions are nominal.

Bowl configuration:	Single
Installation:	Above-counter
Bowl area	Length: 17-9/16" (446 mm) Width: 12-3/16" (310 mm) Water depth: 3-3/4" (95 mm)
Number of deck holes:	3
Drain hole:	1-3/4" (44 mm)
Template:	1020953-7, required, included

Notes

Install this product according to the installation instructions.

Product does not have an overflow.

Pop-up style drains cannot be used with this bathroom sink.

IMPORTANT! Product rests on a countertop. Consider height of product when designing installation.

NOTICE: The countertop manufacturer or cutter must use the cut-out template provided with the product, or a current cut-out template provided by Kohler (call 1-800-4KOHLER). Kohler is not responsible for errors when incorrect cut-out template is used.

KOHLER. Faucets

Loure®

Widespread Bathroom Sink Faucet

K-14661-4

Features

- Brass construction.
- Brass valve bodies.
- Quarter-turn washerless ceramic disc valves.
- Lever handles are ADA compliant.
- For 8" (203 mm) or 16" (406 mm) centers.
- Stationary spout.
- 3-7/8" (98 mm) spout reach.
- Pop-up drain with lift rod and tailpiece.
- 1.2 gal/min (4.5 l/min) maximum flow rate [max at 60 psi (4.14 bar)].

ADA

Codes/Standards

ASME A112.18.1/CSA B125.1
NSF 61
NSF 372
All applicable US Federal and State material regulations
DOE - Energy Policy Act 1992
EPA WaterSense®
California Energy Commission (CEC)
ADA
ICC/ANSI A117.1

KOHLER® Faucet Lifetime Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color	Code	Description
	CP	Polished Chrome
	SN	Vibrant® Polished Nickel
	BN	Vibrant® Brushed Nickel

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
1-13-2017 04:10

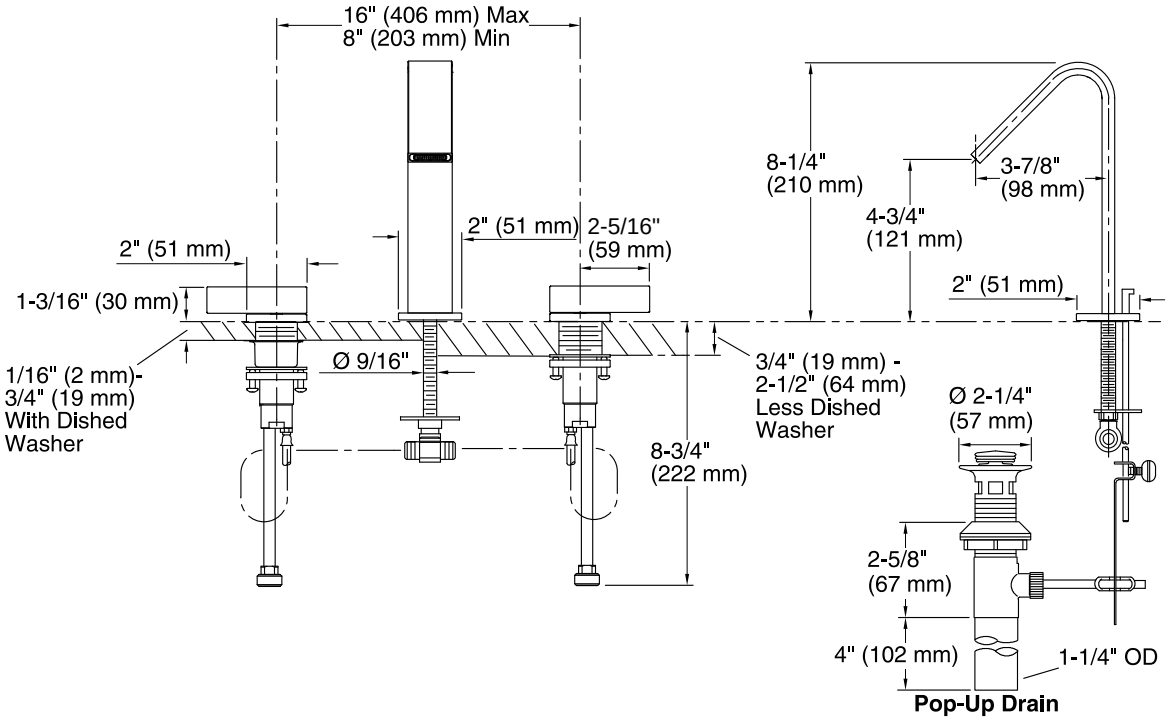
THE BOLD LOOK OF KOHLER®

KOHLER. Faucets

Loure®

Widespread Bathroom Sink Faucet

K-14661-4



Technical Information

All product dimensions are nominal.

Drain included:	YES
Drain tailpiece included:	YES

Spout:

Spout reach:	3-7/8" (98 mm)
Handle clearance:	2-5/16" (59 mm)

Faucet:

Flow rate:	1.2 gal/min (4.5 l/min)
Pressure:	60 psi (4.1 bar)

Notes

Install this product according to the installation guide.

ADA compliant when installed to the specific requirements of these regulations.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
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THE BOLD LOOK OF KOHLER.

KOHLER. Faucets

Purist®

Valve w/Diverter Only Trim

K-T14501-4

Features

- Brass construction.
- Lever handle.
- Push-button diverter.

Required Accessories

K-11748 Series Rite-Temp® Valves

or

K-11748-KS

Adapters, Rough-in and Extension Kits

1016154

Optional Accessories

88526 Thin Wall Trim Kit

ADA	CSA B651	OBC

Codes/Standards

ASME A112.18.1/CSA B125.1
ASSE 1016
ADA
ICC/ANSI A117.1
CSA B651
OBC

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

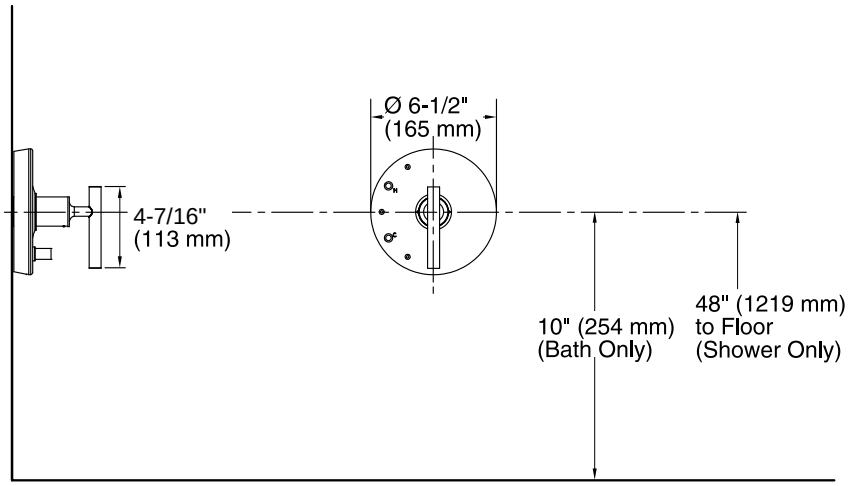
Color	Code	Description
	CP	Polished Chrome
	BGD	Vibrant® Moderne Brushed Gold
	BN	Vibrant® Brushed Nickel
	BV	Vibrant® Brushed Bronze

KOHLER. Faucets

Purist®

Valve w/Diverter Only Trim

K-T14501-4



Technical Information

All product dimensions are nominal.

Notes

Install this product according to the installation guide.

Cap the shower outlet if deck-mount spout, diverter, or handshower is connected to the spout outlet.

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

KOHLER. Faucets

Purist®
Multifunction Handshower
K-978

Features
- Adjustable oversized sprayface
- MasterCleanTM sprayface resists hard water buildup and is easy to clean
- Complements Purist® faucet line
- Ergonomic sprayhead pivots
- 1.75 gpm (6.6 L) per minute maximum flow rate
- Wide Coverage, medium coverage, forceful utility spray, and water-saving spray option
- Water–saving spray meets ADA requirement for non-positive shutoff

Optional Accessories
K-8593 72" Shower Hose
K-9514 60" Shower Hose
K-45981 Shower Hose
K-45982 Shower Hose

ADA | CSA B651 | OBC

Codes/Standards
ASME A112.18.1/CSA B125.1
All applicable US Federal and State material regulations
DOE - Energy Policy Act 1992
EPA WaterSense®
ADA
ICC/ANSI A117.1
CSA B651
OBC

KOHLER® Faucet Lifetime Limited Warranty
See website for detailed warranty information.

Available Color/Finishes
Color tiles intended for reference only.

Color	Code	Description
	CP	Polished Chrome
	BGD	Vibrant® Moderne Brushed Gold
	BN	Vibrant® Brushed Nickel

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
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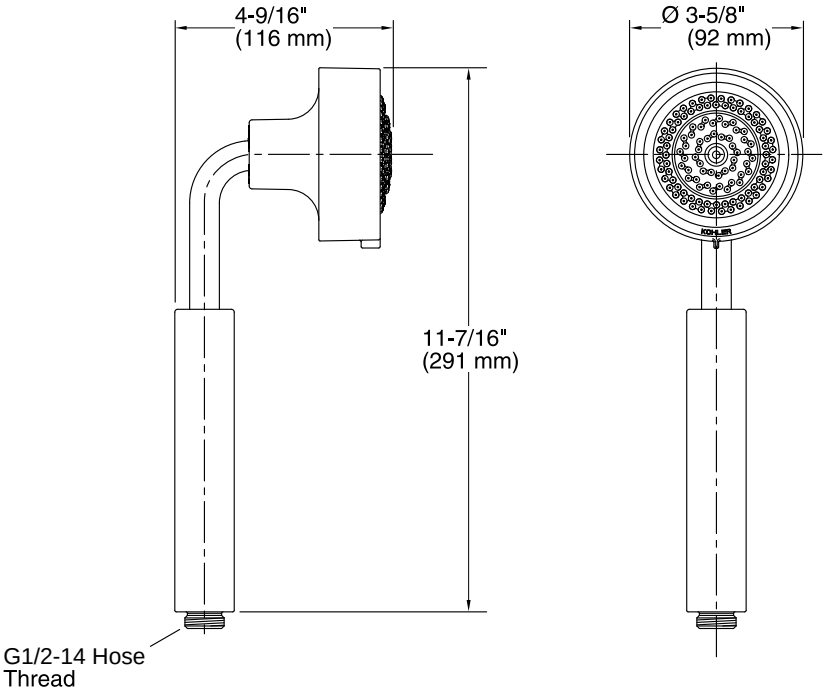
THE BOLD LOOK OF KOHLER®

KOHLER. Faucets

Purist®

Multifunction Handshower

K-978



Technical Information

All product dimensions are nominal.

Handshower:

Rated maximum flow: 1.75 gal/min (6.6 l/min)

Notes

Install this product according to the installation guide.

Plumbing codes require approved backflow prevention devices to be installed in-line to handshowers. Please consult with local plumbing officials.

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

KOHLER®

MasterShower®

72" Shower Hose

K-8593

Features

- 72-inch hose length.
- Swivel base helps reach target areas.
- For use with a handshower (sold separately).

Material

- Durable metal construction.
- KOHLER finishes resist corrosion and tarnishing.

ADA | **CSA B651** | **OBC**

Codes/Standards

ADA
ICC/ANSI A117.1
CSA B651
OBC

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

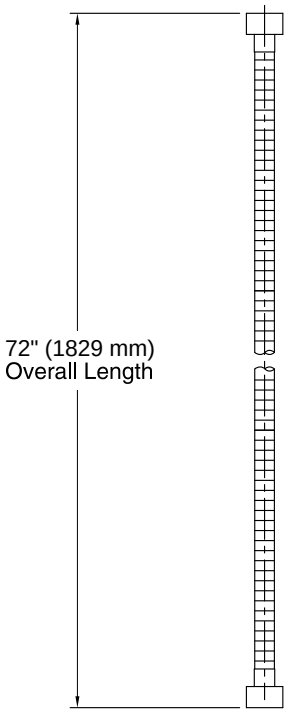
Color	Code	Description
	CP	Polished Chrome
	SN	Vibrant® Polished Nickel
	AF	Vibrant® French Gold
	PB	Vibrant® Polished Brass
	G	Brushed Chrome
	BN	Vibrant® Brushed Nickel

KOHLER®

MasterShower®

72" Shower Hose

K-8593



Technical Information

All product dimensions are nominal.

Notes

ADA, OBC, CSA B651 compliant when installed to the specific requirements of these regulations.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
12-20-2016 07:41

THE BOLD LOOK OF KOHLER®

KOHLER® FAUCETS

PURIST®

MULTI-FUNCTION SHOWERHEAD
K-997

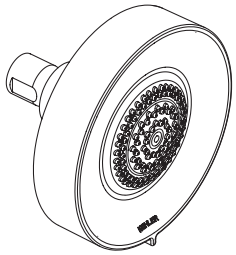
Features

- *3-function showerhead with wide coverage, medium coverage, and concentrated spray options*
- *1.75 gpm (6.6 L) per minute flow rate*
- *5-1/2″ (14 cm) diameter showerhead*
- *Complements Purist® Suite*
- *MasterClean™ spray nozzles to prohibit mineral build-up for easy cleaning*
- *1/2″ - 14 NPT connection*

Codes/Standards Applicable

Specified model meets or exceeds the following:

- *ASME A112.18.1/CSA B125.1*
- *EPA WaterSense®*



Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Accessories

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description		
K-997	Multi-function showerhead	❑ CP	❑ Other ____

Recommended Accessories			
K-7397	Shower arm and flange – 7-1/2″ (13.7 cm) length, 1/2″ NPT	❑ CP	❑ Other ____

Product Specification

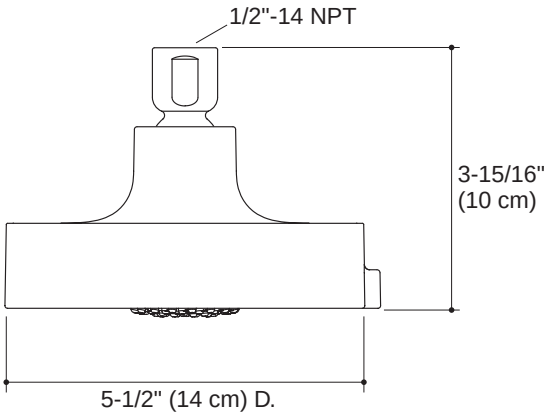
The showerhead shall feature a Masterclean sprayface nozzles to prohibit mineral build-up for easy cleaning. Showerhead shall have a 5-1/2″ (14 cm) diameter showerhead and a 1/2″-14 NPT connection. Showerhead shall feature a 1.75 gpm (6.6 L) per minute flow rate. Showerhead shall be available with a 3-function showerhead with wide coverage, medium coverage and concentrated spray options. Showerhead shall complement Purist suite. Multi-function showerhead shall be Kohler Model K-997-____.

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

PURIST®

Installation Notes

Install this product according to the installation guide.



Product Diagram

PURIST® MULTI-FUNCTION SHOWERHEAD
Page 2 of 2
1100341-4-**B**

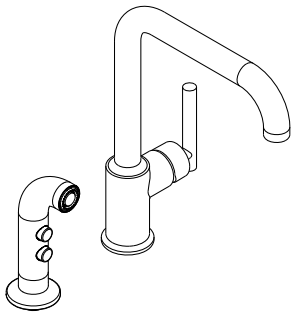
THE BOLD LOOK OF KOHLER®

KOHLER FAUCETS

PURIST®

KITCHEN SINK FAUCET
K-7507
ALSO K-7508, K-7509, K-7511

ADA



Features

- *Metal construction*
- *One-piece, self-contained ceramic disc valve allows both volume and temperature control*
- *Temperature memory allows faucet to be turned on and off at any temperature setting*
- *Flexible connections for easy installation*
- *Available with or without matching finish sidespray*
- *360° spout rotation with 8-7/8″ (225 mm) or 7-3/8″ (187 mm) clearance below the spout*
- *Single-hole mounting*
- *Available with 8″ (203 mm) or 6″ (152 mm) swing spout reach*
- *Optional aerator kits available*
- *1.8 gallons (6.8 L) per minute maximum flow rate*
- *Meets CalGreen requirements for kitchen faucets*

Codes/Standards Applicable

Specified model meets or exceeds the following:

- *ADA*
- *ICC/ANSI A117.1*
- *ASME A112.18.1/CSA B125.1*
- *Energy Policy Act of 2005*
- *NSF 61*
- *All applicable US Federal and State material regulations*

Colors/Finishes

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Accessories

- NA: None applicable

Specified Model

Model	Description	Colors/Finishes	
K-7507	Kitchen sink faucet – 8″ (203 mm) swing spout reach, without sidespray	☐ CP	☐ Other ____
K-7508	Kitchen sink faucet – 8″ (203 mm) swing spout reach, with sidespray (shown)	☐ CP	☐ Other ____
K-7509	Kitchen sink faucet – 6″ (152 mm) swing spout reach, without sidespray	☐ CP	☐ Other ____
K-7511	Kitchen sink faucet – 6″ (152 mm) swing spout reach, with sidespray	☐ CP	☐ Other ____

Product Specification

The kitchen sink faucet shall be made of metal construction. Product shall feature a 1.8 gallon (6.8 L) per minute maximum flow rate. Product shall feature a one-piece, self-contained ceramic disc valve, which allows both volume and temperature control. Product shall feature temperature memory, allowing the faucet to be turned on and off at any temperature setting. Product shall feature 360° spout rotation with 8-7/8″ (225 mm) or 7-3/8″ (187 mm) clearance below the spout, and flexible connections for easy installation. Product shall be for single-hole mounting. Product shall be available with an 8″ (203 mm) or 6″ (152 mm) swing spout reach. Product shall be available with or without matching finish sidespray. Product shall be available with optional aerator kits. Product shall meet CalGreen requirements for kitchen faucets. Kitchen faucet shall be Kohler Model K-____-____.

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

PURIST®

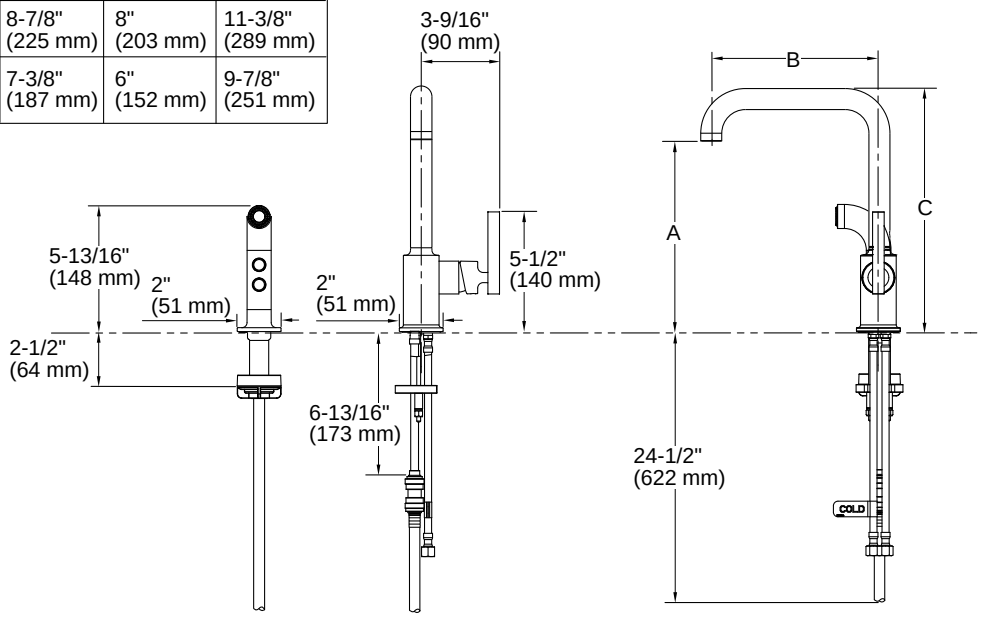
Optional Accessories		
1030920	Sidespray deep roughing-in kit	▯ NA
1088956	Aerator kit – 2.2 gpm (8.3 lpm)	▯ NA
1089003	Low flow aerator kit – 1.5 gpm (5.7 lpm)	▯ NA

Installation Notes

Install this product according to the installation guide.

ADA compliant when installed to the specific requirements of the regulation.

Model	A	B	C
K-7507 **K-7508**	8-7/8" (225 mm)	8" (203 mm)	11-3/8" (289 mm)
K-7509 **K-7511**	7-3/8" (187 mm)	6" (152 mm)	9-7/8" (251 mm)



Product Diagram

PURIST® KITCHEN SINK FAUCET
Page 2 of 2
1140937-4-**E**

THE BOLD LOOK OF KOHLER®

KOHLER®

Vault™

Top-mount/ Under-mount Kitchen Sink

K-3894-4

Features

- Small single bowl.
- 6-inch depth.
- Three faucet holes with one accessory hole to the right.
- 27-inch minimum base cabinet width.
- 25" (635 mm) x 22" (559 mm)

Material

- 18-gauge stainless steel.

Technology

- SilentShield® sound-absorption technology offers quieter performance.

Installation

- Top-mount or under-mount.

Optional Accessories

K-6645 Sink Rack
K-8801 Sink Strainer
1177161 Installation Clip Kit

Components

Product includes:
1130570 Hardware Kit, Self-Rimming

ADA

Codes/Standards

ASME A112.19.3/CSA B45.4
ADA
ICC/ANSI A117.1

KOHLER® One-Year Limited Warranty

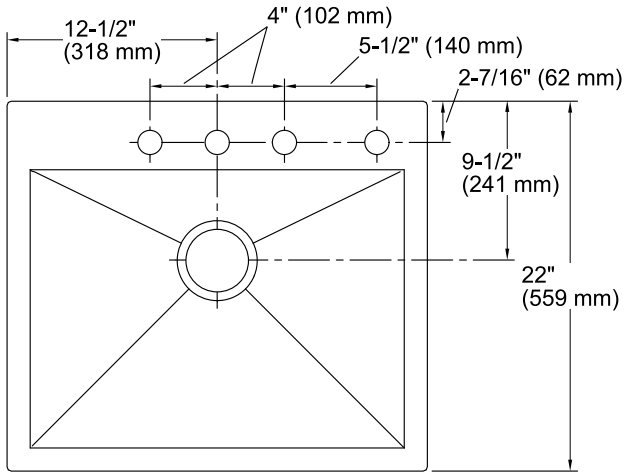
See website for detailed warranty information.

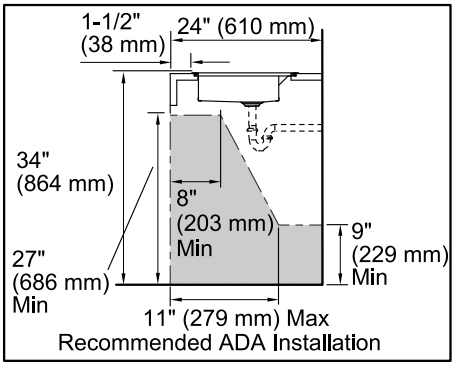
KOHLER®

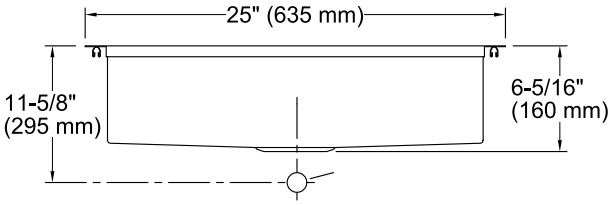
Vault™

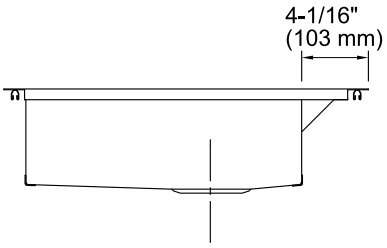
Top-mount/ Under-mount Kitchen Sink

K-3894-4









Technical Information

All product dimensions are nominal.

Bowl configuration:	Single
Installation:	Top-mount, Under-mount
Bowl area (Only)	Length: 22-1/4" (565 mm) Width: 16-9/16" (420 mm) Bowl depth: 6" (152 mm) Water depth: 6" (152 mm)
Number of deck holes:	4
Faucet hole(s):	1-7/16" (37 mm)
Soap/Lotion hole:	1-7/16" (37 mm)
Drain hole:	3-3/4" (94 mm)
Template:	1130822-7, required, included

Notes

Install this product according to the installation instructions.

Hardward Kit 1177161 needed for countertops with a 2-1/2" (64 mm) thickness or less.

For under-mount installation, counter top thickness can not be greater than 1" (25 mm) for ADA compliance.

ADA compliant when installed to the specific requirements of these regulations.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
Kohler Co. reserves the right to make revisions without notice to product specifications.
For the most current Specification Sheet, go to www.kohler.com.
1-13-2017 05:17

THE BOLD LOOK OF KOHLER®

24" Built-In Custom Panel Bottom Freezer

800 Series – Custom Panel B09IB80NSP

BOSCH
Invented for life

B09IB80NSP
Custom Panel

The 24" Custom Panel bottom freezer provides a new solution for small kitchen spaces requiring large Frig / Freezer storage.

Features & Benefits
Installs completely flush.
Bright all LED lighting shines throughout the entire interior.
Optiflex® Hinge allows flush-mount doors with no worry about cabinetry.
ENERGY STAR® qualified for energy efficiency.

General Properties	
Reversible door hinge	Yes
Water filter	No
Lighting	Maintenance-free LED lighting
Defrost process refrigerator section	Frost-free
Number of shelves - refrigerator	5
Adjustable shelves - refrigerator	4
Shelf material - refrigerator	Glass w/metal trim
Type of shelves - refrigerator	4 adjustable, 1 varial shelf
Gallon storage bins	No
Humidity control drawer	Yes
Defrost process freezer section	Automatic
Number of drawers - freezer	3
Ice maker	No
Quick ice	No
Capacity	
Total unit gross capacity (cu. ft.) - AHAM	9.6 cu. ft.
Refrigerator gross capacity (cu. ft.)	6.6 cu. ft.
Freezer gross capacity (cu. ft.)	3 cu. ft.

Technical Details	
Watts (W)	90 W
Current (A)	10 A
Volts (V)	120 V
Frequency (Hz)	60 Hz
Power cord length (in.)	90"
Plug type	3-Prong
Dimensions & Weight	
Appliance dimensions (H x W x D) (in.)	69 3/4” x 22 x 21 1/2”
Required cutout size (H x W x D) (in.)	70” x 22 1/4” x 24 3/4”
Net weight (lbs)	151
Efficiency	
ENERGY STAR® qualified	YES
Energy consumption (kWh/yr)	394 kWh

For help and assistance with Bosch accessories please visit: www.bosch-eshop.com/eshop/bosch/us or call 1-800-944-2904 Mon-Fri 5am to 6pm PST Sat 6am to 3pm PST

Notes: All height, width and depth dimensions are shown in inches. BSH reserves the absolute and unrestricted right to change product materials and specifications, at any time, without notice. Consult the product’s installation instructions for final dimensional data and other details prior to making cutout. Applicable product warranty can be found in accompanying product literature or you may contact your account manager for further details.

Warranties: Bosch warrants that the Product is free from defects in materials and workmanship for a period of three hundred and sixty-five (365) days 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. This Product is also warranted to be free from cosmetic defects in material and workmanship (such as scratches of stainless steel, paint/porcelain blemishes, chip, dents, or other damage) to the finish of the Product, for a period of thirty (30) days from the date of purchase or closing date for new construction. This cosmetic warranty excludes slight color variations due to inherent differences in painted and porcelain parts, as well as differences caused by kitchen lighting, product location, or other similar factors. This cosmetic warranty specifically excludes any display, floor, “As Is”, or “B” stock appliances.

For more information on our entire line of products, go to www.bosch-home.com/us or call 1-800-944-2904

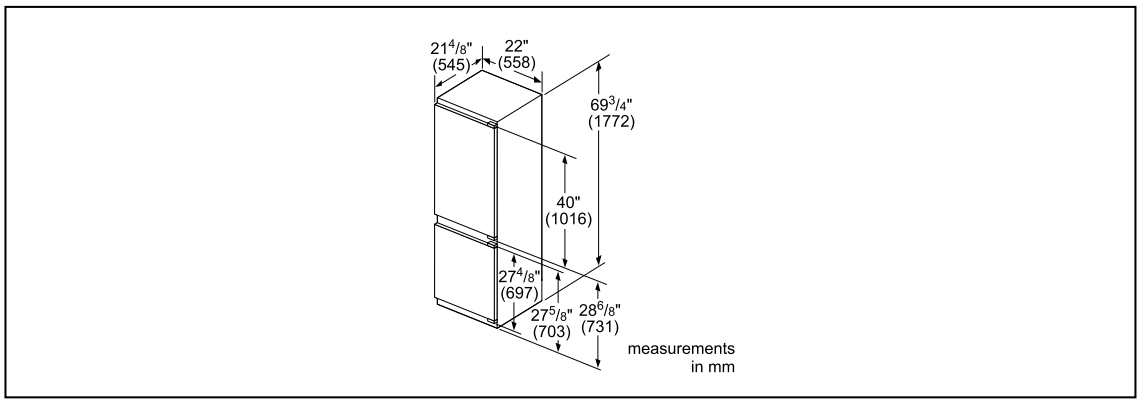
09/16

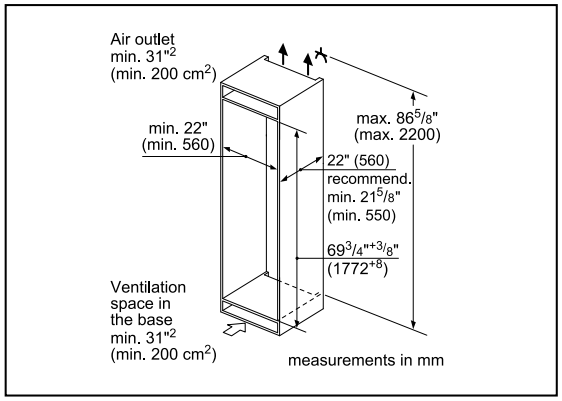
24" Built-In Custom Panel Bottom Freezer

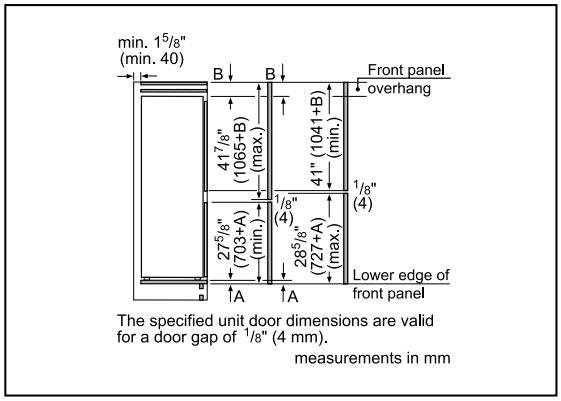
800 Series – Custom Panel B09IB80NSP

BOSCH
Invented for life

Installation Details







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For more information on our entire line of products, go to www.bosch-home.com/us or call 1-800-944-2904

09/16

24" Single Wall Oven

500 Series – Stainless Steel HBE5451UC

BOSCH
Invented for life

HBE5451UC
Stainless Steel

The 24" Bosch Wall Oven features Genuine European Convection and is Designed for Kitchens with a Smaller Footprint

Features & Benefits
A full-extension telescopic rack offers better access to the oven cavity.
Genuine European Convection for even baking results on multiple racks.
Beautifully designed knob controls that are easy to use.
The wall oven is designed to be installed flush with your cabinetry.
The DualClean™ system uses the cavity coating and heat to burn off most grease.

General Properties	
Cooking modes	Bake, Broil Plus, Convection Bake, Convection Broil, Convection Broil Plus, Multi-Rack Genuine European Convection, Pie, Warm, Defrost, Frozen Foods
Cleaning type	DualClean™
Telescopic rack	1
Illumination type	Halogen
Interior lights	2
Oven Performance	
Bake / broil element wattages	1,300 / 3,060 W
Convection element wattages	2,200 W
Technical Details	
Watts (W)	3,300 W
Circuit breaker (A)	20 A
Volts (V)	240 / 208 V
Frequency (Hz)	60 Hz
Power cord length (in)	47 1/4"
Plug type	Fixed Connection, No Plug
Energy source	Electric

Dimensions & Weight	
Overall appliance dimensions (HxWxD) (in)	23 5/16" x 23 1/2" x 22 1/2"
Required cutout size (HxWxD) (in)	21 15/16" – 23 1/16" x 21 15/16" x 22 1/16"
Oven cavity size (cu. ft.)	2.8
Overall oven interior dimensions (HxWxD) (in)	15 1/16" x 18 3/16" x 17 11/16"
Usable oven interior dimensions (HxWxD) (in)	11" x 17 1/4" x 16 1/4"
Net weight (lbs)	87 lbs
Accessories–Included	
Included	1 Standard Rack, 1 Telescopic Rack

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09/15

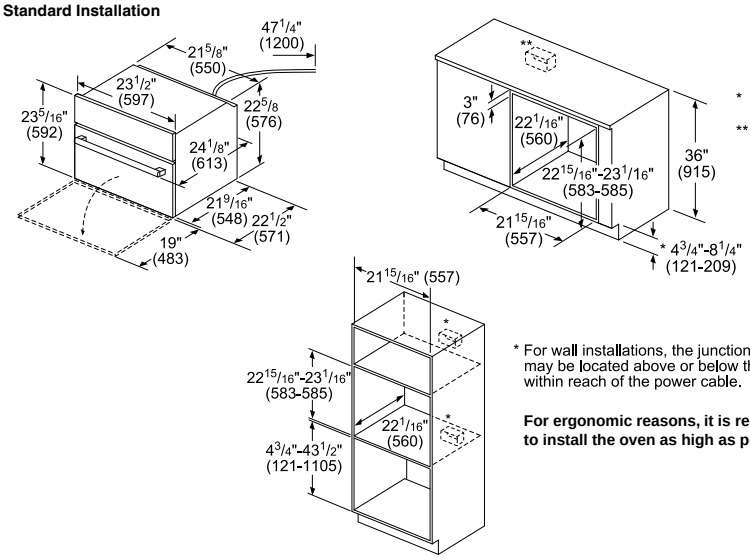
24" Single Wall Oven

500 Series – Stainless Steel HBE5451UC

BOSCH
Invented for life

Installation Details

Standard Installation



* Includes 3/4" (19) base plate

** For single ovens installed under a worktop, the junction box may be located to the left or right of the unit within reach of the power cable.

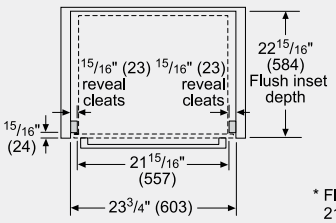
* For wall installations, the junction box may be located above or below the unit within reach of the power cable.

For ergonomic reasons, it is recommended to install the oven as high as possible.

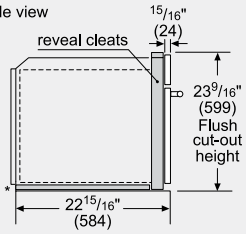
measurements in inches (mm)

Flush Installation

Top view



Side view



* Flush installation requires a 3/16" (5 mm) high x 21 15/16" (557 mm) wide x 22 1/16" (560 mm) deep baseplate underneath the unit body.

Example Flush Install

measurements in inches (mm)

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09/15

30" Induction Cooktop

500 Series – Black NIT5068UC

BOSCH
Invented for life

NIT5068UC
Black

The 500 Series induction cooktop is sleek in design, and offers quick and even cooking results.

Features & Benefits
Induction – faster than gas and electric cooktops. Precise cooking, easy cleaning and more efficient
11" cooking zone for larger pots and pans
17 power levels for each cooking zone
Each cooking zone has an Independent countdown timer
SpeedBoost® – adds even more power to speed up the cooking process

Element Performance	
Power of Front Left heating element	1,400 W
Power of Front Left heating element (in boost)	2,200 W
Power of Back Left heating element	2,200 W
Power of Back Left heating element (in boost)	3,700 W
Power of Back Right heating element	2,600 W
Power of Back Right heating element (in boost)	3,700 W
Power of Front Right heating element	1,400 W
Power of Front Right heating element (in boost)	2,200 W
Burners with booster	All
Element Size	
Dimension of Front Left heating element	6"
Dimension of Back Left heating element	9"
Dimension of Back Right heating element	11"
Dimension of Front Right heating element	6"

Technical Details	
Watts	7,200 W
Circuit breaker	30 A
Volts	208-240 V
Frequency	60 Hz
Plug type	No plug
Power cord length	37"
Energy source	Electric
Dimensions & Weight	
Overall appliance dimensions (HxWxD)	1/4" +4 1/8" x 31" x 21 1/4"
Required cutout size (HxWxD)	4 1/8" x 28 7/8" x 20"
Minimum distance from counter front	2 1/4"
Minimum distance from rear wall	2"
Net weight	42 lbs
Accessories—Optional	

HEZ390210
8" AutoChef® pan

HEZ390230
10" AutoChef® pan

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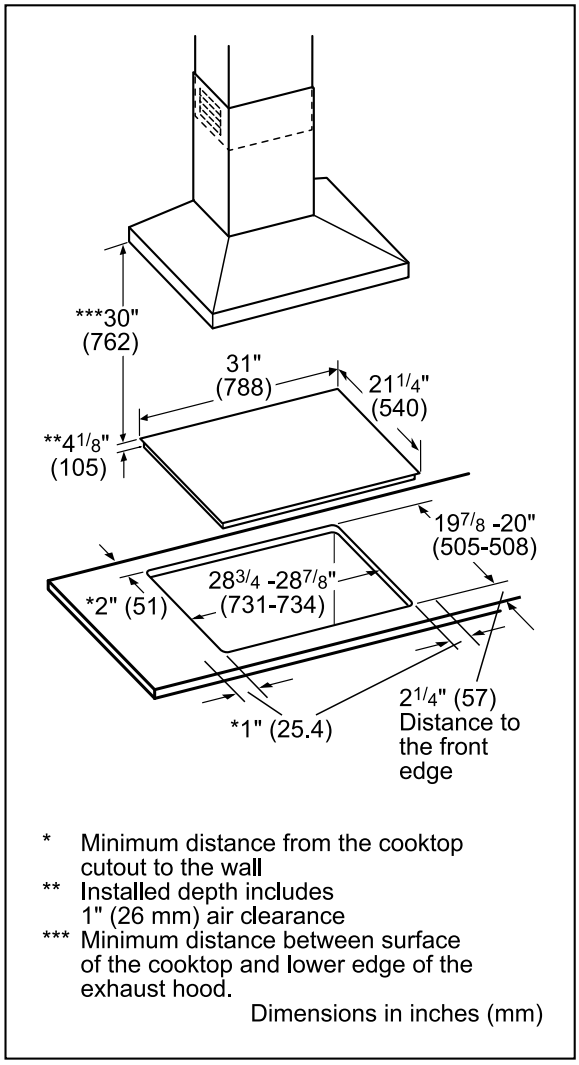
1/17

30" Induction Cooktop

500 Series – Black NIT5068UC

BOSCH
Invented for life

Installation Details



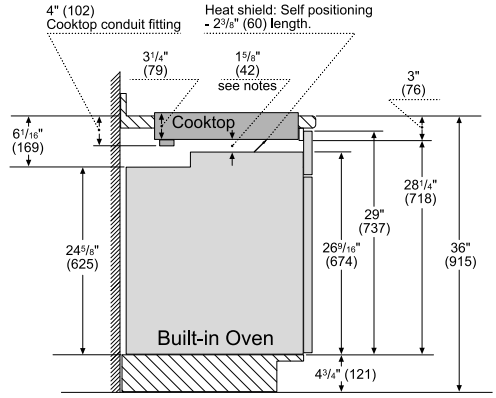
* Minimum distance from the cooktop cutout to the wall

** Installed depth includes 1" (26 mm) air clearance

*** Minimum distance between surface of the cooktop and lower edge of the exhaust hood.

Dimensions in inches (mm)

Installation above Wall Ovens

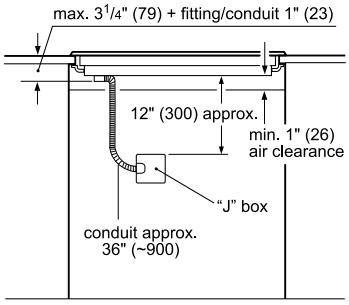


Notes:

Dimensions based on standard countertop height (36" with 4 3/4" toe kick including base plate).

The built-in oven can be installed below the induction cooktop as long as there is a minimum 1" (26) clearance between the bottom of the cooktop and the top of the oven.

measurements in inches (mm)



Measurements in inches (mm)

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1/17

24" Bar Handle Dishwasher

800 Series – Stainless Steel SHXM78W55N

BOSCH
Invented for life

SHXM78W55N
Stainless Steel

Also available in:

White	SHXM78W52N
Black	SHXM78W56N

The flexible 3rd rack allows you to accommodate deeper items, while adjustable tines let you customize the rack's loading space.

Features & Benefits
42 dBA: Quietest dishwasher brand in the US.
A flexible 3rd rack with folding tines adds 30% more loading area.
Touch Control Technology allows for quick cycle programming.
EasyGlide™ rack provides a smooth glide for easier loading & unloading.
RackMatic® offers 3 height levels, for 9 possible rack positions.

General Properties	
Number of wash cycles	6
Number of options	5
dBA	42
Third rack	Flexible 3rd Rack
Rack adjustability	Rackmatic®
Tub material	Stainless Steel
Control type	Touch Control
Concealed heating element	Yes
Leak protection system	24/7 AquaStop®
Water softener	No
Five-level wash	Yes
ChildLock	No
Special features	InfoLight®, Extra Dry Option

Efficiency	
Water usage per cycle	2.9
Energy efficiency class	Tier 1
ENERGY STAR® qualified	Yes
Total annual energy consumption (kWh)	269
Total annual water consumption (g)	623.5

Capacity	
Number of place settings	16

Technical Details	
Watts (W)	1440 W
Current (A)	12 Amps
Volts (V)	120 V
Frequency (Hz)	60 Hz
Power cord length	N/A
Minimum water pressure (lb/sin)	14
Length outlet hose (in)	79"

Dimensions & Weight	
Overall appliance dimensions (HxWxD) (in)	33 7/8" x 23 9/16" x 23 3/4"
Required cutout size (HxWxD) (in)	33 7/8" x 23 5/8" x 24"
Adjustable feet	Yes
Net weight (lbs)	92 lbs

Accessories—Optional	
Drain Hose Extension Kit	SGZ1010UC
Dishwasher Accessory Kit	SMZ5000
Anti-Tarnish Silverware Cassette	SMZ5002UC
Powercord with Cold Plug	SMZPC002UC

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11/16

24" Bar Handle Dishwasher

800 Series – Stainless Steel SHXM78W55N

BOSCH
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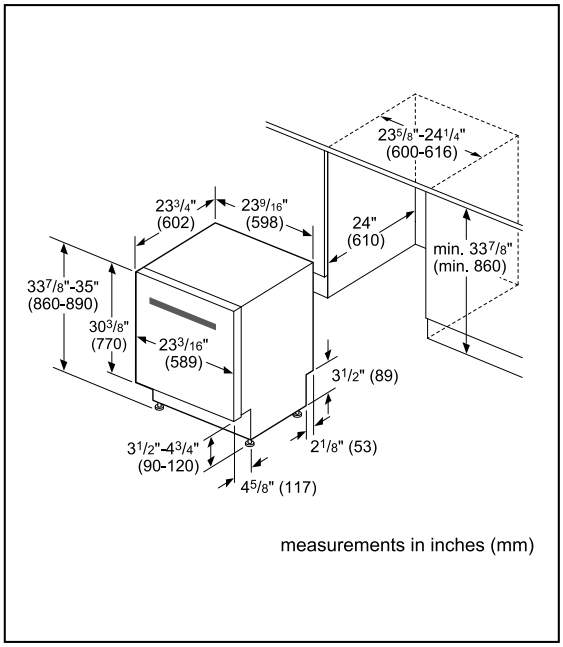
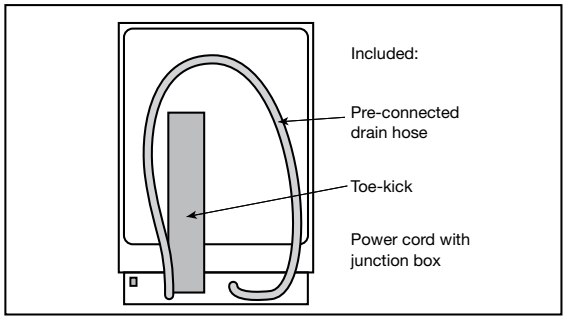
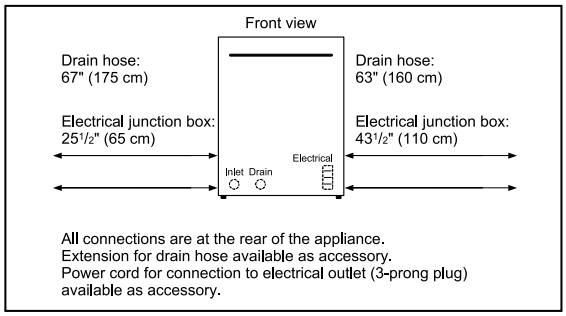
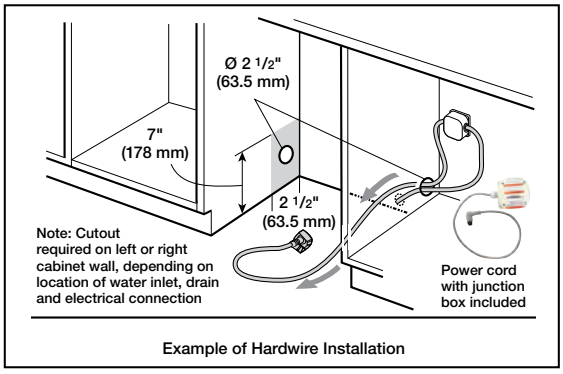
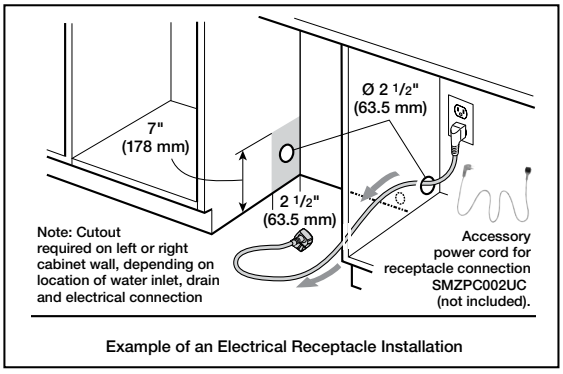
Installation Details











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11/16

24" Bar Handle Dishwasher

800 Series – Stainless Steel SHXM78W55N

BOSCH
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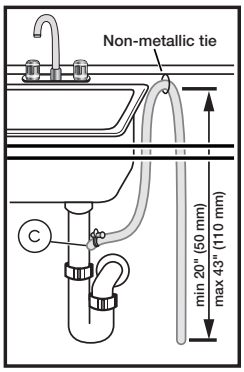
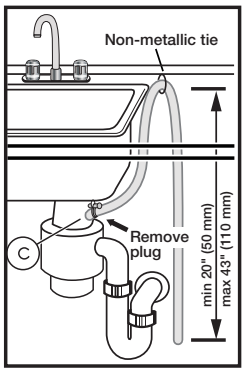
Installation Details





Note: Plumbing installations will vary - refer to local codes. Drain hose included is 79 (201 cm) and can be extended to a maximum of 155 3/4" (396 cm).

Always use the approved drain hose extension kit (SGZ1010UC).

Ensure a portion of the drain hose is raised between min. 20" (50 cm) and max. 43" (110 cm) above the cabinet floor.

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11/16

24" Compact Condensation Dryer

800 Series – WTG86402UC

BOSCH
Invented for life

WTG86402UC
White

The 800 series laundry pair is ENERGY STAR® qualified and offers matching quality, water protection, design and fast wash and dry cycles.

Features & Benefits
Quietest dryer in the 24" category.
Only ENERGY STAR® dryer in 24" compact laundry market.
Bosch Washers and Dryers are the only ENERGY STAR® 24" laundry pair.
Condensation drying doesn't require ducting.
Perfect design match to Bosch 800 series washer.
Washer plugs into dryer for easy installation.
Dry up to 18 towels in one load.

General Properties	
Dryer type	Condensing
Drum material	Stainless Steel
Interior light	Yes (LED)
Ventless drying (no ducting)	Yes
Stackable	Yes
Silence level (dBA)	63
Programs (No.), [Special]	(15), [Super Quick 15, Anti Shrink]
Options (No.), [Special]	(6), [Dry Level, Finished In]
Energy consumption (kWh/yr)	311
ENERGY STAR® qualified	Yes
Capacity	
Capacity (cu. ft.)	4.0
Relative load	18 bath towels
Design Elements	
Door ring	Chrome
Control type	Touch
Dial	Chrome design, metal material
Bosch logo on door glass	Yes
Technical Details	
Energy source	Electric
Watts (W)	2,800
Circuit breaker (A)	30
Volts (V)	208/220-240
Current (A)	13
Frequency (Hz)	60
Plug type	240V; NEMA 14-30 (4 prong)

ENERGY STAR

c UL us LISTED

Technical Details (Continued)	
Power cord included	Yes
Power cord length (in)	63 (Full Length)
Drain hose length (in)	78 (Full Length)
Door hinge	Right Side (Reversible)
Dimensions & Weight	
Overall appliance dimensions (HxWxD)(in)	33 1/4" x 23 1/2" x 25"
Net weight (lbs)	99 lbs
Minimum stack height (in)	67 3/4"

ADA compliance
– Meets ADA height and access requirements *when installed on pedestal*.
– Meets ADA operable parts requirements for controls and lint filter.

Accessories–Optional

WTZ11400
Stacking kit with shelf

WTZ20410
Stacking kit without shelf

WMZ20500
Pedestal

WMZ20600
Drying Rack

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09/15

24" Compact Washer

800 Series – WAT28402UC

BOSCH
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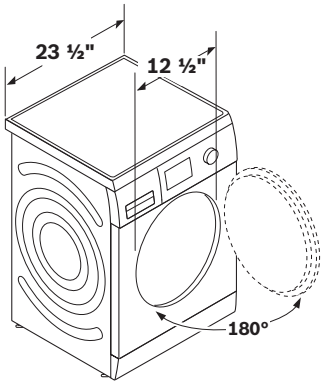
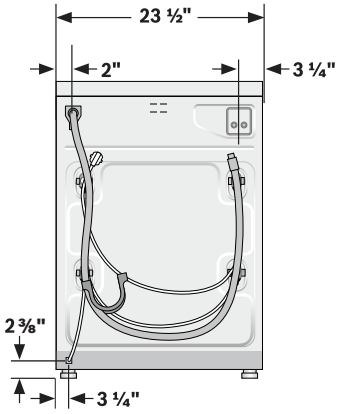
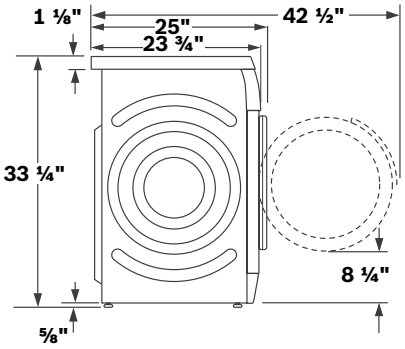
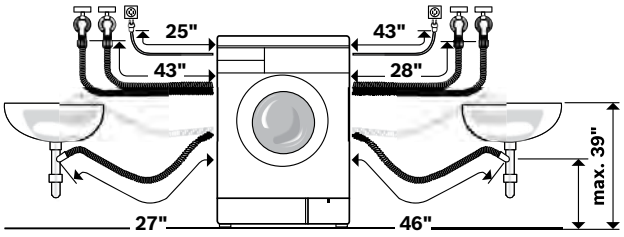
Installation Details

Dimensions in inches

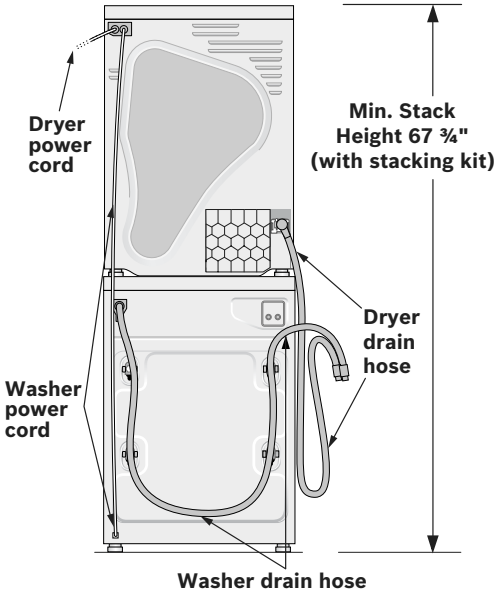




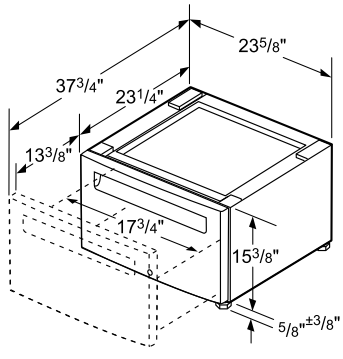




Washer plugged into the dryer



Optional Pedestal



measurements in inches

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09/15

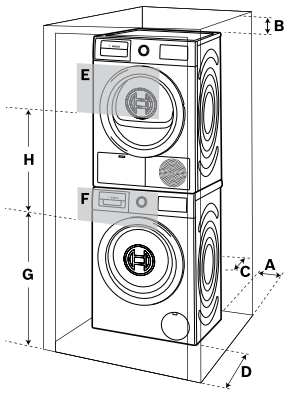
24" Compact Washer

800 Series – WAT28402UC

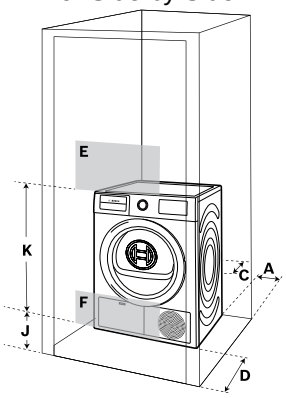
BOSCH
Invented for life

Installation Details

Closet: Stacked



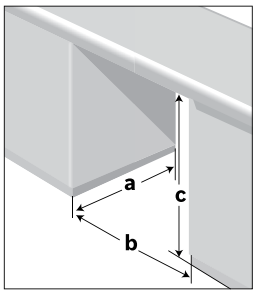
Closet: Stand Alone (shown) or Side by Side



Clearance requirements (Minimum)	
A Both Sides	5/8 in.
B Top	6 1/4 in.
C Rear	2 1/2 in.
D Front	2 1/2 in.
Ventilation Area (Minimum)	
E Top	63 sq. in
F Bottom	63 sq. in.
Vent Spacing	
G	37 in.
H	26 in.
J	3 in.
K	29 in.

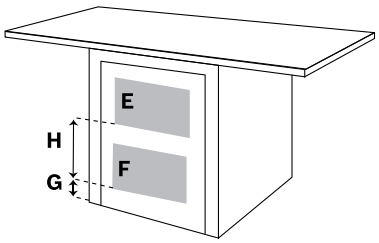
Enclosure Dimensions

Under Counter: (Preferred)



Front of the appliance fully open. No doors or coverings.

Under Counter: (Less Preferred)



If the front of the appliance is covered, ventilation openings must be installed as shown and front/rear clearances adhered to according to closet installations.

Minimum opening dimensions	
a	28 in.
b	23 7/8 in.
c	34 1/2 in.
E & F are minimum area sizes	
E	63 sq. in.
F	63 sq. in.
G & H actual spacing dimensions for min. open area sizes	
G	3 in.
H	14 in.

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09/15

24" Compact Condensation Dryer

800 Series – WTG86402UC

BOSCH
Invented for life

WTG86402UC
White

The 800 series laundry pair is ENERGY STAR® qualified and offers matching quality, water protection, design and fast wash and dry cycles.

Features & Benefits

- Quietest dryer in the 24" category.
- Only ENERGY STAR® dryer in 24" compact laundry market.
- Bosch Washers and Dryers are the only ENERGY STAR® 24" laundry pair.
- Condensation drying doesn't require ducting.
- Perfect design match to Bosch 800 series washer.
- Washer plugs into dryer for easy installation.
- Dry up to 18 towels in one load.

General Properties	
Dryer type	Condensing
Drum material	Stainless Steel
Interior light	Yes (LED)
Ventless drying (no ducting)	Yes
Stackable	Yes
Silence level (dBA)	63
Programs (No.), [Special]	(15), [Super Quick 15, Anti Shrink]
Options (No.), [Special]	(6), [Dry Level, Finished In]
Energy consumption (kWh/yr)	311
ENERGY STAR® qualified	Yes
Capacity	
Capacity (cu. ft.)	4.0
Relative load	18 bath towels
Design Elements	
Door ring	Chrome
Control type	Touch
Dial	Chrome design, metal material
Bosch logo on door glass	Yes
Technical Details	
Energy source	Electric
Watts (W)	2,800
Circuit breaker (A)	30
Volts (V)	208/220-240
Current (A)	13
Frequency (Hz)	60
Plug type	240V; NEMA 14-30 (4 prong)

ENERGY STAR

c UL us LISTED

Technical Details (Continued)	
Power cord included	Yes
Power cord length (in)	63 (Full Length)
Drain hose length (in)	78 (Full Length)
Door hinge	Right Side (Reversible)
Dimensions & Weight	
Overall appliance dimensions (HxWxD)(in)	33 1/4" x 23 1/2" x 25"
Net weight (lbs)	99 lbs
Minimum stack height (in)	67 3/4"

ADA compliance
– Meets ADA height and access requirements *when installed on pedestal*.
– Meets ADA operable parts requirements for controls and lint filter.

Accessories—Optional

WTZ11400
Stacking kit with shelf

WTZ20410
Stacking kit without shelf

WMZ20500
Pedestal

WMZ20600
Drying Rack

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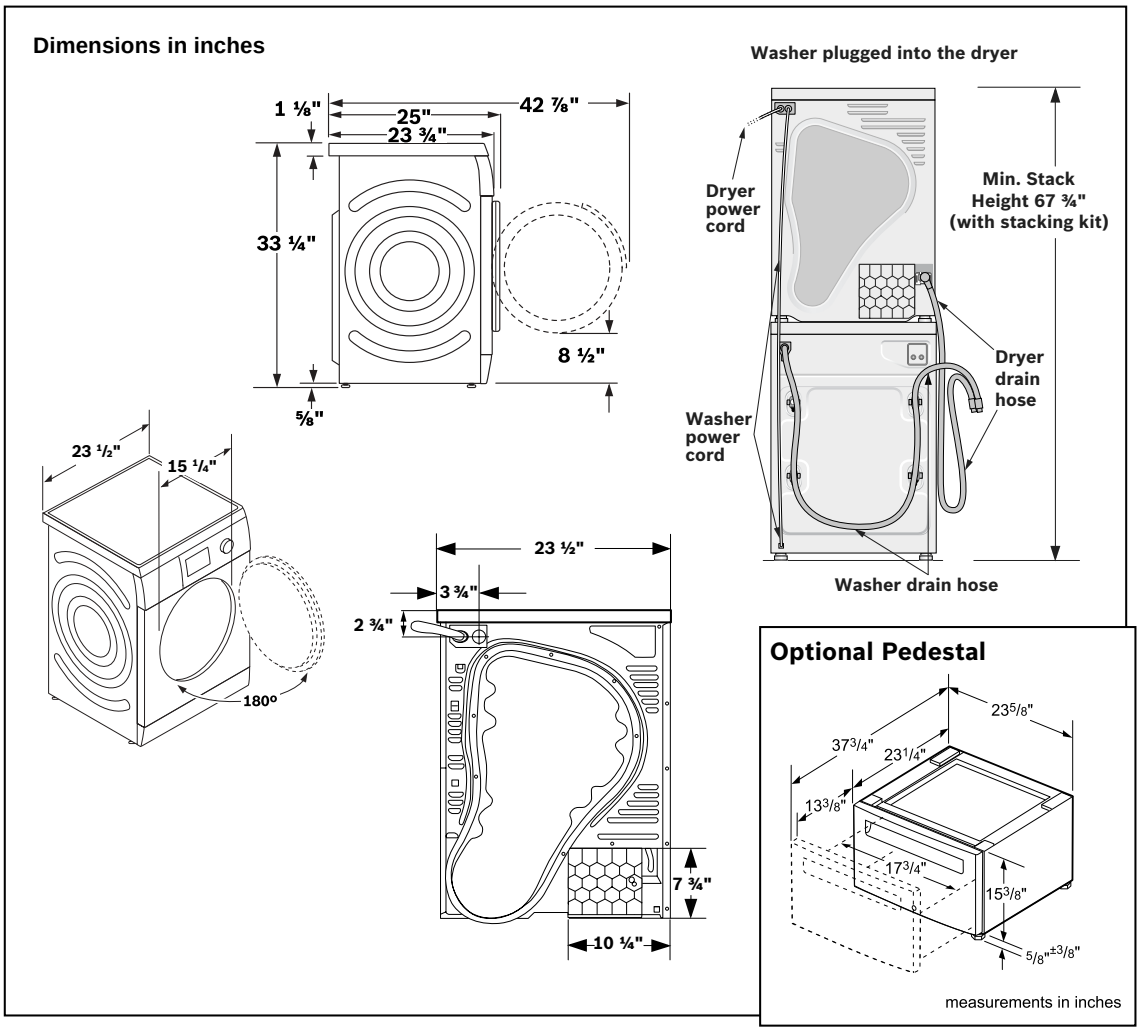
09/15

24" Compact Condensation Dryer

800 Series – WTG86402UC

BOSCH
Invented for life

Installation Details



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Invented for life

Installation Details

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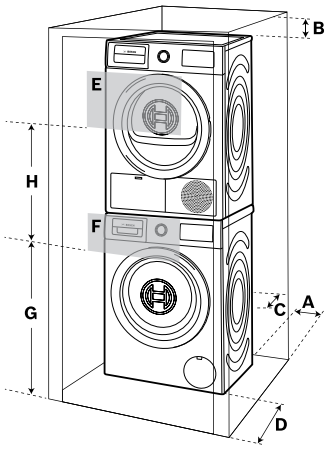

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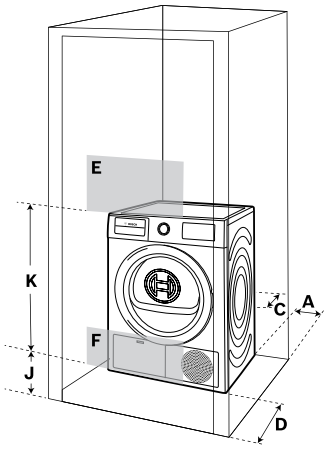

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D Front	2 1/2 in.
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E Top	63 sq. in
F Bottom	63 sq. in.
Vent Spacing	
G	37 in.
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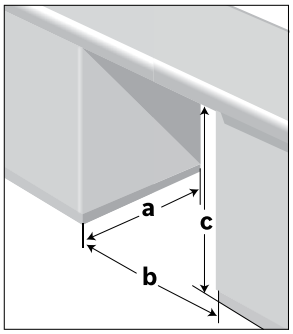
J	3 in.
K	29 in.

Enclosure Dimensions

Under Counter: (Preferred)



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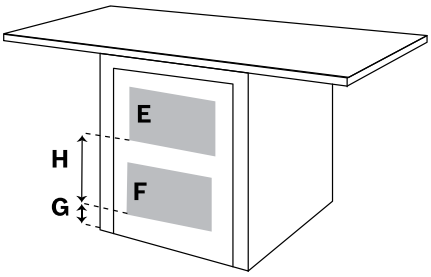

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09/15

29" Custom Insert

500 Series – Stainless Steel DHL755BUC

BOSCH
Invented for life

DHL755BUC

For fast and effective extraction, the high speed setting removes strong odors quickly and effectively.

Features & Benefits
Quickly and quietly clears the air of smoke and odor.
Allows you to adjust the performance of your hood to match the type of cooking.
Efficiently filters grease and other solid particles out of the extracted air.
Halogen lighting illuminates the cooking area efficiently.

General Properties	
Operating mode	Ducted
Maximum CFM	400 CFM
Number of speed settings	3-stage
Motor location	Integrated motor in hood body
Number of lights	2
Bulb type	Halogen
Total power of the lamps (W)	40 W
Damper included	Yes
Grease filter material	Aluminum
Grease filter type	Multilayer cassette
Technical Details	
Watts (W)	270 W
Volts (V)	120 V
Frequency (Hz)	60 Hz
Plug type	120V-3 Prong

Dimensions & Weight	
Overall appliance dimensions (width of canopy included) (HxWxD) (in.)	6 1/4" / x 28 11/16" x 15"
Required distance above cooktop/range cooking surface	30" Electric / 30" Gas
Diameter of air duct (in.) top	6"
Net weight (lbs)	23 lbs

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BOSCH
Invented for life

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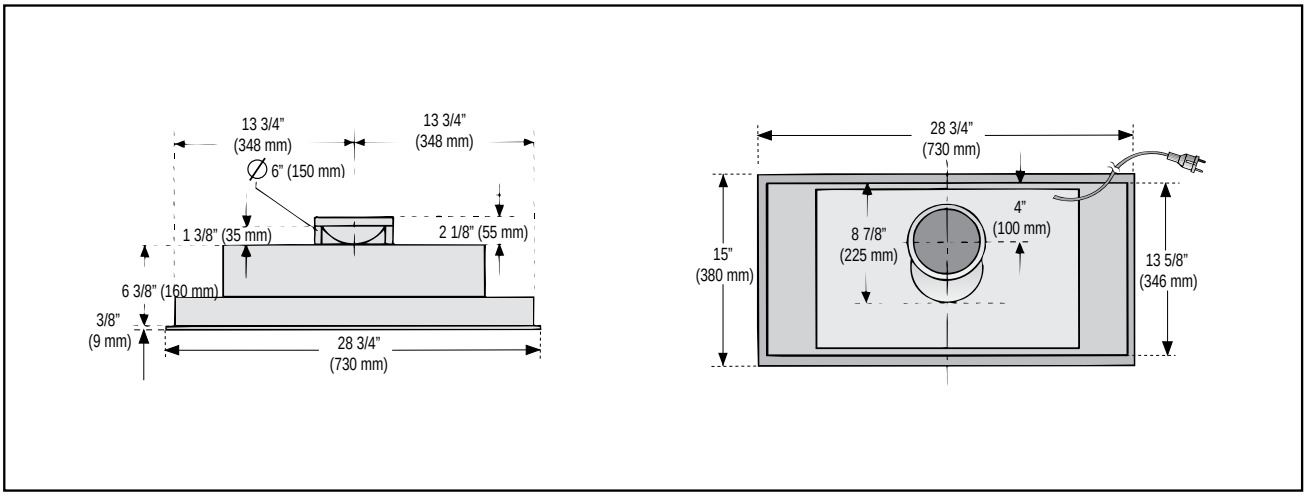

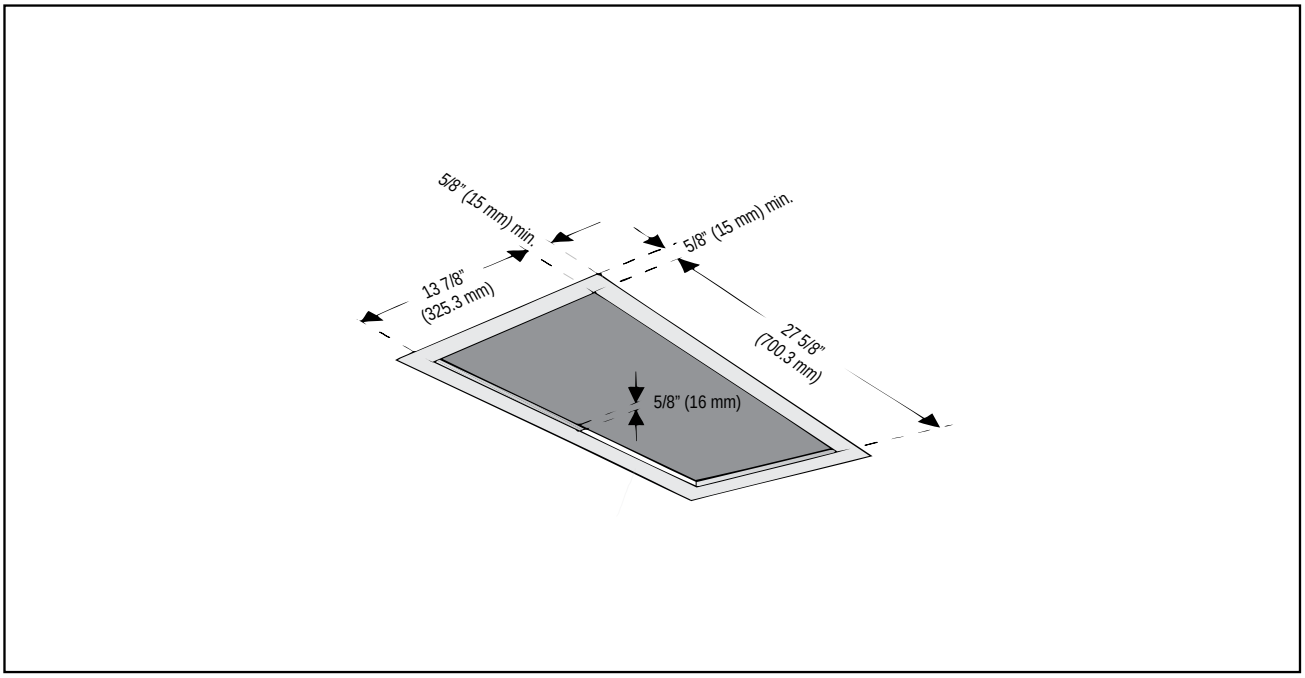

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09/15

FREEDOM LiftSystems

ACCESSIBILITY PROFESSIONALS

TECHNICAL INFORMATION

Baselift 6200 series

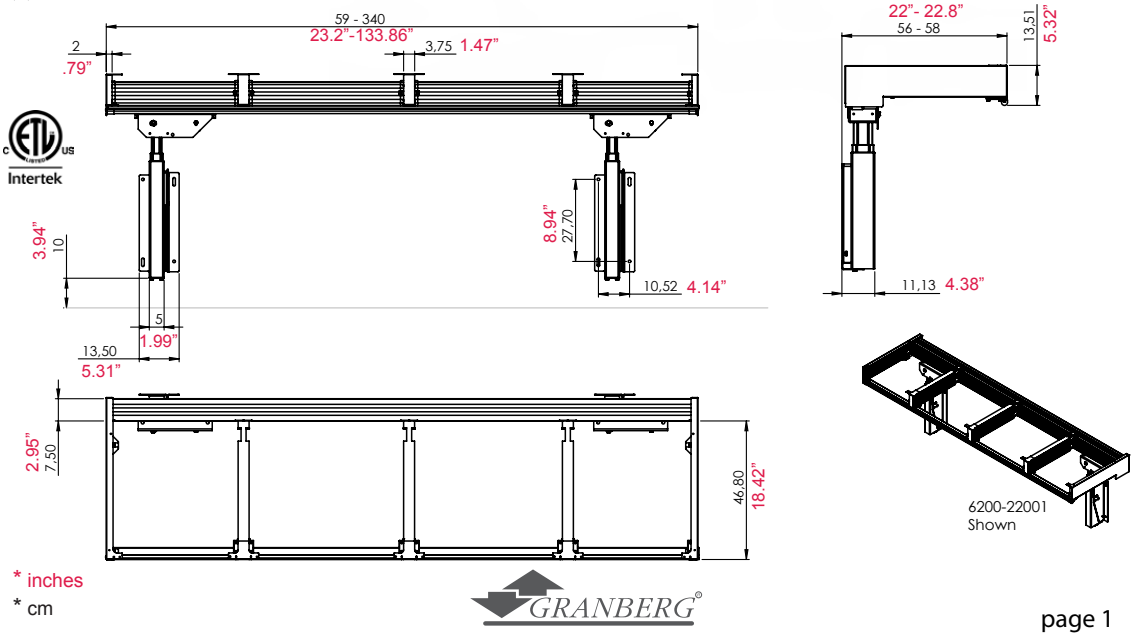
Installation: Wall
Adjustability: Motor-driven, continuously adjustable 30cm/11.8” (70-100cm/27.56-39.37”)
Speed: 1.5cm/sec (.6”/sec)
Operation: Built-in button or remote control
Safety: A security strip is located below the worktop’s front edge. Contact with the strip stops the lift.
Electrical connection: Mains plug for 110V
Connection of water and drainage: Connection is by means of flexible hoses
Max load: 100kg/220lb **Enclosure class**: IP20

Frame depth: 56-58cm / 22.05”-22.83” from wall

Dimensions cover plates: Width = Lift’s width, Height 43.8cm/17.24”, Thickness 1.2-1.6cm/.47-.62”
Depth worktop: 58.5-63cm/22.83-24.8
Width (model 6200): 59-340cm/23.2-133.86”
Space laterally to wall/adjoining cupboard: 0.5cm/.2”
Space to wall (for tiles): 1.5cm/.6”
Tiling: From 70cm/27.6” above floor (alternatively right down to floor)Delivery modules:

Assembled work surface incl. safety switch. Wall mounted motors.
Fittings supplied: Attachments for fronts (Counter tops and cabinetry not included)
Material: Frame in aluminum. Powder coated sheet-metal parts (Alu-grey RAL 9006), black motors

CE



* inches
* cm

GRANBERG®

FREEDOM LiftSystems

ACCESSIBILITY PROFESSIONALS

MODEL # Information

Baselift 6200 series

Frame system in anodised aluminium. Outer sides in alu design. Black motorised leg.

	Width	Planning width*	Sides		Art. no.	Price group	
BASELIFT 6200 **Incl. ALU control button** 2 x motorised leg							
	23.24″	23.62″	2		6200-05901	A	
	23.62″	24″	2		6200-06001	A	
	27.16″	27.56″	2		6200-06901	A	
	27.56″	27.95″	2		6200-07001	A	
	31.1″	31.5″	2		6200-07901	A	
	31.5″	31.9″	2		6200-08001	A	
	35.04″	35.43″	2		6200-08901	A	
	35.43″	35.83″	2		6200-09001	A	
	38.98″	39.37″	2		6200-09901	A	
	39.37″	39.76″	2		6200-10001	A	

Frame system in anodised aluminium. Outer sides in alu design. Black motorised leg.

	Width inches	Planning width*	Sides		Art. no.	Price group	
BASELIFT 6200 **Incl. ALU control button** 2 x motorised leg, 2 x intermediate side							
	42.91	43.3	4		6200-10901	A	
	43.3	43.7	4		6200-11001	A	
	46.85	47.24	4		6200-11901	A	
	47.24	47.64	4		6200-12001	A	
	50.79	51.18	4		6200-12901	A	
	51.18	51.57	4		6200-13001	A	
	54.72	55.12	4		6200-13901	A	
	55.12	55.51	4		6200-14001	A	
	58.67	59.06	4		6200-14901	A	
	59.06	59.45	4		6200-15001	A	
	62.6	62.99	4		6200-15901	A	
	62.99	63.38	4		6200-16001	A	
	66.53	66.93	4		6200-16901	A	
	66.99	67.32	4		6200-17001	A	
	70.47	70.86	4		6200-17901	A	
	70.87	71.26	4		6200-18001	A	

FREEDOM LiftSystems

ACCESSIBILITY PROFESSIONALS

MODEL # Information

Baselift 6200 series

Frame system in anodised aluminium. Outer sides in alu design. Black motorised leg.

	Width Inches	Planning width*	Sides		Art. no.	Price group	
BASELIFT 6200 **Incl. ALU control button** 2 x motorised leg, 3 x intermediate side							
	74.41	74.8	5		6200-18901	A	
	74.8	75.2	5		6200-19001	A	
	78.35	78.74	5		6200-19901	A	
	78.74	79.13	5		6200-20001	A	
	82.28	82.67	5		6200-20901	A	
	82.67	83.07	5		6200-21001	A	
	86.22	86.61	5		6200-21901	A	
	86.61	87.	5		6200-22001	A	
	90.16	90.55	5		6200-22901	A	
	90.55	90.94	5		6200-23001	A	
	94.09	94.49	5		6200-23901	A	
	94.49	94.88	5		6200-24001	A	
	98.03	98.42	5		6200-24901	A	
	98.42	98.03	5		6200-25001	A	
	101.97	102.36	5		6200-25901	A	
	102.36	102.75	5		6200-26001	A	

FREEDOM LiftSystems

ACCESSIBILITY PROFESSIONALS

MODEL # Information

Baselift 6200 series

Frame system in anodised aluminium. Outer sides in alu design. Black motorised leg.

	Width inches	Planning width*	Sides		Art. no.	Price group	
BASELIFT 6200 **Incl. ALU control button** 3 x motorised leg, 4 x intermediate side							
	105.9	106.3	6		6200-26901	A	
	106.3	106.69	6		6200-27001	A	
	109.84	110.24	6		6200-27901	A	
	110.24	110.63	6		6200-28001	A	
	113.78	114.17	6		6200-28901	A	
	114.17	114.57	6		6200-29001	A	
	117.71	118.11	6		6200-29901	A	
	118.11	118.5	6		6200-30001	A	
	121.65	122.05	6		6200-30901	A	
	122.05	122.44	6		6200-31001	A	
	125.59	125.98	6		6200-31901	A	
	125.98	126.37	6		6200-32001	A	
	129.53	129.92	6		6200-32901	A	
	129.92	130.31	6		6200-33001	A	
	133.46	133.85	6		6200-33901	A	
	133.85	134.25	6		6200-34001	A	

FREEDOM LiftSystems

ACCESSIBILITY PROFESSIONALS

Accessories Available

Baselift 6200 series

Cover panels for Baselift
White melamine,
thickness .63", height 17.2"

For 6200 models, 23" - 94.5"	6260-24000
For 6200 models, 94.8" - 133.85"	6260-34000
For 6201 models, 6203	6262-25500
For 6202 models	6266-25500

* Divided at 94.5"

Each article contains 2 panels.

Cover for baselift 61506
Grey Plastic

Drawers for baselift

Drawer which can be completely extended & cushioning Depth: 42 cm Height: 8.5 cm

Drawer 30 cm width 469-3006
Drawer 40 cm width 469-4006
Drawer 50 cm width 469-5006
Drawer 60 cm width 469-6006

Pull out Cutting Board for baselift 470-4006

Drawer made of steel plate in Alu-Design. Chopping board in beech incl. front in Alu-Design. Height: 5.5 cm (drawer)

Flexible Drain Hose for Baselift 61801

GRANBERG®

FREEDOM LiftSystems

ACCESSIBILITY PROFESSIONALS

Accessories Available

Baselift 6200 series

Stroke Limiter

The baselifts moves between 70-100cm + worktop.
For range between these measures you will need a stroke limiter.
BUT, even when using a stroke limiter the unit must be able to be lowered to the lowest position for (re)synchronizing!

Stroke limiter (start set) #61400
Used to limit vertical adjustment after installation.

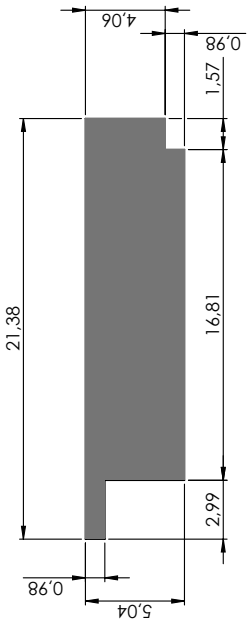
The start set contains programming box + memory adapter.

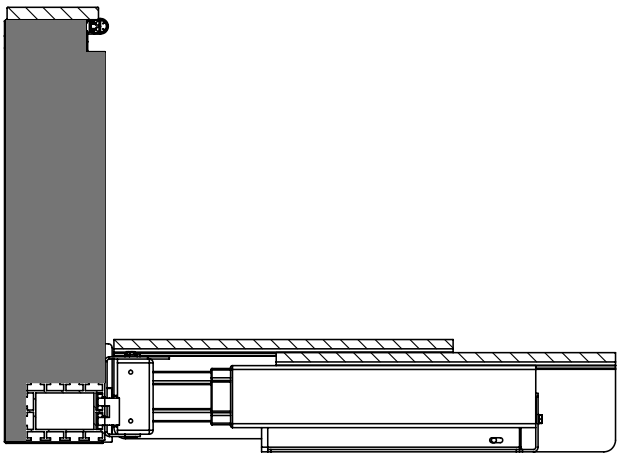
Memory adapter (to Stroke limiter)
Memory adapter. #61401
(If you already have a programming box)

The Memory adapter is used to limit vertical adjustment after installation.

ACCESSIBILITY PROFESSIONALS

Free space for sinks and hobs in Baselift, profile view.
(The appliances must fit within the greay area)





GRANBERG®

page 7

FreedomLiftSystems.com 1-877-947-7769

Specifications
Tek-Wall Measure Backed
399436

maharam

Application
Upholstered Walls, Walls
Note: This textile is available unbacked.

Characteristics
Content: 61% Solution-Dyed Polyolefin, 39% Solution-Dyed Post-Consumer Recycled Polyester
Finish: PFOA-Free Stain Resistant
Backing: Acrylic
Width: 54" (137cm)
Bolt Size: 50 yards (46 m)
Weight: 11.7 oz/ly (363 gr/lm)
Maintenance: W/S/B-Clean with water-based cleanser; mild, water-free dry cleaning solvent, or diluted household bleach.
Traffic: High-Suitable for all applications including heavy duty.
Country of Origin: USA
Note: Variations in color and texture are inherent to this textile.
Note on Mold: Intended for use in buildings designed and maintained to avoid moisture on or within walls. Application must conform to current Installation Guidelines included in each shipment or available at maharam.com.

Price
$29.00 / C$42.25 (FOB destination) / C$38.75 (FOB origin)
A $3.00/C$4.00 per yard cutting charge applies to orders under 50 yards.

Performance
Acoustic Rating: Upholstered Walls: ASTM C423 0.65 NRC
Flammability: This textile meets all appropriate flammability requirements for upholstered walls and walls. See flame certificate for test results.
Lightfastness: 200+ Hours

Environmental
Greenguard and Greenguard Gold Certified
Contains Recycled Content
FR Free
PFOA-Free Finish
Solution-Dyed Product
Produced in an ISO 14001 Facility

Warranty
10 years: Walls
3 years: Upholstered Walls.

Complete product information at maharam.com
800.645.3943

Specifications
Tek-Wall Measure Backed
399436

maharam

001 Vanilla

002 Atrium

003 Steeple

004 Dove

005 Tussah

006 Latte

Specifications
Taut
399568

maharam

Application
Walls

Characteristics
Content: 100% Non-Phthalate Vinyl
Finish: None
Backing: Polyester / Cotton Osnaburg
Width: 54" (137cm)
Repeat: Non-match
Bolt Size: 30 yards (27 m)
Class: Type II
Weight: 20 oz/ly (620 gr/lm)
Maintenance: W-Clean with water-based cleanser.
Traffic: High-Suitable for all applications including heavy duty.
Country of Origin: USA
Note: This product uses iridescent inks which produce subtle variations in color when viewed from different angles and under different light sources.
Note on Mold: Intended for use in buildings designed and maintained to avoid moisture on or within walls. Application must conform to current Installation Guidelines included in each shipment or available at maharam.com.

Price
$21.00 / C$31.50 (FOB destination) / C$28.00 (FOB origin)
A $3.00/C$4.00 per yard cutting charge applies to orders under 30 yards.

Performance
Flammability: This textile meets all appropriate flammability requirements for walls. See flame certificate for test results.
Lightfastness: 200+ Hours

Environmental
FR Free
Non-Phthalate Vinyl

Warranty
10 years.

Complete product information at maharam.com
800.645.3943

Specifications
Taut
399568

maharam

001 Aura


002 Whir


003 Vanish


004 Mood


005 Diadem


006 Terrain


007 Straw


008 Wax


009 Husk


010 Splendor


011 Twist


012 Renew


013 Tonic


014 Horizon


015 Ice


016 Reflect


017 Flint


018 Sentry


019 Majesty


020 Blossom


022 Tryst

Specifications
Spin
399833

maharam

Application
Walls

Characteristics
Content: 100% Vinyl
Finish: None
Backing: Polyester / Cotton Osnaburg
Width: 52" (132cm)
Repeat: 2 ½" V, 2 3/4" H (6cm V, 7cm H)
Bolt Size: 30 yards (27 m)
Class: Type II
Weight: 20 oz/ly (620 gr/lm)
Maintenance: W-Clean with water-based cleanser.
Traffic: High-Suitable for all applications including heavy duty.
Country of Origin: USA
Note on Mold: Intended for use in buildings designed and maintained to avoid moisture on or within walls. Application must conform to current Installation Guidelines included in each shipment or available at maharam.com.

Price
$25.00 / C$37.00 (FOB destination) / C$33.50 (FOB origin)
A $3.00/C$4.00 per yard cutting charge applies to orders under 30 yards.

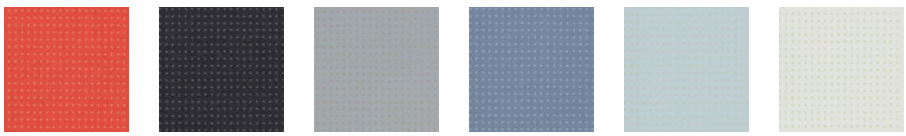
Performance
Flammability: This textile meets all appropriate flammability requirements for walls. See flame certificate for test results.
Lightfastness: 200+ Hours

Environmental
FR Free

Warranty
10 years.

Complete product information at maharam.com
800.645.3943

001 Spur | 002 Squall | 003 Fritter | 004 Rouse | 005 Mill | 006 Sundried



007 Fierce | 008 Disco | 009 Axle | 010 Portage | 011 Hull | 012 Lawn

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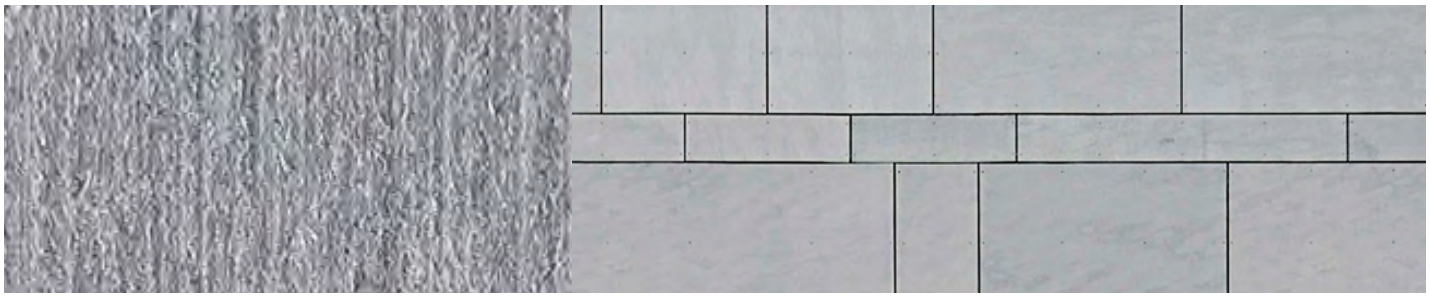
EQUITONE [tectiva]



Product Appearance

EQUITONE [tectiva] is a through coloured panel with no coating. As the panel has an honest, pure and natural appearance colour differences are possible. The surface of the sheet is characterised by fine sanding lines and white spots. The rear receives no back-sealing coating. The board receives a hydrophobation which prevents moisture ingress into the core of the panel.

Colour

As [tectiva] is an uncoated panel the Δ L is fluctuating more than a and b and is therefore the followed parameter.

	EQUITONE [tectiva]
Δ L brightness	± 2.50

Dimensions

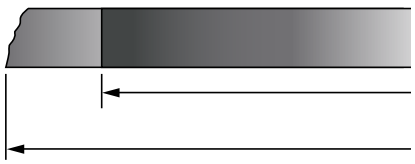
EQUITONE [tectiva] is available in 8mm thicknesses. The panels are also available in either untrimmed or trimmed formats.

Not rectified untrimmed	3070 x 1240 mm	2520 x 1240 mm
Rectified trimmed	3050 x 1220 mm	2500 x 1220 mm

Rectified Panels

The panels that come off the production line have untrimmed (not rectified) edges. These panels are available for distributors with the proper equipment to allow them to cut and trim the panel for any project. The factory also provides a cutting service for customers who do not have the necessary cutting facilities.

Approximately ±10mm needs to be trimmed from the untrimmed panel to ensure correct squareness of a full size panel.



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APPENDIX III
ELECTRICAL CUTSHEETS

Commercial charging solutions

Power Xpress bollards

The Power Xpress bollard provides reliable, safe EV charging in all conditions. Available as a single or double charging station bollard, the 1/4" gauge steel bollard protects your investment and is impact resistant.

Each bollard features the same fully weatherproof, adjustable output Power Xpress charging station with 23-foot cables and galvanized steel construction. Dual bollard charges 2 vehicles simultaneously at full power.

Specifications	Single Bollard	Dual Bollard		Single Bollard	Dual Bollard
Adjustable Amperage	12-32 Amps	12-32 Amps x2	Input Current	30 Amps	30 Amps x2
Voltage	96-264 VAC	96-264 VAC x2	Breaker Size	40 Amps	40 Amps x2
Cord Length	23 ft	23 ft x2	Temperature Rating	-40°F to +122°F (-40°C to +50°C)	
Weight	125 lbs	150 lbs	Enclosure	NEMA Type 4X; rain, sleet, snow, ice, cold, and heat resistant	
Dimensions	Diameter 7.2" Height 58"	Diameter 7.2" Height 68"	Input/Output Power	7.2 kW	7.2 kW x2

Commercial charging solutions

DC fast charging

The Power DC Plus can charge compatible vehicles to 80 percent in as little as 30 minutes. Manufacturers are building more electric vehicles with DC charging capability to provide more convenience and faster charging to their customers.

The compact, lightweight design can be pedestal or wall-mounted and can be operated as a standalone unit or connected to an OCPP compatible back end network. The 25kW Power DC Plus can reduce installation costs by only requiring a 240V circuit compared to other stations needing a 480v 3 phase circuit .

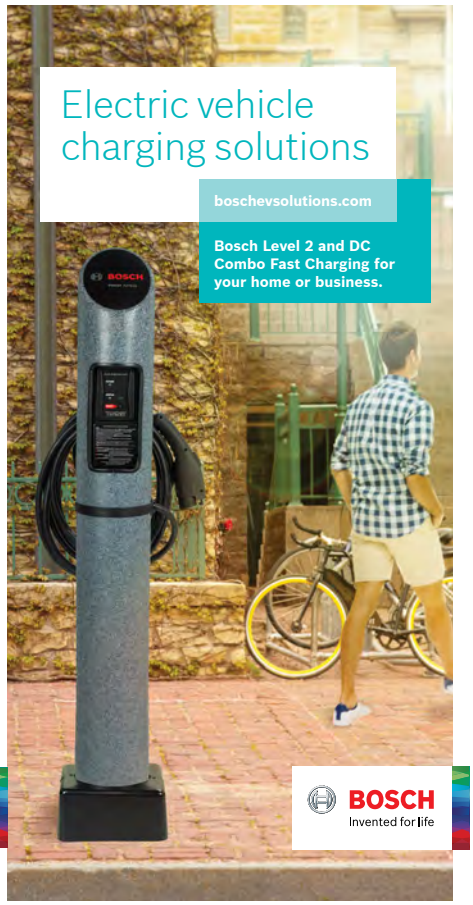
Specifications			
Part Number[1]	EL-52240	Mounting	Wall or Pedestal
Input Voltage	208v/240v, single phase	Input Current	165 Amps max
Cord Length	20 ft	Connector	J1772 SAE DC Combo
Weight	104 lb assembled (65 lb with modules removed)	Enclosure	IP54: indoor / outdoor
Dimensions	600mm x 250mm x 450mm (23"x 10" x 18")	Power Output	25kW

To purchase a Bosch charging station, visit boschevsolutions.com or call +1 877 805-3873

Robert Bosch GmbH
Bosch Automotive Service Solutions
28635 Mound Road
Warren, MI 48092

boschevsolutions.com
+1 877 805-3873

BOSCH
Invented for life



APPENDIX III ELECTRICAL CUTSHEETS

Residential charging solutions

Power Max 2 and Power Max 2Plus

Charge at up to 40 amps with a 25-foot cable for larger-capacity EV batteries. Simple and safe plug-in installation. The NEMA 6-50 Plug includes a thermal sensor to protect against the possibility of overheating. Power Max 2 Plus features Wi-Fi connectivity for remote control and monitoring of your charging station*.

The compact and sleek design is weather-resistant and can be installed inside a garage or outdoors.

The Power Max 2 family includes 30-amp and 40-amp options with various cable lengths. All charging stations are cUL and UL listed and meet or exceed NEC 625, SAE J1882 and NEMA 3R standards.

Specifications	30A / 18' cable	40A / 18' cable	40A / 25' cable	40A / 25' Plus cable
Part No.	EL-51866-3018	EL-51866-4018	EL-51866-4025	EL-51866-4025P
USB data storage	Yes	Yes	Yes	Yes
Networking	No	No	No	Yes, 802.11 b/g/n, OCPP 1.5
Amperage	30 Amps	40 Amps	40 Amps	40 Amps
Voltage	208 VAC- 240 VAC	208 VAC- 240 VAC	208 VAC- 240 VAC	208 VAC- 240 VAC
Cable Length	18 ft	18 ft	25 ft	25 ft
Dimensions	12.6 x 10.3 x 4.5	12.6 x 10.3 x 4.5	12.6 x 10.3 x 4.5	12.6 x 10.3 x 4.5
Input/Output Power	7.2 kW	9.6 kW	9.6 kW	9.6 kW
Enclosure	NEMA Type 3R; indoor/outdoor	NEMA Type 3R; indoor/outdoor	NEMA Type 3R; indoor/outdoor	NEMA Type 3R; indoor/outdoor
Wall Plug	6-50P	6-50P	6-50P	6-50P

* Requires 3rd party OCPP network.

Residential charging stations

Power Max

The original Power Max will work with all electric vehicles in North America, providing unparalleled value and reliability. The weather-resistant housing is suitable for indoor or outdoor installations.

With 16- and 30-amp options and a cable length up to 25 feet, there is a Power Max to perfectly match your charging needs. Charge at up to 7.2 kW for larger EV batteries, reducing overall charging time compared to the factory 110V cordset.

Bosch has engineered Power Max to meet or exceed SAE J1772, NEC 625 and NEMA 3R standards. Power Max has earned cUL and UL listing with integrated safety features that protect the driver and vehicle.

Specifications			
Part No.	EL-51245	EL-51253	EL-51254
Amperage	16 Amps	30 Amps	30 Amps
Voltage	208 VAC- 240 VAC	208 VAC- 240 VAC	208 VAC- 240 VAC
Cable Length	12 ft	18 ft	25 ft
Weight	11 lbs	14 lbs	17 lbs
Dimensions	16 x 14 x 5	16 x 14 x 5	16 x 14 x 5
Input/Output Power	3.3 kW	7.2 kW	7.2 kW
Enclosure	NEMA Type 3R; indoor/outdoor	NEMA Type 3R; indoor/outdoor	NEMA Type 3R; indoor/outdoor

Residential charging stations

Power Xpress

The first weatherproof charging station from Bosch. Power Xpress debuted in 2011 and has been installed in thousands of homes and businesses.

Movable design, adjustable amperage, Plug in option, and a generous 18' cable.

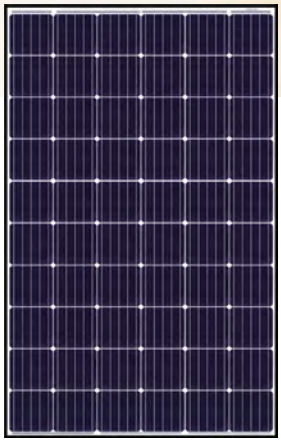
The Power Xpress is wind, rain, snow, sleet, ice, cold and heat resistant, making it ideal for indoor or outdoor installation. It meets or exceeds NEMA 4X, NEC 625, SAE J1772 standards and is UL, ETL and cETL listed.

Specifications			
Adjustable Amperage	12-32 Amps	Input/Output Power	7.2 kW
Voltage	96-264 VAC	Wall Plug	6-50P
Cable length	18 ft	Enclosure	NEMA 4X Type 4; rain, sleet, snow, ice, dust, cold, and heat resistant
Weight	14 lbs	Mounting	Wall or Pedestal
Dimensions	14"L x 5"W x4"D		

CS6K-285|290MS-SD

Canadian Solar's SmartDC module features an innovative integration of Canadian Solar's SuperPower module technology and SolarEdge's power optimization for grid-tied PV applications. By replacing the traditional junction-box with a power optimizer, the SmartDC module optimizes power output at module-level. With this feature, the SmartDC module can eliminate module-level mismatch and decrease shading losses. Furthermore, the SmartDC module provides module-level monitoring that allows effective system management and minimizes operational costs.

Optimized by solaredge



KEY FEATURES

Harvests up to 25% more energy from each module
- Maximizes power from each individual module against potential mismatch risk
- Decreases shading losses

Easy installation, simple system design
- Integrated smart solution, no need to add other accessories
- Enhances the shading tolerance

Reduces BoS Costs
- Up to 11.25 kW ~ 12.75 kW per string allows for more modules to be based on different inverters

Free module-level monitoring system
- Full visibility of system performance with a free smartphone app

Safety
- Automatic drop of DC current and voltage when inverter or grid power is shut down

25 years linear power output warranty

10 years product warranty on materials and workmanship

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001:2008 / Quality management system
ISO/TS 16949:2009 / The automotive industry quality management system
ISO 14001:2004 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety

PRODUCT CERTIFICATES*

IEC 61215 / IEC 61730: VDE/CE
UL 1703: CSA

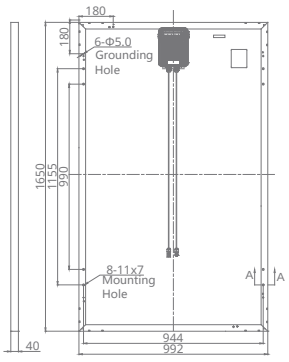
*As there are different certification requirements in different markets, please contact your Canadian Solar sales representative for the specific certificates applicable to the products.

CANADIAN SOLAR INC. is committed to providing high quality solar products, solar system solutions and services to customers around the world. As a leading manufacturer of solar modules and PV project developer with over 14 GW of premium quality modules deployed around the world since 2001, Canadian Solar Inc. (NASDAQ: CSIQ) is one of the most bankable solar companies worldwide.

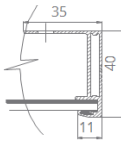
CANADIAN SOLAR (USA) INC.
2420 Camino Ramon, 125 Suite San Ramon, CA, USA 94583-4385, www.canadiansolar.com, sales.us@canadiansolar.com

ENGINEERING DRAWING (mm)

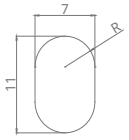
Rear View



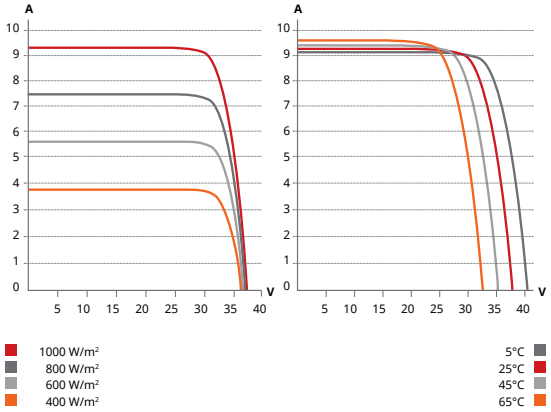
Frame Cross Section A-A



Mounting Hole



CS6K-285MS / I-V CURVES



ELECTRICAL DATA / STC

Power Optimizer connected to a SolarEdge Inverter

CS6K	285MS-SD	290MS-SD
Nom. Max. PWR (Pmax STC)	285 W	290 W
Nom. Max. PWR (Pmax NOCT)	207 W	210 W
Open Circuit Voltage (Voc STC)	39.1 V	39.3 V
Output Voltage Range (Vout)	5-60 V	5-60 V
Max. Output Current (Imax)	15 A	15 A
Max. Series Fuse Rating	20 A	20 A
Module Efficiency	17.41 %	17.72 %
Output During Standby (power optimizer disconnected from inverter or inverter off)	1 V	

MECHANICAL DATA OF PV MODULE

Specification	Data
Cell Type	Mono-crystalline, 6 inch
Cell Arrangement	60 (6×10)
Dimensions	1650×992×40 mm (65.0×39.1×1.57 in)
Weight	19.3 kg (42.5 lbs)
Front Cover	3.2 mm tempered glass
Frame Material	Anodized aluminium alloy
J-Box	IP65
Cable	PV1-F 1*6.0 mm² / 952 mm
Connectors	MC4
Standard Packaging (quantity & weight per pallet)	26 pieces, 548 kg (1208 lbs)
Module Pieces per Container	728 pieces (40' HQ)

PV SYSTEM DESIGN

Min. String Length	EU & APAC	1 ph	8	
		3 ph	16	
		3 ph - MV	18	
	US & Canada	1 ph	8	
		3 ph (208 V)	10	
Max. String Length	EU & APAC	1 ph	18	18
		3 ph	39	38
		3 ph - MV	44	43
	US & Canada	1 ph	18	18
		3 ph (208 V)	21	20
Max. Power per String (W)	EU & APAC	1 ph	5250	
		3 ph	11250	
		3 ph - MV	12750	
	US & Canada	1 ph	5250	
		3 ph (208 V)	6000	
Parallel Strings of Diff. Lengths			Yes	
Parallel Strings of Diff. Orientations			Yes	
Operating Temperature			-40°C ~ +85°C	
Max. System Voltage			1000 V (IEC) / 600 V (UL)	
Application Classification			Class A	
Fire Rating			Type 1 (UL1703) / Class C (IEC61730)	
Power Tolerance			0 ~ +5 W	

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.41% / °C
Temperature Coefficient (Voc)	-0.31% / °C
Temperature Coefficient (Isc)	0.053 % / °C
Nominal Operating Cell Temperature	45±2°C

STANDARD COMPLIANCE

Specification	Standard
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3
PV Module	IEC61215, IEC61730, UL1703, CEC listing
PV Optimizer J-Box	EN50548, UL3730, IEC2109-1 (class II safety), UL1741
Fire Safety	VDE-AR-E 2100-712:2013-05

PARTNER SECTION

CANADIAN SOLAR (USA) INC.

CATALOG NUMBER DESCRIPTION

QO® Load Centers

Number Segment	Character	Description	QO®	1	3040	L	200	G	—	—
Load Center Family	QO®	UL and NOM Listed								
	CQO	CSA® Certified								
Phase	1	Blank or 1 = Single								
		3 = Three								
Spaces / Circuits	3040									
Mains Type	M	Main circuit breaker								
	MX	Main circuit breaker for Automatic Transfer Switch								
	L	Main lugs								
	U	Universal mains (studs only)								
Amperes										
Grounding Bar	Blank	Purchase separately								
	G	Included								
	N	Neutral installed								
	T	Factory-installed								
Cover	Blank	Purchase cover separately								
	C	Combination flush / surface indoor cover								
	DF	Flush cover with door								
	DS	Surface cover with door								
	F	Flush cover								
	R	Rainproof								
	RB	Rainproof for B hub								
	S	Surface cover								
Special Construction	CU	Copper bussing								
	FT	Feed-thru lugs								
	GP	Generator panel								
	NM	Non-metallic enclosure								
	R	Generator receptacle								
	WG	Wide gutter riser panel								

SQO120GFI SQD SP 120/240V 20A

SQO120AFI SQD SP-240V-20A CB

SQD SP 120/240V 20A

QO® Circuit Breakers

Number Segment	Character	Description	QO®	1	15	—
Brand	QO	Full Size				
	QOT	Tandem				
Number of Poles						
Amperes						
Device Name	Blank	10,000 AIR				
	EPD	30 mA equipment ground fault protection				
	GFI	Ground fault circuit interruption				
	HID	For use on high intensity discharge lighting systems				
	HM	High magnetic trip circuit breakers are recommended for applications where high initial inrush current may occur				
	K	Key operated				
	PL	Remote control switching capability				
	SWN	Switch neutral common trip				
	VH	22,000 AIR				
	AFI	Arc fault circuit interruption				
	CAFI	Combination arc fault circuit interruption				

200A & 225A Semi-flush Combination Service Entrance Devices

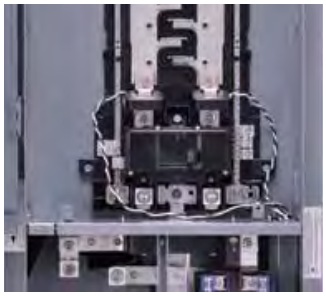
for Photovoltaic Systems

Square D® brand semi-flush combination service entrance devices (CSEDs) are available for use with photovoltaic (PV) system applications and provide a point of connection for utility interactive inverters as defined in NFPA 70, 2008 NEC® Article 690.64 (B). In addition, these products have provisions for PV current transformers (CT) on the load side of the service disconnect when required for PV data monitoring.

Semi-flush devices are available with a 200A or 225A, 120/240 Vac main breaker and Homeline® 26 space/36 circuit interior configurations. An optional 2-Pole Homeline breaker retaining kit is available for the inverter connection point back-fed breaker, as needed.

Features

- Solar ready for new or future installations
- Provisions for two field-install CTs
- Suitable for use with utility-interactive inverter
- Available with 200A or 225A factory installed main breaker
- 225A Max. rating – 2008 NEC 690.64 (B)(2)
- 120/240 Vac, four jaw meter socket with ring style meter cover
- 22kA/10kA series rating
- Combination overhead*/underground service entrance



Application Information

Field-installed current transformers must meet the following specifications:

- Type – Split core current transformer
- Maximum external dimensions – 2.10" x 2.10" x .61"
- Minimum internal window dimensions – .75" x .75" opening
- Insulation voltage rating – 600 Vac
- Certification – UL recognized

Components/Device	Catalog No.	Enclosure Type	Main Ratings	Spaces/ Circuits	UPC
200A semi-flush CSED for PV systems	SC2636M200FPV	Semi-flush	200A	26/36	7 85901 49329 7
225A semi-flush CSED for PV systems	SC2636M225FPV	Semi-flush	225A	26/36	7 85901 48095 2
Optional retaining kit for backfed 2-Pole Homeline inverter breaker	PK2SCPV	N/A	N/A	N/A	7 85901 59142 9
*Optional overhead feed tunnel kit	SCTK30	N/A	N/A	N/A	7 85901 39075 6

SQUARE D by Schneider Electric

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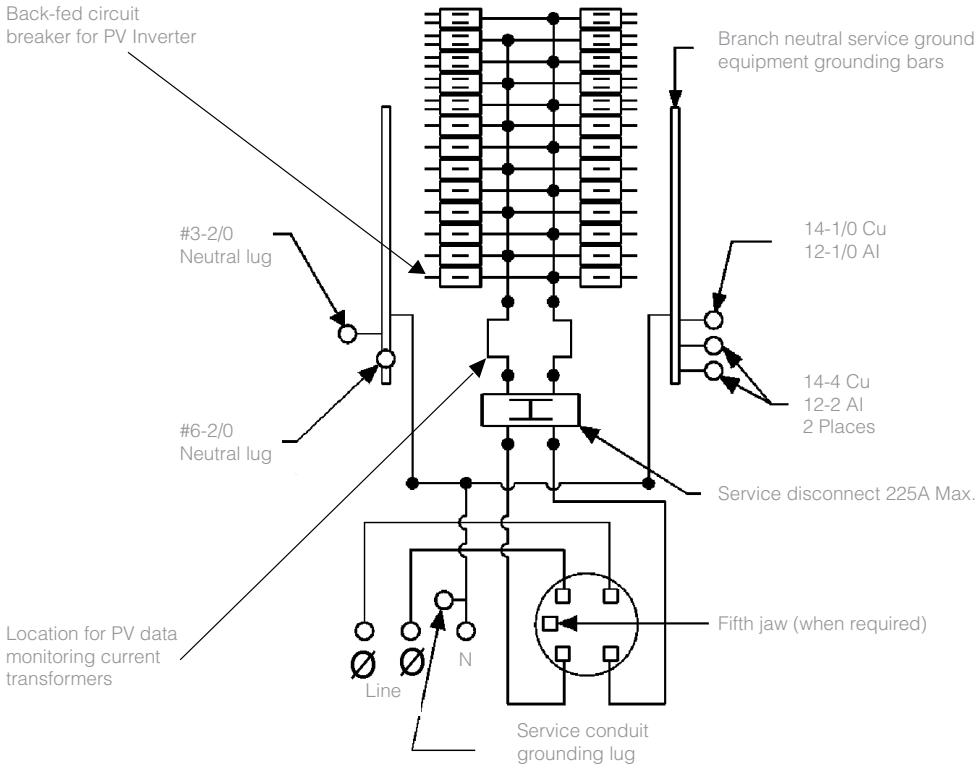
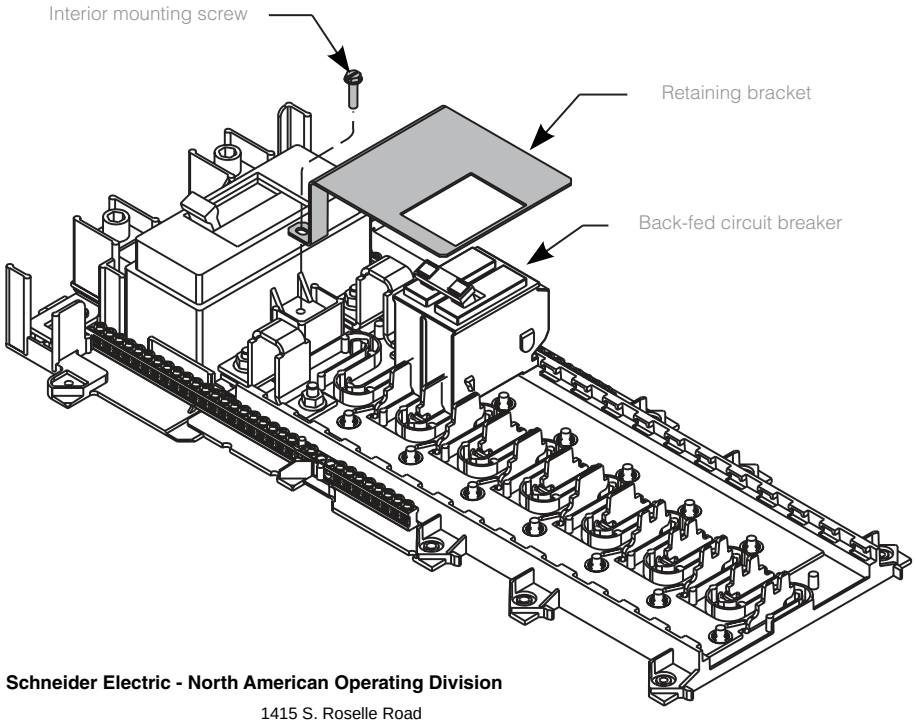
CSED Wiring Diagram



Optional Back-fed Inverter Breaker Retaining Kit – PK2SCPV



Schneider Electric - North American Operating Division

1415 S. Roselle Road
Palatine, IL 60067
Tel: 847-397-2600
Fax: 847-925-7500

Document Number 4119HO0801

06-08 lh

Product data sheet
Characteristics

H323N
SWITCH FUSIBLE HD 240V 100A 3P /NEUTRAL

Product availability : Stock - Normally stocked in distribution facility

Price* : 842.00 USD

Main

Product	Single Throw Safety Switch
Line Rated Current	100 A
Certifications	UL listed
Enclosure Rating	NEMA 1 steel
Factory Installed Neutral	Neutral (factory installed)
Disconnect Type	Fusible disconnect
Short Circuit Current Rating	10 kA H or K 200 kA R, J or L
Mounting Type	Surface
Number of Poles	3
Electrical Connection	Lugs
Duty Rating	Heavy duty
System Voltage	250 V DC 240 V AC
Wire Size	AWG 14...AWG 1/0 (copper) AWG 12...AWG 1/0 (aluminium)

Ordering and shipping details

Category	00008 - H&HU SW,2&3P,N1,30-200A
Discount Schedule	DE1
GTIN	00785901480464
Nbr. of units in pkg.	1
Package weight(Lbs)	17.900000000000002
Returnability	Y
Country of origin	US

Offer Sustainability

Sustainable offer status	Green Premium product
RoHS (date code: YYWW)	Compliant - since 1313 - Schneider Electric declaration of conformity Schneider Electric declaration of conformity
REACh	Reference not containing SVHC above the threshold Reference not containing SVHC above the threshold
Product environmental profile	Available
Product end of life instructions	Need no specific recycling operations

Contractual warranty

Warranty period	18 months

Product data sheet
Characteristics

HOM1224M100PC
HOM INDR 100A MB 12/24CIR

Product availability : Stock - Normally stocked in distribution facility

Price* : 294.00 USD

Main

Product or component type	Load Center
Range of product	Homeline
Load center type	Main breaker
Line Rated Current	100 A
Number of spaces	12
Number of circuits	24
NEMA degree of protection	NEMA 1 indoor
Cover type	Combination flush/surface cover
Electrical connection	Lugs
Provided equipment	Circuit breaker [Space(1) 2P 100 A 120/240 V AC main supply ready assembled

Complementary

Short-circuit current	22 kA
Number of tandem circuit breakers	12
Phase	1 phase
System Voltage	120/240 V AC
AWG gauge	AWG 6...AWG 2/0 aluminium/copper
Wiring configuration	3-wire
Material	Tin plated aluminium busbar
Enclosure material	Welded sheet steel
Cover finish	Gray baked enamel
Box number	6

Environment

Product certifications	UL E-6294

Ordering and shipping details

Category	00045 - HOM LC&CVR,12-42 CKT,NEMA1
Discount Schedule	DE3C
GTIN	00785901863540
Nbr. of units in pkg.	1
Package weight(Lbs)	18.300000000000001
Returnability	Y
Country of origin	US

Offer Sustainability

Sustainable offer status	Green Premium product
RoHS (date code: YYWW)	Compliant - since 1414 - Schneider Electric declaration of conformity Schneider Electric declaration of conformity
REACh	Reference not containing SVHC above the threshold Reference not containing SVHC above the threshold
Product environmental profile	Available
Product end of life instructions	Need no specific recycling operations

ACCESSORIES

SolarEdge Electricity Meter

for North America

SE-MTR240-2-200-S1 / SE-MTR240-2-400-S1

SolarEdge Electricity Meter

- Simple installation and connectivity
- Type NEMA 3R enclosure for outdoor protection
- Provides high accuracy meter readings
- Communicates over RS485 to provide monitoring data
- Suitable for export limitation, consumption monitoring and StorEdge™ applications

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SolarEdge Power Optimizer

Module Add-On for North America

P300 / P320 / P400 / P405

	P300 (for 60-cell modules)	P320 (for high-power 60-cell modules)	P400 (for 72 & 96-cell modules)	P405 (for thin film modules)	
INPUT					
Rated Input DC Power[1]	300	320	400	405	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	48		80	125	Vdc
MPPT Operating Range	8 - 48		8 - 80	12.5 - 105	Vdc
Maximum Short Circuit Current (Isc)	10	11	10.1		Adc
Maximum DC Input Current	12.5	13.75	12.63		Adc
Maximum Efficiency	99.5				%
Weighted Efficiency	98.8				%
Overvoltage Category	II				
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)					
Maximum Output Current	15				Adc
Maximum Output Voltage	60			85	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)					
Safety Output Voltage per Power Optimizer	1				Vdc
STANDARD COMPLIANCE					
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3				
Safety	IEC62109-1 (class II safety), UL1741				
RoHS	Yes				
INSTALLATION SPECIFICATIONS					
Maximum Allowed System Voltage	1000				Vdc
Compatible inverters	All SolarEdge Single Phase and Three Phase inverters				
Dimensions (W x L x H)	128 x 152 x 27.5 / 5 x 5.97 x 1.08		128 x 152 x 35 / 5 x 5.97 x 1.37	128 x 152 x 50 / 5 x 5.97 x 1.96	mm / in
Weight (including cables)	630 / 1.4		750 / 1.7	845 / 1.9	gr / lb
Input Connector	MC4 Compatible				
Output Wire Type / Connector	Double Insulated; MC4 Compatible				
Output Wire Length	0.95 / 3.0		1.2 / 3.9		m / ft
Operating Temperature Range	-40 - +85 / -40 - +185				˚C / ˚F
Protection Rating	IP68 / NEMA6P				
Relative Humidity	0 - 100				%

[1] Rated STC power of the module. Module of up to +5% power tolerance allowed.

PV SYSTEM DESIGN USING A SOLAREDGE INVERTER[2]	SINGLE PHASE	THREE PHASE 208V	THREE PHASE 480V	
Minimum String Length (Power Optimizers)	8	10	18	
Maximum String Length (Power Optimizers)	25	25	50	
Maximum Power per String	5250	6000	12750	W
Parallel Strings of Different Lengths or Orientations	Yes			

[2] It is not allowed to mix P405 with P300/P400/P600/P700 in one string.

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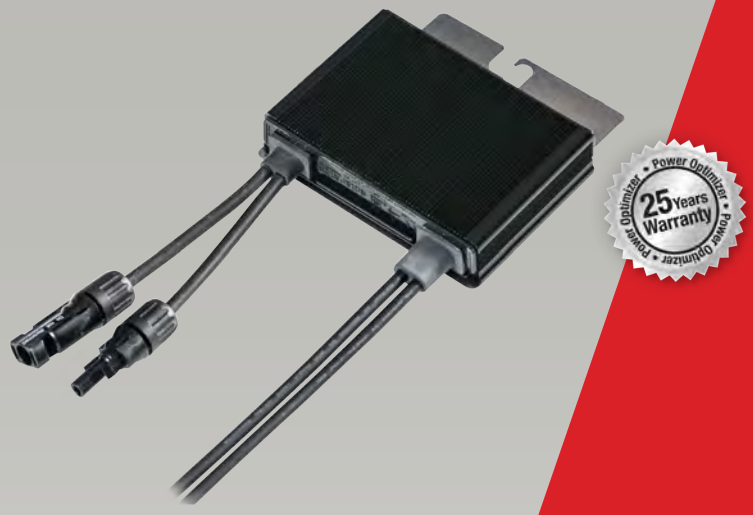
SolarEdge Power Optimizer

Module Add-On For North America

P300 / P320 / P400 / P405

POWER OPTIMIZER



PV power optimization at the module-level

- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch losses, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Fast installation with a single bolt
- Next generation maintenance with module-level monitoring
- Module-level voltage shutdown for installer and firefighter safety

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SolarEdge Power Optimizer

Module Add-On for North America

P300 / P320 / P400 / P405

	P300 (for 60-cell modules)	P320 (for high-power 60-cell modules)	P400 (for 72 & 96-cell modules)	P405 (for thin film modules)	
INPUT					
Rated Input DC Power[1]	300	320	400	405	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	48		80	125	Vdc
MPPT Operating Range	8 - 48		8 - 80	12.5 - 105	Vdc
Maximum Short Circuit Current (Isc)	10	11	10.1		Adc
Maximum DC Input Current	12.5	13.75	12.63		Adc
Maximum Efficiency	99.5				%
Weighted Efficiency	98.8				%
Overvoltage Category	II				
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)					
Maximum Output Current	15				Adc
Maximum Output Voltage	60			85	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)					
Safety Output Voltage per Power Optimizer	1				Vdc
STANDARD COMPLIANCE					
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3				
Safety	IEC62109-1 (class II safety), UL1741				
RoHS	Yes				
INSTALLATION SPECIFICATIONS					
Maximum Allowed System Voltage	1000				Vdc
Compatible inverters	All SolarEdge Single Phase and Three Phase inverters				
Dimensions (W x L x H)	128 x 152 x 27.5 / 5 x 5.97 x 1.08		128 x 152 x 35 / 5 x 5.97 x 1.37	128 x 152 x 50 / 5 x 5.97 x 1.96	mm / in
Weight (including cables)	630 / 1.4		750 / 1.7	845 / 1.9	gr / lb
Input Connector	MC4 Compatible				
Output Wire Type / Connector	Double Insulated; MC4 Compatible				
Output Wire Length	0.95 / 3.0		1.2 / 3.9		m / ft
Operating Temperature Range	-40 - +85 / -40 - +185				˚C / ˚F
Protection Rating	IP68 / NEMA6P				
Relative Humidity	0 - 100				%

[1] Rated STC power of the module. Module of up to +5% power tolerance allowed.

PV SYSTEM DESIGN USING A SOLAREDGE INVERTER[2]	SINGLE PHASE	THREE PHASE 208V	THREE PHASE 480V	
Minimum String Length (Power Optimizers)	8	10	18	
Maximum String Length (Power Optimizers)	25	25	50	
Maximum Power per String	5250	6000	12750	W
Parallel Strings of Different Lengths or Orientations	Yes			

[2] It is not allowed to mix P405 with P300/P400/P600/P700 in one string.

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SolarEdge Single Phase StorEdge™ Solutions for North America

STOREDGE™

SolarEdge StorEdge™ Solutions Benefits:

- **More Energy** - DC-coupled architecture stores PV power directly to the battery without AC conversion losses
- **Simple Design & Installation** - single inverter for PV, battery storage, grid-tied and backup applications
- **Enhanced Safety** - no high voltage during installation, maintenance or firefighting
- **Full Visibility** - monitor battery status, PV production, remaining backup power and self-consumption data

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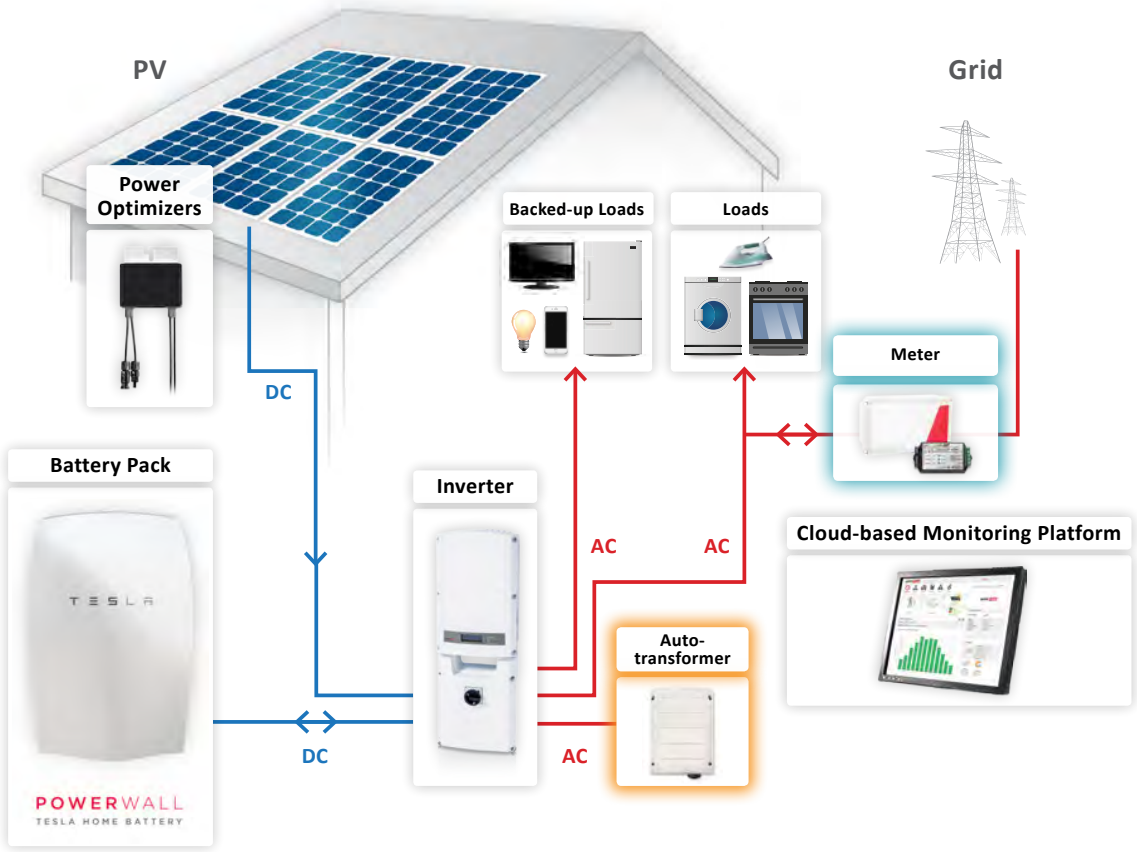
SolarEdge Single Phase StorEdge™ Solutions for North America

StorEdge™ Features:

- Smart Energy Management - export control, time-of-use shifting, maximized self-consumption, demand response and peak shaving capabilities
- Backup power - automatically provides power to backed-up loads in the event of grid interruption
- All-in-one solution uses a single DC optimized phase inverter to manage and monitor both PV generation and energy storage
- Compatible with Tesla Powerwall Home Battery



SolarEdge StorEdge™ Solutions for North America - Product Selector				
	Grid-tied solar, backup power and smart energy management	Grid-tied solar and backup power	Grid-tied solar and smart energy management	
Single Phase StorEdge™ Inverter	✓	✓	✓	
Auto-transformer	✓	✓		
SolarEdge Electricity Meter	✓		✓	
Battery	✓	✓	✓	

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SolarEdge Single Phase StorEdge Inverter
for North America SE7600A-USS2

- Single inverter for PV, grid-tied storage and backup power
- Includes the hardware required to provide automatic backup power to backed-up loads in case of grid interruption
- Includes all interfaces needed for battery connection

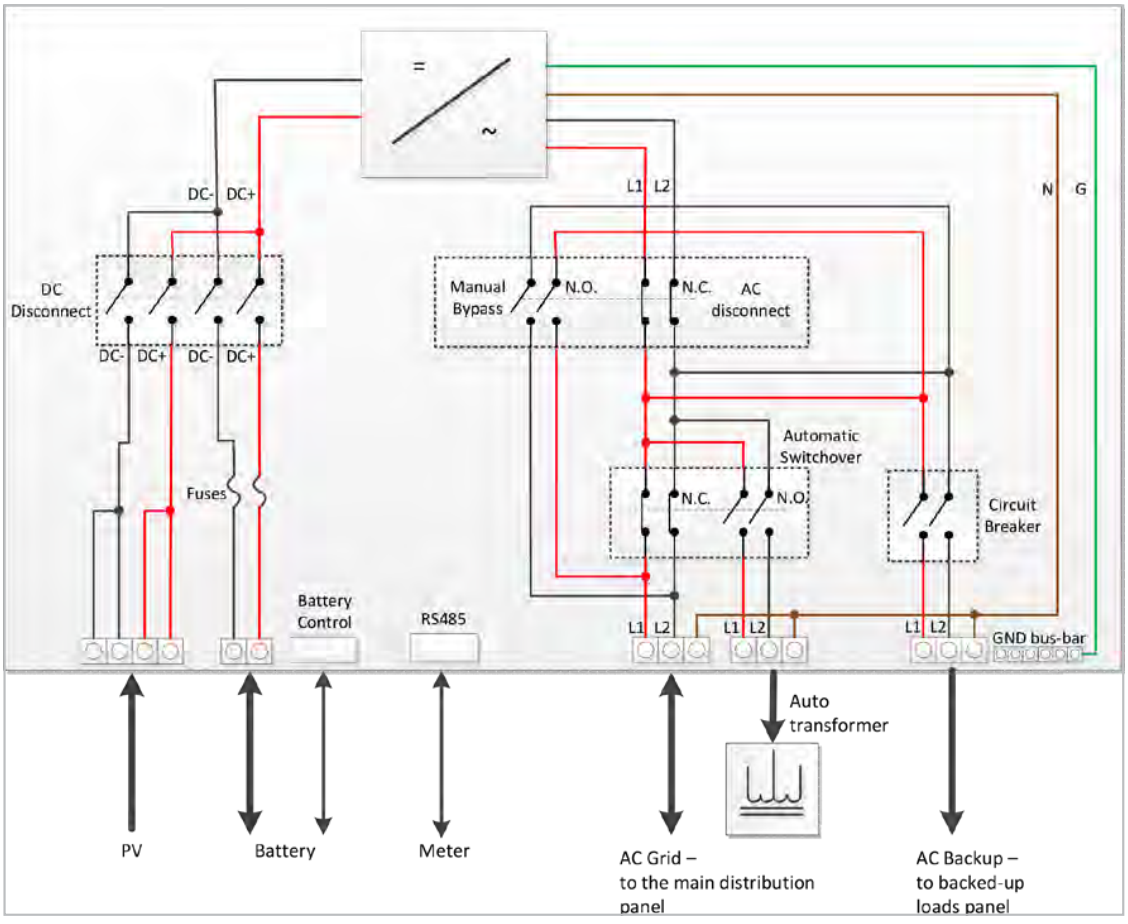
	SE7600A-USS2		
	Single Battery or High Capacity	High Power	
OUTPUT - AC (LOADS/GRID)			
Rated AC Power Output	7600		VA
Max AC Power Output	8350		VA
AC Output Voltage Min-Nom-Max (L-L)[1]	211-240-264		Vac
AC Frequency Min-Nom-Max[1]	59.3 - 60 - 60.5		Hz
Maximum Continuous Output Current @240V	32		A
GFDI	1		A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes		
Charge Battery from AC (if Allowed)	Yes		
THD	<3		%
Power factor with rated power	>0.99 (configurable; 0.9 leading to 0.9 lagging)		
Typical Nighttime Power Consumption	<5		W
OUTPUT - AC (BACKUP POWER)[2]			
Rated AC Power Output	3300	5000	VA
Max AC Power Output - Surge	3300	6600	VA
AC Output Voltage Min-Nom-Max (L-L)	211-240-264		Vac
AC Output Voltage Min-Nom-Max (L-N)	105-120-132		Vac
AC Frequency Min-Nom-Max	55 - 60 - 65		Hz
Maximum Continuous Output Current @240V - Backup Mode	21		A
Max Continuous Output Current per Phase @120V	25		A
GFDI	1		A
AC Circuit Breaker	Yes		
THD	<5		%
Power factor with rated power	0.2 leading to 0.2 lagging		
Automatic switchover time	<2		sec
Typical Nighttime Power Consumption	<5		W
INPUT - DC (PV and BATTERY)			
Transformer-less, Ungrounded	Yes		
Max Input Voltage	500		Vdc
Nom DC Input Voltage	400		Vdc
Reverse-Polarity Protection	Yes		
Ground-Fault Isolation Detection	600kΩ Sensitivity		
Maximum Inverter Efficiency	98		%
CEC Weighted Efficiency	97.5		%
INPUT - DC (PV)			
Maximum DC Power (STC)	10250		W
Max Input Current[3]	23		Adc
2-pole Disconnection	Yes		
INPUT - DC (BATTERY)			
Continuous Peak Power	3300	6600	W
Number of Batteries per Inverter	Up to 2, for high capacity	2, for high power	
Supported Battery Types	Single battery: B, E Two batteries: B+B	B+E, E+E	
Max Input Current	8.5	17.5	Adc
2-pole Disconnection	Yes		
DC Fuses on Plus and Minus	12A (field replaceable)	25A (field replaceable)	
ADDITIONAL FEATURES			
Supported Communication Interfaces	RS485 for battery, RS485, Ethernet, ZigBee (optional)		
Battery Power Supply	Yes, 12V / 53W		
Revenue Grade Data, ANSI C12.1	Optional[4]		
Integrated AC, DC and Communication Connection Unit	Yes		
AC Disconnect	Yes		
Manual Inverter Bypass Switch	Yes		
DC Voltage Rapid Shutdown (PV and Battery)	Yes, according to NEC 2014 690.12		
Auto-transformer thermal protection	Yes		

SolarEdge Single Phase StorEdge Inverter
for North America SE7600A-USS2

	SE7600A-USS2		
	Single Battery or High Capacity	High Power	
STANDARD COMPLIANCE			
Safety	UL1741, UL1699B, UL1998, CSA 22.2		
Grid Connection Standards	IEEE1547, Rule 21, Rule 14		
Emissions	FCC part15 class B		
INSTALLATION SPECIFICATIONS			
AC Output (Loads/Grid) conduit size / AWG range	1" / 14-6 AWG		
AC Output (Backup) conduit size / AWG range	0.75-1" knockouts / 14-6 AWG		
AC Input (Auto-transformer) conduit size / AWG range	0.75-1" / 14-6 AWG		
DC Input (PV) conduit size / AWG range	0.75" / 14-8 AWG		
DC Input (Battery) conduit size / AWG range	0.75" / 16-10 AWG		
Dimensions with Connection Unit (HxWxD)	37 x 12.5 x 7.2 / 940 x 315 x 184		in / mm
Weight with Connection Unit	58.5 / 26.5		lb / kg
Cooling	Natural convection and internal fan (user replaceable)		
Noise	<50		dBA
Min - Max Operating Temperature	-13 to +140 / -25 to +60		˚F / ˚C
Protection Rating	NEMA 3R		

(1) For other regional settings please contact SolarEdge Support
(2) Not designed for standalone applications and requires AC for commissioning
(3) A higher current source may be used; the inverter will limit its input current to the values stated
(4) Revenue grade inverter P/N: SE7600A-USS00NNM2

Inverter Interface



SolarEdge Auto-transformer

SEAUTO-TX-5000

	SEAUTO-TX-5000	
ELECTRICAL RATINGS		
Rated Power - Continuous	5000	VA
Rated Power - Peak	7600 for 10sec	VA
Output Voltage	120/240V Split Phase	
Max Continuous Output Current per Phase @120V	25	A
Split Phase Imbalance (@Rated Power)	Yes, up to 25A difference between phases	
Thermal Protection	Yes	
INSTALLATION SPECIFICATIONS		
AC Output conduit size / AWG range	0.75" / 14-6 AWG	
Dimensions (HxWxD)	6.7 x 7.9 x 5.5 / 170 x 200 x 140	in / mm
Weight	29.7 / 13.5	lb / kg
Min - Max Operating Temperature	-13 to +140 / -25 to +60	°F / °C
Protection Rating	NEMA 3R	
Installation	Wall mounted	

SolarEdge Electricity Meter for North America

SE-MTR240-2-200-S1 / SE-MTR240-2-400-S1

For meter specifications refer to: http://www.solaredge.us/files/pdfs/products/se_electricity_meter_na.pdf

Product Data Sheet

DU222RB

Safety Switch , 60A, Non-Fusible, 2-Pole

SQUARE D by Schneider Electric

List Price $353.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Number of Poles	2-Pole
Terminal Type	Lugs
Type of Duty	General Duty
Maximum Voltage Rating	240VAC
Wire Size	#10 to #2 AWG(Al) - #14 to #2 AWG(Cu)
Action	Single Throw
Ampere Rating	60A
Approvals	UL Listed File Number E2875
Enclosure Rating	NEMA 3R
Enclosure Type	Rainproof and Sleet/Ice proof (Indoor/Outdoor)
Factory Installed Neutral	No
Disconnect Type	Non-Fusible
Mounting Type	Surface

Shipping and Ordering

Category	00106 - Safety Switch, General Duty, 30 - 200 Amp, NEMA3R
Discount Schedule	DE1A
GTIN	00785901491491
Package Quantity	1
Weight	4.7 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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Lithium-Ion Battery Emergency Response Guide Tesla Energy Products, All Sizes			
Release Date: **3-Sept-2015**	Page: **1 of 11**	Document Number: **TS-0004027**	Revision: **02**

Version	Date	Description
01	**14-July-2015**	**ERG for Powerwall and Powerpack**
02	**3-Sept-2015**	**Added part numbers, updated weights, voltages, and temperatures, clarified hazards associated with spilled electrolyte, updated storage requirements, updated warning label icons, updated packing group.**

Rechargeable Lithium Ion Batteries: Tesla Energy Products

The products referenced herein are exempt articles and are not subject to OSHA's Hazard Communication Standard requirements for preparation of material safety data sheets (MSDS).

MSDS

Material Safety Data Sheets (MSDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article". OSHA has defined "article" as a manufactured item other than a fluid or particle; (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities (e.g. minute or trace amounts) of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Tesla Energy Products meet the OSHA definition of "articles". Thus, they are exempt from the requirements of the Hazardous Communication Standard, and an MSDS is not required.

1. IDENTIFICATION OF PRODUCTS AND COMPANY				
Product	Rechargeable lithium-ion Powerwall and Powerpack systems for residential, commercial, and industrial Tesla Energy applications, and modules and sub-assemblies that can be installed in Powerwall and Powerpack systems (Tesla Energy Products). Specific part numbers are listed below.			
Locations	**Headquarters**	**Europe**	**Asia/ Pacific**	**Manufacturer**
	Tesla Motors, Inc. (USA) 3500 Deer Creek Road Palo Alto, CA 94304 Tel. No. (650) 681-5000	**Tesla Europe** Burgemeester Stramanweg 122 1101EN Amsterdam The Netherlands Tel. No. +31 20 258 3916	**Tesla Asia / Pacific** 2-23-8, Minami Aoyama Tokyo, Japan Tel: +81 3 6890 7700	**Tesla Motors, Inc.** (USA) 3500 Deer Creek Road Palo Alto, CA 94304 Tel. No. (650) 681-5000
Emergency Contacts	CHEMTREC	For Hazardous Materials [or Dangerous Goods] Incidents: Spill, Leak, Fire, Exposure, or Accident Call CHEMTREC Day or Night Within USA and Canada: 1-800-424-9300 Contract Number: CCN204273 Outside USA and Canada: +1 703-527-3887 (collect calls accepted)		

TS-0004027 Revision 02	**Lithium-Ion Battery Emergency Response Guide Tesla Energy Units, All Sizes**	Page 2 of 11

Tesla Energy Powerwall and Powerpack systems contain battery subassemblies made up of rechargeable lithium-ion cells. Tesla Energy Powerwall and Powerpack systems and their respective subassemblies are covered by this document (Tesla Energy Products).

Tesla Energy Powerwall, Powerpack, and their battery subassemblies contain sealed lithium-ion battery cells (cells) that are similar to rechargeable batteries in many consumer electronic products. Cells are individually, hermetically sealed cylinders approximately 18 mm in diameter and 65 mm in length. These cylinders each contain lithium-ion electrodes and electrolyte (approximate composition listed below). THE CELLS AND BATTERIES DO NOT CONTAIN METALLIC LITHIUM. Individual cells have nominal voltages of approximately 3.6 V.

Materials/Ingredients of Battery Cells	**Approx. % by wt.**
The lithium-ion cell positive electrodes can be composed of: Lithium Nickel Cobalt Aluminum Oxide (NCA material), $LiNi_xCo_yAl_zO_2$; Lithium Nickle, Manganese, Cobalt Oxide (NMC material) $LiNi_xMn_yCo_zO_2$; Lithim Nickle, Manganese Oxide (NMO material), $LiNi_xMn_yO_2$ Lithium Cobalt Oxide, $LiCoO_2$; or a mixture of these compounds	33
Carbon	21
Iron	12
Copper	7
Aluminum	5
Nickel	<1
Organic electrolyte (mainly composed of alkyl carbonate)*	10
Polypropylene	3
Polyethylene Terephthalate	<1
Other	8

*An acceptable exposure concentration of electrolyte has not been identified by the American Council of Governmental Industrial Hygienists (ACGIH). In case of electrolyte leakage from the battery, the oral (rat) LD50 is greater than 2 g/kg (estimated).

Powerwall and Powerpack systems also include sealed thermal management systems containing coolants and refrigerants.

Non-Cell Materials found in Powerwall and Powerpack Systems	**Approximate Quantity**
Ethylene glycol 50/50 mixture with water	Powerwall: 1.6 L of 50/50 mixture Powerpack: 26L of 50/50 mixture
R134a: 1,1,1,2-Tetrafluoroethane refrigerant	Powerwall: none Powerpack: 400g

TS-0004027 Revision 02	**Lithium-Ion Battery Emergency Response Guide Tesla Energy Units, All Sizes**	Page 3 of 11

Individual lithium-ion cells are connected to form modules. Modules are connected to form pods. Pods are installed in a Powerwall or Powerpack. Approximate specifications of lithium-ion based modules, pods, Powerwalls, and Powerpacks are listed below. Modules and pods are battery sub-assemblies.

Part Number	Description	Nominal Voltage (V)	Max Voltage (V)	Weight (kg)	Height (cm)	Width (cm)	Depth (cm)
	Powerwall Versions						
1050100-0x*-y*	POWERWALL, 2KW, 7KWH	400	450	95 (210 lb)	130 (51 in)	86 (34 in)	18 (7 in)
1067000-0x*-y*	POWERWALL, 3.3KW, 7KWH	400	450	95 (210 lb)	130 (51 in)	86 (34 in)	18 (7 in)
1068000-0x*-y*	POWERWALL, 6.6KW, 10KWH	400	450	101 (223 lb)	130 (51 in)	86 (34 in)	18 (7 in)
	Powerpack Versions						
1068538-0x*-y*	POWERPACK (1hr continuous net discharge)	400	450	1720 (3800 lb)	219 (86 in)	97 (38 in)	132 (52 in)
1047404-0x*-y*	POWERPACK (2hr continuous net discharge)	400	450	1680 (3700 lb)	219 (86 in)	97 (38 in)	132 (52 in)
1060119-0x*-y*	POWERPACK (4hr continuous net discharge)	400	450	1665 (3670 lb)	219 (86 in)	97 (38 in)	132 (52 in)
	Powerwall and Powerpack Sub-Assemblies						
1071000-00-A	POD, 1.6KW	400	450	72 (159 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1055000-0x*-y*	POD, 2KW	400	450	73 (160 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1073000-0x*-y*	POD, 3.3KW	400	450	73 (160 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1076600-0x*-y*	POD, 6.6KW	400	450	75 (165 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1047816-0x*-y*	ASY,HVBAT, MODULE, BB	20	25	25 (55 lb)	70 (28 in)	30 (12 in)	8 (3 in)
1063198-0x*-y*	ASY,HVBAT,MODULE, 22V	20	25	25 (55 lb)	70 (28 in)	30 (12 in)	8 (3 in)

* Note that the 9th digit could be any number or letter and the 10th digit could be any letter.

2. HANDLING AND USE PRECAUTIONS/IDENTIFICATION OF HAZARDS

The products described by this document are dangerous if mishandled. Injury to property or person, including loss of life is possible if mishandled.

Tesla Energy Products contain lithium-ion batteries. **A battery is a source of energy**. Do not short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. An internal- or external-short circuit can cause significant overheating and provide an ignition source resulting in fire, including surrounding materials or materials within the cell or battery. Under normal conditions of use, the electrode materials and electrolyte they contain are not exposed, provided the battery integrity is maintained and seals remain intact. Risk of exposure may occur only in cases of abuse (mechanical, thermal, electrical).

2A. HIGH VOLTAGE HAZARDS

Under normal conditions of use, provided that a Tesla Energy Product enclosure remains closed, handling the product does not pose an electrical hazard. Numerous safeguards have been designed into Tesla Energy Products to help ensure that the high-voltage-battery is kept safe and secure as a result of a number of expected abuse conditions. All of the constituent component battery cells are sealed within the pack as sub-groups in metal enclosures (Pods). The exterior of each Pod is isolated from internal components and connectors are touch-safe. Pods are then installed in a rigid metal enclosure, which is isolated from high voltage.

A Tesla Energy Product may pose a significant high voltage and electrocution risk if the outer enclosure, Pod enclosures, and/or safety circuits have been compromised or have been significantly damaged. **A battery pack, even in a normally discharged condition is likely to contain substantial electrical charge and can cause injury or death if mishandled.** If a Tesla Energy Product has been significantly visibly damaged or its enclosure compromised, then practice appropriate high-voltage preventative measures until the danger has been assessed (and dissipated if necessary).

WARNING: NEVER CUT INTO A SEALED TESLA ENERGY PRODUCT ENCLOSURE due to the high voltage and electrocution risks.

For proper installation / removal instructions please contact Tesla Motors at (650) 681-5000.

2B. HAZARDS ASSOCIATED WITH MECHANICAL DAMAGE

Mechanical damage to Tesla Energy Products can result in a number of hazardous conditions (discussed below) including:

- Leaked battery pack coolant (See Section 2D)
- Leaked refrigerant (Powerpack systems only See Section 2E)
- Leaked cell electrolyte (See Section 2F)
- Rapid heating of individual cells due to exothermic reaction of constituent materials (cell thermal runaway), venting of cells, and propagation of self-heating and thermal runaway reactions to neighboring cells.
- Fire

To prevent mechanical damage to Tesla Energy Products, these items should be stored in their original packaging when not in use or prior to being installed. (See Section 6 below).

2C. HAZARDS ASSOCIATED WITH ELEVATED TEMPERATURE EXPOSURE

The Tesla Energy Powerwall and Powerpack are designed to withstand operating temperatures up to 50°C (122°F) and 95% non-condensing humidity.

Exposure of Tesla Energy Products to elevated temperatures can drive battery cells into thermal runaway and result in a fire.

- Storage for more than 24 hours at temperatures above approximately 80°C (176 °F) could result in cell thermal runaway reactions and should be avoided.
- Storage for more than a few minutes at temperatures above approximately 150°C (302°F) could result in cell thermal runaway reactions and should be avoided.
- Exposure of battery packs to localized heat sources such as flames could result in cell thermal runaway reactions and should be avoided.

2D. HAZARDS ASSOCIATES WITH LEAKED COOLANT

Powerpack and Powerwall thermal management is achieved via liquid cooling using a 50/50 mixture of ethylene glycol and water. A typical Powerpack system includes about 26L of coolant. A typical Powerwall system includes about 1.6 L of coolant. Mechanical damage of a Tesla Energy Product that has been installed could result in leakage of the coolant. The fluid is blue in color and does not emit a strong odor.

For information regarding the toxicological hazards associated with ethylene glycol, as well as ecological effects and disposal considerations, refer to the specific Material Safety Data Sheet (MSDS) for battery coolant.

Extended exposure of a Tesla Energy Product to leaked coolant could cause additional damage to product such as corrosion and compromise of protection electronics.

2E. HAZARDS ASSOCIATES WITH LEAKED REFRIGERANT (POWERPACK ONLY)

The Powerpack thermal management system includes 400g of R134a: 1,1,1,2-Tetrafluoroethane refrigerant in a sealed system. Mechanical damage of a Powerpack could result in a release of the refrigerant. Such a release would appear similar to the emission of smoke.

For information regarding the toxicological hazards associated with R134a, as well as ecological effects and disposal considerations, refer to the specific Safety Data Sheet (SDS) for R134a.

2F. HAZARDS ASSOCIATED WITH LEAKED ELECTROLYTE

The electrolyte within constituent cells includes a volatile hydrocarbon-based liquid and a dissolved lithium salt (which is a source of lithium ions) such as lithium hexofluorophosphate. The electrolyte is largely absorbed in electrodes within individual sealed cells. Under normal usage conditions battery electrolyte should not be encountered by anyone handling a Tesla Energy Product.

Severe mechanical damaged (e.g. severe crushing) can cause a small quantity of electrolyte (up to approximately 1 g) to leak out of a cell. For the electrolyte liquid to come into contact with a user of a Tesla Energy Product, the Powerwall or Powerpack external enclosure, the Pod enclosure, and the cell would have to be mechanically damaged.

The possibility of a spill of electrolyte from a Tesla Energy battery pack is very remote. Electrolyte can be extracted from a single cell using a centrifuge, or under some extreme abuse conditions such as a severe crush. However, it is very difficult to mechanically damage cells in such a way as to cause leakage of electrolyte. Even if a single cell were damaged in a manner that could cause electrolyte leakage, it is extremely difficult to cause a leak from more than a few cells due to any incident. Furthermore, cells are connected into modules which are placed within a sealed steel, compartmentalized enclosure. Each compartment can contain liquid from a large number of individual cells.

Any released electrolyte liquid is likely to evaporate rapidly leaving a white salt residue. Evaporated electrolyte is flammable and will contain alkyl-carbonate compounds. Leaked electrolyte is colorless and characterized by a sweet odor. If an odor is obvious, evacuate or clear the surrounding area and ventilate the area. **WARNING: AVOID CONTACT WITH ELECTROLYTE.**

Leaked electrolyte solution is flammable and corrosive / irritating to the eyes and skin. If a liquid is observed that is suspected electrolyte, ventilate the area and avoid contact with the liquid until a positive identification can be made and sufficient protective equipment can be obtained (eye, skin, and respiratory protection). Chemical classifier strips can be used to identify the spilled liquid (electrolyte will contain petroleum/organic solvent and fluoride compounds.

In case of an electrolyte leak, the following protective equipment is recommended: an air purifying respirator with organic vapor/acid gas cartridges, safety goggles or a full face respirator, and safety gloves (Butyl rubber or laminated film (Silver Shield)). Protective clothing should be worn. Use a dry absorbent material to clean up a spill.

2G. HAZARDS ASSOCIATED WITH VENTED ELECTROLYTE

Lithium-ion cells are sealed units, and thus under normal usage conditions, venting of electrolyte should not occur. If subjected to abnormal heating or other abuse conditions, electrolyte and electrolyte decomposition products can vaporize and be vented from cells. Accumulation of liquid electrolyte is unlikely in the case of abnormal heating. Vented gases are a common early indicator of a thermal runaway reaction – an abnormal and hazardous condition.

If gases or smoke are observed escaping from a Tesla Energy Product, evacuate the area and notify a first responder team and/or the local fire department. Gases or smoke exiting a lithium-ion battery pack are likely flammable and could ignite unexpectedly as the condition that led to cell venting may also cause ignition of the vent gases. A venting Tesla Energy Product should only be approached with extreme caution by trained first responders equipped with appropriate personal protective equipment (PPE) (discussed in Section 3).

Cell vent gas composition will depend upon a number of factors, including cell composition, cell state of charge, and the cause of cell venting. Vent gases may include volatile organic compounds (VOCs) (such as alkyl-carbonates, methane, ethylene, and ethane), hydrogen gas, carbon dioxide, carbon monoxide, soot, and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Additionally, phosphorus pentafluoride, POF_3 and HF vapors may form.

WARNING: AVOID CONTACT WITH VENTED GASES. Vented gases may irritate the eyes, skin, and throat. Cell vent gases are typically hot: upon exit from a cell, vent gas temperatures can exceed 600 ºC (1,110 ºF). Contact with hot gases can cause thermal burns. Vented electrolyte is flammable, and may ignite on contact with a competent ignition source such as an open flame, spark, or a sufficiently heated surface. Vented electrolyte may also ignite on contact with cells undergoing a thermal runaway reaction.

3. FIREFIGHTING MEASURES

Responding to a Venting Tesla Energy Product. Smoke emanating from a Tesla Energy Product is an indication of an abnormal and hazardous condition. The smoke is likely flammable and may ignite at any time. If fire or smoke is observed emanating from a Tesla Energy Product at any time, evacuate the area, and notify appropriately trained first responders and the local fire department.

A trained first responder team or the local fire department should shut off power to the Tesla Energy Product, to prevent charging of the battery. However, shutting off power to the Tesla Energy Product does not de-energized the battery, and thus a shock hazard may still be present. The Tesla Energy Product should then be monitored for evidence of continued smoke evolution. Application of high volumes of water from a safe distance to cool the battery pack may prevent further reaction and prevent a fire from developing.

If a fire develops, the Incident Commander should determine whether an attempt will be made to suppress the fire (aggressive firefighting) or allow the battery to burn until it self-extinguishes, while protecting surrounding materials (defensive firefighting).

Virtually all fires involving lithium-ion batteries can be controlled with water. To date, water has been found to be the most effective agent for controlling lithium-ion battery fires. Water will suppress flames and can cool cells, limiting propagation of thermal runaway reactions. If water is used, electrolysis of water (splitting of water into hydrogen and oxygen) may contribute to the flammable gas mixture formed by venting cells, burning plastic, and burning of other combustibles. Thus copious volumes of water should be used to fight a lithium-ion battery fire.

Gaseous agents such as CO_2 or Halon, or dry chemical suppressants may temporarily suppress flaming of lithium-ion battery packs, but they will not cool lithium-ion batteries and will not limit the propagation of cell thermal runaway reactions. Metal fire suppressants such as LITH-X, graphite powder, or copper powder are not appropriate agents for suppressing fires involving lithium-ion battery packs as they are unlikely to be effective.

A battery fire may continue for several hours and it may take 24 hours or longer for the battery pack to cool. A lithium-ion battery fire that has been extinguished can re-ignite due to the exothermic reaction of constituent materials from broken or damaged cells. To avoid this, remove sources of ignition and cool the burned mass by flooding with water.

Aggressive Firefighting: If a decision is made to aggressively fight a fire involving a Tesla Energy Product, then copious amounts of water should be applied from a safe distance. The water may not suppress all cell thermal runaway reactions within the battery pack, but it may cool cells and control the spread of the fire. If possible, direct the application of water towards openings in the battery pack enclosure, if any have formed, with the intent of flooding the pack enclosure. The objective is to contact the surfaces of the affected and surrounding individual battery cells with water.

Defensive Firefighting If a decision is made to fight a Tesla Energy Product fire defensively, then the fire crew should pull back a safe distance and allow the battery to burn itself out. Fire crews may choose to utilize a water stream or fog pattern to protect exposures or control the path of smoke. A battery fire may continue for several hours and may result in multiple re-ignition events. It may take 24 hours or longer for the battery pack to cool.

Firefighter PPE. Firefighters should wear self-contained breathing apparatus (SCBA) and fire protective turnout gear. Cells or batteries may flame or leak potentially hazardous organic vapors if exposed to excessive heat, fire or over voltage conditions. These vapors may include volatile organic compounds (VOCs), hydrogen gas, carbon dioxide, carbon monoxide, soot, and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Additionally, phosphorus pentafluoride, POF_3 and HF vapors may form

4. FIRST AID MEASURES

Electric Shock / Electrocution: Seek immediate medical assistance if an electrical shock or electrocution has occurred (or is suspected).

Contact with Leaked Electrolyte: The constituent battery cells are sealed. Contents of an open (broken) constituent battery cell can cause skin irritation and/or chemical burns. If materials from a ruptured or otherwise damaged cell or battery contact skin, flush immediately with water and wash affected area with soap and water. If a chemical burn occurs or if irritation persists, seek medical assistance.

For eye contact, flush with significant amounts of water for 15 minutes without rubbing and see physician at once.

Inhalation of Electrolyte Vapors: If inhalation of electrolyte vapors occurs, move person into fresh air. If not breathing give artificial respiration. Consult a physician.

Vent Gas Inhalation: The constituent battery cells are sealed and venting of cells should not occur during normal use. If inhalation of vent gases occurs, move person into fresh air. If not breathing give artificial respiration. Consult a physician.

5. STORAGE PRECAUTIONS

Powerwalls, Powerpacks, and battery subassemblies should be stored in approved packaging prior to installation.

Do not store Tesla Energy Products in a manner that allows terminals to short circuit (do not allow the formation of an electrically-conductive path).

Elevated temperatures can result in reduced battery service life. Powerwall and Powerpack systems can withstand temperatures of -30°C to 60°C for up to 24 hours. However, Tesla Energy products stored for longer than one month should be stored at temperatures between -20°C and 30°C (-4 °F and 86 °F), at humidity <70%, and protected from condensation. Extended storage (more than a month) at temperatures outside the recommended range can result in degradation of product lifetime. Storage in areas where temperatures routinely approach or exceed 80°C (176°F) could result in a hazardous condition. Do not store Tesla Energy Products near heating equipment.

Ideally, a Tesla Energy Product should be stored at 50% state of charge (SOC) or less. Tesla Energy Products should not be stored for extended periods either at a full state of charge (SOC) or completely discharged since both conditions adversely impact battery life. Tesla Energy Products should not be stored untended longer than twelve (12) months since battery service life likely will be adversely impacted.

The storage area should be protected from flooding.

Extended storage areas should be compliant with the appropriate local fire code requirements.

Acceptable storage density of battery packs and storage height of battery packs will be defined by the local authority having jurisdiction. Requirements and limits will be based upon a number of factors including the structural and fire protection characteristics of the storage area and recommendations for fire protection promulgated by the National Fire Protection Association (NFPA) and similar organizations. At the time of this writing, no Commodity Classification has been defined for lithium-ion cells or battery packs (See NFPA – 13 Standard for the Installation of Sprinkler Systems). Until a Commodity Classification has been defined based on testing by NFPA or a similar organization, Tesla recommends treating lithium-ion cells and batteries in packaging as equivalent to a Group A Plastic Commodity.

6. INSTALLATION PRECAUTIONS

Elevated temperatures can result in reduced battery service life, or a hazardous condition.

The desired installation temperature for Tesla Energy Powerwall and Powerpack is between -20 °C and 50°C (-4 °F and 122 °F). Installation in areas with ambient temperatures over 50°C (122°F) is not recommended as this can result in degradation of product lifetime or a hazardous condition.

Installation in areas where temperatures routinely approach or exceed 80 °C (176 °F) could result in a hazardous condition. Do not install batteries near heating equipment.

The installation area should be protected from flooding.

Installation areas should be compliant with the appropriate local fire code requirements.

7. HANDLING, STORAGE, & TRANSPORTATION OF DAMAGED TESLA ENERGY PRODUCTS

If a Tesla Energy Product has been damaged (battery enclosure has been dented or compromised), it is possible that heating is occurring that may eventually lead to a fire. Damaged or opened cells/batteries can result in rapid heating (due to exothermic reaction of constituent materials), the release of flammable vapors, and propagation of self-heating and thermal runaway reactions to neighboring cells.

Before handling or transporting a damaged Tesla Energy Product, wait at least 1 hour. Smoke may be an indication that a thermal reaction is in progress. If no smoke, flame, leakage of electrolyte, leakage of coolant, or signs of heat has been observed for 1 hour, the Tesla Energy Product may be disconnected and moved into a safe location. Please contact Tesla (650) 681-5000 to obtain specific instructions for evaluating, disconnecting, and preparing a damaged Tesla Energy Product for transport.

A damaged Tesla Energy Product should be monitored during storage for evidence of smoke, flame, leakage of electrolyte, leakage of coolant, or signs of heat. If full-time monitoring of the Product is not possible (for example during extended storage), the Product should be moved to a safe storage location.

A safe storage location for a damaged battery will be free of flammable materials, accessible only by trained professionals, and 50 feet downwind of occupied structures. For example, a fenced, open yard may be an appropriate safe location. **DO NOT STORE DAMAGED TESLA ENERGY PRODUCTS ADJACENT TO UNDAMAGED TESLA ENERGY PRODUCTS.** It is possible that a damaged battery may sustain further damage during transportation that may lead to a fire. To further reduce this risk, handle the damaged battery with extreme caution.

8. DISPOSAL PROCEDURES

Tesla Energy lithium-ion batteries do not contain heavy metals such as lead, cadmium, or mercury.

Tesla Energy Products should be disposed of or recycled in accordance with local, state, and federal regulations. Note that regulations regarding disposal of batteries vary by jurisdiction. In the United States batteries are classified as Universal Waste, and in addition, many individual states have specific regulations regarding disposal of battery packs. For example, in California, all batteries must be taken to a Universal Waste handler or authorized recycling facility.

Tesla Energy Products contain recyclable materials. Tesla strongly encourages recycling. For more information on the recycling of Tesla Energy Products, please contact Tesla (650) 681-5000.

If disposing without return to Tesla, please consult with local, state and /or federal authorities on the appropriate methods for disposal and recycling.

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9. TRANSPORT INFORMATION	
Lithium-ion batteries are regulated as Class 9 Miscellaneous dangerous goods (also known as "hazardous materials") pursuant to the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, International Air Transport Association (IATA) Dangerous Goods Regulations, the International Maritime Dangerous Goods (IMDG) Code, European Agreements concerning the International Carriage of Dangerous Goods by Rail (RID) and Road (ADR), and applicable national regulations such as the USA's hazardous materials regulations (see 49 CFR 173.185). These regulations contain very specific packaging, labeling, marking, and documentation requirements. The regulations also require that individuals involved in the preparation of dangerous goods for transport be trained on how to properly package, label, mark and prepare shipping documents.	
UN Number	3480
Proper Shipping Name	Lithium ion batteries
Hazard Classification	Class 9 Miscellaneous
Packing Group	N/A

UN Number	3481
Proper Shipping Name	Lithium ion battery contained in equipment or lithium ion battery packed with equipment
Hazard Classification	Class 9 Miscellaneous
Packing Group	N/A

Notice: The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. TESLA MOTORS, INC. makes no warranty, expressed or implied, with respect to this information.

POWERWALL 2 DC

The Tesla Powerwall is a DC battery system for residential or light commercial use. Its rechargeable lithium-ion battery pack provides energy storage for solar self-consumption, load shifting and backup power.

Powerwall's electrical interface is provided by an internal isolated bi-directional DC/DC converter that controls the charge and discharge of the battery for integration with grid-tied solar inverters. Its revolutionary compact design achieves market-leading energy density and is easy to install, enabling owners to quickly realize the benefits of reliable, clean power.

PERFORMANCE SPECIFICATIONS

DC Energy[1]	13.5 kWh
Power, continuous	5 kW (charge and discharge)
Power, peak (10 s)	7 kW (discharge only)
DC Voltage Range	350–550 V
DC Current, continuous	14.3 A
DC Current, peak (10 s)	20 A
Depth of Discharge	100%
Internal Battery DC Voltage	50 V
Round Trip Efficiency[1,2]	91.8%
Warranty	10 years

[1]Values provided for 25°C (77°F), 3.3 kW charge/discharge power.
[2]DC to battery to DC, at beginning of life.

INTERFACE SPECIFICATIONS

Communication Protocols	Modbus (RS485), CAN
Modularity	Multi-Powerwall capability with compatible inverters
User Interface	Tesla App

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	–20°C to 50°C (–4°F to 122°F)
Storage Temperature	–30°C to 60°C (–22°F to 140°F)
Operating Humidity (RH)	Up to 100%, condensing
Maximum Altitude	3000 m (9843 ft)
Environment	Indoor and outdoor rated
Enclosure Type	NEMA 3R
Ingress Rating	IP67 (Battery & Power Electronics) IP56 (Wiring)
Noise Level @ 1m	<40 dBA at 30°C (86°F)

MECHANICAL SPECIFICATIONS

Dimensions	1150 mm x 755 mm x 155 mm (45.3 in x 29.7 in x 6.1 in)
Weight	120 kg (264.5 lbs)
Mounting options	Floor or wall mount

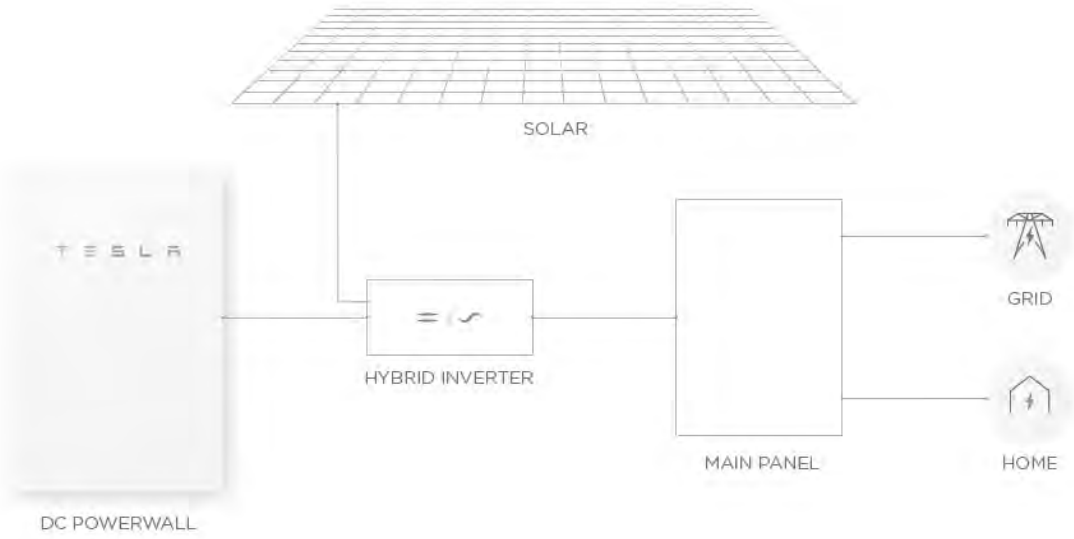
COMPLIANCE INFORMATION

Safety	UL 1642, UL 1741, UL 1973, UL 9540, UN 38.3, IEC 62109-1, IEC 62619, CSA C22.2.107.1
Emissions	FCC Part 15 Class B, ICES 003, EN 61000 Class B
Environmental	RoHS Directive 2011/65/EU, WEEE Directive 2012/19/EU, 2006/66/EC
Seismic	AC156, IEEE 693-2005 (high)

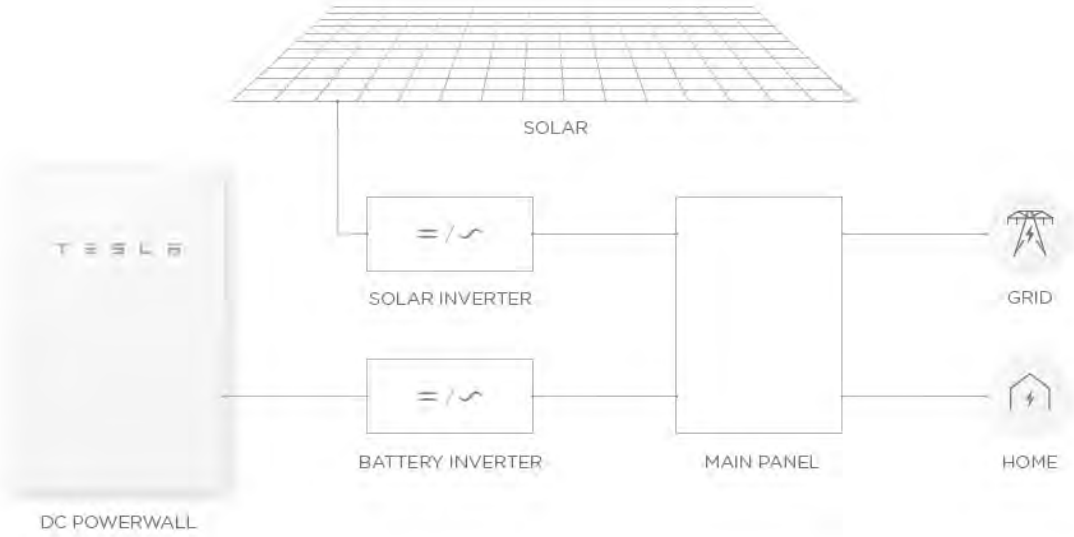
TESLA POWERWALL 2

TYPICAL SYSTEM LAYOUTS

DC-COUPLED POWERWALL SYSTEM WITH SOLAR



AC-COUPLED POWERWALL SYSTEM WITH SOLAR



TESLA POWERWALL 2

DESIGN	
DISPLAY	LED MATRIX WITH TOUCH INTERFACE
WALL MOUNTING	MOUNTING BRACKET WITH MAGNETIC CONNECTION TO MAIN BODY
COLOUR	WHITE BODY WITH WHITE DISPLAY BLACK BODY WITH WHITE DISPLAY

SYSTEM CONTROL	
TEMPERATURE CONTROL MODES	COOL, HEAT, AUTO AND EMERGENCY HEAT
FAN MODES	1, 2 OR 3 STAGE FAN SYSTEMS, WITH AUTO FAN MODE
TEMPERATURE ADJUSTMENT	1 °F OR 0.5°C

HVAC SYSTEM COMPATIBILITY	
HEATING SYSTEM TYPES	FORCED AIR, HEAT PUMP, GAS, ELECTRIC, MILLIVOT, HYDRONIC
HEATING STAGES	1 OR 2, PLUS EMERGENCY HEAT
COOLING SYSTEM TYPES	HEAT PUMP, EVAPORATIVE, HYDRONIC
COOLING STAGES	1 OR 2
HEATPUMP SUPPORT	TWO-STAGE REVERSIBLE HEATPUMP (WITH AUXILLARY/EMERGENCY HEAT)

CONNECTIVITY	
WIRELESS PROTOCOL	ZIGBEE (HA 1.2)
FIRMWARE UPGRADE	OVER-THE-AIR (OTA) UPGRADE

SETUP AND INSTALLATION	
HVAC SYSTEM RATING	24V AC (NOMINAL) 2A MAX PER RELAY
BATTERY LIFE	2 YEARS (ON 4 X AA ALKALINE BATTERIES, WITH TYPICAL USE) CONTINUOUS OPERATION IF A C-WIRE IS CONNECTED
INSTALLATION	PAPER-BASED QUICK-START GUIDE WEB-BASED SYSTEM SETUP AND WIRING GUIDE
DISPLAY LANGUAGE	ENGLISH, FRENCH, SPANISH
PACKAGE CONTENTS	ZEN THERMOSTAT, 4 X AA BATTERIES, MOUNTING HARDWARE & INSTRUCTION MANUAL

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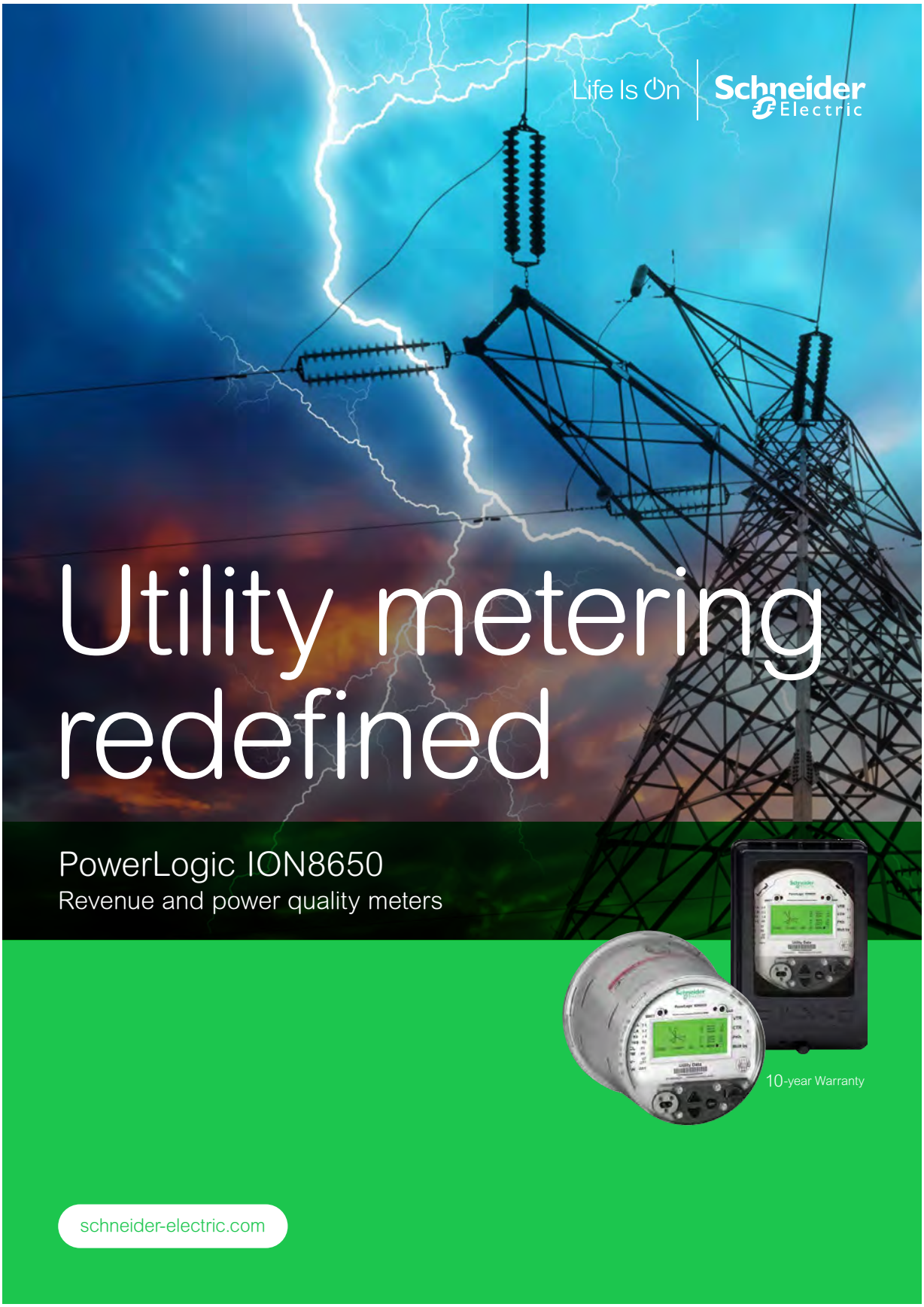

Life Is On
Schneider Electric
Utility metering redefined
PowerLogic ION8650
Revenue and power quality meters
10-year Warranty
schneider-electric.com

The new benchmark for smart grid utility metering

The PowerLogic ION8650™ meter is the world's most advanced socket-based energy and power quality meter. It offers unparalleled versatility, reliability, and total performance.

Bidirectional, four-quadrant metering and industry-leading accuracy make the PowerLogic ION8650 the only choice to monitor network interties, substations, and service entrances. Our meter enables utilities to manage complex energy supply contracts that include commitments to power quality. Exceptional connectivity enables the meter to be integrated with both StruxureWare™ Power Monitoring Expert software or virtually any other energy management software and SCADA software.

The PowerLogic ION8650 embodies everything we have learned as the leading global supplier of advanced revenue meters. Rethought and re-engineered from the ground up, it has the versatility and robustness that today's utilities demand. From leading-edge performance intended to quickly maximize your return on investment, through power quality compliance monitoring that helps increase electrical network reliability, to an adaptable, modular architecture that's ready to solve your future challenges, the PowerLogic ION8650 has it all.

Life Is On Schneider Electric

Reliability and versatility beyond expectations

The PowerLogic ION8650 meets the critical demands of grid revenue, power quality, and substation automation applications in one durable device.

Utility grid revenue metering

Use the meter for billing at key grid interchange points on transformers and large industrial loads. It securely shares billing data, interfaces with SCADA systems to enhance real-time electrical network reliability, enables energy savings through real-time load shedding, monitors and controls capacitor banks, helps augment predictive maintenance, and facilitates automating remote power systems.

Power quality

Verify power quality contract compliance to IEC 61000-4-30 Class A, EN 50160 Ed. 4, and other key compliance standards. Isolate and analyze the source of power quality problems with simultaneous capture of subcycle disturbance transients on all voltage and current channels. Configure it for custom power quality applications or recommendations such as IEEE 519 and IEE 1159.

Substation automation

An integral component of your substation automation strategy, the PowerLogic ION8650 provides vital operational information. Extensive I/O combined with onboard intelligence and an array of communication choices gives you access to real-time and historic equipment status data from remote and local substations. Use the facts to improve reliability, optimize capital investment decisions, and increase operational and labor efficiency.

Extensive measurements, unbeatable accuracy

Today, utilities need the highest precision metering possible at intertie and bulk power interfaces to ensure maximum revenue. Singularly unique amongst revenue meters, the PowerLogic ION8650 offers you uniform accuracy over a wide current range spanning .01 A to 20 A. With its single current range, you stock one meter for all your measurement applications whether they are small loads such as offline generators or an electrical network running at full capacity.

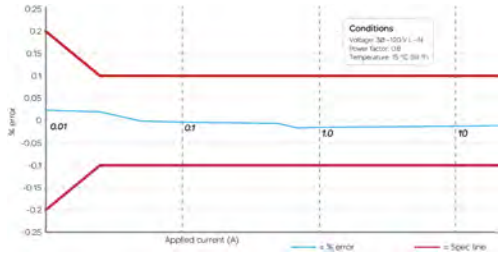
Parameter	Accuracy (% reading)
Voltage (line-line) (line-neutral): per phase, total, min/max, unbalance, phase reversal	0.1%
Current: per phase, total, neutral, min/max, unbalance phase reversal, demand	0.1%
Power: kW, kvar, kVA, per phase, total, demand	0.1%
Energy: kWh, kvarh, kVAh, bidirectional, net, total, volt-hours, and amp-hours	0.1%, twice the accuracy of IEC 62053-22/23 (0,2S) and ANSI C12.20 Class 0.2
Power factor: per phase, total	0.1%
Frequency V1, V2, V3 (47 – 63 Hz): per phase, total	±0.001 Hz

High-accuracy measurements

The meter provides high-accuracy (1-second), high-speed (½-cycle) true RMS 3-phase and total measurements with twice the accuracy specified by current IEC and ANSI Class 0.2 standards for key power and energy parameters in preparation for the new ANSI class 0.1 standard. However, the ION8650 performs better than 0.05% accuracy under normal conditions.

Transformer/line loss compensation

Automatically measure, compensate, and correct for transformer or line losses when the meter is physically separated from the billing point.



Flexible communications, secure data, easy alarms

Utilities need secure, cost-effective, targeted information to optimize their business operations. They also need open, standardized protocols to lower implementation costs, safeguard their capital investments, and facilitate interoperability between devices and networks.

The PowerLogic ION8650 offers all that and more, with multiport, multiprotocol access to a wide variety of the most common communication standards for simultaneous data sharing with utility systems and customers. The PowerLogic ION8650 is a smart grid enabler that easily integrates with existing systems and has the flexibility you need to meet future needs.

Complete communications: Ethernet (fiber) – serial – modem – cellular – infrared

Simple, flexible communications reduce connection costs. Concurrent Ethernet, serial, and modem ports with a variety of protocols such as ION, DLMS, IEC 61850 Ed. 2, DNP 3.0, Modbus RTU, Modbus TCP, Modbus Master (serial, TCP), and MV-90 ensure comprehensive interoperability.

Internet connectivity

An onboard Web server provides access to real-time values and power quality data, and an FTP server now provides COMTRADE fault records and IEC 61850 configuration.

You can exchange information using XML to integrate with custom reporting, spreadsheet, database, and other applications. Gateway functionality lets you log and view data from downstream devices.

With so many sophisticated features in just one device, the ION8650 gives you the information you need to grow your competitive advantage

Multiuser, multilevel security

Control and customize access to sensitive data for up to 50 users. Password protection, hardware revenue locking, session-based event logging of user account access, and anti-tamper seal protection enhance meter security.

Cybersecurity enhancements

- Password management
- Assign communication admin rights to select users
- Security events logged by user
- Prevention measures to ensure no loss of security logs
- Support of syslog for external security log management
- Firmware validation
- Ability to disable ports not in use
- User configurable Ethernet protocol ports

Data and event logging for any condition

Depending on the meter you chose, standard, non-volatile onboard memory is available in 32 MB, 64 MB, and 128 MB capacities. Data is prioritized and stored onboard to eliminate data loss if communication is interrupted. Data recorders are preconfigured for revenue, losses, historic data, harmonics, waveforms, power system data, sags/swells, transients, and event parameters. In addition, custom logging of any parameter is easy to configure with PowerLogic ION Setup.

Multiple tariffs and time-of-use calculations

A 20-year calendar, automatic leap year, seasonal adjustments, and clock synchronization, combined with five daily profiles per season and four rate periods per daily profile ensure complete accommodation of specific billing requirements.

Alarming and control made easy

The meter automatically provides high-priority alarm notifications or scheduled system status updates. Sixty-five setpoints configurable for 1-second or ½-cycle operation can trigger on any parameter or condition. Activate audible and visible alarms, data logging, waveform recording, relays, and other control and reset functions.

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APPENDIX III ELECTRICAL CUTSHEETS

Your 24/7 power quality specialist

Unlike other ANSI revenue meters in the market today, each PowerLogic ION8650 is a flexible power quality system. Reduce equipment damage and system downtime with out-of-the-box support for key power quality applications or use its flexibility to create your own custom application. Depending on the model, the ION8650 can calculate and display simple harmonics up to fully certified power quality IEC 61000-4-30 Class A measurements that support international quality of supply standards like N 50160 Edition 4.

Power quality applications

With the PowerLogic ION8650, you can detect, record, and report the specifics of:

- Voltage or current imbalances and loss, frequency/power factor variations, over- and undervoltages
- Sag/swell magnitude and duration, plus sub-disturbances that may occur during a sag/swell event
- Disturbance direction detection determines the source of a disturbance by indicating whether it originated upstream or downstream of the meter
- Harmonics, individual up to the 63rd, K factor, total harmonic distortion, plus voltage and current magnitude, phase and inter-harmonics in accordance with IEC 61000-4-7 up to the 50th harmonic with the A model
- Transient capture for Type 1 disturbances at 1024 samples per cycle with resolution to 17 µs at 60 Hz and 20 µs at 50 Hz with the A model
- Waveform capture via two recorders with selectable resolution enables simultaneous transient capture and sag/swell fault recording on the A model

Designed to meet your workflow

The PowerLogic ION8650 is designed and built to the most exacting standards. The user-focused design means fewer options to stock, and simpler repair and maintenance. Easy to retrofit, it integrates seamlessly with our previous generation revenue meters and their configuration frameworks.

Front panel

The bright, easy-to-read, backlit LCD screen with adjustable contrast is easy to see whether viewing system data or configuring the meter. An ANSI Type II optical serial port facilitates infrared communication with the device. Two LEDs are preconfigured for energy pulsing. The meter supports Kilo/MegaWatt value scaling for high energy metering points.

Simplified mounting and installation

The meter is available in socket or switchboard form factors that easily let you upgrade obsolete equipment with dramatically reduced installation costs. A switchable volts mode accessed through the front panel gives you all the flexibility of multiple form factor choices without the procurement and stocking complexities:

- 2 socket types: one for 9S/29S/36S, one for 35S
- 1 switchboard type to cover 9/29/35/36 modes

Circuit and control power connections

The meter has three voltage and three current inputs compatible with 4-wire Wye, 4-wire Delta, 3-wire Wye, 3-wire Delta, and direct Delta systems. Direct connect ANSI socket mount 9S, 29S, and 36S systems up to 277 V AC line-to-neutral, or a 35S system up to 480 V AC line-to-line. Power the meter by the voltage source being monitored or from an auxiliary power pigtail.

Expand your I/O capabilities

Onboard meter I/O includes two onboard options:

- Four Form C digital outputs and three Form A digital inputs
- Four Form C digital outputs, one Form A digital output, and one Form A digital input

Optional I/O expander provides eight digital inputs, four Form A digital outputs and four Form C digital outputs, or four analog outputs in place of the four Form A digital outputs (requires external power supply in order to use analog outputs).

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Integrated adapter retrofits

The retrofit adapter kit allows users to install the latest generation meter from Schneider Electric, the PowerLogic ION8650, into many switchboard cases including GE, Westinghouse, Basler, and others. The meter will fit flush inside a new or existing case.

The retrofit adapter kit makes installations fast, simple, and cost-effective. Customers will not have to be concerned about miswiring or handling old abestos wiring. Easy installation translates into lower labor costs, which makes the meter upgrade feasible for many applications. Integrated adapters can retrofit into existing meter cases or be used with new cases for new metering installations. Adapters are available for eight different cases. Customers will benefit from higher accuracy and enhanced communications capabilities, which include Ethernet TCP/IP, Modbus TCP/IP, Modbus RTU, DN 3.0 and 61850 protocols, Power Quality capabilities including Waveform Recording, monitoring and alarming on harmonics and transients.

Installation is a matter of minutes, not hours. Simply remove the cover, slide out the old meter, slide in the new Retrofit Adapter assembly, and attach the new flush cover. There is no need to shut down the circuit or do any rewiring. Customers will not experience any power interruptions.

For more information on the retrofit adapter kit, visit www.schneideradapters.com

General specifications

Description	Specification
Operating range	-40 °C to +85 °C (no formation of ice) (-40 °F to 185 °F)
Display operating range	-40 °C to 70 °C (-40 °F to 158 °F)
Storage range	-40 °C to +85 °C (-40 °F to 185 °F)
Relative humidity range	5% to 95% noncondensing
Safety/construction	ANSI C12.20-2010 American National Standard for Electricity Meters and IEC 62052-11-2003
Emissions	FCC Part 15 Subpart B, CISPR 22 Radiated/Conducted Emissions (Class B)
Utility approvals	California ISO, ERCOT, and New York State; Industry Canada; EGR Code of Practice 4 for New Zealand; Certified by Comision Federal de Electricidad and LAPEM in Mexico*
Warranty	Industry-leading 10-year warranty

* Contact factory for approval certificate availability

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Features and options

Feature sets	A	B	C
Metering			
Power, energy, and demand	■	■	■
Power quality			
Sag/swell with direction detection, harmonics monitoring	■	■	■
Harmonics: individual, even, odd, up to	63rd	63rd	31st
Harmonics: magnitude, phase, and inter-harmonics	50th	40th	-
IEC 61000-4-30 Class A/S	A	S	
Symmetrical components: zero, positive, negative	■	■	■
Transient detection, microseconds (50 Hz/60 Hz)	20/17	-	-
Logging and recording			
Onboard memory	128 MB	64 MB	34 MB
Min/max logging for any parameter	■	■	■
Timestamp resolution in seconds	0.001	0.001	0.001
GPS time synchronization	■	■	■
Communications and I/O			
RS-232/485; RS-485; optical; IRIG-B	■	■	■
Ethernet and internal modem or cell modem (optional)	■	■	■
DLMS & DNP 3.0 via serial, modem, Ethernet, Optical ports (if present)	■	■	■
Modbus TCP Master/Slave (Ethernet port)	■ / ■	■ / ■	■ / ■
Modbus RTU Master (serial ports)/Slave (all ports)	■ / ■	■ / ■	■ / ■
Gateway functionality, onboard Web server	■	■	■
RS-232/485; RS-485; Ethernet; Optical; IRIG-B	■	■	■
4 Form C outputs/3 Form A inputs	opt.	opt.	opt.
4 Form C outputs/1 Form A output/1 Form A input	opt.	opt.	opt.
External digital status inputs/counter/solid state outputs	opt.	opt.	opt.
Setpoints, alarming, and control			
Setpoints, number/minimum response time	65/½ cycle	65/½ cycle	65/1 sec
Math, logic, trig, log, linearization formulas	■	■	■
Call-out on single and multicondition alarms	■	■	■
Revenue metering			
MV-90 on serial, modem, Ethernet ports (if present)	■	■	■
Multiyear scheduling: hourly activity profiles	■	■	■
Transformer/line loss compensation/ITC	■ / ■	■ / ■	■ / ■

For more detailed specifications, please refer to Technical Data Sheet PLSED310027EN.

Life Is On Schneider Electric

Expert, on-going support from your dedicated meter application engineering team

As a PowerLogic ION8650 meter customer, you will have access to and support from the Schneider Electric meter application engineering team. Our dedicated experts can walk you through specific technical requirements, troubleshooting, and advanced capabilities.

For more information, contact USEnergySalesSupport@schneider-electric.com

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January 2016

TESLA

ENERGY

POWERWALL WAREHOUSE GUIDELINES

April 6, 2016

Rev. 1.07

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1. Purpose

This document provides Tesla Energy Authorized Resellers necessary details about Powerwall packaging, storage, and shipping. For further information or questions, please contact Tesla.

2. Safety

Refer to the Tesla *Lithium-Ion Emergency Response Guide* (ERG) TS-0004027 for detailed hazard information specific to the lithium-ion battery. TS-0004027 provides the hazard information for Tesla Energy Powerwall. The ERG document is included in hardcopy on the outer side of each Powerwall crate in a shipping pouch.

3. Packaging

Caution: Powerwall has a pre-installed aesthetic cover. Do not put pressure on the center of the Powerwall packaging.

Caution: Keep Powerwall flat on its back and in its packaging until installation.

Packaging Specifications

Powerwall is packaged in a wooden crate that is specifically designed to hold the Powerwall and its parts. Each crate is attached to an individual pallet.

Weight of Powerwall and packaging	132 kg (291 lbs)
Length	1360 mm (53.5 in)
Width	930 mm (36.6 in)
Height, crate and included pallet	483 mm (19 in)

Contents

Powerwall does not need to be uncrated for storage or transportation. Each Powerwall crate contains all components needed for an installation:

- Documents in a pouch on the outside of the crate:
  - *Powerwall Installation and User's Manual*
  - *Lithium-Ion Emergency Response Guide*
- Powerwall unit
- Wall mount bracket
- Side covers
- Bag of fasteners

If the crate appears damaged, address high voltage and other safety risks first.

Handling

Caution: Each Powerwall is to be handled in its crate only. Keep the Powerwall unit in its banded crate until it reaches its destination.

Caution: Ensure the packaging is not punctured. Protect packaging from weather and extreme temperatures.

Follow these rules when handling Powerwall crates in the warehouse:

- Only stack a maximum of 5 crates vertically.
- If stacking more than 3 crates, brace to a wall or rack.
- Only forklift a maximum of 2 crates at a time.

When transporting more than one Powerwall together, band or ratchet-strap them together at each end inside the pallet feet.

3. Storage

References to storage in this section refer to on-the-shelf conditions with batteries disconnected from the grid.

The maximum acceptable storage duration (without measures to maintain function) is 12 months if the unit has an initial SOE of 25% and humidity is <95% non-condensing.

Storage Duration	Allowable Temperature Range
< 24 hours	-30 °C to 60 °C (-22 °F to 140 °F)
< 1 month	-20 °C to 45 °C (-4 °F to 113 °F)
Between 1 and 12 months	-20 °C to 30 °C (-4 °F to 86 °F)

4. Shipping

General Shipping Guidance

Powerwall is considered a regulated good since it is categorized as a Class 9 Miscellaneous Hazardous Material. The liability of the product is transferred when the ownership is transferred. Therefore, each distributor is liable when shipping Tesla Powerwall. Below, Tesla has listed some rough guidelines to follow, however please refer to your company's shipping policies and the Code of Federal Regulations, 49 CFR 172.704.

Shipping Paperwork must include:

- Origin Address
- Destination Address
- iShip Hazardous Code
- Format: UN#, proper shipping name, class, packing group.

  Example: UN3481, LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT,9,II
- 24/7 Hazardous Hotline including:
  - Company Name
  - Account Number
  - Phone Number

Tesla recommends that the shipping paperwork be hard coded to include the iShip Hazardous Code and Hotline information any time Powerwall part number is added. Tesla also recommends that the shipping paperwork includes "Tesla Powerwall Home Battery" to help all handlers acknowledge which product they have.

If Powerwalls are shipped by air, add stickers for “Class 9 – Lithium Ion Battery – UN 38.3” and “Cargo Aircraft Only”.

Each distributor of Powerwalls must either create a 24/7 emergency hotline or get a contract with a 3rd party emergency contact number (ex. Chemtrek, Chemtel, etc.).

Truck Shipments

When shipping Class 9 goods by truck, hazmat guidelines can vary by region:

- **Within the United States, Australia, and New Zealand:** Trucks are exempt from placards and drivers are not required to have hazmat endorsement / licensing.
- **Within Europe:** Trucks carrying less than 300 kg are exempt from placards, and drivers are not required to have hazmat endorsement / licensing. Trucks carrying more than 300 kg are required to use placards and have hazmat endorsement / licensing.
- **Shipping in all other regions:** Please consult local regulations.

In all regions, regardless of shipment weight, the driver must be made aware that the shipment includes regulated Class 9 goods / materials and Powerwall must be sent with proper shipping paperwork. The shipping paperwork can be in the form of a Bill of Lading (BOL), Job Sheet, or Delivery Order.

In addition to the guidance above, be sure to conform to all applicable national, state/provincial, and local regulations regarding storage and transport.

Coolant

The coolant used in the Tesla Powerwall is not a regulated substance (not dangerous goods). The coolant MSDS can be provided upon request.

5. Repacking

If the original packaging has been damaged, repackage the unit before shipment.

NOTE: This process requires two people.

Open the Old Crate

1. Lay the old crate flat on the ground with the pallet side down.
2. Use a T20 Torx to remove 2 screws from each of the 8 blocks on the crate lid sides. Set the screws aside for reuse.

   NOTE: Do not remove the screws from the corners of the crate. Only remove screws from the highlighted area below on each side.

3. Use two people to lift up on the crate lid from each side. Be careful to lift straight up so as not to scratch Powerwall.
4. Put the crate lid to the side.
5. Move Powerwall on its pallet out of the way so that it is not damaged during the following work.

Pack the New Crate

1. Lay the pallet side of the new crate down (on all 4 feet) and lay the crate lid aside. Make sure the pallet already has 4 wooden blocks attached, 2 per side.
2. Transfer the 2 side covers from the lid of the old crate to the lid of the new crate. Secure with Velcro.
3. Transfer the small bag of fasteners from the old crate to the new crate. Staple the bag to the base of the pallet in the same location.
4. Carefully lower the new crate lid onto Powerwall. Slide it sideways until the top edge of the lid contacts the top of Powerwall inside.
5. Secure the new lid to Powerwall by attaching 2 screws into each of the 4 blocks.
6. Using at least two people, carefully tilt Powerwall up on end. Have one person hold it in place safely until the new pallet is ready.

7. Transfer the wall mount bracket from the old pallet to the new pallet. Secure with Velcro.
8. Move the new pallet behind the Powerwall in its new lid and tilt the pallet up to stand behind the unit.
9. Secure the pallet to the crate using a ratchet strap or other mechanism to ensure the pallet and crate do not slide in relation to each other during the next step.
10. Using two people, carefully lower both lid and pallet down together to lie flat on the pallet's feet.
11. Undo the ratchet straps.
12. Carefully slide the lid sideways to align the wooden blocks on the pallet to be directly in line with the wooden blocks attached to Powerwall.
13. Remove the wood screws holding the lid to Powerwall and reinstall them so that the pallet and lid are in line.
14. Install all 16 screws, 2 per wood block, to attach the lid to both the pallet blocks and the Powerwall blocks.
15. If new copies are not already present, transfer the *Lithium-Ion Battery Emergency Response Guide* and *Powerwall Installation and User's Manual* documents from the pouch on the side of the old crate to a sealed plastic pouch on the side of the new crate lid. These must ship with Powerwall.

APPENDIX IV
MECHANICAL CUTSHEETS

MANUFACTURED FOR: MITSUBISHI ELECTRIC US, INC.

Thermostat Interface

PAC-US444CN-1

INSTALLATION/INSTRUCTION MANUAL **FOR INSTALLER**

Before using the device, carefully read this installation/instruction manual to ensure proper operation.
Keep this manual for future reference and give it to the technician when the device is reinstalled or repaired.

Contents

1. Supplied Parts.....1
2. Safety Precautions.....1
3. System Configuration.....3
4. How to Install.....5
5. Usage.....8

1. Confirming the Supplied Parts

Check that the box includes the following part(s) in addition to this installation manual:

PAC-US444CN-1 Thermostat Interface (1)

2. Safety Precautions

- Thoroughly read the following safety precautions before use.
- Hazards that can occur from incorrect handling are classified by the symbols below:

⚠ Warning	Incorrect handling can result in death, serious injury, etc.
⚠ Caution	Incorrect handling can result in bodily injury and/or structure damage.

- After reading this manual, keep this manual for future reference. When the device is reinstalled or repaired, give this manual to those who provide these services. When the user changes, make sure that the new user receives this manual.

⚠ Warning

- **Only a dealer or qualified technician should install, relocate, reinstall, or repair the device.**
  Improper installation or repair may result in electrical shock or fire.
- **Properly install the device on a stable, load-bearing surface.**
  Device installed on an unstable surface may fall and cause injury.

- **Only use the specified cables; securely connect each so that the terminals do not bear any cable weight.**
  Improperly connected or short-circuited cables may produce heat and cause a fire.
- **Do not make any modifications or alternations to the device.**
  Modifications or improper repair may result in electric shock or fire. Consult your dealer for repair.
- **All electrical work should be performed by an authorized electrician according to local regulations and instructions outlined in this manual.**
  Capacity shortage to the power supply circuit or improper installation may result in electrical shock or fire.
- **Properly install the device according to the instructions in this Installation/Instruction Manual.**
  Improper installation may result in electric shock or fire.

⚠ Caution

- **Do not install the device in a location where a flammable gas leak may occur.**
  Gas may leak, collect around the device, ignite, and/or explode.
- **Do not install the device in environments where large amounts of oil (including machine), sulfidizing gas, or acidic, alkaline, chemical sprays are present.**
  These types of substances may damage internal parts, cause device performance to be reduced, and cause electrical shock.
- **Do not install the device in a bathroom, kitchen, or any room where steam could form.**
  Condensation may develop and cause electrical shock and/or the device to malfunction.
- **Use standard wires with the proper current capacity**
  to avoid the possibility of current leak, excessive heat, and/or fire.
- **Do not touch the main circuit board; also, make sure that dust does not accumulate on the circuit board.**
- **When installing the device in a hospital, communication facility, etc., provide sufficient protection against frequency noise.**
  Power generators and inverters, high-frequency medical, or radio communication equipment may interfere with the normal operation of this device. Subsequently, the device may also affect medical treatment, image broadcasting, etc., by creating frequency noise.
- **Include some slack in the power supply wires.**
  Tension on the wires may cause them to excessively heat up and/or break, resulting in a fire.
- **Do not install the device in a location where there is direct sunlight or where the temperature may become greater than 40°C (104°F) or less than 0°C (32°F).**
  If the device is installed in such place, it may result in deformation or malfunctions.
- **Do not immerse the device in water.**
  Doing so may lead to electric shock or malfunctions.

3. System Configuration

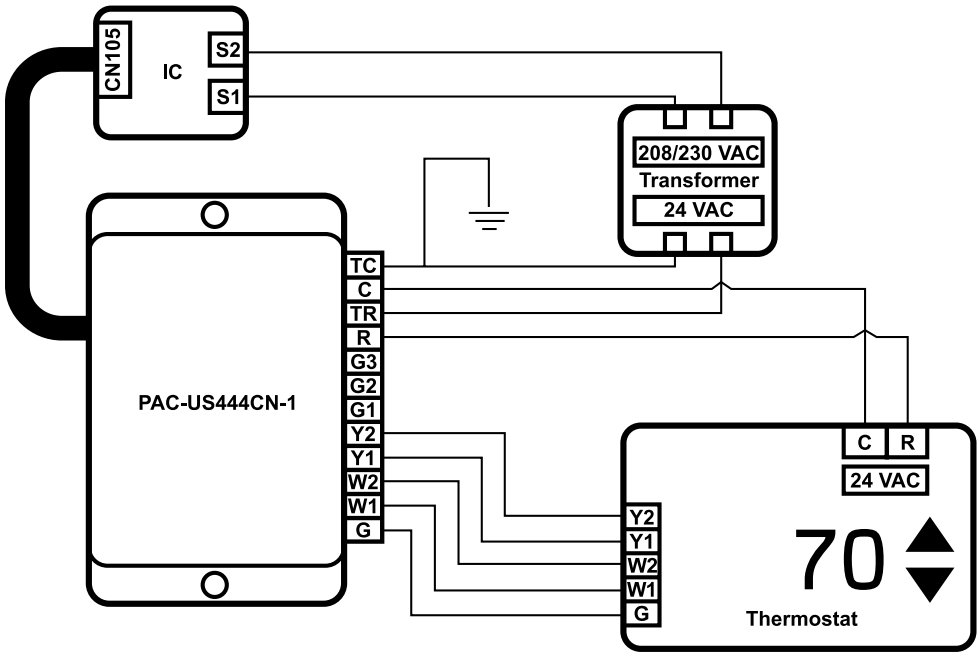
Warning: Thermostat should be configured for use with a conventional system (not heat pump).

Note: When either Y2 or W2 is left unconnected, it is recommended to set SW2-6 to the OFF position.

1. All wiring shown should be performed with 18 AWG thermostat wire.
2. Terminals on the PAC-US444CN-1 support 20-30VAC.
3. High/medium/low fan signals are optional, and may not be available on all thermostat models.
4. W2 and Y2 signals are optional, and may be omitted for single-stage thermostats.

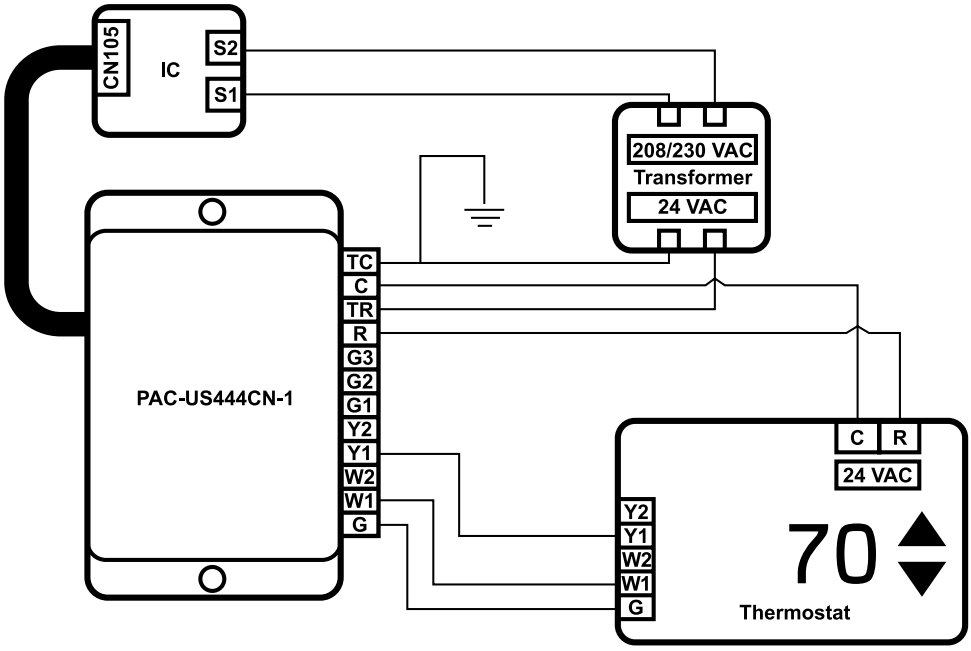
Example 1: Two-stage Cooling and Heating

Note: When both Y2 and W2 are connected, it is recommended to set SW2-6 to the ON position.



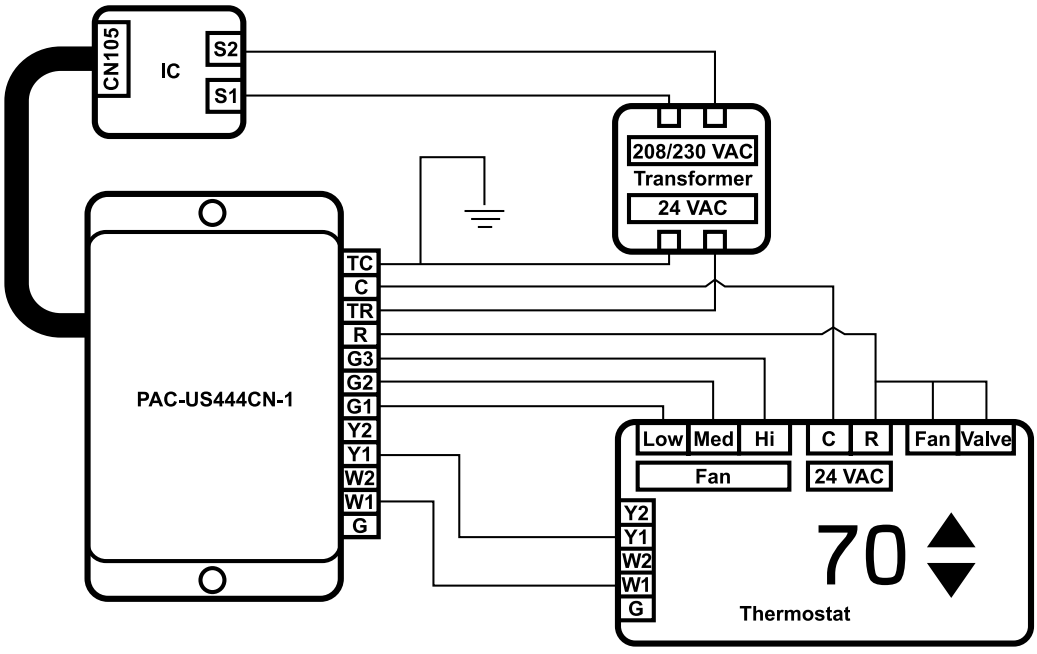
Example 2: Single-stage Cooling and Heating

Note: When either Y2 or W2 is left unconnected, it is recommended to set SW2-6 to the OFF position.



Example 3: Single-stage Cooling and Heating with Dedicated Fan Speed Relays

Note: When connecting only first stage signals (Y1/W1), it is recommended to set SW2-6 to the OFF position.



Example 4: Single-stage Cooling with Alternate Primary Heating Source

Note: For this configuration, it is recommended to set SW2-6 to the OFF position.

Follow the wiring from example 2, with the following adjustments:

1. Connect thermostat W1 to the alternate heat source.
2. Connect the thermostat W2 terminal to the PAC-US444CN-1 W1 terminal.

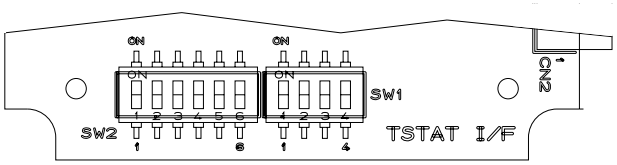
Connector	Purpose	Purpose
TC	Common (In)	C
C	Common (Out)	C
TR	24VAC (In)	R
R	24VAC (Out)	R
G3	Fan High	High Fan Speed
G2	Fan Medium	Medium Fan Speed
G1	Fan Low	Low Fan Speed
Y2	Y2	Stage 2 Cooling
Y1	Y1	Stage 1 Cooling
W2	W2	Stage 2 Heating
W1	W1	Stage 1 Heating
G	G	Fan

4. How to Install

1. Choose a place where to install the PAC-US444CN-1. The device provides two mounting holes that can be used to mechanically affix the case to a solid surface. Double-sided tape may be used to affix the device. When using tape, ensure that the tape is approved for use within the anticipated operating temperature ranges.
2. Install the transformer, as necessary, per building code and manufacturer's installation instructions.
3. Connect the PAC-US444CN-1 cable to the connector CN105 on the indoor unit control board.
4. Connect PAC-US444CN-1 terminals using 18 AWG wire.

Device Configuration

Initial settings can be configured via the two banks of dip switches on the circuit board, SW1 and SW2. The circuit board can be accessed by unfastening the four screws on the back of the case.



DIP Switch Definitions (Factory default is OFF for all switches):

Delayed Off

SW1-1/2: After reaching thermostat set point, the unit will continue to run for a set period of time in order to improve efficiency. The period of time is set by adjusting SW1-1 and SW1-2 according to the following table:

SW1-1	SW1-2	Result
OFF	OFF	5 minutes (Default)
ON	OFF	10 minutes
OFF	ON	30 minutes
ON	ON	0 minutes

SW1-3/4: The indoor unit fan speed can be adjusted via the following settings:

SW1-3	SW1-4	Result
OFF	OFF	Auto (Default)
ON	OFF	Medium
OFF	ON	High
ON	ON	Custom Auto

Note: Custom Auto provides more comfortable fan speed operation vs. the more efficient Auto (default).

Two-Stage Thermostat Operation

SW2-6: Adjusts indoor unit operation during stage 1 heating and stage 1 cooling according to the following table:

SW2-6	Operation during stage 1
OFF	Full capacity
ON	The capacity is adjusted so that the room temperature is adjusted (heated or cooled) at a fixed rate.

Note: When either Y2 or W2 is left unconnected, it is recommended to set SW2-6 to the OFF position. When both Y2 and W2 are connected, it is recommended to set SW2-6 to the ON position.

Static Pressure Settings

SW2-1, SW2-2, SW2-3: These adjust the static pressure function settings of the indoor unit according to the following table:

DIP switch position on PAC-US444CN-1			Indoor Unit Settings			
SW2-1	**SW2-2**	**SW2-3**	**Mode 8**	**Mode 10**	**Mode 23**	**Mode 11**
OFF	OFF	OFF	Not set	Not set	Not set	Not set
OFF	OFF	ON	Not set	Not set	Not set	Not set
OFF	ON	OFF	2	1	Set by SW2-4	2
OFF	ON	ON	2	2	Set by SW2-4	2
ON	OFF	OFF	1	1	Set by SW2-4	2
ON	OFF	ON	1	2	Set by SW2-4	2
ON	ON	OFF	3	1	Set by SW2-4	2
ON	ON	ON	3	2	Set by SW2-4	2

**Refer to the appropriate Indoor Unit Installation Manual for Mode 8 and Mode 10 function setting definitions.*

CN24 Operation During Defrost

SW2-4: Adjusts Mode 23 function settings according to the following table:

SW2-4	Result	Fan and CN24
OFF	Setting 2 (Default)	ON
ON	Setting 1	OFF

**Refer to the appropriate Indoor Unit Installation Manual for Mode 23 function setting definitions.*

Fan Speed During Heating Mode, Thermal Off

SW2-5: Adjusts Mode 25 initial setting (fan speed in thermal off for heating) according to the following table:

SW2-5	Result
OFF	Extra low (Default)
ON	Set by Thermostat Interface

In addition, the adapter also affects the following function settings of the connected indoor unit:

Mode	When using the adapter
Mode 1 (auto recovery after power failure)	Always enabled
Mode 2 (room temperature detection location)	Unused (room temperature detected by the connected thermostat)
Mode 24 (heat offset for height)	Unused

Additional function settings not addressed by the thermostat interface may be configured by temporarily connecting an MA remote controller.

Grouping

The connection of more than one PAC-US444CN-1 to a single set of thermostat dry-contacts is not supported.

Temperature Sensing

The PAC-US444CN-1 relies upon both the dry-contact thermostat and the indoor unit's thermistors in order to monitor room temperature. The thermostat's temperature sensing is used to set the room temperature. The indoor unit thermistor is used when calculating cooling and heating rates of change.

5. Usage

Operate the third-party thermostat per the manufacturer's instructions. During normal operation, the connection of Mitsubishi remote controllers (e.g. MA/ME) is not supported, as they will interfere with the correct operation of the PAC-US444CN-1.

Notes:

1. The indoor unit will limit the internal temperature control set point based on the indoor unit specification.
2. Fan signals G1,G2,G3, when energized, take precedence over SW1-3&4.
3. Only fan speeds available on the IDU can be set by the Thermostat Interface.
4. The G signal is used only for operating the IDU in ventilation mode when all cooling and heating signals are disabled.
5. When all cooling and signals are disabled, energizing G will place the IDU into ventilation mode.

MODELS 350 AND 500 PORTABLE HEPA SYSTEMS

FOR USE AS STAND ALONE PORTABLE UNITS OR ATTACHED TO HVAC SYSTEMS FOR CENTRAL OR AREA FILTRATION

Pure Air Systems introduces a new high performance, commercial quality, portable HEPA air filtration system that shares the same performance standards as our well known line of high volume HEPA filtration units.

HIGH PERFORMANCE IN A SMALL PACKAGE

The HPS 350 unit is only 13" square and 21 1/2" long and produces over 350 CFM of air through our certified 99.99% HEPA filters. The unit has a four speed volume control switch which allows you to control the air volume for your specific application or room size. The HPS 500, which is the same size as the HPS 350, produces over 500 CFM of HEPA filtered air and is one of the most powerful portable HEPA air filtration units on the market today.

TWO HPS VERSIONS * FOUR VARIATIONS * MULTIPLE APPLICATIONS

The HPS 350 and 500 are available in both the standard unit and the upgraded "C" unit. Both units have the same motor/blower and controls but the "C" unit also has two hand holds on the cabinet and a digital filter replacement timer. Either one of the units can be used as a stand alone portable or attached to the return air duct of an HVAC system for central or large area HEPA filtration.

HPS 350 Standard Portable
With Extended Inlet Collar
For Attachment To HVAC
Or Duct Syst

HPS 500 "C" Portable Unit
With Digital Filter Replacement
Timer And Hand Holds

DESIGN SPECIFICATIONS

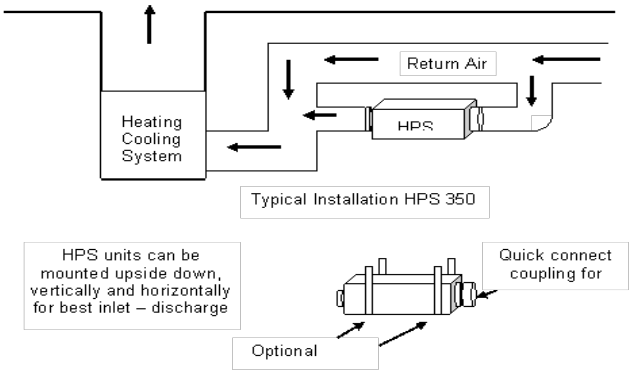
Dimensions:	13” x 13” x 21 1/2” Long
Weight:	28 lbs
Construction:	20 Gauge Powder Coated Steel
Connections:	6” Dia. Discharge (caged), 13” x13” Open Screened Inlet
By-Pass Config:	8” Dia. Inlet
CFM Rating 350	Max 350 CFM, Min 140 CFM
CFM Rating 500	Max 500 CFM, Min 200 CFM
Electrical Req:	120 volt, 15 Amps
Motor/Blower:	EBM Integrated Mrt/Blower 5 Amp, Four Speed Induction
Filters:	Combination Polyester Ring Panel Prefilter With Carbon Media Certified 99.99% at 0.3 Microns Mini-Pleat HEPA Filter
Controls:	Lighted on/off Rocker Switch Four Speed Selector Switch 12’ Power Cord With Grounded Plug
“C” Version:	Digital Filter Replacement Timer Control

HPS 350 AND 500 PORTABLE APPLICATIONS

Bedrooms	Office Area	Clean Room	Nursery
Laboratory	Day-Care	Playroom	Hospital Rooms
Pet Hospitals	Townhome	Mini-Clinics	Retail
Condominium	Dental Offices	Pharmacies	Recreational Vehicles
Schools	Apartments		

PARTIAL BY-PASS CONFIGURATION - HVAC

The HPS units have a very small footprint and as a result these powerful HEPA units can be installed in areas and applications where our larger units will not fit especially in townhomes, apartments and condominiums.



Pure Air Systems, Indianapolis, IN 46245 800-869-8025
Info@pureairsystems.com

MITSUBISHI ELECTRIC
COOLING & HEATING

M-SERIES SINGLE-ZONE

MSZ-FH**NA

PRODUCT GUIDE

H2i™ MSZ-FH SINGLE-ZONE HEAT PUMP

Product Overview

Heat pumps are now a realistic option for any home, in any climate. The new MSZ-FH family of Hyper-Heating INVERTER residential systems offer year-round, high-efficiency cooling and heating for a variety of rooms, including bedrooms, basements, sunrooms and more. The slim, wall-mounted indoor units provide zone comfort control while the INVERTER-driven compressor and electric LEVs offer higher efficiency with controlled power usage.

- Industry-leading efficiency of 30.5 SEER (MSZ-FH09NA).
- Hyper-Heating performance down to -13° F outdoor ambient.
- 100% heating capacity at 5° F outdoor ambient.
- Triple-action filtration.
  - Nano-platinum filter.
  - Electrostatic anti-allergen enzyme filter.
  - Deodorizing filter.
- Double-vane air delivery for enhanced circulation.
  - Option to set each vane separately.
  - Indirect or direct setting option.
  - Natural flow setting that creates air movement like a natural breeze.
- i-see Sensor™ 3D.
  - Infrared human sensing technologies to measure location of human heat signatures.
  - i-see sensing floor temperature to deliver conditioned air to those areas by double-van airflow.
- NEW multi-function wireless controller.
- Optional controllers.
  - MHK1 wireless wall-mounted controller (compatible with Honeywell Remote Internet Gateway for iPhone, Android, smart device control via the internet).
  - Wired wall-mounted controller (PAR-31MAA requires MAC-333IF).
  - Simple MA remote controller (PAC-YT53CRAU requires MAC-333IF).

Form No. PLG_MSZFH_01.14. OA | Printed In The U.S.A

PRODUCT GUIDE **MSZ**

MSZ-FH**NA

Model Name	Indoor Unit		MSZ-FH09NA	MSZ-FH12NA	MSZ-FH15NA
	Outdoor Unit		MUZ-FH09NA	MUZ-FH12NA	MUZ-FH15NA
Cooling *1	Rated Capacity	Btu/h	9,000	12,000	15,000
	Capacity Range	Btu/h	2,800-9,000	2,800-12,000	6,450 - 19,000
	Rated Total Input	W	560	870	1,200
	Energy Efficiency	SEER	30.5	26.1	22.0
	Moisture Removal	Pints/h	0.6	1.9	4.0
	Sensible Heat Factor		0.920	0.830	0.700
Heating at 47° F *2	Rated Capacity	Btu/h	10,900	13,600	18,000
	Capacity Range	Btu/h	1,600 - 18,000	3,700 - 21,000	5,150 - 24,000
	Rated Total Input	W	710	950	1,300
	HSPF (IV)	Btu/h/W	13.5	12.5	12.0
Heating at 17° F *3	Rated Capacity	Btu/h	6,700	8,000	11,000
	Rated Total Input	W	600	720	1,020
	Maximum Capacity	Btu/h	12,200	13,600	18,000
Heating at 5° F	Maximum Capacity	Btu/h	10,900	13,600	18,000
Power Supply	Phase, Cycle, Voltage		1 Phase, 60Hz, 208/230V *4		
Voltage	Indoor - Outdoor S1 - S2		AC 208 / 230V		
	Indoor - Outdoor S2 - S3		DC ±24V		
	Indoor - Remote Controller		Wireless Type (Optional Wired Controller: DC12V)		
Indoor Unit	MCA	A	1.0		
	Blower Motor (ECM)	F.L.A.	0.67		
	Airflow at Cooling (Lo-Med-Hi-Super HI-Powerful) *1	DRY (CFM)	137-167-221-304-381	137-167-221-304-398	225-262-304-355-411
		WET (CFM)	117-143-190-261-328	117-143-190-261-342	194-225-261-305-354
	Airflow at Heating (Lo-Med-Hi-Super HI-Powerful) *2	WET (CFM)	140-167-225-325-437	140-167-225-325-454	201-254-317-394-497
	Sound Pressure Level at Cooling (Lo-Med-Hi-Super HI-Powerful) *1	dB(A)	20-23-29-36-40	21-24-29-36-41	27-31-35-39-44
	Sound Pressure Level at Heating (Lo-Med-Hi-Super HI-Powerful) *2	dB(A)	20-24-29-36-42	21-24-29-36-42	25-29-34-39-46
	External Finish Color		Munsell No. 1.0Y 9.2 / 0.2		
	Dimension Unit	W: In.	36-7/16		
		D: In.	9-3/16		
		H: In.	12(+11/16)		
	Weight Unit	Lbs.	29		
	Field Drainpipe Size O.D.	In.	19/32		
Remote Controller	Type		Select from MHK1 (Preferred), PAR-31MAA, or PAC-YT53CRAU Remote Controllers		
Outdoor Unit	MCA	A	11		16
	MOCP	A	15		20
	Fan Motor (ECM)	F.L.A.	0.50		0.93
	Compressor	Model (Type)	DC INVERTER-driven Twin Rotary		
		R.L.A.	8.2		12.0
		L.R.A.	10.3		15.0
	Airflow (Cooling/Heating)	CFM	1,150/1,280		1,190/1,320
	Refrigerant Control		Linear Expansion Valve		
	Defrost Method		Reverse Cycle		
	Sound Pressure Level at Cooling *1	dB(A)	48	49	51
	Sound Pressure Level at Heating *2	dB(A)	49	51	55
	External Finish Color		Munsell No. 3Y 7.8 / 1.1		
	Dimensions	W: In.	31-1/2		33-1/16
		D: In.	11-1/4		13
		H: In.	21-5/8		34-5/8
	Weight	Lbs.	81	83	124
Refrigerant	Type		R410A		
	Charge	Lbs., Oz.	2, 9		3, 7
	Oil	Type (fl. oz.)	FV50S 350cc		FV50S 400cc
Refrigerant Pipe	Gas Side O.D.	In.	3/8		1/2
	Liquid Side O.D.	In.	1/4		
Refrigerant Pipe Length	Height Difference (Max.)	Ft.	40		50
	Length (Max.)	Ft.	65		100
Connection Method	Indoor/Outdoor		Flared/Flared		

NOTES: Test conditions are based on AHRI 210/240.
*1. Rating conditions (cooling)-Indoor: D.B. 80° F (27° C), W.B. 67° F (19° C); Outdoor: D.B. 95° F (35° C), W.B. 75° F (24° C).
*2. Rating conditions (heating)-Indoor: D.B. 70° F (21° C), W.B. 60° F (16° C); Outdoor: D.B. 47° F (8° C), W.B. 43° F (6° C).
*3. Rating conditions (heating)-Indoor: D.B. 70° F (21° C), W.B. 60° F (16° C); Outdoor: D.B. 17° F (-8° C), W.B. 15° F (-9° C).
*4. Indoor units receive power from outdoor units through field-supplied interconnected wiring.
Specifications are subject to change without notice.
LIMITED WARRANTY I Seven-year warranty on compressor. Five-year warranty on parts.

MOTORIZED DAMPERS

SPRING RETURN - POWER OPEN OR POWER CLOSE – AD__

Model **ADO** Shown

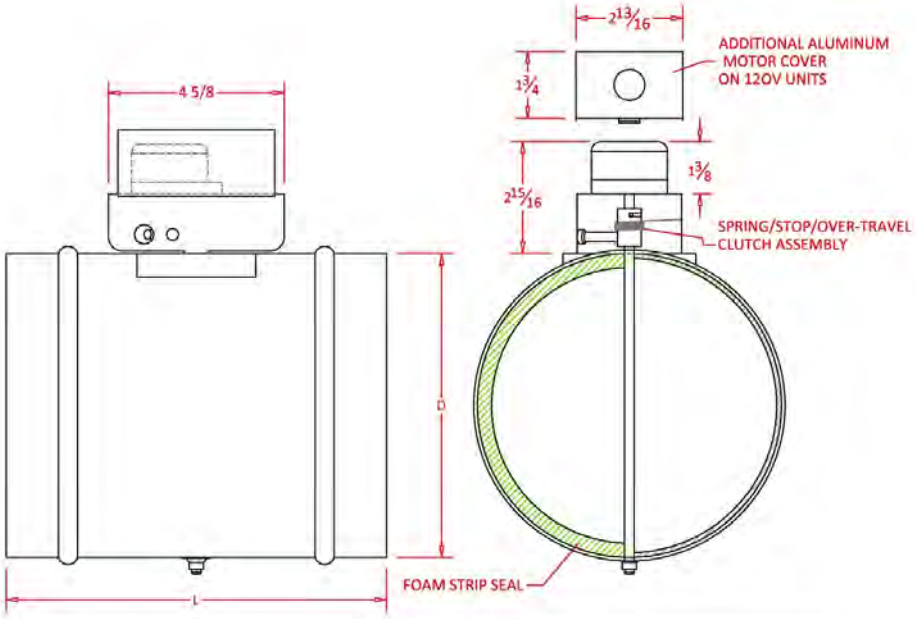
DIAMETER IN INCHES	WITH 24 VOLTS MOTORS				WITH 120 VOLTS MOTORS			
	NORMALLY CLOSED		NORMALLY OPEN		NORMALLY CLOSED		NORMALLY OPEN	
	STANDARD	END SWITCH	STANDARD	END SWITCH	STANDARD	END SWITCH	STANDARD	END SWITCH
4	ADC424	ADC424ES	ADO424	ADO424ES	ADC4120	ADC4120ES	ADO4120	ADO4120ES
5	ADC524	ADC524ES	ADO524	ADO524ES	ADC5120	ADC5120ES	ADO5120	ADO5120ES
6	ADC624	ADC624ES	ADO624	ADO624ES	ADC6120	ADC6120ES	ADO6120	ADO6120ES
7	ADC724	ADC724ES	ADO724	ADO724ES	ADC7120	ADC7120ES	ADO7120	ADO7120ES
8	ADC824	ADC824ES	ADO824	ADO824ES	ADC8120	ADC8120ES	ADO8120	ADO8120ES
10	ADC1024	ADC1024ES	ADO1024	ADO1024ES	ADC10120	ADC10120ES	ADO10120	ADO10120ES
12	ADC1224	ADC1224ES	ADO1224	ADO1224ES	ADC12120	ADC12120ES	ADO12120	ADO12120ES
14	ADC1424	ADC1424ES	ADO1424	ADO1424ES	ADC14120	ADC14120ES	ADO14120	ADO14120ES
16	ADC1624	ADC1624ES	ADO1624	ADO1624ES	N/A	N/A	N/A	N/A

- Available in 24 VAC or 120 VAC
- Normally open or normally closed (Spring return)
- Tight seal provides positive closure
- Adjustable flow control standard (N/A with end-switch models)
- Optional end-switch available

FRESH AIR MANUFACTURING CO.
Technologies in Ventilation
*649 N. Ralstin St., Meridian, ID 83642 * (208)884-8931 * (800)-234-1903 * FAX: (208)884-8943*

MOTORIZED DAMPERS

SPRING RETURN - POWER OPEN OR POWER CLOSED– AD__



MOTORIZED DAMPERS		
SPRING CLOSED (NORMAL) / POWER OPEN		
ITEM #	D	L
ADC4__	4	10
ADC5__	5	10
ADC6__	6	10
ADC7__	7	10
ADC8__	8	10
ADC10__	10	10
ADC12__	12	12
ADC14__	14	14
ACD16__	16	16

MOTORIZED DAMPERS		
SPRING OPEN (NORMAL) / POWER CLOSED		
ITEM #	D	L
ADO4__	4	10
ADO5__	5	10
ADO6__	6	10
ADO7__	7	10
ADO8__	8	10
ADO10__	10	10
ADO12__	12	12
ADO14__	14	14
ADO16__	16	16

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APPENDIX V
PLUMBING

AquaSAFE™ quick reference guide for residential fire safety systems

This guide is meant for reference only and does not intend to cover all applications or specific construction features. Always follow the requirements of NFPA 13D, sprinkler listings and local codes and ordinances. If in doubt about any requirements, contact the Authority Having Jurisdiction (AHJ).

Jobsite review

Always review the design prints and walk the job to verify before starting the installation.

Sprinkler locations

Mark sprinkler mounting locations—indicate sprinkler node (e.g., H13) from the design print.

Sprinkler mounting details

Correct placement of ProPEX® fire sprinkler adapters depend on the type of sprinkler heads and the thickness of the ceiling material being used. Refer to the design prints for proper mounting dimensions. Always field verify with escutcheons or cover plates to ensure proper fit (measure and/or test with ceiling material).

Tubing supports

Only use Uponor tube talons (F7050750 or F7051000) or other supports intended for plastic tubing. Refer to **Table 1** for tubing supports.

Tubing support table		
Horizontal runs, unsupported	Horizontal runs, supported	Vertical runs
Every 32"	Every 72"	Every 4' to 5'; at each floor with a mid-story guide
When installed in exposed (unfinished) areas, metal hangers designed for use with non-metallic tubing are required every 24".		

Table 1: Tubing support table

AquaSAFE™ systems

Use ProPEX engineered polymer (EP) or lead-free (LF) brass tees or EP multiport tees between sprinkler adapters to connect cold-water plumbing fixtures.

Pendent sprinklers

Typically mount 1" from the face of the ceiling. Refer to the sprinkler manufacturer's guideline installation bulletin(s) for specific sprinkler listings and mounting requirements.

Sidewall sprinklers

Typically mount 4" to 6" from the ceiling; may be located up to 12" from the ceiling to avoid obstructions. Design prints and hydraulic calculations must reflect mounting positions 6" to 12".

Sprinkler deflectors

Always mount parallel to the plane of the ceiling.

Sloped ceilings

Refer to the sprinkler manufacturer's guideline installation bulletin(s) for specific flow, pressure, coverage and listing information when installing sprinklers in sloped ceiling applications. At least one sprinkler must be installed within 3' vertically from the ridgeline.

Heat sources

Maintain 12" spacing between Uponor AquaPEX® tubing and heating ducts or recessed lighting fixtures. Refer to **Table 4** on the back of this page for minimum sprinkler spacing from heating ducts, diffusers and other heat sources.

Attic spaces (insulation)

Ensure adequate insulation when running tubing in attic spaces. Refer to NFPA 13D, Annex A or the Uponor AquaSAFE Attic Insulation Guidelines on uponorpro.com for additional information.

Field modifications

Submit marked-up design prints to Uponor Design Services at design.services@uponor.com. Some changes may require additional hydraulic calculations.

Flow test verification

Uponor recommends submission of a Flow Test Verification Form for every installation. Refer to the AquaSAFE Flow Test Instruction Sheet available on uponorpro.com. Be sure to use the proper test orifice.

Warning sign

Affix adjacent to the main shutoff valve.

Sprinkler spacing

Refer to **Table 2** on the back of this page for sprinkler spacing requirements. Always refer to the NFPA 13D Standard, the sprinkler manufacturer's guideline installation bulletin(s) or contact Uponor Design Services at design.services@uponor.com for special requirements.

Exposed (unfinished) areas

Uponor AquaPEX® and ProPEX fittings may be installed and left exposed with dimensional lumber, engineered wood, wood I-joists up to 16" deep and wood floor trusses up to 18" deep with on-center spacing of 12" to 24". Metal hangers designed for non-metallic tubing must be used in these areas (see **Table 1**). Refer to installation instructions and/or listings for additional requirements and limitations.

Spacing requirement table	
Minimum spacing between sprinklers	Dependent on sprinkler (8' is typical); verify with manufacturer's sprinkler guideline bulletin(s); refer to NFPA 13D, 2016 Edition, 8.1.1 for sloped ceilings
Maximum spacing between sprinklers	Per design spacing noted on plan (e.g., spacing can be 12' x 12' up to 20' x 20')
Minimum distance from wall	Pendent sprinklers can be no closer than 4" from wall
Maximum spacing away from a wall	Half the design spacing noted on plan (e.g., spacing can be 12' x 12' up to 20' x 20'; therefore max. distance from wall could be from 6' up to 10')
Spacing from non-continuous obstructions	36" from the center of the obstruction; refer to NFPA 13D, 2016 Edition, 8.2.5 for more information

Table 2: Spacing requirement table

Position of pendent sprinklers to avoid obstructions	
Distance from sprinklers to side of obstruction (A)	Maximum allowable distance of deflector above bottom of obstruction in inches (B)
Less than 1' 6"	0
1' 6" to less than 3'	1
3' to less than 4'	3
4' to less than 4' 6"	5
4' 6" to less than 6'	7
6' to less than 6' 6"	9
6' 6" to less than 7'	11
7' and greater	14

Table 3: Position of pendent sprinklers to avoid obstructions to discharge
Source: NFPA 13D, 2016 Edition, Table 8.2.5.3.2, Position of pendent sprinklers to avoid obstructions to discharge (refer to **Figure 1** and **Figure 2**).

Minimum distances for ordinary-temperature residential sprinklers	
Heat source	Minimum distance from edge of source in inches
Side of open or recessed fireplace	36
Front of recessed fireplace	60
Coal- or wood-burning stove	42
Kitchen range	18
Wall oven	18
Hot-air flues	18
Uninsulated heat ducts	18
Uninsulated hot water pipes	12
Side of ceiling- or wall-mounted hot-air diffusers	24
Front of ceiling- or wall-mounted hot-air diffusers	36
Hot-water heater or furnace	6
Light fixture (0 W to 250 W)	6
Light fixture (250 W to 499 W)	12

Table 4: Minimum distances for ordinary-temperature residential sprinklers
Source: NFPA 13D, 2016 Edition, Table 7.5.6.3, Minimum distances for ordinary temperature residential sprinklers

Continuous obstructions

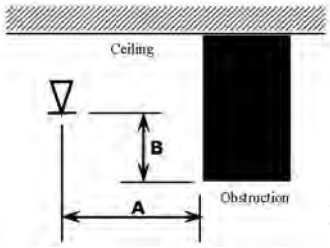

Figure 1: Sprinkler positioning
Source: NFPA 13D, 2016 Edition, Figure 8.2.5.3.2, Positioning of sprinkler to avoid obstruction to discharge

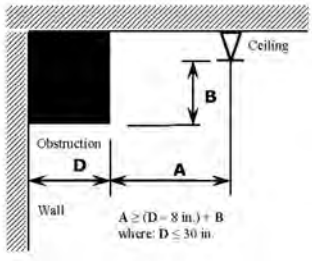

Figure 2: Sprinkler positioning
Source: NFPA 13D, 2016 Edition, Figure 8.2.5.3.3(a), Positioning of sprinkler to avoid obstruction against walls (i.e., pendent sprinkler with respect to a soffit)

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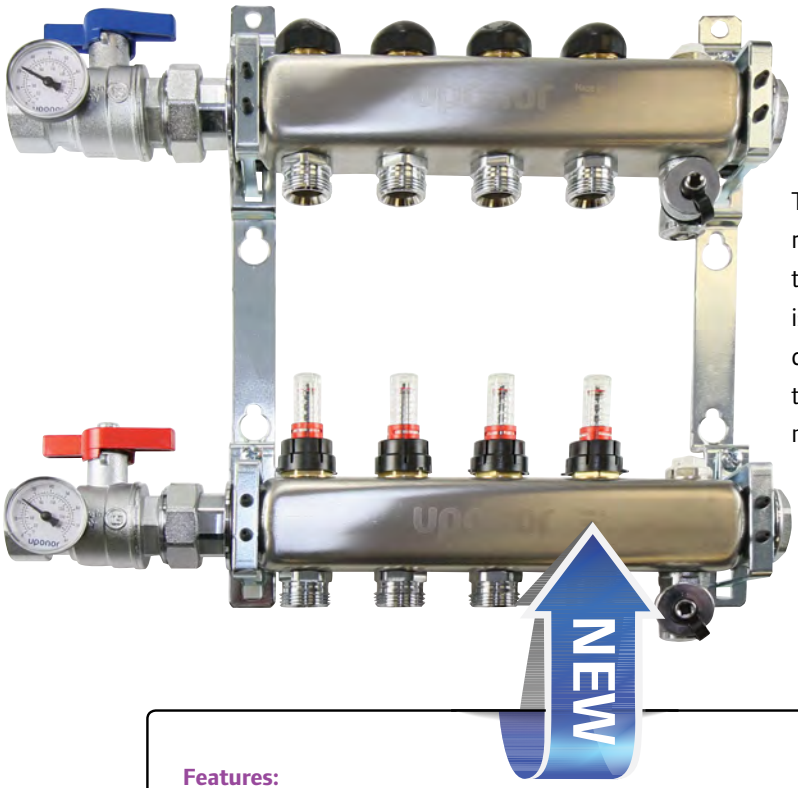
RADIANT HEATING AND COOLING SYSTEMS

STAINLESS-STEEL MANIFOLD

SELL SHEET

Stainless-steel Manifold

for Radiant Heating and Cooling Systems



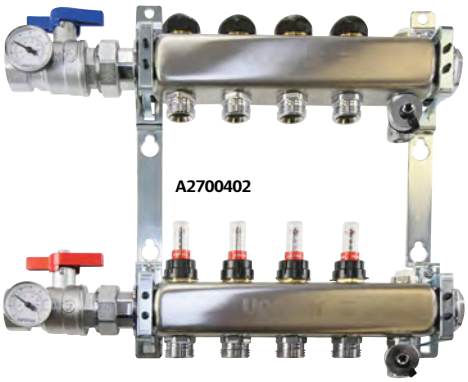
Targeted for commercial and residential radiant heating and cooling applications, the new Uponor Stainless-steel Manifold is available in 1" and 1¼" sizes and comes pre-assembled right out of the box for faster installs and greater material cost savings.

Features:

- 1" and 1¼" manifold offering
- Competitively priced metal alternative
- Corrosion-resistant, stainless-steel barrel
- NPT-threaded ball valve for easy, cost-effective transition
- Balancing and isolation valves for complete loop isolation
- Compatible with all glycols used in radiant heating and cooling systems
- Integrated, full-port ball valves with temperature gauges
- Integrated flow meters for simple system balancing
  - 1" manifold features 1.5 gpm flow meters
  - 1¼" manifold features 2 gpm flow meters
- Temperature/Pressure ratings:
  - 68°F (20°C) at 145 psi
  - 158°F (70°C) at 87.4 psi
  - 194°F (90°C) at 43.8 psi
- Pre-assembled and ready to install right out of the box

Stainless-steel Manifold Product Offering

Part No.	Part Description
A2700202	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 2 loops
A2700302	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 3 loops
A2700402	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 4 loops
A2700502	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 5 loops
A2700602	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 6 loops
A2700702	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 7 loops
A2700802	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 8 loops
A2701002	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 10 loops
A2701202	Stainless-steel Manifold Assembly, 1" with flow meter, B&I, ball valve, 12 loops
A2720202	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 2 loops
A2720302	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 3 loops
A2720402	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 4 loops
A2720502	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 5 loops
A2720602	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 6 loops
A2720702	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 7 loops
A2720802	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 8 loops
A2721002	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 10 loops
A2721202	Stainless-steel Manifold Assembly, 1¼" with flow meter, B&I, ball valve, 12 loops
A2771251	Stainless-steel Manifold Supply and Return 1" NPT Ball Valve with Temperature Gauge, set of 2
A2771252	Stainless-steel Manifold Supply and Return 1¼" NPT Ball Valve with Temperature Gauge, set of 2
A2771010	Mounting Bracket for Stainless-steel Manifold, 1", replacement part, set of 2
A2771011	Mounting Bracket for Stainless-steel Manifold, 1¼", replacement part, set of 2
A2771020	Stainless-steel Manifold Flow Meter 1.5 GPM Valve Body, replacement part
A2771021	Stainless-steel Manifold Flow Meter 2 GPM Valve Body, replacement part
A2771030	Stainless-steel Manifold Isolation Valve Body, replacement part
A2771035	Stainless-steel Manifold Isolation Valve Body, O-ring, replacement part
A2771040	Stainless-steel Manifold Replacement Gasket for R32 Union Connection
A2771050	Stainless-steel Manifold Temperature Gauge, set of 2
A2771060	Spacer Ring VA10 for White Thermal Actuators
A2771070	Stainless-steel Manifold Installation Kit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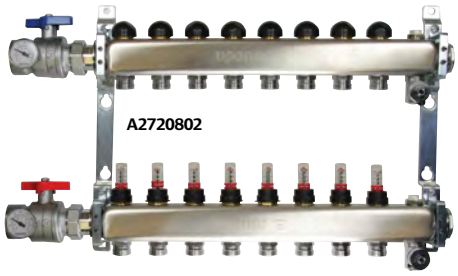
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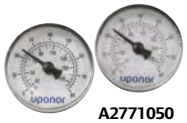
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Fax: 952.891.2008

Uponor Ltd.
2000 Argentia Rd., Plaza 1, Ste. 200
Mississauga, ON L5N 1W1 CANADA
Tel: 888.994.7726
Fax: 800.638.9517

uponor

www.uponorpro.com

warmboard.com
877.338.5493

Warmboard-S specification sheet

Specification data for Warmboard-S, our structural subfloor and radiant panel in one.

Warmboard-S panels shall be 4' x 8' plywood, tongue and groove, with a thickness of $1^{1}/_{8}$". Panels shall have $^{5}/_{8}$" depth channels, consisting of straight and turn patterns. Such channels on 12" centers will interface with $^{1}/_{2}$" PEX Aluminum PEX tubing. There shall be four limber slots per panel, two cut on the bottom of each 4' end, 12" from the outside. Each slot shall be $5^{3}/_{8}$" x $^{3}/_{8}$".

The entire top skin (4' x 8') of plywood shall have a highly conductive continuous sheet of 1060 series aluminum alloy, bonded to the surface. This continuous sheet of aluminum shall completely contour in all channel depths, both turns and straight runs.

Panels shall be in one of the following tubing configurations:

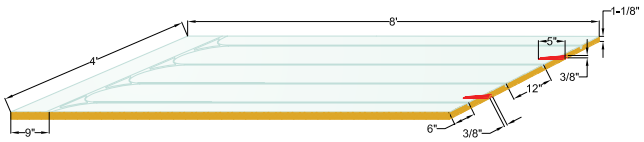
- Right turn panel
- Left turn panel
- Straight panel
- Double panel

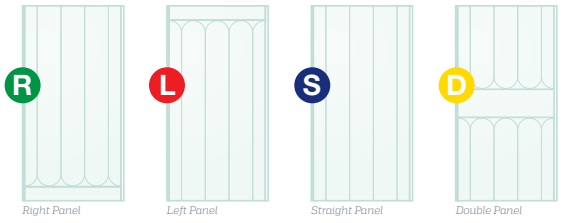
All panels installed shall meet or exceed all specifications documented on Warmboard engineered AutoCAD drawings and installation manual.

Supplied panels will meet or exceed APA certification and report #T2002Q-37. Supplied panels will meet or exceed ICC Evaluation ESR #1421.

Panel assembly shall be of the following:

- Warmboard-S (structural subfloor) installed over existing Joist or TJI
- Warmboard-S installed over existing concrete slab
- Warmboard-S installed over existing concrete slab with sleepers
- Warmboard-S installed over structural plywood decking or OSB





uponor

ProPEX® Lead-free (LF) Brass Tee

Submittal Information
Revision B: Jan. 28, 2010

Project Information

Job Name:

Location: Part No. Ordered:

Engineer: Date Submitted:

Contractor: Submitted By:

Manufacturer's Representative: Approved By:

Technical Data

Material: C69300 Brass

Product Information and Application Use

Uponor's ProPEX® Lead-free Brass Tees are ideal for use in hot and cold domestic potable water systems.[1]

This product is approved for use in the AquaSAFE™ Residential Fire Safety System. Also approved for any hydronic heating system application.

Each end of the ProPEX LF Brass Tee is manufactured with the Uponor ProPEX Fitting for connections to Wirsbo hePEX™ or Uponor AquaPEX® tubing. This product is safe for direct burial in soil.

✓	Description	Part Number	Length	Width	Weight
☐	ProPEX LF Brass Tee, ½" PEX x ½" PEX x ½" PEX	LF4705050	2.52"	1.45"	0.20 lbs.
☐	ProPEX LF Brass Tee, ¾" PEX x ¾" PEX x ¾" PEX	LF4707575	3.27"	1.93"	0.40 lbs.
☐	ProPEX LF Brass Tee, 1" PEX x 1" PEX x 1" PEX	LF4701010	4.09"	2.42"	0.40 lbs.

Installation

ProPEX Tool and ProPEX Rings (sold separately) are required for connecting the PEX tubing. Do not solder within 18 inches of the ProPEX connection. Refer to the AquaPEX Professional Plumbing Installation Guide, AquaSAFE Homeowner Handbook or Radiant Floor Heating Installation Handbook for additional information.

Standards

CSA B137.5; ASTM F877; ASTM F1960

Codes

IPC; UPC; NSPC; NPC of Canada

Listings

IAPMO 3558; ANSI/NSF 14- and 61-certified; HUD MR 1269; ICC ESR 1099; UL 1821; ULC/ORD C 199P; U.P. Code, Annex G

Related Applications

PEX-a Plumbing Systems
Uponor Residential Fire Safety Systems
Radiant Heating and Cooling Systems

Contact Information

Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124 USA
Phone: (800) 321-4739
Fax: (952) 891-2008
www.uponor-usa.com

Uponor Ltd.
2000 Argentia Rd., Plaza 1, Ste. 200
Mississauga, ON L5N 1W1 CANADA
Phone: (888) 994-7726
Fax: (800) 638-9517
www.uponor.ca

[1]ProPEX® is a registered trademark of Uponor, Inc. ProPEX™ is a trademark of Uponor Ltd.

uponor

ProPEX® Lead-free (LF) Ice Maker Box

Submittal Information
Revision A: Jan. 20, 2009

Project Information

Job Name:

Location: Part No. Ordered:

Engineer: Date Submitted:

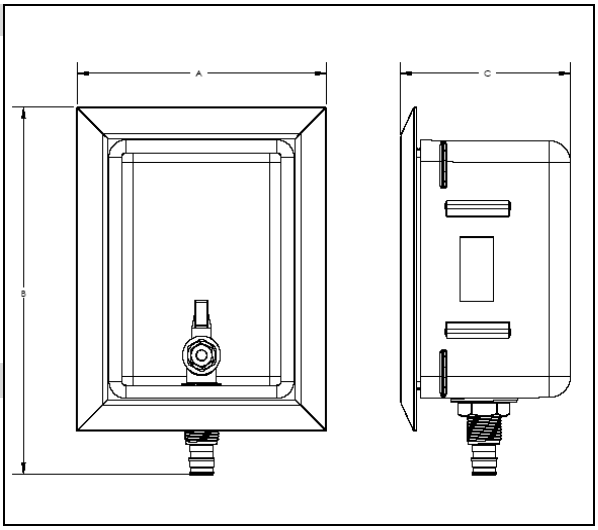
Contractor: Submitted By:

Manufacturer's Representative: Approved By:

Technical Data

Materials:

Box: High-impact polystyrene
Frame: High-impact polystyrene
Support Brackets: High-impact polystyrene
Valve: C69300 Brass



Product Information and Application Use

The ProPEX® Lead-free Ice Maker Box with snap-in frame includes a ½" lead-free brass valve with ¼" O.D. compression connection.[1] This high-impact box is an aesthetic, convenient option for connecting to standard ice maker tubing. Two support brackets are provided for easy mounting.

✓	Description	Part Number	Length (A)	Height (B)	Depth (C)	Weight
☐	ProPEX LF Ice Maker Box	LF5955025	5.9"	8.5"	4.0"	0.87 lbs.

Installation

Mount in wall cavity at the desired location (e.g., behind refrigerator) using the supplied mounting brackets or directly to studs. For more information, refer to the AquaPEX® Professional Plumbing Installation Handbook.

Standards

ASME A112.18.1 / CSA B125-1 / ASTM F1960

Codes

IPC; UPC; NSPC; NPC of Canada

Listings

ANSI/NSF 14- and 61-certified; U.P. Code, Annex G

Related Applications

PEX-a Plumbing Systems

Contact Information

Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124 USA
Phone: (800) 321-4739
Fax: (952) 891-2008
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Uponor Ltd.
2000 Argentia Rd., Plaza 1, Ste. 200
Mississauga, ON L5N 1W1 CANADA
Phone: (888) 994-7726
Fax: (800) 638-9517
www.uponor.ca

ProPEX® Washing Machine Outlet Box, ½" (LF Brass) Valves

Submittal Information
Revision A: Jan. 26, 2010

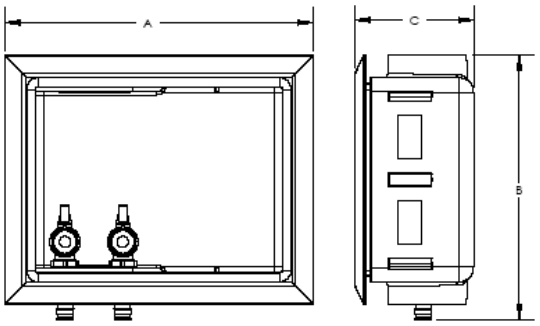
Project Information

Job Name:	
Location:	Part No. Ordered:
Engineer:	Date Submitted:
Contractor:	Submitted By:
Manufacturer's Representative:	Approved By:

Technical Data

Materials:

Box:	High-impact polystyrene
Frame:	High-impact polystyrene
Support Brackets:	High-impact polystyrene
Valve:	C69300 Brass



Product Information and Application Use

Uponor's ProPEX® Washing Machine Outlet Box comes with two ½" ProPEX hot and cold, color-coded, lead-free brass valves.[1] The valves may be mounted from the top or bottom. The four support brackets provide easy mounting between studs. The snap-on frame (included) accommodates up to 1" drywall.

✓	Description	Part Number	Length (A)	Height (B)	Depth (C)	Weight
☐	ProPEX Washing Machine Outlet Box, ½" (LF Brass) Valves	LF5930500	10.6"	9.0"	4.0"	1.95 lbs.

Installation

Mount in wall cavity at the desired location (e.g., behind washing machine) using the supplied mounting brackets or directly to studs. For more information, refer to the AquaPEX® Professional Plumbing Installation Guide.

Standards

ASME A112.18.1; CSA B125-1; ASTM F1960

Codes

IPC; UPC; NSPC; NPC of Canada

Listings

ANSI/NSF 14- and 61-certified; U.P. Code, Annex G

Related Applications

PEX-a Plumbing Systems

Contact Information

Uponor, Inc.
5925 148th Street West
Apple Valley, MN 55124 USA
Phone: (800) 321-4739
Fax: (952) 891-2008
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[1]ProPEX® is a registered trademark of Uponor, Inc. ProPEX™ is a trademark of Uponor Ltd.

Independent 4 Life Limited
Specialist Adaptation Suppliers

Granberg Flexible Drain Hose for Kitchen Sink Waste

SKU: 61801

£41.28 (Price includes VAT)

Flexible hose by Granberg, for connecting a kitchen sink waste when using a height adjustable worktop lift. Hose stretches from 190 - 510mm. 3 x Jubilee clips supplied.

Product description

Granberg flexible drain hose for connecting sinks on height adjustable worktop lifts.
The hose can stretch from 190 - 510mm.
Key benefits:

Trouble-free connection
Couplings supplied - 2 x 40-60mm jubilee clips and 1 x 50-65mm jubilee clip
T - Shaped fixing bracket - Waste to wall
Spiral steel wire reinforced PVC flexible tube
Black in colour
Internal diameter for connection: 48mm

Warranty:

3 year manufacturer warranty

Additional Information

Manufacturer	Granberg
VAT Exemption Available	Yes

Independent 4 Life Limited
Specialist Adaptation Suppliers

KOHLER®

Air Gap Body with Cover
K-9110

Features
- KOHLER finishes resist corrosion and tarnishing.
- Keeps kitchen pipes free of dirt by preventing wastewater backflow.
- Body: 1-3/16" (30 mm) x 8-3/4" (222 mm)
- Cover: 1-3/16" (30 mm) x 2-7/16" (62 mm)

Material
- Solid brass cap and polyprophylene body.

Codes/Standards
None Applicable

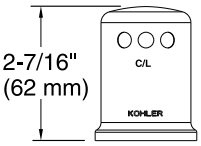
KOHLER® Faucet Lifetime Limited Warranty
See website for detailed warranty information.

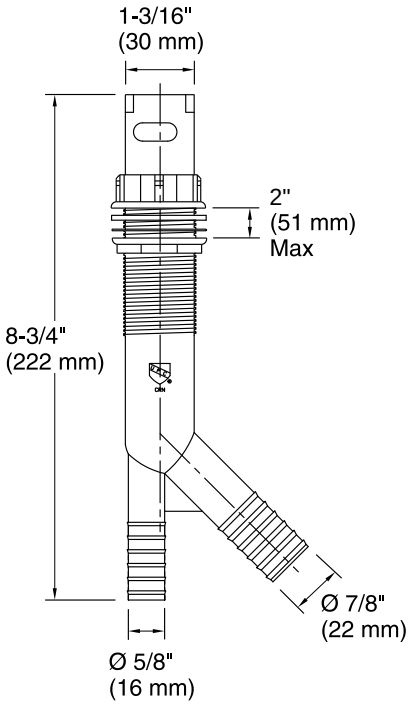
Available Color/Finishes
Color tiles intended for reference only.

Color	Code	Description
	CP	Polished Chrome
	SN	Vibrant® Polished Nickel
	PB	Vibrant® Polished Brass
	G	Brushed Chrome
	BN	Vibrant® Brushed Nickel
	VS	Vibrant® Stainless
	BV	Vibrant® Brushed Bronze
	2BZ	Oil-Rubbed Bronze
	BL	Matte Black

KOHLER®

Air Gap Body with Cover
K-9110





Technical Information
All product dimensions are nominal.

Notes
Install this product according to the installation guide.

GRUNDFOS **BMQE & MQ**

GRUNDFOS **Pressure Boosting**

– Domestic water supply solutions

BMQE

Grundfos' BMQE is a complete constant pressure boosting system. Its rugged design and easy-to-use interface ensures low-maintenance and trouble free operation.

- Dry-run protection
- Over voltage and under voltage protection
- Standard home outlet voltages (single phase)
- Many installation options

MQ

The Grundfos MQ is a compact, all-in-one pressure boosting system, designed for domestic water supply applications. The MQ, with it's smart operation is both easy to install and reliable.

- Complete system
- Low noise
- Built-in protective functions
- Automatic reset

BE › THINK › INNOVATE ›

GRUNDFOS

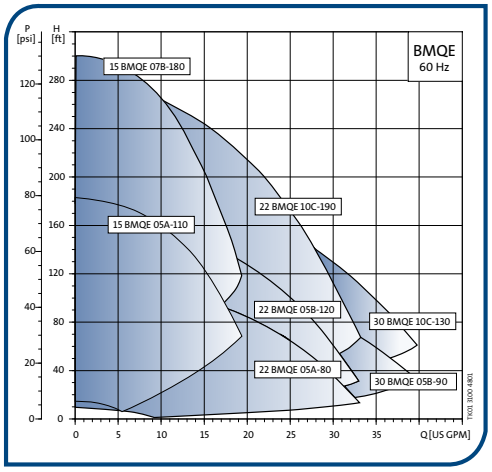
BE › THINK › INNOVATE ›

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

GRUNDFOS **BMQE**

Constant pressure at the touch of a button

Performance Curve:

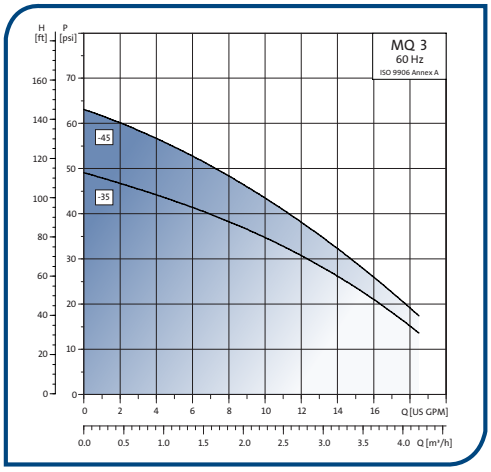


Pump Type	Volts	Material #
15 BMQE 05A-110	115	91128524
15 BMQE 05A-110	230	91128525
15 BMQE 07B-180	230	91128526
22 BMQE 05A-80	115	91128527
22 BMQE 05A-80	230	91128528
22 BMQE 05B-120	230	91128529
22 BMQE 10C-190	230	91128530
30 BMQE 05B-90	230	91128531
30 BMQE 10C-130	230	91128533

GRUNDFOS **MQ**

Flow-based pressure boosting system

Performance Curve:



Pump Type	Volts	Material #
MQ 3-35	115	96860172
MQ 3-45	115	96860195
MQ 3-35	230	96860201
MQ 3-45	230	96860207

L-DWS-SL-02 9/10 (US)

U.S.A.
GRUNDFOS Pumps Corporation
17100 West 118th Terrace
Olathe, Kansas 66061
Phone: (913) 227-3400
Telefax: (913) 227-3500

www.grundfos.com

Canada
GRUNDFOS Canada Inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Phone: (905) 829-9533
Telefax: (905) 829-9512

Mexico
Bombas GRUNDFOS de Mexico S.A. de C.V.
Boulevard TLC No. 15
Parque Industrial Stiva Aeropuerto
C.P. 66600 Apodaca, N.L. Mexico
Phone: 011-52-81-8144 4000
Telefax: 011-52-81-8144 4010

GRUNDFOS

Hudson Reed

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HOME / FLAT HEATED BATHROOM TOWEL RACK 31.5" X 23.5" - CHROME FINISH

Flat Heated Bathroom Towel Rack 31.5" x 23.5" - Chrome Finish

Product Code NAHB0010A

BE THE FIRST TO REVIEW THIS PRODUCT

~~$280,95~~ $252,86

Minimalist Modern Angled Radiator Valves +$0.00

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In Brief...

This flat Ladder Style Heated Towel Warmer, with a high quality chrome finish, produces a heat output of 270 Watts (922 BTUs), enough to keep your towels warm and heat a small bathroom or cloakroom.

Supplied complete with a fixing pack for wall mounting, this minimalist towel rail has 14 horizontal rungs and provides a functional and stylish centrepiece to any contemporary setting. This product is from the Kudox Premium range and has 0.86"

bars which give both a higher output and improved aesthetics. Manufactured by an ISO 9001 registered company.

Suitable for closed loop heating systems, the 31.5" x 23.5" Kudox Heated Bathroom Towel Rail connects to your heating system via the radiator valves included, please choose either straight or angled.

Kudox Chrome Flat Heated Bathroom Towel Radiator Rail 31.5" x 23.5" Details

Overview
Specification
Reviews
Help & Advice
Overview
This flat Ladder Style Heated Towel Warmer, with a high quality chrome finish, produces a heat output of 270 Watts (922 BTUs), enough to keep your towels warm and heat a small bathroom or cloakroom.

Supplied complete with a fixing pack for wall mounting, this minimalist towel rail has 14 horizontal rungs and provides a functional and stylish centrepiece to any contemporary setting. This product is from the Kudox Premium range and has 0.86" bars which give both a higher output and improved aesthetics. Manufactured by an ISO 9001 registered company.

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Kudox Chrome Flat Heated Bathroom Towel Radiator Rail 31.5" x 23.5" Details

- **Dimensions:** (H x W x D) 31.5" (800mm) x 23.5" (600mm) x 3" (75mm)
- Output: 270 Watts (922 BTUs)
- Number of cross-bars: 14 with a thickness of 0.86" (22mm), divided into 3 sections of 3, 3, 8
- Pipe Centres: 22" (560mm)
- Fixing Pack Included
- Suitable for bathroom, cloakroom, kitchen etc.
- Expertly plated with high quality 62.5 micron chrome on copper plated mild steel, with swagged oven brazed joints.
- Tested to BS EN442 - 140 psi maximum working pressure
- **Please note:** Radiator valves are included, please choose either straight or angled radiator valves.

Buy now, to transform your bathroom, at an affordable price.

Specification

Brand	Hudson Reed
Finish	Chrome

Style	Modern
Dimensions	31.5" x 23.5" x 3"
Watts (Radiator)	270
Pipe Centers	22"
Material	Steel
Watts	922
BTU	922
Warranty	10 Years

Reviews

HOW DO YOU RATE THIS PRODUCT?

RATING

* Required Fields

LET US KNOW YOUR THOUGHTS *

SUMMARY OF YOUR REVIEW *

WHAT'S YOUR NICKNAME? *

SUBMIT REVIEW

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Water Circulation
Pumps & Circulators

Taco® "00®" Series Cartridge Circulators

For over 70 years, Taco has led the industry with the highest quality circulators you can buy. Designed for a wide range of residential and light commercial applications, every "00®" comes with the reliability that has made Taco famous.

HYDRONIC COMPONENTS & SYSTEMS

Do it once. Do it right.® Taco®

Effective Date: 08/01/06
Printed in USA

Cartridge Circulators

Meet the "00®" Family.

Every Taco "00®" cartridge circulator is designed to make your job easier. Installation is quick and easy, and maintenance is a snap. With no mechanical seal, the self-lubricating design provides unmatched reliability. Every "00®" features a field-replaceable cartridge that contains all the moving parts. Replacing the cartridge rebuilds the circulator! Additional features include:

- Standard High Capacity Output
- Direct Drive, Low Power Consumption
- Universal Flange To Flange Dimension

We've got you covered.

From the compact, low flow 003 to the high-head 0013, there's a Taco Circulator to fit your job. Use for:

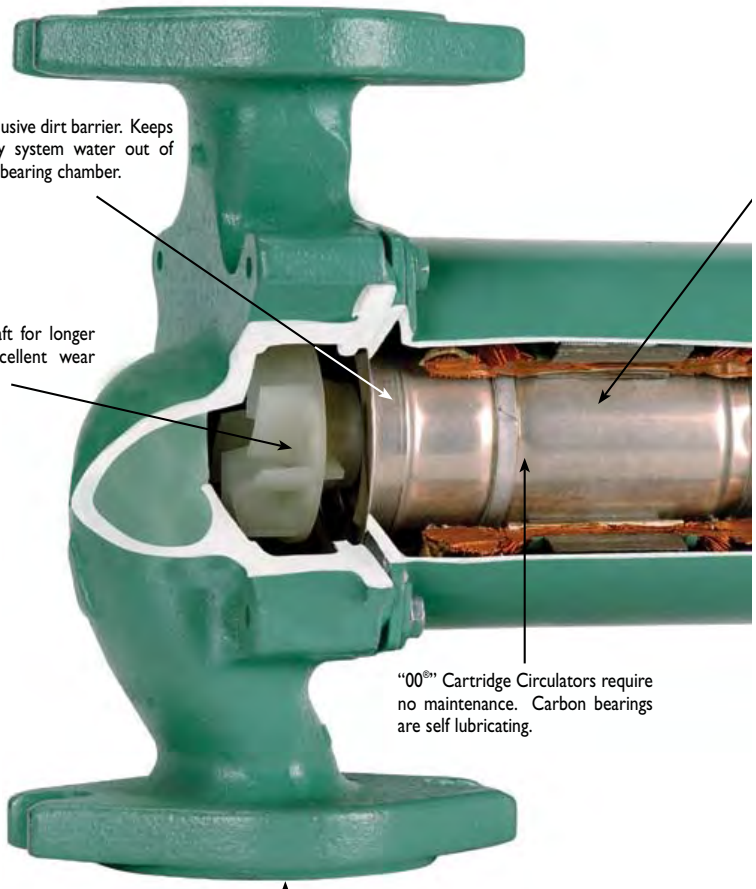
- Hydronic Heating
- Radiant In-Floor/Panel Heating
- Indirect Domestic Water Heating
- Solar Heating
- Heat Recovery
- Water Source Heat Pumping
- Domestic Water Recirculation
- Chilled Water Cooling Systems
- Small to Large Residential Applications
- Light Commercial Applications

Innovation all the way.

Our new IFC® Cartridge Circulators feature an Integral Flow Check, eliminating additional installation costs associated with separate in-line flow checks. The IFC® also improves system performance and is a snap to maintain. What could be better than lower cost and better performance?

Support, support, support.

Every pump we sell is included in our TacoNet® 7.0 software, so product selection and specification is as easy as typing in a few numbers. Contact us online at www.taco-hvac.com to get your TacoNet® 7.0 software. And while you're there, browse our product lines, ask us a question, or just get to know Taco a little better. You'll see why we're known industry-wide as the easiest company to do business with.



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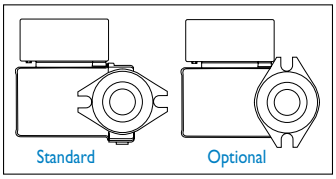
Submittal Data Information

Exclusive stainless steel replaceable cartridge design. Replacing the cartridge rebuilds the circulator.

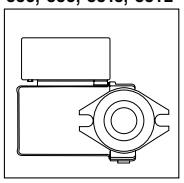
CUL Listed circulator. Motor is impedance protected.

Flange Orientation

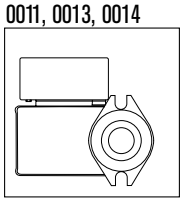
007



005, 008, 0010, 0012

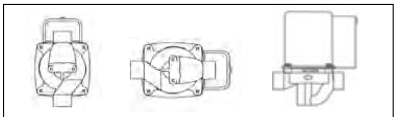


All IFC Models & 009, 0011, 0013, 0014

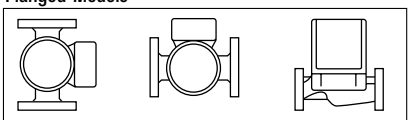


Mounting Positions

Sweat Models



Flanged Models



Features

- Standard High Capacity Output-Compact Design
- Quiet, Efficient Operation
- Direct Drive-Low Power Consumption
- Unique Replaceable Cartridge Design-Field Serviceable
- Self Lubricating
- No Mechanical Seal
- Unmatched Reliability-Maintenance Free
- Anti-Condensate Baffle (ACB) to Protect Motor Windings (0011, 0012, 0013)
- Integral Flow Check (IFC)™ Optional
- Priority Zoning Relay - Optional
- Plumb n' Plug - Pre-wired Timer Control

Materials of Construction

	003, 006	005, 007, 008	009-0014
Casing (Volute):	Bronze Only	Cast Iron or Bronze	Cast Iron or Bronze
Stator Housing:	Steel	Steel	Aluminum
Cartridge:	Stainless Steel	Stainless Steel	Stainless Steel
Impeller:	Non-Metallic	Non-Metallic	Non-Metallic
Shaft:	Ceramic	Ceramic	Ceramic
Bearings:	Carbon	Carbon	Carbon
O-Ring & Gaskets:	EPDM	EPDM	EPDM

Performance Data

	003, 006	005	007	008-0014
Minimum Fluid Temperature:	40°F (4°C)	40°F (4°C)	40°F (4°C)	40°F (4°C)
Maximum Fluid Temperature:	220°F (104°C)	220°F (104°C) Bronze 230°F (110°C) Cast Iron	230°F (110°C) Bronze 240°F (115°C) Cast Iron	230°F (110°C)
Maximum Working Pressure:	125 psi	125 psi	125 psi	125 psi

c UL us LISTED

FOR INDOOR USE ONLY

3.

Model 003 Cartridge Circulator

Model Nomenclature

B – Bronze, Sweat
BC – Bronze, Sweat, Panel Mount Tappings
BT – Bronze, Threaded
BC-1 – Bronze, Union, Panel Mount Tappings

Performance Data

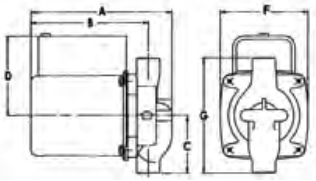
Flow Range: 0 – 6 GPM
Head Range: 0 – 5 Feet
Connection Sizes: 1/2" Swt, 3/4" Swt, 3/4" NPT, Union

Application

The Taco 003 is designed for circulating hot or chilled fresh water in open or closed loop, lower flow applications. Flow characteristics are ideal for Domestic Hot Water Recirculation, Heat Recovery Units, Water Source Heat Pumps, and Potable Water Systems. The unique, replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. The compact, low power consumption design is ideal for high efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Connection	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
003-B4	3/4" Swt	5-1/8	130	4-1/8	105	2-3/16	56	3-1/16	78	3-5/16	84	4-13/32	112	6.0	2.7
003-BC4	1/2" Swt	5-1/8	130	4-1/8	105	2-1/8	54	3-1/16	78	3-5/16	84	4-1/4	108	6.0	2.7
003-BT4	3/4" NPT	5-5/8	143	4-7/8	124	2	51	3-1/16	78	3-5/16	84	4	102	6.0	2.7
003-BC4-1	Union	5-5/32	131	4-11/32	110	2-31/32	76	3-1/16	78	3-5/16	84	5-15/16	151	6.0	2.7



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
003 All Models	115	60	1	.43	3250	1/40
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 006 Cartridge Circulator

Model Nomenclature

B – Bronze, Sweat
BC – Bronze, Sweat, Panel Mount Tappings
BT – Bronze, Threaded
BC-1 – Bronze, Union, Panel Mount Tappings

Performance Data

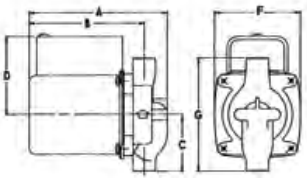
Flow Range: 0 – 10 GPM
Head Range: 0 – 9 Feet
Connection Sizes: 1/2" Swt 3/4" Swt, 3/4" NPT, Union

Application

The Taco 006 is designed for circulating hot or chilled fresh water in open or closed loop, lower flow applications. Typical uses include Domestic Hot Water Recirculation,Hydro-Air Heating/ Cooling, Heat Recovery Units, Water Source Heat Pumps, Drain Down Open Loop Solar systems and Potable Water applications. The unique, replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. The compact, low power consumption design is ideal for high efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Connection	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
006-B4	3/4" Swt	5-1/8	130	4-1/8	105	2-3/16	56	3-1/16	78	3-5/16	84	4-13/32	112	6.0	2.7
006-BC4	1/2" Swt	5-1/8	130	4-1/8	105	2-1/8	54	3-1/16	78	3-5/16	84	4-1/4	108	6.0	2.7
006-BT4	3/4" NPT	5-5/8	143	4-7/8	124	2	51	3-1/16	78	3-5/16	84	4	102	6.0	2.7
006-BC4-1	Union	5-5/32	131	4-11/32	110	2-31/32	76	3-1/16	78	3-5/16	84	5-15/16	151	6.0	2.7



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
006 All Models	115	60	1	.52	3250	1/40
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

4.

Model 005 Cartridge Circulator

Model Nomenclature

F – Cast Iron, Flanged
BF – Bronze, Flanged

Variations:

Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data

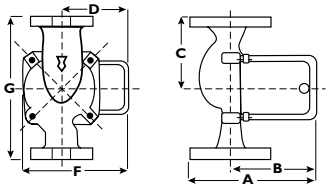
Flow Range: 0 – 18 GPM
Head Range: 0 – 9.5 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application

The Taco 005 is designed for a wide range of Residential/Light Commercial water circulating applications. Typical uses include Hydronic heating, add a zone additions, Zoning with circulators, Chilled Water cooling and Domestic Water Systems. Available in Cast Iron or Bronze construction with universal flange to flange dimensions. The unique replaceable cartridge contains all of the moving parts and allows for easy service, instead of replacing the entire circulator. Compact, direct-drive, low power consumption design is ideal for high efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
005-F2	Cast Iron	5-5/8	143	4	102	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6
005-BF2	Bronze	5-5/8	143	4	102	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
005-F2	115	60	1	.53	3250	1/35
005-BF2	115	60	1	.54	3250	1/35
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 007 Cartridge Circulator

Model Nomenclature

F – Cast Iron, Flanged
BF – Bronze, Flanged

Variations:

Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data

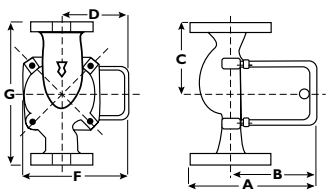
Flow Range: 0 – 20 GPM
Head Range: 0 – 11 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application

The Taco 007 is a cartridge style, maintenance free, wet-rotor, in-line, single stage circulator. It is designed for quiet operation in Hydronic Heating, Radiant Heating, Hydro-Air Fan Coils, Indirect Water Heating, Chilled Water cooling, and Domestic Water Systems. Available in Cast Iron or Bronze construction with universal flange to flange dimensions. The unique replaceable cartridge contains all of the moving parts and allows for easy service, instead of replacing the entire circulator. Ideal for a wide range of applications.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
007-F5	Cast Iron	6-1/8	156	4-1/2	114	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6
007-BF5	Bronze	6-1/8	156	4-1/2	114	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
007-F5	115	60	1	.70	3250	1/25
007-BF5	115	60	1	.76	3250	1/25
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

5.

Model 008 Cartridge Circulator

Model Nomenclature
F – Cast Iron, Flanged
BF – Bronze, Flanged
BC – Bronze, Sweat Connections

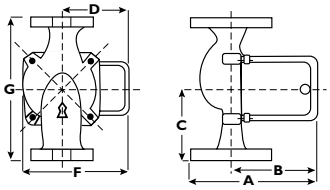
Variations:
Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data
Flow Range: 0 – 14 GPM
Head Range: 0 – 16 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged, 3/4" Sweat

Application
The Taco 008 is designed for a wide range of Residential/Light Commercial higher-head water circulating applications. Typical uses include Hydronic heating, Radiant In-Floor/Panel heating and closed-loop Solar heating systems. The Bronze 008 can be used in higher-head Heat Recovery, Water Source Heat Pumps, open-loop Solar heat and Domestic Water Recirculation systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service, instead of replacing the entire circulator. Compact, direct-drive, low power consumption design is ideal for high-efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
008-F6	Cast Iron	6	152	4	102	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6
008-BF6	Bronze (F)	6	152	4	102	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6
008-BC6	Bronze (S)	5-5/8	143	4-9/16	116	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
008-F6	115	60	1	.79	3250	1/25
008-BF6	115	60	1	.84	3250	1/25
008-BC6	115	60	1	.84	3250	1/25
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 009 Cartridge Circulator

Model Nomenclature
F – Cast Iron, Flanged
BF – Bronze, Flanged

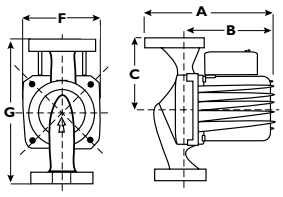
Variations:
Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data
Flow Range: 0 – 8 GPM
Head Range: 0 – 34 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application
The Taco 009 is designed for a wide range of Residential/Light Commercial higher-head/lower-flow water circulating applications. Typical uses include Hydronic heating, Radiant In-Floor/Panel heating and closed-loop Solar heating systems. The Bronze 009 can be used in higher-head/lower-flow Heat Recovery, open-loop Solar heating and Light Commercial Domestic Water Recirculation systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service, instead of replacing the entire circulator. Compact, direct-drive, low power consumption design is ideal for high-efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
009-F5	Cast Iron	7	178	5-11/16	144	3-3/16	81	3-5/16	84	4-1/8	105	6-3/8	162	9.5	4.3
009-BF5	Bronze	7	178	5-11/16	144	3-3/16	81	3-5/16	84	4-1/8	105	6-3/8	162	9.5	4.3



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
009-F5	115	60	1	1.40	3250	1/8
009-BF5	115	60	1	1.40	3250	1/8
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

6.

Model 0010 Cartridge Circulator

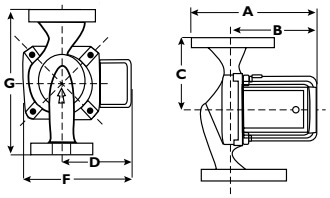
Model Nomenclature
F – Cast Iron, Flanged
BF – Bronze, Flanged
Variations:
Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data
Flow Range: 0 – 30 GPM
Head Range: 0 – 11.5 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application
The Taco 0010 is designed for a wide range of Residential/Light Commercial medium head/ medium flow water circulating applications. Typical uses include Hydronic heating, Radiant heating, Primary-Secondary loops, Indirect water heaters, Chilled Water cooling, and Potable Hot Water systems. The Bronze 0010 is designed for all open-loop, fresh water systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service, instead of replacing the entire circulator. Compact, direct-drive, low power consumption design makes it ideal for high-efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0010-F2	Cast Iron	7-1/4	184	5-5/16	135	3-3/16	81	3-5/16	84	5-3/8	137	6-3/8	162	13	6
0010-BF2	Bronze	7-1/4	184	5-5/16	135	3-3/16	81	3-5/16	84	5-3/8	137	6-3/8	162	13	6



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
0010-F2	115	60	1	1.10	3250	1/8
0010-BF2	115	60	1	1.17	3250	1/8
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 0011 Cartridge Circulator

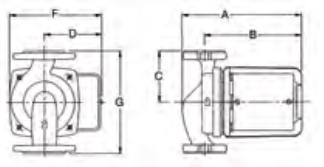
Model Nomenclature
F – Cast Iron, Flanged
BF – Bronze, Flanged
Variations:
Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data
Flow Range: 0 – 28 GPM
Head Range: 0 – 30 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application
The Taco 0011 is specifically designed for high head / medium flow applications in Large Residential / Light Commercial closed loop Hydronic heating and Chilled Water cooling systems. Ideal for high pressure drop Boilers, Fan Coil units, Heat Exchangers, large Radiant Heating and Heat Recovery / Geothermal systems. Exclusive Anti-Condensate Baffle (ACB) protects motor windings on chilled water jobs. The Bronze 0011 can be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0011 to easily replace other models.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0011-F4	Cast Iron	7-5/8	194	6-7/32	158	3-1/4	82	3-3/4	95	6	152	6-1/2	165	12.0	5.5
0011-BF4	Bronze	7-5/8	194	6-7/32	158	3-1/4	82	3-3/4	95	6	152	6-1/2	165	12.0	5.5



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
0011-F4	115	60	1	1.76	3250	1/8
0011-BF4	115	60	1	1.76	3250	1/8
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

7.

Model 0012 Cartridge Circulator

Application

The Taco 0012 is specifically designed for high flow / medium head applications in Large Residential/ Light Commercial systems. Ideal for large BTUH Boilers, 2" Recirculation Loops, Primary/Secondary Loops, Commercial Water Heaters and light Commercial Heating and Cooling systems. Exclusive Anti-Condensate Baffle (ACB) protects motor windings on chilled water jobs. The Bronze 0012 can be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0012 to easily replace other models. The 0012-F4 is a direct replacement for the HV Series and the 0012-F4-1 is a direct replacement for the 2" Series using existing flanges.

Model Nomenclature

F – Cast Iron, Flanged
BF – Bronze, Flanged

Variations:

Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

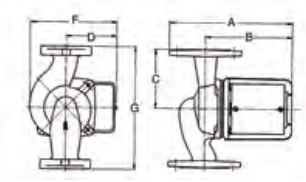
Performance Data

Flow Range: 0 – 50 GPM
Head Range: 0 – 14.5 Feet
Connection Sizes: 1-1/4", 1-1/2", 2" Flanged

Pump Dimensions & Weights

			A		B		C		D		F		G		Ship Wt.	
Model	Flange*	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0012-F4	1-1/2"	Cast Iron	8-5/8	219	6-3/8	162	4-1/4	108	3-7/8	98	6	152	8-1/2	216	13.0	5.9
0012-F4-1	2"	Cast Iron	9	229	6-3/8	162	4-1/4	108	3-7/8	98	6	152	8-1/2	216	13.0	5.9
0012-BF4	1-1/2"	Bronze	8-5/8	219	6-3/8	162	4-1/4	108	3-7/8	98	6	152	8-1/2	216	13.0	5.9
0012-BF4-1	2"	Bronze	9	229	6-3/8	162	4-1/4	108	3-7/8	98	6	152	8-1/2	216	13.0	5.9

*Flanges included in carton.



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
All Models	115	60	1	1.33	3250	1/8
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 0013 Cartridge Circulator

Application

The Taco 0013 is specifically designed for high head / high flow applications in Large Residential/Light Commercial systems. Ideal for high pressure drop Boilers, Fan Coil units, Heat Exchangers, larger Radiant systems, Heat Recovery and Geothermal systems. Exclusive Anti-Condensate Baffle (ACB) protects motor windings on chilled water jobs. The Bronze 0013 should be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0013 to easily replace other models.

Model Nomenclature

F – Cast Iron, Flanged
BF – Bronze, Flanged

Variations:

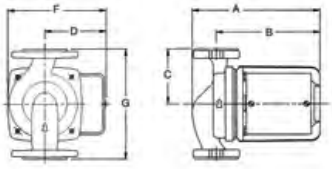
Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data

Flow Range: 0 – 33 GPM
Head Range: 0 – 33 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0013-F3	Cast Iron	7-3/4	197	6-3/8	162	3-1/4	82	3-3/4	95	6	152	6-1/2	165	12.0	5.5
0013-BF3	Bronze	7-3/4	197	6-3/8	162	3-1/4	82	3-3/4	95	6	152	6-1/2	165	12.0	5.5



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
0013-F3	115	60	1	2.0	3250	1/6
0013-BF3	115	60	1	2.0	3250	1/6
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

8.

Model 0014 Cartridge Circulator

Model Nomenclature

F – Cast Iron, Flanged
BF – Bronze, Flanged

Variations:

Z – Zoning Circulator
J – Bronze Cartridge with Cast Iron Casing

Performance Data

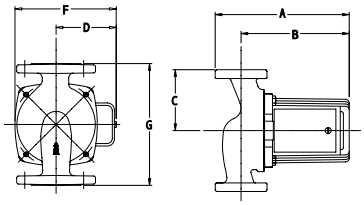
Flow Range: 0 – 32 GPM
Head Range: 0 – 22 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application

The Taco 0014 is specifically designed for medium head / medium flow applications in Large Residential/Light Commercial systems. Ideal for large BTUH Boilers, Primary/Secondary loops, Commercial Water Heaters, and light Commercial Heating and Cooling systems. The Bronze 0014 should be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0014 to easily replace other models. The Compact, Direct-Drive, Low Power Consumption design makes it ideal for high-efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0014-F1	Cast Iron	7-1/4	184	5-13/16	148	3-1/4	83	3-5/16	84	5-3/8	137	6-1/2	165	12.0	5.5
0014-BF1	Bronze	7-1/4	184	5-13/16	148	3-1/4	83	3-5/16	84	5-3/8	137	6-1/2	165	12.0	5.5

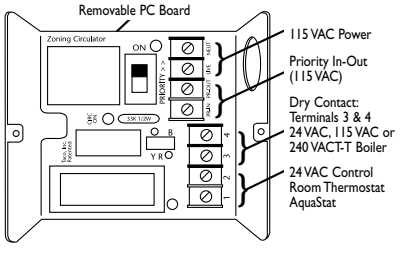


Electrical Data

Model	Volts-	Hz	Ph	Amps	RPM	HP
0014-F1	115	60	1	1.55	3250	1/8
0014-BF1	115	60	1	1.55	3250	1/8
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Priority Zoning Circulator

PC Board and Electrical Hook Up



Application

Thermostat ready. The Taco Priority Zoning Circulator combines the reliability of the "00®" circulator with the convenience and efficiency of a PC board mounted switching relay package. Each zoning circulator has low and high voltage terminal strips for ease of electrical hookup, as well as a built-in priority switch. The priority switch allows the installer to choose the zone that requires the most attention and, when activated, run only that circulator. The priority zoning circulator can be used in conjunction with other circulators or zone valves. It is ideal for indirect hot water heaters, adding another zone, zoning with circulators, and for prioritizing under-sized zones. Available in a full range of sizes from 003 - 0014.

Contact Ratings

Terminals 1 & 2	24VAC	1 Phase
Terminals 3 & 4	24VAC	1 Phase 5 Amps
	115VAC	1 Phase 5 Amps
	240VAC	1 Phase 5 Amps (max)
PR-IN & PR-OUT	115VAC	1 Phase 8 Amps Inrush Current (max)
Live & Neutral	115VAC	1 Phase (max)

Thermostat Ratings

24VAC SPDT 2-Wire Heating
24VAC Digital Electronic
2-Wire Max Draw 30 Milliamps

Features

"00®" Reliability
Snap-in PC Board
Low and High Voltage Terminal Strips
UL and CSA Listed
Simplified Wiring
LED Power Light
100% Factory Tested
Works With Other Circulators or Zone Valves
Universal Thermostat Compatibility
Available In Sizes 003 - 0014
Patented Design
Made in the USA

9.

Model 003 Plumb n' Plug®

Model Nomenclature

B – Bronze, Sweat
BC – Panel Mount Tappings
BT – Bronze, 3/4" FNPT
BC-1 – Bronze, Union Connection
PNP – Plumb n' Plug® Prewired Timer & Cord

Performance Data

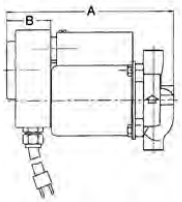
Flow Range: 0 – 6 GPM
Head Range: 0 – 5 Feet
Connection Sizes: 1/2", 3/4" Swt; 3/4" NPT; Union

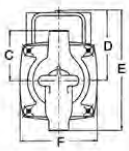
Application

The Taco 003-PNP periodically re-circulates hot water through the domestic piping system to decrease the delivery time to outlet fixtures and reduce wasted water. Typical timer programming will cycle the Plumb n' Plug during high peak usage periods such as early morning or early evening. An optional Aquastat is available for constant circulation applications to maintain temperature between 95°F and 115°F. The 003-PNP is ideal for recirculation loops. Its design operating condition of 3 gpm at 3 feet of head helps to reduce erosion, corrosion and noise in system piping. Use the 003 for systems up to 200 total feet (supply and return) of 3/4" pipe. Installation of Isolation Valves, Pipe Insulation and Flow Check valves are recommended.

Pump Dimensions & Weights

		A		B		C		D		E		F		Ship Wt.	
Model	Connection	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
003-BC4-PNP	1/2" Swt	7-1/4	184	1-15/16	49	2-1/8	54	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
003-B4-PNP	3/4" Swt	7-1/4	184	1-15/16	49	2-3/16	56	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
003-BT4-PNP	3/4" FNPT	7-1/4	184	1-15/16	49	2	51	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
003-BC4-1PNP	Union	7-1/4	184	1-15/16	49	2-31/32	76	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
PNP Models with Integral Flow Check (IFC®)															
003-BC4-3PNP	1/2" Swt	8-1/8	205	1-15/16	49	2-13/16	56	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
003-BC4-2PNP	3/4" Swt	8-1/8	205	1-15/16	49	2-13/16	56	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7





Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
003-PNP	115	60	1	.43	3250	1/40
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 006 Plumb n' Plug®

Model Nomenclature

B – Bronze, Sweat
BC – Panel Mount Tappings
BT – Bronze, 3/4" FNPT
BC-1 – Bronze, Union Connection
PNP – Plumb n' Plug® Prewired Timer & Cord

Performance Data

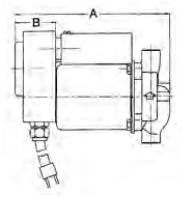
Flow Range: 0 – 10 GPM
Head Range: 0 – 9 Feet
Connection Sizes: 1/2", 3/4" Swt; 3/4" NPT; Union

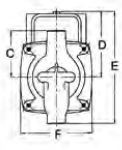
Application

The Taco 006-PNP periodically re-circulates hot water through the domestic piping system to decrease the delivery time to outlet fixtures and reduce wasted water. Typical timer programming will cycle the Plumb n' Plug during high peak usage periods such as early morning or early evening. An optional Aquastat is available for constant circulation applications to maintain temperature between 95°F and 115°F. The Taco 006-PNP is designed for systems using 200-400 feet of 3/4" pipe. Installation of Isolation Valves, Pipe Insulation and Flow Check valves are recommended.

Pump Dimensions & Weight

		A		B		C		D		E		F		Ship Wt.	
Model	Connection	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
006-BC4-PNP	1/2" Swt	7-1/4	184	1-15/16	49	2-1/8	54	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
006-B4-PNP	3/4" Swt	7-1/4	184	1-15/16	49	2-3/16	56	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
006-BT4-PNP	3/4" FNPT	7-1/4	184	1-15/16	49	2	51	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
006-BC4-1PNP	Union	7-1/4	184	1-15/16	49	2-31/32	76	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
PNP Models with Integral Flow Check (IFC®)															
006-BC7-1PNP	1/2" Swt	8-1/8	205	1-15/16	49	2-13/16	56	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7
006-BC7-PNP	3/4" Swt	8-1/8	205	1-15/16	49	2-13/16	56	3-1/16	78	5-1/4	134	3-5/16	84	6.0	2.7





Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
006-PNP	115	60	1	.52	3250	1/40
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

10.

Model 003-IFC® Cartridge Circulator

Model Nomenclature

BC – Bronze, Sweat, Panel Mount

IFC® – Integral Flow Check

Performance Data

Flow Range: 0 - 6 GPM

Head Range: 0 - 4.5 Feet

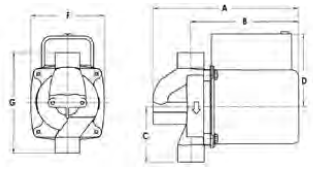
Connection Sizes: 1/2", 3/4" Sweat

Application

The Taco 003-IFC® with an Integral Flow Check (IFC®) is designed for the circulation of hot or chilled fresh water in open or closed loop applications. The IFC® feature eliminates separate in-line flow check, reduces installation costs and improves system performance. Typical uses include Domestic Hot Water Recirculation, Hydro-Air Fan Coil, Heat Recovery Units, Water Source Heat Pumps, and Potable Water applications. With its patented location at the Impeller inlet, the IFC® is easy to service without removing the entire unit from system piping. The unique, replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Available with optional Plumb n' Plug Timer®, Power Cord and Thermostat.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Connection	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
003-BC4-1-IFC	1/2" Swt	6	152	4-7/8	124	2-3/16	56	2-15/16	75	3-5/16	84	4-3/8	111	6.0	2.7
003-BC4-IFC	3/4" Swt	6	152	4-7/8	124	2-3/16	56	2-15/16	75	3-5/16	84	4-3/8	111	6.0	2.7



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
All 003 Models	115	60	1	.45	3250	1/40
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 006-IFC® Cartridge Circulator

Model Nomenclature

BC – Bronze, Sweat, Panel Mount

IFC® – Integral Flow Check

Performance Data

Flow Range: 0 – 9 GPM

Head Range: 0 – 9 Feet

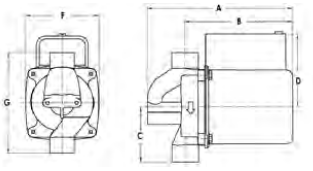
Connection Sizes: 1/2", 3/4" Sweat

Application

The Taco 006-IFC® with an Integral Flow Check (IFC®) is designed for the circulation of hot or chilled fresh water in open or closed loop applications. The IFC® feature eliminates separate in-line flow check, reduces installation costs and improves system performance. Typical uses include Domestic Hot Water Recirculation, Hydro-Air Fan Coil, Heat Recovery Units, Water Source Heat Pumps, Drain Down Open Loop Solar systems and Potable Water applications. Available in Bronze construction with 1/2" & 3/4" Sweat Connections. With its patented location at the Impeller inlet, the IFC® is easy to service without removing the entire unit from system piping. The unique, replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Compact, Low Power Consumption design is ideal for high efficiency jobs.

Pump Dimensions & Weights

		A		B		C		D		F		G		Ship Wt.	
Model	Connection	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
006-BC7-1IFC	1/2" Swt	6	152	4-7/8	124	2-3/16	56	2-15/16	75	3-5/16	84	4-3/8	111	6.0	2.7
006-BC7-IFC	3/4" Swt	6	152	4-7/8	124	2-3/16	56	2-15/16	75	3-5/16	84	4-3/8	111	6.0	2.7



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
All 006 Models	115	60	1	.52	3250	1/40
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

11.

Model 005-IFC® Cartridge Circulator

Model Nomenclature

F – Cast Iron, Flanged
Z – Zoning Circulator
IFC® – Integral Flow Check

Performance Data

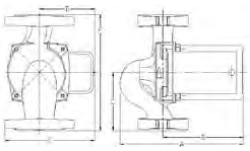
Flow Range: 0 - 11.5 GPM
Head Range: 0 - 10 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application

The Taco 005-IFC® with an Integral Flow Check (IFC®) is designed to reduce installation costs when zoning with "00®" circulators on Hydronic or Radiant heating, Hydro-Air Fan Coils or Indirect water heaters. By locating the patented IFC® inside the pump casing, a separate in-line flow check is eliminated, reducing installation costs. The reduced pressure drop of the IFC®, increases the 005 flow performance up to 240% over in-line check valves. Both the IFC® and cartridge are easily accessed for service instead of replacing the entire unit. The 005-Z-IFC® combines the circulator, flow-check and patented Priority Zoning control with built-in transformer, relay and priority switch in one complete, compact package to make it ideal for zoning. Available in Cast Iron construction with flanged connections.

Pump Dimensions & Weights

		A		B		C		D		E		F		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
005-F2-IFC	Cast Iron	6-5/8	168	4-1/8	105	3-3/16	81	2-15/16	75	5	127	6-3/8	162	8	3.6
005-ZF2-IFC	Cast Iron	6-5/8	168	4-1/8	105	3-3/16	81	3-5/8	92	5-9/16	143	6-3/8	162	8	3.6



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
005-F2-IFC	115	60	1	.52	3250	1/35
005-ZF2-IFC	115	60	1	.52	3250	1/35
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Model 007-IFC® Cartridge Circulator

Model Nomenclature

F – Cast Iron, Flanged
Z – Zoning Circulator
IFC® – Integral Flow Check

Performance Data

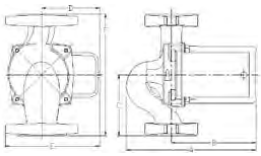
Flow Range: 0 – 12.5 GPM
Head Range: 0 – 11 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged

Application

The Taco 007-IFC® with an Integral Flow Check (IFC®) is designed to reduce installation costs when zoning with "00®" circulators on Hydronic or Radiant heating, Hydro-Air Fan Coils or Indirect water heaters. By locating the IFC® inside the pump casing, a separate in-line flow check is eliminated, reducing installation costs. The reduced pressure drop of the IFC®, increases the 007 flow performance by up to 240% over in-line check valves. Both the IFC® and the replaceable cartridge are easily accessed for service instead of replacing the entire unit. The 007Z-IFC® combines the circulator, flow-check and patented Priority Zoning control with built-in transformer, relay and priority switch in one complete, compact package to make it ideal for zoning. Available in Cast Iron construction with flanged connections.

Pump Dimensions & Weights

		A		B		C		D		E		F		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
007-F5-IFC	Cast Iron	7	178	4-1/2	114	3-3/16	81	2-15/16	75	5	127	6-3/8	162	9	4.0
007-ZF5-IFC	Cast Iron	7	178	4-1/2	114	3-3/16	81	3-5/8	92	5-9/16	143	6-3/8	162	9	4.0



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
All 007 Models	115	60	1	.71	3250	1/25
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

12.

Model 008-IFC® Cartridge Circulator

Model Nomenclature

F – Cast Iron, Flanged
Z – Zoning Circulator
BC – Bronze, Sweat, Panel Mount
IFC® – Integral Flow Check

Performance Data

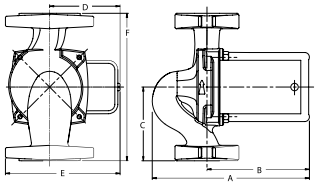
Flow Range: 0 - 12.5 GPM
Head Range: 0 - 15 Feet
Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged or 3/4" Sweat

Application

The 008-IFC® with an Integral Flow Check (IFC®) is designed to reduce installation costs when zoning with "00®" circulators on Hydronic or Radiant heating, Hydro-Air Fan Coils or closed loop solar heating systems. By locating the patented IFC® inside the pump casing, a separate in-line flow check is eliminated, reducing installation costs. The reduced pressure drop of the IFC®, increases the 008 flow performance up to 260% over in-line check valves. Both the IFC® and cartridge are easily accessed for service instead of replacing the entire unit. The 008-Z-IFC® combines the circulator, flow-check and patented Priority Zoning control with built-in transformer, relay and priority switch in one complete, compact package to make it ideal for zoning. Available in Cast Iron or Bronze construction.

Pump Dimensions & Weights

		A		B		C		D		E		F		Ship Wt.	
Model	Casing	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
008-F6-IFC	Cast Iron	7	178	4-1/2	114	3-3/16	81	2-15/16	75	5	127	6-3/8	162	9	4.0
008-ZF6-IFC	Cast Iron	7	178	4-1/2	114	3-3/16	81	3-5/8	92	5-9/16	143	6-3/8	162	9	4.0
008-BC6-IFC	Bronze	6-1/2	165	4-9/16	116	3-3/16	81	2-15/16	75	4-11/16	119	6-3/8	162	9	4.0



Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
All 008 Models	115	60	1	.79	3250	1/25
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

13.

freedom Flange™

Application

Use Taco *freedom* Flanges on all your Circulator jobs for a complete professional installation. Available in Ductile Iron or Bronze, Threaded, Sweat or Threaded Shut-Off design. There's a *freedom* Flange™ to fit every "00®" Circulator. The unique hex design provides easy-on, easy-off installation with a standard adjustable wrench.

Shut-Off *freedom* Flange™ - Bronze

Shut-Off *freedom* Flange™ Features

- 2-Piece Design
- 1/4" Steel Flange - Won't Bend or Crack
- Dual Teflon Seated Solid Brass Ball
- Upgraded Stem Seal
- Available in 3/4", 1", 1-1/4" Threaded Connections

Sweat *freedom* Flange™ - Bronze

Sweat & Threaded *freedom* Flange™ Features

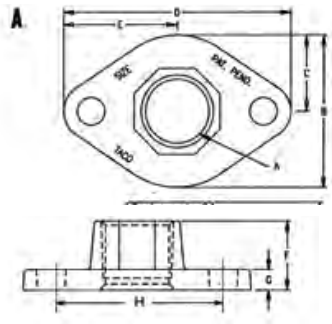
- Fits All "00®" Circulators
- Easy-On, Easy-Off with an Adjustable Wrench
- Ductile Iron - Stronger than Cast Iron
- Ductile Iron 3/4" – 2"
- Bronze Threaded 3/4" – 2"
- Bronze Sweat 1/2" – 1-1/2"

Threaded *freedom* Flange™ - Bronze

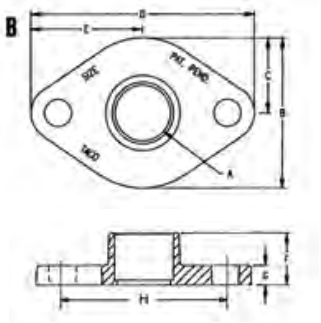
Threaded *freedom* Flange™ - Ductile Iron

14.

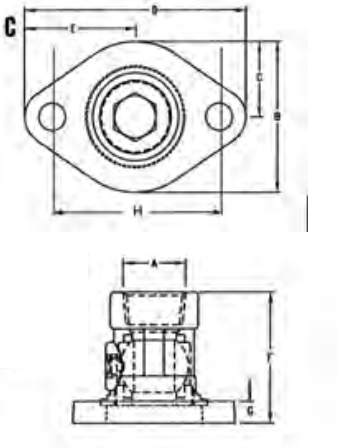
Threaded *freedom* Flange™



Sweat *freedom* Flange™



Shut-Off *freedom* Flange™-Threaded



Ductile Iron Freedom Flange™

Ductile Iron Freedom Flange Sets (005, 007-0011, 0013, 0014, 110-113)

Figure	Product #	Size A	B	C	D	E	F	G	H
A	110-251F	3/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-252F	1" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-253F	1-1/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-7/16"	3/8"	3-1/8"
A	110-254F	1-1/2" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-7/16"	3/8"	3-1/8"

0012 Ductile Iron Freedom Flange Sets (Directly Replaces HV Series Circulators)*

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1540F	1-1/4" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-9/16"	9/16"	3-7/16"
A	194-1542F	1-1/2" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-9/16"	9/16"	3-7/16"

* 1-1/2" Flange set included in each 0012-F4 box.

2" 0012 Ductile Iron Freedom Flange Sets (Directly Replaces 2" Series Circulators)**

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1543F	1-1/2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	1/2"	4-1/8"
A	194-2124F	2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	1/2"	4-1/8"

** 2" Flange set included in each 0012-F4-1 box.

Bronze Freedom Flange™

Bronze Threaded Freedom Flange Sets (005, 007-0011, 0013, 0014, 110-113)

Figure	Product #	Size A	B	C	D	E	F	G	H
A	110-251BF	3/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-252BF	1" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-253BF	1-1/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-254BF	1-1/2" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"

0012 Bronze Threaded Freedom Flange Sets (Directly Replaces HV Series Circulators)***

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1540BF	1-1/4" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-9/16"	9/16"	3-7/16"
A	194-1542BF	1-1/2" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-9/16"	9/16"	3-7/16"

*** 1-1/2" Flange set included in each 0012-BF4 box.

2" 0012 Bronze Freedom Flange Sets (Directly Replaces HV Series Circulators)****

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1543BF	1-1/2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	1/2"	4-1/8"
A	194-2124BF	2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	1/2"	4-1/8"

**** 2" Flange set included in each 0012-BF4-1 box.

Bronze Sweat Freedom Flange Sets (005, 007-0011, 0013, 0014, 110-113)

Figure	Product #	Size A	B	C	D	E	F	G	H
B	110-522BSF	1/2" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	7/8"	3/8"	3-1/8"
B	110-523BSF	3/4" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	7/8"	3/8"	3-1/8"
B	110-524BSF	1" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	3/8"	3-1/8"
B	110-525BSF	1-1/4" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/8"	3/8"	3-1/8"
B	110-526BSF	1-1/2" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"

Bronze Shut-Off Freedom Flange™

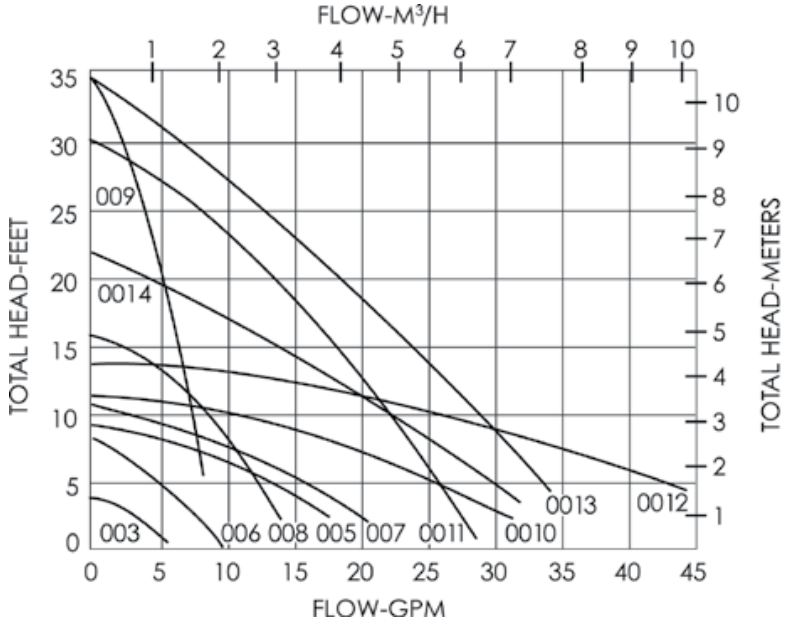
2-Piece Bronze Shut-Off Freedom Flange Sets (005, 007-0011, 0013, 0014, 110-113)

Figure	Product #	Size A	B	C	D	E	F	G	H
C	254-2	3/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	2-3/16"	3/8"	3-1/8"
C	255-2	1" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/12"	3/8"	3-1/8"
C	256-2	1-1/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	2-5/16"	3/8"	3-1/8"

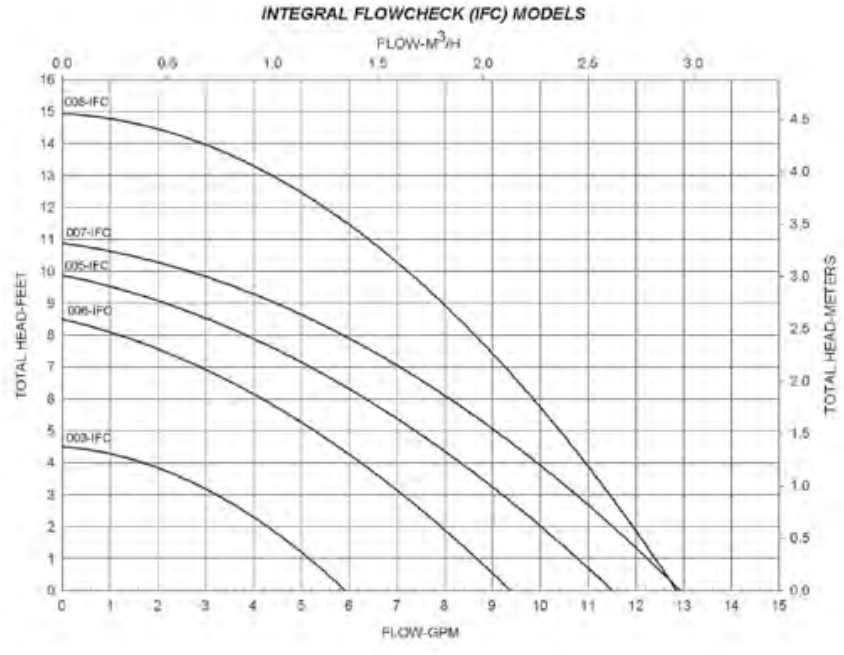
15.

Performance Field Information

60 Hz Performance Field



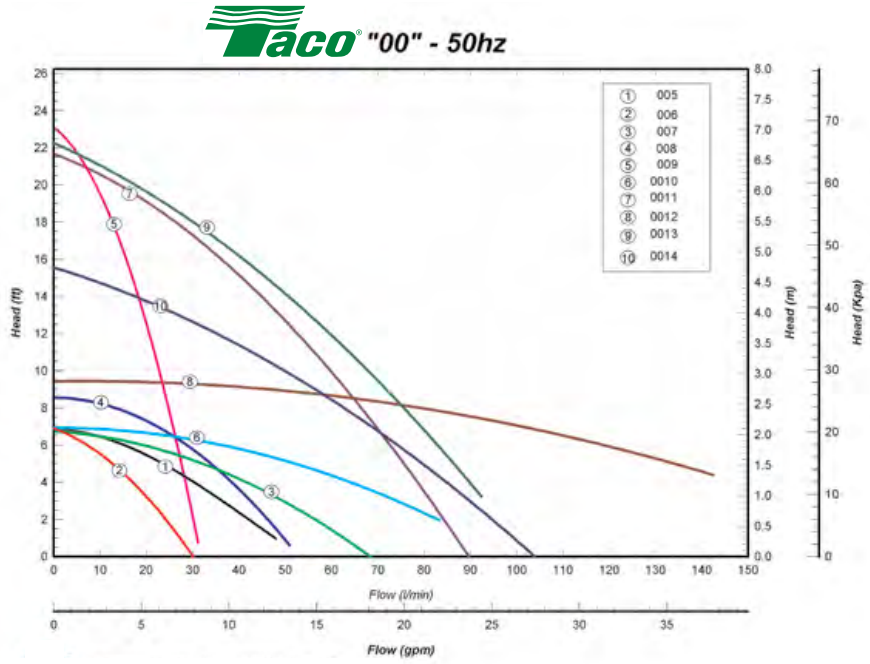
60 Hz Performance Field



16.

Performance Field Information

50 Hz Performance Field



17.

Other Quality Products from Taco®

Wags®

The WAGS® valve shuts off the water supply (plus gas supply for gas-fired water heaters) when it detects a water leak, preventing disastrous flooding and damage to structures and belongings.

Electronic Controls

Whether your looking for switching relays, zone valves, priority zoning circulators, fan controls or low water cutoffs. Taco has everything you need. Together with Taco zone valves, thermostats, the "00®" family of circulators, and a host of add-on controls, we offer the highest quality and broadest selection of zoning products.

5000 Series Mixing Valves

ASSE 1017 approved the 5000 Series Mixing Valve delivers fail-safe security in a high flow, low headloss valve. With an extended mix temperature range of 85°-150°F, it provides the ultimate performance across multiple mixing and diverting applications.

18.

Other Quality Products from Taco®

Electronic Ball Valve (EBV) Zone Valve

The most reliable and technologically advanced zone valve on the market. Microcircuit technology lowers the amp draw so you can install up to 12 valves per 40 VA transformer, or use a smaller transformer. The EBV has the industry's highest CV and drop tight shut-off up to 125psi. The lower profile of the EBV allows it to fit into tighter spaces. Last, the EBV features a universal actuator, so it fits all sizes of valves, reduces inventory and can be installed in any position, in any direction.

VorTech® Air Separator

Taco's innovative tangential flow pattern, primary separation chamber and standard Taco Hy-Vent® makes the VorTech® the most effective and reliable air separator on the market. Available in 3/4" - 2" size, they require no minimum run of pipe and have convenient 1/2" bottom tapping for installation of an expansion tank.

Cartridge PRV

Taco's cartridge style pressure reducing valve sets a new standard for performance and serviceability. All the parts are contained in a one-piece cartridge, which can be easily removed and serviced without reducing line pressure. A one handed fast-fill button delivers increased flow to speed system fill times while its unique dial-in pressure setting allows for easy adjustment throughout the 10-50 psi range, without the need for an external gauge.

19.

Bulletin 006 Rev. K February 2017

Reliable

Model RFC Series Residential Sprinklers

Flat Cover Plate, Concealed Pendent Sprinkler

cULus Listed

Product Features

- **cULus Listed as Residential Sprinklers**
- **Push-On cover plate installation**
- **Low water flow requirements**

Product Description

Model RFC Series residential sprinklers are flat cover plate, concealed pendent sprinklers intended for installation in accordance with NFPA 13, NFPA 13R, or NFPA 13D. The sprinklers are cULus Listed as Residential Sprinklers in accordance with UL 1626.

Model RFC30, RFC43, and RFC49 sprinklers have a 165°F (74°C) temperature rated fusible-link operating element. Model RFC58 sprinklers are offered with either a 165°F (74°C) or 212°F (100°C) temperature rated fusible-link operating element. Sprinklers with a 165°F (74°C) temperature rating are ordinary temperature classification and should be used with a 135°F (57°C) temperature rated cover plate. Sprinklers with a 212°F (100°C) temperature rating are intermediate temperature classification and should be used with a 165°F (74°C) temperature rated cover plate.

Model RFC Series sprinklers are installed with a Model RFC cover plate. Model RFC cover plates may be installed by either pushing or threading the cover plate into the sprinkler cup. Model RFC30, RFC43, and RFC49 sprinklers allow 1/2" (13 mm) of cover plate adjustment. Model RFC58 sprinklers allow 3/4" (19 mm) of cover plate adjustment.

Model RFC cover plates are available in a variety of finishes as listed in Table H. In addition, Model RFC cover plates may be ordered as either traditional solid cover plates or perforated cover plates.

Model RFC30

Model RFC43

Model RFC49

Model RFC58

Model RFC Cover Plate

Table A

Sprinkler Model	Nominal K-Factor gpm/psi$^{1/2}$ (l/min/bar$^{1/2}$)	Max. Coverage Area ft x ft (m x m)	Sprinkler Identification Number (SIN)
RFC30	3.0 (43.2)	14 x 14 (4.3 x 4.3)	RA0611
RFC43	4.3 (62)	20 x 20 (6.1 x 6.1)	RA0612
RFC49	4.9 (70.6)	20 x 20 (6.1 x 6.1)	RA0616
RFC58	5.8 (84)	20 x 20 (6.1 x 6.1)	RA0613

Model RFC30 Residential Sprinkler **SIN RA0611**

Technical Specifications
Style: Flat Concealed Pendent
Threads: 1/2" NPT or ISO 7-1 R1/2
Nominal K-Factor: 3.0 (43.2 metric)
Max. Working Pressure: 175 psi (12 bar)
Min. Spacing: 8 ft. (2.4 m)

Material Specifications
Thermal Sensor: Nickel Alloy Solder Link
Sprinkler Body: Brass Alloy
Levers: Bronze Alloy
Yoke: Brass Alloy
Sealing Assembly: Nickel Alloy with PTFE
Load Screw: Bronze Alloy
Towers: Copper Alloy
Pins: Stainless Steel
Deflector: Bronze Alloy
Cup: Steel

Cover Plate Finishes
(See Table H)

Sensitivity
Fast-response

Temperature Rating
165°F (74°C) sprinkler
135°F (57°C) cover plate

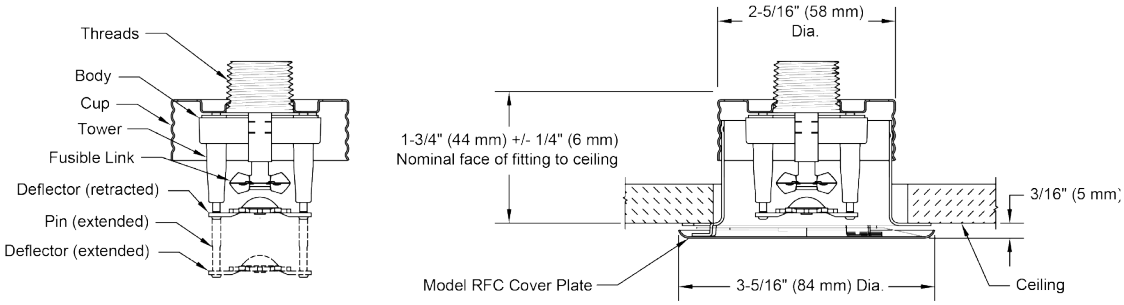
Cover Plate
Model RFC cover plate

Sprinkler Wrench
Model FC

Listings and Approvals
cULus Listed

Bottom View

Model RFC30 Sprinkler Components and Dimensions **Figure 1**



Model RFC30 Sprinkler Hydraulic Design Criteria **Table B**

Minimum Flow and Residual Pressure		
Max. Coverage Area ft. x ft. (m x m)	**Flow gpm (l/min)**	**Pressure psi (bar)**
12 x 12 (3.6 x 3.6)	9 (34)	9.0 (0.62)
14 x 14 (4.3 x 4.3)	10 (38)	11.0 (0.76)

Notes:
1. For NFPA 13 installations the flow per sprinkler must be the greater of: (1) the flow listed in Table B above and (2) the flow required to achieve a minimum design density of 0.1 gpm/sq ft over the design area of the sprinkler.
2. For coverage area dimensions less than those listed above, use the minimum required flow for the next larger max. coverage area listed.

Model RFC43 Residential Sprinkler **SIN RA0612**

Technical Specifications
Style: Flat Concealed Pendent
Threads: 1/2" NPT or ISO 7-1 R1/2
Nominal K-Factor: 4.3 (62 metric)
Max. Working Pressure: 175 psi (12 bar)
Min. Spacing: 8 ft. (2.4 m)

Material Specifications
Thermal Sensor: Nickel Alloy Solder Link
Sprinkler Body: Brass Alloy
Levers: Bronze Alloy
Yoke: Brass Alloy
Sealing Assembly: Nickel Alloy with PTFE
Load Screw: Bronze Alloy
Towers: Copper Alloy
Pins: Stainless Steel
Deflector: Bronze Alloy
Cup: Steel

Cover Plate Finishes
(See Table H)

Sensitivity
Fast-response

Temperature Rating
165°F (74°C) sprinkler
135°F (57°C) cover plate

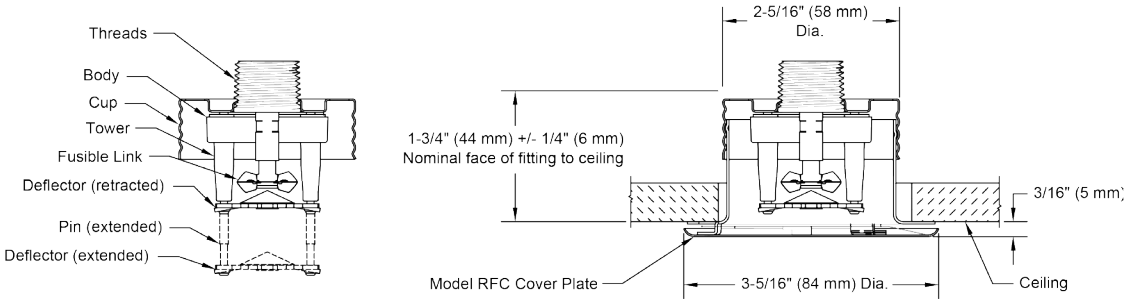
Cover Plate
Model RFC cover plate

Sprinkler Wrench
Model FC

Listings and Approvals
cULus Listed

Bottom View

Model RFC43 Sprinkler Components and Dimensions **Figure 2**



Model RFC43 Sprinkler Hydraulic Design Criteria **Table C**

Minimum Flow and Residual Pressure		
Max. Coverage Area ft. x ft. (m x m)	**Flow gpm (l/min)**	**Pressure psi (bar)**
12 x 12 (3.6 x 3.6)	12 (45)	7.8 (0.54)
14 x 14 (4.3 x 4.3)	13 (49)	9.1 (0.63)
16 x 16 (4.9 x 4.9)	13 (49)	9.1 (0.63)
18 x 18 (5.5 x 5.5)	18 (68)	17.5 (1.21)
20 x 20 (6.1 x 6.1)	21 (79)	23.8 (1.64)

Notes:
1. For NFPA 13 installations the flow per sprinkler must be the greater of: (1) the flow listed in Table C above and (2) the flow required to achieve a minimum design density of 0.1 gpm/sq ft over the design area of the sprinkler.
2. For coverage area dimensions less than those listed above, use the minimum required flow for the next larger max. coverage area listed.

Model RFC49 Residential Sprinkler **SIN RA0616**

Technical Specifications
Style: Flat Concealed Pendent
Threads: 1/2" NPT or ISO 7-1 R1/2
Nominal K-Factor: 4.9 (70.6 metric)
Max. Working Pressure: 175 psi (12 bar)
Min. Spacing: 8 ft. (2.4 m)

Material Specifications
Thermal Sensor: Nickel Alloy Solder Link
Sprinkler Body: Brass Alloy
Levers: Bronze Alloy
Yoke: Brass Alloy
Sealing Assembly: Nickel Alloy with PTFE
Load Screw: Bronze Alloy
Towers: Copper Alloy
Pins: Stainless Steel
Deflector: Bronze Alloy
Cup: Steel

Cover Plate Finishes
(See Table H)

Sensitivity
Fast-response

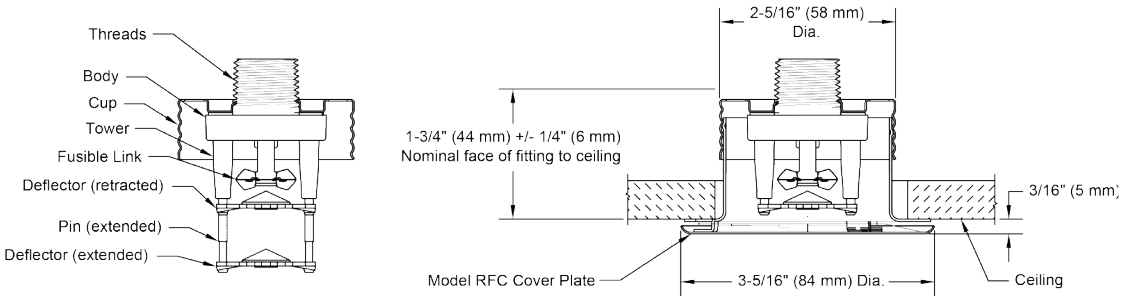
Temperature Rating
165°F (74°C) sprinkler
135°F (57°C) cover plate

Cover Plate
Model RFC cover plate

Sprinkler Wrench
Model FC

Listings and Approvals
cULus Listed

Model RFC49 Sprinkler Components and Dimensions **Figure 3**



Model RFC49 Sprinkler Hydraulic Design Criteria **Table D**

Minimum Flow and Residual Pressure		
Max. Coverage Area ft. x ft. (m x m)	**Flow gpm (l/min)**	**Pressure psi (bar)**
16 x 16 (4.9 x 4.9)	13 (49.0)	7.0 (0.48)
18 x 18 (5.5 x 5.5)	17 (64.3)	12.0 (0.83)
20 x 20 (6.1 x 6.1)	20 (75.7)	16.7 (1.15)

Notes:
1. For NFPA 13 installations the flow per sprinkler must be the greater of: (1) the flow listed in Table D above and (2) the flow required to achieve a minimum design density of 0.1 gpm/sq ft over the design area of the sprinkler.
2. For coverage area dimensions less than those listed above, use the minimum required flow for the next larger max. coverage area listed.

Model RFC58 Residential Sprinkler — **SIN RA0613**

Technical Specifications
Style: Flat Concealed Pendent
Threads: 1/2" NPT or ISO 7-1 R1/2
Nominal K-Factor: 5.8 (84 metric)
Max. Working Pressure: 175 psi (12 bar)
Min. Spacing: 8 ft. (2.4 m)

Material Specifications
Thermal Sensor: Nickel Alloy Solder Link
Sprinkler Body: Brass Alloy
Levers: Bronze Alloy
Yoke: Brass Alloy
Sealing Assembly: Nickel Alloy with PTFE
Load Screw: Bronze Alloy
Towers: Copper Alloy
Pins: Stainless Steel
Deflector: Chrome Plated Bronze Alloy
Cup: Steel

Cover Plate Finishes
(See Table H)

Sensitivity
Fast-response

Temperature Ratings
Ordinary:
165°F (74°C) sprinkler
135°F (57°C) cover plate
Intermediate:
212°F (100°C) sprinkler
165°F (74°C) cover plate

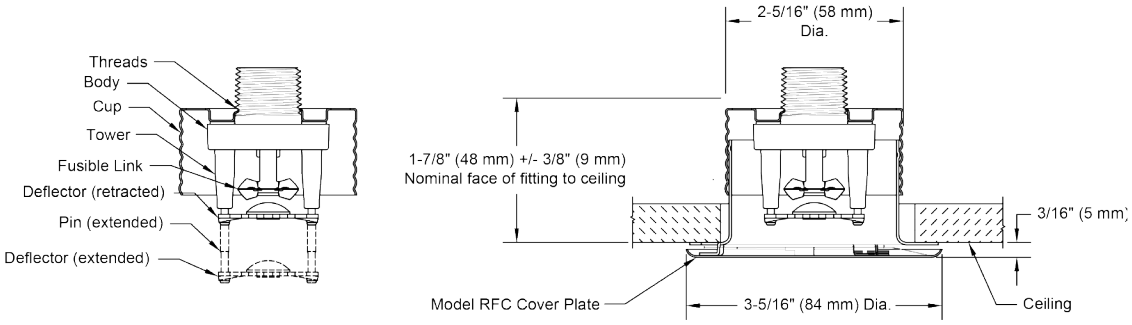
Cover Plate
Model RFC Cover Plate

Sprinkler Wrench
Model FC

Listings and Approvals
cULus Listed

Bottom View

Model RFC58 Sprinkler Components and Dimensions — **Figure 4**



Model RFC58 Sprinkler Hydraulic Design Criteria — **Table E**

Minimum Flow and Residual Pressure		
Max. Coverage Area[2] ft. x ft. (m x m)	**Flow gpm (l/min)**	**Pressure psi (bar)**
16 x 16 (4.9 x 4.9)	16 (60.6)	7.6 (0.53)
18 x 18 (5.5 x 5.5)	18 (68.1)	9.6 (0.66)
20 x 20 (6.1 x 6.1)	20 (75.7)	11.9 (0.82)

Notes:
1. For NFPA 13 installations the flow per sprinkler must be the greater of: (1) the flow listed in Table E above and (2) the flow required to achieve a minimum design density of 0.1 gpm/sq ft over the design area of the sprinkler.
2. For coverage area dimensions less than those listed above, use the minimum required flow for the next larger max. coverage area listed.

Cover Plate Finishes[1] — **Table H**

Standard Finishes	Special Application Finishes		
White Polyester	Off White Paint	Black Paint	Raw Brass
Chrome Plated	Bright Brass	Finished Bronze	Black Plated
	Satin Chrome	Stainless Steel Clad[3]	Custom Color Paint[2]

Notes:
1. Paint or any other coating applied over the factory finish will void all approvals and warranties.
2. Custom color paint is semi-gloss, unless specified otherwise.
3. Stainless steel clad cover plates are Type 316 Stainless Steel on the finished side and C102 Copper Allow on the back side. Cover plates are not listed or approved as corrosion resistant. Stainless steel clad cover plates are not available perforated.

Installation Dimensions — **Table J**

Sprinkler Model	Cover Plate Model	Cover Plate Diameter inch (mm)	Recommended Hole Diameter in Ceiling inch (mm)	Cover Plate Adjustment inch (mm)	Min. to Max. Face of Fitting to Ceiling[1] inch (mm)	Min. to Max. Dropped Deflector Distance below Ceiling inch (mm)	Cover Plate Temperature Rating
RFC30 RFC43 RFC49	RFC	3-5/16 (84)	2-5/8 (67)	1/2 (13)	1-1/2 to 2 (38 to 51)	1/2 to 1 (13 to 25)	135°F (57°C)
RFC58	RFC	3-5/16 (84)	2-5/8 (67)	3/4 (19)	1-1/2 to 2-1/4 (38 to 57)	1/4 to 1 (6 to 25)	135°F[2] (57°C) or 165°F[3] (74°C)

Notes:
1. Face of fitting to ceiling dimensions are based on a nominal thread make up. Verify dimensions based on fitting and thread sealing method prior to installation. A 1/2" x 1/2" brass nipple extension (Reliable P/N 6999991900) is available where necessary for replacement of existing sprinklers.
2. For use with 165°F (74°C) temperature rated sprinklers where the Maximum Ceiling Temperature does not exceed 100°F (38°C).
3. For use with 212°F (100°C) temperature rated sprinklers with the Maximum Ceiling Temperature does not exceed 150°F (66°C).

Installation

Model RFC series sprinklers are intended to be installed in accordance with NFPA 13, NFPA 13R, or NFPA 13D, as well as the requirements of applicable authorities having jurisdiction. Model RFC series sprinklers must not be installed in ceilings with positive pressure in the space above. Ensure that the 4 slots in the cup are open and unobstructed following installation. Model RFC series sprinklers are shipped with a protective cap that should remain on the sprinkler until installed. The protective cap should be replaced following installation of the sprinkler and permanently removed only when the cover plate is installed and the sprinkler system is placed in service following construction.

Model RFC series sprinklers are installed with the Model FC wrench. The use of any other wrench to installed Model RFC series sprinklers is not permitted and may damage the sprinkler. Temporarily remove the protective cap during installation of the sprinkler. Insert the Model FC wrench over the sprinkler until the wrench engages the body. Do not wrench any other part of the sprinkler/cup assembly. The Model FC wrench is designed to be turned with a standard 1/2" square drive. Tighten the sprinkler into the fitting after applying a PTFE based thread sealant to the sprinkler's threads. Recommended installation torque is 8 to 18 ft/lb (11 to 24 N/m).

Do not exceed the maximum recommended torque. Exceeding the maximum recommended torque may cause leakage or impairment of the sprinkler. Use care when inserting or removing the wrench from the sprinkler to avoid damage to the sprinkler.

Install the cover plate by hand by pushing the cover plate into the cup and turning the cover in the clockwise direction until it is tight against the ceiling.

Application

Model RFC series sprinklers are intended for installation where residential sprinklers are permitted or required by NFPA 13, NFPA 13R, and NFPA 13D. The sprinklers are concealed pendent residential sprinklers.

Model RFC 30, RFC43, and RFC49 sprinklers are available in ordinary temperature classification for installation where the Maximum Ceiling Temperature does not exceed 100°F (38°C). Model RFC58 sprinklers are available in either ordinary or intermediate temperature classification for installation where the Maximum Ceiling Temperature does not exceed 100°F (38°C) or 150°F (66°C), respectively.

Wrench

Model FC

Maintenance

Model RFC series sprinklers should be inspected and the sprinkler system maintained in accordance with NFPA 25. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Remove dust by gentle vacuuming. Replace any sprinkler cover plate assembly which has been painted (other than factory applied) or damaged in any way. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinklers should be maintained in the original cartons and packaging until used to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

Listings and Approvals

Listed by Underwriters Laboratories, Inc. and UL Certified for Canada (cULus)

UL Listing Category

Residential Automatic Sprinkler

UL Guide Number

VKKW

Guarantee

For the Reliable Automatic Sprinkler Co., Inc. guarantee, terms, and conditions, visit www.reliablesprinkler.com.

Patents

Model RFC30, RFC43, RFC49, and RFC58 sprinklers are covered by U.S. Patent No. 9,248,327 and U.S. Patent No. 7,275,603.

Model RFC30 and RFC43 sprinklers are additionally covered by U.S. Patent No. 8,776,903.

Ordering Information

Specify the following when ordering.

Sprinkler
- Model (RFC30, RFC43, RFC49, RFC58)
- Temperature Rating

Cover Plate
- Model RFC
- Temperature Rating
- Finish (See Table H)

Sprinkler Wrench
- Model FC

P/N 999970261

EP Flow-through Multi-port Tee

Submittal Information
Revision B: April 10, 2009

Project Information

Job Name:

Location: Part No. Ordered:

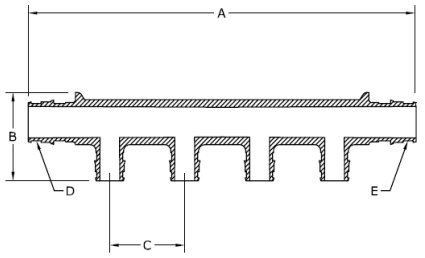
Engineer: Date Submitted:

Contractor: Submitted By:

Manufacturer's Representative: Approved By:

Technical Data

Material:	UDEL GF120
Maximum Temperature (no pressure):	320°F (160°C)
Maximum Working Temperature/Pressure:	210°F (99°C) at 150 psi
Maximum Manifold Flow for ¾" Outlet:	7.5 gpm @ 8 fps 3.75 gpm @ 4 fps
Maximum Manifold Flow for 1" Outlet:	16.5 gpm @ 8 fps 6.6 gpm @ 4 fps



Product Information and Application Use

EP Flow-through Multi-port Tee features ¾" ProPEX® inlets with ½" ProPEX branch outlets or 1" ProPEX inlets or ¾" ProPEX inlets with ½" ProPEX branch outlets.[1] The tee is made of EP, the time-tested, high-performance material used in demanding hot-water applications.

✓	Description	Part Number	A	B	C	D	E	Weight
☐	EP Flow-through Multi-port Tee, 2 outlets, ¾" x ¾" ProPEX	Q2227557	4.40"	1.77"	1.25"	¾" ProPEX	¾" ProPEX	0.60 lbs.
☐	EP Flow-through Multi-port Tee, 3 outlets, ¾" x ¾" ProPEX	Q2237557	5.70"	1.77"	1.25"	¾" ProPEX	¾" ProPEX	1.00 lbs.
☐	EP Flow-through Multi-port Tee, 4 outlets, ¾" x ¾" ProPEX	Q2247557	7.80"	1.77"	1.50"	¾" ProPEX	¾" ProPEX	1.00 lbs.
☐	EP Flow-through Multi-port Tee, 4 outlets, 1" x ¾" ProPEX	Q2241057	7.10"	2.00"	1.25"	1" ProPEX	¾" ProPEX	1.25 lbs.
☐	EP Flow-through Multi-port Tee, 6 outlets, ¾" x ¾" ProPEX	Q2267557	9.41"	1.62"	1.25"	¾" ProPEX	¾" ProPEX	1.60 lbs.
☐	EP Flow-through Multi-port Tee, 6 outlets, 1" x ¾" ProPEX	Q2261057	9.60"	2.00"	1.25"	1" ProPEX	¾" ProPEX	2.30 lbs.
☐	EP Flow-through Multi-port Tee, 6 outlets, 1" x 1" ProPEX	Q2261051	9.90"	2.00"	1.25"	1" ProPEX	1" ProPEX	2.30 lbs.

Installation

Any product designed to mount 1" copper pipe (for the ¾" EP Flow-through Multi-port Tee) or 1¼" copper pipe (for the 1" EP Flow-through Multi-port Tee) can serve as a mounting bracket. For more information, refer to the Uponor Professional Plumbing Installation Guide.

Standards

CAN/CSA B137.5; ASTM F877; ASTM F1960

Codes

IPC; UPC; NSPC; NPC of Canada

Listings

ANSI/NSF -14- and 61-certified; ICC ESR 1099; IAPMO 3946; HUD MR 1269

Related Applications

PEX-a Plumbing Systems

Contact Information

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Apple Valley, MN 55124 USA
Phone: (800) 321-4739
Fax: (952) 891-2008
www.uponor-usa.com

Uponor Ltd.
655 Park Street
Regina, SK S4N 5N1 CANADA
Phone: (888) 994-7726
Fax: (800) 638-9517
www.uponor.ca

[1] ProPEX® is a registered trademark of Uponor, Inc. ProPEX™ is a trademark of Uponor Ltd.

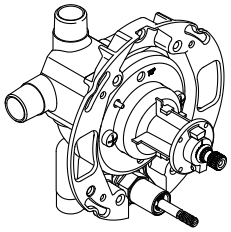
KOHLER FAUCETS

RITE-TEMP®

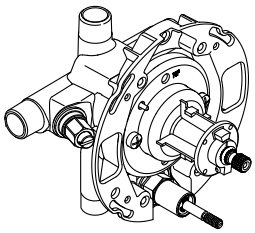
PRESSURE-BALANCING VALVE
K-11748

Features

- *Brass valve bodies*
- *Rite-Temp® pressure-balancing diaphragm design*
- *Pressure-balancing mechanism of one-piece diaphragm cartridge design for ease of maintenance*
- *Mixing valve cycles from "cold" to "hot"*
- *Integral diverter mechanism*
- *High-temperature limit setting for added safety*
- *Available with or without screwdriver stops*
- *Designed for showerhead and handshower applications*



K-11748-K



K-11748-KS

Codes/Standards Applicable

Specified model meets or exceeds the following:

- *ASME A112.18.1/CSA B125.1*
- *ASSE 1016*

Colors/Finishes

- NA: None applicable

Specified Model

Model	Description	Colors/Finishes
K-11748-K	Pressure-balancing valve without screwdriver stops	NA
K-11748-KS	Pressure-balancing valve with screwdriver stops	NA

Optional Accessories
Deep rough-in kits are available (refer to the trim set Specification Sheet).

Product Specification

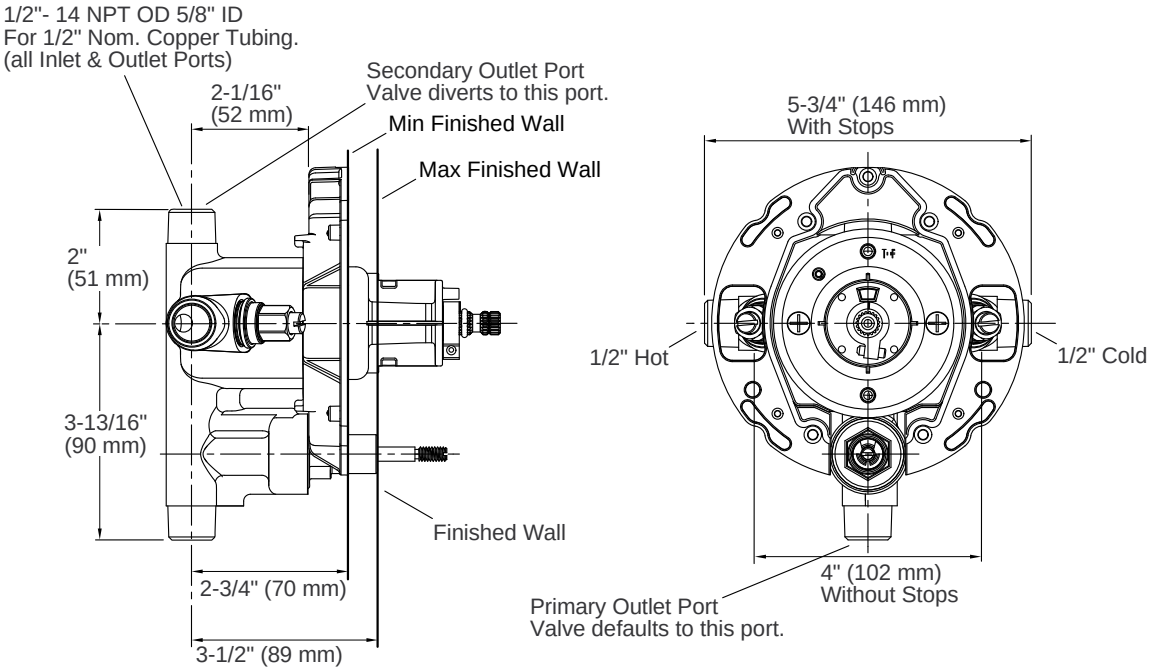
Rite-Temp pressure-balancing single-control valve shall feature a brass valve body. Valve shall feature mixing valve cycles from "cold" to "hot" and a high-temperature limit setting for added safety. Valve shall feature a Rite-Temp pressure-balancing diaphragm design and a pressure-balancing mechanism of one-piece diaphragm cartridge design for ease of maintenance. Valve shall have integral diverter mechanism. Valve shall be available with or without screwdriver stops. Valve shall be designed for showerhead and handshower applications. Rite-Temp pressure-balancing valve shall be Kohler Model K-11748-_____-NA.

USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

RITE-TEMP®

Installation Notes

Avoid cross-flow conditions. Do not install shut-off device on either valve outlet.



Product Diagram

RITE-TEMP® PRESSURE-BALANCING VALVE
Page 2 of 2
1114241-4-**D**

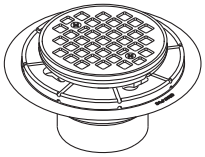
THE BOLD LOOK OF KOHLER®

KOHLER FAUCETS

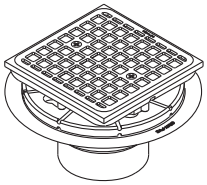
TILE-IN SHOWER DRAIN
K-9135
ALSO K-9136

Features
- *Brass and PVC construction*
- *Through-the-floor tile-in installation*
- *Removable grid plate*
- *Reversible collar to accommodate a variety of tile thicknesses*
- *2″ and 3″ PVC connection*

Codes/Standards Applicable
Specified model meets or exceeds the following:
- *ASME A112.18.2/CSA B125.2*



K-9135



K-9136

Colors/Finishes
- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

Specified Model

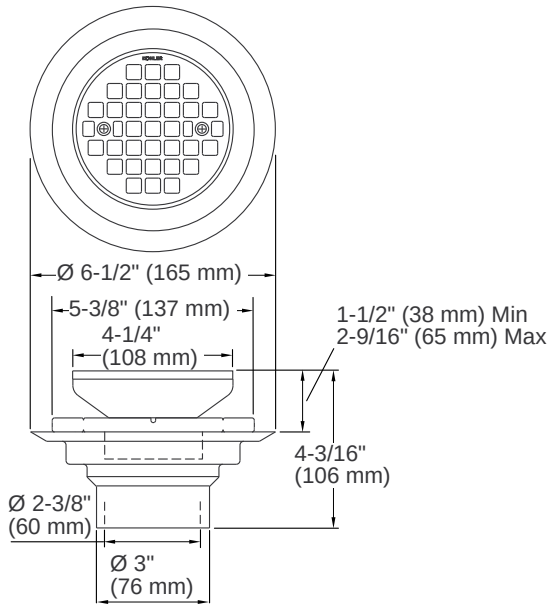
Model	Description	Colors/Finishes	
K-9135	Tile-in shower drain – round shaped grid plate	☐ CP	☐ Other ____
K-9136	Tile-in shower drain – square shaped grid plate	☐ CP	☐ Other ____

Product Specification
The tile-in shower drain shall be made of brass and PVC construction. Drain shall be for through-the-floor tile-in installation. Drain shall be for 2″ and 3″ PVC connection. Drain shall feature a removable grid plate and reversible collar to accommodate a variety of tile thicknesses. Drain shall be Kohler Model K-____-____.

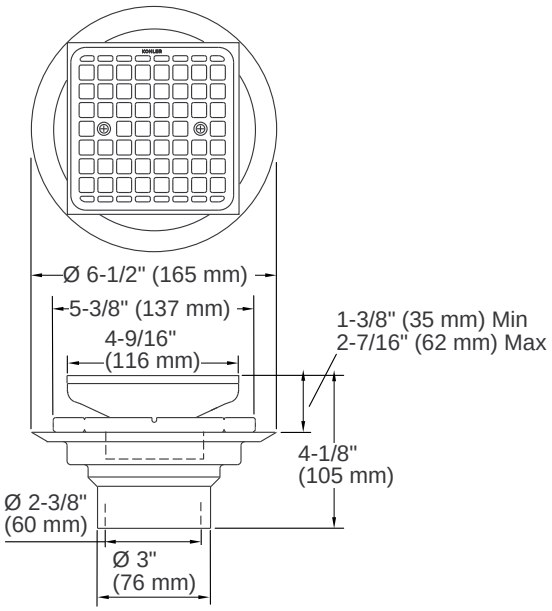
USA/Canada: 1-800-4KOHLER
(1-800-456-4537)
www.kohler.com

Installation Notes

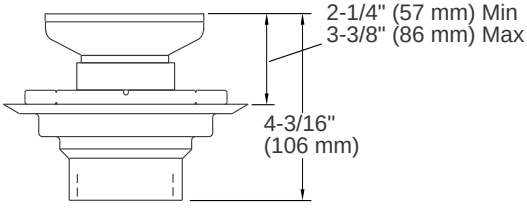
Install this product according to the installation guide.



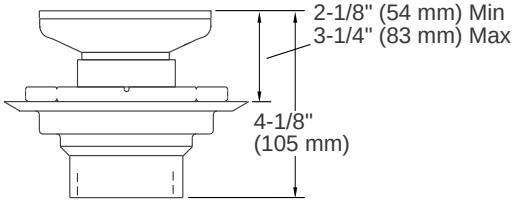
K-9135
Collar with Threads Facing Down



K-9136
Collar with Threads Facing Down



Collar with Threads Facing Up



Collar with Threads Facing Up

Product Diagram

TILE-IN SHOWER DRAIN
Page 2 of 2
1090854-4-**C**

THE BOLD LOOK OF KOHLER®

S, SU, and LT Thermoglaze Single Coil Tanks
SM Thermoglaze Dual Coil Tanks
SST Stainless Steel Single-Coil Tanks

Clean, Pure, Reliable Hot Water

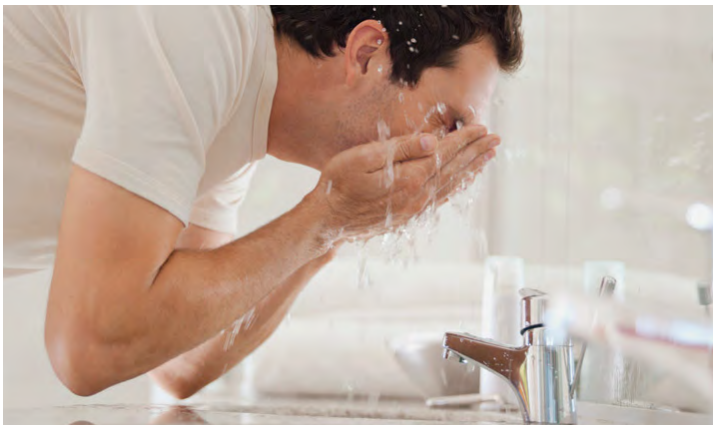
Buderus North America 20 YEARS FOUNDED 1731

Comfortable. Efficient. Intelligent Heating.

Buderus

The Buderus Hot Water Advantage

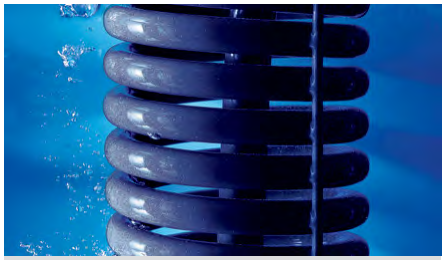
In North America the average household spends around 30% of their energy costs on domestic hot water. Buderus designs its hot water tanks to work more economically and efficiently. Buderus pioneered new methods of producing and storing domestic hot water, so you are assured of greater operating efficiencies, lower fuel consumption and consistent hot water while saving money.



Buderus water tanks are a reliable and clean way to store hot water. From small residences to large commercial operations, there is a Buderus domestic hot water tank that is just right for your application.

Simple Maintenance and Reliable Operation

Buderus domestic hot water tanks offer features that provide for ease of installation, simple maintenance and reliable operation. All Thermoglaze models are equipped with a magnesium anode rod for protection against corrosion, a drain for easy maintenance, and have adjustable screw-on feet for leveling. An easy-access cover aids in cleaning and maintaining the coil and tank interior.



Thermoglaze Tank Features and Benefits

Buderus' patented Thermoglaze® is a ceramic material which is thermally bonded to the internal components of the tank to provide a glass-like coating to protect against the corrosive effects of minerals naturally existing in water. All Thermoglaze tanks are equipped with the following additional features:

- Corrosion Protection – the Buderus Thermoglaze® process and standard magnesium anode rod(s) protect tank interior from corrosion caused by most types of water
- Economical – high density insulation for better temperature maintenance of stored hot water
- Heat exchanger has large surface area for excellent hot water recovery rates

NEW

S and SU Series – Buderus Thermoglaze Single-Coil Tanks

Buderus' four single coil indirect DHW storage tank models S32, SU54, SU80 and SU100 offer easy installation and simple maintenance to provide excellent value at a competitive price.

- All tanks feature an aesthetic white cover design, patented Thermoglaze® enamel interior and magnesium anode rod for optimal service life
- Models SU80 and SU100 have a large front clean out port for easy maintenance and a second magnesium anode rod for extended tank life*
- Screw-on feet enable easy leveling of the tank
- Available capacities 30, 51, 77 and 98 gallons

*Consult Installation and Service Instructions for recommended maintenance

LOW-LEAD UPC ® AHRI CERTIFIED® www.ahridirectory.org

BUDERUS
Indirect Fired Domestic Hot Water Tanks

SM Series – Buderus Thermoglaze Dual-Coil Tanks

Buderus' dual coil indirect DHW storage tanks, SM80 and SM100, are designed for solar and high performance applications.

- Tanks have two internal coils for connection to two heat sources such as one solar thermal system and one boiler
- Features a blue or universal white cover design, patented Thermoglaze® enamel interior and magnesium anode rod for optimal service life
- Second magnesium anode rod for extended tank life and a large front clean out port for easy service*
- Screw-on feet enable easy leveling of the tank
- Available capacities 75 and 97 gallons

*Consult Installation and Service Instructions for recommended maintenance

LT Series – Buderus Thermoglaze Horizontal Single-Coil Tanks

Short on space? The LT horizontal tanks are designed to fit under Buderus boilers resulting in a smaller footprint.

- Horizontal design for small footprint
- Constant hot water at the turn of the tap
- Available capacities in 42, 52 and 76 gallons

SST Series – Buderus Stainless Steel Single-Coil Tanks

The SST stainless steel indirect hot water tank has a welded and passivated 316L stainless steel interior and a 316L stainless steel single coil heat exchanger. This provides durability and resistance to the corrosive tendencies of domestic water.

- Stainless steel heating coil efficiently transfers high volumes of BTU's from the heat source to domestic water stored in the tank
- Two inches of high density CFC/HCFC-free polyurethane foam with a tested R Value of 13.4 provide economical standby losses
- Available capacities 40, 67, 82 and 113 gallons

Configuration	Vertical Single Coil Models				Vertical Dual Coil Models								Horizontal Single Coil Models		
Model	**S32**	**SU54**	**SU80**	**SU100**	**SM80**				**SM100**				**LT160**	**LT200**	**LT300**
Physical Data															
Tank Capacity, gal	**30.0**	**51.3**	**77.4**	**98.4**	**75.4**				**96.9**				**42.6**	**52.5**	**76.0**
Diameter, in.	21¾	21¾	26⅜	26⅜	26⅜				26⅜				25¾	25¾	25¾
Height, in.	38⅝	60¼	58⅞	72¼	58⅞				72¼				25¾	25¾	25¾
Length, in.	–	–	–	–	–				–				36¼	42¼	57¾
Connection Heat Exchanger Coil, in.	¾	1	1	1	1				1				1	1	1
Connection DHW outlet, in.	¾	1	1	1	1				1				1	1	1
Connection Cold Water Inlet, in.	¾	1	1	1	1				1				1¼	1¼	1¼
Connection Recirculation, in.	¾	¾	¾	¾	¾				¾				¾	¾	¾
Approx. Dry Weight, lbs	160	170	231.5	282	260				298				220	247	364
Max. DHW Temperature, °F	203	203	203	203	203				203				203	203	203
Max. DHW Operating Pressure, psi	150	150	150	150	150				150				150	150	150
Standby Heat Loss, °F/h	**1.0**	**0.4**	**0.5**	**0.4**	**0.6**				**0.5**				**0.6**	**0.6**	**0.4**
Max. Heat Exchanger Coil Water Temperature, °F	230	230	230	230	230				230				212	212	212
Max. Heat Exchanger Coil Pressure, psi	232	232	232	232	232				232				232	232	232
Performance Data*					Lower Coil	Upper Coil	Dual Coil	Dual Coil, Parallel	Lower Coil	Upper Coil	Dual Coil	Dual Coil, Parallel			
Heat Input to Tank, MBH	**88.0**	**84.9**	**119.2**	**143.9**	**112.4**	78.2	178.8	156.7	**169.1**	87.9	235.4	202.9	**76.1**	**83.0**	**126.3**
Continuous Rating: (gph)	**137**	**130**	**189**	**218**	**185**	135	298	278	**265**	153	376	344	**122**	**128**	**208**
First Hour Rating: (gph)	**165**	**180**	**264**	**312**	**257**	135	363	345	**356**	153	462	434	**163**	**176**	**276**
Boiler Water Flow Rate, gpm	**8.0**	**11.4**	**11.4**	**14.0**	**11.4**	11.4	11.4	11.4	**14.0**	14.0	14.0	14.0	**14.0**	**14.0**	**14.0**
Coil Pressure Drop: ft of Head:	**1.9**	**2.4**	**2.7**	**3.8**	**2.5**	1.8	3.2	1.4	**5.8**	3.5	10.2	2.1	**2.4**	**2.8**	**3.3**

Configuration	Stainless Steel Models			
	SST150-40	SST250-65	SST300-80	SST450-119
Physical Data				
Tank Capacity, gal	**40**	**67**	**81.5**	**113.4**
Diameter, in.	20	24	24	28
Height, in.	56	60	70	69
Length, in.	–	–	–	–
Connection Heat Exchanger Coil, in.	1	1	1	1
Connection DHW outlet, in.	1	1.5	1.5	1.5
Connection Cold Water Inlet, in.	1	1.5	1.5	1.5
Approx. Dry Weight, lbs (5% higher including packaging)	105	147	177	213
Max. DHW Temperature, °F	194			
Max. DHW Operating Pressure, psi	150			
Standby Heat Loss, °F/h*	**0.9**	**0.7**	**0.6**	**0.5**
Performance Data†				
Heat Input to Tank, MBH	**115**	**154**	**171**	**216**
Continuous Rating: (gph)	**181**	**263**	**285**	**349**
First Hour Rating: (gph)	**208**	**327**	**358**	**459**
Boiler Water Flow Rate, gpm	**14**	**14**	**14**	**14**
Coil Pressure Drop: ft of Head	**4.5**	**5.7**	**6.1**	**6.5**

* Performance data tested at 180°F (82.2°C) Boiler Supply Temperature, 58°F (14.4°C) Cold Water Inlet Temperature, 135°F (57.2°C) DHW Outlet Temp

NOTES:
1. **All AHRI Certified ratings are in BLUE Boldface type**
2. SM80 & SM100 are UPC, USEC and Low-Lead Certified by IAPMO R & T
3. S32, SU54, SU80, SU100, LT160, LT200, LT300 have UPC and Low-Lead Certification by IAPMO Research & Testing
4. Ratings in BLACK are outside the scope of AHRI-IWH Certification Program

A Tradition of Excellence

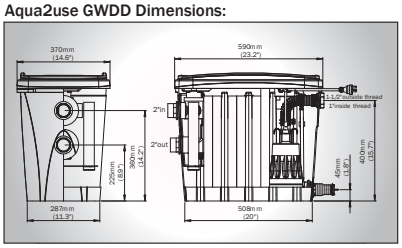
The world leader in heating technologies since 1825, Buderus produced the first low-temperature hydronic heating systems. Today, Buderus products are acknowledged as the global standard in high-efficiency, low emissions hydronic heating. All Buderus products are designed to meet strict safety and environmental regulations.

Buderus boilers are quick and easy to install and will outlast and outperform virtually any other hot water heating system. They are designed for easy access and service. With appropriate maintenance, Buderus boilers deliver the highest efficiencies throughout the lifespan of operation. Buderus is a member of Bosch Thermotechnology.

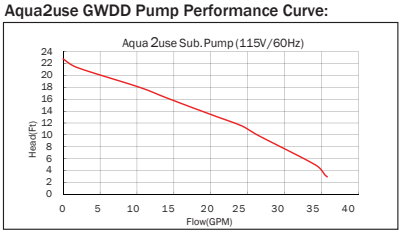
Bosch Thermotechnology Corp., 50 Wentworth Avenue, Londonderry, NH 03053 • Tel: (603) 552-1100 • Fax: (603) 965-7568 • www.buderus.us

Aqua2use
TECHNICAL SPECIFICATIONS

Aqua2use GWDD Dimensions:



Aqua2use GWDD Pump Performance Curve:



Aqua2use GWDD Pump Specifications:

Output			Rated		Maximum		Dimension	Weight
HP	W	inch	Head (Ft)	Flow (GPM)	Head (Ft)	Flow (GPM)	L x W x H (in)	Pounds
1/4	200	1-1/4"	16	14	23	36	6.1 x 6.1 x 9.45	9.26

POTENTIAL WATER REUSE OF 40,000 GALLONS ANNUALLY FOR AN AVERAGE FAMILY OF FOUR

Connection requirements
Power: 110v
Plumbing: 2" inlet and sewer connection
Outlet: Easy connection to 1/2" irrigation tube

Other features
Pump will only run when the tank is full or when activated by the timer - a very efficient system.

Can be disconnected when water is not required

Easy to clean - every 4 to 6 months

The pump and filters can handle water at elevated temperatures

The Aqua2use is UV resistant high grade polyethylene which will not break down in the sun

All parts and the pump are covered by a 12 month replacement warranty

INNOVATED & MANUFACTURED BY
Matala® "Make water alive"
MATALA WATER TECHNOLOGY CO., LTD.

AVAILABLE FROM
water wise GROUP
phone: 805.468.4920
info@waterwisegroup.com

www.waterwisegroup.com

water wise GROUP

Matala® "Make water alive"

The Answer for Graywater Reuse

PATENTED

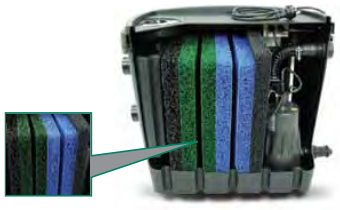
SUSTAINABLE LIVING

Aqua2use
Graywater Diversion Device

Matala® 3D Progressive Filtration:
Technology proved in more than 40 countries

Aqua2use GWDD

MATALA PROGRESSIVE FILTRATION TECHNOLOGY APPLIED IN GRAYWATER DIVERTER



How it works:

Step 1 When the Matala GWDD valve is open, graywater flows directly to the mains sewage.

Step 2 When the Matala GWDD valve is closed, graywater from the house is diverted to the inlet of the filter.

Step 3 The graywater flows through the 1st filter web that retains major and medium particles such as hair, lint, paper, detergent clogs and other impurities. (The filter web: Matala Black - low density, Matala Green - medium density)

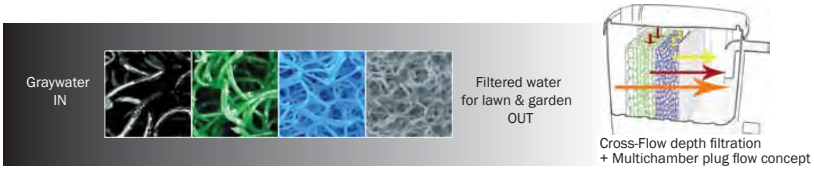
Step 4 The graywater flows through the 2nd filter web that retains medium and small particles. (The filter web: Matala Green - medium density, Matala Blue - high density)

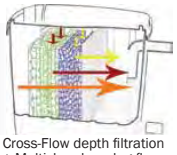
Step 5 The graywater flows through the 3rd filter web that retains small and minor particles. (The filter web: Matala Blue - high density. Matala Gray - super high density)

Step 6 Filtered graywater is pumped to the irrigation.

FEATURES & BENEFITS:

- State of the Art Progressive Filtration.
- 6.8 gallons of Matala filter media provides 108 sqft of specific surface area & 90% void space.
- Cross-Flow depth filtration: each filter web has a 3-dimensional structure, able to trap a high volume of impurities without plugging.
- Multichamber plug flow concept: If the first filter web gets clogged the filtration is done by the 2nd and 3rd filter web. If the second web gets clogged, the filtration is done by the 3rd filter web.
- Solid removal: up to 75% for pump opearted unit, 90% for gravity unit.
- Submersible pump with integrated Electronic Pump Controller(EPC).
- The pump is protected from dry run, clogging and damage.
- Built in overflow safety.
- Easy to clean.
- System can be installed above ground, half-submerged in ground, or underground.
- Water mark approved.

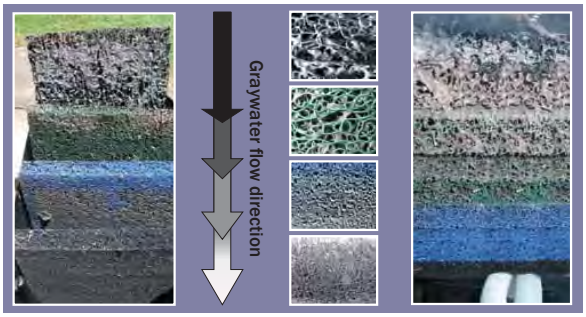




Cross-Flow depth filtration
+ Multichamber plug flow concept

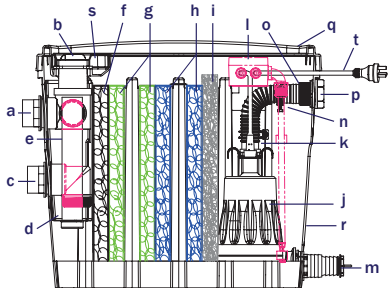
Unit tested in an RV park, Australia:
Matala graywater diverter checked after filtering 40,000L (10,567 gallons) incoming graywater: public shower rooms and laundry

The pictures prove the high filtration efficiency, achieved with progressive density Matala filter sheets. The filter can take up a huge volume of hair, lint, sand, soap residus etc....



Aqua2use GWDD Components

a. inlet(2")
b. Diverting valve
c. Outlet to sewer (2")
d. basket
e. Overflow stand pipe
f. Matala FSM190, Black
g. Matala FSM290, Green
h. Matala FSM365, Blue
i. Matala FSM460, Grey
j. water pump
k. pump outlet
l. electronic pump controller
m. drain/clean out point with 1" plug
n. kinkfree hose + hose clamp
o. outlet connector
p. outlet
q. tank cover
r. tank
s. inlet cover
t. electrical pump lead

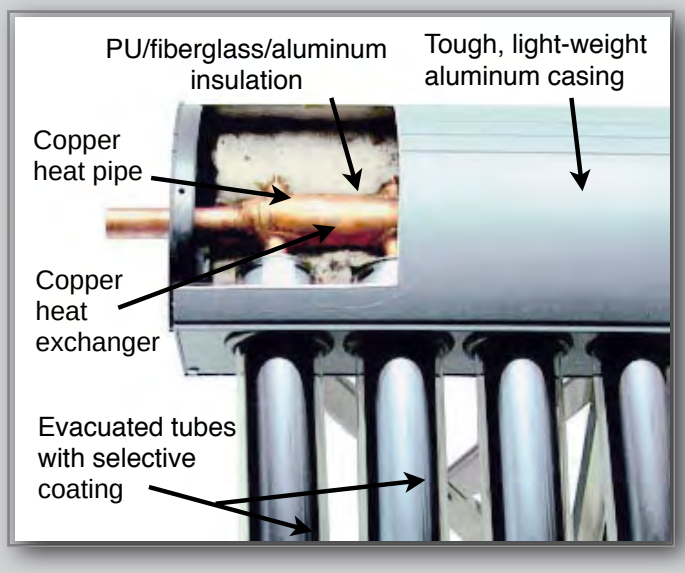


SolarUS SL-30

Solar Collector Product Specifications

Dimensions

Overall Length	76.2 in. / 1935 mm
Overall Height	5.7 in. / 145 mm
Overall Width	90.2 in. / 2290 mm
Absorber Area	26.22 ft^2 / 2.436 m^2
Net Weight	216 lbs / 98 kg
Volume (manifold)	0.46 gal / 1740 mL



Performance (aperture area)

Efficiency (η0G)*	74.4%
Peak Power Output	1917W/hr / 6541 BTU

*PET test report: y-intercept x gross area/aperture area

Installation Guidelines

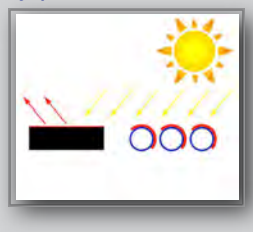
Max Flow Rate	2.11 gpm / 8Lpm
Recommended Flow Rate	0.8 gpm / 3Lpm
Max Tubes in Series	150 tubes
Install Angle Range	15° - 85°

Key Materials

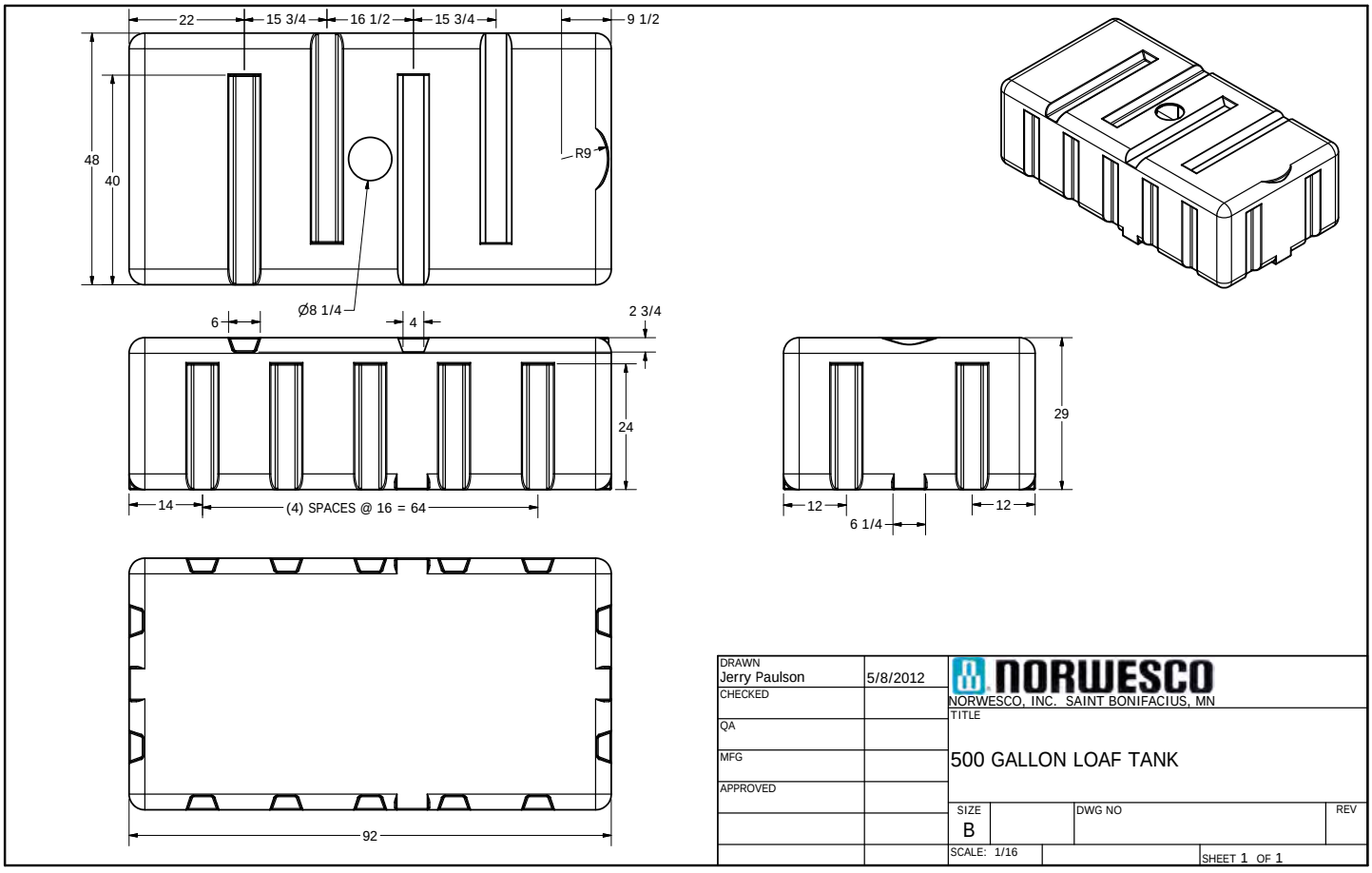
Evacuated Tubes	Borosilicate 3.3 Glass
Absorber	SS-AlN_x/Cu
Heat Pipes	TP_2 Copper
Heat Transfer Fins	3003 Aluminum Alloy
Rubber Components	Silicone Rubber
Mounting Frame	6063 Aluminum Alloy
Manifold Casing	6063 Aluminum Alloy
Bolts, Washers & Nuts	SUS 304 or 201
Insulation	Fiberglass/PU/Aluminum composite

The SolarUS Difference:

- Top-rated composite insulation minimizes heat-loss and prevents moisture unlike normal fiber glass or rock wool insulation
- Special conductive heat pipe design provides supreme heat transfer without stagnation risk
- Incident angle modifier provides maximum direct solar exposure all day unlike flat plate collectors which only peak at noontime (image right)



For more information please visit us online: **www.solarusmfg.com** or call: **(203) 208-3533**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SHEET 1 OF 1

APPENDIX VI
AUTOMATION + INSTRUMENTATION

QS System	QSE-CI-NWK-E	Control Interface

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QSE-CI-NWK-E Control Interface

The QSE-CI-NWK-E is a versatile integration access point for Lutron® QS-based systems. Through either RS232 or TCP/IP over Ethernet, third-party devices can control and/or monitor a QS system.

Features

- Easily integrate with touchscreens, PCs, A/V systems, or other digital systems and devices.
- Control and monitor GRAFIK Eye® QS, Sivoia® QS, Energi Savr Node™, and other products on the wired QS link.
- Monitor lighting scenes, levels, shade positions and more. For a full list of commands see Integration Protocol document (P/N 040249) at www.lutron.com
- Up to 10 QSE-CI-NWK-E control interfaces are allowed per QS link.
- The QSE-CI-NWK-E is Quantum® compatible. Refer to the Quantum® System Specification Sheet (P/N 369634) at www.lutron.com for compatibility details.

LUTRON® SPECIFICATION SUBMITTAL Page 1

Job Name:	Model Numbers:	
Job Number:		

QS System	QSE-CI-NWK-E	Control Interface

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Specifications

Power

- SELV/PELV/NEC® Class 2
- Operating voltage: 24–36 V⎓ 65 mA

QS Link Limits

- The QS wired communications link is limited to 100 devices and 100 zones. Each QSE-CI-NWK-E control interface counts as 1 device and 0 zones.
- Each QSE-CI-NWK-E control interface consumes 2 Power Draw Units (PDU) on the QS link. Refer to the QS Link Power Draw Units Specification Submittal (P/N 369405) at www.lutron.com for more information.
- The maximum wiring length for the QS link is 2000 ft (610 m).

Environment

- 32 °F to 104 °F (0 °C to 40 °C).
- Relative humidity less than 90% non-condensing.
- Indoor use only.
- Unit generates heat, maximum 8 BTU/hr.

Integration Features

- Monitoring: Current scene, zone level, button presses, shade group levels.
- Control: Scene selection, scene lockout, zone lockout, sequencing, zone raise/lower, master raise/lower, set shade group level, simulate button press/release.

  For the full list of features and commands, please refer to the Integration Protocol document (P/N 040249) on the accompanying CD or at www.lutron.com

Compatible Components

- Compatible with most QS devices. For a complete list of compatible components see Integration Protocol document (P/N 040249) at www.lutron.com

Requirements

- QS Link Power Supply, such as a:
  – GRAFIK Eye® QS.
  – QS Link power supply, such as the QSPS-P1-1-50 .
  – Energi Savr Node™ QS.
- QS Communication Link - SELV/PELV/NEC® Class 2 (see QS Link Wire Sizes table).

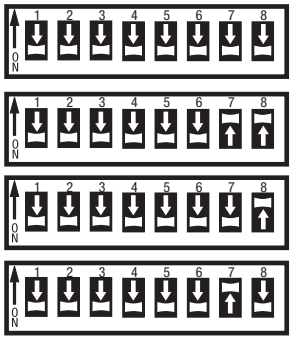
Protocol

- Integration Protocol document (P/N 040249) included on a CD accompanying the packaged QSE-CI-NWK-E.
- Also available for download, see Integration Protocol document (P/N 040249) at www.lutron.com

RS232 Connection

- Standard 9-pin female serial connector on interface.
- 50 ft (15 m) maximum serial cable length.
- Dip switches are set at factory, all Off.
- Dip switches are used to set RS232 baud rate:

DIP Switch Settings for RS232 Baud Rate



Ethernet Connection

- Standard CAT5 (or better) cable, 328 ft (100 m) maximum, connects the QSE-CI-NWK-E interface to a PC or other Ethernet source.
- Supports MDI/MDIX auto-crossover (no crossover cable needed).
- Auto-negotiation of 10 or 100 Mbps speed and full- or half-duplex operation.
- Default IP address is 192.168.250.1. Can be changed using the Lutron® DeviceIP tool located on the accompanying CD.

Note: Either the RS232 or the Ethernet can be used, but not both.

LUTRON® SPECIFICATION SUBMITTAL Page 2

Job Name:	Model Numbers:	
Job Number:		

QS System	QSE-CI-NWK-E	Control Interface

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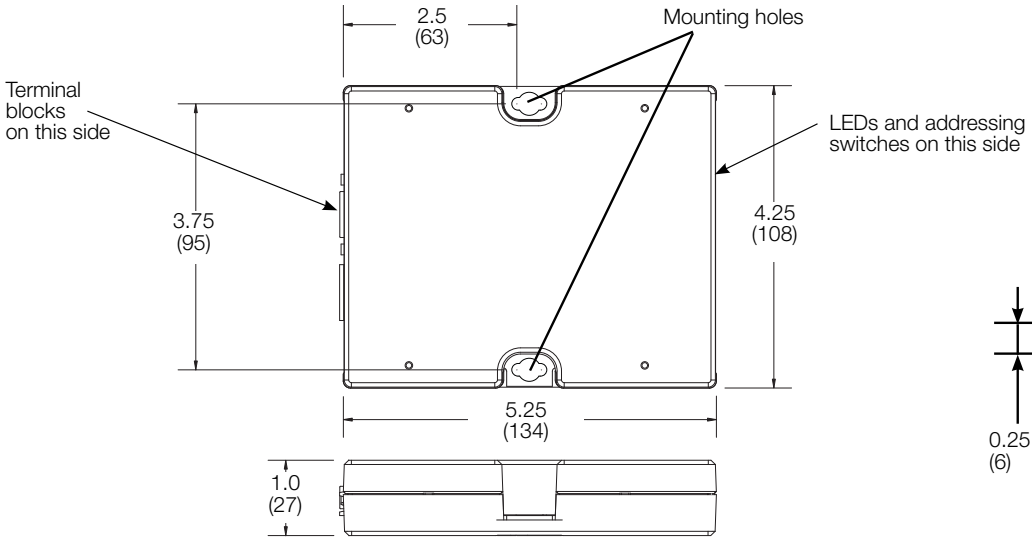
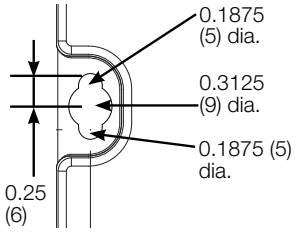
Dimensions

Dimensions are in inches (mm)



Mounting Hole Detail



#6 or #8 (M3 or M4)
screw recommended

Mounting Options

Mount where terminal blocks, switches, and LEDs are accessible. Strip 3/8 in (10 mm) of insulation from wires. Each data link terminal will accept up to two 18 AWG (1.0 mm²) wires. Connect wiring as shown on the Wiring page. LED 1 lights continuously (Power) and LED 7 blinks rapidly (Data Link RX) when the SELV/PELV/NEC® Class 2 Data Link is installed correctly. Choose from the following mounting methods:

1 Direct Wall Mounting

Mount the control interface directly on a wall, as shown in Mounting Methods at right, using screws (not included). When mounting, provide sufficient space for connecting cables.

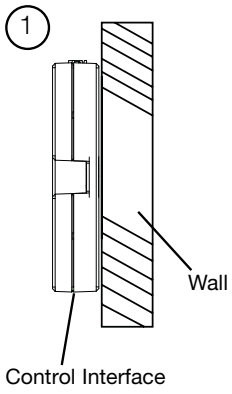
2 Rack Mounting

Place the unit in the LUT-19AV-1U AV rack using screws provided with the unit. The LUT-19AV-1U will hold up to four units.

3 Enclosed Wall Mounting

If conduit is desired for wiring, use the LUT-5x10-ENC to mount one unit.

Mounting Methods



LUT-19AV-1U

LUT-5x10-ENC

LUTRON® SPECIFICATION SUBMITTAL Page 3

Job Name:	Model Numbers:	
Job Number:		

QS System	QSE-CI-NWK-E	Control Interface

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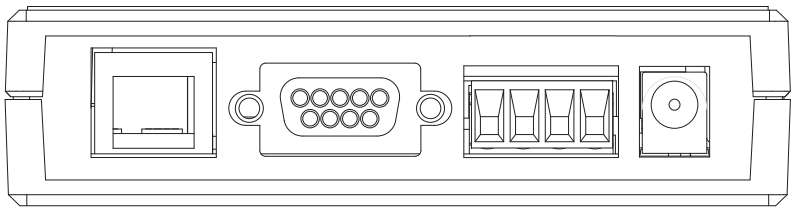
Terminal Locations

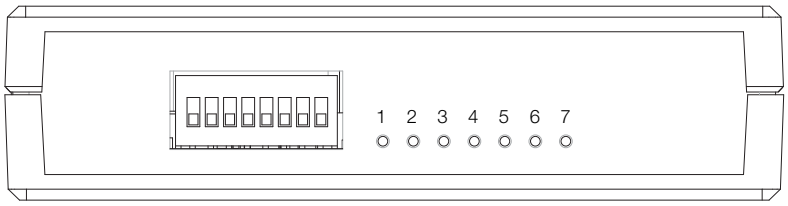


Ethernet Link (to PC or AV Equipment

Female 9-pin RS232 Link (to PC or AV Equipment)

QS Link to other wired QS system Devices

LED and DIP Switch Locations



DIP Switches

LED 1: Power
LED 2: Ethernet Activity
LED 3: Unused
LED 4: RS232 Link Tx
LED 5: RS232 Link Rx
LED 6: QS Link Tx
LED 7: QS Link Rx

LUTRON® SPECIFICATION SUBMITTAL Page 4

Job Name:	Model Numbers:	
Job Number:		

QS System	QSE-CI-NWK-E	Control Interface

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Wiring

RS232 Link

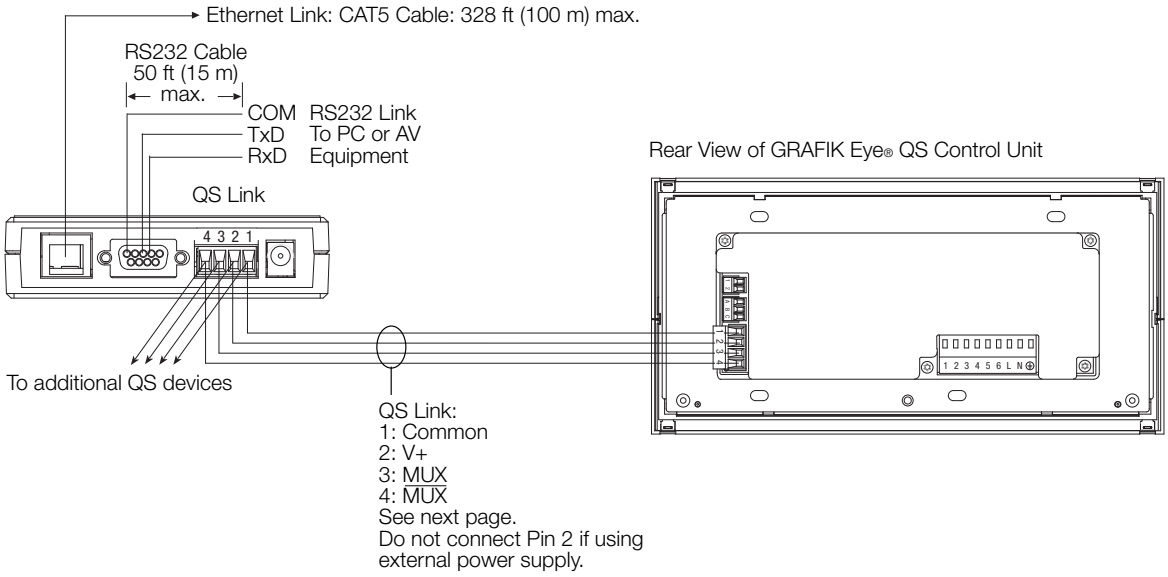
- Standard 9-pin serial connector plugs into RS232 equipment, and to QSE-CI-NWK-E.
- Must be 50 ft (15 m) or less.

RS232 Signals

Signals	Pin on 9-Pin Cable
Com	5
TxD	3
RxD	2

Ethernet Link Wiring

- Standard CAT5 cable connects QSE-CI-NWK-E Interface to PC, router, or other Ethernet source.
- No crossover cable needed.
- Must be 328 ft (100 m) or less.
- Ethernet network and cable provided by others.



QS System	QSE-CI-NWK-E	Control Interface

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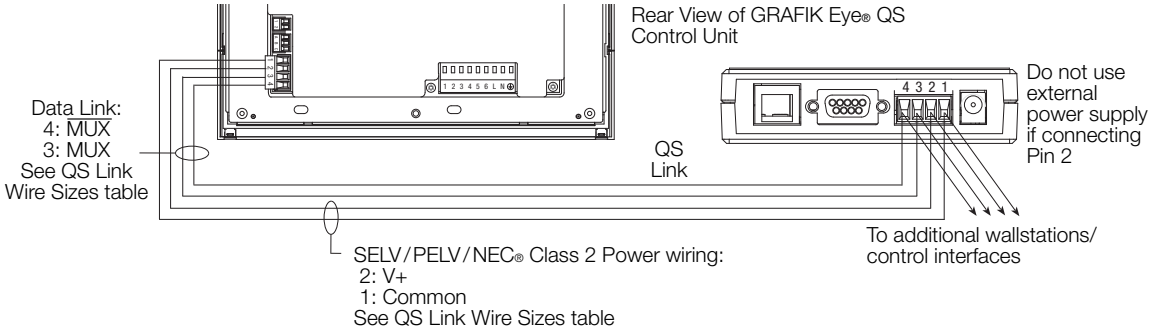
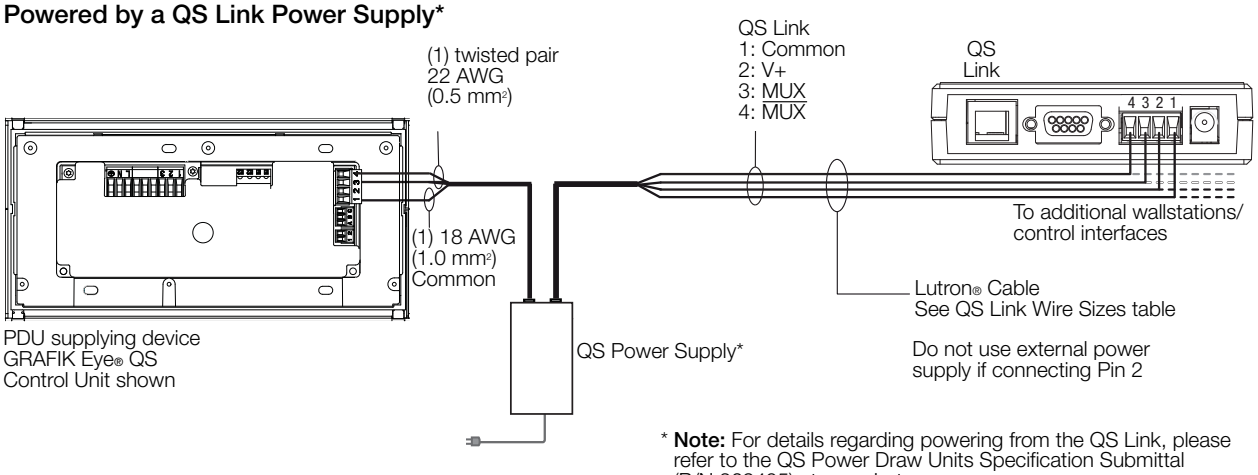
Wiring (continued): QS Link Wiring Methods (choose one)

- System communication uses SELV/PELV/NEC® Class 2 wiring. Follow all local and national electrical codes for installation.
- Each terminal accepts up to two 18 AWG (1.0 mm²) wires or one 12 AWG (4.0 mm²) wire.
- Total length of control link must not exceed 2000 ft (610 m).
- Do not allow SELV/PELV/NEC® Class 2 wires to contact live/mains wire.
- Typical Wire Sizes: See QS Link Wire Sizes table.
- Connect the terminal 1, 3, and 4 connections to all control units, wallstations, and control interfaces in the QS system. For terminal 2 connectivity, see below.

Powered by GRAFIK Eye® QS Control Unit



Powered by a QS Link Power Supply*



* **Note:** For details regarding powering from the QS Link, please refer to the QS Power Draw Units Specification Submittal (P/N 369405) at www.Lutron.com

QS Link Wire Sizes (check compatibility in your area)

QS Link Wiring Length	Wire Gauge	Lutron Cable Part Number
< 500 ft (153 m)	Power (terminals 1 and 2) 1 pair 18 AWG (1.0 mm²)	GRX-CBL-346S (non-plenum) GRX-PCBL-346S (plenum)
	Data (terminals 3 and 4) 1 twisted, shielded pair 22 AWG (0.5 mm²)	
500 ft–2000 ft (153 m–610 m)	Power (terminals 1 and 2) 1 pair 12 AWG (4.0 mm²)	GRX-CBL-46L (non-plenum) GRX-PCBL-46L (plenum)
	Data (terminals 3 and 4) 1 twisted, shielded pair 22 AWG (0.5 mm²)	

LUTRON® SPECIFICATION SUBMITTAL Page 6

Job Name:	Model Numbers:	
Job Number:		

SMC® Networks

Oaziss™ Smoke Alarm

SMCSM10-Z

Smoke Alarm: SMCSM10-Z

The Oaziss™ SMCSM10-Z Smoke Alarm is a battery-operated photoelectric smoke alarm. It continually monitors operational status and provides a visual trouble condition if it drifts out of the sensitivity range or fails internal diagnostics.

The SMCSM10-Z provides a built-in drift compensation that allows the alarm to adjust sensitivity automatically as dust levels change over time, dramatically increasing the time between cleaning, as well as reducing false alarms.

Technical Specifications

- Sounder: 85dBA at 10m, Temporal Pattern
- Outputs: Alarm, Restore, Tamper, Low Battery, Trouble
- Heat Alarm Specifications:
  Rate-of-Rise: 8.3°C/Min >40.6°C (15°F/Min >105°F)
  Fixed: 57.2° ± 2.8°C (135° ± 5°F)
- Environmental Sensitivity: 2.2% +/- 1.3%/ft
- Drift Compensation Adjustment: 0.5%/ft Max
- Low Battery beep: 1 every 45 seconds
- Transceiver: ZigBee IEEE 802.15
- Frequency: 2405-2475MHz, Channels: 16
- 802.11g Rejection: 35dB
- Tx Output: 19dBm Max
- Rx Sensitivity: -104dBm Min
- Operating Temperature: 0° to 40°C (32° to 104°F)
- Relative Humidity: 0-95% Non-Condensing
- Storage Temperature: -10° to 50°C (14° to 122°F)
- Battery:
  CR123A 3V Lithium Battery
  Battery Life: 5 Years Typical
  Low Battery Beep Rate: 1 every 45 +/- 2 sec
- Dimensions:
  Sensor: 142 x 61 mm (5.6 x 2.4 in)
  Base: 137 x 11.7 mm (5.4 x 0.46 in)
- Compliance:
  CFR Part 15B and C, RSS-210, RSS-Gen
  UL 217, 268, ULC-S529

Key Features

- 85dBA temporal sounder for various audible alerts to occupants
- Heat detection included for comprehensive fire safety
- Built-in drift compensation for consistent performance over time
- Test switch for manual verification of the product

Package Information

- Model Name: SMCSM10-Z
- Package Contents:
  1x Smoke Alarm
  2x CR123A 3V Lithium Battery
  1x Set Mounting Screws and Anchors
  1x Quick Start Guide

Contact

SMC Networks - North America
20 Mason
Irvine, CA 92618
1-800-SMC-4YOU
24/7 Technical Support

With over 40 years of experience, SMC Networks is a leading equipment provider in gateway and home security customer premises equipment for Service Providers in North America and internationally.

Visit us at: www.smc.com

V1.21

COMPONENTS

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

NL121
Ethernet Module

Adds Ethernet Connectivity

Connect CR1000 or CR3000 to an IP network

Overview

The NL121 is the easiest and lowest cost way to add an Ethernet interface connection to your CR1000 or CR3000. This small device, about the size of a deck of cards, simply plugs onto the datalogger's peripheral port. Through the NL121, you can access the Internet capabilities of the datalogger such as PakBus, Modbus, and DNP3 over TCP, as well as Web, email, file transfer, and cloud-based application clients. You can collect from and control your datalogger over any standard IP network, within your office or across the Internet.

Benefits and Features

- Easiest way to add Ethernet to a CR1000 or CR3000
- Native Ethernet connection that allows the datalogger to communicate directly using a variety of Internet protocols
- Integrated protection for surge and ESD
- Datalogger controlled power management for low power operation

questions & quotes: **435.227.9120**
www.campbellsci.com/nl121

Ordering Information

Ethernet Module

NL121 Ethernet Module for CR1000 or CR3000 dataloggers.

Temperature Range Options (choose one)

-ST Tested -40° to +70°C

-XT Tested -40° to +85°C

Warranty (choose one)

-SW Standard 1 year warranty

-XW 4 year warranty extension (total warranty period of 5 years).

Ethernet Cables

28900 10 ft Ethernet cable. Recommended for external hub or PC connections.

28899 2 ft Ethernet cable. Recommended for connecting a device inside the same enclosure.

28898 6 in Ethernet cable. Recommended for connecting a device mounted right next to the NL121.

Specifications

- Datalogger Compatibility: CR1000 or CR3000 using OS 28 or later
- Datalogger Interface: 40-pin peripheral port on CR1000 or CR3000
- Ethernet: 10/100 Mbps, auto-detect 10BaseT/100Base-TX, full/half duplex, IEEE 802.3, auto MDI/MDI-X
- Power Source: 12 V from datalogger's peripheral port
- Power Requirements: 12 V supplied through the datalogger's peripheral port
- Power Consumption: 58 mA typical, 3 mA Ethernet off
- Dimensions: 10.2 x 6.4 x 2.8 cm (4.0 x 2.5 x 1.1 in)
- Weight: 66.62 g (2.35 oz)
- EU Declaration of Conformity: https://s.campbellsci.com/documents/us/compliance/eudoc_nl121.pdf

COMPONENT

CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

CR1000

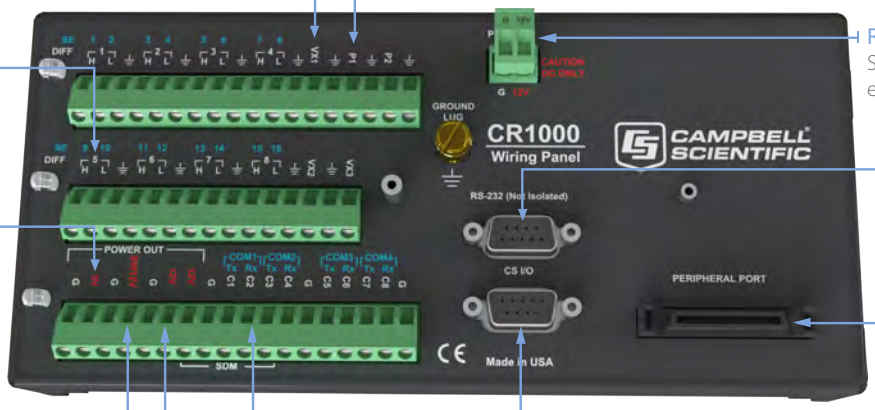
Measurement and Control Datalogger

Rugged, Reliable, and Ready for any Application

More info: **435.227.9120**
campbellsci.com/cr1000

CR1000 Measurement and Control Datalogger

The CR1000 provides precision measurement capabilities in a rugged, battery-operated package. It consists of a measurement and control module and a wiring panel. Standard operating range is -25° to +50°C; an optional extended range of -55° to +85°C is available.



Switched Excitation Outputs
Provides programmable excitation for resistive bridge measurements

Pulse Counters
For measuring switch closures, low-level ac sine waves, or high frequency pulses

Analog Inputs
For differential, single-ended, and period averaging measurements

Removable Power Terminal
Simplifies connection to external power supply.

RS-232 Port
For connecting battery-powered PCs, serial sensors, or RS-232 modems

5 V Terminal
For sensor or modem power

Peripheral Port
For Ethernet communications and/or storing data on a CompactFlash card.

Switched 12 V Terminal
For switching power to sensors or communication devices

CS I/O Port
For connecting to ac-powered PCs and Campbell Scientific peripherals

12 V Terminal
For continuous sensor or modem power

Digital I/O Ports
For controlling external devices, reading SDI-12 sensors or SDM peripherals

Benefits and Features

- 4 MB memory*
- Program execution rate of up to 100 Hz
- CS I/O and RS-232 serial ports
- 13-bit analog to digital conversions
- 16-bit H8S Renesas Microcontroller with 32-bit internal CPU architecture
- Temperature compensated real-time clock
- Background system calibration for accurate measurements over time and temperature changes
- Single DAC used for excitation and measurements to give ratio metric measurements
- Gas Discharge Tube (GDT) protected inputs
- Battery-backed SRAM memory and clock ensuring data, programs, and accurate time are maintained while the CR1000 is disconnected from its main power source
- Serial communications with serial sensors and devices supported via I/O port pairs
- PakBus®, Modbus, DNP3, TCP/IP, FTP, and SMTP protocols supported

Measurement and Control Module

The module measures sensors, drives direct communications and telecommunications, reduces data, controls external devices, and stores data and programs in on-board, non-volatile storage. The electronics are RF shielded and glitch protected by the sealed, stainless steel canister. A battery-backed clock assures accurate timekeeping. The module can simultaneously provide measurement and communication functions. The on-board, BASIC-like programming language supports data processing and analysis routines.

Wiring Panel

The CR1000WP is a black, anodized aluminum wiring panel that is compatible with all CR1000 modules. The wiring panel includes switchable 12 V, redistributed analog grounds (dispersed among analog channels rather than grouped), unpluggable terminal block for 12 V connections, gas-tube spark gaps, and 12 V supply on pin 8 to power our COM-series phone modems and other peripherals. The control module easily disconnects from the wiring panel allowing field replacement without rewiring the sensors. A description of the wiring panel's input/output channels follows.

**Originally, the standard CR1000 had 2 MB of data/program storage, and an optional version, the CR1000-4M, had 4 MB of memory. In September 2007, the standard CR1000 started having 4 MB of memory, making the CR1000-4M obsolete. Dataloggers that have a module with a serial number greater than or equal to 11832 will have a 4 MB memory. The 4 MB dataloggers will also have a sticker on the canister stating "4M Memory".*

Analog Inputs
Eight differential (16 single-ended) channels measure voltage levels. Resolution on the most sensitive range is 0.67 µV.

Pulse Counters
Two pulse channels can count pulses from high level (5 V square wave), switch closure, or low level AC signals.

Switched Voltage Excitations
Three outputs provide precision excitation voltages for resistive bridge measurements.

Digital I/O Ports
Eight ports are provided for frequency measurements, digital control, and triggering. Three of these ports can also be used to measure SDM devices. The I/O ports can be paired as transmit and receive. Each pair has 0 to 5 V UART hardware that allows serial communications with serial sensors and devices. An RS-232-to-logic level converter may be required in some cases.

CS I/O Port
AC-powered PCs and many communication peripherals connect with the CR1000 via this port. Connection to an AC-powered PC requires either an SC32B or SC-USB interface. These interfaces isolate the PC's electrical system from the datalogger, thereby protecting against ground loops, normal static discharge, and noise.

RS-232 Port
This non-isolated port is for connecting a battery-powered laptop, serial sensor, or RS-232 modem. Because of ground loop potential on some measurements (e.g., low level single-ended measurements), AC-powered PCs should use the CS I/O port instead of the RS-232 port (see above).

Peripheral Port
One 40-pin port interfaces with the NL116 Ethernet Interface and CompactFlash Module, the NL121 Ethernet Interface, or the CFM100 CompactFlash® Module.

Switched 12 Volt
This terminal provides unregulated 12 V that can be switched on and off under program control.

Storage Capacity
The CR1000 has 2 MB of flash memory for the Operating System, and 4 MB of battery-backed SRAM for CPU usage, program storage, and data storage. Data is stored in a table format. The storage capacity of the CR1000 can be increased by using a CompactFlash card.

Enclosure/Stack Bracket
A CR1000 housed in a weather-resistant enclosure can collect data under extremely harsh conditions. The 31551 and 31143 stack brackets allow a peripheral to be placed under the mounting bracket, thus conserving space. The 31143 is hinged, allowing easy access to the lower component during wiring or during maintenance.

Communication Protocols
The CR1000 supports the PakBus, Modbus, DNP3, TCP/IP, FTP, and SMTP communication protocols. With the PakBus protocol, networks have the distributed routing intelligence to continually evaluate links. Continually evaluating links optimizes delivery times and, in the case of delivery failure, allows automatic switch over to a configured backup route.

The Modbus RTU protocol supports both floating point and long formats. The datalogger can act as a slave and/or master.

The DNP3 protocol supports only long data formats. The dataloggers are level 2 slave compliant, with some of the operations found in a level 3 implementation.

The TCP/IP, FTP, and SMTP protocols provide TCP/IP functionality when the CR1000 is used in conjunction with an NL240, NL201, NL116, or NL121. Refer to the CR1000 manual for more information.

Power Supplies
Typically, the CR1000 is powered with a PS200, PS150, or BPALK. The PS200 and PS150 provide a 7 Ah sealed rechargeable battery that should be connected to a charging source (either a power converter or solar panel). The BPALK consists of eight non-rechargeable D-cell alkaline batteries with a 7.5 Ah rating at 20°C.

Also available are the BP7, BP12, and BP24 battery, which provide nominal ratings of 7, 12, and 24 Ah, respectively. The BP7 is typically used instead of the PS150 or PS200 when the battery needs to be mounted under the 31143 Hinged Stack Bracket. The BP12 and BP24 batteries are for powering systems that have higher current drain equipment such as satellite transmitters. The BP7, BP12, and BP24 should be connected to a regulated charging source (e.g., a CH200 or CH150 connected to a unregulated solar panel or power converter).

The PS200 (above) and CH200 can monitor charge input voltage, battery voltage, on-board temperature, battery current, and load current.

Communication Options

To determine the best option for an application, consider the accessibility of the site, availability of services (e.g., cellular phone or satellite coverage), quantity of data to collect, and desired time between data-collection sessions. Some communication options can be combined—increasing the flexibility, convenience, and reliability of the communications.

Keyboard Display

The CR1000KD can be used to program the CR1000, manually initiate data transfer, and display data. The CR1000KD displays 8 lines by 21 characters (64 by 128 pixels) and has a 16-character keyboard. Custom menus are supported allowing customers to set up choices within the datalogger program that can be initiated by a simple toggle or pick list. One CR1000KD can be carried station to station in a CR1000 network.

Mountable Displays

The CD100 and CD295 can be mounted in an enclosure lid. The CD100 has the same functionality and operation as the CD1000KD, allowing both data entry and display without opening the enclosure. The CD295 displays real-time data only.

The CD100 has a vacuum flourescent display for responsive use through a very wide operating temperature range.

iOS Devices and Android Devices

An iOS device or Android device can communicate with the datalogger or connect to the LoggerNet network using Apps available, at no charge, from the Apple Store or Google Play.

Direct Links

AC-powered PCs connect with the datalogger's CS I/O port using an SC32B or SC-USB interface. These interfaces provide optical isolation. A battery-powered laptop can be attached to the CR1000's RS-232 port via an RS-232 cable—no interface required.

External Data Storage Devices

A CFM100 or NL116 module can store the CR1000's data on an industrial-grade CompactFlash (CF) card. The CR1000 can also store data on an SC115 2 GB Flash Memory Drive.

Short Haul Modems

The SRM-5A RAD Short Haul Modem supports communications between the CR1000 and a PC using a four-wire unconditioned line (two twisted pairs).

Multidrop Interface

The MD485 intelligent RS-485 interface permits a PC to address and communicate with one or more dataloggers over the CABLE2TP two-twisted pair cable. Distances up to 4000 feet are supported.

Internet and IP Networks

Campbell Scientific offers several interfaces that enable the CR1000 to communicate with a PC using TCP/IP.

Radios

Radio frequency (RF) communications are supported using narrowband UHF, narrowband VHF, spread spectrum, or meteor burst radios. Line-of-sight is required for all of our RF options.

Satellite Transmitters

The CR1000 can transmit data using the Argos, Iridium, Inmarsat BGAN, GOES, or Meteosat satellite systems. Satellite telemetry offers an alternative for remote locations where phone lines or RF systems are impractical.

Telephone Networks

The CR1000 can communicate with a PC using landlines or cellular transceivers. A voice synthesized modem enables anyone to call the CR1000 via phone and receive a verbal report of real-time site conditions.

In Virginia, our RF500M Narrowband Radio Modem provides time- and event-driven ALERT data transmission.

Channel Expansion

4-Channel Low Level AC Module

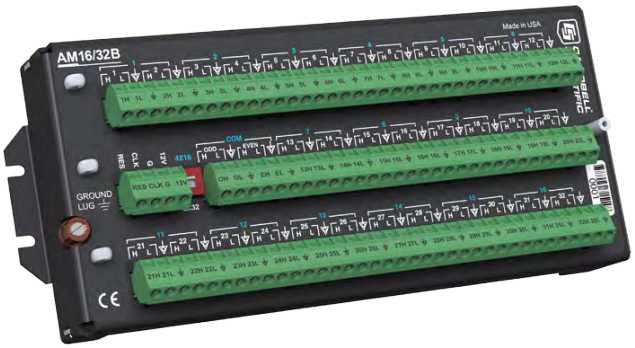
The LLAC4 is a small peripheral device that allows customers to increase the number of available low-level ac inputs by using control ports. This module is often used to measure up to four anemometers, and is especially useful for wind profiling applications.

Synchronous Devices for Measurement (SDMs)

SDMs are addressable peripherals that expand the datalogger's measurement and control capabilities. For example, SDMs are available to add control ports, analog outputs, pulse count channels, interval timers, or even a CANbus interface to the system. Multiple SDMs, in any combination, can be connected to one datalogger.

Multiplexers

Multiplexers increase the number of sensors that can be measured by a CR1000 by sequentially connecting each sensor to the datalogger. Several multiplexers can be controlled by a single CR1000.



The CR1000 is compatible with the AM16/32B (shown above) and AM25T multiplexers.

Software

Starter Software

Our easy-to-use starter software is intended for first time users or applications that don't require sophisticated communications or datalogger program editing. SCWin Short Cut generates straight-forward datalogger programs in four easy steps. PC200W allows customers to transfer a program to, or retrieve data from a CR1000 via a direct communications link.

At www.campbellsci.com/downloads, the starter software can be downloaded at no charge. Our Resource DVD also provides this software as well as PDF versions of our brochures and manuals.

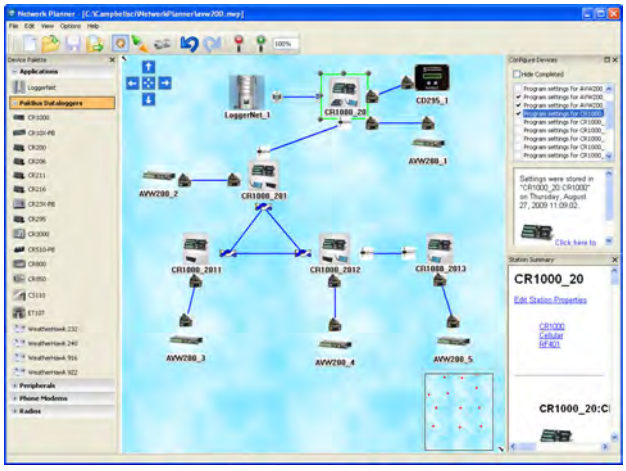
Datalogger Support Software

Our datalogger support software packages provide more capabilities than our starter software. These software packages contains program editing, communications, and display tools that can support an entire datalogger network.

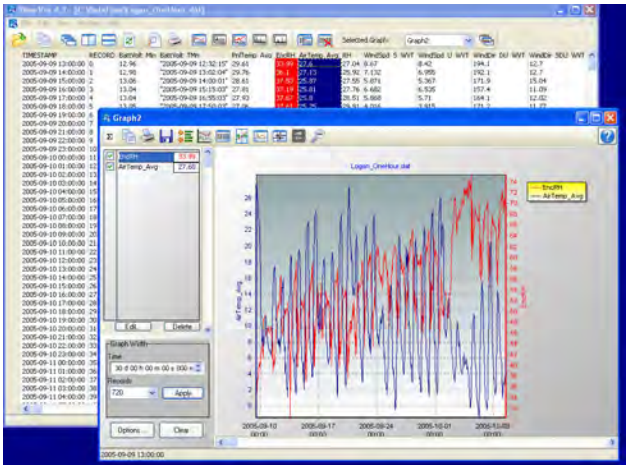
PC400, our mid-level software, supports a variety of telemetry options, manual data collection, and data display. For programming, it includes both Short Cut and the CRBasic program editor. PC400 does not support combined communication options (e.g., phone-to-RF), PakBus® routing, and scheduled data collection.

RTDAQ is an ideal solution for industrial and real-time users desiring to use reliable data collection software over a single telecommunications medium, and who do not rely on scheduled data collection. RTDAQ's strength lies in its ability to handle the display of high speed data.

LoggerNet is Campbell Scientific's full-featured datalogger support software. It is referred to as "full-featured" because it provides a way to accomplish almost all the tasks you'll need to complete when using a datalogger. LoggerNet supports combined communication options (e.g., phone-to-RF) and scheduled data collection.



The Network Planner, included in LoggerNet 4 or higher, generates device settings and configures the LoggerNet network map for PakBus networks.



Both LoggerNet and RTDAQ use View Pro to display historical data in a tabular or graphical format.

Applications

The measurement precision, flexibility, long-term reliability, and economical price of the CR1000 make it ideal for scientific, commercial, and industrial applications.

Meteorology

The CR1000 is used in long-term climatological monitoring, meteorological research, and routine weather measurement applications.

Our rugged, reliable weather station measures meteorological conditions at St. Mary's Lake, Glacier National Park, MT.

Sensors the CR1000 can measure include:

- cup, propeller, and sonic anemometers
- tipping bucket rain gages
- wind vanes
- pyranometers
- ultrasonic ranging sensor
- thermistors, RTDs, and thermocouples
- barometers
- RH probes
- Cooled mirror hygrometers

Agriculture and Agricultural Research

The versatility of the CR1000 allows measurement of agricultural processes and equipment in applications such as:

- plant water research
- canopy energy balance
- plant pathology
- machinery performance
- frost prediction
- crop management decisions
- food processing/storage
- integrated pest management
- irrigation scheduling

This vitaculture site in Australia integrates meteorological, soil, and crop measurements.

Wind Profiling

Our data acquisition systems can monitor conditions at wind assessment sites, at producing wind farms, and along transmission lines. The CR1000 makes and records measurements, controls electrical devices, and can function as PLCs or RTUs. Because the datalogger has its own power supply (batteries, solar panels), it can continue to measure and store data and perform control during power outages. Typical sensors for wind assessment applications include, but are not limited to:

- cup, propeller, and sonic anemometers (up to 10 anemometers can be measured by using two LLAC4 peripherals)
- wind vanes
- thermistors, RTDs, and thermocouples
- barometers
- pyranometers

For turbine performance applications, the CR1000 monitors electrical current, voltage, wattage, stress, and torque.

A Campbell Scientific system monitors an offshore wind farm in North Wales.

Photo courtesy npower renewables

Soil Moisture

The CR1000 are compatible with the following soil moisture measurement technologies:

- **Soil moisture blocks** are inexpensive sensors that estimate soil water potential.
- **Matric water potential sensors** also estimate soil water potential but are more durable than soil moisture blocks.
- **Time-Domain Reflectometry Systems (TDR)** use a reflectometer controlled by the datalogger to accurately measure soil water content. Multiplexers allow sequential measurement of a large number of probes by one reflectometer.
- **Self-contained water content reflectometers** are sensors that emit and measure a TDR pulse.
- **Tensiometers** measure the soil pore pressure of irrigated soils and calculate soil moisture.

Air Quality

The CR1000 can monitor and control gas analyzers, particle samplers, and visibility sensors. The datalogger can also automatically control calibration sequences and compute conditional averages that exclude invalid data (e.g., data recorded during power failures or calibration intervals).

Road Weather/RWIS

Our fully NTCIP-compliant Environmental Sensor Stations (ESS) are robust, reliable weather stations used for road weather/RWIS applications. A typical ESS includes a tower, CR1000, two road sensors, remote communication hardware, and sensors that measure wind speed and direction, air temperature, humidity, barometric pressure, solar radiation, and precipitation.

Water Resources/Aquaculture

Our CR1000 is well-suited to remote, unattended monitoring of hydrologic conditions. Most hydrologic sensors, including SDI-12 probes, interface directly to the CR1000.

Typical hydrologic measurements:

- **Water level** is monitored with incremental shaft encoders, double bubblers, ultrasonic ranging sensors, resistance tapes, strain gage pressure transducers, or vibrating wire pressure transducers. Vibrating wire transducers require an CDM-VW300-series, AVW200-series or another vibrating wire interface.
- **Well draw-down tests** use a pressure transducer measured at logarithmic intervals or at a rate based on incremental changes in water level.
- **Ionic conductivity measurements** use one of the switched excitation ports from the datalogger.
- **Samplers** are controlled by the CR1000 as a function of time, water quality, or water level.
- **Alarm and pump actuation** are controlled through digital I/O ports that operate external relay drivers

A turbidity sensor was installed in a tributary of the Cedar River watershed to monitor water quality conditions for Seattle, Washington.

Vehicle Testing

This versatile, rugged datalogger is ideally suited for testing cold and hot temperature, high altitude, off-highway, and cross-country performance. The CR1000 is compatible with our SDM-CAN interface and GPS16X-HVS receiver.

Vehicle monitoring includes not only passenger cars, but airplanes, locomotives, helicopters, tractors, buses, heavy trucks, drilling rigs, race cars, and motorcycles.

The CR1000 can measure:

- **Suspension**—strut pressure, spring force, travel, mounting point stress, deflection, ride.
- **Fuel system**—line and tank pressure, flow, temperature, injection timing.
- **Comfort control**—ambient and supply air temperature, solar radiation, fan speed, ac on and off, refrigerant pressures, time-to-comfort, blower current.
- **Brakes**—line pressure, pedal pressure and travel, ABS, line and pad temperature.
- **Engine**—pressure, temperature, crank position, RPM, time-to-start, oil pump cavitation.
- **General vehicle**—chassis monitoring, road noise, vehicle position and speed, steering, air bag, hot/cold soaks, wind tunnels, traction, CANbus, wiper speed and current, vehicle electrical loads.

Other Applications

- Eddy covariance systems
- Wireless sensor/datalogger networks
- Fire weather
- Geotechnical
- Mesonet systems
- Avalanche forecasting, snow science, polar, high altitude
- Historic preservation

CR1000 Specifications

Electrical specifications are valid over a -25° to +50°C, non-condensing environment, unless otherwise specified. Recalibration recommended every three years. Critical specifications and system configuration should be confirmed with Campbell Scientific before purchase.

PROGRAM EXECUTION RATE

10 ms to one day @ 10 ms increments

ANALOG INPUTS (SE1-SE16 or DIFF1-DIFF8)

8 differential (DF) or 16 single-ended (SE) individually configuredinput channels. Channel expansion provided by optional analog multiplexers.

RANGES and RESOLUTION: Basic resolution (Basic Res) is the A/D resolution of a single A/D conversion. A DIFF measurement with input reversal has better (finer) resolution by twice than Basic Res.

Range (mV)[1]	*DF Res (µV)*[2]	*Basic Res (µV)*
±5000	667	1333
±2500	333	667
±250	33.3	66.7
±25	3.33	6.7
±7.5	1.0	2.0
±2.5	0.33	0.67

[1]Range overhead of ~9% on all ranges guarantees that full-scale values will not cause over range.
[2]Resolution of DF measurements with input reversal.

ACCURACY[3]:
±(0.06% of reading + offset), 0° to 40°C
±(0.12% of reading + offset), -25° to 50°C
±(0.18% of reading + offset), -55° to 85°C (-XT only)

[3]Accuracy does not include the sensor and measurement noise. Offsets are defined as:
Offset for DF w/input reversal = 1.5•Basic Res + 1.0 µV
Offset for DF w/o input reversal = 3•Basic Res + 2.0 µV
Offset for SE = 3·Basic Res + 3.0 µV

ANALOG MEASUREMENT SPEED:

Integration Type/Code	*Integration Time*	*Settling Time*	*Total Time*[4] *SE w/ No Rev*	*Total Time*[4] *DF w/ Input Rev*
250	250 µs	450 µs	~1 ms	~12 ms
60 Hz[5]	16.67 ms	3 ms	~20 ms	~40 ms
50 Hz[5]	20.00 ms	3 ms	~25 ms	~50 ms

[4]Includes 250 µs for conversion to engineering units.
[5]AC line noise filter.

INPUT NOISE VOLTAGE: For DF measurements with input reversal on ±2.5 mV input range (digital resolution dominates for higher ranges).
250 µs Integration: 0.34 µV RMS
50/60 Hz Integration: 0.19 µV RMS

INPUT LIMITS: ±5 Vdc

DC COMMON MODE REJECTION: >100 dB

NORMAL MODE REJECTION: 70 dB @ 60 Hz when using 60 Hz rejection

INPUT VOLTAGE RANGE W/O MEASUREMENT CORRUPTION: ±8.6 Vdc max.

SUSTAINED INPUT VOLTAGE W/O DAMAGE: ±16 Vdc max.

INPUT CURRENT: ±1 nA typical, ±6 nA max. @ 50°C; ±90 nA @ 85°C

INPUT RESISTANCE: 20 GΩ typical

ACCURACY OF BUILT-IN REFERENCE JUNCTION THERMISTOR (for thermocouple measurements):
±0.3°C, -25° to 50°C
±0.8°C, -55° to 85°C (-XT only)

ANALOG OUTPUTS (VX1-VX3)

3 switched voltage, sequentially active only during measurement.

RANGE AND RESOLUTION:

Channel	*Range*	*Resolution*	*Current Source/Sink*
(VX 1–3)	±2.5 Vdc	0.67 mV	±25 mA

ANALOG OUTPUT ACCURACY (VX):
±(0.06% of setting + 0.8 mV), 0° to 40°C
±(0.12% of setting + 0.8 mV), -25° to 50°C
±(0.18% of setting + 0.8 mV), -55° to 85°C (-XT only)

VX FREQUENCY SWEEP FUNCTION: Switched outputs provide a programmable swept frequency, 0 to 2500 mv square waves for exciting vibrating wire transducers.

PERIOD AVERAGE

Any of the 16 SE analog inputs can be used for period averaging. Accuracy is ±(0.01% of reading + resolution), where resolution is 136 ns divided by the specified number of cycles to be measured.

INPUT AMPLITUDE AND FREQUENCY:

Voltage Gain	*Input Range (±mV)*	*Signal (peak to peak) Min. (mV)*[6]	*Signal (peak to peak) Max (V)*[7]	*Min Pulse Width (µV)*	*Max*[8] *Freq (kHz)*
1	250	500	10	2.5	200
10	25	10	2	10	50
33	7.5	5	2	62	8
100	2.5	2	2	100	5

[6]Signal centered around Threshold (see PeriodAvg() instruction).
[7]With signal centered at the datalogger ground.
[8]The maximum frequency = 1/(twice minimum pulse width) for 50% of duty cycle signals.

RATIOMETRIC MEASUREMENTS

MEASUREMENT TYPES: Provides ratiometric resistance measurements using voltage excitation. 3 switched voltage excitation outputs are available for measurement of 4- and 6-wire full bridges, and 2-, 3-, and 4-wire half bridges. Optional excitation polarity reversal minimizes dc errors.

RATIOMETRIC MEASUREMENT ACCURACY:[9,10, 11]
±(0.04% of Voltage Measurement + Offset)

[9]Accuracy specification assumes excitation reversal for excitation voltages < 1000 mV. Assumption does not include bridge resistor errors and sensor and measurement noise.

[10]Estimated accuracy, ΔX (where X is value returned from the measurement with Multiplier = 1, Offset = 0):
BrHalf() instruction: $\Delta X = \Delta V_x/V_x$
BrFull() instruction $\Delta X = 1000 \cdot \Delta V_x/V_x$, expressed as mV•V^{-1}.
ΔV^{-1} is calculated from the ratiometric measurement accuracy. See Resistance Measurements Section in the manual for more information.

[11]Offsets are defined as:
Offset for DIFF w/input reversal = 1.5•Basic Res + 1.0 µV
Offset for DIFF w/o input reversal = 3•Basic Res + 2.0 µV
Offset for SE = 3•Basic Res + 3.0 µV
Excitation reversal reduces offsets by a factor of two.

PULSE COUNTERS (P1-P2)

2 inputs individually selectable for switch closure, high frequency pulse, or low-level ac. Independent 24-bit counters for each input.

MAXIMUM COUNTS PER SCAN: 16.7x10^6

SWITCH CLOSURE MODE:
Minimum Switch Closed Time: 5 ms
Minimum Switch Open Time: 6 ms
Max. Bounce Time: 1 ms open w/o being counted

HIGH-FREQUENCY PULSE MODE:
Maximum Input Frequency: 250 kHz
Maximum Input Voltage: ±20 V
Voltage Thresholds: Count upon transition from below 0.9 V to above 2.2 V after input filter with 1.2 µs time constant.

LOW-LEVEL AC MODE: Internal ac coupling removes ac offsets up to ±0.5 Vdc.
Input Hysteresis: 12 mV RMS @ 1 Hz
Maximum ac Input Voltage: ±20 V
Minimum ac Input Voltage:

Sine Wave (mV RMS)	*Range(Hz)*
20	1.0 to 20
200	0.5 to 200
2000	0.3 to 10,000
5000	0.3 to 20,000

DIGITAL I/O PORTS (C1-C8)

8 ports software selectable, as binary inputs or control outputs. Provide on/off, pulse width modulation, edge timing, subroutine interrupts / wake up, switch closure pulse counting, high frequency pulse counting, asynchronous communications (UARTs), and SDI-12 communications. SDM communications are also supported.

LOW FREQUENCY MODE MAX: <1 kHz

HIGH-FREQUENCY MODE MAX: 400 kHz

SWITCH-CLOSURE FREQUENCY MAX: 150 Hz

EDGE TIMING RESOLUTION: 540 ns

OUTPUT VOLTAGES (no load): high 5.0 V ±0.1 V; low <0.1

OUTPUT RESISTANCE: 330 Ω

INPUT STATE: high 3.8 to 16 V; low -8.0 to 1.2 V

INPUT HYSTERESIS: 1.4 V

INPUT RESISTANCE: 100 kΩ with inputs <6.2 Vdc
220 Ω with inputs ≥6.2 Vdc

SERIAL DEVICE/RS-232 SUPPORT: 0 TO 5 Vdc UART

SWITCHED 12 VDC (SW-12)

1 independent 12 Vdc unregulated source is switched on and off under program control. Thermal fuse hold current = 900 mA at 20°C, 650 mA at 50°C, 360 mA at 85°C.

EU DECLARATION OF COMPLIANCE

https://s.campbellsci.com/documents/us/compliance/eudoc_cr1000-series.pdf
https://s.campbellsci.com/documents/us/compliance/eudoc_cr1000kd.pdf

COMMUNICATIONS

RS-232 PORTS:
DCE 9-pin: (not electrically isolated) for computer connection or connection of modems not manufactured by Campbell Scientific.
COM1 to COM4: 4 independent Tx/Rx pairs on control ports (non-isolated); 0 to 5 Vdc UART
Baud Rates: selectable from 300 bps to 115.2 kbps.
Default Format: 8 data bits; 1 stop bits; no parity
Optional Formats: 7 data bits; 2 stop bits; odd, even parity

CS I/O PORT: Interface with telecommunications peripherals manufactured by Campbell Scientific.

SDI-12: Digital control ports C1, C3, C5, and C7 are individually configured and meet SDI-12 Standard v 1.3 for datalogger mode. Up to 10 SDI-12 sensors are supported per port.

PERIPHERAL PORT: 40-pin interface for attaching CompactFlash or Ethernet peripherals

PROTOCOLS SUPPORTED: PakBus, AES-128 Encrypted PakBus, Modbus, DNP3, FTP, HTTP, XML, HTML, POP3, SMTP, Telnet, NTCIP, NTP, Web API, SDI-12, SDM.

SYSTEM

PROCESSOR: Renesas H8S 2322 (16-bit CPU with 32-bit internal core running at 7.3 MHz)

MEMORY: 2 MB of flash for operating system; 4 MB of battery-backed SRAM for CPU usage and final data storage; 512 kB flash disk (CPU) for program files.

REAL-TIME CLOCK ACCURACY: ±3 min. per year. Correction via GPS optional.

REAL-TIME CLOCK RESOLUTION: 10 ms

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 Vdc

INTERNAL BATTERIES: 1200 mAh lithium battery for clock and SRAM backup that typically provides three years of backup

EXTERNAL BATTERIES: Optional 12 Vdc nominal alkaline and rechargeable available. Power connection is reverse polarity protected.

TYPICAL CURRENT DRAIN at 12 Vdc:
Sleep Mode: < 1 mA
1 Hz Sample Rate (1 fast SE meas.): 1 mA
100 Hz Sample Rate (1 fast SE meas.): 6 mA
100 Hz Sample Rate (1 fast SE meas. w/RS-232 communication): 20 mA
Active external keyboard display adds 7 mA (100 mA with backlight on).

PHYSICAL

DIMENSIONS: 23.9 x 10.2 x 6.1 cm (9.4 x 4 x 2.4 in); additional clearance required for cables and leads.

MASS/WEIGHT: 1 kg / 2.1 lb

WARRANTY

3 years against defects in materials and workmanship.

FCC / IC

En

This device complies with part 15 of the FCC and industry Canada license-exempt RSS standards). Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
— Reorient or relocate the receiving antenna.
— Increase the separation between the equipment and receiver.
— Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
— Consult the dealer or an experienced radio/TV technician for help

Important note: To comply with the FCC RF exposure compliance requirements, no change to the antenna or the device is permitted. Any change to the antenna or the device could result in the device exceeding the RF exposure requirements and void user's authority to operate the device.

Fr

Cet appareil est conforme au paragraphe 15 des normes FCC et au CNR pour les appareils exempts de licence d'Industrie Canada. Son utilisation est sujette aux deux conditions suivantes:
(1) cet appareil ne doit pas occasionner de brouillage préjudiciable et (2) cet appareil doit accepter toutes les interférences reçues, notamment les interférences qui peuvent provoquer un fonctionnement non désiré.

NOTE DE LA FCC: Le fabricant n'est pas responsable des interférences sur les fréquences radioélectriques ou télévisuelles pouvant être causées par des modifications non autorisées de ce matériel. De telles modifications peuvent annuler le droit de l'utilisateur à utiliser cet appareil.

REMARQUE: Cet appareil a été testé et certifié conforme aux limites relatives aux appareils numériques de catégorie B définies dans le paragraphe 15 des normes FCC. Ces limites ont été définies afin de fournir une protection raisonnable contre le brouillage préjudiciable en milieu résidentiel. Cet appareil produit, utilise et peut émettre des ondes de fréquence radio et, s'il n'est pas installé et utilisé conformément aux instructions, il peut provoquer un brouillage préjudiciable aux communications radio. Il n'existe toutefois aucune garantie que des interférences ne se produiront pas au sein d'une installation donnée. Si cet appareil occasionne un brouillage préjudiciable à la réception radiophonique ou télévisuelle, il suffit d'allumer et d'éteindre l'appareil pour déterminer sa responsabilité. Nous encourageons l'utilisateur à essayer de corriger ces interférences en appliquant une ou plusieurs des mesures suivantes:
— Réorienter ou déplacer l'antenne de réception.
— Augmenter la distance entre l'appareil et le récepteur.
— Brancher l'appareil à une prise secteur différente de celle du récepteur.
— Consulter le revendeur ou un technicien spécialisé en postes radio ou téléviseurs.

Remarque importante: Pour se conformer aux exigences de conformité de la FCC concernant l'exposition aux RF, aucune modification apportée à l'antenne ou au dispositif n'est autorisée. Toute modification apportée à l'antenne ou au dispositif pourrait faire en sorte que le dispositif dépasse les exigences d'exposition aux RF et pourrait annuler le droit de l'utilisateur à utiliser ce dispositif.

Es

Este dispositivo cumple con las Especificaciones del apartado 15 de las normas de la FCC y con las especificaciones de las normas radioeléctricas RSS del Ministerio de Industria de Canadá aplicables a aparatos exentos de licencia. El funcionamiento está sujeto a las siguientes dos condiciones:
(1) este dispositivo no debe provocar interferencia perjudicial, y (2) este dispositivo debe aceptar toda interferencia que reciba, incluso la que pudiera causar un funcionamiento no deseado.

NOTA DE LA FCC: El fabricante no se hace responsable de ninguna interferencia de radio o TV ocasionada por modificaciones no autorizadas efectuadas a este equipo. Dichas modificaciones podrían anular la autoridad del usuario para utilizar el equipo.

NOTA: Este equipo ha sido probado y cumple con los límites para aparatos digitales de Clase B, de conformidad con el apartado 15 de las normas de la FCC. Estos límites están diseñados para proporcionar protección razonable contra interferencias perjudiciales en una instalación residencial. Este equipo genera, usa y puede irradiar energía de radiofrecuencias y, si no se instala y usa según las instrucciones, puede provocar interferencia perjudicial a las radiocomunicaciones. No obstante, no hay garantías de que no ocurrirá interferencia en una instalación en particular. Si este equipo provoca interferencia perjudicial a la recepción de radio o televisión, lo que puede determinarse encendiendo y apagando el equipo, se recomienda que el usuario intente corregir la interferencia por medio de la implementación de uno o más de las siguientes medidas:
— Reorientar o reubicar la antena receptora.
— Incrementar la separación entre el equipo y el receptor.
— Conectar el equipo a un tomacorriente de un circuito diferente del circuito al que está conectado el receptor.
— Consultar al distribuidor o a un técnico con experiencia en radio/televisión para solicitar asistencia.

Nota importante: Para cumplir con los requisitos de cumplimiento de exposición de radiofrecuencia de la FCC, no se permiten cambios a la antena o al dispositivo. Cualquier cambio a la antena o dispositivo podría hacer que el dispositivo supere los requerimientos de exposición de radiofrecuencia y anular la autoridad del usuario para operar el dispositivo.

FCC – U2ZZB4001 | IC: 6924A-ZB4001
Jasco Products Company | Model: ZB4001 / 45856GE
CAN ICES-3(B) / NMB-3(B)

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10 E. MEMORIAL RD.,
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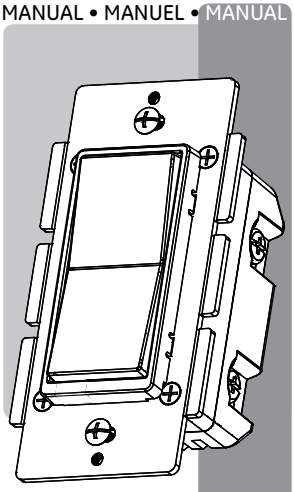

In-wall Wireless
Smart Switch
Montage mural sans fil
intelligent enfichable
Interruptor
inalámbrico de pared
inteligente

ZigBee® Certified product

This ZigBee® Certified product works with ZigBee Gateway products.
ZigBee Global 2.4 GHz wireless use. ZigBee® Certified is a registered trademark of the ZigBee Alliance.
Ce produit ZigBee® Certified fonctionne avec les produits de la passerelle ZigBee.
Utilisation sans fil mondiale (2,4 GHz). ZigBee® Certified est une marque déposée de ZigBee Alliance.
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Home

Scan to view installation guide
Balayez ce code pour consulter le guide d'installation.
Escanear para ver la guía de instalación

45856GE
ZB4001

STOP

DO NOT RETURN THIS PRODUCT TO THE STORE
NE RETOURNEZ PAS CE PRODUIT AU MAGASIN
NO DEVUELVA ESTE PRDUCTO A LA TIENDA.

If you have any problems or questions, contact our tech support team at 1-800-654-8483, option 1, Monday–Friday, 7:30–5pm CST.

For the most up-to-date product support, accessories, electronic (PDF) format manuals and more, visit www.byjasco.com/support.

- No user serviceable parts in this unit.

Si vous avez des problèmes ou des questions, communiquez avec notre équipe de soutien technique au 1-800-654-8483, option1, du lundi au vendredi, de 7 h 30 à 17 h (HNC).

Pour le soutien relatif aux produits le plus à jour, les accessoires, les manuels en format électronique (PDF) et plus encore, visitez le site www.byjasco.com/support.

- Aucune des pièces de ce dispositif ne peut être réparée par l'utilisateur.

Si tiene problemas o dudas, comuníquese con nuestro equipo técnico al número: 1-800-654-8483, opción 1 de lunes a viernes, de 7:30 a 5 p.m., hora estándar del centro (CST).

Para recibir el soporte técnico más actualizado sobre productos, accesorios, manuales en formato digital (PDF), entre otros, visite www.byjasco.com/support.

- Esta unidad no contiene piezas que el usuario pueda reparar.

WARNING

RISK OF FIRE
RISK OF ELECTRICAL SHOCK
RISK OF BURNS

CONTROLLING APPLIANCES:
EXERCISE EXTREME CAUTION WHEN USING ZIGBEE DEVICES TO CONTROL APPLIANCES. OPERATION OF THE ZIGBEE DEVICE MAY BE IN A DIFFERENT ROOM THAN THE CONTROLLED APPLIANCE. ALSO AN UNINTENTIONAL ACTIVATION MAY OCCUR IF THE WRONG BUTTON ON THE REMOTE IS PRESSED. ZIGBEE DEVICES MAY AUTOMATICALLY BE POWERED ON DUE TO TIMED EVENT PROGRAMMING, DEPENDING UPON THE APPLIANCE, THESE UNATTENDED OR UNINTENTIONAL OPERATIONS COULD POSSIBLY RESULT IN A HAZARDOUS CONDITION. FOR THESE REASONS, WE RECOMMEND THE FOLLOWING:
DO NOT USE ZIGBEE DEVICES TO CONTROL ELECTRIC HEATERS OR ANY OTHER APPLIANCES WHICH MAY PRESENT A HAZARDOUS CONDITION DUE TO UNATTENDED OR UNINTENTIONAL OR AUTOMATIC POWER ON CONTROL.

AVERTISSEMENT

RISQUE D'INCENDIE
RISQUE DE CHOC ÉLECTRIQUE
RISQUE DE BRÛLURES

COMMANDE DES APPAREILS:
SOYEZ TRÈS PRUDENT LORSQUE VOUS UTILISEZ LES DISPOSITIFS ZigBee POUR COMMANDER LES APPAREILS. LE DISPOSITIF ZigBee PEUT ÊTRE UTILISÉ DANS UNE SALLE DIFFÉRENTE DE CELLE DANS LAQUELLE SE TROUVE L'APPAREIL COMMANDÉ ET UNE ACTIVATION INVOLONTAIRE PEUT AUSSI SE PRODUIRE SI LE MAUVAIS BOUTON EST ACTIVÉ SUR LA TÉLÉCOMMANDE. LES DISPOSITIFS ZigBee POURRAIENT ÊTRE ACTIVÉS AUTOMATIQUEMENT À CAUSE D'UN ÉVÉNEMENT PROGRAMMÉ. SELON L'APPAREIL, CES UTILISATIONS INVOLONTAIRES ET SANS SUPERVISION PEUVENT ENGENDRER UN RISQUE. POUR CES RAISONS, NOUS RECOMMANDONS CE QUI SUIT :
N'UTILISEZ PAS LES DISPOSITIFS ZigBee POUR COMMANDER LES RADIATEURS ÉLECTRIQUES OU D'AUTRES APPAREILS QUI POURRAIENT PRÉSENTER UN DANGER EN CAS DE COMMANDE D'ACTIVATION IMPRÉVUE, INVOLONTAIRE OU AUTOMATIQUE.

ADVERTENCIA

RIESGO DE INCENDIO
RIESGO DE DESCARGA ELÉCTRICA
RIESGO DE QUEMADURAS

CONTROL DE EQUIPOS ELECTRODOMÉSTICOS:
PRECAUCIÓN CUIDADO AL USAR LOS DISPOSITIVOS ZigBee PARA CONTROLAR EQUIPOS ELECTRODOMÉSTICOS. EL DISPOSITIVO ZigBee PUEDE FUNCIONAR EN UNA HABITACIÓN DIFERENTE A LA DEL EQUIPO CONTROLADO. ADEMÁS, PODRÍA PRODUCIRSE UNA ACTIVACIÓN ACCIDENTAL SI SE OPRIME EL BOTÓN INCORRECTO EN EL CONTROL REMOTO. LOS DISPOSITIVOS ZigBee PUEDEN ENCENDERSE AUTOMÁTICAMENTE DEBIDO A EVENTOS CRONOMETRADOS PROGRAMADOS. SEGÚN EL EQUIPO DEL QUE SE TRATE, ESTE FUNCIONAMIENTO ACCIDENTAL O SIN SUPERVISIÓN PODRÍA CREAR UNA SITUACIÓN PELIGROSA. POR TALES MOTIVOS, RECOMENDAMOS LO SIGUIENTE:
NO USAR LOS DISPOSITIVOS ZigBee PARA CONTROLAR CALENTADORES ELÉCTRICOS U OTROS APARATOS ELECTRODOMÉSTICOS QUE PUDIERAN IMPLICAR UN PELIGRO DEBIDO A UN ENCENDIDO SIN SUPERVISIÓN, ACCIDENTAL O AUTOMÁTICO.

NOT FOR USE WITH MEDICAL OR LIFE SUPPORT EQUIPMENT
ZigBee enabled devices should never be used to supply power to, or control the On/Off status of medical and/or life support equipment.

NE PAS UTILISER AVEC UN ÉQUIPEMENT MÉDICAL OU DE SURVIE
Les dispositifs compatibles avec la technologie ZigBee ne devraient jamais être utilisés pour alimenter ou commander la mise en marche ou l'arrêt de l'équipement médical ou de survie.

SE PROHÍBE SU EMPLEO EN EQUIPO MÉDICO O EQUIPO PARA EL MANTENIMIENTO DE LAS FUNCIONES VITALES
Los dispositivos ZigBee nunca se deben usar para suministrar energía eléctrica al equipo médico o al equipo para el mantenimiento de funciones vitales, ni para controlar el estado de encendido o apagado de dichos equipos.

WARRANTY
JASCO Products warrants this product to be free from manufacturing defects for a period of two years from the original date of consumer purchase. This warranty is limited to the repair or replacement of this product only and does not extend to consequential or incidental damage to other products that may be used with this product. This warranty is in lieu of all other warranties, expressed or implied. Some states do not allow limitations on how long an implied warranty lasts or permit the exclusion or limitation of incidental or consequential damage, so the above limitations may not apply to you. This warranty gives you specific rights, and you may also have other rights which vary from state to state. Please contact Customer Service at 800-654-8483 (option 1) between 7:30AM – 5:00PM CST or via our website www.byjasco.com if the unit should prove defective within the warranty period.

GARANTIE
JASCO Products garantit que ce produit est exempt de tout défaut de fabrication pour une période de deux ans à compter de la date de l'achat original par l'acheteur. Cette garantie se limite exclusivement à la réparation ou au remplacement de ce produit et n'est pas applicable aux dommages indirects ou accessoires survenus sur d'autres produits utilisés avec ce produit. Cette garantie se substitue à toute autre garantie expresse ou implicite. Certains États ne permettent pas de restrictions quant à la durée d'une garantie implicite ou permettent l'exclusion ou la limitation des dommages indirects et accessoires; il se peut, par conséquent, que cette garantie ne s'applique pas dans votre cas. Cette garantie vous confère des droits juridiques précis; vous pouvez jouir d'autres droits qui peuvent varier d'un État à l'autre. Veuillez communiquer avec le service à la clientèle au 1-800-654-8483 (option 1) entre 7 h 30 et 17 h (heure normale du Centre) ou par l'intermédiaire de notre site Web www.byjasco.com si l'appareil s'avère défaillant au cours de la période de garantie.

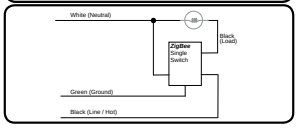
GARANTÍA
JASCO Products garantiza que este producto está libre de defectos de fabricación durante un período de dos años a partir de la fecha original de compra por parte del consumidor. Esta garantía se limita a la reparación o sustitución de este producto solamente y no se extiende a daños derivados o accidentales causados a otros productos que se usen con esta unidad. Esa garantía remplaza a todas las demás garantías expresas o implícitas. Algunos estados no autorizan limitaciones en cuanto a la duración de una garantía implícita ni permiten la exclusión o limitación por daños accidentales o derivados; por lo tanto, puede que las anteriores limitaciones no apliquen en su caso. Esta garantía le da a usted derechos específicos, y otros que usted puede tener y que varían según el estado en el que usted reside. Si la unidad resultare defectuosa dentro del período de garantía, comuníquese por favor con Atención al Cliente en el 800-654-8483 (opción 1) entre 7:30 a.m. y 5:00 p.m., Hora del Centro, o a través de nuestro sitio de internet a www.byjasco.com.

JASCO Products Company, Building B
10 E. Memorial Rd. Oklahoma City, OK 73114

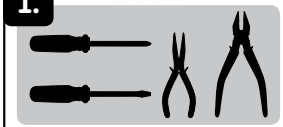
SPECIFICATIONS
ZW4001
Power : 120 VAC, 60 Hz.
Signal (Frequency): 2.4 Ghz IEEE 802.15.4.
Maximum Loads: 1800W incandescent, ½ HP Motor or 1440W (12A) Resistive
Range: Up to 150 feet line of sight between the Wireless Controller and the closest ZigBee receiver module.
Normal Operating Temperature: 77° F (25° C)
For indoor use only.
Complies with FCC and Industry Canada regulations
Use 14 AWG or larger wires suitable for at least 80° C.
Specifications subject to change without notice due to continuing product improvement

SPÉCIFICATIONS
ZW4001
Tension : 120 V ca , 60 Hz.
Signal (fréquence) : 2.4 Ghz IEEE 802.15.4.
Charges maximales : 900 watts (incandescent), moteur de ½ HP ou résistance de 1440 W (12 A).
Portée : Distance à vue entre la télécommande et le module de réception ZigBee le plus proche allant jusqu'à 150 pi.
Température de service : 77 ° F (25 °C).
Utilisation intérieure uniquement.
Conforme aux normes FCC et d'Industrie Canada
Fils de calibre 14 AWG ou de calibre supérieur, adaptés à des températures d'au moins 80 °C.
En raison d'améliorations continues du produit, les spécifications peuvent faire l'objet de changements sans préavis.

ESPECIFICACIONES
ZW4001
Energía: 120 VCA, 60 Hz.
Señal (Frecuencia): 2.4 Ghz IEEE 802.15.4.
Cargas máximas: 900 W, incandescente; ½ HP motor o 1440 W (12 A) resistiva
Alcance: Hasta 150 pies (45.7m) en línea de visibilidad directa entre el control inalámbrico y el módulo receptor ZigBee más cercano.
Temperatura de funcionamiento normal: 77 °F (25 °C)
Para uso en interiores exclusivamente.
Cumple con la normativa de la FCC y del Ministerio de Industria de Canadá
Use cables de 14 AWG o superior que sean adecuados para una temperatura de al menos 80 °C
Especificaciones sujetos a cambio sin aviso debido a continuas mejoras del producto



1. Tools You Will Need

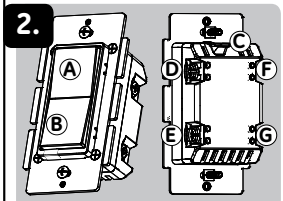


IMPORTANT!
The fixture controlled by the ZigBee In-Wall Smart Switch must not exceed 900 watts (Incandescent); 1440W (12A) Resistive or ½ HP Motor. The switch is designed only for use with permanently installed fixtures.

Getting to know your new ZigBee device

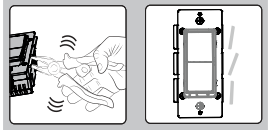
- Turn ON/OFF manually or remotely via the ZigBee controller
- Can be included in multiple groups and scenes
- May be used in single-pole installation or with up to two GE Add-on switches in 3-way or 4-way wiring configurations
- Interchangeable paddle switch — White & light almond paddle in package
- Over-the-air updates — Once joined to your ZigBee network, the Smart Switch can automatically receive updates through your ZigBee gateway
- Energy monitoring — The Smart Switch can report wattage (W) and kilowatt hours (kWh). Energy usage is monitored through the ZigBee controller interface
- Uses a standard, decorative-size wallplate for single gang installations (wallplate not included)
- Blue LED indicates Smart Switch location in a dark room (LED can be enabled/disabled manually)
- LED status indicator — Indicates Smart Switch scanning during pairing process
- ZigBee HA 1.2 Certified for simple pairing and integrated home automation
- Screw terminal installation — requires wiring connections for Line (Hot), Load, Neutral and Ground. Traveler wire required for 3-way or 4-way installation

2.

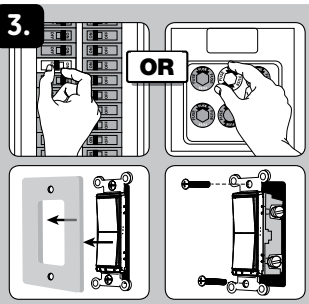


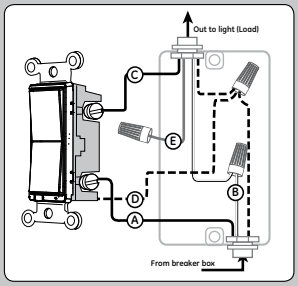
A. Top Rocker — *Press & release to turn switch on*
B. Bottom Rocker — *Press & release to turn switch off*
C. Ground (Green/Bare)
D. Load (Black)
E. Line (Black)
F. Traveler (Red/Other)
G. Neutral (White)

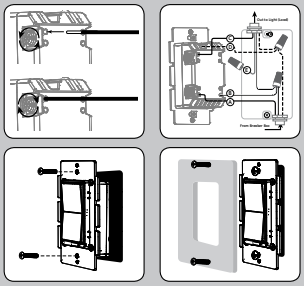
Single-, dual- and triple-gang boxes
When installing the In-Wall Smart Switch in multiple gang boxes it may be necessary to break off one or both sides of the scored tabs on the front yoke. This does not affect the electrical rating of the Smart Switch (see specifications for details).



3.







WARNING — SHOCK HAZARD
Turn OFF the power to the branch circuit for the Smart Switch and lighting fixture at the service panel. All wiring connections must be made with the POWER OFF to avoid personal injury and/or damage to the Smart Switch. This device is intended for installation in accordance with the National Electric Code and local regulations in the United States, or the Canadian Electrical Code and local regulations in Canada. If you are unsure or uncomfortable about performing this installation, consult a qualified electrician.

Multi-switch wiring
For 3-way installations, please refer to Add-on switch manual

Single-switch wiring
Before you start; you may wish to change the paddle color to match your wallplate or decor. Please proceed to section 5.

1. Shut off power to the circuit at circuit breaker or fuse box.
IMPORTANT! Verify power is OFF to switch box before continuing.
2. Remove wallplate.
3. Remove the existing switch mounting screws.
4. Carefully remove the existing switch from the switch box. DO NOT disconnect the wires.
5. There are up to five screw terminals on the Smart Switch; these are marked
   A. LINE (Hot) — Black (connected to power)
   B. NEUTRAL — White
   C. LOAD — Black (connected to lighting)
   D. GROUND — Green/Bare
   E. TRAVELER — Red/Other (only used in 3-way installations)
Match these screw terminals to the wires connected to the existing switch.
6. Disconnect the wires from the existing switch. Be careful to label wires according to the previous terminal connection.

Observe important wiring information
IMPORTANT: This Smart Switch is rated for and intended to only be used with copper wire.

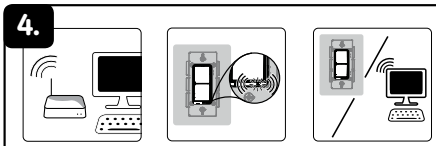
Wire gauge requirements
Use 14 AWG or larger wires suitable for at least 80° C for supplying Line (HOT), Load, Neutral, Ground and Traveler connections.

Wire strip length
For attachment to screw terminals: Strip insulation 1" (25mm)
For attachment using the enclosure's holes: Strip insulation 5/8" (16mm)
UL specifies that the tightening torque for the screws is 24 Kgf-cm (12 lbf-in).
7. Connect the green or bare copper ground wire to the GROUND terminal.
8. Connect the black wire that goes to the fixture to the terminal marked LOAD.
9. Connect the black wire that comes from the electrical service panel (Hot) to the terminal marked LINE.
10. Connect the white wire to the neutral terminal (use included jumper wire if needed).
Note: *The Traveler terminal is only used for 3-way or 4-way wiring and should remain insulated if the switch is being installed in a 2-way system (one switch & one load.*
11. Insert the Smart Switch into the switch box being careful not to pinch or crush wires.
12. Secure the Smart Switch to the box using the supplied screws.
13. Mount the wallplate.
14. Reapply power to the circuit at fuse box or circuit breaker and test the system.

Basic operation
The connected light can be turned ON/OFF in two ways:
1. Manually from the front panel of the In-wall Smart Switch
2. Remotely with a ZigBee Controller

Manual control
The Front Panel Rocker Switch allows the user to:
Turn ON/OFF the connected fixture.
To turn the connected fixture ON: Press and release the top of the rocker.
To turn the connected fixture OFF: Press and release the bottom of the rocker.

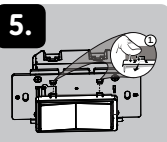
4.



ZigBee network pairing — Join the Smart Switch to the ZigBee network
1. From your ZigBee Controller's interface, choose to add lighting device and enter Locating/Pairing mode as instructed by the controller.
2. Restore power to the Smart Switch at the circuit breaker
3. Network pairing begins automatically. LED status indicator blinks as the Smart Switch automatically scans for a compatible network controller to pair with.
4. After the Smart Switch is located and paired to the ZigBee network, the LED status indicator will stop blinking and the Smart Switch will appear in your controller's menu.
5. The Smart Switch is now paired to the ZigBee network and can be controlled remotely.

Note: LED status indicator stops blinking if a timeout occurs. Auto-Scan mode will eventually time out if the Smart Switch has not joined a ZigBee network. Press and release the front panel rocker on the Smart Switch to restart pairing process following timeout.

5.



To change color of the paddle
This step is optional. Before you start you may want to change the color of the paddle to match your wallplate or decor.

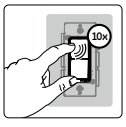
1. Push side tabs in on one side and then the other to release paddle. Lift the cover up and off.
2. Simply put the new paddle onto the switch by inserting the side tabs and snapping securely into place.

Once this step has been completed, please return to section 3.

Reset Smart Switch (Remove From ZigBee network)

From the ZigBee controller
From your controller or hub interface, choose to remove or delete the Smart Switch as instructed. The Smart Switch will be removed from the ZigBee network following indication from your controller. All configuration parameters will be reset after the Smart Switch is removed from the network.

Manual
To manually reset and remove the Smart Switch from the ZigBee network, tap top of rocker (ON Switch) 10x quickly (short presses.)



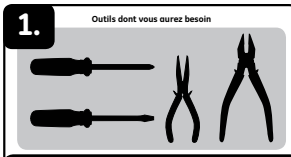
LED parameters
To assist with locating the Smart Switch in a dark room, the LED glows blue when the Smart Switch is turned OFF.

To turn LED off/restore LED:
Tap top rocker (ON Switch) 3x quickly and then tap bottom rocker (OFF Switch) 1x. Follow the same series of button presses used to disable the LED to restore.

The GE Add-on Switch is required for Multi-switch 3-way or 4-way installations.
Connecting the traveler terminal of this switch to a standard, non-GE switch will cause damage or result in improper function. If this switch is a part of a 3-way or 4-way multi-switch installation, do not connect the traveler wire or apply power until GE Add-on switches are correctly installed. For more information on 3-way or 4-way installations, view the manual or quick start guide that comes with the GE Add-on Switch.

1.

Outils dont vous aurez besoin

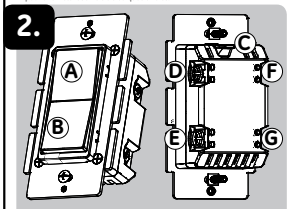


IMPORTANT!
Le luminaire branché à l'interrupteur marche-arrêt à montage mural ZigBee ne doit pas dépasser une résistance de 900 watts (lampe à incandescence), 1 440 W (lampe 12 A) ou avoir un moteur de puissance supérieure à ½ HP. Le gradateur est conçu pour être utilisé uniquement avec des appareils d'éclairage installés de façon permanente.

Familiarisez-vous avec l'utilisation de votre nouveau dispositif ZigBee

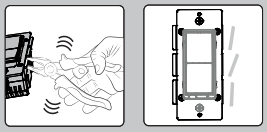
- Mise en marche ou arrêt manuellement ou à distance au moyen de la télécommande ZigBee.
- Peut être inclus dans de nombreux groupes et de nombreuses scènes.
- Peut être utilisé en installation unipolaire ou avec un ou deux interrupteurs supplémentaires GE dans des configurations de câblage à trois ou quatre voies.
- Compatible avec toutes les lampes incandescentes et les ampoules à DEL et fluocompactes.
- Palette d'interrupteur interchangeable — Le dispositif est livré avec une palette blanche et une palette amande pâle.
- Se fixe sur une plaque murale décorative de taille standard pour des installations à compartiment unique (plaque murale non incluse).
- La DEL bleue indique l'emplacement de l'interrupteur dans une pièce sombre.
- Le ZigBee est certifié pour un appairage simple et une domotique intégrée.
- Borne à vis – Nécessite des raccordements de câblage pour le fil sous tension, le fil à la charge, le fil neutre et le fil de mise à la terre. Un fil pendentif est requis pour une installation à trois ou quatre voies.

2.



A. Partie supérieure de l'interrupteur basculant – *Appuyez et relâchez pour allumer*
B. Partie inférieure de l'interrupteur basculant – *Appuyez et relâchez pour éteindre*
C. Terre *(Ground (Fil vert/Fil nu)*
D. Charge *(Load) (Fil noir)*
E. Ligne *(Line) (Fil noir)*
F. Pendentif *(Traveler) (Fil rouge/Autre couleur)*
G.Neutre *(Neutral) (Fil blanc)*

Boîtiers à un, deux et trois compartiments
Au moment d'installer l'interrupteur à montage mural sans fil dans des boîtiers constitués de plusieurs compartiments, il peut s'avérer nécessaire de rompre les languettes pointillées sur un côté de la bride avant au les deux. Cela n'aura aucune incidence sur la valeur électrique nominale de l'interrupteur (voir les spécifications pour obtenir des détails).



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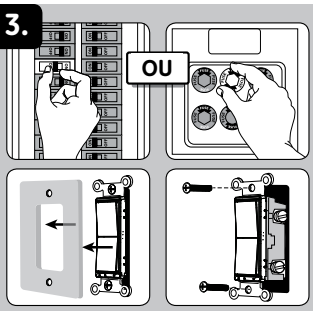
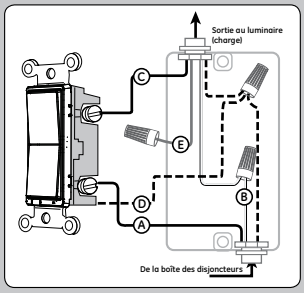
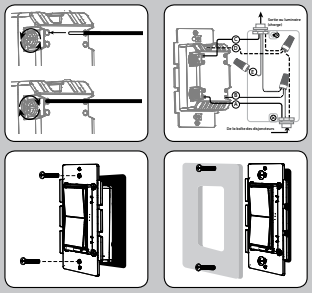






AVERTISSEMENT — RISQUE D'ÉLECTROCUTION
Coupez l'alimentation dans le circuit de dérivation relatif à l'interrupteur et à l'appareil d'éclairage sur le panneau de branchement. Toutes les connexions de câblage doivent être effectuées HORS TENSION pour éviter de vous blesser ou d'endommager l'interrupteur.
Ce dispositif est prévu pour une installation conforme au Code national de l'électricité et aux règlements locaux des États-Unis ou au Code canadien de l'électricité et aux règlements locaux du Canada. Si vous n'êtes pas certain de la façon d'effectuer cette installation ou si vous ne vous sentez pas à l'aise pour l'accomplir, veuillez consulter un électricien qualifié.

Câblage des installations multi-interrupteurs
Pour les installations à trois voies, veuillez consulter le *Manuel complémentaire*.

Câblage avec un seul interrupteur
Avant de commencer, vous pourriez vouloir changer la couleur de la palette pour l'harmoniser à votre plaque murale ou à la décoration. Veuillez passer à la section 5.

1. Coupez l'alimentation au disjoncteur ou à la boîte à fusibles.

IMPORTANT! Avant de poursuivre, assurez-vous que l'alimentation est COUPÉE à la boîte de jonction.

2. Retirez la plaque murale.
3. Retirez les vis de montage de l'interrupteur.
4. Retirez avec soin l'interrupteur de la boîte de jonction. NE débranchez PAS les fils.
5. Il y a cinq bornes à vis sur l'interrupteur. Celles-ci sont indiquées.
   A. LIGNE (LINE) (sous tension) — Fil noir (relié à l'alimentation)
   B. Neutre (Neutral) — Fil blanc
   C. CHARGE (LOAD) — Fil noir (relié au luminaire)
   D. TERRE (GROUND) — Fil vert/Fil nu
   E. PENDENTIF (TRAVELER) — Fil rouge ou d'une autre couleur (utilisé uniquement pour les installations à trois voies)

Faites correspondre ces bornes à vis avec les fils reliés à l'interrupteur existant.

6. Retirez les fils de l'interrupteur existant. Prenez soin de marquer les fils selon leurs raccordements antérieurs aux bornes.

Notez les renseignements importants relatifs au câblage
IMPORTANT! Cet interrupteur est conçu pour et doit être utilisé uniquement avec du fil en cuivre.

Exigences en matière de calibre de fil
Utilisez des fils de calibre 14 AWG ou de calibre supérieur, adaptés à des températures d'au moins 80 °C, pour les raccordements du fil sous tension, du fil à la charge, du fil neutre, du fil de mise à la terre et du fil pendentif.

Longueur de fil à dénuder :
Pour les fixations aux bornes à vis : Dénudez l'isolant sur 1 po (25 mm).
Pour les fixations utilisant les orifices du boîtier : Dénudez l'isolant sur 5/8 po (16 mm).

UL précise que le couple de serrage des vis est de 14 kgf/cm (12 lbf/po).

7. Raccordez le fil de mise à la terre vert ou en cuivre nu à la borne de mise à la terre (GROUND).
8. Raccordez le fil noir relié au luminaire à la borne marquée CHARGE (LOAD).
9. Raccordez le fil noir relié au panneau de branchement électrique (sous tension) à la borne marquée LIGNE (LINE).
10. Raccordez le fil blanc à la borne neutre (NEUTRAL) (utilisez le fil de connexion inclus au besoin).

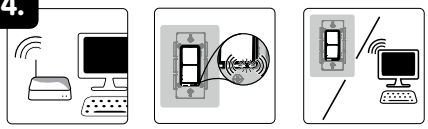
Remarque : La borne du fil pendentif est seulement utilisée pour le câblage à trois ou quatre voies et doit rester isolée si l'interrupteur est installé dans un système à deux voies lun interrupteur et une charge).

11. Insérez l'interrupteur dans la boîte de jonction en prenant soin de ne pas pincer ou écraser les fils.
12. Fixez l'interrupteur sur la boîte à l'aide des vis fournies.
13. Montez la plaque murale.
14. Rétablissez l'alimentation dans le circuit, à la boîte à fusibles ou au disjoncteur et mettez le système à l'essai.

Fonctionnement de base
Le luminaire branché peut être allumé ou éteint de deux façons différentes :
1. Manuellement, à partir du panneau avant de l'interrupteur mural.
2. À distance, à l'aide de la télécommande ZigBee.

Commande manuelle
L'interrupteur basculant du panneau avant permet à l'utilisateur :
d'allumer et d'éteindre le luminaire branché.
Pour allumer le luminaire branché : Appuyez sur la partie supérieure de l'interrupteur basculant, et relâchez-la.
Pour éteindre le luminaire branché : Appuyez sur la partie inférieure de l'interrupteur basculant, et relâchez-la.

4.

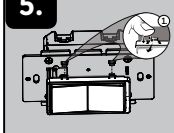


Appairage au réseau ZigBee — Relier l'interrupteur au réseau ZigBee
1. À partir de l'interface de votre télécommande ZigBee, choisissez d'ajouter un appareil d'éclairage et entrez dans le mode de veille de l'appairage en suivant les instructions de la télécommande.
2. Rétablissez l'alimentation de l'interrupteur au disjoncteur.
3. L'appairage au réseau s'effectue automatiquement : le témoin d'état à DEL clignote lorsque le dispositif est à la recherche d'une télécommande compatible sur le réseau.
4. Lorsque l'appairage de l'interrupteur au réseau ZigBee est effectué, le dispositif s'affiche sur le menu de votre interrupteur et le témoin d'état à DEL cesse de clignoter. Configurez l'interrupteur comme une commande d'intensité et nommez l'interrupteur de manière qu'il soit facile de l'identifier.

L'interrupteur est maintenant appairé au réseau ZigBee et peut être commandé à distance.

Remarque: Le témoin d'état à DEL cesse de clignoter après un certain délai d'attente : le mode de balayage automatique sera interrompu si le dispositif ne parvient pas à se connecter au réseau ZigBee après un certain temps. Pour relancer le processus d'appairage, appuyez sur le bouton-poussoir situé sur le panneau avant.

5.

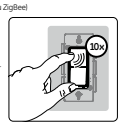


Pour changer la couleur de la palette.
Cette étape est facultative. Avant de commencer, vous pourriez vouloir changer la couleur de la palette pour l'harmoniser à votre plaque murale ou à la décoration.

1. Enfoncez les languettes latérales une après l'autre pour libérer la palette. Soulevez le couvercle et retirez-le.
2. Placez simplement la nouvelle palette sur l'interrupteur et insérez la languette à la base de la palette et les languettes latérales dans les fentes, puis enclenchez la palette.

Une fois cette étape terminée, revenez à la section 3.

Réinitialiser le dispositif (déconnexion du réseau ZigBee)
À partir de la télécommande ZigBee
À partir de votre télécommande ou de l'interface du concentrateur, retirez ou supprimez l'appareil d'éclairage en suivant les instructions. L'appareil sera déconnecté du réseau ZigBee suivant une indication sur votre télécommande. Tous les paramètres de configuration sont réinitialisés lorsque l'appareil est déconnecté du réseau.



Manuellement
TPour réinitialiser manuellement le dispositif et le déconnecter du réseau ZigBee, effectuez dix brèves pressions sur la partie supérieure de l'interrupteur basculant (position marche).

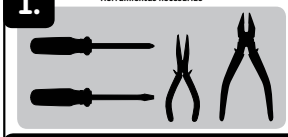
LED Parameters
To assist with locating the Smart Switch in a dark room, the LED glows blue when the Smart Switch is turned OFF.

Pour éteindre la DEL/Pour remettre la DEL en fonctionnement :
Effectuez trois brèves pressions sur la partie supérieure de l'interrupteur basculant (position marche), puis une brève pression sur la partie inférieure (position arrêt).

Un interrupteur supplémentaire GE est exigé pour les installations multi-interrupteurs à trois ou quatre voies. Raccorder la borne du fil pendentif de cet interrupteur à un interrupteur standard qui n'est pas de marque GE entraînera des dommages ou altèrera son fonctionnement. Dans le cas où cet interrupteur fait partie d'une installation multi-interrupteurs à trois ou quatre voies, ne raccordez pas le fil pendentif ou ne le mettez pas sous tension tant que les interrupteurs supplémentaires GE ne sont pas correctement installés. Pour plus de renseignements sur les installations à trois ou quatre voies, consultez le manuel ou le guide d'installation rapide livré avec l'interrupteur supplémentaire GE.

1.

Herramientas necesarias

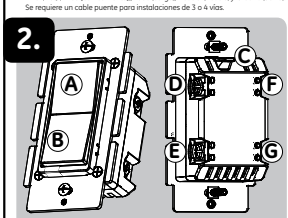


IMPORTANTE:
El dispositivo controlado por el interruptor de pared para encendido/apagado ZigBee no debe exceder los 900 watts (para dispositivos incandescentes), 1440 W (12 A) de carga resistiva o un motor de ½ caballo de fuerza. Este interruptor está diseñado para usarse con aparatos de iluminación de instalación permanente.

Cómo familiarizarse con su nuevo dispositivo ZigBee

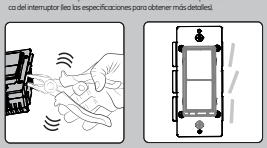
- ENCENDIDO/APAGADO manual o remoto a través del controlador ZigBee
- Se puede incluir en varios grupos y escenas
- Se puede utilizar en una instalación monofásica o con hasta dos interruptores auxiliares GE en configuraciones de cableado de tres o cuatro vías.
- Compatible con todas las bombillas incandescentes y las bombillas CFL/LED
- Interruptor de paleta intercambiable — el paquete incluye una paleta blanca y marrón claro
- Utiliza una placa de pared estándar y decorativa para instalaciones de conexión sencilla (de salida única) (la placa de pared no está incluida)
- Un LED azul indica la ubicación del interruptor en habitaciones oscuras
- ZigBee está certificado para sincronización simple y automatización integrada del hogar
- Instalación de terminales de tornillo — requiere de conexiones de cables para Line (Hot) (Línea) (con corriente), Load (carga), Neutral (neutro) y Ground (tierra). Se requiere un cable puente para instalaciones de 3 o 4 vías.

2.



A. Interruptor basculante superior – *Pulse y suelte el botón para encenderlo*
B. Interruptor basculante – *Pulse y suelte el botón para apagarlo*
C. Tierra (verde/pelado)
D. Carga (Negro)
E. Línea (Negro)
F. Traveler(Puente) (Roja/Otro)
G. Neutro (Blanco)

Cajas para conexión simple, doble y triple
Al instalar el interruptor de pared inalámbrico en cajas para conexión múltiple (de salida múltiple), puede que sea necesario quitar uno o ambos lados de las presillas con muescas de la horquilla frontal. Esta acción no afectará la especificación eléctrica del interruptor (lea las especificaciones para obtener más detalles).



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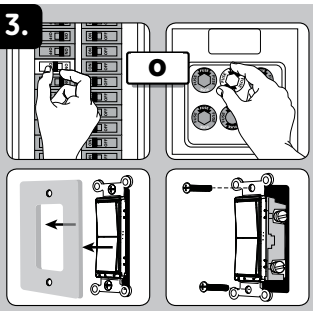
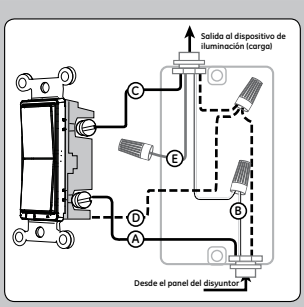
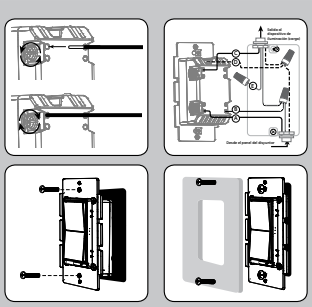






ADVERTENCIA — DESCARGA ELÉCTRICA
Interrumpa el suministro de corriente del circuito de derivación del interruptor y del artefacto de iluminación en el panel de servicio. Todas las conexiones de cableados deben realizarse con el SUMINISTRO DE CORRIENTE INTERRUMPIDO para evitar lesiones personales y/o provocar daños al interruptor.
Este dispositivo está diseñado para la instalación conforme al Código de Normas de Electricidad y las reglamentaciones locales en EE. UU. o el Código de Normas de Electricidad y las reglamentaciones locales en Canadá. Si no está seguro o tiene dudas sobre cómo realizar la instalación, contacte a un electricista profesional.

Cableado de interruptores múltiples
Para instalaciones de 3 vías, consulte el manual sobre Interruptores auxiliares

Cableado del interruptor monofásico
Antes de comenzar, tal vez necesite cambiar el color de la paleta para que combine con la placa o la decoración de pared. Continúe con la sección 5.

1. Interrumpa el suministro de energía al circuito desde el panel de fusibles o el de cortacircuitos.

IMPORTANTE: Antes de continuar, compruebe que se ha INTERRUMPIDO la alimentación eléctrica a la caja del interruptor.

2. Quite la placa de la pared.
3. Retire los tornillos de montaje del interruptor.
4. Saque el interruptor de la caja con cuidado. NO desconecte los cables.
5. Hay hasta cinco terminales de tornillo en el interruptor; están marcados de la siguiente manera:
   A. LINE (Hot) (Línea [con corriente])— Negro (conectada al suministro eléctrico)
   B. Neutral (Neutro) — Blanco
   C. LOAD (Carga) — Negro (conectada al dispositivo de iluminación)
   D. GROUND (Tierra) — Verde/Pelado
   E. TRAVELER (Puente) — Roja/Otro (solo en instalaciones de 3 vías)

Haga corresponder estos terminales de tornillo con los cables conectados al interruptor existente.

6. Desconecte los cables del interruptor existente. Tome la precaución de rotular los cables según la conexión anterior al terminal.

Observe la siguiente información importante sobre el cableado
IMPORTANTE: este interruptor ha sido clasificado para usarse exclusivamente con alambre de cobre y está diseñado precisamente para ese tipo de alambre.

Requisitos de calibre del cableado
Use cables de 14 AWG o superior que sean adecuados para una temperatura de al menos 80 °C para suministro de las conexiones Line (Hot) (Línea [con corriente]), Load (carga), Neutral (neutro), Ground (tierra) y Traveler (puente).

Longitud de cable sin aislamiento:
Para conectar en terminales de tornillo: pelar 1" (25 mm) del aislamiento.
Para conectar utilizando los orificios del recinto: pelar 5/8" (16 mm) del aislamiento.

La norma de UL especifica que el par de apriete de los tornillos debe ser de 14 Kgf-cm (12 lbf-in).

7. Conecte el cable de cobre verde o pelado de conexión a tierra al terminal GROUND (tierra).
8. Conecte el cable negro que va al dispositivo de iluminación al terminal marcado LOAD (carga).
9. Conecte el cable negro que viene del panel de servicio eléctrico (Hot) (con corriente) al terminal marcado LINE (línea).
10. Conecte el cable blanco al terminal neutro (use el cable del puente incluido, de ser necesario).

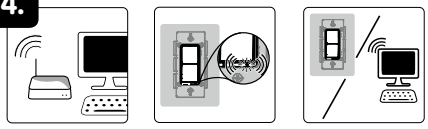
Note: ***El terminal puente solo se usa para el cableado de tres o cuatro vías y deberá permanecer aislado si el interruptor se instala en un sistema de dos vías (un interruptor y una carga).***

11. Introduzca el interruptor en la caja del interruptor, teniendo cuidado de no comprimir o pellizcar los cables.
12. Asegure bien el interruptor a la caja usando los tornillos que se suministran.
13. Coloque la placa de la pared.
14. Reanude el suministro de energía al circuito desde el panel de fusibles o el de cortacircuitos y pruebe el sistema.

Funcionamiento básico
La luz conectada se puede encender o apagar de dos formas:
1. De manera manual, desde el panel frontal del interruptor incorporado en la pared.
2. De manera remota con el controlador ZigBee.

Control manual
Con el interruptor basculante del panel frontal, el usuario puede:
ENCENDER/APAGAR el dispositivo conectado.
Para ENCENDER el dispositivo conectado: pulse y suelte la parte superior del interruptor basculante.
Para APAGAR el dispositivo conectado: pulse y suelte la parte inferior del interruptor basculante.

4.

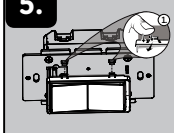


Sincronización con la red ZigBee — Conecte el dispositivo con la red ZigBee
1. Desde la interfaz del controlador ZigBee, elija la opción de agregar el dispositivo de iluminación e ingrese al modo Localizar/Sincronizar, siguiendo las instrucciones del controlador.
2. Reanude el suministro de energía al interruptor desde el cortacircuitos
3. El proceso de sincronización con la red comienza automáticamente: el indicador del estado del LED parpadea a medida que el dispositivo busca automáticamente un controlador de red compatible para sincronizarse con éste.
4. Una vez que el interruptor haya sido localizado y sincronizado con la red ZigBee, el indicador del estado del LED dejará de parpadear y el interruptor aparecerá en el menú del controlador. Configure el interruptor como control de electrodoméstico de luz y asígnele un nombre que permita identificarlo fácilmente.

El interruptor ahora está sincronizado con la red ZigBee y se puede controlar de manera remota.

Nota: el indicador del estado del LED deja de parpadear una vez transcurrido el tiempo de espera: el modo de Auto-búsqueda se detendrá eventualmente si el dispositivo no se ha incorporado a una red ZigBee. Presione el botón del panel frontal del módulo para reiniciar el proceso de sincronización tras caducar el tiempo de espera.

5.

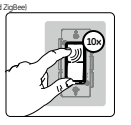


Para cambiar el color de la paleta
Este paso es opcional. Antes de comenzar, tal vez necesite cambiar el color de la paleta para que combine con la placa o la decoración de pared.

1. Presione las presillas laterales primero de un lado y luego del otro para aflojar la paleta. Levántela y sáquela.
2. Simplemente coloque la nueva paleta sobre el interruptor al insertar el entrehierro y las presillas laterales encajándolas bien en su lugar.

Una vez completado este paso, regrese a la sección 3.

Cómo reiniciar el dispositivo (quitarlo de la red ZigBee)
Desde el controlador ZigBee
Desde la interfaz del controlador o del concentrador, elija la opción quitar o eliminar el dispositivo de iluminación siguiendo las instrucciones. El dispositivo será eliminado de la red ZigBee después de recibir la indicación del controlador. Todos los parámetros de configuración se restablecerán una vez que el dispositivo sea eliminado de la red.



Manual
Para reiniciar y quitar el dispositivo manualmente de la red ZigBee, pulse rápidamente la parte superior del interruptor basculante (interruptor ENCENDIDO) 10 veces (golpecitos cortos)

Parámetros del LED
Para ayudar a localizar el interruptor en habitaciones oscuras, el LED emitirá una luz azul cuando el interruptor de la luz esté APAGADO.

Para apagar el LED/ Para restablecer el LED:
Pulse la parte superior del interruptor basculante (interruptor ENCENDIDO) tres veces y luego pulse la parte inferior del interruptor basculante (interruptor APAGADO) una vez
Presione la misma serie de botones utilizados para desactivar el LED

El interruptor auxiliar GE es necesario para instalaciones de interruptores múltiples 3 o 4 vías. Conectar el terminal puente de este interruptor a un interruptor estándar que no sea GE provocará daños o mal funcionamiento.
Si este interruptor es parte de una instalación de varios interruptores de 3 o 4 vías, no conecte el cable puente ni suministre electricidad hasta que los interruptores auxiliares GE estén instalados correctamente. Para obtener más información sobre instalaciones de interruptores de 3 o 4 vías, consulte el manual o la guía rápida que viene con el interruptor auxiliar GE.

SMC® Networks Oaziss™ Carbon Monoxide Sensor

SMCCO02-Z

CO Sensor: SMCCO02-Z

Carbon Monoxide (CO) is an odorless, tasteless, and colorless gas that kills in minutes. The SMCCO02-Z provides early detection against the silent threat of CO poisoning by providing visual and audio alarms when potentially dangerous CO levels exist. The alarm resets automatically when CO is no longer detected. In addition to alarms, the SMCCO02-Z detects low battery, wall tamper, and sensor end-of-life. These trouble codes are sent to the SMC touchscreen, which reports the condition to the central monitoring station.

Technical Specifications

- Sensor: Electrochemical
- Sensor Life: 7 Years Max
- Supervisory Interval: 27 Minutes
- Audible Alarm: Temporal 4
- Alarm Response Times:
  70 PPM = 60-240 Minutes
  150 PPM = 10-50 Minutes
  400 PPM = 4-15 Minutes
- Transceiver: ZigBee IEEE 802.15
- Frequency: 2400~2483.5MHz, 16 Channels 802.11g
- Rejection: 35dB
- TX Output: 19dBm Max Rx Sensitivity: -104dBm Min
- NTC Thermistor for Temperature data
- Operating Temperature: 4.4 to 37.8°C (40° to 100°F)
- Storage Temperature: -10 to 50°C (14° to 122°F)
- Relative Humidity: 0 to 95% Non-Condensing
- Dimensions: 119 * 70 * 47 mm (4.7 * 2.8 * 1.9 in)
- Battery:
  3x 1.5VDC Alkaline AA Batteries
  Battery Life: 5 Years Typical
- Compliance:
  CFR Part 15B and C, RSS-210, RSS-Gen
  UL 639 CAN/ULC-S306

Package Information

Package Contents:

1x Carbon Monoxide Sensor
3x AA Batteries
2x Wall Mounting Screws and Anchors
1x Quick Start Guide

Key Features

- Highly accurate electrochemical CO sensor and sophisticated on-board microprocessor to effectively track CO levels over time
- Unaffected by normal indoor temperature variations
- Flashing LED and loud ANSI S3.41 temporal 4-pattern siren provide early warning of CO detection
- Fully integrated wireless transmitter sends alarm and status messages to the SMC Touchscreen, notifying the user and/or the central station Alarm, RF communication, and full-functional CO gas diagnostics ensure optimal performance Battery operated for continuous protection, even during power outages, with low battery, wall tamper, and sensor end-of-life indications
- Easy wall installation, with no need for cabling work; simple battery replacement
- 5-year battery and 7-year sensor life for reduced service calls and lower total cost of ownership.

Contact

SMC Networks, Inc. - North America
20 Mason
Irvine, CA 92618
1-800-SMC-4YOU
24/7 Technical Support

Check www.na.smc.com for your local country contact information

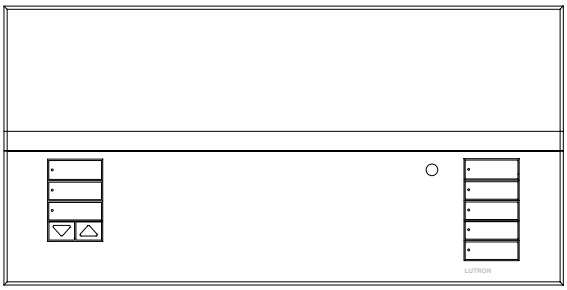
V1.6

GRAFIK Eye® QS

The GRAFIK Eye® QS controls up to six zones of light and will operate the following sources with a continuous Square Law dimming curve or on a full conduction non-dim basis:

- Incandescent
- LED[1, 2]
- Tungsten Halogen
- Electronic Low-Voltage (ELV)[3]
- Magnetic Low-Voltage (MLV) Transformer
- Metal Halide/High Pressure Sodium Switched
- Neon/Cold Cathode
- Lutron Tu-Wire® Electronic Fluorescent Dimming Ballasts
- Approved LED and CFL Lamps/Fixtures

The GRAFIK Eye® QS can be configured for wired, QS link (HomeWorks® QS only), or wireless, RF link (HomeWorks® QS and RadioRA® 2), communication.



GRAFIK Eye® QS

Models

Model Number	Zones	Voltage	Additional Features
QSGRJ-3P-XX	3	120 V~, 220–240 V~	-
QSGRJ-4P-XX	4	120 V~, 220–240 V~	-
QSGRJ-6P-XX	6	120 V~, 220–240 V~	-
QSGRJ-3P-1XX	3	120 V~, 220–240 V~	1 extra button column
QSGRJ-3P-TXX	3	120 V~, 220–240 V~	translucent cover
QSGRJ-3P-1TXX	3	120 V~, 220–240 V~	1 extra button column, translucent cover
QSGRJ-4P-1XX	4	120 V~, 220–240 V~	1 extra button column
QSGRJ-4P-TXX	4	120 V~, 220–240 V~	translucent cover
QSGRJ-4P-1TXX	4	120 V~, 220–240 V~	1 extra button column, translucent cover
QSGRJ-6P-1XX	6	120 V~, 220–240 V~	1 extra button column
QSGRJ-6P-TXX	6	120 V~, 220–240 V~	translucent cover
QSGRJ-6P-1TXX	6	120 V~, 220–240 V~	1 extra button column, translucent cover
QSGFP-	Faceplate kit		

NOTES

- "XX" in the model number represents color/finish code. See pages 9 and 10 for Colors and Finishes.
- See page 6 for model number breakdown.

[1] Dimming curve will be dependent on specific LED models.
[2] For more information on controlling LEDs, please see Application Note #487 on www.lutron.com
[3] ELV can be controlled with a smooth, continuous Square Law dimming curve or on a full conduction non-dim basis through a separate Lutron® power module, ELV, or Phase Adaptive power module.

GRAFIK Eye® QS

Specifications

Model Numbers	See previous page
Power	120 V~ 50/60 Hz 220–240 V~ (non CE) 50/60 Hz
Typical Power Consumption	7 W, 0 Power Draw Units (PDUs). **The GRAFIK Eye® QS is not powered from the link, Pin 2 should not be connected.** Typical Power Consumption test conditions: all loads off, one button LED on.
Regulatory Approvals	UL, CSA, FCC, IC, SCT, NOM, CEC (Title 24)
Environment	Ambient operating temperature: 32 °F to 104 °F (0 °C to 40 °C) Ambient operating humidity: 0-90% humidity, non-condensing. Indoor use only.
Communications	**Wired (HomeWorks® QS only)**: Low-voltage type IEC PELV/NEC® Class 2 wiring connects GRAFIK Eye® QS to processor. Each HomeWorks® QS processor has two configurable links. GRAFIK Eye® QS communicates with the processor via the QS link. **RF (RadioRA® 2 and HomeWorks® QS)**: Lutron® wireless Clear Connect® Technology
ESD Protection	Tested to withstand electrostatic discharge without damage or memory loss, in accordance with IEC 801-2.
Surge Protection	Tested to withstand surge voltages without damage or loss of operation, in accordance with IEEE C62.41-1991 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
Power Failure	Provides 10-year power failure memory: Automatically restores lighting to levels prior to power interruption.
Mounting	Installs in a standard 4-gang U.S. wallbox, 3½ in (89 mm) deep is strongly recommended. Always allow at least 4½ in (114 mm) clearance above and below the control unit to provide adequate space for cooling. Wallplate snaps on with no visible means of attachment.
Line Voltage Wiring	Each line voltage terminal can accept one 12 AWG (4.0 mm^2) wire.
IEC PELV/NEC® Class 2 QS System Low-Voltage Wiring (HomeWorks® QS only)	System communication uses low-voltage wiring. Wiring can be daisy-chained or T-tapped. Wiring must be run separately from line/mains voltage. IEC PELV/NEC® Class 2 wiring link requires: Two 18 AWG (0.75 mm^2) conductors for control power. One twisted, shielded pair of 22 AWG (0.34 mm^2) for data link. Available from Lutron, P/N GRX-CBL-346S; check compatibility in your area. Total length of control link must not exceed 2000 ft (610 m).
Warranty	www.lutron.com/TechnicalDocumentLibrary/Warranty.pdf www.lutron.com/TechnicalDocumentLibrary/Intl_Warranty.pdf

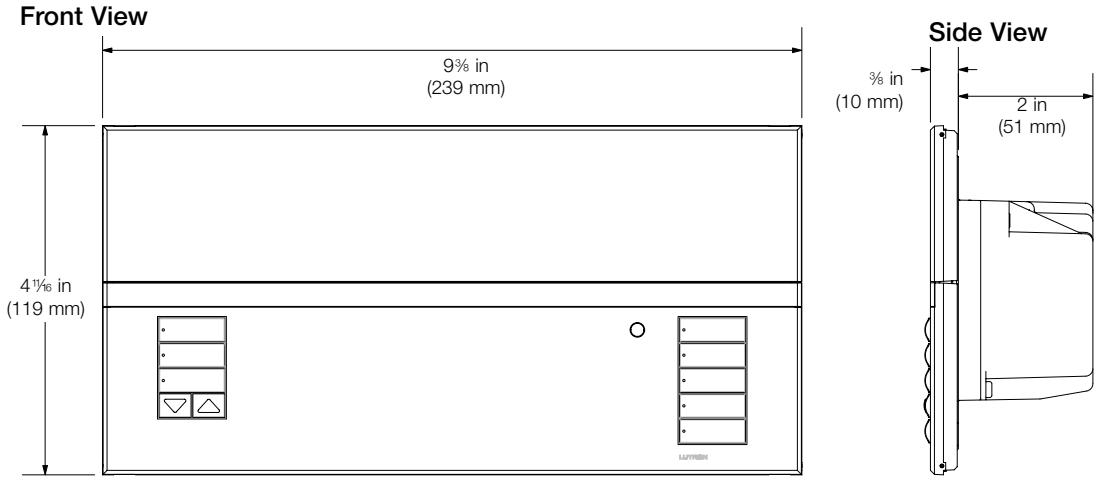
GRAFIK Eye® QS

Design Features

- Contains RTISS Equipped® technology to compensate in real time for incoming line voltage variations: No visible flicker with +/-2% change in RMS voltage/cycle and +/-2% change in frequency/second.
- Buttons are programmable to select scene or room preset levels or positions.
- Wallplate snaps on with no visible means of attachment.
- Can be configured for wired, QS link (HomeWorks® QS only), or wireless, RF link (HomeWorks® QS and RadioRA® 2), communication.

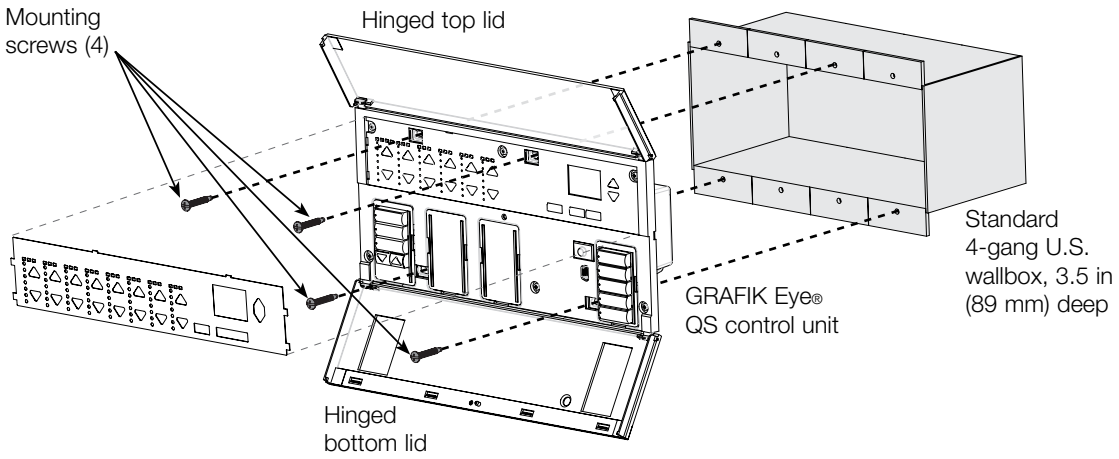
Dimensions

Dimensions shown as: in (mm)



Fits into a 4-gang U.S. backbox, 3.5 in (89 mm) deep; Lutron® P/N 241400

Mounting



GRAFIK Eye® QS

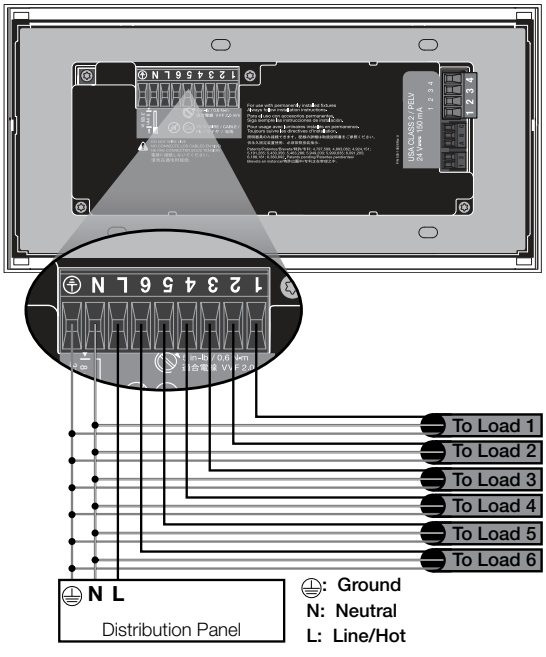
Load Capacity

	120 V~ 50/60 Hz	220–240 V~ 50/60 Hz
Unit Capacity (watts)	2000 W	3000 W
Magnetic Low-Voltage	2000 VA/1600 W	3000 VA/2400 W
Zone Capacity (watts)	25–800 W	40–1200 W
Magnetic Low-Voltage	25–800 VA/25–600 W	40–1200 VA/40–960 W
LED	See Application Note #487	

Load Type Notes

- When dimming Electronic Low-Voltage (ELV) lighting, an ELV interface (such as PHPM-PA-DV-WH) must be used with the control unit. Before installing an ELV light source, verify with the manufacturer that their transformer can be dimmed.
- When controlling 0–10 V loads, a Ten Volt Interface (GRX-TVI) must be used with the control unit.
- Not all zones must be connected; however, **connected zones must have a minimum load as specified above.**
- Maximum total lighting load for a Magnetic Low-Voltage (MLV) varies by input voltage **(specified above):**
  – 120 V~: 800 VA / 600 W
  – 220–240 V~: 1200 VA/960 W
- No zone may be loaded with more than the capacity specified above. For higher wattage applications, or for 277 V~ applications, use Lutron® power module PHPM-PA, PHPM-WBX, PHPM-PA-DV, PHPM-SW, or PHPM-WBX-DV.

Power and Load Wiring

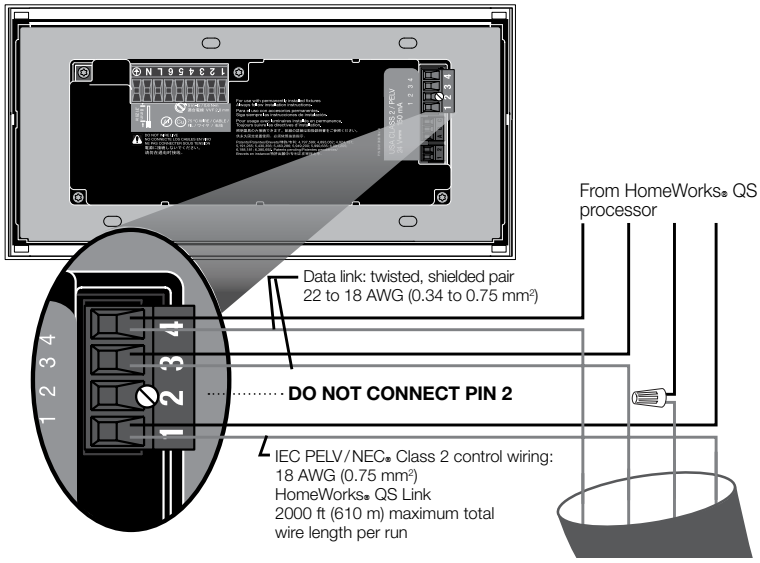


GRAFIK Eye® QS

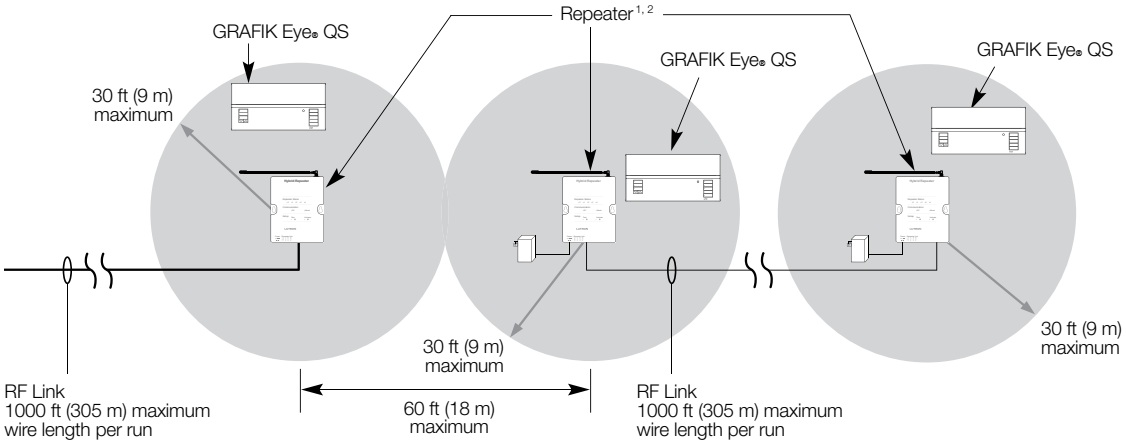
Communications

HomeWorks® QS supports selection of wired or RF communications. A GRAFIK Eye® QS main unit that communicates back to a HomeWorks® QS processor through the RF link should not have any QS wired link connections. Only RF communication is available in RadioRA® 2.

QS Link Wiring (HomeWorks® QS only)



RF Link (RadioRA® 2 and HomeWorks® QS)



[1] In HomeWorks® QS systems, use Hybrid Repeaters for range extension. In RadioRA® 2, the repeater shown may be either a main repeater (1 required) or auxiliary repeater (up to 4 permitted).

[2] For reliable RF performance, the GRAFIK Eye® QS main unit should be located at least 6 ft (2 m) away from the main or auxiliary repeater.

GRAFIK Eye® QS

Wireless Control Unit: Custom Color Options and Model Numbers

You must order a Base Unit and a Faceplate Kit
See Standard Color Combinations page for faceplate, stripe, and button colors

Base Unit

QSGRJ - _ P

- QSGRJ — Prefix
- _ — Number of Zones: 3 = 3 zones; 4 = 4 zones; 6 = 6 zones
- P — Phase Control Triac

Example:

QSGRJ-6P
6-zone base unit
and
QSGFP-2IV-EGN
Ivory faceplate kit with two shade columns and general engraving

Faceplate Kit
(includes coordinating stripe and buttons)

QSGFP - - -

- QSGFP — Faceplate Prefix
- Number of Shade Columns: Omit = none; 1 = 1 column; 2 = 2 columns; 3 = 3 columns
- Top Door Color: Omit = same as unit; T = Translucent
- Color/Finish
- Keypad Engraving Code

Faceplate Custom Color/Finish Codes

Architectural Matte Finishes

Standard (ship in 48 hours)

White	WH
Ivory	IV
Beige	BE
Gray	GR
Brown	BR
Black	BL
Almond	AL
Light Almond	LA

Architectural Metal Finishes

Bright Brass	BB
Bright Chrome	BC
Bright Nickel	BN
Satin Brass	SB
Satin Chrome	SC
Satin Nickel	SN
Antique Brass	QB
Antique Bronze	QZ

Anodized Aluminum Finishes

Clear	CLA
Black	BLA
Brass	BRA

Satin Color Matte Finishes

Snow	SW
Biscuit	BI
Eggshell	ES
Taupe	TP
Midnight	MN
Limestone	LS
Stone	ST
Desert Stone	DS
Terracotta	TC
Hot	HT
Goldstone	GS
Palladium	PD
Plum	PL
Turquoise	TQ
Bluestone	BG
Sea Glass	SG
Greenbriar	GB
Sienna	SI
Merlot	MR
Mocha Stone	MS

Keypad Engraving Codes

Omit = Unengraved
Ships with engraving certificate that customer can redeem at no charge

EGN = General Engraving

Lighting keypad

Shade column

NST = Non-Standard Text Engraving Please visit the GRAFIK Eye® QS website at **www.lutron.com/grafikeyeqs** for custom engraving forms. Submit completed form with order, and unit will ship engraved as specified by customer.

GRAFIK Eye® QS

Wireless Control Unit: Custom Options and Model Numbers

See previous pages for Standard and Other Custom Model Numbers
See Standard Color Combinations page for faceplate, stripe, and button colors

Custom Button Kit

QSGB - 5B - WH -

- QSGB: Custom Button Kit Prefix
- 5B: Button Configuration
- WH: Button Color/Finish
- Keypad Engraving Code

Button Configuration:
- 3BRL = 3-button with raise/lower (shade column)
- 5B = 5-button (lighting keypad)

Button Kit Custom Color/Finish Codes

Architectural Matte Finishes		Satin Color Matte Finishes	
White	WH	Snow	SW
Ivory	IV	Biscuit	BI
Beige	BE	Eggshell	ES
Gray	GR	Taupe	TP
Brown	BR		
Black	BL		
Almond	AL		
Light Almond	LA		

Keypad Engraving Codes

Omit = Unengraved
Ships with engraving certificate that customer can redeem at no charge

EGN = General Engraving

Lighting keypad

Shade column

NST = Non-Standard Text Engraving
Please visit the GRAFIK Eye® QS website at **www.lutron.com/grafikeyeqs** for custom engraving forms. Submit completed form with order, and unit will ship engraved as specified by customer.

Custom Stripe Kit

QSGS - WH

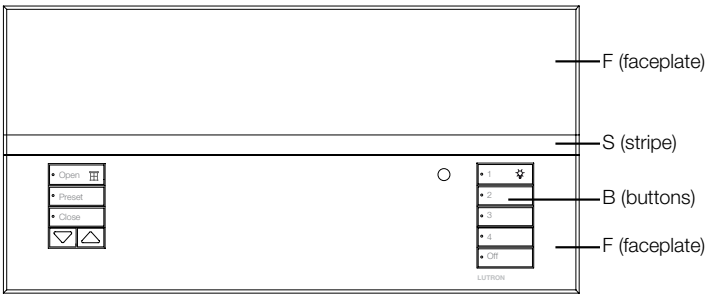
- QSGS: Stripe Kit Prefix
- WH: Stripe Color/Finish

Stripe Custom Color/Finish Codes
Same as Faceplate colors on previous page

GRAFIK Eye® QS

Wireless Control Unit: Standard Color Combinations

See previous pages for Standard and Custom Model Numbers



Faceplate is comprised of a top and bottom. The bottom will always be the color indicated under "faceplate." The top may be the same color or translucent. Use the chart for faceplates that have the same color top and bottom. If a translucent lid is chosen, the stripe will automatically be the same color as the bottom lid.

Example:
If you order QSGRJ-4P-1WH, your GRAFIK Eye® QS with 4 lighting zones and 1 shade zone will come with a white faceplate (both top and bottom), gray stripe, and white buttons.

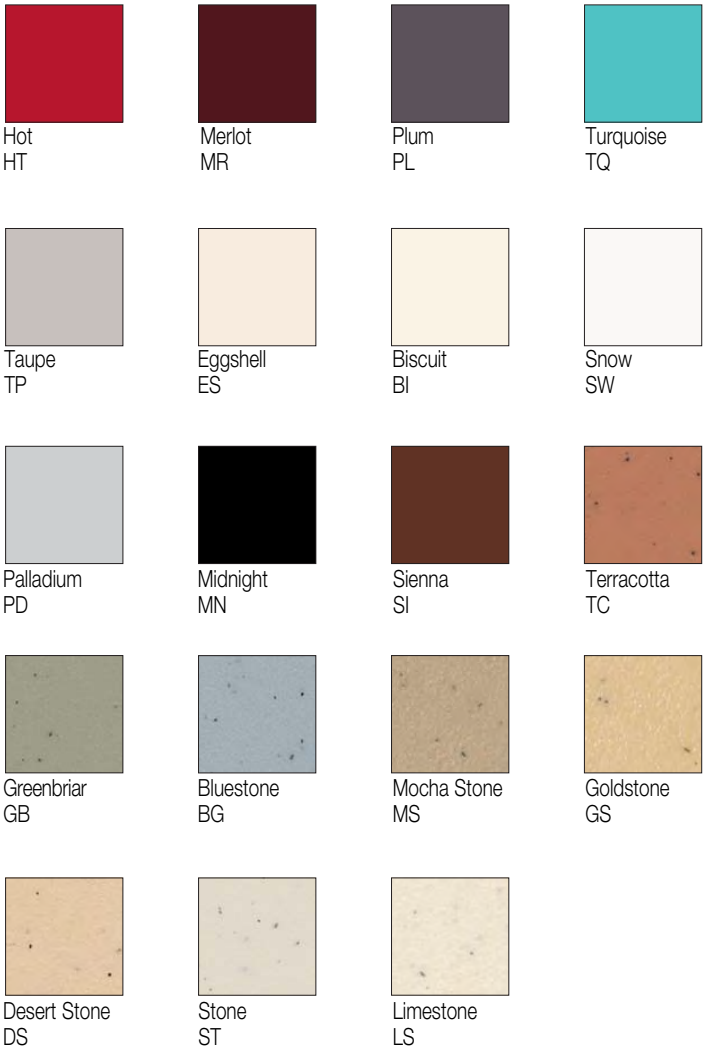
Suffix	Faceplate (F)	Stripe (S)	Button (B)
Architectural Matte			
WH	White	Gray	White
IV	Ivory	Beige	Ivory
BE	Beige	Ivory	Beige
GR	Gray	Black	Gray
BR	Brown	Black	Brown
BL	Black	Gray	Black
AL	Almond	Light Almond	Almond
LA	Light Almond	Almond	Light Almond
Architectural Metal			
BB	Bright Brass	Black	Black
BC	Bright Chrome	Black	Black
BN	Bright Nickel	Black	Black
SB	Satin Brass	Black	Black
SC	Satin Chrome	Black	Black
SN	Satin Nickel	Black	Black
QB	Antique Brass	Black	Black
QZ	Antique Bronze	Black	Black
Anodized			
CLA	Clear	Black	Black
BLA	Black	Black	Black
BRA	Brass	Black	Black

Suffix	Faceplate (F)	Stripe (S)	Button (B)
Satin Matte			
MN	Midnight	Gray	Black
TP	Taupe	Gray	Taupe
SW	Snow	Gray	Snow
ES	Eggshell	Beige	Eggshell
BI	Biscuit	Eggshell	Biscuit
LS	Limestone	Gray	Gray
ST	Stone	Gray	Gray
DS	Desert Stone	Taupe	Taupe
TC	Terracotta	Taupe	Taupe
BG	Bluestone	Gray	Gray
HT	Hot	Taupe	Taupe
MR	Merlot	Taupe	Taupe
SI	Sienna	Brown	Brown
GB	Greenbriar	Gray	Gray
SG	Sea Glass	Gray	Gray
MS	Mocha Stone	Taupe	Taupe
GS	Goldstone	Ivory	Ivory
PD	Palladium	Gray	Gray
PL	Plum	Taupe	Taupe
TQ	Turquoise	Gray	Gray

GRAFIK Eye® QS

Colors and Finishes (continued)

Satin Finishes (Faceplate kit only)



- Due to printing limitations, colors and finishes shown cannot be guaranteed to perfectly match actual product colors.
- Color chip keychains are available for more precise color matching:
  Satin Finishes: SC-CK-1

Accessory:

Haiku Wall Control with SenseME Technology

TECHNICAL SPECIFICATIONS

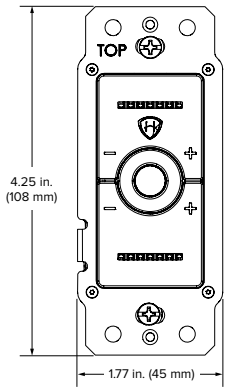
Haiku Wall Control wirelessly connects as many as 30 Haiku fans and lights, giving you seamless, synchronized control of your Haiku products — even if they're not on the same electrical circuit[1].

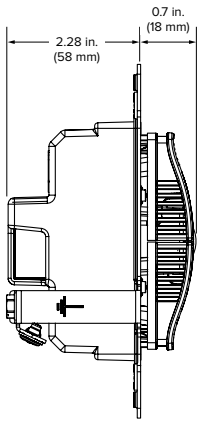
TOTAL CONVENIENCE, TOTAL CONTROL

- **Compatibility** — Compatible with SenseME-capable Haiku products. Enables SenseME® technology[2] in L Series fans.
- **Manual Controls** — Fan on/off, fan speed adjustment, light on/off, light brightness adjustment, light color temperature adjustment[3]
- **Convenience** — Four buttons allow easy adjustment of fan speed, light brightness or color temperature, while built-in SenseME technology monitors room conditions and adjusts fans and lights automatically to keep you comfortable and reduce energy costs.
- **Integrations** — Connect to third-party devices like Amazon Echo, Nest Learning Thermostat™ and ecobee® smart thermostats to increase convenience and efficiency.
- **Finish** — White
- **Installation** — Installs in existing wall junction box (neutral wire required)
- **Environment** — Indoor use only

Technical Specifications	
Model number	005836
Operating voltage and frequency	100–240 VAC, 1 Φ, 50/60 Hz
Amperage	0.055–0.036 A
Operating temperature	32° to 104° F (0° to 40° C)
Wiring	Neutral wire required
Sensors	Ambient temperature, motion, relative humidity

[1] Wall control must be connected to products via Wi-Fi, using the Haiku Home app.
[2] SenseME Technology and the Haiku Home app are supported by Android™ and iOS®. When ordering a Haiku Wall Control with L Series fan(s), you will receive a Wi-Fi module to be installed in the fan(s), which is necessary for the Wall Control to "talk" to the fan(s).
[3] Color temperature adjustment available only when Premier Haiku Lights are grouped to the wall control.





Intertek

Specifications subject to change without notice.

HAIKU BY BIG ASS SOLUTIONS

AMERICAS HAIKUHOME.COM 855-694-2458 | CANADA HAIKUHOME.COM/CA 844-924-4277 | AUSTRALIA HAIKUHOME.COM/AU 1-300-244-277 | HONG KONG HAIKUHOME.COM/HK +852 2836 5808 | SINGAPORE HAIKUHOME.COM/SG +65 6709 8500 | MALAYSIA +603 5565 0888

APPENDIX VII
MSDS (SDS)

Material Safety Data Sheet – Perlite

----------I. Product Identification ----------

Trade Name (as labeled)	Supreme Perlite (Expanded)
Manufacturers Name	Supreme Perlite Company
Website & Email:	www.perlite.com info@perlite.com
Address:	4600 N. Suttle Rd. Portland, OR 97217
Phone Number:	503-286-4333
Date Revised:	02/24/2004

----------II. Product Ingredients----------

Ingredient Name	CAS Number	%	PEL	TLV(total)
Perlite	93763-70-3	100	15 mg/M3	10mg/M3

A mineral composed of sodium potassium aluminum silicate of variable composition.

Perlite is considered a nuisance dust (also called “Particulates Not Otherwise Classified (PNOC) by ACGIH).

Alpha-Cristobalite & Tridymite:	Less than 0.1%
Alpha Quartz:	0.01 to 0.05%

----------III. Physical Properties----------

Vapor Density (air=1)	NA	**Melting point or range. ^{o}F**	2000+
Specific Gravity	2.35	**Boiling point or range. ^{o}F**	N/A
Solubility in Water	<1%	**Evaporation rate (butyl acetate = 1)**	N/A
Vapor Pressure (mmHg @ 20^{o}C)	N/A		
Appearance and odor:	White to off white granules, no odor.		

HOW TO DETECT THIS SUBSTANCE (warning properties of substance as a gas, vapor, dust or mist)

Visual only (dust). No gas, vapors, or mist emitted.

----------IV. Fire and Explosion----------

Flash Point, ^{o}F (give method) Perlite is a fully oxidized, non-flammable mineral. It is noncombustible and non-flammable.

Auto ignition temp., ^{o}F N/A

Flammable limits in air, Vol. % N/A lower (LEL) N/A upper (UEL) N/A

Fire extinguishing materials: N/A

_____water spray _____ carbon dioxide _____other

_____foam _____dry chemical

Special fire fighting procedures: N/A

Usual fire & explosion hazards: N/A

----------V. Health Hazard Information----------

SYMPTOMS OF EXPOSURE for each potential route of exposure

Inhaled: Coughing

Contact with skin or eyes: Possible eye irritation from dust particles; wear eye protection.

Absorbed through skin: N/A

Swallowed: N/A

HEALTH EFFECTS OR RISKS FROM EXPOSURE.

Acute: None

Chronic: Excessive inhalation over long period may cause harmful irritation; use mask suitable for nuisance dust.

Target Organ: None

FIRST AID: EMERGENCY PROCEDURES

Eye Contact: Attempt to wash out with clear water; if unable, have particle removed by doctor.

Skin Contact: None

Inhaled: Remove affected individual from dusty area to area with clean air.

Swallowed: None

SUSPECTED CANCER AGENT?

__X__ No: This product's ingredients are not found in below lists.

YES: ____Federal OSHA _____NTP _____IARC

MEDICAL CONDITIONS AGGREVATED BY EXPOSURE

Any respiratory illnesses, which a nuisance dust may aggravate.

----------VI Reactivity Data----------

Stability: **__X__Stable** _____Unstable

Incompatibility: Hydrofluoric Acid

Hazardous Polymerization: _____May occur **__X__Will not occur**

Conditions to avoid: None in designed use.

Hazardous Decomposition Products: May react with hydrofluoric acid form toxic gas.

----------VII. Spill, Leak & Disposal Procedures----------

Spill response procedures (include employee protection measures):

Vacuum clean or sweep material; Use respirators suitable for nuisance dust & eye protection.

Preparing wastes for disposal (container types, neutralization, etc.):

Dispose in bulk or containers according to local dump requirements. No special treatment required.

NOTE: Dispose of all wastes in accordance with federal, state and local regulations.

----------VIII. SPECIAL HANDLING INFORMATION----------

Ventilation and engineering controls:

Maintain dust level below TLV.

Respiratory protection (type):

Masks suitable for nuisance dust.

Eye protection (type):

Protective goggles.

Gloves (specify material):

Not required.

Work practices, hygienic practices:

Use good housekeeping to avoid transient dust.

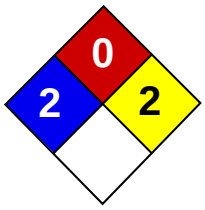
Other handling and storage requirements:

Use good housekeeping to avoid transient dust.

Protective measures during maintenance of contaminated equipment:

No special equipment, other than respirators and goggles.

As of the date of this document, the foregoing information is believed to be accurate and is provided in good faith to comply with applicable federal and state laws. However, no warranty or representation with respect to such information is intended or given, and it is the responsibility of the user to comply with all applicable federal, state and local laws and regulations



Material Safety Data Sheet
Calcium chloride, Anhydrous MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium chloride, Anhydrous

Catalog Codes: SLC5011, SLC2221, SLC4012, SLC4798, SLC1006

CAS#: 10043-52-4

RTECS: EV9800000

TSCA: TSCA 8(b) inventory: Calcium chloride, Anhydrous

CI#: Not available.

Synonym:

Chemical Name: Calcium Chloride, Anhydrous

Chemical Formula: CaCl2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Calcium chloride, Anhydrous	10043-52-4	100

Toxicological Data on Ingredients: Calcium chloride, Anhydrous: ORAL (LD50): Acute: 1000 mg/kg [Rat]. 1940 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to heart, cardiovascular system. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Furan-2-peroxycarboxylic acid + calcium chloride causes explosion at room temperature.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as moisture.

Storage:
Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 30°C (86°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Synthetic apron. Gloves (impervious).

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Odorless.

Taste: Saline.

Molecular Weight: 110.99 g/mole

Color: Colorless. White. Off-white.

pH (1% soln/water): 9 [Basic.]

Boiling Point: 1670°C (3038°F)

Melting Point: 772°C (1421.6°F)

Critical Temperature: Not available.

Specific Gravity: 2.15 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, acetone.

Solubility:
Easily soluble in cold water, hot water, acetone. Freely soluble in alcohol. Soluble in Acetic Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture.

Incompatibility with various substances: Reactive with moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Hygroscopic. Reacts violently (violent boiling) with water, generating heat. Forms flammable gases and evolves hydrogen when reacted with zinc. Solutions attack some metals. Generates heat and violent polymerization occurs when mixed with methyl vinyl ether. Bromine trifluoride reacts violently with and attacks calcium chloride.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 1000 mg/kg [Rat].

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: heart, cardiovascular system.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Rabbit] - Route: Oral; Dose: 1384 mg/kg

Special Remarks on Chronic Effects on Humans:
May affect genetic material based on animal data. May cause cancer (tumorigenic) based on animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause severe irritation and possible burns, especially if skin is wet. Contact with dry skin causes mild irritation. Contact of solid with moist/wet skin or skin contact with strong solutions may cause marked irritation or possible burns. Eyes: May cause severe irritation, possible transient corneal injury, and possible eye burns. Inhalation: May cause severe irritation of the upper respiratory tract with pain, inflammation and possible burns. Ingestion: May cause severe gastrointestinal (digestive) tract irritation with nausea, vomiting and possible burns. May affect cardiovascular system (cardiac disturbances, slow heart beat), behavior (seizures), metabolism, blood, and brain, respiration (rapid respiration). Chronic Potential Health Effects: effects may be delayed.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 100 mg/l 96 hours [Fish].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Calcium chloride, Anhydrous

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36- Irritating to eyes. S2- Keep out of the reach of children. S22- Do not breathe dust. S24- Avoid contact with skin.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 1

Personal Protection: C

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves (impervious). Synthetic apron. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Lithium-Ion Battery Emergency Response Guide Tesla Energy Products, All Sizes			
Release Date: **3-Sept-2015**	Page: **1 of 11**	Document Number: **TS-0004027**	Revision: **02**

Version	Date	Description
01	**14-July-2015**	**ERG for Powerwall and Powerpack**
02	**3-Sept-2015**	**Added part numbers, updated weights, voltages, and temperatures, clarified hazards associated with spilled electrolyte, updated storage requirements, updated warning label icons, updated packing group.**

Rechargeable Lithium Ion Batteries: Tesla Energy Products

The products referenced herein are exempt articles and are not subject to OSHA's Hazard Communication Standard requirements for preparation of material safety data sheets (MSDS).

MSDS

Material Safety Data Sheets (MSDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article". OSHA has defined "article" as a manufactured item other than a fluid or particle; (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities (e.g. minute or trace amounts) of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Tesla Energy Products meet the OSHA definition of "articles". Thus, they are exempt from the requirements of the Hazardous Communication Standard, and an MSDS is not required.

1. IDENTIFICATION OF PRODUCTS AND COMPANY				
Product	Rechargeable lithium-ion Powerwall and Powerpack systems for residential, commercial, and industrial Tesla Energy applications, and modules and sub-assemblies that can be installed in Powerwall and Powerpack systems (Tesla Energy Products). Specific part numbers are listed below.			
Locations	**Headquarters**	**Europe**	**Asia/ Pacific**	**Manufacturer**
	Tesla Motors, Inc. (USA) 3500 Deer Creek Road Palo Alto, CA 94304 Tel. No. (650) 681-5000	**Tesla Europe** Burgemeester Stramanweg 122 1101EN Amsterdam The Netherlands Tel. No. +31 20 258 3916	**Tesla Asia / Pacific** 2-23-8, Minami Aoyama Tokyo, Japan Tel: +81 3 6890 7700	**Tesla Motors, Inc.** (USA) 3500 Deer Creek Road Palo Alto, CA 94304 Tel. No. (650) 681-5000
Emergency Contacts	CHEMTREC	For Hazardous Materials [or Dangerous Goods] Incidents: Spill, Leak, Fire, Exposure, or Accident Call CHEMTREC Day or Night Within USA and Canada: 1-800-424-9300 Contract Number: CCN204273 Outside USA and Canada: +1 703-527-3887 (collect calls accepted)		

Tesla Energy Powerwall and Powerpack systems contain battery subassemblies made up of rechargeable lithium-ion cells. Tesla Energy Powerwall and Powerpack systems and their respective subassemblies are covered by this document (Tesla Energy Products).

Tesla Energy Powerwall, Powerpack, and their battery subassemblies contain sealed lithium-ion battery cells (cells) that are similar to rechargeable batteries in many consumer electronic products. Cells are individually, hermetically sealed cylinders approximately 18 mm in diameter and 65 mm in length. These cylinders each contain lithium-ion electrodes and electrolyte (approximate composition listed below). THE CELLS AND BATTERIES DO NOT CONTAIN METALLIC LITHIUM. Individual cells have nominal voltages of approximately 3.6 V.

Materials/Ingredients of Battery Cells	**Approx. % by wt.**
The lithium-ion cell positive electrodes can be composed of: Lithium Nickel Cobalt Aluminum Oxide (NCA material), $LiNi_xCo_yAl_zO_2$; Lithium Nickle, Manganese, Cobalt Oxide (NMC material) $LiNi_xMn_yCo_zO_2$; Lithim Nickle, Manganese Oxide (NMO material), $LiNi_xMn_yO_2$ Lithium Cobalt Oxide, $LiCoO_2$; or a mixture of these compounds	33
Carbon	21
Iron	12
Copper	7
Aluminum	5
Nickel	<1
Organic electrolyte (mainly composed of alkyl carbonate)*	10
Polypropylene	3
Polyethylene Terephthalate	<1
Other	8

*An acceptable exposure concentration of electrolyte has not been identified by the American Council of Governmental Industrial Hygienists (ACGIH). In case of electrolyte leakage from the battery, the oral (rat) LD50 is greater than 2 g/kg (estimated).

Powerwall and Powerpack systems also include sealed thermal management systems containing coolants and refrigerants.

Non-Cell Materials found in Powerwall and Powerpack Systems	**Approximate Quantity**
Ethylene glycol 50/50 mixture with water	Powerwall: 1.6 L of 50/50 mixture Powerpack: 26L of 50/50 mixture
R134a: 1,1,1,2-Tetrafluoroethane refrigerant	Powerwall: none Powerpack: 400g

Individual lithium-ion cells are connected to form modules. Modules are connected to form pods. Pods are installed in a Powerwall or Powerpack. Approximate specifications of lithium-ion based modules, pods, Powerwalls, and Powerpacks are listed below. Modules and pods are battery sub-assemblies.

Part Number	Description	Nominal Voltage (V)	Max Voltage (V)	Weight (kg)	Height (cm)	Width (cm)	Depth (cm)
	Powerwall Versions						
1050100-0x*-y*	POWERWALL, 2KW, 7KWH	400	450	95 (210 lb)	130 (51 in)	86 (34 in)	18 (7 in)
1067000-0x*-y*	POWERWALL, 3.3KW, 7KWH	400	450	95 (210 lb)	130 (51 in)	86 (34 in)	18 (7 in)
1068000-0x*-y*	POWERWALL, 6.6KW, 10KWH	400	450	101 (223 lb)	130 (51 in)	86 (34 in)	18 (7 in)
	Powerpack Versions						
1068538-0x*-y*	POWERPACK (1hr continuous net discharge)	400	450	1720 (3800 lb)	219 (86 in)	97 (38 in)	132 (52 in)
1047404-0x*-y*	POWERPACK (2hr continuous net discharge)	400	450	1680 (3700 lb)	219 (86 in)	97 (38 in)	132 (52 in)
1060119-0x*-y*	POWERPACK (4hr continuous net discharge)	400	450	1665 (3670 lb)	219 (86 in)	97 (38 in)	132 (52 in)
	Powerwall and Powerpack Sub-Assemblies						
1071000-00-A	POD, 1.6KW	400	450	72 (159 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1055000-0x*-y*	POD, 2KW	400	450	73 (160 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1073000-0x*-y*	POD, 3.3KW	400	450	73 (160 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1076600-0x*-y*	POD, 6.6KW	400	450	75 (165 lb)	99 (39 in)	75 (30 in)	12 (5 in)
1047816-0x*-y*	ASY,HVBAT, MODULE, BB	20	25	25 (55 lb)	70 (28 in)	30 (12 in)	8 (3 in)
1063198-0x*-y*	ASY,HVBAT,MODULE, 22V	20	25	25 (55 lb)	70 (28 in)	30 (12 in)	8 (3 in)

* Note that the 9th digit could be any number or letter and the 10th digit could be any letter.

2. HANDLING AND USE PRECAUTIONS/IDENTIFICATION OF HAZARDS

The products described by this document are dangerous if mishandled. Injury to property or person, including loss of life is possible if mishandled.

Tesla Energy Products contain lithium-ion batteries. **A battery is a source of energy**. Do not short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. An internal- or external-short circuit can cause significant overheating and provide an ignition source resulting in fire, including surrounding materials or materials within the cell or battery. Under normal conditions of use, the electrode materials and electrolyte they contain are not exposed, provided the battery integrity is maintained and seals remain intact. Risk of exposure may occur only in cases of abuse (mechanical, thermal, electrical).

2A. HIGH VOLTAGE HAZARDS

Under normal conditions of use, provided that a Tesla Energy Product enclosure remains closed, handling the product does not pose an electrical hazard. Numerous safeguards have been designed into Tesla Energy Products to help ensure that the high-voltage-battery is kept safe and secure as a result of a number of expected abuse conditions. All of the constituent component battery cells are sealed within the pack as sub-groups in metal enclosures (Pods). The exterior of each Pod is isolated from internal components and connectors are touch-safe. Pods are then installed in a rigid metal enclosure, which is isolated from high voltage.

A Tesla Energy Product may pose a significant high voltage and electrocution risk if the outer enclosure, Pod enclosures, and/or safety circuits have been compromised or have been significantly damaged. **A battery pack, even in a normally discharged condition is likely to contain substantial electrical charge and can cause injury or death if mishandled.** If a Tesla Energy Product has been significantly visibly damaged or its enclosure compromised, then practice appropriate high-voltage preventative measures until the danger has been assessed (and dissipated if necessary).

WARNING: NEVER CUT INTO A SEALED TESLA ENERGY PRODUCT ENCLOSURE due to the high voltage and electrocution risks.

For proper installation / removal instructions please contact Tesla Motors at (650) 681-5000.

2B. HAZARDS ASSOCIATED WITH MECHANICAL DAMAGE

Mechanical damage to Tesla Energy Products can result in a number of hazardous conditions (discussed below) including:

- Leaked battery pack coolant (See Section 2D)
- Leaked refrigerant (Powerpack systems only See Section 2E)
- Leaked cell electrolyte (See Section 2F)
- Rapid heating of individual cells due to exothermic reaction of constituent materials (cell thermal runaway), venting of cells, and propagation of self-heating and thermal runaway reactions to neighboring cells.
- Fire

To prevent mechanical damage to Tesla Energy Products, these items should be stored in their original packaging when not in use or prior to being installed. (See Section 6 below).

2C. HAZARDS ASSOCIATED WITH ELEVATED TEMPERATURE EXPOSURE

The Tesla Energy Powerwall and Powerpack are designed to withstand operating temperatures up to 50°C (122°F) and 95% non-condensing humidity.

Exposure of Tesla Energy Products to elevated temperatures can drive battery cells into thermal runaway and result in a fire.

- Storage for more than 24 hours at temperatures above approximately 80°C (176 °F) could result in cell thermal runaway reactions and should be avoided.
- Storage for more than a few minutes at temperatures above approximately 150°C (302°F) could result in cell thermal runaway reactions and should be avoided.
- Exposure of battery packs to localized heat sources such as flames could result in cell thermal runaway reactions and should be avoided.

2D. HAZARDS ASSOCIATES WITH LEAKED COOLANT

Powerpack and Powerwall thermal management is achieved via liquid cooling using a 50/50 mixture of ethylene glycol and water. A typical Powerpack system includes about 26L of coolant. A typical Powerwall system includes about 1.6 L of coolant. Mechanical damage of a Tesla Energy Product that has been installed could result in leakage of the coolant. The fluid is blue in color and does not emit a strong odor.

For information regarding the toxicological hazards associated with ethylene glycol, as well as ecological effects and disposal considerations, refer to the specific Material Safety Data Sheet (MSDS) for battery coolant.

Extended exposure of a Tesla Energy Product to leaked coolant could cause additional damage to product such as corrosion and compromise of protection electronics.

2E. HAZARDS ASSOCIATES WITH LEAKED REFRIGERANT (POWERPACK ONLY)

The Powerpack thermal management system includes 400g of R134a: 1,1,1,2-Tetrafluoroethane refrigerant in a sealed system. Mechanical damage of a Powerpack could result in a release of the refrigerant. Such a release would appear similar to the emission of smoke.

For information regarding the toxicological hazards associated with R134a, as well as ecological effects and disposal considerations, refer to the specific Safety Data Sheet (SDS) for R134a.

2F. HAZARDS ASSOCIATED WITH LEAKED ELECTROLYTE

The electrolyte within constituent cells includes a volatile hydrocarbon-based liquid and a dissolved lithium salt (which is a source of lithium ions) such as lithium hexofluorophosphate. The electrolyte is largely absorbed in electrodes within individual sealed cells. Under normal usage conditions battery electrolyte should not be encountered by anyone handling a Tesla Energy Product.

Severe mechanical damaged (e.g. severe crushing) can cause a small quantity of electrolyte (up to approximately 1 g) to leak out of a cell. For the electrolyte liquid to come into contact with a user of a Tesla Energy Product, the Powerwall or Powerpack external enclosure, the Pod enclosure, and the cell would have to be mechanically damaged.

The possibility of a spill of electrolyte from a Tesla Energy battery pack is very remote. Electrolyte can be extracted from a single cell using a centrifuge, or under some extreme abuse conditions such as a severe crush. However, it is very difficult to mechanically damage cells in such a way as to cause leakage of electrolyte. Even if a single cell were damaged in a manner that could cause electrolyte leakage, it is extremely difficult to cause a leak from more than a few cells due to any incident. Furthermore, cells are connected into modules which are placed within a sealed steel, compartmentalized enclosure. Each compartment can contain liquid from a large number of individual cells.

Any released electrolyte liquid is likely to evaporate rapidly leaving a white salt residue. Evaporated electrolyte is flammable and will contain alkyl-carbonate compounds. Leaked electrolyte is colorless and characterized by a sweet odor. If an odor is obvious, evacuate or clear the surrounding area and ventilate the area. **WARNING: AVOID CONTACT WITH ELECTROLYTE.**

Leaked electrolyte solution is flammable and corrosive / irritating to the eyes and skin. If a liquid is observed that is suspected electrolyte, ventilate the area and avoid contact with the liquid until a positive identification can be made and sufficient protective equipment can be obtained (eye, skin, and respiratory protection). Chemical classifier strips can be used to identify the spilled liquid (electrolyte will contain petroleum/organic solvent and fluoride compounds.

In case of an electrolyte leak, the following protective equipment is recommended: an air purifying respirator with organic vapor/acid gas cartridges, safety goggles or a full face respirator, and safety gloves (Butyl rubber or laminated film (Silver Shield)). Protective clothing should be worn. Use a dry absorbent material to clean up a spill.

2G. HAZARDS ASSOCIATED WITH VENTED ELECTROLYTE

Lithium-ion cells are sealed units, and thus under normal usage conditions, venting of electrolyte should not occur. If subjected to abnormal heating or other abuse conditions, electrolyte and electrolyte decomposition products can vaporize and be vented from cells. Accumulation of liquid electrolyte is unlikely in the case of abnormal heating. Vented gases are a common early indicator of a thermal runaway reaction – an abnormal and hazardous condition.

If gases or smoke are observed escaping from a Tesla Energy Product, evacuate the area and notify a first responder team and/or the local fire department. Gases or smoke exiting a lithium-ion battery pack are likely flammable and could ignite unexpectedly as the condition that led to cell venting may also cause ignition of the vent gases. A venting Tesla Energy Product should only be approached with extreme caution by trained first responders equipped with appropriate personal protective equipment (PPE) (discussed in Section 3).

Cell vent gas composition will depend upon a number of factors, including cell composition, cell state of charge, and the cause of cell venting. Vent gases may include volatile organic compounds (VOCs) (such as alkyl-carbonates, methane, ethylene, and ethane), hydrogen gas, carbon dioxide, carbon monoxide, soot, and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Additionally, phosphorus pentafluoride, POF_3 and HF vapors may form.

WARNING: AVOID CONTACT WITH VENTED GASES. Vented gases may irritate the eyes, skin, and throat. Cell vent gases are typically hot: upon exit from a cell, vent gas temperatures can exceed 600 ºC (1,110 ºF). Contact with hot gases can cause thermal burns. Vented electrolyte is flammable, and may ignite on contact with a competent ignition source such as an open flame, spark, or a sufficiently heated surface. Vented electrolyte may also ignite on contact with cells undergoing a thermal runaway reaction.

3. FIREFIGHTING MEASURES

Responding to a Venting Tesla Energy Product. Smoke emanating from a Tesla Energy Product is an indication of an abnormal and hazardous condition. The smoke is likely flammable and may ignite at any time. If fire or smoke is observed emanating from a Tesla Energy Product at any time, evacuate the area, and notify appropriately trained first responders and the local fire department.

A trained first responder team or the local fire department should shut off power to the Tesla Energy Product, to prevent charging of the battery. However, shutting off power to the Tesla Energy Product does not de-energized the battery, and thus a shock hazard may still be present. The Tesla Energy Product should then be monitored for evidence of continued smoke evolution. Application of high volumes of water from a safe distance to cool the battery pack may prevent further reaction and prevent a fire from developing.

If a fire develops, the Incident Commander should determine whether an attempt will be made to suppress the fire (aggressive firefighting) or allow the battery to burn until it self-extinguishes, while protecting surrounding materials (defensive firefighting).

Virtually all fires involving lithium-ion batteries can be controlled with water. To date, water has been found to be the most effective agent for controlling lithium-ion battery fires. Water will suppress flames and can cool cells, limiting propagation of thermal runaway reactions. If water is used, electrolysis of water (splitting of water into hydrogen and oxygen) may contribute to the flammable gas mixture formed by venting cells, burning plastic, and burning of other combustibles. Thus copious volumes of water should be used to fight a lithium-ion battery fire.

Gaseous agents such as CO_2 or Halon, or dry chemical suppressants may temporarily suppress flaming of lithium-ion battery packs, but they will not cool lithium-ion batteries and will not limit the propagation of cell thermal runaway reactions. Metal fire suppressants such as LITH-X, graphite powder, or copper powder are not appropriate agents for suppressing fires involving lithium-ion battery packs as they are unlikely to be effective.

A battery fire may continue for several hours and it may take 24 hours or longer for the battery pack to cool. A lithium-ion battery fire that has been extinguished can re-ignite due to the exothermic reaction of constituent materials from broken or damaged cells. To avoid this, remove sources of ignition and cool the burned mass by flooding with water.

Aggressive Firefighting: If a decision is made to aggressively fight a fire involving a Tesla Energy Product, then copious amounts of water should be applied from a safe distance. The water may not suppress all cell thermal runaway reactions within the battery pack, but it may cool cells and control the spread of the fire. If possible, direct the application of water towards openings in the battery pack enclosure, if any have formed, with the intent of flooding the pack enclosure. The objective is to contact the surfaces of the affected and surrounding individual battery cells with water.

Defensive Firefighting If a decision is made to fight a Tesla Energy Product fire defensively, then the fire crew should pull back a safe distance and allow the battery to burn itself out. Fire crews may choose to utilize a water stream or fog pattern to protect exposures or control the path of smoke. A battery fire may continue for several hours and may result in multiple re-ignition events. It may take 24 hours or longer for the battery pack to cool.

Firefighter PPE. Firefighters should wear self-contained breathing apparatus (SCBA) and fire protective turnout gear. Cells or batteries may flame or leak potentially hazardous organic vapors if exposed to excessive heat, fire or over voltage conditions. These vapors may include volatile organic compounds (VOCs), hydrogen gas, carbon dioxide, carbon monoxide, soot, and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Additionally, phosphorus pentafluoride, POF_3 and HF vapors may form

4. FIRST AID MEASURES

Electric Shock / Electrocution: Seek immediate medical assistance if an electrical shock or electrocution has occurred (or is suspected).

Contact with Leaked Electrolyte: The constituent battery cells are sealed. Contents of an open (broken) constituent battery cell can cause skin irritation and/or chemical burns. If materials from a ruptured or otherwise damaged cell or battery contact skin, flush immediately with water and wash affected area with soap and water. If a chemical burn occurs or if irritation persists, seek medical assistance.

For eye contact, flush with significant amounts of water for 15 minutes without rubbing and see physician at once.

Inhalation of Electrolyte Vapors: If inhalation of electrolyte vapors occurs, move person into fresh air. If not breathing give artificial respiration. Consult a physician.

Vent Gas Inhalation: The constituent battery cells are sealed and venting of cells should not occur during normal use. If inhalation of vent gases occurs, move person into fresh air. If not breathing give artificial respiration. Consult a physician.

5. STORAGE PRECAUTIONS

Powerwalls, Powerpacks, and battery subassemblies should be stored in approved packaging prior to installation.

Do not store Tesla Energy Products in a manner that allows terminals to short circuit (do not allow the formation of an electrically-conductive path).

Elevated temperatures can result in reduced battery service life. Powerwall and Powerpack systems can withstand temperatures of -30°C to 60°C for up to 24 hours. However, Tesla Energy products stored for longer than one month should be stored at temperatures between -20°C and 30°C (-4 °F and 86 °F), at humidity <70%, and protected from condensation. Extended storage (more than a month) at temperatures outside the recommended range can result in degradation of product lifetime. Storage in areas where temperatures routinely approach or exceed 80°C (176°F) could result in a hazardous condition. Do not store Tesla Energy Products near heating equipment.

Ideally, a Tesla Energy Product should be stored at 50% state of charge (SOC) or less. Tesla Energy Products should not be stored for extended periods either at a full state of charge (SOC) or completely discharged since both conditions adversely impact battery life. Tesla Energy Products should not be stored untended longer than twelve (12) months since battery service life likely will be adversely impacted.

The storage area should be protected from flooding.

Extended storage areas should be compliant with the appropriate local fire code requirements.

Acceptable storage density of battery packs and storage height of battery packs will be defined by the local authority having jurisdiction. Requirements and limits will be based upon a number of factors including the structural and fire protection characteristics of the storage area and recommendations for fire protection promulgated by the National Fire Protection Association (NFPA) and similar organizations. At the time of this writing, no Commodity Classification has been defined for lithium-ion cells or battery packs (See NFPA – 13 Standard for the Installation of Sprinkler Systems). Until a Commodity Classification has been defined based on testing by NFPA or a similar organization, Tesla recommends treating lithium-ion cells and batteries in packaging as equivalent to a Group A Plastic Commodity.

6. INSTALLATION PRECAUTIONS

Elevated temperatures can result in reduced battery service life, or a hazardous condition.

The desired installation temperature for Tesla Energy Powerwall and Powerpack is between -20 °C and 50°C (-4 °F and 122 °F). Installation in areas with ambient temperatures over 50°C (122°F) is not recommended as this can result in degradation of product lifetime or a hazardous condition.

Installation in areas where temperatures routinely approach or exceed 80 °C (176 °F) could result in a hazardous condition. Do not install batteries near heating equipment.

The installation area should be protected from flooding.

Installation areas should be compliant with the appropriate local fire code requirements.

7. HANDLING, STORAGE, & TRANSPORTATION OF DAMAGED TESLA ENERGY PRODUCTS

If a Tesla Energy Product has been damaged (battery enclosure has been dented or compromised), it is possible that heating is occurring that may eventually lead to a fire. Damaged or opened cells/batteries can result in rapid heating (due to exothermic reaction of constituent materials), the release of flammable vapors, and propagation of self-heating and thermal runaway reactions to neighboring cells.

Before handling or transporting a damaged Tesla Energy Product, wait at least 1 hour. Smoke may be an indication that a thermal reaction is in progress. If no smoke, flame, leakage of electrolyte, leakage of coolant, or signs of heat has been observed for 1 hour, the Tesla Energy Product may be disconnected and moved into a safe location. Please contact Tesla (650) 681-5000 to obtain specific instructions for evaluating, disconnecting, and preparing a damaged Tesla Energy Product for transport.

A damaged Tesla Energy Product should be monitored during storage for evidence of smoke, flame, leakage of electrolyte, leakage of coolant, or signs of heat. If full-time monitoring of the Product is not possible (for example during extended storage), the Product should be moved to a safe storage location.

A safe storage location for a damaged battery will be free of flammable materials, accessible only by trained professionals, and 50 feet downwind of occupied structures. For example, a fenced, open yard may be an appropriate safe location. **DO NOT STORE DAMAGED TESLA ENERGY PRODUCTS ADJACENT TO UNDAMAGED TESLA ENERGY PRODUCTS.** It is possible that a damaged battery may sustain further damage during transportation that may lead to a fire. To further reduce this risk, handle the damaged battery with extreme caution.

8. DISPOSAL PROCEDURES

Tesla Energy lithium-ion batteries do not contain heavy metals such as lead, cadmium, or mercury.

Tesla Energy Products should be disposed of or recycled in accordance with local, state, and federal regulations. Note that regulations regarding disposal of batteries vary by jurisdiction. In the United States batteries are classified as Universal Waste, and in addition, many individual states have specific regulations regarding disposal of battery packs. For example, in California, all batteries must be taken to a Universal Waste handler or authorized recycling facility.

Tesla Energy Products contain recyclable materials. Tesla strongly encourages recycling. For more information on the recycling of Tesla Energy Products, please contact Tesla (650) 681-5000.

If disposing without return to Tesla, please consult with local, state and /or federal authorities on the appropriate methods for disposal and recycling.

9. TRANSPORT INFORMATION	
Lithium-ion batteries are regulated as Class 9 Miscellaneous dangerous goods (also known as "hazardous materials") pursuant to the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, International Air Transport Association (IATA) Dangerous Goods Regulations, the International Maritime Dangerous Goods (IMDG) Code, European Agreements concerning the International Carriage of Dangerous Goods by Rail (RID) and Road (ADR), and applicable national regulations such as the USA's hazardous materials regulations (see 49 CFR 173.185). These regulations contain very specific packaging, labeling, marking, and documentation requirements. The regulations also require that individuals involved in the preparation of dangerous goods for transport be trained on how to properly package, label, mark and prepare shipping documents.	
UN Number	3480
Proper Shipping Name	Lithium ion batteries
Hazard Classification	Class 9 Miscellaneous
Packing Group	N/A

UN Number	3481
Proper Shipping Name	Lithium ion battery contained in equipment or lithium ion battery packed with equipment
Hazard Classification	Class 9 Miscellaneous
Packing Group	N/A

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