

EMPOWERHOUSE



U.S. DEPARTMENT
OF ENERGY
SOLAR DECATHLON 2011

PROJECT MANUAL

TEAM

PARSONS THE NEW SCHOOL FOR DESIGN

MILANO THE NEW SCHOOL FOR MANAGEMENT AND URBAN POLICY



STEVENS
INSTITUTE *of* TECHNOLOGY
THE INNOVATION UNIVERSITY

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August 10 2011

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SUMMARY OF CHANGES

SUMMARY OF CHANGES

Changes to the project manual are outlined below.

EXTERIOR

The rooftop canopy structure has been eliminated

The roof is no longer accessible from the interior and is now at one continuous level

The solar panels have been racked at an angle and include low planting trays.

Exterior materials have been relocated and re-oriented. See plans and elevations.

The specific dimensions, position, and types of fenestration have changed. Total glazed quantity has not changed drastically. See plans and elevations.

FLOOR PLAN

The bathroom, Mechanical room, and kitchen have been moved to the east wall

The bedroom closet has been moved from the East to the South wall of the room

The stair has been changed and now has a L-shaped configuration

The office has been moved from the entryway to the stair area

The ceiling height in the kitchen and bedroom have been raised; the ceiling in the entry has been lowered

The laundry closet has been shifted away from the kitchen

The kitchen has been reconfigured to incorporate an island

STRUCTURE/ASSEMBLY

Panel size of the structural prefabricated wall panels has changed from 4' wide to various sizes, between 8' and 11'. To lift these panels into place a Lull or large forklift will be required.

Connection details between panels has changed from splines and internal steel angles to external steel angle clips. An interior non-structural "finish wall" has been added in several locations.

MECHANICAL

The outdoor condenser unit has moved from the roof to the ground, adjacent to the building.

The mini-split heat pump has been relocated from the kitchen ceiling to above the entry hall.

The heat pump water heater has changed from a GE GeoSpring to an AirGenerate ATI66 (a different heat pump water heater)

ELECTRICAL

The location of the organizer-provided power

EXHIBITION/ DECK

The layout of the decking and ramps has changed, there are two main decked areas at the front and the back of the house, divided with the water tanks that are covered in planters.

A rainwater catchment feature that leads water into a planted rain-garden planter has been added to the exterior design.

the dimensions of the vegetable planters have changed, the planters are now situated on the ground as part of the exterior landscaping.

there is signage in form of printed banners integrated into the railings of the ramps..

A geotextile is now covering the ground as protection of the turf at all uncovered lot areas.

There is no freestanding exhibitry on either the deck nor the open area of the lot.

RULES COMPLIANCE CHECKLIST

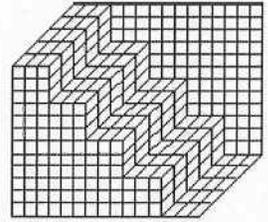
RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 4-2	Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	O-102
Rule 4-2	Construction Equipment	Specifications for heavy machinery	O-102
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	S-501
Rule 4-4	Impact on the Turf	Drawing(s) showing the location, contact area, and soil-bearing pressure of every component resting directly on the turf	S121
Rule 4-5	Generators	Specifications for generators	PM 245
Rule 4-6	Spill Containment	Drawing(s) showing the locations of all equipment, containers, and pipes that will contain liquids at any point during the event	P-101 P102 L-401 L501
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	P601-P901
Rule 4-7	Lot Conditions	Calculations showing that the structural design remains compliant even if 18 in. (45.7 cm) of vertical elevation change exists	S-501
Rule 4-7	Lot Conditions	Drawing(s) showing shimming methods and materials to be used if 18 in. (45.7 cm) of vertical elevation change exists on the lot	S-501
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	G-101
Rule 5-2	Solar Envelope Dimensions	List of solar envelope exemption requests accompanied by justifications and drawing references	N/A
Rule 6-1	Structural Design Approval	List of, or marking on, all drawing and project manual sheets that have been or will be stamped by the qualified, licensed design professional in the stamped structural submission; the stamped submission shall consist entirely of sheets that also appear in the drawings and project manual	S-001, S-101, S-102, S-103, S104, S-121, S-401, S-501, PM
Rule 6-2	Finished Square Footage	Drawing(s) showing all information needed by the rules officials to measure the finished square footage electronically	G-102
Rule 6-2	Finished Square Footage	Drawing(s) showing all movable components that may increase the finished square footage if operated during contest week	G-102, A525 PM 41
Rule 6-3	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route and the ground surface area that will be covered by organizer-provided walkway material	G-111, G-121, G211
Rule 7-1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	L-101

Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	NA
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	PM 250
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	N/A
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	N/A
Rule 8-5	Village Grid	Completed interconnection application form.	PM 44
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	G-122
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	PM
Rule 8-5	Village Grid	One-line electrical diagram	E-901
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	E-601
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	A-201
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	G-122
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	P-101
Rule 9-1	Container Locations	Drawing(s) demonstrating that the primary supply water tank(s) is fully shaded from direct solar radiation between 9 a.m. and 5 p.m. EDT or between 8 a.m. and 4 p.m. solar time on October 1	P-101
Rule 9-2	Team-Provided Liquids	Quantity, specifications, and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure testing, and thermodynamic system operation	PM 38
Rule 9-3	Greywater Reuse	Drawing(s) showing the layout and operation of greywater reuse systems	N/A

Rule 9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	L501- L502
Rule 9-6	Thermal Mass	Drawing(s) showing the locations of liquid-based thermal mass systems	N/A
Rule 9-6	Thermal Mass	Specifications for components of liquid-based thermal mass systems	N/A
Rule 9-7	Greywater Heat Recovery	Drawing(s) showing the layout and operation of greywater heat recovery systems	N/A
Rule 9-8	Water Delivery	Drawing(s) showing the complete sequence of water delivery and distribution events	P-101, P902 PM 38
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	PM 38
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	OP-102, P-903
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	PM 158
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	G111-G121

STRUCTURAL CALCULATIONS

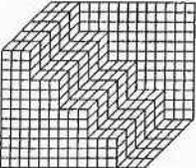
PROJECT: SOLAR DECATHALON
PROJECT No: 029055
DATE: MAY 2011
ENG: MD



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EMPOWERSHOUSE



 Buro Happold	PROJECT: SOLAR DECATHALON	PROJECT #: 029055	PAGE #:
	DESCRIPTION: 	AUTHOR / DATE: MD 110503	
		CHECKED BY / DATE: <i>EH 05/03/11</i>	

THIS CALCULATION PACKAGE IS FOR REFERENCE ONLY

THESE CALCULATIONS ARE NOT FOR CONSTRUCTION AND ARE ONLY TO BE USED TO DEMONSTRATE THE STRUCTURAL SYSTEM OF THE BUILDING

CALCS DO NOT GOVERN OVER WHAT IS SHOWN IN THE CONSTRUCTION DOCUMENTS, AND ARE TO BE USED WITH ALL CODES AND DOCUMENTS REFERENCED IN THE GENERAL NOTES

CALCS ARE FOR A ONE STORY STRUCTURE ONLY
 NOTIFY ENGINEER OF ANY CHANGES MADE TO THE SHAPE OR SIZE OF THE STRUCTURE

GENERAL NOTES:

1. THE PROJECT SHALL CONFORM TO THE *2009 INTERNATIONAL BUILDING CODE, ALONG WITH THE DISTRICT OF COLUMBIA BUILDING CODE SUPPLEMENT 1999*. ALL LOADS SHOWN ARE FACTORED.
2. ALL STRUCTURAL WORK SHALL CONFORM TO THE PROJECT SPECIFICATIONS, ALL DRAWING NOTES, AND APPLICABLE REFERENCE STANDARDS. THE SCOPE OF WORK IS NOT SOLELY DEFINED BY THESE DOCUMENTS.
3. TYPICAL DETAILS APPLY THROUGHOUT THE PROJECT, EVEN IF NOT SPECIFICALLY REFERENCED IN PLANS OR DETAILS. DETAILS OF CONSTRUCTION NOT FULLY SHOWN OR NOTED ON THE DRAWINGS NOR CALLED OUT IN THE SPECIFICATIONS SHALL BE OF THE SAME SIZE AND CHARACTER AS FOR SIMILAR CONDITIONS WHICH ARE SHOWN AND NOTED.
4. DO NOT USE SCALED DIMENSIONS; USE ONLY WRITTEN DIMENSIONS. WHERE NO DIMENSION IS PROVIDED, CONSULT THE ARCHITECT FOR CLARIFICATIONS BEFORE PROCEEDING WORK.
5. SEE ARCHITECTURAL DRAWINGS FOR SITE POSITIONING AND PROJECT DATUM REFERENCE (0'-0") SHOWN ON ARCHITECTURAL DRAWINGS.
6. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF PERSONS AND PROPERTY AND THE MEANS AND METHODS OF CONSTRUCTION.
7. STRUCTURAL ELEMENTS SHALL BE CENTERED ABOUT GRIDLINES OR DIMENSION LINES, UNLESS OTHERWISE NOTED.
8. ALL STRUCTURAL WORK SHALL BE COORDINATED WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING, ETC. REQUIREMENTS. REFER TO ARCHITECTURAL DRAWINGS FOR DIMENSIONS NOT SHOWN ON PLAN. DISCREPANCIES AND/OR INTERFACES SHALL BE REPORTED TO THE ARCHITECT IMMEDIATELY.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ENGINEERED DESIGNS AND COORDINATION OF FINAL SUPPORT DETAILS OF NON-STRUCTURAL ITEMS IDENTIFIED IN CONTRACT DOCUMENTS INCLUDING; BUT NOT LIMITED TO:
 - A. MECHANICAL EQUIPMENT ATTACHMENTS
10. DETAILS SHOWN IN STRUCTURAL DRAWINGS ARE INDICATIVE IN NATURE. CONTRACTOR TO DESIGN, COORDINATE, AND/OR PROVIDE ADDITIONAL FRAMING AS REQUIRED.
11. OPENINGS SHALL NOT BE MADE IN ANY STRUCTURAL MEMBER UNLESS SPECIFICALLY SHOWN ON THE STRUCTURAL DRAWINGS OR APPROVED BY THE STRUCTURAL ENGINEER.
12. DEFICIENT WORK AND WORK NOT IN CONFORMANCE WITH THE CONTRACT DOCUMENTS AS IDENTIFIED BY THE ARCHITECT OR INSPECTOR SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. CONTRACTOR SHALL COMPENSATE OWNER FOR SERVICES ARISING FROM DEFICIENT WORK.
13. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ANY REQUIRED DEWATERING OF THE SITE DURING CONSTRUCTION.

DESIGN LOADS:

BUILDING LOADS

1. STRUCTURAL DESIGN OF THIS BUILDING IS IN ACCORDANCE WITH THE 2009 INTERNATIONAL BUILDING CODE, ALONG WITH THE DISTRICT OF COLUMBIA BUILDING CODE SUPPLEMENT 1999.

A. LIVE LOAD 40 PSF (FIRST FLOOR DESIGNED FOR 100PSF ASSEMBLY LL)

B. DEAD LOAD

JOISTS/STUDS

NI-90x 4.0 PLF

NI-40x 2.9 PLF

NI-20x 2.4 PLF

DECK 4 PSF

BLOCKING 1.5 PSF

MISC/MECH 5 PSF

INTERIOR PARTITIONS 10 PSF

C. WIND LOAD

BASIC WIND SPEED 120 MPH

IMPORTANCE FACTOR 1.0

EXPOSURE B

D. SNOW LOAD

NO DRIFT REGIONS 20 PSF

DRIFT REGIONS 40 PSF

E. SEISMIC LOAD

SOIL PROFILE D

SITE CLASS II

FOR **TEMPORARY** PAD FOOTINGS AT
TEMPORARY SITE LOCATION IN

WASHINGTON DC

NOTIFY ENGINEER OF ANY CHANGE
OF SITE LOCATION

F. ROOF DEAD LOAD

OPTIGREEN PANELS 15 PFS

ROOF PANELS 10 PSF

G. ROOF LIVE LOAD

20 PSF (SERVICE)

WOOD:

1. ALL FRAMING LUMBER AND DETAILS OF WOOD CONSTRUCTION SHALL CONFORM TO THE "NATIONAL DESIGN SPECIFICATION FOR STRESS GRADE LUMBER AND ITS FASTENINGS" (INCLUDING SUPPLEMENTS).
2. ALL ENGINEERED WOOD PRODUCTS ARE TO BE PROVIDED BY NORDIC ENGINEERED WOOD AND ARE TO MEET ALL SPECIFICATIONS OF "NORDIC ENGINEERED WOOD RESIDENTIAL CONSTRUCTION GUIDE" OR APPROVED EQUAL.
3. LAMINATED LUMBER SECTION ARE OF GRADE 24F-1.9E LVL, AS PER NORDIC ENGINEERED WOOD, OR APPROVED EQUAL.
4. REFER TO "NORDIC RESIDENTIAL CONSTRUCTION GUIDE" FOR ALL INFORMATION INCLUDING, BUT NOT LIMITED TO:
 - A. PENETRATION ALLOWANCES IN WOOD MEMBERS
 - B. BEARING REQUIREMENTS OF JOISTS
 - C. CONNECTION / BLOCKING DETAILS
5. TYPICAL LUMBER SHALL BE OF THE FOLLOWING MINIMUM GRADE AND SHALL BE GRADE STAMPED BY A RECOGNIZED GRADING AGENCY, SHALL BE SURFACED DRY, AND SHALL BE USED AT A MAXIMUM OF 19% MOISTURE CONTENT.

SPECIES	SPRUCE-PINE-FUR
GRADE	2
MIN. Fb	875
MIN. Fc	1,150
MODULUS OF ELASTICITY, E	1,400,000 PSI

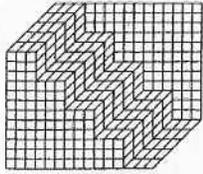
6. PLYWOOD SHEATHING SHALL BE APA GRADE STAMPED FOR THE SPECIFIED SPAN, AND SHALL BE MADE WITH EXTERIOR GLUE, AND SHALL BE OF THE FOLLOWING THICKNESS:

FLOORS/ROOFS:	APA RATED SHEATHING EXPOSURE I
NON-SHEAR WALLS:	APA RATED SHEATHING EXTERIOR EXPOSURE I
SHEAR WALLS:	APA RATED STRUCTURAL SHEATHING GRADE I EXTERIOR EXPOSURE I

7. ALL PLYWOOD SHEATHING SHALL BE GLUE AND NAILED TO FLOOR JOISTS USING APA APPROVED ELASTOMERIC CONSTRUCTION ADHESIVE AND CODE REQUIRED NAILING.
8. DETAILS OF WOOD FRAMING SUCH AS NAILING, BLOCKING, BRIDGING, ETC. SHALL CONFORM TO THE *2009 INTERNATIONAL BUILDING CODE* OR THE "NORDIC RESIDENTIAL CONSTRUCTION GUIDE" UNLESS GREATER REQUIREMENTS ARE SHOWN IN DETAILS.
9. WHERE BEAMS ARE FLUSH FRAMED TO HEADER, USE APPROVED TYPE BEAM HANGER.
10. NO BEAMS, EXCEPT AS SHOWN IN DETAILS, SHALL BE CUT OR NOTCHED WITHOUT APPROVAL..

GRAVITY

LOADS



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STRUCTURAL CAPACITY (JOISTS)

FIRST FLOOR GRAVITY

NI-90x @ 16" O.C.
12' SPAN 11 7/8" DEPTH

NORDIC LAM PROVIDES THAT
NI-80 @ 12' SPAN w/ 11 7/8" DEPTH
HAS A CAPACITY OF 299 plf (FACTORED LOAD)

UNIFORM CAPACITY > 225 psf @ 12' SPAN @ 16" O.C.

$$1.2D + 1.6L = 1.2(20) + 1.6(100) = 184\# \checkmark$$

LOW ROOF GRAVITY

NI-40x DEPTH 11 7/8"
@ 16" O.C.
12' SPAN

NORDIC LAM PROVIDES
CAPACITY OF 189 plf ($\Delta = \frac{5}{180} LL$)
284 plf (FACTORED LOAD CAPACITY)

UNIFORM CAPACITY = 142 psf (DEFLECTION CONTROLLED)

$$1.2D + 1.6S + L = 1.2(20+15) + 1.6(30) + 20 = 110\# \checkmark$$

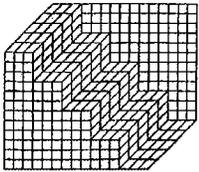
HIGH ROOF GRAVITY

NI-20 DEPTH 11 7/8"
@ 24" O.C.
9' SPAN

NORDIC LAM PROVIDES
CAPACITY OF 222 plf (FACTORED LOAD)

UNIFORM CAPACITY = 111 psf

$$1.2D + 1.6S = 1.2(20) + 1.6(30) = 72\# \checkmark$$



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BEAMS

FIRST FLR

	SPAN	TRSB WIDTH	(AXIAL+SW) WALL ABOVE	AREA LOAD	ALLOWABLE UNIFORM LOAD
GLA	5'-3"	6'	720 p/f	120 psf	1440 p/f
GLB	" "	12'	-	120 psf	1440
GLC	" "	6'	720 p/f	120 psf	1440

LOW ROOF

GLA	16'	6'	-	85 psf	510 p/f
GLB	16'	12'	-	85 psf	1020
GLC	16'	6'	-	85 psf	510
GL3	11'	-	318 p/f	-	318
GL4	11'	-	318 p/f	-	318

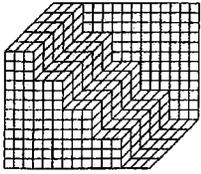
SIZES

FIRST FLR

	LVL
GLA	3 1/2" x 9 1/2"
B	3 1/2" x 9 1/2"
C	3 1/2" x 9 1/2"

LOW ROOF

GLA	BW	
B	(2) 3.5 x 14	(2) 3.5 x 9 1/2 @ North short span
C	BW	
3	(3) 2 x 12	
4	(3) 2 x 12	



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OVERHANG

JOISTS

$$5 + 30 = 35 \text{ p.s.f.}$$

8' SPAN @ 16" O.C.

2x8 ✓ O.K. per JBC

BEAMS

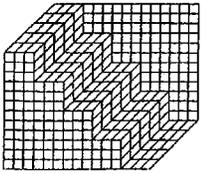
$$2 \text{ SPAN } w = 35 (4') = 140 \text{ p.f.}$$

(3) 2x12 ✓

COLUMNS

$$(30 + 5 \text{ p.s.f.}) (14 \times 5) = 2.5 \text{ K}$$

3.5" x 7" Col QP = 24K See Col. CALCS. ✓



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WALL VERTICAL LOADS

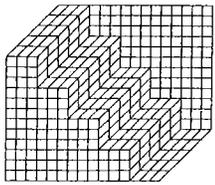
SECOND FLR

$$4ft \times [1.2(20) + 1.6(30)] = 288 \text{ plf}$$

FIRST FLR

$$6' \times [1.2(20+15) + 1.6(30) + 20] = 660 \text{ plf}$$

ADDITIONAL 1.2k WHERE SECOND FLR WALLS COME DOWN.
(BEARING ON POST)



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NORDIC I-JOIST BEARING CAPACITY

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BEARING WALL CAPACITY

NI-40x @ 16" O.C.

THE AXIAL COMPRESSION CAPACITY OF THE I-JOISTS IS CONSIDERED TO BE DEVELOPED ONLY BY THE AXIAL COMPRESSION CAPACITY OF THE FLANGES, WHICH ARE ASSUMED TO BE BRACED IN THEIR WEAK AXIS BY THE WEB OF THE I-JOIST

Per NORDIC JOIST CONSTRUCTION GUIDE
FLANGES USE ONLY black spruce MSR lumber.

1950F MSR (see p. 7, Nordic Joist construction Guide)

1950F - 1.5 E (lowest grade of 1950F available per 2005 NDS)

$F_b = 1950$
 $F_z = 1375$
 $F_c = 1800$
 $E_{min} = 760,000$

$l_e = 10 \text{ ft} = 120 \text{ in}$
 $d = 2.5 \text{ in}$

$C_D = 0.9$
 $C_M = 1$
 $C_F = 1$
 $C_T = 1.05$
 $C_i = 1$
 $c = 0.8$

$$F_{CE} = \frac{0.822 E_{min}}{(l_e/d)^2} = 271$$

$$F_c^* = F_c C_D C_M C_T C_F C_i = 1701$$

$$C_P = \frac{1 + \frac{F_{CE}}{F_c^*}}{2c} - \sqrt{\left[\frac{1 + \frac{F_{CE}}{F_c^*}}{2c} \right]^2 - \frac{F_{CE}/F_c^*}{c}} = 0.154$$

$$P_{CA} = F_c^* C_P = 262 \text{ psi}$$

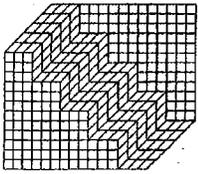
$$F_{CA} = (2.5)(1.5)(P_{CA}) = 982 \text{ lbs}$$

$$\Phi F_{CA} = 884 \text{ lbs (single Flange)}$$

$$I = \frac{2.5^3 \cdot 1.5}{12} = 1.95 \text{ (assume braced in weak axis by Joist web)}$$

$$P_{Per} = \frac{\Phi^2 EI}{l^2} = 914 \# > 884 \# \quad (2)884 \left(\frac{12}{16}\right) = 1.3 \text{ klf}$$

BEARING WALL CAPACITY



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COLUMNS

@ B.5
 $A_T = 108$
 $P = 9.2^k$

(2) 3 1/2" x 7" GL POST SEE CALCS ON FOLLOWING PAGE



@ B.4
 $A_T = 156$
 13.3^k

(2) 3 1/2" x 7" GL POST SEE CALCS ON FOLLOWING PAGE



@ B.3
 $A_T = 120$
 10.2^k

(2) 3 1/2" x 7" GL POST SEE CALCS ON FOLLOWING PAGE



@ B.2
 $A_T = 72$
 6.2^k

(2) 3 1/2" x 7" GL POST SEE CALCS ON FOLLOWING PAGE



@ A.4
 $A_T = 24$
 1.2^k

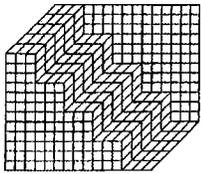
(2) 3 1/2" x 7" GL POST SEE CALCS ON FOLLOWING PAGE



@ A.3
 $A_T = 24$
 1.2^k

(2) 3 1/2" x 7" GL POST SEE CALCS ON FOLLOWING PAGE





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CHECKED BY / DATE:

ETH 05/03/11

WOODEN GL POST CAPACITY

3.5" x 7" LVL GL POST

$$F_{ce} = \frac{0.822 E_{min}}{(L_e/d)^2}$$

$$E_{min} = 1,900,000$$
$$L_e = 10ft = 120 in$$
$$d = 3.5 in$$

$$F_{ce} = 1328 \text{ ksi}$$

$$c = 0.9 \text{ (GL)}$$

$$F_c^* = 1150 \times 0.9 \times 1 \times 1 \times 1.05 \times 1 = 1087 = F_c^*$$

$$\frac{F_{ce}}{F_c^*} = 1.22$$

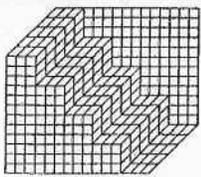
$$C_p = \frac{1 + (F_{ce}/F_c^*)}{2} - \sqrt{\left[\frac{1 + (F_{ce}/F_c^*)}{2} \right]^2 - \frac{(F_{ce}/F_c^*)}{c}}$$

$$= 1.11 - \sqrt{1.52 - 1.36}$$

$$C_p = 0.71$$

$$P_{cr} = F_c^* C_p = 772 \text{ psi}$$

$$\phi F_{ca} = (0.9)(P_{cr})(3.5 \times 7) = 17k = \phi F_{ca}$$



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DECK LOADS

DECK

6' SPAN 100 psf
@ 16" O.C.

2x8

RAMP

5' SPAN 100 psf
@ 16" O.C.

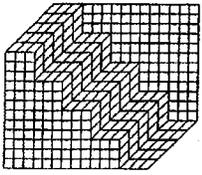
2x8 @ 12"

BEAMS

400plf - 11' SPAN (2) 2x12

600plf - 3 1/2' SPAN 2x12

LATERAL **LOADS**



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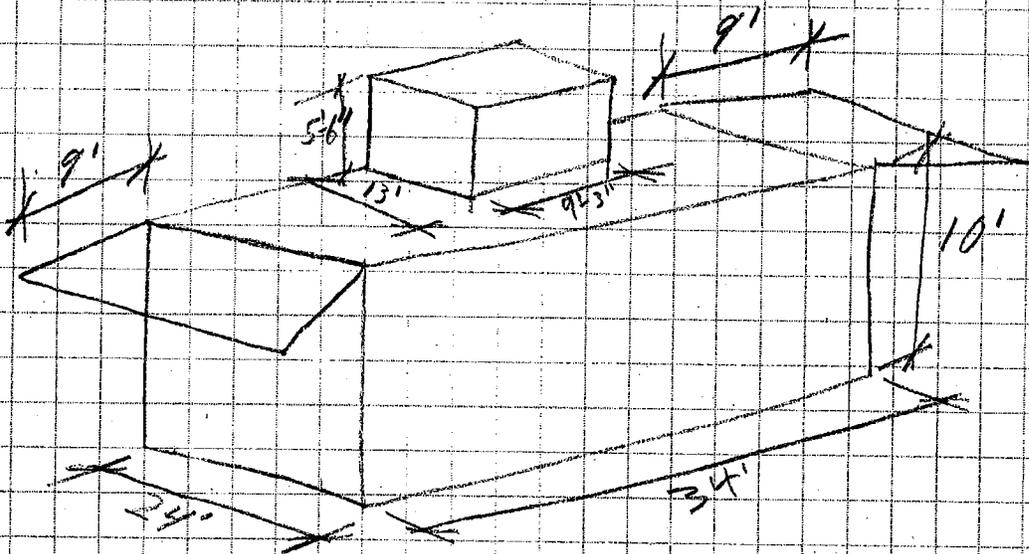
WIND LOADS

EXPOSURE CATEGORY B

WIND SPEED = 90 mph \Rightarrow DESIGN FOR 120 mph, Competition Spec.

IMPORTANCE FACTOR = 1

SLOPE $< 5^\circ$



WIND FORCE RESISTING SYSTEM PRESSURES

COMPONENTS & CLADDING PRESSURES

WALLS 22.8

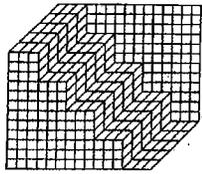
-34.7

for 10ft² PANELS or greater

ROOFS -27.4

-28.1

OVER HANGS -38.4



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WIND REACTIONS

BUILDING FORCES

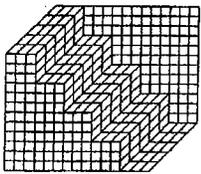
	N-S WIND	E-W WIND
BUILDING SHEAR	7.1k	9.0k
FIRST FLR SHEAR	4.4k	5.1k
SECOND FLR SHEAR	0.9k	0.6k

CLADDING FORCES

FIRST FLR WALL PANEL 10' SPAN $M_w = 0.43 \frac{k \cdot ft}{ft}$ $V_w = 0.173 \frac{k}{ft}$ ✓

FIRST FLR ROOF PANEL 12' SPAN $M_w = 0.51$ $V_w = 0.169$ ✓

O.K. SEE NORPIC JOIST CONSTRUCTION GUIDE P. 7



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SEISMIC LATERAL LOAD

$$V = C_s W$$

$$C_s = \frac{S_{ps}}{(R/F)} = 0.16$$

TABLE 12.2-1 R = 2

$$11.4.4 \quad S_{ps} = \frac{2}{3} S_{ms} = \frac{2}{3} F_a S_s = 0.32$$

$\begin{matrix} \swarrow > 0.3 \\ \searrow > 1.6 \end{matrix}$

HIGH ROOF

$$\begin{aligned} \text{ROOF WEIGHT} &= \overset{20\text{psf} + \text{DL}}{(5.8\text{psf})} (8 \times 13) = 2683\# \\ \text{WALL WEIGHT} &= 903\# \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{ROOF WEIGHT} \\ \text{WALL WEIGHT} \end{aligned}} \right\} = 3590\#$$

$$V_{HR} = 575\# \quad \text{WIND GOVERNS}$$

LOW ROOF

$$\begin{aligned} \text{ROOF WEIGHT} &= \overset{\text{DL } 9\#}{(35\text{psf} + 9\#)} (24 \times 34) = 29000. \\ \text{WALL WEIGHT} &= [9 \times (24 + 24 + 34 + 34)] \times 5 = 5400 \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{ROOF WEIGHT} \\ \text{WALL WEIGHT} \end{aligned}} \right\} = 34000\#$$

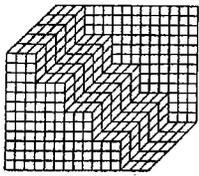
$$V_R = 5.4^k$$

TOTAL

$$\text{WALL} = [(24 + 24 + 34 + 34) \times 10] \times 9\text{psf} + [6 \times (8 + 8 + 13 + 13)] \times 6 = 12^k$$

$$\text{ROOFS} \overset{+DL}{=} 36^k$$

$$V_T = 7.7^k$$



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SHEAR WALLS

LOADS (shear @ Top of...)

N-S

E-W

FIRST FLR

5.4^k 4.4^w

5.4^k 5.1^w

SEISMIC

SEISMIC

SECOND FLR

0.9^k 0.6^w

0.6^k 0.6^w

WIND

WIND

SHEAR IN FIRST FLR ACCOUNTING FOR FUTURE 2ND STORY.

SEISMIC GOVERNS $\Rightarrow 5.4 - 0.6 = 4.8$ FIRST FLOOR SEISMIC

$4.8 + 0.5 \times 4.8 = 7.2^k$

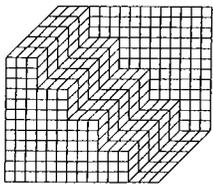
Second FLR
~ 1/2 1st FLR

Design FOR 8^k

4^k TO EACH WALL

SEE CONSTRUCTION DOCUMENTS FOR SHEAR WALL LOCATION + NAILING Schedule

TEMPORARY **FOUNDATION** **DESIGN**



Buro Happold

PROJECT: **EMPOWERHOUSE**

PROJECT #: **029055**

PAGE #:

DESCRIPTION: **FOOTING LOADS**

AUTHOR / DATE: **MD 110718**

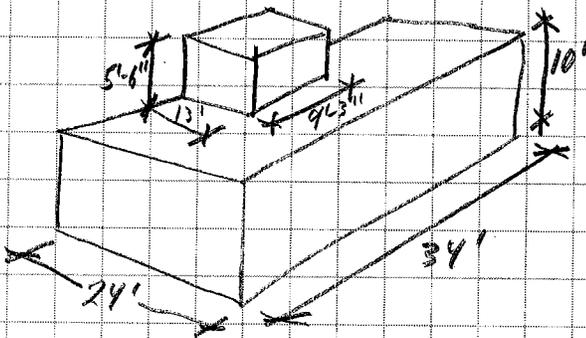
PER SECTION 5.5 FOUNDATION

CHECKED BY / DATE:

BUILDING WIND LOADS

85 mph \Rightarrow A=11.5 E=-13.8 G=-9.6
Slope $< 5^\circ$ C=7.6 F=-7.8 H=-6.1

Importance = 1
Exposure C \Rightarrow $\alpha = 1.21$



WIND E-W

1.) HORIZONTAL FORCES @ BASE

$q_{wz} = 3.4' = 10\% (34)$, $d_{avg} = 3'$

$2850 + 515 = 3365 \#$

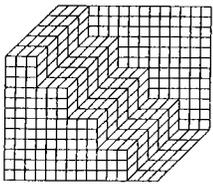
2.) VERTICAL UPLIFT

$3876 + 2893 = 6770 \#$

$6770 / (34 \times 24) = 8.3 \text{ psf}$

$1.6 W_{uplift} < 0.9 D \Rightarrow$ * No Uplift Case

WIND LOADS ARE PER ASCE 7-05
EXPOSURE CATEGORY AND WIND SPEED ARE
PER 2011 SOLAR DECATHALON DESIGN CRITERIA
SECTION 5.5 - FOUNDATION



Buro Happold

PROJECT:

EMPOWERHOUSE

PROJECT #:

029055

PAGE #:

DESCRIPTION:

TEMPORARY FOOTING CAPACITY

AUTHOR / DATE:

MD 110718

CHECKED BY / DATE:

TEMPORARY FOUNDATION DESIGN

GOVERNING LATERAL LOAD = WIND E-W = 3.4^k

$5/8"$ A490 bolts per foundation

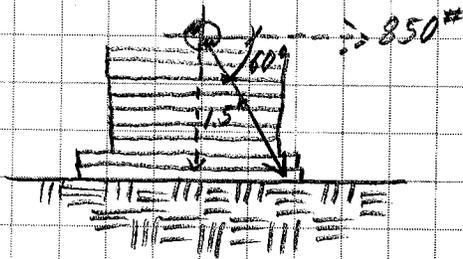
Shear Capacity of a single bolt = 13.8^k ✓ O.K.

EXTERIOR

ASSUME MIN OF 4^V FOOTINGS RESIST LATERAL FORCE FOR DESIGN

$850^{\#}$ per footing = V

$$DL = \underbrace{(5 \times 5 (15))}_{\text{FLOOR WT}} \times 2 + \underbrace{15 \times 10 \times 5}_{\text{2 FLRS WALL WT}} = 1500^{\#} \quad \left. \begin{array}{l} \text{Min DL for Lateral Design} \\ \text{of FOOTING} \end{array} \right\}$$



Max.
FOOTINGS TO ACHIEVE 60° FROM HORIZONTAL
BETWEEN WORK POINT OF LOAD TO
ANY EXTERIOR POINT OF FOOTING

(4) $3/4"$ EARTH ANCHORS PER FOOTING

$220^{\#}$ Shear Capacity Min ✓ O.K.

PROVIDE CONNECTION APPROVED FOR $900^{\#}$ OF SHEAR FORCE
MIN + BEARING CAPACITY OF FOOTING. FOR CONNECTION
OF MAIN STRUCTURE TO FOOTING.

DETAILED WATER BUDGET

Competition Water Usage

Day	Competition	Time (pm)																Volume of Water Usage (gal)
		2:30	3:00	3:30	4:00	4:30	5:00	5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00	9:30		
10	Clothes Washer					18											18	
	Dishwasher					2.38											2.38	
	Cooking					1											1	
	Hot Water								15								15	
	Total Per Day																36.38	
11	Clothes Washer										18						18	
	Hot Water (2 draws)											15		15			30	
	Total Per Day															48		
12	Clothes Washer										18						18	
	Dishwasher										2.38						2.38	
	Cooking										1						1	
	Hot Water (2)											15		15			30	
	Total Per Day															51.38		
13	Hot Water (3)				15			15				15					45	
Total Per Day																45		
14	Clothes Washer (2)	18															36	
	Dishwasher										2.38						2.38	
	Hot Water (2)					15			15								30	
	Cooking for Movie night															MOVIE NIGHT	10	
	Total Per Day																78.38	
15	Cooking				1												1	
	Hot Water (2)						15		15								30	
	Cooking for Movie															MOVIE NIGHT	10	
	Total Per Day															41		
16	Clothes Washer (2)				18						18						36	
	Dishwasher										2.38						2.38	
	Hot Water (2)								15					15			30	
	Total Per Day															68.38		
17	Clothes Washer				18												18	
	Dishwasher										2.38						2.38	
	Hot Water (2)						15		15								30	
	Cooking					1											1	
	Total Per Day															51.38		
COMPETITION TOTAL																		420

Activity
Extra Time

Water Budget Totals	
Competition Water Usage	420
Fire Protection	260
Vegetation	100
Contingency	220
TOTAL	1000

Filling Schedule				
Day	Locations (Ref to P-101)	Openings	Clearance	Volume
5	Water Supply tank #1	24"	>12"	1000
TOTAL				1000

Val Schedule				
Day	Locations (Ref to P-101)	Openings	Clearance	Volume
20	Grey Water Tank #1	24"	>12"	900
TOTAL				900

SUMMARY OF UNLISTED ELECTRICAL COMPONENTS

SUMMARY OF UNLISTED ELECTRICAL COMPONENTS

SUMMARY

There are no unlisted electrical components.

SUMMARY OF RECONFIGURABLE FEATURES

SUMMARY OF RECONFIGURABLE COMPONENTS

The design incorporates three reconfigurable components:

A: Operable counter at kitchen island.

The kitchen counter incorporates an operable counter section that can be pulled up on the side facing the living room to allow using the island as a small dining table with a workspace.

See drawings A525

B: Hidden Desk under Light Loft

The space under the staircase incorporates among a series of storage elements a fold down desk that creates additional flexible workspace. When folded up the flap lines up flush with the cabinetry around.

See drawing A 522

C. Hidden Twin-sized bed under staircase

Below the stringer of the stair is a pull-out twin bed that allows the flex space in the middle of the house to convert into a sleeping space.

See drawing A 405 and A521

INTERCONNECTION APPLICATION FORM

Interconnection Application Form

Parson New School Stevens / Lot Number 204

PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
Yingli Solar	Two (2) strings of eight (8) Yingli YL260C-30b modules	4.16kW DCp

Total DC power of all arrays is 4.2 kW (in tenths)

INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
Fronius	IG 5100	240VAC	5.1kW AC	One (1)

Total AC power of all inverters is 5 kW (in whole numbers)

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

1. One-Line Electrical schematic – the loads do not have to be detailed.
2. Calculations of service/feeder net computer load and neutral load (NEC 220)
3. Plan view of the lot showing the house, decks, ramps, tour paths, the service point and the distribution panel or load center.

Provide the Team’s “Electrical Engineer” contact in the “Team Officer Contact Info” database on the Yahoo Group as required per Rule 3-2.

Please see the “SD2011_Microgrid_Interconnection_Process_v1” file located the Files/Rules/Team Interconnection Process section of the Yahoo Group for more details on the interconnection process.

ENERGY ANALYSIS RESULTS AND DISCUSSION

ENERGY ANALYSIS RESULTS AND DISCUSSION

1.0 - EXECUTIVE SUMMARY

1.1 - INTRODUCTION

The Empowerhouse team's Energy Analysis Report is a detailed overview of all the systems in the house that directly affect energy performance. Each section includes an explanation of the stages of each system design, including the development, the specific modeling and the assumptions used to predict the overall performance.

This document demonstrates the relationships between the various systems and types of designs used in the Empowerhouse. Most importantly, it explains the ways in which the mechanical systems have been integrated into the architecture and overall feel of the house, while still maintaining highly efficient and reliable operation.

1.2 - FUNCTIONALITY

The Empowerhouse has been designed to function in the peak heating and cooling periods of Washington D.C.. The house has a planned project afterlife in Deanwood, Washington, D.C. (as part of the team's partnership with Habitat for Humanity); Hence, efficient performance in the yearly D.C. climate (and not just for the competition month of September) was a critical factor in the design of the home. Additionally, the home's mechanical systems have been designed with a strong emphasis on reliability. This consideration is important for the family living in the house after the competition (since it will help to minimize future operation and maintenance costs for the house).

1.3 - PASSIVE HOUSE

To meet the efficiency goals the team has set, the house incorporates Passive House principles for energy usage and system design. Passive Houses are super-insulated and extremely air-tight buildings. Generally, they minimize a home's heating load by taking advantage of solar gains (through windows), and internal gains (from people, electronics, and appliances). Similarly, they minimize a home's cooling load through the use of strategic glazing orientation and shading devices. Also, the highly airtight nature of passive houses provide the opportunity to save energy by recovering heat from exhaust air (by using a heat or energy recovery ventilator) before expelling the air outside. The team worked closely with passive house consultants in order to ensure the validity of the design. The design was also presented to Passivhaus Institute US Executive Director Katrin Klingenburg and Passive House founder Dr. Wolfgang Feist.

2.0 - ENERGY ANALYSIS

2.1 - INTRODUCTION

This section discusses the thermal analysis of the Empowerhouse.

2.2 - ENERGY MODELING

2.2.1 - ENERGY MODELING MOTIVATION

Energy analysis is a critical step in the iterative process of designing an energy efficient home. It is exceptionally important for the sizing of the Mechanical and Photovoltaic systems. By minimizing heating and cooling loads (via an iterative design process between engineers and architects), the engineering systems included in the house were able to be minimized.

2.2.2 - HOUSE DESIGN PHILOSOPHY

Energy efficient performance was an extremely influential design driver for the Empowerhouse. This was a guiding design philosophy for two main reasons. First of all, optimal performance is critical for the success of the Empowerhouse in the measured contests of the Solar Decathlon competition. Second, energy efficient performance will be very important for the Habitat for Humanity home-owners that will reside in the home after completion of the competition. By minimizing the need for mechanical systems to heat and cool the home, the team was able to design a

cost-efficient photovoltaic array to eliminate the end-user's energy costs in the future.

2.3 - DETAILED ENERGY ANALYSIS

2.3.1 - ENERGY ANALYSIS RESULTS AND DISCUSSION

The team conducted a thorough energy analysis throughout the design of the Empowerhouse home using Passive House Planning Package software. This study had a significant impact on the design of the home, allowing the Empowerhouse team to create a cost-effective energy-efficient design.

2.3.2 - ANALYSIS SOFTWARE

The heating and cooling demands were calculated with Passive House Planning Package software (referred to as PHPP henceforth). PHPP was designed by the Passivhaus Institut for the purpose of helping engineers, designers, and builders to design homes to Passivhaus energy standards. This software package was used for performing the energy analysis (despite not aiming to meet Passivhaus standards on the mall) because of the team's planned after-life for the project.

2.3.3 - THERMAL DESIGN PARAMETERS

PHPP incorporates a vast amount of inputs in its calculations. Some of this information is listed in the following figure, though much information was intentionally left out in order to keep this document concise and easy to read.

Critical Thermal Design Parameters		
Envelope		
	Walls (General):	R-41.4
	East Wall:	R-29.3
	Roof (Main):	R-62.6
	Roof (Periscope):	R-29.6
	Floor:	R-42.5
Glazing		
	Type 1:	Low Gain
	SHGC	0.373
	R Value	R-2.0
	Frame R Value	R-1.37
	Type 2:	High Gain
	SHGC	0.53
	R Value	R-1.67
	Frame R Value	R-1.37
Mechanical		
	Mini Split	Heating COP of 3.49
		Coolin COP of 3.66
	Ventilator	Overall Efficiency 93%
Occupants		
	3 Occupants	Normal Activity
Climate		
	Washinton DC	

* R-Values in (ft² *F hr / Btu)

2.3.4 - BUILDING MASSING

2.3.4.1 - INTRODUCTION

This section discusses the building massing processes that drove the design to its present form. Also, it discusses the workflow process between the thermal analysis team and the architects.

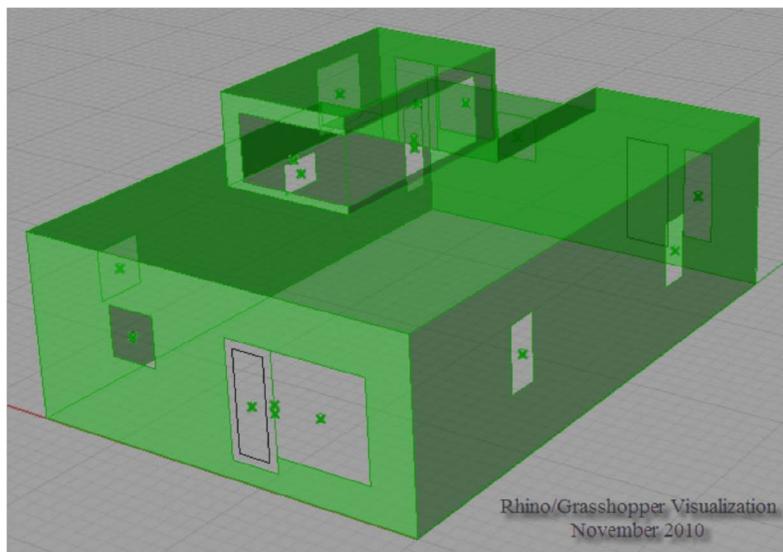


2.3.4.2 - FORMER BUILDING MASSING WORKFLOW

Earlier in the project's life, there was a large downtime between the creation of an envelope massing and the completion of the corresponding thermal analysis of that massing. This lengthy analysis time was the result of having to manually change a large amount of information (including wall, roof, floor, and window sizes and orientation) within the PHPP program for each iteration of the design process. Additionally, inputs had to be thoroughly examined for accuracy each time since it was very easy to make a mistake when manually adding the plethora of information into the PHPP program. This was further complicated by the non-visually-intuitive nature of the MS Excel-based PHPP program, which made it easy to overlook critical inputs.

2.3.4.3 - THERMAL DESIGN WORKFLOW AND 3D INTEGRATION

To speed up the workflow between the architects and thermal analysis team, a 3D interface to PHPP was created. The 3D interface incorporates the use of the following software: Rhinoceros 4.0 (modeling software), Grasshopper 0.6 (graphical programming add-on), and PHPP. The first step in the process was to create a basic wireframe model of the house, including all exterior building surfaces and windows. Using code written by the team in Grasshopper, we were able to begin automatically exporting geometric information from the Rhino model to PHPP. Any modifications to the Rhino model would then result in Grasshopper automatically updating the appropriate inputs in PHPP. Using this process, significant reductions in thermal analysis times were achieved. In addition to these time savings, the use of Rhino and Grasshopper also provided a visual interface to manipulate the PHPP with. The following figure depicts a Rhino model of the house, after the Grasshopper visualization has been applied.



2.3.5 - CALCULATED ANNUAL HEATING AND COOLING DEMANDS

The following figures display the annual heating and cooling demands for the home. These tables were generated by the PHPP software package. They incorporate transmission losses, solar losses, and internal heat gains. Notice that for the month of September, heating demand is zero and cooling demand is 167 kWh. This indicates that September is a cooling dominated month for the Washington D.C. climate.

ANNUAL HEATING DEMAND

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating Degree Hours -	16.7	13.9	11.3	7.1	3.1	-0.6	-2.5	-1.9	1.1	6.2	10.1	14.8	79	kKh
Heating Degree Hours -	11.6	12.3	13.5	10.7	7.0	2.4	-1.3	-3.4	-3.1	-0.7	3.2	7.8	60	kKh
Losses - Exterior	877	731	595	372	162	-30	-133	-98	59	324	528	775	4163	kWh
Losses - Ground	250	266	291	231	151	53	-28	-73	-66	-15	69	168	1297	kWh
Sum Spec. Losses	18.1	16.0	14.2	9.7	5.0	0.4	-2.6	-2.7	-0.1	4.9	9.6	15.1	87.5	kWh/m ²
Solar Gains - North	5	5	8	10	14	16	15	11	9	7	5	4	110	kWh
Solar Gains - East	8	9	14	16	18	19	19	17	15	12	8	6	162	kWh
Solar Gains - South	218	220	224	187	166	156	166	181	213	236	199	195	2362	kWh
Solar Gains - West	29	35	47	57	68	66	64	61	50	40	28	24	568	kWh
Solar Gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar Gains - Opaque	37	44	61	70	82	86	84	76	66	54	37	32	729	kWh
Internal Heat Gains	97	88	97	94	97	94	97	97	94	97	94	97	1148	kWh
Sum Spec. Gains Solar	6.3	6.4	7.2	7.0	7.1	7.0	7.2	7.1	7.2	7.2	6.0	5.7	81.4	kWh/m ²
Utilisation Factor	99%	99%	97%	91%	65%	5%	0%	0%	0%	64%	94%	99%	51%	
Annual Heat Demand	736	601	448	206	26	0	0	0	0	24	247	589	2878	kWh
Spec. Heat Demand	11.8	9.6	7.2	3.3	0.4	0.0	0.0	0.0	0.0	0.4	4.0	9.4	46.1	kWh/m ²

ANNUAL COOLING DEMAND

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating Degree Hours -	19.1	16.0	13.7	9.3	5.4	1.6	-0.3	0.4	3.3	8.5	12.3	17.1	107	kKh
Heating Degree Hours -	13.8	14.3	15.7	12.8	9.2	4.6	1.0	-1.1	-0.9	1.5	5.3	10.0	86	kKh
Losses - Exterior	903	759	646	441	254	77	-12	19	158	401	583	810	5041	kWh
Losses - Ground	298	310	339	278	200	99	21	-24	-20	33	115	216	1865	kWh
Losses Summer Ventila	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Sum Spec. Heat Losses	19.2	17.1	15.8	11.5	7.3	2.8	0.1	-0.1	2.2	7.0	11.2	16.5	110.7	kWh/m ²
Solar Load North	5	6	9	11	15	17	17	12	10	8	6	5	122	kWh
Solar Load East	12	14	20	24	27	29	28	25	23	18	12	9	240	kWh
Solar Load South	215	216	220	184	163	153	163	178	209	232	195	192	2319	kWh
Solar Load West	36	44	60	71	85	83	81	78	63	51	35	30	717	kWh
Solar Load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar Load Opaque	37	44	61	70	82	86	84	76	66	54	37	32	729	kWh
Internal Heat Gains	97	88	97	94	97	94	97	97	94	97	94	97	1148	kWh
Sum Spec. Loads Solar	6.5	6.6	7.5	7.3	7.5	7.4	7.6	7.5	7.5	7.4	6.1	5.8	84.6	kWh/m ²
Utilisation Factor Losses	33%	38%	46%	60%	83%	99%	100%	100%	100%	84%	53%	35%	50%	
Useful Cooling Energy D	2	4	9	25	93	287	462	472	327	96	12	2	1793	kWh
Spec. Cooling Demand	0.0	0.1	0.2	0.4	1.5	4.6	7.4	7.6	5.2	1.5	0.2	0.0	28.7	kWh/m ²

2.3.6 - PEAK ANNUAL HEATING AND COOLING LOADS

Peak annual heating and cooling loads were calculated within PHPP to facilitate mechanical equipment selection. The peak heating load is calculated based on a worst case winter day (in terms of low solar access, cold temperatures, and low internal gains) during the heating period. Similarly, the peak cooling load is calculated based on a worst case summer day (in terms of high solar gains, high temperatures, high latent loads, and high internal gains). Based on the PHPP, the peak heating load expected is 1,499 W, and the peak cooling load is 2,320 W.

3.0 - MECHANICAL SYSTEM

3.1 - INTRODUCTION

This section discusses the mechanical systems of the Empowerhouse.

3.2 - VENTILATION DESIGN

After considering many types of ventilators, the team decided to incorporate an energy recovery ventilator into the design of the house. The device acts as a non-mixing heat exchanger between the exhaust air and the supply air, thereby improving the efficiency of an already efficient home.

The team decided on the Comfoair 200, a product from Zehnder, to ventilate the house. The specifications of the model met the houses needs and the company will act as a sponsor. In addition, the Comfoair 200 was easy to integrate into the HVAC system.

The Comfoair 200 has height, width and depth dimensions as roughly 47.2 in, 21.1 in, and 12.4 in, respectively. Furthermore, the model can be mounted on a wall or ceiling adding a degree of versatility when designing the mechanical room. The installation requirements are few and the unit installation will be within the abilities of the team. The heat recovery efficiency of the unit has been rated at 93% sensible and offers variable volumetric flow rates ranging from 12cfm to 150cfm. This range corresponds well with the passive house adjusted requirement of 71cfm. A variety of flow rates can be achieved through the use of individually programmable 1% increments. The HVAC system has been designed to allow for easy installation as well as an efficient use of the allotted housing space. For this reason the team has chosen to integrate the heating and cooling device with the Comfoair 200. The Zehnder unit will be placed within the Mechanical room where air will be drawn from the outside and flows through a heat exchanger. Upon exiting the ERV, the supply duct will combine with the return of the air handler, mounted within the ceiling above the front hall.

The ducts will then be distributed throughout the house to the necessary living spaces. A return duct into the Mitsubishi minisplit will be placed near the south side of the living room. Bathroom and kitchen exhaust will run within the same duct and enter into the MVHR to complete the heat recovery before being exhausted outside. To avoid any excessive moisture problems as a result of showering, the bath tub will be enclosed and a direct exhaust fan will be placed above the tub. The bath exhaust will have a humidity sensor to detect excess levels of humidity, which will have a value preset by the user, and will turn on when the shower space reaches the designated level of humidity. The strategy of the ducting scheme is to develop a simple yet effective design using commonly available sizes with a minimum of custom made sections.

3.3 - MINI SPLIT DESIGN

3.3.1 INTRODUCTION

As the home design emphasizes passive energy conservation strategies, only a minimal active unit is required to meet the heating and cooling demand of the house. The particular model chosen is the Mitsubishi SEZ-KD12NA and SUZ-KA12NA units. These were chosen because their capacities most closely matched the calculated maximum heating and cooling loads of the house.

After thorough research and analyzing different models of ducted and ductless mini splits, the team has selected the ducted Mitsubishi heat pump model: SEZ-KD12NA & SUZ-KA12NA. Models from companies such as Fujitsu, Sanyo, Mitsubishi, Daiken, etc. were thoroughly scrutinized, and the models' specifications were compared, as shown in the next page. In the case of ductless and ducted mini split heat pumps, the team decided to chose a one-zone/singe zone indoor unit, since the Solar Decathlon house will require a unit with a low heating and cooling capacity. The diagram below shows the peak heating and cooling loads of the house, which was calculated using the Passive House Design Package.

Peak heating loads: 7310 Btu/h
Peak cooling loads: 11310 Btu/h } obtained from PHPP
(Passive House Design Package)

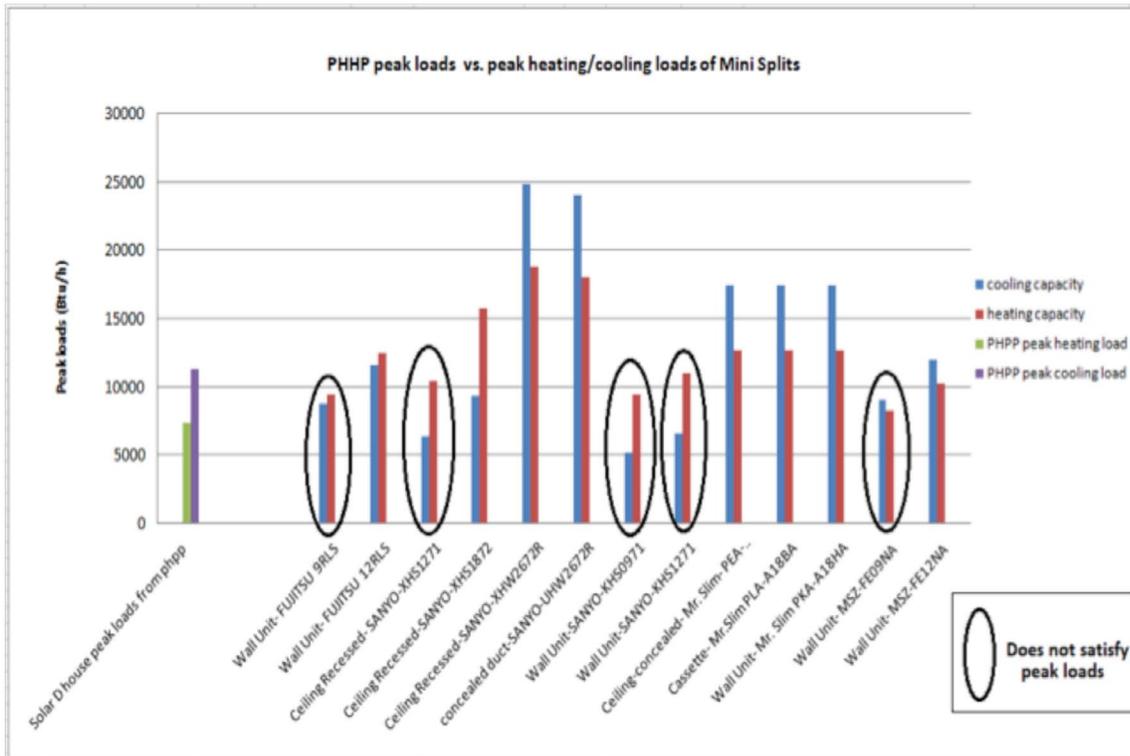
3.3.2 DUCTLESS MINI SPLIT ANALYSIS

The following few pages compare all the possible candidates for ductless mini splits, with respect to cost, COP (coefficient of performance) heating/cooling efficiencies, and whether or not the models can satisfy the peak heating/cooling capacities of the Solar Decathlon house.

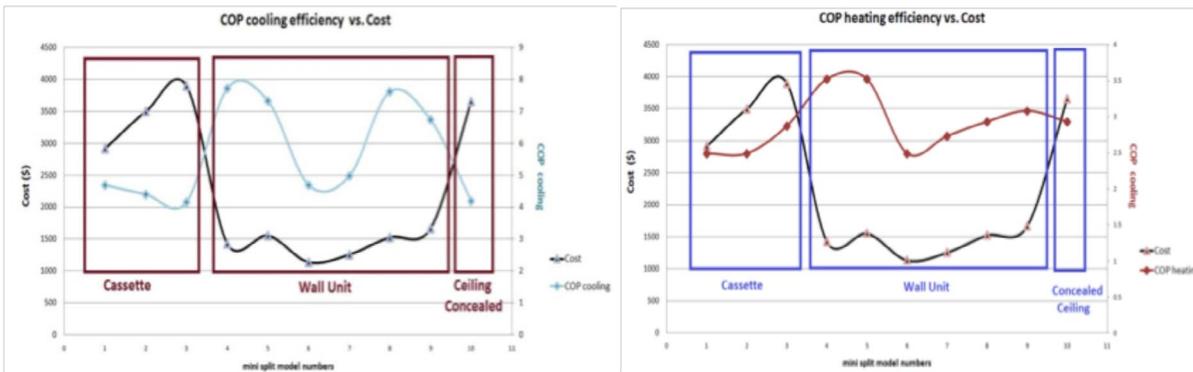
The table displayed on the next page is a compilation of the data found on a large variety of different types of mini split systems. Having the information readily available and easy to understand made the subsequent steps of finding the correct model for this particular situation much simpler. The models were quickly narrowed down based on efficiency and capacity, the two main factors in the mechanical system design of this house. All the other details included in the table were utilized in finding the minor differences between the few that would work for this application. These few models were then graphed based on a few different factors, like cost and efficiency. This visual representation is shown later in the report, and represents quite well the differences in the models that, in a table, look extremely similar.

Ductless Mini split Heat Pump Analysis

Manufacturer	Minisplit Component		Capacity		Sizing of equipment (Using capacity tables)		Cost	Efficiency		COP		Noise/Experimen- tal Aspects	moisture removal	air circulation	Space Requireme
	Outdoor unit	Indoor unit	Cooling (BTU/h)	Heating (BTU/h)	Cooling Capacity (BTU/h)	Heating Capacity (BTU/h)		SEER (cooling)	HSPF (heating)	cooling	heating				
Fujitsu	AOU-18RLX	Cassette- FUJITSU AOU-18RLX	17,800	21,000			\$ 2,915.95	8.5	2.49	2.49	5.3 (2.5)	559-477-394	9-3/4"x23-3/4"x23-3/4"		
	AOU-24RLX	Cassette- FUJITSU AOU-24RLX	22,200	24,200			\$ 3,495.95	8.5	2.49	2.49	6.4 (3.0)	618-536-686	9-3/4"x23-3/4"		
	AOU-96LS	Wall Unit- FUJITSU 96LS	9,000 (3,600-11,000)	12,000 (3,800-14,500)	8,730	9,380	\$ 1,425.95	12	7.62	3.32	2.8 (1.3)	430-353-265-177	295 X 790 X 215/244		
	AOU-12RLS	Wall Unit- FUJITSU 12RLS	12,000 (5,100-13,600)	14,000 (5,100-13,600)	11,640	12,510	\$ 1,555.95	12	7.33	3.32	2.8 (1.3)	430-353-265-177	295 X 790 X 215/244		
Sanyo	Model #: 12WH571 CH1271	Ceiling Recessed- SANVO-KHS1271	11,900 (3,000-11,900)	13,600 (3,000-13,600)	6,380	10,440		8.5	2.49	2.49	4.26	235-206-194	11-5/16" X 24-19/32" X 24-		
	Model #: 18WH572 CH1872	Ceiling Recessed- SANVO-KHS1872	17,500 (4,000-17,500)	20,400 (4,000-20,400)	9,340	15,730		8.5	2.49	2.49	4.89	341-294-253	11-5/16" X 24-19/32" X 24-		
	Model #: 26UHW72R CH2672R	Ceiling Recessed- SANVO-KHW2672R	24,800 (9,500-24,800)	29,800 (8,000-29,800)	24,800	18,774		9.6	4.13	2.81	8.1	38-35-31-	13-5/16"x33-55/64"x33-55/64"		
	Model #: 26UHW72R CH2672R	concealed duct- SANVO-UHW2672R	24,000 (9,500-24,000)	28,600 (8,000-28,600)	24,000	18018		9	4.10	2.64	7.2	670-530-460-	7/32"x39x3/8"x24x19/16"		
	Model #: 09KH571 CH0971	Wall Unit- SANVO-KHS0971	9,000 (3,000-9,000)	12,200 (3,000-12,200)	5,220	9,470	\$ 1,135.95	8.5	4.69	2.49	3.4	200-247-382-	11-7/32"x32-15/32"x7-		
	Model #: 12WH571 CH1271	Wall Unit- SANVO-KHS1271	11,900 (3,000-11,900)	13,300 (3,000-13,300)	6,530	11,050	\$ 1,255.95	9.3	4.98	2.73	4.26	212-259-294-	11-7/32"x32-15/32"x7-		
Mitsubishi	MUZ-FE69NA	Ceiling-concealed-Mr. Slim- PEA-A18AA	8,000-18,000	8,000-20,000	17,460	12,730	\$ 3,655.95	14.3	4.19	2.93	3.26	403-509-655-	31-1/2"x13"x23-		
	MUZ-FE93NA	Cassette- Mr. Slim PEA-A18AA	8,000-18,000	8,000-20,000	17,460	12,730	\$ 3,895.00	14.2	4.16	2.87	3	33-1/16"x33-1/16"x30-	33-1/16"x33-1/16"x30-		
	MUZ-FE93NA	Wall Unit- Mr. Slim PEA-A18AA	8,000-18,000	8,000-20,000	17,460	12,730	\$ 3,375.95	15.3	4.48	2.78	5.2	300-370-425-	31-1/2"x13"x23-		
	MUZ-FE121NA	Wall Unit- MSZ-FE93NA	9,000 (2,800-9,000)	10,900 (3,000-10,900)	9,000	8,200	\$ 1,515.95	10	7.62	2.93	2.1	350-230-164-	31-1/2"x11-1/4"x21-5/8"		
MUZ-FE121NA	Wall Unit- MSZ-FE121NA	2,800 -12,000	3,000-13,600	12,000	10,200	\$ 1,665.95	10.5	6.74	3.08	2.9	410-381-226-162	11-5/7"x31-7/16" X 19-1/8"			



The graph above compares all ductless heat pump models heating/cooling capacities with the Solar Decathlon-house. The peak capacities of the house were calculated using the PHPP model. From this graph, it can be visually noticeable which models are below the house peak requirements. These models are circled in black to denote its insufficient capacities, and thus are eliminated, from the pool of possibilities.



The mini split model numbered above corresponds to the models listed below. The dots directly above each other are from the same model heat pump. The two numbers refer to values of COP values and costs.



3.3.3 DUCTED MINI SPLIT ANALYSIS

After analyzing the cut sheets of all the applicable ducted mini splits, the team chose the Mitsubishi SUZ-K129NA (outdoor) & SEZ-KD12NA (indoor) model. It is known that ducted mini splits lose heat through ducting, and thus have a lower SEER and HSPF efficiency rating than ductless mini splits. So, it is critical to choose a ducted mini split that has the highest efficiency rating. Aside from static pressure, and assuming that the heat pump meets the heating/cooling capacity, the efficiency criterion is the top factor to consider. The chosen Mitsubishi model by far has the highest efficiency in the market for single zone ducted mini splits that would satisfy the house's heating/cooling capacity, without over-sizing it. Cost is also another major criteria, but unlike the ductless mini split which has three different types of models to choose from, the ducted mini splits has only one type of model: concealed ceiling duct. So, the prices for most of these ducted heat pumps will be relatively similar to each other.

Manufacturer	Component		Capacity (Btu/hr)		Efficiency		SHF	Max Power (W)	
	Outdoor	Indoor	Heating	Cooling	SEER	HSPF		Heating	Cooling
Mitsubishi	SUZ-KA09NA	SEZ-KD09NA	8100	10900	15	10	0.76	1020	670
	SUZ-K129NA	SEZ-KD12NA	11500	13600	16	10	0.76	1140	920
Daikin	RXS-09DVJU	FDXS-09DVJU	8500	10000	13	7.7			
	RXS-12DVJU	FDXS-12DVJU	11500	11500	13	7.7	0.66	960	1290
Sanyo*	CHDX09053	UHX1252	107500	95500	-	-		105	109

3.4 Mini Split Ventilator Integration

The purpose of conducting the following analysis was to ensure that the combination of both the Energy Recovery Ventilator (ERV) and the Mini-Split Heat Pump along the same duct path would achieve the necessary healthy indoor conditions. Passive House Planning Package (PHPP), software being used to model the loads on the house under different climate scenarios, along with the ASHRAE 2009 manual provided the values and methodology for calculating the cooling loads. These values were compared to the capacities obtained from the manufacturers at the specific conditions.

The overall examination stemmed from the fundamentals of heating and cooling found in the ASHRAE manual. A basic understanding of psychrometrics was necessary to locate the moist air states in the system and the transfer of sensible and latent loads. The sensible and latent loads of the system were calculated to determine whether the specifications of the Mini-Split could handle humid conditions and if not, the analysis would determine an equilibrium state for the final indoor temperature based on the limitations of the system.

Evaluating the system's viability utilized the cooling capacities for the Mini-Split under the specified conditions of an outdoor dry bulb 83.3oF and a humidity ratio of 0.0194 lb/lb. From these values a suitable Sensible Heat Fraction (SHF) was obtained and could be compared to the SHF of the house during an overcast day with the ASHRAE

specified climate. The SHF for the Mini-Split was obtained by dividing the Sensible Heat Capacity (SHC) by the Total Capacity (CA) and the resulting value was 0.669. Since the data used was from a previous model with a larger SHF, the number was multiplied by the fractional difference of the values. The adjusted SHF emerged as 0.66 and this was compared to the home's value computed by summing the sensible loads and dividing them by the total loads (sensible and latent), where the value obtained was 0.64

Internal Load Calculations

	T Dry Bulb (F)	ω (lb/lb)	T Wet Bulb (F)
Indoor	75.00	0.0120	66.5
Outdoor	83.30	0.0194	77.8
ERV to MS	76.16	0.0147	70.4
Return Air	75.32	0.0128	67.5

ASHRAE Dehumidification factor

187.5
428.1

	BTU/hr Sensible	BTU/hr Latent
Envelope	640	-
Solar	438	-
Ventilation	89	927.28
Infiltration	75	294.74
Internal	1478	303.40
Total	2719	1525.42

	Watts Sensible	Btu/hr Sensible
Envelope	187.5	639.776556
Solar	428.1	1460.73783

Weather Factor 0.3 overcast

SHF	0.6406
-----	--------

4244.61
47.85704545
86.43351906

6330.665 8546.95 8435.950649 2473.8858 4236.05
12783 12616.98701 3699.9962

0.66861848 0.987012987 0.6599351

572 1950.52 975.26
433.431085 1478
88.97360704

Required 0.695 pints/hr Max 2.4pints /hr

Δω (lb/lb)	Q (cfm)	Moisture Removal (Pints/hr)	
		Required	Limitation
0.0008	256	0.695	2.4

3.5 Hot Water System Selection

The hot water system selection was based on several criteria though cost and performance was the chief concern. Approximately eight systems, have of which were solar thermal, the other, heat pump water heaters were compared. Using Habitat for Humanity's 30 year, interest free mortgage as a metric, the systems were evaluated. A "real" increase of the cost of end use electricity of 2% per kWh and a 3% inflation rate was used. The electricity consumption and initial cost annualized over 30 years was entered and the results compared. The results show similar costs for solar thermal systems compared to the heat pump water heaters. Given this, secondary criteria were used as a basis for selection. Ease of use, user maintenance, product warranty and sponsorship potential were compared for each of the lowest cost systems. The Airgenerate performed best for both primary and secondary criteria and was selected for use in the competition.

Solar Thermal Vs Solar Electric Analysis

NOTE: Thermal Equipment Cost				
Solar thermal system 1				
Heliodyne 433-001	1	\$1,308	\$4,077	1,200
Marathon 95 gal tank	1	\$1,318	\$8,130	\$1,318
Drainback tank (gallon)	1	\$298	\$800	\$298
Pump/water	1	\$4,556	\$8,150	\$1,559
Total			\$27,077	\$4,288
Solar thermal system 2				
Viewstarr 4 panel complete system		\$4,903		
Etra 2 200W panel	2	110		
Total				\$4,993
Solar thermal system 3				
Viewstarr 3 panel complete system		\$4,903		
Etra 3 200W panel	3	330		
Total				\$1,870
Solar thermal system 4				
System and tank and panels	1	4,500	\$4,500	
Solar US Evac Tube	2	1,500	\$3,950	
Marathon 95 gal tank	1	1,300	\$8,130	
Total				\$3,800

Results	
System	30 Year Cost
GT Electric	\$1,940(9)
Airgenerate 70 gal	\$1,570(5)
Heated floor slab	\$1,700(6)
American 80 gal	\$1,500(5)
Heliodyne 3 Panel complete	\$1,910(6)
Viewstarr 4 Panel 200W	\$1,920(6)
Viewstarr 3 Panel 200W	\$1,900(6)
Solar US Evacuated Tube	\$1,540(5)

4.0 - ELECTRICAL SYSTEM

4.2 - APPLIANCES

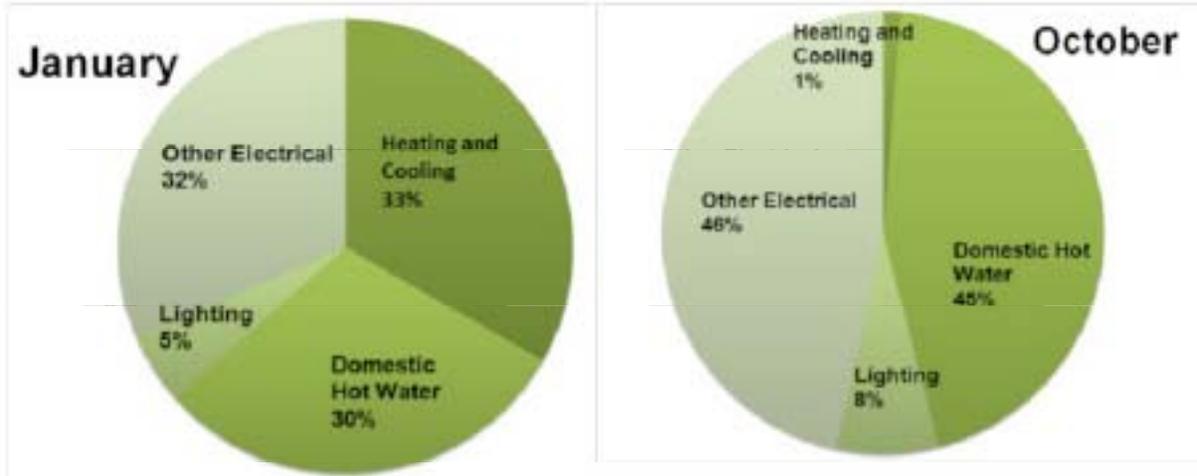
The main objective of the appliance selection is to choose the appropriate appliance that will best fit the needs of the inhabitants while maintaining efficiency and low energy consumption. A refrigerator, washer, dryer and dishwasher, oven range were chosen based on performance, homebuilder client availability, and affordability. A stacked clothes washer and condensing dryer (Bosch models WAS20160UC and WTC82100US respectively) was chosen for compact size and efficiency. The absence of a dryer duct reduces the number of envelope penetrations, decreasing energy losses due to infiltration and exfiltration. The Whirlpool Top Freezer Refrigerator, model W5TXEWFWB, is an attractive refrigerator that provides useable storage volume and efficiency with a fair price. This refrigerator consumes about 354 kWh yearly, which is a competitive efficiency rating.

4.3 - CALCULATED ELECTRICITY DEMAND AND DISTRIBUTION

The monthly electricity demand was calculated with PHPP to facilitate Photovoltaic array sizing. For the purposes of this analysis electrical demand due to Domestic Hot Water, Lighting, and plug loads are assumed to be constant monthly values based on constant use schedules. The heating and cooling electrical demand is based on the expected heating and cooling demands and the systems respective coefficients of performance. The following illustration depicts the projected monthly electricity demand for the house.

Electrical Demand Table

	Projected Monthly Electrical Demand (kWh)												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg.
Heating and Cooling	164	126	77	20	7	43	73	69	36	4	40	128	66
Domestic Hot Water	148	148	148	148	148	148	148	148	148	148	148	148	148
Lighting	25	25	25	25	25	25	25	25	25	25	25	25	25
Other Electrical	154	154	154	154	154	154	154	154	154	154	154	154	154
Total Demand	491	454	404	347	335	370	400	396	363	331	367	456	393



Displayed above are the estimated electrical loads for the months of January and October. It is evident that the power used to run the systems in the house is distributed differently depending on the time of year. These estimates were obtained by using historical data for the Washington DC region and this knowledge to the current systems utilized in the house. Because of this great differentiation between the electricity distributions the control system must be highly in tune with the demands of the house. It is also notable to mention that in the month of January, only 33% of the entire electrical load is going towards running the heating/cooling system. This is the highest percentage of the total power per month that goes to heating during any month of the year. This is mainly due to the use of Passive House techniques in order to decrease the need for an excessive amount of mechanical heating or cooling.

4.4 - SOLAR ENERGY COLLECTION

4.4.1 - PV ARRAY DESIGN

The design goal of the array system was to generate as close to net zero energy balance as possible with a simple ballasted array configuration and the smallest number of low cost, high efficiency modules. Working with the design of the house, an array system was implemented to provide the necessary AC energy demand and conform to the overall roof design and shading conditions.

Using the PHPP modeling package, a monthly energy demand in kWh was projected. From the PHPP demand predictions, energy demands for the timeframe of the competition and annual demands were calculated. The use of NREL's PVwatts v1 was implemented to reverse calculate a DC rating required to meet the AC energy output.

From the calculations, the Yingli Panda 260 module was selected for its high cell and module efficiency. The array is designed to allow 16 modules to be installed in a ballasted racking system. The peak DC power rating for the array is 4.2kW. Performance data will be collected and analyzed.

4.4.2 - INVERTER

The inverter that was selected was the Fronius 5100 for its efficiency of 96% and has a large enough capacity for our array. With an extended warranty of 25 years, it allows for long use with little maintenance and replacement needs. Two strings will be run from the inverter to a total of eight modules per string. The inverter and array design were evaluated to run properly under the extreme temperatures of Washington DC without failure.

4.5 - FIRE SUPPRESSION

4.5 - FIRE SUPPRESSION

The spreadsheets below include the breakdown of calculations for the sizing of the fire suppression system. In addition, code related regulations and notes are included below to clarify the assumptions made. The methodology is a straight forward application of the code requirements of the IRC P2904 on sizing a fire sprinkler system.

Codes	p 632-643 of IRC	P 2904
Sprinkler temp rating	>135degF	>57degC
Sprinkler temp rating	<170degF	<77degC
Intermediate Sprinkler temp rating	>175degF	>79degC
Intermediate Sprinkler temp rating	<225degF	>107degC
sprinkler coverage	<400sqft	
supply time	7min	
pipe size to sprinkler	> 3/4"	
sprinkler adapter	>0.5"	
Pressure Supply		43 Psi

Exceptions P2904.1.1

1) Attics & crawl spaces normally unoccupied with no fuel fired appliances

Exceptions for sprinklers

Bathrooms	<55	sqft	5.1 sqm
Closets	<24	sqft	2.2 sqm

TABLE P2904.2.2
LOCATIONS WHERE INTERMEDIATE TEMPERATURE SPRINKLERS ARE REQUIRED

HEAT SOURCE	MAXIMUM CLEARANCE FROM HEAT SOURCE WITHIN WHICH INTERMEDIATE TEMPERATURE SPRINKLERS ARE REQUIRED ^a (inches)
Fireplace, side of open or recessed fireplace	12 to 36
Fireplace, front of recessed fireplace	36 to 60
Coal and wood burning stove	12 to 42
Kitchen range top	9 to 18
Oven	9 to 18
Vent connector or chimney connector	9 to 18
Boiling duct, not insulated	9 to 18
Hot water pipe, not insulated	6 to 12
Side of ceiling or wall warm air register	12 to 24
Front of wall mounted warm air register	18 to 36
Water heater, furnace or boiler	9 to 9
Luminaires up to 250 watts	9 to 9
Luminaires 250 watts up to 499 watts	6 to 12

For SI: 1 inch = 25.4 mm.

a. Sprinklers shall not be located at distances less than the maximum table clearance unless the sprinkler listing allows greater clearance.

b. Distances shall be measured in a straight line from the nearest edge of the heat source to the nearest edge of the sprinkler.

TABLE P2904.4.2(1)
WATER SERVICE PRESSURE LOSS (PSI/ft)

FLOW RATE ^a (gpm)	1/2" HIGH WATER SERVICE PRESSURE LOSS (PSI)				1" HIGH WATER SERVICE PRESSURE LOSS (PSI)				1 1/2" HIGH WATER SERVICE PRESSURE LOSS (PSI)			
	Length of water service pipe (feet)				Length of water service pipe (feet)				Length of water service pipe (feet)			
	0 to 100	01 to 26	26 to 100	101 to 1000	0 to 100	01 to 26	26 to 100	101 to 1000	0 to 100	01 to 26	26 to 100	101 to 1000
8	5.1	8.7	11.8	17.4	1.5	2.5	3.4	5.1	0.6	1.0	1.3	1.9
10	7.7	13.1	17.5	26.3	2.3	3.8	5.2	7.7	0.8	1.4	2.0	2.9
12	10.6	18.4	24.9	NP ^b	3.2	5.4	7.3	10.7	1.3	2.0	2.7	4.0
14	14.9	24.5	NP ^b	NP ^b	4.2	7.1	9.6	14.3	1.6	2.7	3.6	5.4
16	18.4	NP ^b	NP ^b	NP ^b	5.4	9.1	12.4	18.3	2.0	3.4	4.7	6.9
18	22.9	NP ^b	NP ^b	NP ^b	6.7	11.4	15.4	22.7	2.5	4.3	5.8	8.6
20	27.5	NP ^b	NP ^b	NP ^b	8.1	13.5	18.7	27.6	3.1	5.2	7.0	10.4
22	NP ^b	NP ^b	NP ^b	NP ^b	9.7	16.5	22.3	NP ^b	4.7	6.3	8.4	12.4
24	NP ^b	NP ^b	NP ^b	NP ^b	11.4	19.5	26.2	NP ^b	6.3	7.3	9.0	14.6
26	NP ^b	NP ^b	NP ^b	NP ^b	13.2	22.4	NP ^b	NP ^b	8.0	8.5	11.4	16.9
28	NP ^b	NP ^b	NP ^b	NP ^b	15.1	25.7	NP ^b	NP ^b	9.7	9.7	13.1	19.4
30	NP ^b	NP ^b	NP ^b	NP ^b	17.2	NP ^b	NP ^b	NP ^b	11.5	11.0	14.9	22.0
32	NP ^b	NP ^b	NP ^b	NP ^b	19.4	NP ^b	NP ^b	NP ^b	13.5	12.4	16.5	24.8
34	NP ^b	NP ^b	NP ^b	NP ^b	21.7	NP ^b	NP ^b	NP ^b	15.6	13.9	18.2	NP ^b
36	NP ^b	NP ^b	NP ^b	NP ^b	24.1	NP ^b	NP ^b	NP ^b	17.8	15.4	20.0	NP ^b

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 gallon per minute = 0.063 L/s, 1 pound per square inch = 0.070 MPa.

NP = Not permitted. Pressure loss exceeds accessible limits.

a. Values not applicable for underground piping systems listed in Table P2903.1 and are based on an ICRF of 11 and a Hazen-Williams C Factor of 130.

b. Values include the following length allowances for fittings: 25% length increase for actual lengths up to 100 feet and 10% length increase for actual lengths over 100 feet.

c. Flow rate from Section P2904.4.1. Add 3 gpm to the flow rate required by Section P2904.4.1 when the water-service pipe supplies more than one dwelling.

Maximum Coverage Area ⁽¹⁾	Maximum Spacing	Horizontal Ceiling Minimum Flow ⁽²⁾ and Residual Pressure (Maximum 2-inch rise for 12-inch run)	Sloped Ceiling Minimum Flow ⁽²⁾ and Residual Pressure (Greater than 2-inch rise up to maximum 4-inch rise for 12-inch run)	Sloped Ceiling Minimum Flow ⁽²⁾ and Residual Pressure (Greater than 4-inch rise up to maximum 8-inch rise for 12-inch run)
		160°F (71°C) Sprinkler	160°F (71°C) Sprinkler	160°F (71°C) Sprinkler
12' x 12' (3.7 m x 3.7 m)	12'	13 GPM (49.2 LPM) 7.0 psi (0.48 bar)	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)
14' x 14' (4.3 m x 4.3 m)	14'	13 GPM (49.2 LPM) 7.0 psi (0.48 bar)	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)
16' x 16' (4.9 m x 4.9 m)	16'	13 GPM (49.2 LPM) 7.0 psi (0.48 bar)	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)
18' x 18' (5.5 m x 5.5 m)	18'	17 GPM (64.3 LPM) 12.0 psi (0.83 bar)	22 GPM (83.3 LPM) 20.2 psi (1.39 bar)	22 GPM (83.3 LPM) 20.2 psi (1.39 bar)
20' x 20' (6.1 m x 6.1 m)	20'	20 GPM (75.7 LPM) 16.7 psi (1.15 bar)	24 GPM (90.8 LPM) 24.0 psi (1.65 bar)	24 GPM (90.8 LPM) 24.0 psi (1.65 bar)

(1) For coverage area dimensions less than or less than or equal to those indicated, use the minimum required flow for the next highest coverage area for which Hydraulic Design section under the Design Criteria are stated.

(2) The Minimum Flow requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the wet pipe K-factor. Refer to "Hydraulic Design" in the Design Criteria section for details.

TABLE A
SERIES LPFI RESIDENTIAL FLAT-PLATE CONCEALED PENDENT SPRINKLER (TY250)
NFPA 13D AND NFPA 13R HYDRAULIC DESIGN CRITERIA
WET PIPE SYSTEMS

Maximum Coverage Area ⁽¹⁾ Width x Length ⁽²⁾ Ft. x Ft. (M x M)	Maximum Spacing Ft. (M)	Minimum Flow ⁽³⁾ and Residual Pressure	
		Top-Of-Deflector - To - Ceiling 4 to 6 inches (100 to 150 mm)	602°F/321°C
12 x 12 (3.7 x 3.7)	12 (3.7)	13 GPM (49.2 LPM) 7.0 psi (0.48 bar)	
14 x 14 (4.3 x 4.3)	14 (4.3)	13 GPM (49.2 LPM) 7.0 psi (0.48 bar)	
16 x 16 (4.9 x 4.9)	16 (4.9)	20 GPM (75.7 LPM) 16.7 psi (1.15 bar)	

Water closets, lavatories and bidets. A water closet, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition or vanity or closer than 30 inches (762 mm) center-to-center between adjacent fixtures. There shall be at least a 21-inch (533 mm) clearance in front of the water closet, lavatory or bidet to any wall, fixture or door.

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional story of the dwelling, including basements and habitable attics but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

When more than one smoke alarm is required to be installed within an individual dwelling unit the alarm devices shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit.

Sprinkler Sizing

Room	Area (ft ²)	Sprinkler coverage (ft)	Wall/Ceiling Unit	Sprinkler Requirements		System Design Flowrate (gpm)	Pressure Loss (psi)			Pressure available to overcome friction, P _a (psi)	1" Copper Pipe			3/4" CPVC			1" PEX		
				Flow rate (gpm)	Max Pressure P ₁ (psi)		Service pipe PL	Water PL	Elevation PL		Distance from service water meter (ft)	Pipe size (in)	Allowable pipe length (ft)	Pipe size (in)	Allowable pipe length (ft)	Pipe size (in)	Allowable pipe length (ft)		
Bedroom (row)	98	12x12	W	13	9.6	25	5	2	4.4	21									
Bedroom (end)	98	12x12	W	13	9.6	25	5	2	4.4	21									
Living Room	244	12x12	W	13	9.6	26	5	2	4.4	21	87	3.00	111	0.16	80	1	87		
Office / Study	79	12x12	W	13	9.6	25	5	2	4.4	21									
Bathrooms	52	No sprinklers. Bathrooms under 55 sqft																	
Entryway	115	25x7.5	E	28	18.7	20	5	2	4.4	31	14	3.00	91	0.15	78	1	95		
mechanical room		12x12	W	13	9.6	15	5	2	4.4										
Jan. Room	206	12x12	W	13	9.6	15	5	2	4.4	31									
Jan. Room Closet	22	No sprinklers. Closet under 40 sqft																	
Periclase		12x12	W	13	9.6	15													
Mechanical Closet	84	12x12	E	13	7	15	5	2	4.4	21									
System design flowrate						28			4.4										

Notes:
 Service pipe is 1/2 inch and with a system design flowrate of 28 gpm.
 Water meter is on a 1/2 inch and a system design flow rate of 28 gpm.
 No back flow preventer or any other pressure reducing device on the fire suppression line.
 Assuming an elevation rise of 10 ft for the floor sprinkler and 10 ft for 2nd floor.
 Assuming Pressure supply is 80 psi.
 Multiple use the average value.

Fire Suppression Schedule

DESCRIPTION	MANUFACTURER	MODEL	MASTER FORMAT #	QTY
Wall Mounted Fire Sprinkler	TYCO	TFF425	21 13 39	7
Ceiling Mounted Fire Sprinkler	TYCO	TFF443	21 13 39	2
Smoke Detector	Simplex	4098-971d	28 31 06	2
Fire Alarm	Simplex	4098-9794	28 31 63	2
Fire Suppression piping	Wegs	UltraPEX	21 13 13	NA

SUBJECTIVE CONTEST DOCUMENTS

SUBJECTIVE CONTEST DOCUMENTS

MISSION

Empowerhouse is a community-based approach to building affordable, solar-powered housing that addresses all aspects of domestic life.

To accomplish this mission, we have assembled a multi-disciplinary team that is establishing strategic community partnerships, and developing technological innovations that will serve as a catalyst for developing affordable and energy-efficient housing on a broad scale. We are examining the policy implications of this effort in order to recommend viable solutions to lawmakers and to advocate for change.

TARGET CLIENT

Empowerhouse Collaborative has the unique opportunity to serve a potential home-owner after the competition. Working with Habitat for Humanity of Washington, D.C. and D.C. Department of Housing and Community Development, The Parsons NS Stevens team has designed Empowerhouse for a family to inhabit in the Deanwood neighborhood of Ward 7 in DC. The family will be evaluated based on Habitat for Humanities three main criteria:

Need: The family to have experienced overcrowding, dangerous surroundings, environment, heating, electrical, plumbing, structural deficiencies and/or severe rent burden.

Ability to Pay: The family must satisfy minimum income requirements that may vary from project to project.

Willingness to Partner: The family must earn hours of “sweat equity” toward the construction of their home; attend homeowner education workshops; and, demonstrate a willingness to maintain the home and property after purchase.

Working within the Habitat for Humanity selection criteria, Empowerhouse provides the family with a safe, comfortable, and self-sustaining new home.

Conversations with community stakeholders and residents have informed us of the aspects of the home they find most important. The front porch is a crucial extension of the home into the neighborhood. Additionally, a large kitchen for family cooking is an essential focal point for the home.

The final location of the home in Deanwood is on the south side of Gault Place with the north side of the house facing the street, and the south side facing Marvin Gaye Park. The lot, too narrow to accommodate more than a limited number of south facing windows, drove the investigation in creating a passive house. This site challenges led to an effort to bring light deep into the center of the home through a light loft above.

Empowerhouse will be constructed of prefabricated panels that minimize labor and overall construction costs. Habitat for Humanity of Washington, D.C. will likely utilize this method of construction in many of their projects in the future. While this specific home is designed for one family in Deanwood, the design model may be adaptable to other family types and sizes and sites across Washington, D.C.

Most importantly, Empowerhouse will provide the client with an ability to produce all of their own energy, reduce their water use, and grow their own food. These benefits will not only save the client significant capital throughout the life of the home, but will empower the homeowner with the means for creating a sustainable life.

The initial investment the homeowners will make to live in this house will be repaid within the first two years through the long term cost savings in energy bills, as well as provide the enjoyment of participating in an affordable and sustainable lifestyle.

ARCHITECTURAL NARRATIVE

Our architectural design stems from strategies which create a comfortable living environment focused on a whole-life approach while augmenting Habitat for Humanity's current building practices with high-performance energy efficient technologies.

Designed for a specific urban lot in the Deanwood Neighborhood of Ward 7 in Washington, D.C. after the Solar Decathlon Competition, Empowerhouse is elongated on the north/south axis with living spaces in the southern end of the home, and a front entrance facing the street on the north. With the site orientation driving the overall form, the home is divided longitudinally into three parts. A service "wet" module containing the mechanical equipment, bathroom, and kitchen, anchors the house on the east while the living "dry" module containing the living area, office, light-loft, and bedroom are open and airy. The west wall of the home, accentuated by the thick envelope required to meet passive house standards, wraps the house to become both floor, roof and porch as it extends beyond the front and rear of the house to embrace the neighborhood beyond.

The circulation through Empowerhouse is simple and direct. Upon entering the home on the north, you see straight through a central corridor to the rear entrance and backyard. This visual connection pulls the outdoors into the interior of the home. Once inside, the bedroom and bathroom flank the corridor. The home then opens up to a spacious living area, kitchen, office and light-loft above. At the rear, the house opens to a convenient and comfortable porch for outdoor dining.

Our lighting strategy combines natural daylight, highly-efficient and cost effective supplementary light sources, and occupancy and daylight sensors to ensure high-quality light for a variety of activities throughout the home. General lighting is provided by low-cost, high-efficiency linear fluorescents and LED light sources that reflect off of the vertical and horizontal surfaces of the house, using the architectural form as the luminaire. Focused activities are provided for with additional task lighting. These two systems are independent, however, complement each other to create a rich and varied living environment. To increase the amount of natural light in the living space, a light-loft pops up in the middle of the home. An office space is embedded in the stair that leads up to this experiential light-loft.

Highly-efficient active systems, together with naturally lit, open living spaces, create a compact, livable home, wrapped in a thick insulating envelope.

ENGINEERING NARRATIVE

Energy efficiency is a primary design driver for Empowerhouse. Not only will optimal performance be important for success in the measured contests of the Solar Decathlon competition; it will be crucial for providing the Deanwood home-owners with a sustainable and affordable home. By minimizing the need for mechanical systems to heat and cool the home, the team was able to design a cost-effective photovoltaic array to help alleviate the end-user's energy costs in the future.

Empowerhouse has been engineered for peak heating and cooling periods in Washington, D.C.. To meet the efficiency goals the team has set, the house incorporates Passive House principles for energy usage and system design. Passive Houses are super-insulated, air-tight buildings. In the winter, they minimize a home's heating load by maximizing solar gains (through windows), and internal gains (from people, electronics, and appliances). Conversely, the home's cooling load is minimized through the use of strategic glazing orientation and shading devices. The airtight nature of passive houses provide the opportunity to save energy by recovering heat from exhaust air (by using a heat or energy recovery ventilator) before expelling the air outside. Additionally, the home's mechanical systems have been designed for reliability to help mitigate maintenance costs.

Lighting fixtures and controls are optimized for low-energy consumption. High-efficiency linear fluorescents and LED's are utilized for light sources. Additionally, Wireless switches, and occupancy and daylight sensors maximize efficiency.

MARKET VIABILITY NARRATIVE

Our house has been designed to accommodate the future lifestyle goals of an urban couple with an annual income of about \$50,000. It embodies a shared vision from Habitat for Humanity as we believe that all our neighbors deserve safe, comfortable homes that are affordable. The house is 1000 sq. ft., one bedroom, (placed in the back of the house for increased security and privacy).

Our inhabitants will enjoy its open floor plan. The kitchen, dining room and living room flow into one another. This serves for easy visual and activity access and creates an intimate environment for entertaining and family interaction. Additionally, this open plan conforms to codes for wheelchair access.

As stated in our initial proposal, our house will maintain a give and take relationship with its inhabitants. Along with specific site placement specifications, (to ensure maximum natural light) the kinetic elements of sustainable design have been taken into account here. Sensors for heat, lighting and air quality will react to the customized bodily requirements the occupants place on the space. Through a web platform the inhabitants will be able to evaluate the energy usage quickly. The result will be an environment that feels comfortable, livable and natural to their physical needs. It will feel like 'home'.

The contemporary design can fit in to most urban settings. Building construction elements are fabricated, not custom, so it is easier for contractors to compare prices, secure materials and deliver them in a timely fashion to the construction site.

The initial investment our urban couple will make to live in this house will be repaid through the long term cost savings in energy bills as well as the enjoyment of participating in an affordable and sustainable lifestyle.

ENGINEERING NARRATIVE

Energy efficient performance is the primary design driver for the Empowerhouse. This was a guiding design philosophy for two main reasons. First of all, optimal performance is critical for the success of the Empowerhouse in the measured contests of the Solar Decathlon competition. Second, energy efficient performance will be very important for the Habitat for Humanity home-owners that will reside in the home after completion of the competition. By minimizing the need for mechanical systems to heat and cool the home, the team was able to design a cost-efficient photovoltaic array to eliminate the end-user's energy costs in the future.

The Empowerhouse has been designed to function in the peak heating and cooling periods of Washington D.C.. To meet the efficiency goals the team has set, the house incorporates Passive House principles for energy usage and system design. Passive Houses are super-insulated and extremely air-tight buildings. They minimize a home's heating load by taking advantage of solar gains (through windows), and internal gains (from people, electronics, and appliances). Similarly, they minimize a home's cooling load through the use of strategic glazing orientation and shading devices. Also, the airtight nature of passive houses provide the opportunity to save energy by recovering heat from exhaust air (by using a heat or energy recovery ventilator) before expelling the air outside. Additionally, the home's mechanical systems have been designed with a strong emphasis on reliability. This consideration is important for the family living to help minimize future operation and maintenance costs for the house.

CONSTRUCTION SPECIFICATIONS

SPECIFICATILONS

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SECTION 01 11 00 - PROJECT SUMMARY

A. PROJECT DESCRIPTION

1. Project Name and Location: Parsons the New School for Design, Stevens Institute of Technology, 2011 Solar Decathlon Competition Entry.
2. Project Summary: The construction of an 800 SF solar house to be located on the National Mall in Washington, D.C.
3. Projected Date of Substantial Completion: September 1, 2011.
4. Special Requirements:
 - a. Protect existing site during assembly.
 - b. Contractor to abide by rules and regulations governing construction projects of the District of Columbia and the Department of Energy.

B. TESTING: Independent testing agency engaged and paid for by Owner.

C. COORDINATION

1. Coordination: Coordination of utilities and project construction.
2. Schedule: Critical path method.

D. FIELD ENGINEERING: Verification and location of all utilities, facilities, and equipment.

E. PROJECT MEETINGS

1. Pre-Construction Conference: Attendance by Owner, Architect, Engineers, Contractor, major subcontractors, and suppliers.
2. Progress Meetings: Once every week: attendance by Owner, Architect, Engineers, Contractor, applicable subcontractors, and suppliers.

F. SUBMITTALS: Reproducible plus one copy of shop drawings, two copies for product data and warranties, one representative unit for samples, and one set of photographs each month with negatives.

G. TEMPORARY FACILITIES

1. Temporary Utility Service: Provide temporary utility services for the duration of the construction.

2. Temporary Facilities: Provide temporary construction as required, support facilities, and security measures for the duration of the construction.

SECTION 01 43 00 - QUALITY REQUIREMENTS

A. GENERAL

1. SECTION REQUIREMENTS

- a. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

Testing and inspecting services shall be performed by independent testing agencies.

- b. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Architect for a decision.
- c. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision.
- d. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - Date of issue,
 - Project title and number,
 - Name, address, and telephone number of testing agency,
 - Dates and locations of samples and tests or inspections,
 - Record of temperature and weather conditions at time of sample taking and testing and inspecting,
 - Names of individuals making tests and inspections,
 - Description of the Work and test and inspection method,
 - Complete test or inspection data, test and inspection results, an interpretation of test results, and comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements,
 - Name and signature of laboratory inspector,
 - Recommendations on retesting and re-inspecting.
- e. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, notices, receipts for fee payments, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- f. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities.
- g. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting



and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- h. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

Promptly notify Architect and Contractor of irregularities or deficiencies in the Work observed during performance of its services.

Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.

Do not perform any duties of Contractor.

- i. **Associated Services:** Cooperate with testing agencies and provide reasonable auxiliary services as requested. Provide the following:

Access to the Work.

Incidental labor and facilities necessary to facilitate tests and inspections.

Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

Facilities for storage and field curing of test samples.

Security and protection for samples and for testing and inspecting equipment.

- j. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

Schedule times for tests, inspections, obtaining samples, and similar activities.

SECTION 01 52 00 - TEMPORARY FACILITIES AND CONTROLS

A. GENERAL

1. SECTION REQUIREMENTS

- a. **Use Charges:** Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated.
- b. First paragraph below assume services are available and Owner will permit tapping into existing system without charge.
- c. **Water and Electric Power:** Available from Owner's existing system without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- d. **Erosion- and Sedimentation-Control Plan:** Submit plan showing compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- e. **Electric Service:** Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.



- f. Accessible Temporary Egress: Comply with applicable provisions in ICC/ANSI A117.1.

B. PRODUCTS

1. MATERIALS

- a. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts and top and bottom rails.
- b. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

2. TEMPORARY FACILITIES

- a. Provide field offices, storage and fabrication sheds, and other support facilities as necessary for construction operations. Store combustible materials apart from building.

3. EQUIPMENT

- a. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- b. Revise first paragraph below to suit Project. Liquid-propane-gas or fuel-oil heaters are commonly used. Steam or hot-water heaters, gas-fired space heaters, or electric unit heaters are also used.
- c. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

Usually retain first subparagraph below. Gasoline burning and salamander type heating units are usually prohibited,

Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited,

Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use,

Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction.

- d. Scaffolding: Pro Jax Utility Scaffold Single Unit w/ Guard Rail:

Length: 6'-0"

Platform Height Range: 2'-0" – 6'-0"



- Max Work Height: 12'-6"
- Overall Height: 9'-6"
- Operation Weight: 240 lbs.
- Weight Capacity: 1,000 lbs.
- e. Typical Loader for Panel Assembly: LULL Model 944E-42 Telehandler w/ Diesel Engine.
- Rated Capacity: 9,000 lbs.
- Maximum Lift Height: 42'-0"
- Operating Weight: 28,350 lbs.
- Forward Reach: 35'-6"
- f. Generator: Honda Generator Model EU6500 X2.
- Engine: Honda 13 HP 389cc Single Cylinder
- Max AC Output (60 Hz) 120/ 240V: 6500 W max.
- Rated AC Outout (60 Hz) 120/ 240V: 5500 W max.
- Receptacles:(2) 3-prong, 20A 125 V, 3-prong 30A 110V L5-30 twist lock, 4-prong 30A 220V L14-30 twist lock
- Continuous Operating Hours: 4.7 hrs @ rated load, 14 hours @ 1/4 load
- Dimensions: 33.5" x 26.4" 27.5"
- Dry Weight: 253 lbs
- Operating Noise: 60 dB(A) @ rated load
- Cooling System: Forced Air
- g. Jacking Systems: Unified Hydraulic Jacking System
- Lifting Capacity: Min. 50 ton
- h. Truck & Trailer: 50-ton Low Boy Trailer
- Bed Length: Min. 38'
- Loaded Capacity: Min. 50-ton
- i. Typical Floodlights: Bull Dog Work Light Model 8ft Floodlight.
- Lamps: Twin 500 Watt UL listed weatherproof fixtures

Switches: 2 x 10 Amp switches allow for independent operation

Cord: 8'-16 gauge heavy-duty cord

Illumination: 14,000 sq ft.

Stability: PVC coated solid steel base (up to 40')

C. EXECUTION

1. TEMPORARY UTILITY INSTALLATION

- a. **General:** Install temporary service or connect to existing service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- b. **Sanitary Facilities:** Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
- c. **Heating and Cooling:** Provide temporary heating and cooling required for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- d. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

2. SUPPORT FACILITIES INSTALLATION

- a. Install project identification and other signs in locations approved by the DOE to inform the public and persons seeking entrance to Project.
- b. **Waste Disposal Facilities:** Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of the DOE.

3. SECURITY AND PROTECTION FACILITIES INSTALLATION

- a. Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- b. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to DOE requirements.

- c. Barricades, Warning Signs, and Lights: Comply with requirements of the DOE for erecting structurally adequate barricades, including warning signs and lighting.
- d. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- e. Install and maintain temporary fire-protection facilities. Comply with NFPA 241.

4. MOISTURE AND MOLD CONTROL

- a. Do not load or install drywall or porous materials into partially enclosed building. Discard water-damaged and wet material and material that begins to grow mold. Allow installed wet materials adequate time to dry before being enclosed.

5. OPERATION, TERMINATION, AND REMOVAL

- a. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- b. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion.

SECTION 01 61 00 - PRODUCT REQUIREMENTS

A. GENERAL

1. SECTION REQUIREMENTS

- a. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- b. Comparable Product Requests:

Submit request for consideration of each comparable product.

Do not submit unapproved products on Shop Drawings or other submittals.

Identify product to be replaced and show compliance with requirements for comparable product requests.

Include a detailed comparison of significant qualities of proposed substitution with those of the Work specified.

Architect will review the proposed product and notify Contractor of its acceptance or rejection.

Basis-of-Design Product Specification Submittal: Show compliance with requirements.

- c. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.
- d. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- e. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
- f. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- g. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- h. Store materials in a manner that will not endanger Project structure.
- i. Store products that are subject to damage by the elements, under cover in a weather-tight enclosure above ground, with ventilation adequate to prevent condensation.
- j. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. PRODUCTS

1. PRODUCT SELECTION PROCEDURES

- a. Where Specifications name a single manufacturer and product, provide the named product that complies with requirements.
- b. Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
- c. Where Specifications name a single product, or refer to a product indicated on Drawings, as the "basis-of-design," provide the named product. Comply with provisions for "comparable product requests" for consideration of an unnamed product by another manufacturer.
- d. Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- e. Unless otherwise indicated, Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- f. Provide products that comply with the Contract Documents, are undamaged, and are new at the time of installation.

- g. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
- h. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS

A. GENERAL

1. CLOSEOUT SUBMITTALS

- a. Record Drawings: Maintain a set of prints of the Contract Drawings as record Drawings. Mark to show actual installation where installation varies from that shown originally.
- b. Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- c. Operation and Maintenance Data: Submit two copies of manual. Organize data into three-ring binders with identification on front and spine of each binder, and envelopes for folded drawings. Include the following:
 - i. Manufacturer's operation and maintenance documentation,
 - ii. Maintenance and service schedules,
 - iii. Maintenance service contracts,
 - iv. Emergency instructions,
 - v. Spare parts list,
 - vi. Wiring diagrams,
 - vii. Copies of warranties.

2. CLOSEOUT PROCEDURES

- a. Substantial Completion: Before requesting Substantial Completion inspection, complete the following:
 - i. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - ii. Advise Owner of pending insurance changeover requirements.
 - iii. Submit specific warranties, maintenance service agreements, and similar documents.
 - iv. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.



- v. Submit record Drawings and Specifications, operation and maintenance manuals, property surveys, and similar final record information.
 - vi. Deliver tools, spare parts, extra materials, and similar items.
 - vii. Make final changeover of permanent locks and deliver keys to Owner.
 - viii. Complete startup testing of systems.
 - ix. Remove temporary facilities and controls.
 - x. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - xi. Complete final cleaning requirements, including touchup painting.
 - xii. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- b. Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.
 - c. Request inspection for Final Completion, once the following are complete:
 - i. Submit a copy of Substantial Completion inspection list stating that each item has been completed or otherwise resolved for acceptance,
 - ii. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
 - d. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - e. Submit a written request for final inspection for acceptance. On receipt of request, Architect will proceed with inspection or advise Contractor of unfulfilled requirements. Architect will prepare final Certificate for Payment after inspection or will advise Contractor of items that must be completed or corrected before certificate will be issued.
- B. EXECUTION**
- 1. EXAMINATION AND PREPARATION**
- a. Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - i. Verify compatibility with and suitability of substrates,
 - ii. Examine roughing-in for mechanical and electrical systems,

- iii. Examine walls, floors, and roofs for suitable conditions.
 - b. Proceed with installation only after unsatisfactory conditions have been corrected.
 - c. Take field measurements as required to fit the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
 - d. Verify space requirements and dimensions of items shown diagrammatically on Drawings.
2. CONSTRUCTION LAYOUT AND FIELD ENGINEERING
 - a. Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks.
 - b. Engage a land surveyor to lay out the Work using accepted surveying practices.
3. INSTALLATION
 - a. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated. Make vertical work plumb and make horizontal work level.
 - b. Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections to form hairline joints.
 - c. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - d. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
 - e. Comply with manufacturer's written instructions and recommendations.
 - f. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
 - g. Use products, cleaners, and installation materials that are not considered hazardous.
 - h. Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place. Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed.
4. CUTTING AND PATCHING
 - a. Provide temporary support of work to be cut. Do not cut structural members without prior written approval of Architect.

- b. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
- c. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction in a manner that will minimize evidence of patching and refinishing.
- d. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

5. CLEANING

- a. Clean Project site and work areas daily, including common areas. Dispose of materials lawfully:
 - i. Remove liquid spills promptly,
 - ii. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate,
 - iii. Remove debris from concealed spaces before enclosing the space.
- b. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion:
 - i. Remove labels that are not permanent,
 - ii. Clean transparent materials, including mirrors. Remove excess glazing compounds. Replace chipped or broken glass,
 - iii. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. Sweep concrete floors broom clean,
 - iv. Vacuum carpeted surfaces and wax resilient flooring,
 - v. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication. Clean plumbing fixtures. Clean light fixtures, lamps, globes, and reflectors,
 - vi. Clean Project site, yard, and grounds, in areas disturbed by construction activities. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds to a smooth, even-textured surface.

6. DEMONSTRATION AND TRAINING

- a. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system. Include instruction for basis of system design and operational requirements, review of documentation, emergency procedures, operations, adjustments, troubleshooting, maintenance, and repairs.

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL



A. GENERAL

1. SECTION REQUIREMENTS

- a. Performance Requirements: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work.

2. SUBMITTALS

- a. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.
- b. Waste Reduction Progress Reports: Submit concurrent with each Application for Payment. Include total quantity of waste, total quantity of waste salvaged and recycled, and percentage of total waste salvaged and recycled.
- c. Records of Donations and Sales: Receipts for salvageable waste donated or sold to individuals and organizations. Indicate whether organization is tax exempt.
- d. Recycling and Processing Facility Records: Manifests, weight tickets, receipts, and invoices.
- e. Landfill and Incinerator Disposal Records: Manifests, weight tickets, receipts, and invoices.
- f. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Administrative Requirements." Review methods and procedures related to waste management.
- g. Waste Management Plan: Develop a waste management plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan:
 - i. Salvaged Materials for Reuse: Identify materials that will be salvaged and reused,
 - ii. Salvaged Materials for Sale: Identify materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers,
 - iii. Salvaged Materials for Donation: Identify materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers,
 - iv. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers,
 - v. See Evaluations for example of cost/revenue analysis in subparagraph below,



- vi. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan.

C. EXECUTION

1. PLAN IMPLEMENTATION

- a. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- b. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
- c. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

2. SALVAGING DEMOLITION WASTE

- a. Salvaged Items for Reuse in the Work: Clean salvaged items and install salvaged items to comply with installation requirements for new materials and equipment.
- b. Salvaged Items for Donation: Permitted on Project site.
- c. Salvaged Items for Owner's Use: Clean salvaged items and store in a secure area until delivery to Owner.

3. RECYCLING WASTE

- a. General: Recycle paper and beverage containers used by on-site workers.
- b. Packaging:

Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

Polystyrene Packaging: Separate and bag materials.

Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

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

Metals: Separate metals by type.

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

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

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

4. DISPOSAL OF WASTE

- a. Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- b. Do not burn waste materials.

SECTION 05 52 00 – METAL PIPE RAILING

A. GENERAL

1. GENERAL REQUIREMENTS

- a. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

2. SECTION INCLUDES

- a. Work of this Section includes all labor, materials, equipment and services necessary to complete the ornamental metals, including heavy gauge stainless steel and nonferrous metal products which are used in building construction for functional, architectural and decorative effects and which are not a part of other metal systems specified in other Sections. The extent of these items is indicated on the drawings and/or specified herein.

3. RELATED SECTIONS

- a. Miscellaneous metals - Section 055000
- b. Painting – Section 099123

4. QUALITY ASSURANCE

- a. General: Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings, specifications, and approved shop drawings, and be of highest quality practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. All work shall be accurately and neatly fabricated, assembled, and erected.
- b. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay the work.

- c. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Work that cannot be permanently shop assembled, shall be completely assembled, marked and disassembled in shop before shipment to insure proper assembly in field. Shop-assemble work in largest practical sizes to minimize field work. It is the responsibility of the Contractor for this work to assure himself that the shop fabricated items will properly fit the field condition. In the event that shop fabricated items do not fit the field condition, the item shall be returned to the shop for correction.

5. SUBMITTALS

- a. Shop Drawings: Submit for all items of work of this Section, as enumerated under paragraph 1.2, showing locations, layouts, materials, thicknesses, finishes, dimensions, construction, relation to adjoining construction, erection details, profiles, jointing and all other details to fully illustrate the work of this Section.
- b. Samples: Submit fabricated samples (of sufficient size to fully show construction, materials, and finishes) of all items of work as enumerated under paragraph 1.2 herein.
- c. Product Data: Submit manufacturer's, fabricator's and finisher's specifications and installation instructions for products used in ornamental metal work, including finishing materials and methods.

6. PRODUCT HANDLING

- a. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.
- b. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

B. PRODUCTS

1. MATERIALS

- a. Provide materials which have been selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Surfaces exposed to view that exhibit pitting, seam marks, roller marks, "oil-canning," stains, discolorations, or other imperfections on the finished units will not be acceptable.
- c. Malleable Iron Castings: ASTM A 48, Class 30, and shall be uniform in quality, free from blow holes, porosity, hard spots, shrinkage defects, swells, cracks or other defects. Surfaces shall be smooth and true to pattern.
- d. Steel (Carbon):

Structural Shapes: ASTM A 36,
Plates (for forming or bending cold): ASTM A 283, Grade C,
Steel Sheets: ASTM A 366, Grade 1,

Shop prime with rust inhibitive primer equal to Series 88 Azerox made by Tnemec, or approved equal made by Benjamin Moore or Sherwin Williams.

- e. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of the metal to be welded, and as required for color match, strength and compatibility in the fabricated items.
- f. Fasteners: Furnish basic metal and alloy, matching finished color and texture as the metal being fastened, unless otherwise indicated. Provide Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- g. Anchors and Inserts: Either furnish inserts to be set in concrete or masonry work, or provide other anchoring devices as required for the installation of ornamental metal items. Provide toothed steel or lead shield expansion bolt devices for drilled-in-place anchors. Provide galvanized or cadmium-coated anchors and inserts for exterior installations. Provide units with exposed surfaces matching the texture and finish of the metal item anchored.
- h. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).
- i. Cast-in-Place and Preinstalled Anchors: Anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete.

2. FABRICATION

- a. Cutting: Cut metal by sawing, shearing or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces or metals.
- b. Holes: Drill or cleanly punch holes (do not burn), so that holes will be accurate, clean, neat and sharp without deforming adjacent surfaces or metals.
- c. Connections:
 - i. Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to water. Locate joints where indicated on drawings. Provide connections to allow for thermal movement of metal at locations and by methods approved by Architect. For work exposed to view, use concealed fasteners (unless welded or other connections indicated) with joints accurately fitted, flush and rigidly secured with hairline contacts.
 - ii. Welding: Welding shall be in accordance with recommendations of the American Welding Society and shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces so that joint will not be visible; undercut metal edges where welds are required to be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling,

depressions or other forms of distortion or discoloration. Remove weld splatter and welding oxides from all welded surfaces.

- iii. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use lock nuts. Bolts and screw heads, where shown to be exposed to view, shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts of adjacent metal.
- d. Operating Mechanism: Operating devices, mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.
- e. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items for architectural metal work to be built into concrete, masonry, or work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.
- f. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.
- g. Coordination: Accurately cut, fit, drill and tap work of this Section to accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.
- h. Exposed Work: In addition to requirements specified herein or shown on drawings, all surfaces exposed to view shall be clean, and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs and other defects, which mar appearance of finished work. Ornamental metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.
- i. Materials used shall be of such strength, thickness and alloy that they are capable of meeting all standards and descriptions specified herein and as detailed on drawings.

3. SHOP FINISHING

- a. General
 - i. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated.
 - ii. Provide colors or color matches as indicated on selected samples.
 - iii. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.
 - iv. Corrosion Protection: Coat concealed surfaces which will be in contact with concrete, masonry, wood or dissimilar metals, in exterior work and work to be built into exterior and below grade walls and decks, with a heavy coat of bituminous paint. Do not extend coating onto exposed surfaces.

- c. Finish Products
 - i. AFM Safecoat

4. PROTECTION

- a. Provide necessary protection to all exposed surfaces of architectural metal work, so as to prevent damage, staining, discoloration, abrasion, etc., to these surfaces from time of shipment from factory to acceptance of work of this project. Protection shall be provided by wrappings, strippable coatings, or other means. After installation, remove protective paper or strippable coating and clean exposed surfaces, and then provide additional temporary protection to protect architectural metal work from damage during subsequent construction activities. Surfaces that are damaged, stained, discolored, abraded etc., shall be rejected and replaced with new materials, at no cost to the Owner.

5. STEEL FRAMING, BRACING, SUPPORTS AND REINFORCEMENTS

- a. Steel framing, plate reinforcing, supplementary steel framing or reinforcing, bracket assemblies, and the like required for the support, framing, reinforcing, bracing, etc., of work of this Section shall be of such sizes and shapes as indicated on the drawings, or as required to suit the conditions, and shall be provided with all necessary supports and accessory items such as inserts, hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly and rigidly fasten, anchor or attach work of this Section in place and to the concrete, masonry and other connecting and adjoining work.

6. ORNAMENTAL HANDRAILS AND RAILINGS

- a. For the interior railing:
 - i. 2" x 1" Steel Bars: ASTM A 36
 - ii. 1/2" diameter steel rods: ASTM A 36
 - iii. 3" x 3" Steel angle: ASTM A 36
 - iv. Nuts and Bolts
 - v. Shop Primer for Ferrous Metal
- b. For the exterior railing:
 - i. 2x2" Steel Pipe: ASTM A36
 - ii. Fabric
 - iii. Pine Wood
 - iv. Welded connections, fasteners TBD
 - v. Aluminum bar for the fabric signage holders)
 - vi. Shop Primer for Ferrous Metal
- c. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:
 - i. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

- ii. Obtain fusion without undercut or overlap.
 - iii. Remove flux immediately.
 - iv. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
 - v. Form changes in direction of railing members by radius bends.
 - vi. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of handrail and railing components.
 - vii. Provide wall returns at ends of wall-mounted handrails, close ends of returns.
 - viii. Close exposed ends of handrail and railing members with prefabricated end fittings.
 - ix. Brackets, Flanges, Fittings, and Anchors: Provide brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.
- d. Furnish inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.
 - e. For railing posts set in concrete, provide preset sleeves of steel, not less than 6 inches long and inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

C. EXECUTION

1. INSPECTION

- a. Examine the areas and conditions where ornamental metal work is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

2. INSTALLATION

- a. General: Install work of this Section square, plumb, straight, true to line or radius, accurately fitted and located, with flush, tight hairline joints (except as otherwise indicated or to allow for thermal movement), with provisions for other trades, with provisions to allow for thermal movement, with provisions to exclude water where exposed to weather, and with attachment devices as required for secure and rigid installation. It is the responsibility of the Contractor to assure himself that shop fabricated architectural metal items will properly fit



the field condition. In cases where the shop fabricated architectural metal items do not fit the field condition, the item shall be returned to the shop for correction.

- b. Attachments:
 - i. Unless otherwise indicated, work to be built into concrete or masonry shall be anchored with shop welded on galvanized steel strap anchors; work to be attached to concrete or masonry shall be anchored by bolts into embedded inserts or expansion shields; work attached to structural steel shall be anchored by welds or bolts; work attached to metals other than structural steel shall be anchored by bolts or screws. Power actuated fasteners not permitted unless approved by Architect. Provide all supplementary parts necessary to complete each item of work of this Section.
 - ii. All attachment devices shall be of type, size and spacing to suit condition and as approved by Architect. Provide shims, slotted holes, or other means necessary for leveling, plumbing and other required adjustments. Attachment devices for work exposed to view shall be concealed, unless indicated otherwise. Where bolts or screws are permitted in work exposed to view, they shall be oval head and counter sunk, unless otherwise noted, with projecting end cut off flush with nuts or adjacent material, and shall match adjacent surfaces.
 - iii. Do all necessary drilling, tapping, cutting or other preparations of surrounding construction in the field accurately, neatly and as necessary for the attachment and support of work of this Section, but obtain Architect's approval prior to such preparation to work of others.
- c. Tolerances: All work of this Section shall be plumb, square, level, true to radius and correctly aligned within the following limitations:
 - i. Offset from true horizontal, vertical and design location shall not exceed 1/16" per ten (10) feet of length for any component, not cumulative.
 - ii. Maximum offset from true alignment between abutting components shall not exceed 1/32".
- d. All railings shall be installed to withstand loads as required by prevailing Building Code.
- e. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units at Contractor's option.
- f. Install concealed gaskets and joint fillers as the work progresses, so as to make the work soundproof or lightproof as required.
- g. Restore protective coverings, which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.
- h. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
- i. Field Welding: Comply with AWS Code for the procedures of manual shielded

metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

3. CLEANING

- a. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

4. PROTECTION

- a. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at the time of Substantial Completion.
- b. Restore finishes damaged during construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

Section 06 05 23 – Wood and Plastic Fastenings

A. GENERAL

1. SECTION INCLUDES

- a. Pre-engineered metal or plastic connectors used to support a wood, plated truss or composite wood, from a concrete, masonry, steel, wood, or composite wood supporting member(s).

2. RELATED SECTIONS

- a. Section 033000 – Cast-In-Place Concrete – Concrete provides support or anchorage.
- b. Section 040500 – Common Work Results for Masonry – Masonry provides support or anchorage.
- c. Section 042000 – Unit Masonry – Unit Masonry provides support or anchorage.
- d. Section 051200 – Structural Steel Framing – Steel provides support or anchorage.
- e. Section 061000 – Rough Carpentry – Wood supported by fastenings or providing support or anchorage.

3. REFERENCES

- a. ASTM A36 – Carbon Structural Steel
- b. ASTM A193 – Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
- c. ASTM A240 – Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications
- d. ASTM A307 – Carbon Steel Bolts and Studs
- e. ASTM A449 – Hex Cap Screws, Bolts and Studs, Steel, Heat Treated
- f. ASTM A480 – General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- g. ASTM A493 – Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

- h. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- i. ASTM A653 – Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- j. ASTM A706 – Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
- k. ASTM A924 – General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- l. ASTM A1011 – Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability and Ultra-High Strength
- m. ASTM D7147 – Standard Specification for Testing and Establishing Allowable Loads of Joist Hangers.
- n. ASTM D2395 – Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials
- o. ASTM F1554 – Anchor Bolts, Steel
- p. ASTM F1575 – Standard Test Method for Determining Bending Yield Moment of Nails
- q. ASTM F1667 – Driven Fasteners: Nails, Spikes, and Staples
- r. ICC-ES AC13 – Acceptance Criteria for Joist Hangers and Similar Devices
- s. ICC-ES AC116 – Acceptance Criteria for Nails and Spikes
- t. ICC-ES AC118 – Acceptance Criteria for Tapping Screw Fasteners
- u. ICC-ES AC120 – Acceptance Criteria for Wood Screws Used in Horizontal Diaphragms and Vertical Shear Walls
- v. ICC-ES AC155 – Acceptance Criteria for Hold-Downs (Tie-Downs) Attached to Wood Members
- w. ICC-ES AC233 – Acceptance Criteria for Alternate Dowel-Type Threaded Fasteners
- x. ICC-ES AC261 – Acceptance Criteria for Connectors Used with Cold-Formed Steel Structural Members
- y. ICC-ES AC316 – Acceptance Criteria for Shrinkage Compensating Devices
- z. ICC-ES AC398 – Acceptance Criteria for Cast-In-Place Cold-Formed Steel Connectors in Concrete for Light-Frame Construction
- aa. ICC-ES AC399 Acceptance Criteria for Cast-In-Place Proprietary Bolts in Concrete for Light-Framed Construction
- bb. AISI 2001 – Cold-Formed Steel Specification
- cc. 2005 NDS – National Design Specification

4. DELIVERY, STORAGE, AND HANDLING

- a. Deliver products to job site in manufacturer’s or distributor’s packaging undamaged, complete with installation instructions.
- b. Protect and handle materials in accordance with manufacturer’s recommendations to prevent damage or deterioration.

B. PRODUCTS

1. MANUFACTURERS

- a. Manufacturer: Simpson Strong-Tie Co., Inc.
- b. Manufacturer: McMaster Carr
- c. Manufacturer: McFeely's
- d. Manufacturer: Maze Nails

2. MATERIALS

- a. Steel:
 - i. Sheet: ASTM A36, ASTM A653, ASTM A1011
 - ii. Fasteners: ASTM A307, ASTM F1554, ASTM F1667, SAE C1022 (SDS Screws)
- b. Stainless Steel:
 - i. Sheet: ASTM A240, ATT M A480
 - ii. Fasteners: ASTM A493
- c. Finishes:
 - i. Gray paint
 - ii. Hot-dipped galvanized or electro-plated galvanized: G90, G185 (ZMAX or HDG)
 - iii. Powder-coated paint
 - iv. Electro-galvanized, Zinc dichromate and Double Barrier for SD and SDS screws

3. FABRICATION

- a. Shop assembly to occur per the manufacturer's approved production drawings.
- b. Fabrication tolerances per manufacturer.
- c. Fabrication requiring welding shall be performed in accordance with the current American Welding Society's standards.
- d. The manufacturer's identification shall be stamped into the metal or wood part and a label may be attached to the part with adhesive.

4. TESTING

- a. Allowable loads published in manufacturer's catalog to be determined using the minimum load from static and/or cyclic analysis and one or more of the following test methods:
 - i. Static load tests in wood assemblies
 - ii. Static load tests in steel jigs
 - iii. Static load tests of products embedded in concrete or masonry
- b. Testing to determine allowable loads shall be performed as per the applicable ICC-ES Acceptance Criteria or ASTM standard.
- c. Allowable loads for hangers are determined by a static load test resulting in not more than a 1/8" deflection of the joist relative to the header, or either the lowest of 3 or average of 6 ultimate load divided by 3, or the fastener allowable load as determined by the NDS, whichever is lowest.
- d. Manufacturer to provide code-testing data on all products that have been code tested upon request.

C. EXECUTION

1. EXAMINATION

- a. Unless otherwise noted in the manufacturer's catalog, allowable loads are for Douglas Fir-Larch under continuously dry conditions. Allowable loads for other species or conditions must be adjusted according to the code. See manufacturer's catalog for additional notes and requirements.
- b. Built up lumber (multiple members) must be fastened together to act as one unit to resist the applied load.
- c. Verify that the dimensions of the supporting member are sufficient to receive the specified fasteners.

2. INSTALLATION

- a. Unless otherwise noted in the manufacturer's catalog, bolts, screws and/or nails shall not be combined.
- b. All nails shall be common unless otherwise noted in the manufacturer's catalog or substituted by the engineer of record with a reduction taken.
- c. Unless otherwise noted in the manufacturer's catalog, bending steel in the field may cause fractures at the bend line. Fractured steel will not carry the allowable load and must be replaced. When bending is allowed or required in the catalog, the connector shall be allowed one cycle bend, one time only.
- d. Galvanized connectors should not be placed in contact with treated wood unless the treated wood is adequately verified to be suitable for such contact. Some wood treatments may accelerate metal deterioration. See the manufacturer's catalog for specific recommendations.
- e. A fastener that splits the wood will not carry the allowable load. Evaluate splits to determine if the connection will perform as required. Dry wood will split more easily and should be evaluated as needed. If wood tends to split, consider pre-boring holes with a diameter not exceeding 0.75 of the nail diameter, for screws in wood with a specific gravity of 0.5 or greater use: 5/32" for SDS, 5/64" for SD9 or SD10, and 1/16" for SD8 (2005 NDS 11.1.4 and 11.1.5.3).
- f. Wood shrinkage will be taken into consideration when designing and installing connections.
- g. Built-up lumber (multiple members) must be fastened together to act as one unit to resist the applied load.
- h. Top flange hangers may cause unevenness. Possible remedies should be evaluated by a professional and include using a face mount hanger, routing the beam, or cutting the subfloor to accommodate the top flange thickness.
- i. Do not overload by exceeding the manufacturer's catalog allowable load values.
- j. Unless otherwise noted in the manufacturer's catalog, fill all fastener holes with fastener types as specified in the manufacturer's catalog.
- k. All specified fasteners must be installed according to the instructions in the manufacturer's catalog.
- l. Bolt-holes shall be a minimum of 1/32" and a maximum of 1/16" larger than the bolt diameter (2005 NDS 11.1.2.2).
- m. Install all specified fasteners before loading the connection.
- n. Use proper safety equipment.

- o. Welding shall be in accordance with the Welding Society (AWS) standards.
- p. Welding galvanized steel may produce harmful fumes. Follow proper welding procedures and safety precautions.
- q. Nail tools with hole-location mechanisms may be used to install connectors, provided the correct quantity and type of nails are properly installed in the nail holes.
- r. The joist shall bear completely on the connector seat the gap between the joist end and the header or back plate of the hanger shall not exceed 1/8".
- s. The installer of ATS systems shall cut rods to length as required.
- t. Anchor bolt nuts should be finger-tight plus 1/3 to 1/2 turn with a wrench. Do not use an impact wrench to tighten nuts on the anchor bolts.
- u. Modifications to products or changes in installation procedures should only be made by a qualified designer. The performance of such modified products or altered installation procedure is the sole responsibility of the designer.

3. FIELD QUALITY CONTROL

- a. Determine that the proper part is being used in the correct application and has been fabricated by the approved manufacturer by observation of the stamp into the metal part and/or the adhesive label on the product denoting part and manufacturer name.
- b. Before substituting another brand, confirm load capacity based on published testing data and calculations per section 2.4. The engineer/designer of record shall evaluate and give written approval for substitution prior to installation.

SECTION 06 10 53 - ROUGH CARPENTRY

A. PROJECT INCLUDES

- 1. Rough Carpentry:
 - a. Framing with dimension lumber.
 - b. Framing with engineered wood products.
 - c. Wood grounds, nailers, and blocking.
 - d. Wood furring.
 - e. Backing panels.
 - f. Sheathing.
 - g. Subflooring.
 - h. Underlayment.

B. QUALITY STANDARDS

- 1. Lumber Standards and Grade Stamps: PS 20, American Softwood Lumber Standard and inspection agency grade stamps.
- 2. Construction Panel Standards: PS 1, U.S. Product Standard for Construction and Industrial Plywood; APA PRP-108.
- 3. Preservative Treatment: AWPA C2 for lumber and AWPA C9 for plywood, waterborne pressure treatment.

4. Fire-Retarding Treatment: AWPA C20 for lumber and AWPA C27 for plywood, non-corrosive type.
5. NYC Board of Standards and Appeals (BS/A).
6. NYC Materials and Equipment Acceptance (MEA).
7. Forest Stewardship Council, 1155 30th St. NW Suite 300, Washington D.C. 20007, (877) 372-5646, www.fscus.org

D. PRODUCTS

1. Dimension Lumber:

- a. Light Framing: Stud, No. 3 or Standard grade.
- b. Structural Framing: Select structural grade.
- c. Species: Any species of grade indicated.
- d. Exposed Framing: Appearance grade.

2. Boards:

- a. Exposed Boards: 15 percent moisture content.
- b. Concealed Boards: 19 percent moisture content.

3. Miscellaneous Lumber:

- a. Moisture Content: 19 percent.
- b. Grade: Standard grade light framing.

4. Engineered Wood Products:

- a. Laminated Veneer Lumber: Laminated wood veneers with exterior type adhesive, design stresses for use intended. Refer to structural drawings.
- b. Prefabricated Wood I Joists: Stress-graded lumber bonded to APA performance rated panel with exterior type adhesive; design stresses for use intended.
- c. Composite Headers: Laminated lumber veneers; design stresses for use intended.

5. Plywood:

- a. Roof and Wall Sheathing and sub-flooring: APA RATED SHEATHING, EXPOSURE 1. Furnish APA PS 1 veneered panels, with span ratings for the required thicknesses as listed below unless otherwise indicated.

Thickness:	Span Rating:
3/8"	24/0
1/2"	32/16
5/8"	40/20
3/4"	48/24

- b. Underlayment: APA UNDERLAYMENT, EXPOSURE 1.
- c. For use under resilient tile flooring and resilient sheet flooring: Sanded face.

- d. For use under carpet and "liquid" flooring: Touch-sanded.
- e. Manufacturer's:
 - i. Columbia Plywood Corp., 222 SW Columbia, Suite 1575, Portland OR 97201, (800) 547-4261, www.columbiaforestproducts.com.
 - ii. Martco Plywood Division, P.O. Box 1110, Alexandria, LA 71309, (318) 379-2855, www.martco.com
 - iii. Taraca Pacific, 600 Sacramento St., San Francisco, CA 94111, (415) 765-0422
- 6. Auxiliary Materials:
 - a. Air Infiltration Barrier: Asphalt-saturated organic felt, ASTM D 226, Type I, No. 15 felt, unperforated.
 - b. Sill Sealer Gaskets: Glass fiber strip resilient insulation.
 - c. Framing Anchors and Fasteners: Non-corrosive, suitable for load and exposure.

SECTION 06 16 00 - SHEATHING

A. GENERAL

1. SUMMARY

- a. Section Includes: wall sheathing, roof sheathing, sub-flooring.

2. ACTION SUBMITTALS

- a. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

3. QUALITY ASSURANCE

- a. Code Compliance: Comply with requirements of the following:

International Code Council Evaluation Service, ICC-ES ESR-1785.
 Voluntary Product Standard, DOC PS2-04, "Performance Standard for Wood-Based Structural-Use Panels."

4. DELIVERY, STORAGE, AND HANDLING

- a. Outdoor Storage: Comply with manufacturer's recommendations. Set panel bundles on supports to keep off ground. Cover panels loosely with waterproof protective material. Anchor covers on top of stack, but keep away from sides and bottom to assure adequate air circulation. When high moisture conditions exist, cut banding on panel stack to prevent edge damage.

5. WARRANTY

- a. For subflooring and roof and wall sheathing applications, manufacturer shall warrant that the panels will not delaminate nor require sanding due to moisture absorption during installation within 300 days of purchase.
- b. Warranty Period: 50 years from date of manufacture.

B. PRODUCTS

1. PERFORMANCE REQUIREMENTS

- a. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- b. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2. WOOD PANEL PRODUCTS

- a. Oriented Strand Board: DOC PS 2.
- b. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- c. Factory mark panels to indicate compliance with applicable standard.

3. WALL SHEATHING

- a. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
- b. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; AdvanTech Sheathing.
- c. Span Rating and Nominal Thickness: Not less than 32/16, 1/2 inch (13 mm) 40/20, 5/8 inch (15.9 mm).
- d. AdvanTech sheathing is available in 1/2 inch (13 mm) and 5/8 inch (15.9 mm) nominal thickness.
- e. AdvanTech sheathing is available with square edge or tongue and groove edge profiles. Tongue and groove edge profile is only available on 5/8 inch thick AdvanTech sheathing.
- f. Edge Profile: Tongue and groove.
- g. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on center spacings.
- h. ESR-1785 performance is applicable to AdvanTech Sheathing and 23/32 inch thick subfloor only. Huber Engineered Woods ESR-1785 rated performance exceeds strength and stiffness design values of commodity OSB and plywood.
- i. Performance Standard: DOC PS2 and ICC-ES ESR-1785.
- j. Exposure Time: Designed to resist weather exposure for 300 days.

4. ROOF SHEATHING

- a. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.
- b. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; AdvanTech Sheathing.
- c. AdvanTech sheathing is available in 1/2 inch (13 mm) and 5/8 inch (15.9 mm) nominal thickness.

- d. AdvanTech sheathing is available with square edge or tongue and groove edge profiles. Tongue and groove edge profile is only available on 5/8 inch thick AdvanTech sheathing.
- e. Edge Profile: Tongue and groove.
- f. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on center spacings.

5. SUBFLOORING

- a. Oriented-Strand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.
- b. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; AdvanTech Flooring.
- c. Span Rating and Nominal Thickness: Not less than 24 oc, 23/32 inch (18.3 mm) or 32 oc, 7/8 inch (22.2 mm) or 32 oc, 1 inch (25 mm).
- d. Edge Detail: Tongue and groove.
- e. Surface Finish: Fully sanded face.
- f. Performance Standard: DOC PS2 and ICC-ES ESR-1785 (24 oc, 23/32 inch).
- g. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm), 19.2-inches (488 mm) and 24-inches (610 mm) on center spacings.

6. FASTENERS

- a. General: Provide fasteners of size and type indicated that comply with requirements specified in this article by the authority having jurisdiction, International Building Code, International Residential Code, Wood Frame Construction manual, and National Design Specification.

7. MISCELLANEOUS MATERIALS

- a. Adhesives for Field Gluing Subfloor Panels to Framing: Solvent-based Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
- b. Adhesives shall have a VOC content of 0 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. EXECUTION

1. INSTALLATION, GENERAL

- a. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- b. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- c. Securely attach to substrate by fastening as indicated, complying with the following:
 - i. NES NER-272 for power-driven fasteners.
 - ii. 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."

- d. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- e. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- f. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

2. WOOD STRUCTURAL PANEL INSTALLATION

- a. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- b. Fastening Methods: Fasten panels as indicated below:
 - i. Combination Subfloor-Underlayment:
 - Glue and Screw to wood framing.
 - Glue and screw to cold-formed metal framing.
 - APA Recommends spacing panels 1/8 inch apart at edges and ends.
 - Space panels 1/8 inch (3 mm) apart at edges and ends.
 - Install fasteners 3/8 inch (9.5 mm) to 1/2 inch (12.7 mm) from panel edges.
 - Space fasteners 6 inches (152 mm) on centers on supported edges (4-foot ends), and 12 inches (305 mm) on centers at intermediate support locations.
 - For 1-1/8 inch (28.6 mm) panels supported at 48 inch (1220 mm) spacing, space fasteners 6 inches (152 mm) on centers on supported edges and intermediate support locations.
 - Penetrate wood framing members at least 1 inch (25.4 mm).
 - ii. Wall and Roof Sheathing:
 - Nail to wood framing.
 - Screw to cold-formed metal framing.
 - APA recommends spacing panels 1/8 inch apart at edges and ends.
 - Space panels 1/8 inch (3 mm) apart at edges and ends.
 - Install fasteners 3/8 inch (9.5 mm) to 1/2 inch (12.7 mm) from panel edges. Space fasteners in compliance with requirements of authority having jurisdiction.

SECTION 06 16 13 – SHEATHING (ZIP SYSTEM)

A. SUMMARY

- 1. Section Includes:
 - a. Combination wall sheathing, water-resistive barrier, and air barrier.
 - b. Combination roof sheathing and roof underlayment.
 - c. Self-adhering flexible flashing.
 - d. Related Requirements:

Section 061000 "Rough Carpentry"
Section 072700 "Air Barriers"

2. QUALITY ASSURANCE

- a. Manufacturer Qualifications: Capable of demonstrating that all wood procurement operations are conducted in accordance with procedures and policies of the Sustainable Forestry Initiative (SFI) Program.
- b. Code Compliance: Comply with requirements of the following:
 - i. International Code Council (ICC), ICC-ESR1473 (ZIP System Roof Sheathing).
 - ii. International Code Council (ICC), ICC-ESR1474 (ZIP System Wall Sheathing).
 - iii. International Code Council (ICC), ICC-ESR2227 (ZIP System Tape).

3. DELIVERY, STORAGE, AND HANDLING

- a. Outdoor Storage: Comply with manufacturer's recommendations,
- b. Set panel bundles on supports to keep off ground.
- c. Cover panels loosely with waterproof protective material,
- d. Anchor covers on top of stack, but keep away from sides and bottom to assure adequate air circulation,
- e. When high moisture conditions exist, cut banding on panel stack to prevent edge damage.

4. WARRANTY

- a. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sheathing system that fail due to manufacturing defects within specified warranty period.
- b. System Warranty Period: 15 years from date of Substantial Completion.
- c. Panel Warranty Period: 30 years from date of Substantial Completion.

B. PRODUCTS

1. PERFORMANCE REQUIREMENTS

- a. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- b. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

2. WOOD PANEL PRODUCTS

- a. Oriented Strand Board: DOC PS 2.
- b. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- c. Factory mark panels to indicate compliance with applicable standard.

3. COMBINATION WALL SHEATHING, WATER-RESISTIVE BARRIER, AND AIR BARRIER

- a. Oriented-Strand-Board Wall Sheathing: With integral water-resistive barrier, Exposure 1 sheathing.
- b. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; ZIP System Wall.
- c. Span Rating and Nominal Thickness: Not less than 32/16; 1/2 inch (13 mm).
- d. Edge Profile: Self-spacing profile.
- e. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on centers spacings.
- f. Performance Standard: DOC PS2 and ICC-ES ESR-1474.
- g. Factory laminated integral water-resistive barrier facer.
- h. Perm Rating of Integral Water-Resistive Barrier: 12-16 perms.
- i. Assembly maximum air leakage of 0.0072 cfm/sq. ft. (0.037 L/s x sq. *m) infiltration and 0.0023 cfm/ sq. ft. (0.012 L/s x sq.*m) exfiltration at a pressure differential of 1.57 psf (75 Pa).
- j. Exposure Time: Designed to resist weather exposure for 120 days.

3. COMBINATION ROOF SHEATHING AND ROOF UNDERLAYMENT

- a. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; ZIP System Roof Sheathing.
- b. Span Rating and Nominal Thickness: Not less than [32/16; 1/2 inch (13 mm).
- c. Edge Profile: Tongue and groove.
- d. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on center spacings.
- e. Performance Standard: DOC PS2 and ICC-ES ESR-1473.
- f. Factory laminated integral roofing underlayment facer.
- g. Exposure Time: Designed to resist weather exposure for 120 days.

4. FASTENERS

- a. General: Provide fasteners of size and type that comply with requirements specified in this article by the authority having jurisdiction, International Building Code, International Residential Code, Wood Frame Construction manual, and National Design Specification.

5. MISCELLANEOUS MATERIALS

- a. Self-Adhering Tape: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape consisting of polyolefin film with acrylic adhesive.
- b. Basis-of-Design Product: Subject to compliance with requirements provide Huber Engineered Woods; ZIP System Tape.
- c. Thickness: 0.012 inch (0.3 mm).
- d. Code Compliance: Comply with requirements of authorities having jurisdiction and ICC Evaluation Service, Inc. "AC148 (2006) - Acceptance Criteria for Flexible Flashing Material."

C. EXECUTION

1. INSTALLATION, GENERAL

- a. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- b. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- c. Securely attach to substrate by fastening as indicated, complying with the following:
 - NES NER-272 for power-driven fasteners, 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."
- d. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials.
- e. Make tight connections. Install fasteners without splitting wood.
- f. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- g. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- h. Only mechanically attached and drainable EIFS and exterior insulation should be used with ZIP System wall sheathing.

2. WOOD STRUCTURAL PANEL INSTALLATION

- a. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- b. Fastening Methods: Fasten panels as indicated below for wall and Roof Sheathing:

- Nail to wood framing.
- Screw to cold-formed metal framing.
- Space panels 1/8 inch (3 mm) apart at edges and ends.
- Install fasteners 3/8 inch (9.5 mm) to 1/2 inch (12.7 mm) from panel edges.
- Space fasteners in compliance with requirements of authority having jurisdiction.

3. SHEATHING JOINT TREATMENT

- a. Seal sheathing joints according to sheathing manufacturer's written instructions.
- b. Apply proprietary seam tape to joints between sheathing panels.
- c. Utilize self-adhering tape gun or hard rubber roller provided by manufacturer to ensure tape is completely adhered to substrates.

4. FLEXIBLE FLASHING INSTALLATION

- a. Apply flexible flashing where indicated to comply with manufacturers written instructions.
- b. After flashing has been applied, roll surfaces with a hard rubber to ensure that flashing is completely adhered to substrates.

Section 06 17 33 - Prefabricated Structural Wood

A. GENERAL

1. Code Compliance:
 - a. 2006 International Building Code (IBc)
 - b. 2006 International Residential Code (IRc)
2. Uses: NI Series Prefabricated Wood I-Joists are used as rafters and floor Joists.
- B. PRODUCTS
 1. Manufacturer: Nordic Engineered Wood, Windsor Station, 1100 De Lagachetiere St. W., Suite 504, Montreal, Quebec H3b 282, Canada
 2. Description: The NI series prefabricated wood I-joists have solid-sawn or glued laminated lumber flanges and oriented strand board (OSB) webs. The top and bottom flanges are parallel, creating a constant-depth I-joist. The web-to-web connection of adjacent OSB panels is jointed and glued to form a continuous web. The web-to-flange connection is a proprietary glued, tongue-and-groove joint. Joist depths vary from 7 1/8 inches to 24 inches (200 mm to 610 mm).
 3. Materials:
 - a. Flanges: Flange material for all I-joist series except the NI-20 and NI-90x is spruce-pine-fir (SPF), machine stress-rated (MSR), finger-jointed lumber. Flange material for the NI-20 series is visually graded lumber, and flange material for the NI-90x series is glued laminated lumber, manufactured in accordance with the manufacturer's (Nordic Engineered Wood) quality control manual.
 - b. Webs: Webs are 3/8-inch-thick (9.5 mm) or 7/16-inch-thick (11.1 mm) OSB panels conforming with Structural I, Exposure 1, performance-rated panel requirements as noted in DOC Voluntary Product Standard PS2 and the approved manufacturer's quality control manual.
 - c. Adhesive: Exterior-type adhesives used in I-joist fabrication comply with ASTM D 2559 and Section 5.3.3 of ASTM D 5055-08a.
- C. INSTALLATION
 1. Design Properties:
 - a. Duration of load adjustments to the tabulated values for allowable shear and moment are applicable in accordance with the National Design Specification for Wood Construction (NDS).
 - b. When joists are used as simple span members, the design shear to be resisted must be taken as equal to the calculated end reaction for the joists. When joists are used as uniformly loaded multiple span members, continuous over one or more interior supports, or in applications involving cantilevers, the design shear must be taken as the maximum shear at the face of the supports, using standard engineering and loading principles.
 2. Web Hole Size and Location:
 - a. Nordic NI series I-joists provide 1 1/2-inch-diameter (38 mm) knockout holes at 15 inches (381 mm) on center along the length of the joists to facilitate the installation of electrical wiring or light plumbing lines. These knockouts can be removed with a hammer as needed.
 - b. If the size of the knockout holes is insufficient for the specific end-use

application, larger holes may be field-cut in the web in accordance with the limitations set forth by the manufacturer. These provisions apply uniformly loaded, simple or multiple span Nordic NI series I-joists when dead loads do not exceed 10 psf (0.5 kN/m') for Table 3A and 15 psf (0.72 kN/m') for Table 3B, and live loads do not exceed 40 psf (1.9 kN/m').

3. I-Joist Flanges: Flanges must not be cut.
4. Bearing Stiffeners: Field-installed bearing stiffeners must be provided at points of end bearing when reactions exceed those permitted for unstiffened webs.
5. Web Stiffeners: Field-installed web stiffeners are required at points of concentrated loads when required.
6. Bearing Sizes: Ends of joists must be provided with a minimum of 1 ¾ inches (45 mm) of bearing length. Interior supports must be provided with a minimum of 3 ½ inches (89 mm) of bearing length.
7. Blocking Panels: The Nordic NI Proprietary series I-joists must be restrained against lateral movement and rotation at their supports. This may be accomplished by using blocking panels or rim joists at the ends of the joists. The band joist, no matter what its composition, must be placed under the load from above so that it transmits such load to the foundation or supporting structure below.
8. Bracing: Wood panel sheathing complying with the requirements of the code must be nailed or glue-nailed to the top flange of the Nordic NI Proprietary series I-joists to prevent lateral movement in service. Additionally, the top flange must be braced to prevent toppling of the beam or buckling of the top flange during construction.
9. One-hour Rated Floor-ceiling or Roof-ceiling Fire resistant Assemblies: The I-joists described in this report may be used in the assemblies described in IBC Table 720.1 (3), Item Numbers 21-1.1, 23-1.1, 25-1.1, 26-1.1, 27-1.1, 28-1.1 and 29-1.1, provided the I-joists used meet the required criteria as described in the tabulated "Floor or Roof Construction" column.

SECTION 06 20 00 - FINISH CARPENTRY

A. GENERAL

1. Work included in this section: labor and materials required for installation of all cabinetry, wood trim, closet shelving and closet hardware.
2. Delivery and storage of materials: all finish carpentry items may be stored at site if protected.
3. Carpentry quality standard: all cabinetry and trim work shall comply with AWI Custom Grade standards.
4. Moisture content: all finish carpentry materials shall be kiln-dried to an average moisture content of 10%.
5. All work to be produced as specified herein or as otherwise shown in architectural or woodwork drawings, details or shop drawings.

6. Shop Drawings: Shop drawings of all finish carpentry (based on field verified dimensions) to be submitted to Architect for approval.
7. Submittals: submit product information on all hinges, drawer glides and other hardware to architect for approval.
8. Samples: Submit one representative sample of each specified wood type, with the specified finish. Revise and resubmit each sample twice if requested by Architect.
9. Edges: All finished ends and edges shall be hardwood (to match adjacent veneers) as shown on the drawings.
10. Related Sections: Cabinetry Section 12 32 13

B. PRODUCTS

1. General (kitchen): Refer to the drawings and finish schedule for wood types throughout paint grade wood, poplar or similar through out
2. Shelving (closets, not inside cabinets): 3/4" paint grade plywood veneer plywood, 1" edge banded on all edges if adjustable and on front edge only if fixed or as otherwise shown in woodwork documents. Finish painted shop.
3. Closet & shelving hardware: Hanging Rod: 1" diameter hardwood rod with stainless steel wall mounting plates and support brackets
4. Countertops:
 - a. Kitchen and Bath: Solid Surface as detailed (refer to Section 093000).
5. Cabinetry Hardware, Typical:
 - a. Refer to the drawings and schedules for hardware specifications.
6. Kitchen Hardware:
 - a. Refer to the drawings and schedules for hardware specifications.

C. EXECUTION

1. Joints: all standing and running trim, fascia, etc. shall be installed using longest practical lengths so as to minimize joints; joints shall be crafted so as to be as invisible as possible (except for joints detailed otherwise); miter at corners.
2. Finish nailing: Use finish nails only and set heads for filling; leave no hammer marks.

3. Surfaces: after installation all wood work must be free of warping, splintering or other defects, and sanded smooth, free of planar marks and blemishes.
4. Shelving: construction as per drawings; painted finish, refer to painting section below.
5. Countertops: Fabricate and Install in accordance with manufacturer's instructions. Fabricate drop edge as shown on architectural drawings.
6. Cabinetry (installation): scribe to fit tightly to existing finished surfaces.
7. Cabinetry (installation-Kitchen): fabricate and install cabinetry to allow for the precise fit of appliances specified in accordance with appliance manufacturer's installation instructions.

SECTION 07 21 00 - MISCELLANEOUS BUILDING INSULATION

A. DESCRIPTION OF WORK

1. Provide all miscellaneous insulation (rigid, blanket, batt) not specified in other Sections herein, as indicated on the Drawings and as specified in this Section.

B. QUALITY ASSURANCE

1. Samples:
 - a. Submit 12" x 12" sample of each type of insulation.
 - b. Sample shall clearly indicate manufacturer's label and material designation.
2. Certificate: Furnish BSA or MEA resolution of approval of material.
3. Manufacturer: Minimum of Five years successful manufacture of type of product specified.
4. Materials shall be properly identified with manufacturer's name.
5. Store materials on the site in a dry area protected from the weather.
6. Protect with white polyethylene film or light colored covering. Do not leave exposed to direct sunlight.
7. Do not leave exposed in areas where traffic might cause mechanical damage to product.

C. MATERIAL

1. Mineral Fiber Blanket or Batt (ASTM C665, Type 1): Ottawa Fibre, 1365 Johnston Rd., Ottawa ON K1V 821, CANADA, 613-736-1215, www.ofigroup.com
 - a. 75% recycled, 33% post-consumer typical. 70% recycled, 20% post-consumer guaranteed.



2. EPS (Expanded Polystyrene) Insulation: Afm Corp., 24000 W. Hwy. 7, #201, P.O. Box 530, Excelsior, Mn 55331, Toll-Free: 800-255-0176
 - a. R-3.1 – 4.2 per inch.
 - b. Embodied Energy: 50,292.5 Btu/Lb.
3. Sound Batt Insulation: Provide 1 1/2" THERMAFIBER SAFB (Sound Attenuation Fire Blankets) between the joists and tight to the wood deck on each floor.

D. INSTALLATION

1. Verify that surfaces are free of defects or protrusions and ready to receive insulation. Do not begin installation until defects are remedied.
2. Install insulation as shown on Drawings and in accordance with manufacturer's instructions.
3. Butt units tightly together and tight to deck or wall surface.
4. Shape insulation around obstructions by means of saw, knife, or other sharp tool.

SECTION 07 21 26 - THERMAL INSULATION

A. GENERAL

1. APPLICATIONS

- a. Cavity-wall insulation,
- b. Concealed building insulation,
- c. Exposed building insulation,
- d. Loose-fill building insulation,
- e. Self-supported, spray-applied cellulosic insulation,
- f. Vapor retarders,
- g. Sound attenuation insulation.

B. MATERIALS

1. Insulation: NU-WOOL Premium Cellulose Insulation and WALLSEAL are registered trademarks for NUWOOL Co., Inc.
 - a. Cellulose Spray-on Insulation: Installed Density 3.2 lb/cu. ft. (51 kg/cu. m)
 - b. Cellulose Attic Insulation: Installed Density 1.60 lb/cu. ft. (26 kg/cu.)
2. Vapor Retarders: Fire-retardant, reinforced polyethylene. Vapor barriers needed for high humidity areas only.
3. Auxiliary Insulating Materials:
 - a. Eave ventilation troughs,
 - b. Insulation fabric

4. NU-WOOL Premium Cellulose is made from recycled paper (85%) and is packaged in 26-pound bags. Installation is done by factory-trained installers. NU-WOOL WALLSEAL Cellulose Insulation is a spray-in-place cellulose insulation made from recycled paper, primarily newspaper. It is installed in both attics and walls of residential and commercial buildings because of its superior thermal and air infiltration properties. WALLSEAL is an energy-saving material that has an R-Value of 3.8 per inch, and will last for the life of the structure. NU-WOOL uses borate chemicals as a fire retardant, making NU-WOOL WALLSEAL Cellulose Insulation one of the most environmentally friendly materials used in construction.
5. NU-WOOL Premium Cellulose Insulation is an energy saving insulation made from recycled paper. NU-WOOL Premium Cellulose Insulation, with its superior thermal and air infiltration properties, is installed in both attics and walls of residential and commercial buildings. This environmentally friendly, "green" insulation provides up to 40%* savings on energy bills when compared to fiberglass insulation materials. NU-WOOL Premium Cellulose Insulation also contains an EPA registered fungicide making it resistant to the growth of mold. WALLSEAL is applied by a spray-on method that insures the correct density to prevent settling while making the wall resistant to air movement and achieving maximum thermal performance. NU-WOOL Attic insulation is applied with air to open spaces at a density of 1.6 pounds per cubic foot. The manufacturers' coverage chart has reflects the settling after application in open blow situations.

C. PERFORMANCE REQUIREMENTS

1. All cellulose insulation must conform to the CPSC standard 16 CFR Part 1209 and 1404. NUWOOL also meets ASTM C-739. Also refer to UL R-8078 and R-13173.
2. Density is measured using ASTM C-739 standards and is 1.6 lb/ft³.
3. Thermal resistance was measured by test method ASTM C-518 (4 in. thick) and is 3.8 (R-value/in.)
4. Surface Burning Characteristics: Surface burning characteristics are determined using two methods. Critical radiant flux using test-method ASTM E 970 and ASTM E 84. ASTM E 970 Greater than 0.12 watts/ cm² ASTM E 84 Less than 25, Class 1.
5. Moisture Vapor Sorption: NU-WOOL meets the requirements of ASTM C 739 of less than 15% maximum weight gain under test conditions. Variations in relative humidity will not affect the thermal properties of the insulation.
6. Corrosiveness: NU-WOOL is tested for contact against copper, steel and aluminum under the test conditions of ASTM C 739 and is not corrosive to these metals.
7. Building Codes: NU-WOOL meets all the current building codes.
8. Sound Transmission Loss (STC) Ratings: NUWOOL has been tested for numerous wall assemblies at Riverbank Laboratories using ASTM E 90. Specific wall assemblies are listed in this book.
9. Other Test Properties: Under ASTM C 739, there are tests for fungi resistance, odor and smolder resistance.

SECTION 07 46 43 - WOOD SIDING

A. GENERAL

1. SECTION INCLUDES

- a. Lap Siding.

2. RELATED SECTIONS

- a. Section 06100 - Rough Carpentry.

3. REFERENCES

- a. Class A Fire Retardant, Ignition Resistant Material: ASTM E84, 30 minute extended, after 1000 hr of weathering cycles of rain, heat, and UV light per ASTM 2898.
- b. Flame & smoke Spread, Class A: ASTM E84, 30 minute extended, after 1000 hr of weathering cycles of rain, heat, and UV light per ASTM 2898.
- c. Termite Resistance: AWWA E1-97, ASTM D3345-74; ASTM D 1758; AWWA E7-93.

4. SUBMITTALS

- a. Data sheets on each product to be used, including:
 - i. Preparation instructions and recommendations,
 - ii. Storage and handling requirements and recommendations,
 - iii. Installation methods.
- b. Selection Samples: For each finished product specified, two complete sets of color chips representing manufacturer's full range of available materials and finished appearance.
- c. Verification Samples: For each finish product specified, three samples, nominal size 5 1/2 inches (140 mm) square representing actual product with finished color and texture.

5. QUALITY ASSURANCE

- a. Installer Qualifications:
 - i. Installer shall have five (5) years experience installing cedar trim on the type and size of project specified by this section.
 - ii. Installer shall be licensed, registered or otherwise approved by the local jurisdiction to install Wood Siding.

6. DELIVERY, STORAGE, AND HANDLING

- a. Inspect the materials upon delivery to assure that specified products have been received.
- b. Store materials in safe area, away from construction traffic; store under cover and off ground, protected from moisture.

- c. Keep materials clearly separated and identified with grade marks legible. Keep damaged material identified as damaged and stored separately.

7. 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.

8. SUPPLEMENTAL MATERIALS

- a. Fasteners, supports, and hangers shall be provided by manufacturers other than member organizations of the WRCLA, and conform to the requirements set forth by this section.

B. PRODUCTS

1. MANUFACTURERS

- a. TimberSIL® converted glass matrix, found in situ in TimberSIL® wood Product description: TimberSIL® amorphous glass matrix that is distributed throughout TimberSIL® wood. TimberSIL® Products, Springfield, VA 22151, Phone: 703-941-5171.
- b. The TimberSIL® fusion of wood and glass creates a product that is approximately twice as hard as the wood we start with. As measured by the Janka Scale, the hardness of southern yellow pine increases from 690-870 lbs-force (range depends on species), to 1560 lbs-force, approximately double.
- c. TimberSIL® Wood Products are harder than all softwoods, and become harder than most hardwoods.
- d. The resistance of TimberSIL® Wood Products to attack by organisms is due to the protective barrier of the product, and also due to the greatly improved strength of the fibers and the face of the wood, which makes it much more difficult for organisms to penetrate the wood.
- e. Chemical and Common Name: TimberSIL® amorphous glass matrix
- f. Substitutions: Not permitted.

2. SIDING TYPES

- a. Traditional profiles in 4, 6, 8 inch widths,
- b. Shiplap.

3. FASTENERS

- a. Nails: No. 304 stainless steel. Length: Must be sufficient to penetrate solid wood a minimum of 1 1/4".

4. PROTECTING FINISH

- a. Water repellent, fungus and mildew resistant penetrating stain that is resistant to Ultra Violet (UV) light. For solid colors, an alkyd oil primer is recommended. Top coats should be 100% Acrylic Latex.

- b. Adhere to coating manufacturer's instructions.

C. EXECUTION

1. PREPARATION

- a. Coordinate work with related trades; scribe and cope siding boards for accurate fit. Allow installation of related work to avoid cutting and patching.
- b. Select siding boards of longest possible lengths. Discard boards that are warped, twisted, bowed, crooked or otherwise defective.

2. INSTALLATION

- a. Installation must comply with local building codes and regulations.
- b. Finish materials on all sides and ends. Apply touch up coating on new cuts. Factory primed or finishing is preferred.

3. ADJUSTING AND CLEANING

- a. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.

4. MAINTENANCE

- a. Explain proper maintenance procedures to owner or owner's representative at project closeout.
- b. Visually inspect siding, caulking, flashing annually for overall condition. Re-apply caulking and coating as necessary. Adjust flashing as required.
- c. The use of pressure washers is not recommended.

07 46 46 – CEMENT FIBER BOARD

A. GENERAL

1. Provide all exterior cement board as indicated on the Drawings and as specified herein.

2. References:

- a. ASTM E 136-81: Minerit Heavy Duty cement board Non-combustibility test for building materials.
- b. ASTM E 136-81: Minerit Light Weight cement board Non-combustibility test for building materials.
- c. ASTM E 136-81: Minerit Multi Purpose cement board Non-combustibility test for building materials.

3. Quality Assurance:

- a. Single Source Responsibility: Provide cement fiberboard and all accessories as recommended by manufacturer.
- b. Handle cement fiberboards to prevent damage to edges, ends or surfaces. Remove all damaged materials from the premises.

- c. Comply with manufacturer's recommendations for environmental conditions before, during and after application of cement backer board.
 - d. Maintain temperature of 55 degrees F. within the structure for a minimum of 48 hours prior to installation, during installation and for 48 hours following application. Provide adequate ventilation to carry off excess moisture during installation.
- B. PRODUCTS
- 1. Fiber Cement Board:
 - a. Minerit HD: Exterior Cement Board, American Fiber Cement Corporation, 303-972-5103
 - b. Heavy Duty is a Finnish product that is made of clean and non-hazardous raw materials. As a Finnish product, Heavy Duty is designed to withstand wear and extreme weather conditions of the north, such as major temperature and air humidity fluctuations. In addition, Heavy Duty boards are non-combustible.
 - 2. Joint Reinforcement: Provide cement board manufacturer's recommended adhesives, fillers and tapes.
 - 3. Fasteners: Provide cement board manufacturer's recommended nails, screws, and washers.
 - 4. Materials:
 - a. Heavy Duty (HD) is available in 4 by 8 foot and 4 by 10 foot sheets, with a standard thickness ranging from 1/4 to 3/8 of an inch.
 - b. Specially developed for exterior cladding, Heavy Duty (HD) is strong, durable and able to withstand extreme climatic and working conditions. Its smooth, cement gray surface provides the perfect base for a variety of finishes and composite panels.
 - c. Standard Sizes: 5/32", 1/4", 5/16", 3/8"; 4' x 8', 4' x 10',
 - d. Material Characteristics:
 - Physical Properties: HD
 - Density, dry, pcf: 105
 - Moisture Content, normal, %: 5
 - Compressive Strength, psi: 11,600
 - Thermal Conductivity, BTU-in/ft², hr, °F: 2.1
 - Surface Burning Characteristics, Class I: 0
 - Non-combustible: ASTM E 136
 - 5. Warranty:
 - a. American Fiber Cement Corporation (AFCC) warrants that its products are manufactured in accordance with its applicable material specifications and are free from defects in materials and workmanship using AFCC's Specifications as standard. This warranty is applicable only to claims made in writing and received

by AFCC within 30 days after the defect was discovered and within one (1) year after the date of shipment of the product by AFCC. All other claims are waived.

C. EXECUTION

1. General: Examine all Work prepared by others to receive Work of this Section and report any defects affecting installation to the Authority for correction. Commencement of Work will be construed as complete acceptance of preparatory Work by others.
2. Verification of Conditions:
 - a. All framing members shall be straight and true, of uniform dimension and framing shall be properly aligned.
 - b. All surfaces to which board is fastened shall be free and clear of any protrusions, which would cause the panel to be deflected from the line of the wall.
3. Installation: Install cement board in accordance with manufacturer's recommendations for exterior applications.
 - a. Screw attach cement board panels to surfaces as specified, placing fasteners every 6 inches o.c.
 - b. Fasten boards to framing members with 1/4" screws spaced 6" o.c. Space fasteners at least 3/8" from edge of board. Edges or ends parallel to framing shall be continuously supported.
 - c. Where furring "Z" is required on Drawings, place "Z" maximum of 16" o.c. in a straight line with no protrusions from the line of the "Z" such as screw heads, mounting bracelets and flanges of electrical boxes.
 - d. Where two panels abut on a furring "Z", insert the screw in the joint between the panels together with the specified washer to securely catch the edge of both panels.
 - e. All horizontal and vertical joints and corners including joints with dissimilar materials shall have a gap of 3/16" between panels.
 - f. Finish surface of cement board shall be smooth and free from any imperfections, depressions, or raised areas that would inhibit the proper application of tile finish over the boards.

07 55 54 – SHEET MEMBRANE ROOFING

A. General

1. This section provides application information currently available from John's Manville Roofing Systems for UltraGard EPDM. All general information contained in this section and in the current JM UltraGard Single Ply Roofing Systems Manual shall be considered part of these specifications.
2. UltraGard EPDM specifications shall be used for a fully adhered system over insulation. Each specification in this section shall receive a JM UltraGard Roofing System Guarantee. Refer to Section 2 on "Guarantees" in the current JM UltraGard Single Ply Roofing Systems Manual or contact a JM representative for additional information.
3. Positive drainage of water off any roof membrane is necessary to prolong the service life of the system. JM, therefore, has the following policy: Design and installation of the deck and/or membrane substrate must result in the roof

draining freely, to outlets numerous enough and so located as to remove water promptly and completely.

B. PRODUCTS

1. Manufacturer: Johns Manville Roofing Systems.
2. THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE: Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced. Product: JM TPO. Thickness: 80 mils (2.0 mm), nominal.
3. AUXILIARY MATERIALS
 - a. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing. Liquid-type auxiliary materials classified as No VOC.
 - b. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
 - c. Sheet Flashing: Manufacturer's unreinforced sheet flashing of same material as sheet membrane.
 - d. Bonding Adhesive: Manufacturer's standard water-based bonding adhesive for membrane, and solvent-based bonding adhesive for Flashings.
 - e. Slip Sheet: Manufacturer's recommended slip-sheet, of type required for the application.
 - f. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.
 - g. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, pre-punched.
 - h. Fasteners required for all applications. Retain fasteners appropriate for application and change of plane terminations.
 - i. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
 - j. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a patented bifurcation process.
 - k. Coping System: Manufacturer's factory fabricated coping consisting of a base piece and a snap-on cap.

- l. Fascia System: Manufacturer's factory fabricated fascia consisting of a base piece and a snap-on cover.
- m. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

C. INSTALLATION

1. The proper application of roofing materials is as important to the satisfactory performance of the roofing system as the materials themselves. JM strongly recommends the following guidelines for the application of Single Ply materials be followed:
 - a. Never use wet or damaged materials.
 - b. Never apply any roofing materials during rain or snow, or to wet or damp surfaces. Moisture trapped within the roofing system can cause severe damage to the roofing membrane, insulation and deck, as well as cause poor quality of adhesive bonds.
 - c. Heed the specific cold weather application procedures described in the specifications.
 - d. Always install the complete roofing system at one time. Phase construction is unacceptable for any JM roofing system.
 - e. Always install water cut-offs at the end of each day's work, to prevent moisture from getting into and under the completed roof system. Water cut-offs should be completely removed prior to resuming work.
 - f. Never use bituminous materials in contact with any Single Ply membrane. These materials are not compatible with, and may damage the EPDM sheet.
 - g. Thoroughly review the guidelines and procedures for application of the roofing system, flashings, and other materials before starting work.
 - h. Always review warning labels and MSDS, and comply with the published safety procedures for all products being used. See the "Introduction" Section of the current JM UltraGard Single Ply Roofing Systems Manual for health and safety recommendations.
2. Fully adhered systems are totally attached to the substrate, by means of adhesive. A 60-mil (1.5 mm) thick, white-on-black, non-reinforced sheet, shall be used.
3. The product line includes flashing materials, adhesives, sealants, coatings, and accessories, providing a single source systems approach to the roofing assembly.

SECTION 076200 -SHEET METAL FLASHING AND TRIM

PART 1 -GENERAL

1.1 SUMMARY

A. Section Includes:

- 1 Manufactured reglets and counterflashing.
- 2 Formed roof drainage sheet metal fabrications.
- 3 Formed low-slope roof sheet metal fabrications.
- 4 Formed steep-slope roof sheet metal fabrications.
- 5 Formed wall sheet metal fabrications.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop-and field-assembled work.
 1. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.
- C. Samples: For each exposed product and for each finish specified.
- D. Maintenance data.
- E. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- B. 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 roof eave, including fascia fascia trim apron flashing, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
- C. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 -PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Exposed Coil-Coated Finishes:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. Color: Match Architect's samples.

2.2 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
- B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1 Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2 Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
- D. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

1 Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

2 Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. 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 wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

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

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

2.4 REGLETS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

1 Material: Galvanized steel, 0.022 inch thick.

2 Finish: Mill.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1 Obtain field measurements for accurate fit before shop fabrication.

2 Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

3 Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

C. Expansion Provisions: Where lapped expansion provisions cannot be used, form

expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide, joint cover plates. Fabricate from the following materials:

- 1 Galvanized Steel: 0.028 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight. Fabricate from the following materials:

- 1 Galvanized Steel: 0.040 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.040 inch thick.

- C. Base Flashing: Fabricate from the following materials:

- 1 Galvanized Steel: 0.028 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

- D. Counterflashing and Flashing Receivers: Fabricate from the following materials:

- 1 Galvanized Steel: 0.022 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

- E. Roof-Penetration Flashing: Fabricate from the following materials:

- 1 Galvanized Steel: 0.028 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

- 1 Galvanized Steel: 0.022 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

- B. Valley Flashing: Fabricate from the following materials:

- 1 Galvanized Steel: 0.028 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Drip Edges: Fabricate from the following materials:

- 1 Galvanized Steel: 0.022 inch thick.
- 2 Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

PART 3 -EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.
- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1 Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2 Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3 Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4 Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5 Install sealant tape where indicated.
 - 6 Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1 Coat back side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2 Underlayment: Where installing metal flashing directly on cementitious or wood

substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 1 Do not solder metallic-coated steel and aluminum sheet.
 - 2 Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - 3 Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 4 Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.
- G. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in



SMACNA's "Architectural Sheet Metal Manual" and as indicated.

- 1 Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
 - 2 Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with [**elastomeric**] [**butyl**] sealant and clamp flashing to pipes that penetrate roof.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

SECTION 07 84 00 - FIRESTOPPING

A. PROJECT INCLUDES

1. Penetrations through fire-resistance-rated floor construction.
2. Penetrations through fire-resistance-rated walls and partitions.
3. Penetrations through smoke barriers and construction enclosing compartmentalized areas.
4. Sealant joints in fire-resistance-rated construction.

B. QUALITY ASSURANCE

1. Fire Performance: ASTM E 119, ASTM E 814, and local regulations.

C. PRODUCTS

1. Through-Penetration Firestop Systems: Subject to compliance with requirements, provide one of the following:
 - a. Ceramic-Fiber and Mastic Coating.
 - b. Ceramic-Fiber Sealant.
 - c. Endothermic, Latex Sealant.
 - d. Endothermic, Latex Compounds.
 - e. Intumescent Latex Sealant.
 - f. Intumescent Putty.
 - g. Intumescent Wrap Strips.
 - h. Job-Mixed Vinyl Compound.
 - i. Mortar.
 - j. Pillows/Bags.
 - k. Silicone Foams.
 - l. Silicone Sealants.
 - m. Solvent-Release-Curing Intumescent Sealants.
2. Fire-Resistive Elastomeric Joint Sealants:
 - a. Single-component, neutral-curing, silicone sealant.
 - b. Multi-component, nonsag, urethane sealant.
 - c. Single-component, nonsag, urethane sealant.

SECTION 07 92 13 - JOINT SEALANTS

A. PROJECT INCLUDES

1. Joint sealers at interior and exterior vertical and horizontal joints.

B. QUALITY ASSURANCE

1. Field-Constructed Mock-Ups: Each joint type.

C. PRODUCTS

1. Urethane Elastomeric Joint Sealants:
 - a. Type and Application: Multi-part nonsag urethane sealant, ASTM C 920, for vertical [and horizontal] joints, exterior [and interior] use.
 - b. Type and Application: Multi-part pourable urethane sealant, ASTM C 920, for horizontal joints, exterior [and interior] use.
2. Silicone Elastomeric Joint Sealants:
 - a. Type and Application: Multi-part nonacid-curing silicone sealant, ASTM C 920, for vertical [and horizontal] joints, modulus as required for application, exterior [and interior] use.
 - b. Type and Application: One-part acid-curing silicone sealant, ASTM C 920, for vertical joints, exterior [and interior] use.
 - c. Type and Application: One-part mildew-resistant silicone sealant, ASTM C 920, for sanitary applications, interior use.

3. Polysulfide Elastomeric Joint Sealants:
 - a. Type and Application: Two-part nonsag polysulfide sealant, ASTM C 920, for vertical joints, exterior [and interior] use.
 - b. Type and Application: Two-part pourable polysulfide sealant, ASTM C 920, for horizontal joints, exterior [and interior] use.
 - c. Type and Application: Two-part polysulfide sealant, ASTM C 920, for water immersion.
4. Latex Joint Sealants:
 - a. Type: Acrylic-emulsion, ASTM C 834.
 - a. Type: Silicone emulsion, ASTM C 834, and ASTM C 920.
 - b. Application: Interior joints in vertical and overhead surfaces with limited movement.
5. Solvent-Release-Curing Joint Sealants:
 - a. Type: Butyl, FS TT-S-001657.
 - b. Application: Exterior vertical surfaces with limited movement.
6. Fire-Resistive Joint Sealers:
 - a. Type: One part fire-stopping sealant.
 - b. Application: Penetrations in fire-rated floor and wall assemblies.
7. Specialty Sealants:
 - a. Type and Application: Synthetic rubber for acoustical sealant for concealed joints.
 - b. Type and Application: Butyl-polyisobutylene sealant and tape sealant for concealed joints.
8. Auxiliary Materials:
 - a. Plastic foam joint fillers.
 - b. Elastomeric tubing backer rods.
 - c. Bond breaker tape.

SECTION 08 14 16 - FLUSH WOOD DOORS

- A. PROJECT INCLUDES
 1. Flush Wood Doors:
 - a. Interior solid core flush doors.
- B. QUALITY ASSURANCE
 1. Quality Standards: NWWDA I.S. 1-A, and AWI Architectural Quality Standards.
 2. Fire Rated Wood Doors: Meeting ASTM E 152 requirements.
- C. PRODUCTS

1. Interior Solid Core Doors:
 - a. Grade: Custom grade.
 - b. Construction: [5-ply] construction with glued-block core.
 - c. Finish: Opaque finish on closed-grain hardwood faces at hallway doors.
 - d. Finish: Transparent finish on Bamboo faces. Refer to finish carpentry for panel specifications.
2. Fitting and Finish:
 - a. Fitting: Job-site fit doors.
 - b. Factory Finish: Transparent factory finish, catalyzed lacquer.

SECTION 08 31 13 - ACCESS DOORS

A. PROJECT INCLUDES

1. Doors for wall and ceiling mechanical, electrical and plumbing unit and valve access.

B. PRODUCTS

1. Access Doors:
 - a. Frames: 16 gage (.0598 inch)(1.5 mm) stainless steel, AISI No. 4 satin finish with flange suitable for adjacent material.
 - b. Doors: 14 gage (.0625 inch)(1.6 mm) sheet steel.
 - c. Door Type: Flush panel.
 - d. Locking Devices: Cylinder locks.
 - e. Fire Rating: NFPA 80.

SECTION 08 52 13 - WOOD WINDOWS

A. GENERAL

1. SUMMARY

- a. Section includes:
 1. Windows: Fixed frame, fixed sash, storefront, casement, hopper, awning, tilt/turn, single-hung, and/or hopper-hung type operating sash, all with factory glazed components and reinforcing as required.
 2. Trims (if applicable).
 3. Flat steel mullion stiffeners (if applicable).
 4. All labor equipment, materials to furnish and perform work as specified and shown on contract documents.
- b. Related Work Specified Elsewhere
 - i. Section 061053 – Miscellaneous Rough Carpentry: Wood framing or blocking
 - ii. Section 062000 – Finish Carpentry
 - iii. Section 064000 – Architectural Woodwork

- iv. Section 076000 – Flashing and Sheet Metal
- v. Section 079200 – Joint Sealants: Perimeter sealants and backup materials
- vi. Section 088000 – Glazing
- vii. Section 099300 – Staining and Transparent Finishes

2. SYSTEM REQUIREMENTS

- a. General Qualifications: Wood framed windows shall withstand the effects of the performance requirements indicated without failure due to defective manufacture, fabrication or installation.
 - i. Fabricator: Single fabricator regularly engaged for at least ten years fabricating products of the kind and quality required for the project.
 - ii. Installer: Experienced carpenter contractor who has completed comparable work.
- b. Design Criteria
 - i. Manufacturer is responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
 - ii. Wall openings: Accommodate allowable building wall construction tolerances and moisture-caused brick masonry swell without stressing or deforming window units or overstressing anchorage.
 - iii. Moisture changes: Accommodate wood shrinking and swelling caused by ambient conditions at the project, without stressing window units, overstressing anchorage, causing sash to bind, or exceeding air/water entry limits.
 - iv. Comply with applicable provisions in AAMA/WDMA I.S. 2, "Standard Specification for Windows, Doors and Skylights" for operating force, air infiltration, water penetration, structural performance, and forced-entry resistance for wood windows.
 - v. Glazing provisions: As recommended by the glass manufacturer.
- c. Reference Standards
 - i. ASTM E 283 Test method for determining air leakage.
 - ii. ASTM E 330 Test method for determining structural performance.
 - iii. ASTM E 331 Test method for determining water penetration using static air pressure differential.
 - iv. ASTM E 547 Test method for determining water penetration using cyclic air pressure differential.
 - v. ASTM F 588 Test method for forced entry resistance.
 - vi. ASTM E 783-02 Standard test method for field measurement of air leakage through installed exterior windows and doors.
 - vii. AAMA 501.3 Field check of water and air leakage through installed exterior windows, curtain walls and doors by uniform air pressure difference.
 - viii. AWI: *Architectural Woodwork Quality Standards*, 7th edition, version 1.0, 1997, of the Architectural Woodwork Institute.
 - ix. AAMA/WDMA/CSA 101/I.S.2/A440-05 *Standard/Specification for Windows, Doors and Unit Skylights*.

3. PERFORMANCE REQUIREMENTS

a. Performance Requirements:

- i. Air Infiltration: Air leakage shall not exceed 0.15 CFM per square foot of surface area for fixed units and 0.30 CFM per foot of sash crack when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
- ii. Water Infiltration: No uncontrolled leakage when tested in accordance with ASTM E547 at test pressure of 6.24 psf, or 20 percent of full positive design wind load, whichever is greater.
- iii. Thermal Transmittance: Provide window units with the following U-value as determined according to NFRC 100 or calculated according to LBNL Window 5.2 computer analysis. U-value = 0,73 W/(m²K)
- iv. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F588.

- #### b. Structural Requirements: When tested in accordance with ASTM E330 at 150 percent of design pressure, no failure or permanent deflection in excess of 0.003 of any member's span after removing the imposed load, for a positive (inward) and negative (outward) design pressure of 60 psf.

4. SUBMITTALS

- #### a. Wood Samples: Duplicate pairs of samples for each species of unfinished and transparent finished wood proposed for production work.

- i. Samples shall be large enough to accurately show typical appearance characteristics.
- ii. Each pair of samples shall show extremes of appearance characteristic of range proposed for the work. Wood used for production shall be within this range.
- iii. Provide chain-of-ownership documentation for all FSC certified lumber.

- #### b. Sample Windows/Mock-Ups (where specified): Window assemblies for typical wall openings shall be provided, complete and ready to install.

c. Shop Drawings

- i. Schedule: Window types, sizes, locations, and quantities, keyed to scale elevations. Identify materials, finish and species of woods, glazing types, hardware, and anchoring provisions.
- ii. Details: Full or large scale, keyed to scale elevations. Show frame and sash construction, glazing, weep/vent provisions, hardware, weather-stripping and anchorage.
- iii. Installation: Clearly show relation to adjoining construction. Give blocking requirements, clearances, weather proofing & flashing recommendations and all other instructions necessary for proper installation.

5. QUALITY ASSURANCE

a. Single Source Responsibility:

- i. Provide window and door systems that are products of a single manufacturer.
- ii. Glass, glazing, and glazing sealants for window and door systems are required as work of this section for single source responsibility.

b. Certifications

- i. Fabricator qualifications: Not less than 10 years prior successful production of units similar to those required. List projects having windows of the kind required for the project. Installations shall have been done to meet job conditions and performance requirements of the kind shown and specified for this project. Give installation dates, locations, contact names, addresses, and phone numbers for each project.
- ii. Test report: Certified independent testing agency reports to show compliance with specified window performance requirements. Tests shall have been made within 5 years of submission. Reports shall include test descriptions and results, as well as sufficient product descriptions to show that tested products are representative of those proposed for the project.
- iii. Installer Qualifications: Certified in writing by manufacturer with documented experience on at least 5 projects of similar nature in past 5 years.
- c. Maintenance Instructions: Two copies of window manufacturer's product manual with recommendations for routine owner maintenance of window units, hardware and wood finishes; and instructions for removing and replacing sash and glass.

6. DELIVERY, STORAGE AND HANDLING

- a. Deliver factory-assembled, preglazed windows in enclosed vans. Bundle and label loose materials as necessary to prevent loss and damage.
- b. Store products in a clean, protected, dry, well-ventilated building, on platforms or blocking at least 4 inches above floor. Stack products so they do not warp, bend or twist. Store windows upright, not flat or leaning, with at least ¼" air space between units. General contractor is responsible for storage on site.
- c. Protect glazing and frame components from adverse job conditions before, during, and after installation including but not limited to:
 - i. Condensation, temperature changes, direct exposure to sun or other causes that could otherwise damage the assemblies
 - ii. The work of other trades before, during, and after installation (e.g., weld slag, run down staining, masonry dust and similar)
 - iii. Adhere to glass manufacturer's recommendations for venting and sealing insulated units to avoid hermetic seal ruptures or glass breakage at high altitude locations.
- d. Handle windows with clean hands or canvas gloves.

7. PROJECT CONDITIONS

- a. Connecting Work: Constructed to specified tolerances. Field dimensions agreed upon prior to fabrication.
- b. Reference Points: Benchmarks and other required reference points shall be established.
- c. Environmental Conditions: Air temperature during installations shall be at least 40° F and rising, and the wind light or still. Work areas and materials shall be dry and free of ice and snow. Ensure ambient and surface temperatures and joint conditions are suitable for installation of materials.

8. WARRANTY

- a. Provide written warranty signed by manufacturer stating that work is free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components, which fail under normal operation.

- i. Material and workmanship warranty term: 3 years from date of Substantial Completion.
- b. Provide written warranty agreeing to replace defective insulating glass units and stating that insulating glass units will be free from condensation, fogging and obstruction of vision due to film on internal surfaces for 10 years from date of installation. Replacement includes labor and materials.
 - i. Glass seal failure warranty term: 10 years from date of Substantial Completion.

B. PRODUCTS

1. MANUFACTURERS

A. Basis of Design: DOLETA PASSIV WINDOW, DOLETA GmbH, 59422 Jieznas, Litauen

2. FRAME MATERIALS

- a. Lumber: All pieces shall be dried to an average moisture content of 12% (9-14% for individual pieces) before assembly and treatment.
- b. Wood Species: Different species at interior and exterior
 - 1. Exterior: Aluminum for extension sill nosing, exterior frame and sash facing.
 - 2. Interior: Douglas Fir (*Pseudotsuga menziesii*) for all inside frame and sash components.

3. HARDWARE

- a. Anchor Bolts and Screws: Hex head through-bolts and flat head wood screws shall be of corrosion resistant type (zinc chromate, galvanized or stainless steel).
- b. Waterproof Adhesive: Resorcinol, melamine, or polyvinyl acetate emulsion type.
- c. Anchor Clips: Teco, Simpson Strong-Tie Connectors®, or equal.
- d. Operating Hardware:
 - i. Sash locks (awning, out-swing casement, hopper, hopper-hung, single-hung): Oxidized bronze alloy latch designed to be manually operated. Finishes: Lacquered Red Bronze (US 20A), Oil Rubbed Bronze (US 10) and White Bronze (US 26D).
 - ii. Pushbar operator (out-swing casement and awning): Comprised of oxidized bronze alloy components and a solid brass bar, copper plated and oxidized to match bronze. The pushbar operator shall be designed to be manually operated for entire length and to hold sash at intermediate points. Finishes: Lacquered Red bronze (US 20A), Oil Rubbed Bronze (US 10) and White Bronze (US 26D).
 - iii. Roto-crank operator (out-swing casement, awning): Truth Maxim® stainless steel roto-crank. Finishes: Satin Nickel (US15), Oil Rubbed Bronze (US 10).
 - iv. Multi-latchpoint operating hardware (tilt/turn, in-swing casement): G-U Jet Contura with single lever handle and concealed hinging. Finishes: Lever handle style and finish per project requirements.
 - v. Hinges (awning, out-swing casement, hopper, hopper-hung): Heavy duty stainless steel extension type. Heavy duty zinc chromate coated steel or solid brass available for oversized units.

- vi. Insect screens (all unit types): Frames – 1" x 5/16" tubular aluminum extrusions in manufacturer's standard colors. Mesh – 18 x 16 screen mesh in manufacturer's standard materials and finishes: charcoal aluminum, mill finish aluminum, stainless steel, bright brass, or bright copper. Optional wood framed insect screens available.
- vii. Specialty hardware (per project requirements): Egress, sash restrictors, security locks, remote operators.
- e. Weather-Stripping: Extruded ethylene propylene, neoprene or other plastic that remains flexible and non-sticky at project ambient temperature extremes.

4. FABRICATION

a. General

- i. Windows: Produced from standard components. Wood components shall be solid lumber. Like parts shall be interchangeable. Fitting, machining for hardware and glazing shall be done in the factory.
- ii. Frames: AWI Custom Grade Exterior Frames.
- iii. Sash: AWI Custom Grade Finished Exterior Sash. Fixed and operable sash incorporate removable interior glass stops for ease of reglazing.

b. Permanent Joints and Facings: Bonded with water-resistant adhesive.

c. Wood Finish: Interior: Factory-primed for sanding and finish by others in field after installation.

d. Glazing

- i. Products and installation: Satisfy requirements specified in Section 088000 Glazing.
- ii. Dry Glazing: Provide compression type design utilizing extruded neoprene or silicone glazing gasket system recommended by manufacturer.
- iii. All units to be factory-pre-glazed.
- iv. Glazing channel shall be weeped/pressure relief vented per window manufacturer's requirements.
- v. Where required, glass at heat absorbent unit to be suitably tempered.
- vi. Where required, glass at windows with blinds to be suitably tempered.
- vii. Insulated units for high elevation projects to include breather tubes. Tubes to be sealed within two days of arrival at jobsite following manufacturer's written instructions.

e. Measurements:

1. Take accurate field measurements to verify required dimensions prior to fabrication.
2. Where field dimensions cannot be made without delaying the work, establish opening dimensions and proceed with fabricating windows without field dimensions. Coordinate wall construction to ensure that the actual opening dimensions correspond to established dimensions

f. Fabricate components in accordance with manufacturer's tested assemblies. Shop fabricate, glaze, and finish to greatest extent practical to minimize field assembly. Disassemble only to extent necessary for shipping and handling limitations.



- g. Fabricate components true to detail and free from defects impairing appearance, strength or durability.

C. EXECUTION

1. EXAMINATION

- a. Examine conditions with installer present for compliance with all requirements. Inspect wall flashings, vapor retarders, water and weather barriers, and other built in components to ensure a weather tight installation.
- b. Verify dimensions, tolerances, and method of attachment with other work.
- c. Proceed with installation only after unsatisfactory conditions have been corrected.

2. INSTALLATION

- a. General: Install windows per approved shop drawings, in proper relation to adjoining construction. Do not twist frames or force fit them into poorly prepared openings. Anchor windows as required to satisfy design requirements. See manufacturer's installation instructions and shop drawings.
- b. Center window units in wall openings leaving a uniform interface caulking recess on all four sides. The manufacturer strongly suggests that sealant be selected for its adhesion compatibility with the specified exterior wood and adjacent wall materials. Consult the manufacturer for recommended sealant.
- c. Level Units: Install shims at bearing locations, anchors, and latchpoint, so they are not dislodged by subsequent operations. Test sash operation and sash alignment before permanently anchoring units.
- d. Anchorage: Install anchors through frame centerline beside shims. Anchor window units to wood blocking with wood screws and to metal framing with Tek screws; countersink anchor heads. All anchors shall be concealed by closed sash or with wood plugs.
- e. Installation to conform to window manufacturer's requirements as indicated in the manufacturer's product manual.

3. FIELD QUALITY CONTROL

- a. Field Tests: Independent testing laboratory will perform air infiltration tests in accordance with ASTM E783, and water infiltration tests in accordance with AAMA 501.3.
 - 1. Cost of initial testing to be born by owner.
 - 2. Costs for any remedial work and subsequent re-testing to be born by responsible party depending on nature of remedial work required.

4. CLEANING

- a. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.
- b. Clean exposed surfaces exercising care to avoid damage.
 - i. Remove adhered matter and excess sealant materials.
 - ii. Replace glass which is broken, cracked, chipped, scratched, abraded or damaged in other ways.

- c. Wash glass on interior and exterior to remove paint, soil, prints and foreign matter. It is strongly advised that procedures and methods outlined in the following documents be strictly adhered to when cleaning Architectural glass:
 - i. Glass Association of North America (GANA) Technical Bulletin 01-0300: *Glass Cleaning Procedure*
 - ii. GANA Technical Bulletin TD-02-0402: *Heat-treated Glass Surfaces Are Different*
 - iii. PPG Glass Technical Document TD-142: *Glass Cleaning Recommendations*
5. PROTECTION
- a. Institute protective measures required throughout the construction period to ensure that both interior and exterior of wood doors will be without damage or deterioration, other than normal weathering.

SECTION 08 71 00 - DOOR HARDWARE

A. PROJECT INCLUDES

- 1. Hardware for swinging and sliding doors.

B. QUALITY ASSURANCE

- 1. Hardware for Fire-Rated Openings: NFPA 80, and local requirements.
- 2. Handicapped Accessibility: ANSI A117.1, AADAG, and local requirements.
- 3. Materials and Application: ANSI A156 series standards.

C. PRODUCTS

- 1. Door Hardware:
 - a. Quality Level: residential heavy-duty use type.
 - b. Locksets and Latchsets: Mortise type by Omnia Industries, No. 36, US26D finish, available with the smaller rose. The bedrooms and bathrooms shall have privacy sets.
 - c. Lock Cylinders: Interchangeable type.
 - d. Keying: Owner's requirements keying and key control system.
 - e. Hinges and Butts: Full-mortise type with non-removable pins at exterior doors.
 - f. Pivots: Center hung pivot sets by RIXSON No. 128-3/4, typical.
 - g. Push/Pull Units: Through-bolted type.
 - h. Closet Door Edge Pulls: Rajack No. FE158.
 - i. Bath Sliding Door Pulls: Sugatsune No. 3511.
 - j. Door Pulls: Hafele No. 106.74.901 and 124.02.920.
 - k. Sliding/ Pocket Hardware: HAFELE, HAWA Junior 120/A, 40/Z and 80/GS Hardware.
 - l. Hardware Finishes: Satin stainless on all exposed surfaces.
- 2. Auxiliary Materials:
 - a. Door Trim Units: Kick-plates, edge trim, and related trim.
 - b. Stops and overhead door holders.
 - c. Interior sliding door hardware.

- d. Soundstripping.
- e. Weather-stripping and thresholds.

SECTION 08 81 00 - GLAZING

A. PROJECT INCLUDES

- 1. Glazing:
 - a. Exterior windows.
 - b. Interior windows.
 - c. Glass Floor.

B. QUALITY ASSURANCE

- 1. Submittals: 12" x 12" of each type of glazing.
- 2. Testing: Glazing performance.

C. WARRANTY

- 1. Glass Warranties:
 - a. Coated Glass: Manufacturers 5-year warranty.
 - b. Insulating Glass: Manufacturers 10-year warranty.

D. PRODUCTS

- 1. Glass:
 - a. Heat-Treated Glass Products: Tempered glass, ASTM C 1048.
 - b. Triple-paned and Sealed Insulating Glass Units: ASTM E 774, Class A.
 - c. High-Performance Coatings: Low-E (low-emissivity) type.
- 2. Glazing:
 - a. Elastomeric glazing sealants.
 - b. Preformed glazing tapes.
 - c. Glazing gaskets.
 - d. Setting blocks, spacers, and compressible filler rods.

E. SCHEDULE

- 1. Windows: High-Performance™ Low Emissivity, Argon Blend Filled Insulating Glass Units:
 - a. Glass: Insulating glass units to consist of an outboard lite of clear annealed glass conforming to ASTM C 1036, Type 1, Class 1, q3 and an inboard lite of clear, heat strengthened glass conforming to ASTM C 1048, Type 1, Class 1, q3, Kind HS.
 - b. High-Performance™ LoE² Coating : MSVD (magnetron sputtering vapor deposition) LoE² coating applied to the No. 2 surface.

- c. Filling: Fill space between glass lites with an argon gas blend to reduce heat loss.
 - d. Performance Characteristics for the center of glass: The following performance characteristics are based on NFRC validated spectral data files for the respective glazing. The values are for center of glass only. (See section 1.03 for whole fenestration performance values.)
 - U-Factor: 0.28.
 - Solar Heat Gain Coefficient (SHGC): 0.43.
 - Visible Light Transmittance (Vtc): 73%.
 - Ultra-Violet Transmittance (Tuv): 17%.
 - Krochmann Damage Weighted Fading Function (Tdw): 34%.
2. Skylight: Units shall be Heat Mirror Insulating Glass as manufactured by Sunlite Insulating Glass Mfg. Ltd., Mississauga, Ontario, tel. 905-564-8235, Type TC-88.
 - a. Unit configuration: Heat Mirror insulating glass shall be configured as follows by type/group.
 - Outboard Lite laminated.
 - Heat Mirror type SC-75.
 - Inboard Lite laminated.
 - Space to be filled with Krypton.
 - Overall unit thickness is 1-inch.
 - b. Performance: All performance data shall be calculated according to ASHRAE standard procedures and verified using the LBL "WINDOW 4.1" program.
 - Winter nighttime R-value of 5 or better.
 - Shading Coefficient of .37 or better.
 - Daylight transmittance of 61% or better.
 - Ultraviolet blockage shall be 99.5% or better.
 3. Glass Floor: 3-layers total; top is 3/16" annealed and etched, laminated to 2-layers 1/4" annealed glass.
 4. Jalousie: 4" Ilomco Series as manufactured by Lawson Industries, Miami, Florida or equal. Unit width shall be 41", number of louvers shall be 14 and unit height shall be 76 3/4".

SECTION 08 83 13 - MIRRORS/ MISC. GLASS

A. GENERAL

1. Work included in this section: labor and materials required to furnish and install all mirrors and miscellaneous glass products.
2. Related work specified elsewhere: Mirror assemblies require coordination with miscellaneous metals work.

3. Submit shop drawings, based on field verified dimensions where necessary, of all mirror and glass work to show required alignments as detailed of all mirror work with metalwork.
4. Samples: Submit 6" x 6" sample of mirroring to show mirroring and edge condition as specified to Architect for approval. Submit 6" x 6" sample of glass shelving w/ sandblasted finish to Architect for approval.

B. PRODUCTS

1. Mirrors: fabricate as shown. Mirrors to fit tightly within frames as detailed; confirm sealant and/or shims, to be used with Architect for tight fit. Glass thickness to be 1/4". Edges to be seamed and polished. The back side of mirrors, when exposed to view, shall be painted as directed by Architect.
2. Mirror mastic: where necessary, mastic may be used to attach mirrors to metal back panels as detailed.
3. Glass Shelving: fabricate as shown. Glass to be 3/8" thick tempered clear float glass with underside sandblasted. Edges to be seamed and polished. Lacquer sandblasted areas to protect from fingerprints.

C. EXECUTION

1. Fabrication: Fabricate as detailed and according to approved shop drawings and sample.
2. Coordination: All work must be coordinated with miscellaneous metalwork as detailed for precise fit of all work.
3. Cleaning: Upon completion of work, all glass and mirrors must be cleaned and left spotless. If required by General Contractor, protect glass and glass assemblies from damage by other trades.

09 28 13 - TILE BACKER BOARD

A. GENERAL

1. Provide all interior tile backer board as indicated on the Drawings and as specified herein.
2. References:
 - a. American Society for Testing and Materials (ASTM), latest Edition. C 754 - Installation of Steel Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board or Water Resistant Backing Board.
 - b. United States Gypsum Co. Gypsum Construction Handbook.
 - c. Tile Council of America Handbook for Ceramic Tile Installation.
3. Quality Assurance:

- a. Work of this Section shall conform to all requirements of New York City Board of Standards and Appeals (BSA) approval, or New York City Material Equipment Acceptance (MEA) approval.
- b. Single Source Responsibility: Provide tile backer board and all accessories as recommended by manufacturer.
- c. Handle tile backer boards to prevent damage to edges, ends or surfaces. Remove all damaged materials from the premises.
- d. Comply with manufacturer's recommendations for environmental conditions before, during and after application of cement backer board.
- e. Maintain temperature of 55 degrees F. within the structure for a minimum of 48 hours prior to installation, during installation and for 48 hours following application. Provide adequate ventilation to carry off excess moisture during installation.

B. PRODUCTS

1. Tile Backer Board:
 - a. Durock Tile Backer Board by United States Gypsum; Chicago, IL.
 - b. Wonder Board by Modulars, Inc.; Hamilton, Ohio.
2. Joint Reinforcement: Provide tile backer board manufacturer's recommended adhesives, fillers and tapes.
3. Fasteners: Provide tile backer board manufacturer's recommended nails, screws, washers.
4. Materials:
 - a. Tile Backer Board: Provide cementitious tile backer board in 1/2" thickness by 36" widths and 48", 60", 64" or 72" lengths, as required unless indicated otherwise on the Drawings. Provide largest practicable lengths to produce a minimum of joints between boards.
 - b. Joint Treatment Materials: Provide manufacturer's recommended joint treatment materials; mortar, grout, reinforced mesh tape and fasteners. Reinforced mesh tape shall be min. 2" wide open weave fiberglass tape.
 - c. Vapor Barrier: Where vapor barrier is specified; provide 4-mil sheet polyethylene vapor barrier.
 - d. Furring Channel: Continuous 12 gauge galvanized steel "Z", 16" o.c. vertically anchored to masonry wall with "HIT" renovation anchors by Hilti Fastening Systems, Inc., Tulsa Okla.

C. EXECUTION

1. General: Examine all Work prepared by others to receive Work of this Section and report any defects affecting installation to the Authority for correction. Commencement of Work will be construed as complete acceptance of preparatory Work by others.
2. Verification of Conditions:

- a. Steel stud framing members shall be spaced a maximum of 16" o.c. Framing members are to be 18 gage or heavier as required by assembly detailed on Drawings.
 - b. Verify that all steel grounds and additional reinforcement has been installed to support plumbing fixtures, grab bars and other accessories that must be attached to framing.
 - c. All framing members shall be straight and true, of uniform dimension and framing shall be properly aligned.
 - d. All surfaces to which board is fastened shall be free and clear of any protrusions, which would cause the panel to be deflected from the line of the wall.
3. Installation: Install tile backer board in accordance with manufacturer's recommendations and in compliance with assemblies specified and detailed in Tile Council of America's Handbook for Ceramic Tile Installation, for interior ceramic tile applications.
- a. Screw attach tile backer board panels to concrete block or other surfaces as specified, placing fasteners every 6 inches o.c.
 - b. Fasten boards to steel stud-framing members with 1/4" screws spaced 6" o.c. Space fasteners at least 3/8" from edge of board. Edges or ends parallel to framing shall be continuously supported.
 - c. Where furring "Z" is required on Drawings, place "Z" maximum of 16" o.c. in a straight line with no protrusions from the line of the "Z" such as screw heads, mounting bracelets and flanges of electrical boxes.
 - d. Where two panels abut on a furring "Z", insert the screw in the joint between the panels together with the specified washer to securely catch the edge of both panels.
 - e. All horizontal and vertical joints and corners including joints with dissimilar materials shall have a gap of 3/16" between panels. Fill joints solid with mortar specified by manufacturer and tape all joints and corners with manufacturer's recommended methods. Embed tape firmly with tie setting mortar or adhesive.
 - f. Finish surface of tile backer board shall be smooth and free from any imperfections, depressions, or raised areas that would inhibit the proper application of tile finish over the boards.

SECTION 09 30 00 - TILE AND STONE

A. GENERAL

1. Work included in this section: labor and materials required to furnish and install all tile, tile products, stone and stone flooring.
2. Samples: submit color range of grout samples to architect for selection of grout color; submit one sample assembly, 12" x 12" in size of each of the specified tile assemblies to the architect for approval of tile size, color and grout color. Submit two samples of each specified stone, 6" x 6" for Architect to select type & color:

Bath:	PaperStone
Countertop:	Paperstone

3. Shop Drawing: provide shop drawings of tile layouts and stone based on field verified dimensions to Architect for approval. Submit cut sheets on tile accessories specified.
4. Related Sections:
 - a. Simulated Stone Countertops: Section 12 36 23

B. PRODUCTS

1. Ceramic and glazed tile manufactured by Dal-Tile in the sizes, styles and colors in the areas and patterns indicated on the Architectural Drawings. Note thickness of adjacent tiles may vary, finished face of tiles to be flush. Note no tile cove unless noted otherwise.
2. Floor and wall mortar: Dry-set or Latex-Portland Cement Mortar as per "Handbook for Ceramic Tile Installation" of the Tile Council of America, Specifications #F113-90, W222-90.
3. Floor and Wall grout: colored latex-portland cement grout; color to be verified w/Architect.
4. Tile Accessories: As indicated above; by Gilmer Ceramic Accessories, Inc.
7. Stone: Thickness of countertops and splashes as detailed on the Kitchen drawings. Type and color to be specified by Architect. Finish to be honed.
8. Waterproof Membranes: Provide @ Floor at custom tiled tub and shower areas; Schluter Kerdi Shower System with integral drain.

C. EXECUTION

1. General Installation Practices: conform to instructions of the latest edition of the "Handbook for Ceramic Tile Installation" of the Tile Council of America, all mortar and grout products shall be in conformance with manufacturer's instructions.
2. Tile floors: Conform to "Handbook for Ceramic Tile Installation" of the Tile Council of America, Specification # F113-90. Prepare existing floor surfaces as required to insure proper bond of mortar; confirm tile setting specification with Architect.
3. Tile walls: Conform to "Handbook for Ceramic Tile Installation" of the Tile Council of America, Specification # W221-90, #W241-90. Prepare existing wall surfaces as required to insure proper bond of mortar; confirm tile setting specification with Architect.
4. Tile joints: maintain uniform, 1/8" (verify) width joints to maintain modular dimensions indicated on drawings; grout as per products above; damp cure grout in strict accordance with manufacturer's instructions.
5. Coursing: align floor tile joints with wall tile joints; generally, lay out tile horizontally and vertically to achieve largest equal borders; review tile layout in each room with Architect prior to proceeding with installation.

6. Cleanup: immediately upon completion of tile and stone work, clean material in accordance with manufacturer's recommendations.

SECTION 096400 - WOOD FLOORING

GENERAL

SECTION REQUIREMENTS

Submittals: Product Data and material Samples.

Hardwood Flooring: Comply with NOFMA grading rules for species, grade, and cut.

Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.

Certification: Provide flooring that carries MFMA mark on each bundle or piece.

PRODUCTS

MATERIALS

Engineered-Wood Flooring: HPVA EF.

Products: EcoTimber EcoPlanet Float Floor or Similar.

Species: Hard Maple Muir Wood

Grade: Select Grade

Thickness: 1/2 inch

Construction: Five ply.

Width: 5 inch

Length: Manufacturer's standard.

Edges: Micro-beveled edges

Finish: Matte sheen, ceramic enhanced, UV-cured acrylic urethane with scratch-resistant hardened top-coat

Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors; compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

ACCESSORY MATERIALS

Floor Pad: QuietWalk Floating Floor Pad (www.quietwalk.com) or equivalent 1/8" thick underlayment.

Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."

EXECUTION

INSTALLATION

Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."

Provide expansion space at walls and other obstructions and terminations of flooring of not less than 1/2".

Engineered-Wood Flooring: Install Float Floor.

END OF SECTION 096400

SECTION 09 91 23 - PAINTING AND FINISHING

A. GENERAL

1. GENERAL REQUIREMENTS

- a. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

2. SECTION INCLUDES

- a. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing of the entire facility, new and existing surfaces, as shown on the drawings and/or specified herein, including, but not limited to, the following:
 - i. Prime painting unprimed surfaces to be painted under this Section.
 - ii. Painting all items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
 - iii. Painting all ferrous metal (except stainless steel) exposed to view.
 - iv. Painting all galvanized ferrous metals exposed to view.
 - v. Painting gypsum drywall exposed to view.
 - vi. Painting interior plaster surfaces.
 - vii. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers, lighting fixtures, and the like, which are exposed to view through these items.
 - viii. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
 - ix. Painting of any surface not specifically mentioned to be painted herein or on drawings, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, shall be included as though specified.

3. RELATED SECTIONS

- a. Shop priming is required on some, but not all of the items scheduled to be field painted. Refer to other Sections of work for complete description.
- b. Shop coat on machinery and equipment: Refer to the Sections under which various items of manufactured equipment with factory applied shop prime coats are furnished, including, but not necessarily limited to, the following Sections. All items of equipment furnished with prime coat finish shall be finish painted under this Section.
 - i. Heating, ventilation and air conditioning - Division 15.
 - ii. Plumbing - Division 15.
- c. Color Coding of Mechanical Piping and Electrical Conduits - Division 15. This Color Coding consists of an adhesive tape system and is in addition to painting of piping and conduits under this Section, as specified above.

4. QUALITY ASSURANCE

- a. Job Mock-Up:
 - i. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Architect. Paint mock-ups to include door and frame assembly.
 - ii. These applications when approved will establish the quality and workmanship for the work of this Section.
 - iii. Repaint individual areas which are not approved, as determined by the Architect, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.
- b. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces.
- c. Paint Coordination: Provide finish coats, which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Architect in writing of any anticipated problems using the coating systems as specified with substrates primed by others.
- d. All paints must have low or zero Volatile Organic Compounds (VOC) exceeding standards of prevailing codes and ordinances.

5. SUBMITTALS

- a. Materials List:
 - i. Before any paint materials are delivered to the job site, submit to the Architect a complete list of all materials proposed to be furnished and installed under this portion of the work.
 - ii. This shall in no way be construed as permitting substitution of materials

for those specified or accepted for this work by the Architect.

- b. Samples
 - i. Accompanying the materials list, submit to the Architect copies of the full-range of colors available in each of the proposed products.
 - ii. Upon direction of the Architect, prepare and deliver to the Architect two (2) identical sets of Samples of each of the selected colors and glosses painted onto 8-1/2" x 11" x 1/4" thick material; whenever possible, the material for Samples shall be the same material as that on which the coating will be applied in the work.
- c. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.

6. PRODUCT HANDLING

- a. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.
- b. Protection:
 - i. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
 - ii. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.
 - iii. Use all means necessary to protect paint materials before, during and after application and to protect the installed work and materials of all other trades.
- c. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

7. EXTRA STOCK

- a. Upon completion of this portion of the Work, deliver to the Owner an extra stock of paint equaling approximately ten (10) percent of each color and gloss used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

8. JOB CONDITIONS

- a. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.
- b. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

- c. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
 - d. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.
- B. PRODUCTS
- 1. PAINT MANUFACTURERS
 - a. Except as otherwise noted, provide the painting products listed for all required painting made by one of the manufacturers listed in the paint schedule (Section 2.4). These companies are AFM Safecoat and Ivy Coatings. Comply with number of coats and required minimum mil thicknesses as specified herein.
 - 2. MATERIALS
 - a. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.
 - b. Colors and Glosses: All colors and glosses shall be as selected by the Architect. Certain colors will require paint manufacturer to prepare special factory mixes to match colors selected by the Architect. Color schedule (with gloss) shall be furnished by the Architect.
 - c. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.
 - a. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D 234 and D 260, respectively.
 - 3. GENERAL STANDARDS
 - a. The various surfaces shall be painted or finished as specified below in Article 2.4. However, the Architect reserves the right to change the finishes within the range of flat, semi-gloss or gloss, without additional cost to the Owner.
 - b. All paints, varnishes, enamels, lacquers, stains and similar materials must be delivered in the original containers with the seals unbroken and label intact and with the manufacturer's instructions printed thereon.
 - c. All painting materials shall bear identifying labels on the containers with the manufacturer's instructions printed thereon.
 - d. Paint shall not be badly settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency and shall have excellent application properties.
 - e. Paint shall arrive on the job color-mixed except for tinting of under-coats and possible thinning.
 - f. All thinning and tinting materials shall be as recommended by the manufacturer for the particular material thinned or tinted.
 - g. It shall be the responsibility of the Contractor to see that all mixed colors match the color selection made by the Architect prior to application of the coating.
 - 4. SCHEDULE OF FINISHES

- a. Exterior Galvanized Ferrous Metal
Primer: AFM SafeCoat MetalCoat
First Coat: AFM SafeCoat MetalCoat
Second Coat: Same as recommended first coat.
- b. Interior Ferrous Metal
Satin Finish/Latex
Primer: AFM SafeCoat MetalCoat
First Coat: AFM SafeCoat MetalCoat
- c. Interior Plywood Panel and Trim
Stain: Ivy Coatings,
Eggshell Finish

C. EXECUTION

1. INSPECTION

- a. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

2. GENERAL WORKMANSHIP REQUIREMENTS

- a. Application may be by brush, roller or spray application.
- b. The Contractor shall furnish the Architect a schedule showing when he expects to have completed the respective coats of paint for the various areas and surfaces. This schedule shall be kept current as the job progresses.
- c. The Contractor shall protect his work at all times, and shall protect all adjacent work and materials by suitable covering or other method during progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and shall leave his/her part of the work in clean, orderly and acceptable condition.
- d. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide ample in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
- e. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.
- f. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- g. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Owner.
- h. All coats shall be dry to manufacturer's recommendations before applying succeeding coats.
- i. All suction spots or "hot spots" in plaster after the application of the first coat shall be touched up before applying the second coat.
- j. Do not apply paint behind frameless mirrors that use mastic for adhering to wall



surface.

3. PREPARATION OF SURFACES

- a. Existing Surfaces: Clean existing surfaces requiring paint or finishing, remove all loose and flaking paint or finish and sand surface smooth as required to receive new paint or finish. No “telegraphing” of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, Contractor shall be required to sand smooth and re-finish until surface meets with Architect’s approval.
- b. General:
 - i. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom-clean all spaces before painting is started. All surfaces to be painted or finished shall be perfectly dry, clean and smooth.
 - ii. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer’s instructions and as herein specified, for each particular substrate condition.
 - iii. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
- c. Metal Surfaces
 - i. Weld Fluxes: Remove weld fluxes, splatters, and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.
 - ii. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces, where solder flux has been used, with benzene. Clean surfaces by flushing with mineral spirits. For aluminum surfaces, wipe down with an oil free solvent prior to application of any pre-treatment. Bare metal to receive high performance coating specified herein must be blast cleaned SSPC SP-6 prior to application if field applied primer; coordinate with steel trades furnishing ferrous metals to receive this coating to insure that this cleaning method is followed.
 - iii. Shop Primed Metal: Clean off foreign matter as specified for “Bare Metal.” Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.
 - iv. Galvanized Metal: Prepare surface as per the requirements of ASTM D 6386.
 - v. Metal Filler: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with an approved metal filler suitable for the purpose and meeting the requirements of the related Section of work; after setting, sand to a smooth, hard finish, flush with adjoining surface.

- d. Plaster Surfaces: Scrape off all-plaster nibs or other projections and sand smooth or finish to match adjoining surface texture. Cut out all scratches, cracks, holes, depressions and similar voids and fill with non-shrinking grout, spackles, patching plaster or other approved patching material; allow to dry, refill if necessary, then sand smooth (or refinish) to provide a flush, smooth surface of the same texture as the adjacent plaster surface. Allow at least 28 days, from installation of final plaster coat, before starting work.
- e. Gypsum Drywall Surfaces: Scrape off all projections and splatters, spackles all holes or depressions, including taped and spackled joints, sand smooth. Conform to standards established in Section 09250 Gypsum Drywall.
- f. Testing for Moisture Content: Contractor shall test all plaster, masonry, and drywall surfaces for moisture content using a reliable electronic moisture meter. Contractor shall also test latex type fillers for moisture content before application of topcoats of paint. Do not apply any paint or sealer to any surface or to latex type filler where the moisture content exceeds seven (7) percent as measured by the electronic moisture meter.
- g. Touch-Up: Prime paint all patched portions in addition to all other specified coats.

4. MATERIALS PREPARATION

- a. Mix and prepare painting materials in strict accordance with the manufacturer's directions.
- b. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
- c. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film, which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.
- d. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

5. APPLICATION

- a. General:
 - i. Apply paint by brush or roller in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.
 - ii. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone where required to produce an even, smooth surface in accordance with the coating manufacturer's directions.
 - iii. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces,

including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

- i. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- b. "Exposed surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.
 - i. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.
 - ii. Paint the backsides of access panels, removable or hinged covers to match the exposed surfaces.
 - iii. Finish doors on tops, bottoms, and side edges the same as the faces, unless otherwise indicated.
 - iv. Enamel finish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even surface.
 - v. Paste wood filler applied on open grained wood after beginning to flatten, shall be wiped across the grain of the wood, then with a circular motion, to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface with the grain until smooth before applying specified coat.
- c. Scheduling Painting:
 - i. Apply the first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - ii. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 - iii. Prime Coats: Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
 - iv. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.
- d. "Touching-Up" of Factory Finishes: Unless otherwise specified or shown, materials with a factory finish shall not be painted at the project site. To "touch-up," the Contractor shall use the factory finished material manufacturer's recommended paint materials to repair abraded, chipped, or otherwise defective surfaces.

6. PROTECTION

- a. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Architect.
- b. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove

temporary protective wrappings provided by others for protection of their work after completion of painting operations.

7. CLEAN UP

- a. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each workday.
- b. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- c. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

A. DESCRIPTION OF WORK

1. Provide toilet and bath accessories as indicated on Drawings and as scheduled.

B. QUALITY ASSURANCE

1. Manufacturer: Five-(5) years experience, minimum, in successful manufacture of product of type and quality specified.
2. Comply with ANSI: Accessibility Design Guidelines.
3. Deliver, store and handle products as recommended by respective manufacturer to protect from damage.
4. Provide manufacturer's Warranty: Standard, written, for each item.

C. PRODUCTS

1. TOILET PAPER HOLDERS

- a. Provide one paper holder.
- b. Provide concealed locking device for spindle.
- c. Install paper holders at locations and at heights as indicated on the Drawings.
- d. Secure to partitions and/or walls as detailed on the Drawings or as specified. Do not use plastic or lead expansion shields.

2. MEDICINE CABINETS

- a. Cabinet: 22 gage Type 304 stainless steel, integral welded with no visible joints on the face. Grind corners smooth.
- b. Door: 22 gage Type 304 stainless steel sliding door with chrome-plated brass or stainless steel frames to hold the mirror in place. Provide rubber bumpers.
- c. Mirror: Polished plate/float glass, 1/4" thick, electro-copper plated and waterproofed, baked enamel backing; 15 years warranty against silver spoilage.

- d. Visible surfaces: Satin finish stainless steel.
- e. Exposed screws, bolts, and fasteners: chrome-plated.
- f. Provide four (4) 22 gage, Type 304 stainless steel shelves supported on adjustable brackets.

F. INSTALLATION

- 1. Install accessory items as detailed on Drawings and recommended by respective manufacturer.
- 2. Provide stainless steel expansion shields and bolts, and stainless steel toggle bolts at cavities. Do not use plastic or lead anchors.
- 3. Install units plumb, level and anchor securely.
- 4. Clean and polish exposed surfaces of accessory items.
- 5. Remove temporary labels, markings and protective coatings.

SECTION 11 31 13 - DOMESTIC TYPE EQUIPMENT

A. GENERAL

- 1. Provide all domestic type equipment work as indicated on the Drawings, as specified herein and as needed for a complete and proper installation.
- 2. Submit manufacturer's specifications and installation instructions for each type of domestic equipment, including data indicating compliance with requirements. Submit operating and maintenance instructions for each item of residential equipment.
- 3. Schedule: Refer to the schedule for domestic type equipment.
- 4. Maintenance Data: Submit maintenance and operating manual for each type of equipment. Include product data; schedule in the maintenance manuals in accordance with requirements of Division 1.
- 5. Certification Labels: Provide domestic type equipment, which complies with standards and bears certification labels as follows:
 - a. Energy Ratings: Provide "Energy Star" labels with energy cost analysis (annual operating costs) and efficiency information as required by Federal Trade Commission.
 - b. UL Standards: Provide residential equipment with UL labels.
 - c. All electrically heated equipment shall comply with the requirements of the Underwriters laboratory and the Bureau of Electric Controls. All equipment shall have NYC Bureau of Standards (BSA) or NYC Building Department material and equipment acceptance (MEA) number.
- 6. Deliver products to project site in manufacturer's undamaged protective containers after spaces to receive them have been fully enclosed.

7. Submit manufacturer's standard written warranty for each item of domestic type equipment.

B. EQUIPMENT AND APPLIANCES

1. Provide the equipment complete, as listed in the Equipment Schedule and as shown on the Drawings.
2. The equipment shall be the latest model of the current year in design, material and workmanship as indicated on the Equipment Schedule. If a later model has superseded the model specified, the later model shall be submitted for approval.
3. The equipment shall be complete with all standard accessories except as otherwise noted. Extra accessories, when required will be noted in the Equipment Schedule, after the model number or hereinafter indicated.
4. The finish shall be the manufacturers standard finish, unless otherwise specified in Equipment Schedule. All parts subject to corrosion shall be protected until ready for use. Provide manufacturer's standard colors as indicated on the Equipment Schedule. If no color indicated, provide white.
5. All equipment fixed in place requiring electrical input connections shall be provided with integral junction box in rear for solid electrical connection as per NYC Electrical Code.

C. INSTALLATION

1. Comply with manufacturer's instructions and recommendations.
2. Built-In Equipment: Securely anchor units to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
3. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate for proper operation of equipment.
4. Utilities: Refer to the plumbing and electrical drawings for specific requirements.
5. Testing: Test each item of domestic type equipment to verify proper operation. Make necessary adjustments.
6. Accessories: Verify that accessory items required have been furnished and installed.
7. Cleaning: Leave units in clean condition, ready for operation.
8. Each piece of equipment installed shall be fully demonstrated to the Owner.

SECTION 12 32 13 - PREFABRICATED WOOD CABINETS

A. GENERAL

1. GENERAL REQUIREMENTS
 - a. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.
2. SECTION INCLUDES
 - a. Work of this Section includes all labor, materials, equipment, and services necessary to complete the prefabricated wood cabinets as shown on the drawings and specified herein.
3. RELATED SECTIONS
 - a. Finish Carpentry - Section 062000
 - b. Plumbing fixtures - Division 22
4. DEFINITIONS
 - a. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
 - b. Semi-Exposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semi-exposed."
 - c. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."
5. SUBMITTALS
 - a. Product Data: For the following: Cabinets, Cabinet hardware.
 - b. Shop Drawings For Cabinets: Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.
 - c. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.
 - d. Samples for Verification: As follows:
 - i. One full size, finished base cabinet complete with hardware, doors, and drawers, but without countertop.
 - ii. One full size, finished wall cabinet complete with hardware, doors, and adjustable shelves.
 - e. Product Certificates: Signed by manufacturers of casework certifying that products furnished comply with requirements.
6. QUALITY ASSURANCE
 - a. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers.
 - b. Quality Standards: Unless otherwise indicated, comply with ANSI A161.1, for cabinets. Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semi-exposed location of each unit and showing compliance with the above standard.
 - c. Cabinets shall be reinforced as required to accommodate weight imposed by

counters.

7. PROJECT CONDITIONS

- a. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- h. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.
- i. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

8. COORDINATION

- a. Coordinate layout and installation of wood blocking and reinforcements in partitions for support of cabinets.

B. PRODUCTS

1. MANUFACTURER

- a. Provide cabinets from Columbia Forest Products of type scheduled on the drawings.

C. EXECUTION

1. INSTALLATION

- a. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinet abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- b. Install cabinets without distortion so doors and drawers fit openings and are aligned.
- c. Complete installation of hardware and accessories as indicated.
- d. Install cabinets level and plumb to a tolerance of 1/8" in 8'-0".
- e. Fasten cabinets to adjacent units and to backing.
- f. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24" o.c. with No. 10 wafer head screws sized for 1" penetration in to wood framing, wood blocking, or hanging strips.
- g. Coordinate cabinets with installation of countertops.

2. ADJUSTING AND CLEANING

- a. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- b. Clean cabinets on exposed and semi-exposed surfaces. Touch-up factory applied finishes to restore damaged or soiled areas.

12 36 23 - SIMULATED STONE COUNTERTOPS

A. GENERAL

1. GENERAL REQUIREMENTS

- a. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

2. SECTION INCLUDES

- a. Work of this Section includes all labor, materials, equipment, and services necessary to complete the countertops as shown on the drawings and specified herein.

3. RELATED SECTIONS

- a. Prefabricated Wood Cabinets - Section 123212
- b. Plumbing fixtures - Division 22.
- c. Tile and Stone - Section 093000

4. SUBMITTALS

- a. Product Data: Material Data Sheets.
- b. Shop Drawings: Include plans, elevations, details, and attachments to other work. Show materials, finishes, edge and profiles, cutouts for plumbing fixtures, and methods of joining countertops.
- c. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.
- d. Samples for Verification: One full size, finished sample of the type and finish of countertop specified herein.
- e. Product Certificates: Signed by manufacturers of countertops certifying that products furnished comply with requirements.

5. QUALITY ASSURANCE

- d. Product Designations: Drawings indicate size, configurations, and finish material of countertops.
- e. Countertops shall be reinforced as required to accommodate weight imposed by counters.

6. PROJECT CONDITIONS

- a. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- b. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where counters are to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions.
- c. Field Measurements for Countertops: Verify dimensions of countertops by field

measurements after base cabinets are installed but before countertop fabrication is started. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. PRODUCTS

1. Manufacturer: PaperStone, Hoquiam, Washington part of Paneltech Products, Inc. PaperStone is a sustainable composite material made from 100% post- consumer recycled paper, our own PetroFree™ phenolic resins and natural pigments.
2. Type: Paper Stone Solid Surface Panels
3. Color: Slate

C. INSTALLATION

1. MAINTENANCE

- a. Wipe the dry counter with a soft towel after washing to eliminate water spotting.
- b. Use the Original Bee's Wax® spray wax or apply a coat of paste wax after cleaning with a bleach/ water solution or when water doesn't seem to bead up anymore or the luster seems to have diminished. Generally, it is not necessary to reapply The Original Bee's Wax® after every cleaning.
- c. A cleaning solution made from standard bleach diluted down at least 10 times with water is also an effective cleaner and disinfectant for PaperStone counters. It is used in the restaurant industry to wipe down food service areas and kill any food bacteria. The Centers for Disease Control (CDC) recommends a 1:10 bleach to water solution.

2. INSTALLATION

- a. General: As with any quality countertop installation, a high level of precision is required during both the templating and installation processes.
- b. PaperStone is easily worked using traditional high-quality carbide-tipped woodworking tools. No special fabrication equipment is necessary.
- c. A wide variety of edge profiles can be achieved with a router.
- d. Because of PaperStone's rigidity and strength-of-span, it can be cantilevered an impressive distance without deflection.

3. WARRANTY

- a. The warranty applies to PaperStone permanently installed in a residence for countertop use during the warranty period.
- b. The warranty is non-transferable, except in the case of a builder owner/non-resident, transferring ownership from builder to original resident occupants.
- c. The warranty remains in force for the life of the home.
- d. PaperStone permanently installed for residential countertop use by a certified PaperStone fabricator.
- e. Manufacturer's defects in your PaperStone countertops: Cost limited to repair or replacement of affected countertop piece. This warranty does not include plumbing, gas, electrical, tile, wallpaper, painted surface or trim cost, incurred due to replacement of your countertop.

SECTION 22 41 00 - PLUMBING FIXTURES

- A. PROJECT INCLUDES: Extent of fixture and trim work is as indicated on the Drawings and by the requirements of this Section.
1. Submit Shop Drawings for the following: Fixtures, Shower Equipment, Trim, and Fixture Supports. Submit manufacturer's instructions for installation of fixtures. Submit samples consisting of two pieces of each piece of brass work (fitting-trimming-etc.) required in connection with plumbing fixtures and showers, etc., only if other than specified item.
- B. PRODUCTS: See plumbing schedule.
- C. INSTALLATION:
1. SEALING: Seal between fixture and wall and/or fixture and floor with silicone sealant.
 2. FIXTURE HEIGHT: Fixtures shall be installed at height as shown on Drawings and/or as specified in Fixture Mounting Heights Schedule.
 3. FIXTURE INSTALLATION: Fixtures shall be installed in accordance with manufacturer's installation instructions. Fixtures shall have their rim and backsplash set level.
 4. FLOOR OUTLET WATER CLOSET: Install new water closet floor flange on fixture soil pipe (new water closet only). Install new wax seal. Install water closet on a bed of latex portland cement grout, also level fixture and tighten nuts on flange bolts. Connect flush valve to cold water supply (flush valve operated water closet). Connect water closet water supply fitting including stop valve to cold water supply and tank (tank operated water closet). Barrier-Free water closets shall be set at height and location as shown Drawings, including location of operating button or disc.
 5. LAVATORIES, CHINA: Install new chair carrier (new lavatory only). Install faucet or faucets and drain including tailpiece on lavatory. Install stop valves on hot and cold water supplies and trap on fixture waste. Install lavatory on chair carrier and connect tailpiece to trap. Also connect hot and cold water stops to faucet or faucets.

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 SLEEVES

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

2.2 HANGERS AND SUPPORTS

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

2.3 VIBRATION ISOLATION DEVICES

- A. Vibration Supports:
 - 1. Pads: Arranged in single or multiple layers of oil- and water-resistant, neoprene of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match supported equipment.
 - 2. Mounts: Double-deflection type, with molded, oil-resistant fiberglass, rubber or neoprene isolator elements with factory-drilled, encapsulated top plate and baseplate. Provide isolator with minimum 0.5-inch (13-mm) static deflection.
 - 3. Spring Isolators: Freestanding, laterally stable, open-spring isolators. Provide isolator with minimum 1-inch (25-mm) static deflection.

B. Vibration Hangers:

1. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Provide isolator with minimum 0.5-inch (13-mm) static deflection.
2. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression. Provide isolator with minimum 1-inch (25-mm) static deflection.

2.4 PRESSURE GAGES AND TEST PLUGS

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

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

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

3.2 GENERAL EQUIPMENT INSTALLATIONS

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

3.3 HANGERS AND SUPPORTS

- A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.
- B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.
- C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches (100 mm) thick.
- D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
 - 2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
 - 3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
 - 5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).

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

3.4 VIBRATION ISOLATION DEVICE INSTALLATION

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

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 4 - GENERAL

4.1 SECTION REQUIREMENTS

- A. Submittals: Certified TAB reports.
- B. TAB Firm Qualifications: TABB certified.
- C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.
- D. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 5 - PRODUCTS (Not Used)

PART 6 - EXECUTION

6.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine the approved submittals for HVAC systems and equipment.
- C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

- D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- F. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- G. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multi-zone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at indicated values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to indicated values.
- H. Report deficiencies discovered before and during performance of test and balance procedures.

6.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

6.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare schematic diagrams of systems' "as-built" duct layouts.
- B. For variable-air-volume systems, develop a plan to simulate diversity.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Verify that motor starters are equipped with properly sized thermal protection.
- E. Check for airflow blockages.
- F. Check condensate drains for proper connections and functioning.
- G. Check for proper sealing of air-handling unit components.
- H. Check for proper sealing of air duct system.

6.4 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
 - 4. Cooling-Water Flow Rate: Plus or minus 10 percent.

SECTION 23 07 00 - HVAC INSULATION

PART 7 - GENERAL

7.1 SECTION REQUIREMENTS

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

PART 8 - PRODUCTS

8.1 INSULATION MATERIALS

- A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

- B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
- C. Mineral-Fiber Blanket Insulation: Comply with ASTM C 553, Type II and ASTM C 1290, Type I.
- D. Mineral-Fiber Board Insulation: Comply with ASTM C 612, Type IA or Type IB.
- E. Mineral-Fiber, Preformed Pipe Insulation: Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ.
- F. Mineral-Fiber, Pipe and Tank Insulation: Complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB; and having factory-applied ASJ. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less.
- G. Polyolefin Insulation: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
- H. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- I. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- J. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
- K. Factory-Applied Jackets: When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
- L. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
- M. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

PART 9 - EXECUTION

9.1 INSULATION INSTALLATION

- A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.

- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Division 07 Section "Penetration Firestopping."
- D. Flexible Elastomeric Insulation Installation:
 - 1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Mineral-Fiber Insulation Installation:
 - 1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - 3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
 - 4. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 5. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier.
- F. Polyolefin Insulation Installation:
 - 1. Seal split-tube longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of polyolefin pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- G. Plenums and Ducts Requiring Insulation:
 - 1. Concealed and exposed supply and outdoor air.
 - 2. Concealed and exposed return air located in non-conditioned space.
 - 3. Concealed and exposed exhaust between isolation damper and penetration of building exterior.
- H. Plenums and Ducts Not Insulated:
 - 1. Metal ducts with duct liner.
 - 2. Factory-insulated plenums and casings.
 - 3. Flexible connectors.

4. Vibration-control devices.
 5. Factory-insulated access panels and doors.
- I. Piping Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawlspaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

9.2 DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
 4. Polyolefin: 1 inch (25 mm) thick.
- B. Exposed duct insulation shall be one of the following:
1. Flexible Elastomeric: 1 inch (25 mm) thick.
 2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.
 3. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 2-lb/cu. ft. (32-kg/cu. m) nominal density.
 4. Polyolefin: 1 inch (25 mm) thick.

SECTION 23 23 00 - REFRIGERANT PIPING

PART 10 - GENERAL

10.1 SECTION REQUIREMENTS

- A. Comply with ASME B31.5, "Refrigerant Piping," and with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

PART 11 - PRODUCTS

11.1 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.

11.2 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 40 deg F (5 deg C) suction temperature; [700-psig (4820-kPa), 450-psig (3100-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.

11.3 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. Filter Dryers: 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature; with replaceable core kit, gaskets, and filter-dryer cartridge.
- D. Mufflers: Welded steel with corrosion-resistant coating and socket ends; 500-psig (3450-kPa) operating pressure; 240 deg F (116 deg C) operating temperature.
- E. Refrigerant: ASHRAE 34, R-407C.

PART 12 - EXECUTION

12.1 INSTALLATION

- A. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for basic piping installation requirements.
- B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Division 23 Section "Common Work Results for HVAC" for wall penetration systems.
- C. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

- D. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.
 - E. Insulate suction lines to comply with Division 23 Section "HVAC Insulation."
 - F. 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.
 - G. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.
 - H. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.
 - I. 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.
 - J. 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:
 - K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- 12.2 PIPING APPLICATIONS FOR REFRIGERANT R-407C.
- A. Suction Lines: Copper, Type ACR or Type K (A) or Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
 - B. Hot-Gas and Liquid Lines: Copper, Type ACR or Type K (A) or Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 13 - GENERAL

13.1 SECTION REQUIREMENTS

- A. Submittals: Product Data for fire and smoke dampers and Shop Drawings detailing duct layout and including locations and types of duct accessories, duct sizes, transitions, radius and vaned elbows, special supports details, and inlets and outlet types and locations.

- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- C. Comply with NFPA 96 for ducts connected to commercial kitchen hoods.
- D. Comply with UL 181 for ducts and closures.

PART 14 - PRODUCTS

14.1 DUCTS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip galvanized coating.
- B. Carbon-Steel Sheets: ASTM A 1008/A 1008M; with oiled, matte finish for exposed ducts.
- C. Stainless Steel: ASTM A 480/A 480M, Type 316 with a No. 2D finish for concealed ducts and No. 4 finish for exposed ducts.
- D. Fibrous-Glass Duct Board: Comply with UL 181, Class 1, 1-inch- (25-mm-) thick, fibrous glass with fire-resistant, reinforced foil-scrim-kraft barrier, and having the air-side surface treated to prevent erosion.
- E. Joint and Seam Tape, and Sealant: Comply with UL 181A.
- F. Rectangular Metal Duct Fabrication: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- G. Fibrous-Glass Duct Fabrication: Comply with SMACNA's "Fibrous Glass Duct Construction Standard."
- H. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Airstream surface coated with an antimicrobial erosion-resistant coating.
 - 3. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - 4. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment.

14.2 ACCESSORIES

- A. Volume Dampers and Control Dampers: Single-blade and multiple opposed-blade dampers, standard leakage rating, and suitable for horizontal or vertical applications; factory fabricated and complete with required hardware and accessories.
- B. Fire Dampers: Rated and labeled according to UL 555 by an NRTL; factory fabricated and complete with required hardware and accessories.

- C. Ceiling Fire Dampers: Labeled according to UL 555C by an NRTL and complying with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory." Provide factory-fabricated units complete with required hardware and accessories.
- D. Smoke Dampers: Labeled according to UL 555S by an NRTL. Combination fire and smoke dampers shall also be rated and labeled according to UL 555. Provide factory-fabricated units complete with required hardware and accessories.
- E. Flexible Connectors: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- F. Flexible Ducts: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-inch- (25-mm-) thick, glass-fiber insulation around a continuous inner liner complying with UL 181, Class 1.

PART 15 - EXECUTION

15.1 INSTALLATION

- A. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 1. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
 2. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
 3. Conditioned Space, Exhaust Ducts: Seal Class B.
 4. Conditioned Space, Return-Air Ducts: Seal Class C.
- C. Conceal ducts from view in finished and occupied spaces.
- D. Avoid passing through electrical equipment spaces and enclosures.
- E. Support ducts to comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Hangers and Supports."
- F. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- G. Install volume and control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
- H. Install fire and smoke dampers according to UL listing.
- I. Install fusible links in fire dampers.
- J. Clean new duct system(s) before testing, adjusting, and balancing.

15.2 TESTING, ADJUSTING, AND BALANCING

- A. Balance airflow within distribution systems, including submains, branches, and terminals to indicated quantities.

SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES

PART 16 - GENERAL

16.1 SECTION REQUIREMENTS

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

PART 17 - PRODUCTS

17.1 OUTLETS AND INLETS

- A. Diffusers:
 - 1. Material: Aluminum.
 - 2. Finish: painted.
 - 3. Mounting: Surface with beveled frame.
- B. Wall and Ceiling Registers:
 - 1. Material: Aluminum.
 - 2. Finish: painted
 - 3. Mounting: Countersunk screw.
- C. Wall and Ceiling Grilles:
 - 1. Material: Aluminum.
 - 2. Finish: painted
 - 3. Mounting: Countersunk screw.

PART 18 - EXECUTION

18.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of

panel unless otherwise indicated. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

SECTION 23 81 19 - SELF-CONTAINED AIR-CONDITIONERS

PART 19 - GENERAL

19.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Comply with ASHRAE 15.
- C. EER: Equal to or greater than that prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- D. Comply with NFPA 70.
- E. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace refrigeration components that fail in materials or workmanship within [five] <Insert number> years from date of Substantial Completion.

PART 20 - PRODUCTS

20.1 PACKAGED UNITS

- A. Description: Self-contained, factory-assembled, factory-tested, and factory-wired unit.
- B. Cabinet: Structural-steel frame and galvanized-steel panels with baked-enamel finish with access doors or panels. Minimum 1/2-inch- (13-mm-) thick, acoustic duct liner on cabinet interior and control panel. Stainless-steel drain pan.
- C. Discharge Plenum: Cabinet extension with directional louvers.
- D. Evaporator Fan: Galvanized steel; double-width, double-inlet, forward-curved centrifugal fan; statically and dynamically balanced. Direct drive with fan and motor resiliently mounted. Cast-iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed. Adjustable pitch selected so required rpm are obtained when set at midposition. Motor, multispeed, PSC type, or single speed, ODP polyphase.
- E. Evaporator and Condenser Coil: Seamless copper tubes expanded into aluminum fins; leak tested to 425 psig (2930 kPa).

- F. Remote Air-Cooled Condenser: Factory assembled and tested; consisting of condenser coil, fans and motors, and operating controls. Direct-drive propeller-type fans with permanently lubricated motors and built-in thermal-overload protection. Low-ambient control cycle fans and modulates condenser-fan damper assembly to permit operation down to 0 deg F (minus 18 deg C).
 - 1. Annealed-copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; insulated suction line; appropriate fittings at ends, and service valves for both suction and liquid lines.
- G. Compressor: Hermetic reciprocating, 3600 rpm maximum; resiliently mounted with positive lubrication and internal motor protection.
- H. Refrigerant Circuits: Separate circuit for each compressor. Minimum two circuits for units larger than five nominal tons. Equalized expansion valve with replaceable thermostatic element, refrigerant filter-dryer, high- and low-pressure safety switches, thermal overload protection, anti-recycle timer, brass service and charging valves installed in hot-gas and liquid lines, and charged with R-407C refrigerant.
- I. Water Coil: Copper tube, with mechanically bonded aluminum fins; two-position control valve; and leak tested to 300 psig (2070 kPa) underwater.
- J. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and fuses in terminal box for overcurrent protection.
- K. Disposable Filters: 1-inch- (25-mm-) thick, glass-fiber, pleated panel filters.
- L. Control Package: Factory wired and tested, including control-circuit transformer.
 - 1. Thermostat: Remote, programmable for occupied/unoccupied periods and temperatures to cycle compressor or heating coil. Provide field wiring for condenser fan operation with compressor.
 - 2. Supply fan runs continuous during occupied periods, and cycles for night setback when unoccupied. Opens outdoor-air damper during occupied periods.
 - 3. Motorized Outside-Air Damper: Motorized, two-position blade damper allowing induction of up to 25 percent outside air; with spring-return, low-voltage damper motor.
 - 4. Economizer: Damper assembly allowing induction of up to 100 percent outside air to maintain a selected mixed-air temperature; and exhaust damper with spring-return, low-voltage, modulating damper motor with minimum position adjustment.

20.2 CAPACITIES AND CHARACTERISTICS

- A. Supply-Air Fan:
 - 1. Airflow in CFM (Low-Med-High) 247-317-388 ft³/min
 - 2. External Static Pressure: 0.02-0.06-0.14-0.20 in.W.G.

B. Cooling:

1. Rated Cooling Capacity: 11,500 Btu/h
2. Sensible Heat Factor: .76
3. Ambient-Air Dry-Bulb Temperature: 95 deg F
4. Ambient-Air Wet-Bulb Temperature: 75 deg F
5. Entering-Air Dry-Bulb Temperature: 80 deg F
6. Entering-Air Wet-Bulb Temperature: 67 deg F
7. SEER: 16.0
8. Total Input 920 W

C. Heating at 47 deg F:

1. Rated Heating Capacity: 13,600 Btu/hr
2. Ambient-Air Dry-Bulb Temperature: 47 deg F
3. Ambient-Air Wet-Bulb Temperature: 43 deg F
4. Entering-Air Dry-Bulb Temperature: 70 deg F
5. Entering-Air Wet-Bulb Temperature: 60 deg F
6. HSPF: 10.0
7. Total Input: 1,140 W

Heating at 17 deg F:

8. Rated Heating Capacity: 9,000 Btu/hr
9. Ambient-Air Dry-Bulb Temperature: 17 deg F
10. Ambient-Air Wet-Bulb Temperature: 15 deg F
11. Entering-Air Dry-Bulb Temperature: 70 deg F
12. Entering-Air Wet-Bulb Temperature: 60 deg F
13. Total Input: 1,180 W

D. Single-Point Electrical Connection:

1. Volts (Indoor/Outdoor): 208/230 V
2. Phase: [Single]
3. Hertz: 60 Hz
4. Recommended Breaker Size: 15 A
5. Minimum Circuit Ampacity (Indoor): 1 A
6. Full-Load Amperes (Indoor): .57
7. Minimum Circuit Ampacity (Outdoor): 12 A
8. Maximum Overcurrent Protection (Outdoor): 15 A
9. Full-Load Amperes (Outdoor): .50

PART 21 - EXECUTION

21.1 INSTALLATION

- A. Isolation: Mount cabinet and remote air-cooled condenser on spring isolators for minimum 1-inch (25-mm) static deflection.

- B. Install piping adjacent to unit to allow service and maintenance.
- C. Install refrigerant piping between self-contained air-conditioning unit and remote condenser.
- D. Install condensate piping to indirect drain.

CUTSHEETS

DIVISION 00 PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 GENERAL REQUIREMENTS

**INVERTER GENERATOR
WITH CMD TRIPLE-FUEL SYSTEM**

Runs on LP Gas, Natural Gas & Gasoline!
Quieter than Common Speech at Rated Load!



**Inverter Generator w/ CMD
Triple-Fuel System**

Model: Honda EU6500iS

Fully enclosed, triple chamber design makes this generator even *quieter* than common speech at rated load! With CMD's triple-fuel system this generator operates on LP Gas, Natural Gas and Gasoline right out of the box. No mechanical alterations are necessary. Simply change your fuel source!

This unit has both 120 V and 240 V power output and is perfect for outdoor events like concerts, races, parties, trade shows and home back-up power.

This unit features ultra-clean power (a sine wave equal to or better than the current from your household AC wall outlet). This genset automatically adjusts engine speed to the optimum level (for better fuel economy and ultra-quiet operation), AC output, USDA-qualified spark arrestor muffler, LCD display screen for hours of operation, wattage, engine speed and diagnostics, low oil alert shutdown, intake fuel gauge, 120/240 V selector switch, wheel kit w/ folding handles, electric start and a sound level of only 60 decibels!





Generator

Engine

Model	Honda GX390
Type	Overhead Valve
Power	13 HP
Oil Capacity	Approx. 1.63 Qts
Oil Alert Shutdown	Standard
Cylinder Block	Aluminum w/ Cast Iron Sleeve
Electronic Ignition	Standard
Eco-Throttle	Automatically Adjusts Engine Speed w/ Load
Displacement	389 cc
Bore & Stroke	2.7" x 2.1"
Exhaust Outlet	1-3/4" OD Muffler Outlet
Cooling System	Air-cooled
Air Cleaner	Dual Element Type
Fuel	LP Gas, Natural Gas & Gasoline
Starting System	Electric



Generator

Maximum Output	6,500 watts
Continuous Output	5,500 watts
Load Amperage at 120 volts	
Maximum Load	54 Amps
Continuous Load	46 Amps
Load Amperage at 240 volts	
Maximum Load	27 Amps
Continuous Load	23 Amps
Sound Level @ 23 ft(7 m) at full load	60 dB(A)

DIVISION 06

WOOD, PLASTICS, AND COMPOSITES

Fusing Glass And Wood: Provides strength, stability and sustained protection for wood



TimberSIL[®] is a non-toxic fusion of two natural materials—wood and glass, producing the ideal, natural product and a combination of properties never achieved before. More than wood and more than glass, TimberSIL[®] combines the best of both bringing a transformation to wood.

Wow! Homeowners and builders can really benefit from this marriage of wood and glass! Saving lots of money and protecting the environment at the same time. TimberSIL[®] Glass Wood is many times stronger than composite products or common wood; because the glassy portion parallels the grain of wood, greatly increasing strength. The wood fibers are stronger, causing nails, screws, and fasteners to hold more tightly, and the glassy portion strengthens the fibers. TimberSIL[®] products are 8 times more dimensionally stable than oak and maintain their shape better because the glass in TimberSIL[®] is resistant to warping. TimberSIL[®] products are Class A fire retardants because glass's natural resistance to fire helps to overcome the combustible properties of wood.

As states, utilities, and others join with us, take a look at a microscopic view of TimberSIL[®] glass fibers, courtesy of the State of Florida, and their electron microscope. The white layers are TimberSIL[®] ribbon-like layers of harmless amorphous glass, each stronger than steel, formed inside the fibers of wood. The holes are natural pits, through



which TimberSIL[®] flows to enter the interior of fibers, where glassy layers are created inside the wood in the proprietary TimberSIL[®] micro-manufacturing process.

The transparency of glass allows the properties of wood to predominate. TimberSIL[®] cuts like wood and paints or stains like wood. TimberSIL[®] Glass Wood Products will eventually gray in the sun and yet because of the added glass has minimal checking and warping.

TimberSIL[®] provides the protective barriers shown above to prevent rot or decay. Non-toxic, non-corrosive TimberSIL[®] Glass Wood outperforms treated wood and virtually all hardwoods.

(2)





Product Specification Sheet

TimberSIL® glass/wood fusion products are exceptionally strong, exceptionally stable, resistant to fire, and durable, in addition to providing an effective barrier that is resistant to rot, decay and common wood problems. A key feature of TimberSIL®'s patented technology is insolubility. TimberSIL®'s glassy matrix will not dissolve in water, no matter how long it is soaked, no matter how long it is exposed to the elements.

Properties	Test Method/Protocol	Results
Class A Fire Retardant, Ignition Resistant Material	ASTM E84, 30 minute extended, after 1000 hr of weathering cycles of rain, heat, and UV light per ASTM 2898	Meets standard for Class A fire retardant Flame spread: 8.6 (up to 25 is Class A)
Flame & smoke Spread, Class A	ASTM E84, 30 minute extended, after 1000 hr of weathering cycles of rain, heat, and UV light per ASTM 2898	Meets or exceeds standards Smoke Developed: 129 Smoke developed standard: 0-450
Resistance to heat transfer	ASTM E84, 30 minute extended, after 1000 hr of weathering cycles of rain, heat, and UV light per ASTM 2898	Resistance to heat transfer greater than non-flammable control
Strength (rupture) MOR (psi)	ASTM D4761, ASTM D143	16,000 psi F _b 2700 psi
Strength (elasticity) MOE (psi)	ASTM D4761, ASTM D143	1,900,000 psi
Compression parallel to grain	ASTM D143	7,120 psi
Compression perpendicular to grain	ASTM D143	2,700 psi
Tension parallel to grain	ASTM D143	17,000 psi
Shear parallel to grain	ASTM D143	2,300 psi
Fastener Holding Strength	ASTM D-1037	4 times stronger than treated wood
Stability	ASTM 1037; Klauditz & Stegman, 1951	TimberSIL® ≤ 1.48% Oak: 11%; Southern yellow pine: 7.5%
Conductivity	AREMA CH 30.2.8 Test 7	Wet: 97,000 Ω, Dry 1,260,000Ω
TimberSIL® wood: 10 yr accelerated weathering	ASTM G151	Meets or exceeds standards; no rot, no decay, wood silvering
Corrosivity	AWPA E12-94	Non-corrosive
Termite Resistance	AWPA E1-97, ASTM D3345-74; ASTM D 1758; AWPA E7-93	Formosan Termite Grade 10-9.5 Sound, No Weight Loss
Resistance to Decay (field)	ASTM D 1758; AWPA E7-93	Decay Grade 10; Sound, No Weight Loss
Resistance to decay (laboratory)	Flemer et al, Hydrobiologia. 485(1-3):83-96. Kurtz, et al, Environ. Toxicol. Chem. 17(7):1274-1281.	Decay Grade 10, unchanged
Insolubility	Molybdate spectrometry	Insoluble
Chemical Structure Analysis	X-ray diffraction	Composed of non-toxic amorphous glass; no crystalline structure present
Cellular Structure Analysis	polarized light microscopy	Cellular fibers resistant to maceration





Most Widely Accepted and Trusted

ICC-ES Evaluation Report

ESR-1474

Reissued October 1, 2010

This report is subject to re-examination in two years.

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A Subsidiary of the International Code Council®

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 10 00—Sheathing

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 27 00—Air Barriers
Section: 07 25 00—Water-resistive Barriers/Weather Barriers

REPORT HOLDER:

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CHARLOTTE, NORTH CAROLINA 28262
(800) 933-9229
www.huberwood.com

EVALUATION SUBJECT:

ZIP SYSTEM® WALL SHEATHING

1.B EVALUATION SCOPE

Compliance with the following codes:

- 2009 International Building Code® (2009 IBC)
- 2009 International Residential Code® (2009 IRC)
- 2009 International Energy Conservation Code® (2009 IECC)
- 2008 International Building Code® (2008 IBC)
- 2008 International Residential Code® (2008 IRC)
- 2008 International Energy Conservation Code® (2008 IECC)

Properties evaluated:

- Weather resistance
- Air leakage

2.B USES

ZIP System® Wall Sheathing panels are used as combination wall sheathing, air barrier, and water-resistive barrier. This report recognizes the use of the system, when installed with ZIP System™ flexible flashing seam tape, in walls of Type V construction (IBC) and dwellings under the IRC, and as an alternate to the water-resistive barrier required in Chapter 14 of the IBC and Chapter 7 of the

3.B DESCRIPTION

3.1 Sheathing Panel:

The ZIP System® Wall Sheathing panel is an OSB wood structural panel having a laminated face. The OSB substrate complies with US DOC PS 2 for wood structural panels and is overlaid on one side with a medium-density, phenolic-impregnated, kraft paper overlay. The paper overlay complies as a Grade D water-resistive barrier in accordance with the ICC-ES Acceptance Criteria for Water-resistive Barriers (AC308). The panels are nominally 4 feet (1219 mm) wide by 8, 9, 10, 11 or 12 feet (2438, 2743, 3048, 3353 or 3658 mm) long and have a square-finished-edge or machined-edge profile.

3.2 Seam Tape:

The ZIP System™ seam tape is a self-adhering membrane tape consisting of acrylic adhesive laminated to a polyolefin backing. The tape is 0.012 inch (0.30 mm) thick with a minimum width of 3 1/4 inches (85.2 mm), and comes in rolls of various lengths.

4.B INSTALLATION

4.1 General:

Installation of ZIP System® Wall Sheathing panels must comply with the applicable code, this report and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite during installation.

4.2 Application:

4.2.1 General: The ZIP System® Wall Sheathing panels must be attached to wall framing in accordance with the applicable code for wood structural panels, and in compliance with their panel span rating. The panels must be installed with the kraft paper overlay facing the exterior. In accordance with the manufacturer's published installation instructions, it is recommended that the square edges of the panels be installed with a 1/8-inch (3.2 mm) gap between adjacent panels and separating the panels from dissimilar materials. All ZIP System® Wall Sheathing panel seams must be sufficiently sealed with ZIP System™ seam tape. All overlay surfaces must be dry and free of sawdust and dirt prior to application of the ZIP System® seam tape. The ZIP System™ 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



4.2.2 Flashing: 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 recognized in a current ICC-ES evaluation report must be installed to seal all ZIP System® Wall Sheathing flashing joints. Penetration items must be sealed to the panels. The adhesive-backed flashing tape must comply with the ICC-ES Acceptance Criteria for Flashing Materials (AC148). See Figures 1 through 7 of this report for typical flashing, water-resistive barrier and air barrier assembly installation details.

4.2.3 Air Barrier Assembly: ZIP System® Wall Sheathing fastened to maximum 24-inch-on-center (610 mm), wood wall framing, using 6d 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 as required by Section 4.2.1. The assembly has demonstrated a maximum air leakage of 0.0072 cfm/ft² [0.037 L/(s·m²)] infiltration and 0.0023 cfm/ft² [0.012 L/(s·m²)] exfiltration at a pressure differential of 1.57 psf (75 Pa).

5.0 CONDITIONS OF USE

The ZIP System® Wall Sheathing panel described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 This evaluation report and the manufacturer's published installation instructions, when required by the code official, must be submitted at the time of permit application.

5.2 The ZIP System® Wall 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 must govern.

5.3 The ZIP System® Wall Sheathing panels must be covered with either a code-complying exterior wall covering, or one that is recognized in a current ICC-ES evaluation report.

5.4 The OSB sheathing must comply with US DOC PS-2.

5.5 Fire-resistance-rated construction is outside the scope of this report.

6.0 EVIDENCE SUBMITTED

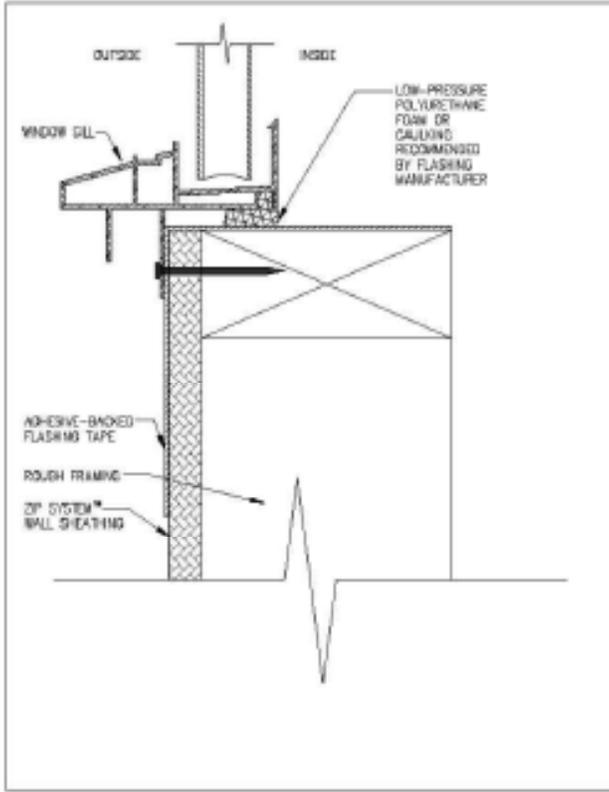
6.1 Data in accordance with the ICC-ES Acceptance Criteria for Water-resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-resistive Barriers (AC310), dated May 2008 (corrected November 2008).

6.2 Air leakage data in accordance with ASTM E 2357.

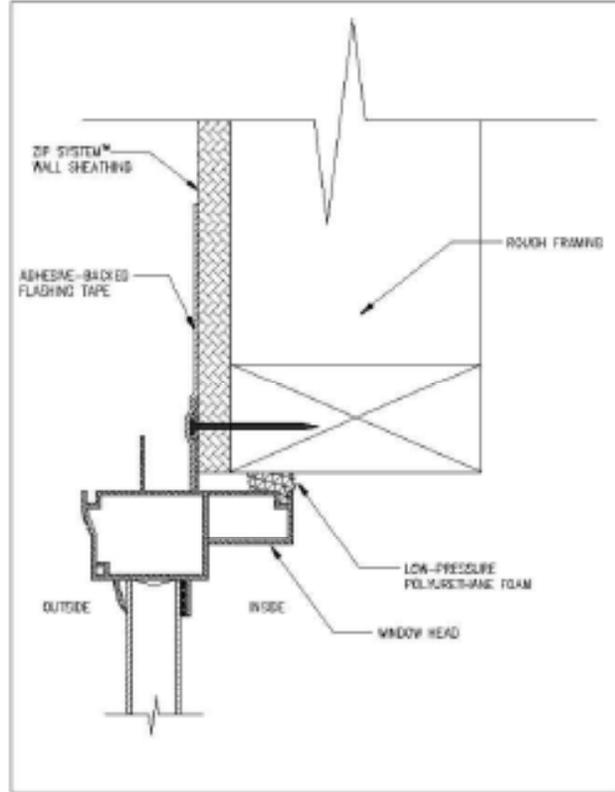
7.0 IDENTIFICATION

Each ZIP System® Wall Sheathing panel described in this report must bear a label on the back face of the panel that includes the manufacturer's name (Huber Engineered Woods LLC), the product name, nominal panel thickness, the evaluation report number (ESR-1474), and the words "Mill 228, Crystal Hill, Virginia"; "Mill 228, Easton, Maine"; "Mill 230, Spring City, Tennessee"; "Mill 227, Commerce, Georgia"; or "Mill 280, Broken Bow, Oklahoma." The OSB sheathing must also bear a label demonstrating compliance with US DOC PS 2 from an approved inspection agency. The ZIP System™ seam tape roll must be labeled with the ZIP System Wall logo and the evaluation report number ESR-1474 (see Figure B).

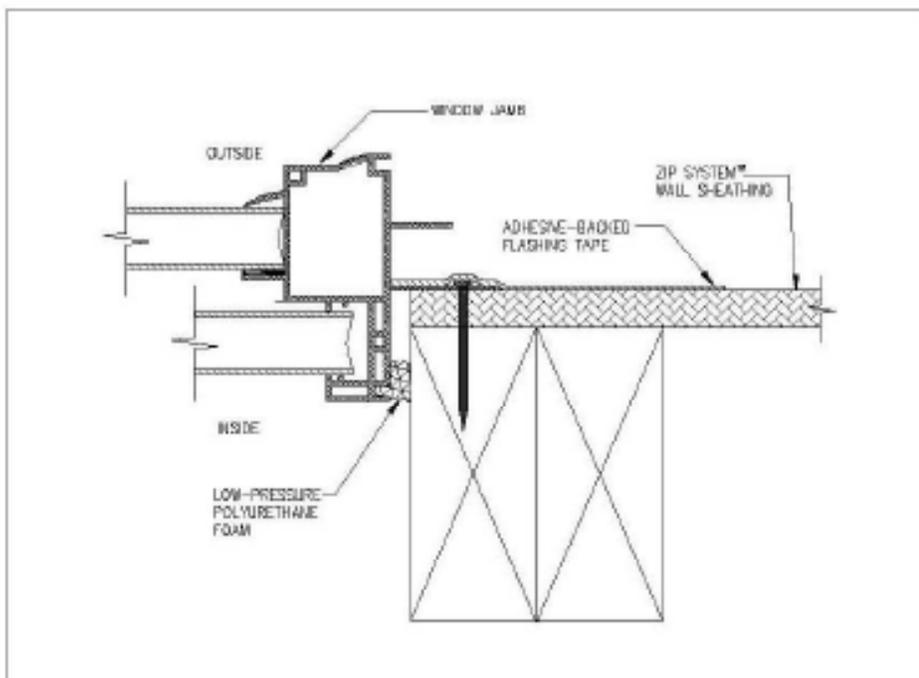


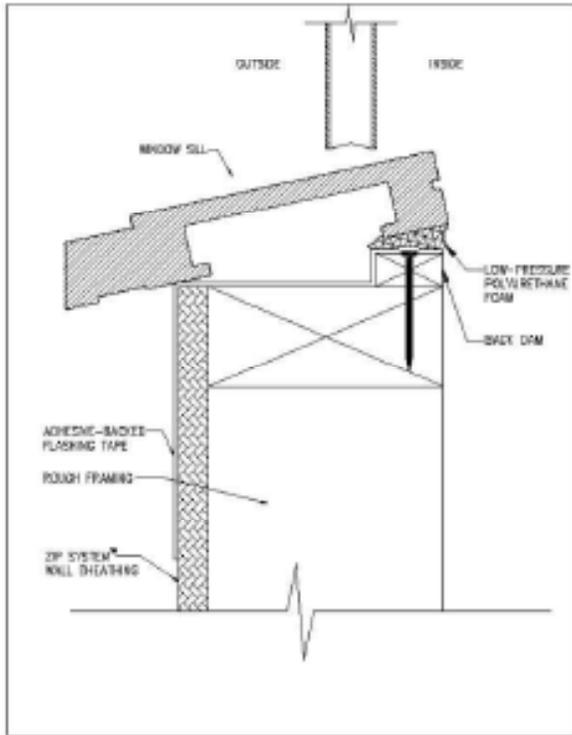


SILL SECTION

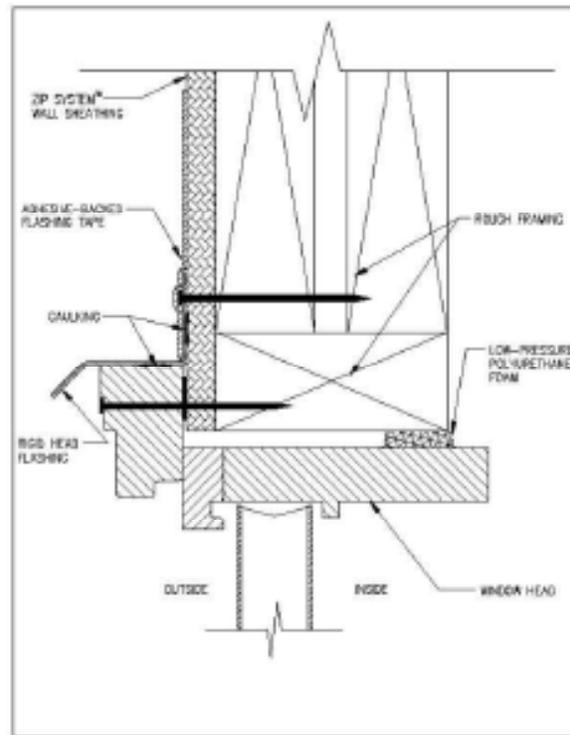


HEADER SECTION

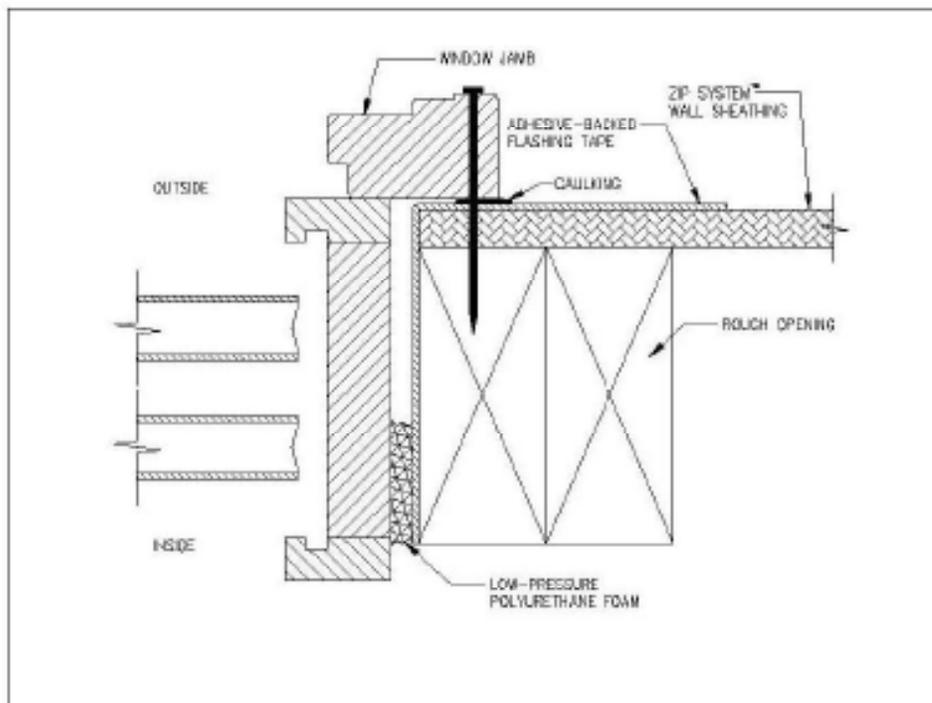




SILL SECTION



HEADER SECTION



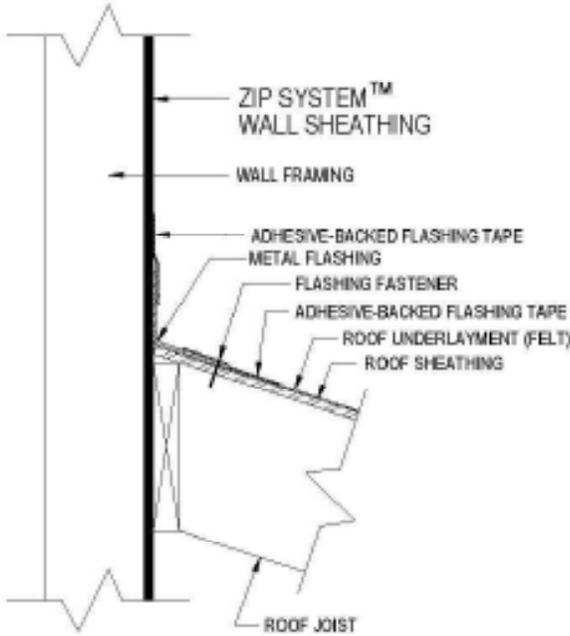


FIGURE 3—ROOF-WALL INTERSECTION (OPTION 1)

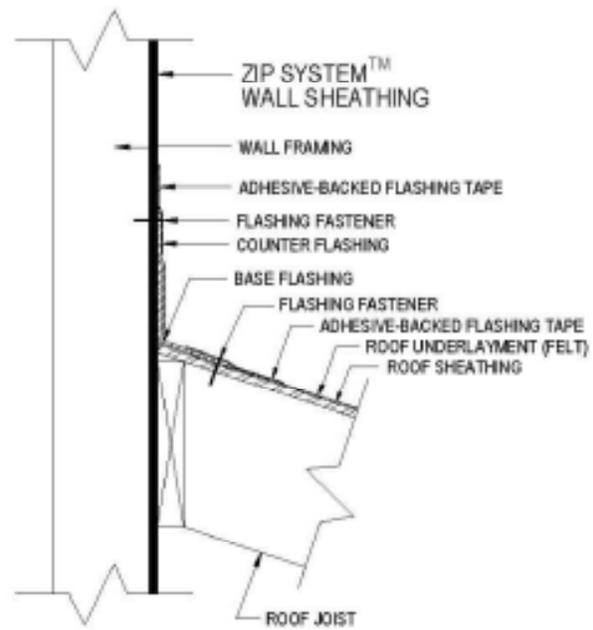


FIGURE 4—ROOF-WALL INTERSECTION (OPTION 2)

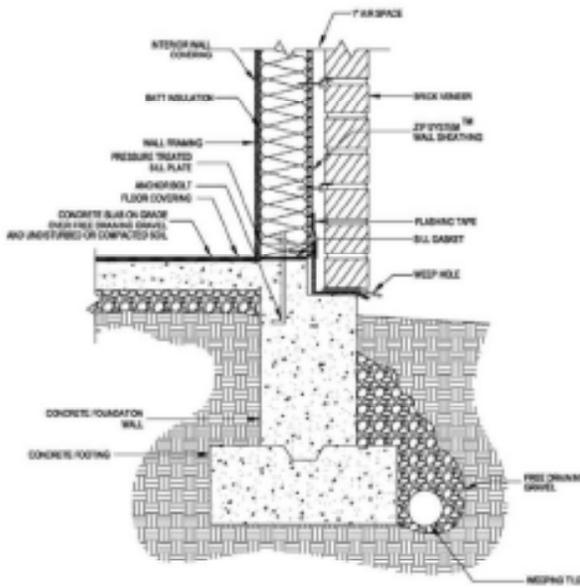


FIGURE 5—TYPICAL WALL-SILL INTERSECTION AND FLASHING DETAILS FOR BRICK SIDING

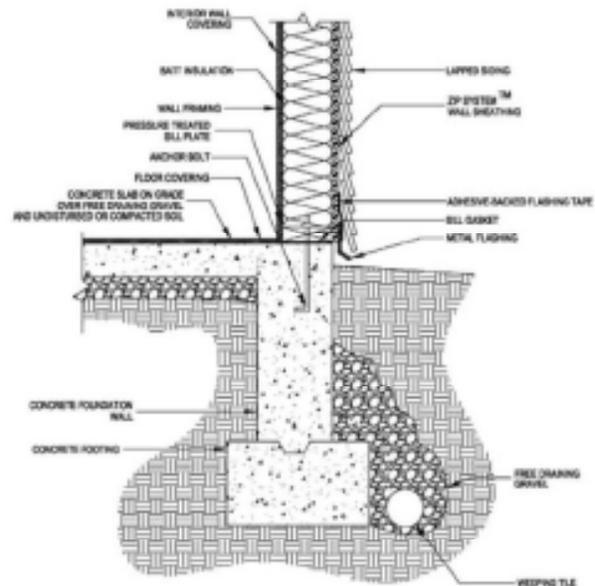


FIGURE 6—TYPICAL WALL-SILL INTERSECTION AND FLASHING DETAILS FOR LAPPED SIDING



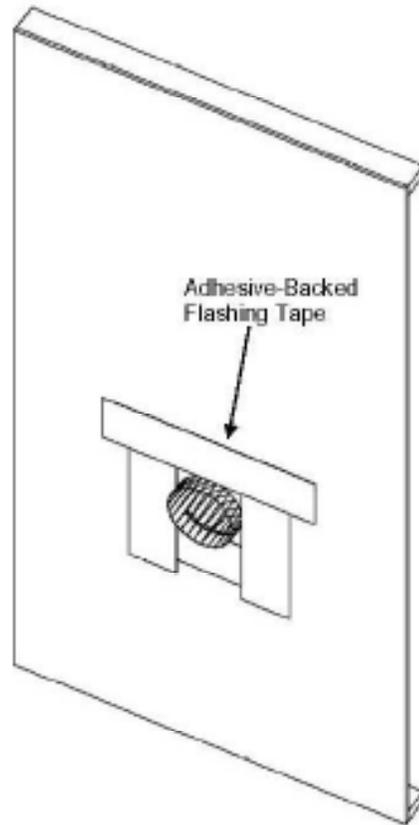


FIGURE 7—INSTALLATION AT PENETRATION OPENING (NON-FIRE-RESISTANCE RATED)



FIGURE 8—LABELING FOR THE ZIP SYSTEM SEAM TAPE ROLL



ICC-ES SAVE: Verification of Attributes Report™**VAR-1012***

Issued September 1, 2010

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Section: 06 10 00—Sheathing
**DIVISION: 07 00 00—THERMAL AND MOISTURE
PROTECTION**
**Section: 07 25 00—Water-Resistive Barriers/Weather
Barriers**
REPORT HOLDER:

HUBER ENGINEERED WOODS, LLC
10525 DAVID TAYLOR DRIVE
CHARLOTTE, NORTH CAROLINA 28262
(800) 933-9229
www.huberwood.com

EVALUATION SUBJECT:

**ADVANTECH® (AT-SERIES) SHEATHING SPAN;
ADVANTECH® (AT-SERIES) FLOOR SPAN; ZIP SYSTEM®
ROOF SHEATHING; ZIP SYSTEM® WALL SHEATHING**

1.0 EVALUATION SCOPE

Compliance with the following evaluation guidelines:

- ICC-ES Evaluation Guideline for Determination of Biobased Material Content (EG102), dated October 1, 2008 (editorially revised July 2009).
- ICC-ES Evaluation Guideline for Determination of Regionally Extracted, Harvested or Manufactured Materials or Products (EG104), dated October 1, 2008
- ICC-ES Evaluation Guideline for Determination of Formaldehyde Emissions of Composite Wood and Engineered Wood Products (EG106), dated October 1, 2008 (editorially revised July 2009).
- ICC-ES Evaluation Guideline for Determination of Certified Wood and Certified Wood Content in Products (EG108), dated October 1, 2008.

Compliance eligibility with the applicable sections of the following green building rating systems, standards and codes:

- National Green Building Standard (ICC 700-2008) (see Table 2 for details)
- LEED for Homes 2008 (see Table 3 for details)
- LEED 2009 for New Construction and Major Renovations (see Table 4 for details)

- LEED 2009 for Schools New Construction and Major Renovations (see Table 5 for details)
- 2010 California Green Building Standards Code (CALGreen), Title 24, Part 11 (see Table 6 for details)
- International Green Construction Code – Public Version 2.0 (IGCC PV2.0) (see Table 7 for details)
- ANSI/APA 101-2010 – Green Building Assessment Protocol for Commercial Buildings (see Table 8 for details)

2.0 USES

AdvanTech® (AT-Series) Sheathing Span, AdvanTech® (AT-Series) Floor Span, ZIP System® Roof Sheathing and ZIP System® Wall Sheathing are used for a variety of interior and exterior framing and sheathing applications.

3.0 DESCRIPTION

AdvanTech® (AT-Series) Sheathing Span and AdvanTech® (AT-Series) Floor Span wood structural panels are Exposure 1 oriented strand board (OSB) panels manufactured with strands from a single wood species or a combination of wood species blended with an exterior-type adhesive system to comply with U.S. Voluntary Product Standard PS-2 and the applicable ICC-ES report as indicated in Table 1.

ZIP System® Roof Sheathing and ZIP System® Wall Sheathing wood structural panels are OSB panels with laminated resin-impregnated Kraft paper facers manufactured to comply with U.S. Voluntary Product Standard PS-2 and the applicable ICC-ES reports as indicated in Table 1. The panels are installed with ZIP System® self-adhering membrane tape. The tape is outside the scope of this evaluation report.

4.0 CONDITIONS**4.1 Code Compliance:**

AdvanTech® (AT-Series) Sheathing Span, AdvanTech® (AT-Series) Floor Span, ZIP System® Roof Sheathing and ZIP System® Wall Sheathing have been evaluated for compliance with the requirements of the International Codes as listed in Table 1 of this report.

4.2 Green Rating Systems, Standards and Code Eligibility:

The information presented in Tables 2 through 8 of this report provides a matrix of areas of evaluation and corresponding limitations and/or additional project-specific requirements, and offer benefit to individuals who are assessing eligibility for credits or points.



The final interpretation of the specific requirements of the respective green building rating system, standard and/or code rests with the developer of that specific rating system or standard or the Authority Having Jurisdiction, as applicable.

Compliance with items noted as "Verified Attribute" is subject to any conditions noted in the tables. Decisions on compliance with those items noted as "Eligible for Points" in Tables 2 through 8 rests with the user of this report, and those items are subject to the conditions noted. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. Rating systems or standards often provide supplemental information as guidance.

5.0 BASIS OF EVALUATION

The information in this report, including the "Verified Attribute," is based upon the following supporting documentation:

- 5.1 ICC-ES EG102 [evaluation applies to ICC 700 Section 608.1(2); CALGreen Section A5.405.2; IGCC PV2.0 Section 503.2.4; ANSVGBH 01-2010 Section 10.1.2.2].
- 5.2 ICC-ES EG104 [evaluation applies to ICC 700 Section 608.1; LEED Homes MR 2.2(c); LEED NC MR 5; LEED Schools MR 5; CALGreen Section A5.405.1; IGCC PV2.0 Section 503.2.5; ANSVGBH 01-2010 Section 10.1.4.1].
- 5.3 ICC-ES EG106 [evaluation applies to ICC 700 Section 801.4(0); LEED NC IEQ 4.4; LEED Schools IEQ 4.4; IGCC PV2.0 Section 806.1].

- 5.4 ICC-ES EG108 [evaluation applies to ICC 700 Section 606.2; LEED Homes MR 2.1; LEED NC MR 7; LEED Schools MR 7; CALGreen Section A5.405.2.1; ANSVGBH 01-2010 Section 10.3.2.1].
- 5.5 Documentation establishing and documenting all major sources of primary manufacturing energy (evaluation applies to ICC 700 Section 608.3).
- 5.6 ICC-ES [ESR-1474](#) documenting that ZIP System Wall Sheathing is equivalent to a code-prescribed water-resistant barrier (evaluation applies to ICC 700 Section 602.9).
- 5.7 Refer to ICC-ES [ESR-1474](#) for evaluation of the ZIP System Wall Sheathing as an air barrier assembly (evaluation applies to ICC 700 Section 703.2.1; LEED Homes EA 3).
- 5.8 ICC-ES reports listed in Table 1 [evaluation applies to ICC 700 Section 801.4(1); IGCC Section 806.1].

6.0 IDENTIFICATION

AdvanTech® (AT-Series) Sheathing Span, AdvanTech® (AT-Series) Floor Span, ZIP System® Roof Sheathing and ZIP System® Wall Sheathing products are identified with a stamp noting the manufacturer's name (Huber Engineered Woods LLC) and address, the product name, the manufacturing location, the ICC-ES evaluation report number (if applicable), and the name or logo of the inspection or grading agency. The report subjects are also identified on the product and/or packaging with the VAR number (VAR-1012) and the ICC-ES SAVE Mark, as applicable.

TABLE 1—REFERENCE STANDARD OR EVALUATION REPORT NUMBER FOR HUBER ENGINEERED WOODS LLC PRODUCTS

PRODUCT	REPORT NUMBER REFERENCE STANDARD
AdvanTech® (AT-Series) Sheathing Span AdvanTech® (AT-Series) Floor Span	ESR-1705
ZIP System® Roof Sheathing	ESR-1474 ESR-2227
ZIP System® Wall Sheathing	ESR-1474 ESR-2227



TABLES 2 THROUGH 8 (Continued)

Feature Number	Feature Label	Possible Points	Conditions of Use to Qualify for Points	Advanced Glazing	Advanced Flooring	ZEP Systems Roof Glazing	ZEP Systems Wall Glazing
TABLE 3—SUMMARY OF AREAS OF ELIGIBILITY WITH USGBC'S LEED FOR HOMES 2009							
EA.3	Air Intake/Exhaust	3 max.	The exam 2 or 3 points meet the air leakage requirements shown in Table 17 of the standard, as applicable.	□	□	□	□
MR2.1	FSC certified tropical wood	0.5 each 8 max.	The exam 0.5 point per component use FSC-certified tropical wood ⁸ .	■	■	■	■
MR2.2(a)	(Environmentally preferable products for wood, wall and floor; interior and exterior finishing and glazing)	0.5 each 8 max.	The exam points use products that are: collected, processed and manufactured within 500 miles (805 km) of the site for a minimum of 20%, by weight or volume, of the component. Regional material calculations based on project location provided by Faber span required.	□	□	□	□
TABLE 4—SUMMARY OF AREAS OF ELIGIBILITY WITH USGBC'S LEED 2009 FOR NEW CONSTRUCTION AND MAJOR RENOVATION							
MR5 (MR5.1)	Regional materials (80% of credits)	1	The exam 1 point use products that are: collected, processed and manufactured within 500 miles (805 km) of the site for a minimum of 10% (by cost) of total materials value. The exam 2 points use a minimum of 20%. Regional material calculations based on project location provided by Faber span required.	□	□	□	□
MR5 (MR5.2)	Regional materials (20% of credits)	2	The exam 1 point use a minimum 50% (based on cost) of wood-based materials/products certified to FSC requirements ⁸ .	■	■	■	■
MR 7	Certified wood	1	The exam 1 point use wood composite wood products containing recycled materials/wood-based resins.	■	■	■	■
EQ4.4	Low-emitting materials	1	The exam 1 point use wood composite wood products containing recycled materials/wood-based resins.	■	■	■	■
TABLE 5—SUMMARY OF AREAS OF ELIGIBILITY WITH USGBC'S LEED 2009 FOR SCHOOLS: NEW CONSTRUCTION AND MAJOR RENOVATION							
MR5 (MR5.1)	Regional materials (80% of credits)	1	The exam 1 point use products that are: collected, processed and manufactured within 500 miles (805 km) of the site for a minimum of 10% (by cost) of total materials value. The exam 2 points use a minimum of 20%. Regional material calculations based on project location provided by Faber span required.	□	□	□	□
MR5 (MR5.2)	Regional materials (20% of credits)	2	The exam 1 point use a minimum 50% (based on cost) of wood-based materials/products certified to FSC requirements ⁸ .	■	■	■	■
MR 7	Certified wood	1	The exam 1 point use wood composite wood products containing recycled materials/wood-based resins.	■	■	■	■
EQ4.4	Low-emitting materials	1	The exam 1 point use wood composite wood products containing recycled materials/wood-based resins.	■	■	■	■
<p>□ = Eligible for points ■ = Verified attribute ■ = This provision does not apply to this product</p>							

Note: Provisions are located after Table 8.

TABLES 2 THROUGH 8 (Continued)

Section Number	Section Label	Possible Points	Conditions of Use to Qualify for Points	Advanced Insulation	Advanced Flooring	ZIP Systems Roof Insulation	ZIP Systems Wall Insulation
TABLE 6—SUMMARY OF AREAS OF ELIGIBILITY WITH 2010 CALIFORNIA GREEN BUILDING STANDARDS CODE							
705.1	Regional materials	N/A	Verify local products that are extracted, processed and manufactured within California or 500 miles (805 km) of the job site. Regional material calculations based on project location provided by Huber upon request.	○	○	○	○
705.2	Eco-based materials	N/A	All Huber used products are qualified as bio-based.	●	●	●	●
705.2.1	Certified Wood	N/A	Under review by California Building Standards Commission ³	N/A	N/A	N/A	N/A
707.1	Water-resistant exterior wall assembly	N/A	Huber products provide a water-resistant exterior wall envelope.				○
804.4	Composite wood product emissions	N/A	EMP products do not apply to the composite wood product definition ⁴				
TABLE 7—SUMMARY OF AREAS OF ELIGIBILITY WITH INTERNATIONAL GREEN CONSTRUCTION CODE – PUBLIC VERSION 2.0 (IGCC PV2.0)							
503.2.4Q2	Bio-based products	N/A	All Huber used products are qualified as bio-based.	●	●	●	●
503.2.5	Indigenous materials	N/A	The same criteria are products that are extracted, processed and manufactured within 500 miles (805 km) of the site for a minimum of 50% dry weight or volume of the component. Regional material calculations based on project location provided by Huber upon request.	○	○	○	○
605.1.2.1.1	UV Inhibitor Installation		Install the systems in accordance with the manufacturer's installation instructions and HCD-EQ evaluation report EIR-1004 .				●
805.1	Farm-to-fork emissions	N/A	Huber wood structural panels comply with US DDC P12 (see Table 1 of this report) and meet the requirements of Table 805.1	●	●	●	●
TABLE 8—SUMMARY OF AREAS OF ELIGIBILITY WITH AMBIGN B1-2010 – GREEN BUILDING ASSESSMENT PROTOCOL FOR COMMERCIAL BUILDINGS							
10.1.2.2	Bio-based Products – building assemblies	7 max	All Huber used products are qualified as bio-based.	●	●	●	●
10.1.4.1	Regional Materials – building assemblies	5 max	The same criteria are products that are extracted, processed and manufactured within 500 miles (805 km) of the site for a minimum of 50% dry weight or volume of the component. Regional material calculations based on project location provided by Huber upon request.	○	○	○	○
10.3.2.1	Certified wood	6	Between 50% and 80% or more of wood-based products used in the building are forest-pair certified.	●	●	●	●
○	= Eligible for points						
●	= Verified attribute						
	= This provision does not apply to this product						

¹ Certification is required of the manufacturer only. Vendor Chain of Custody is not required to qualify for this point.
² Forest certification credit currently recognizes FSC exclusively. Credit of other certification schemes may be at the discretion of the verifier.
³ CCBSC recognizes importance of use of certified forest products however the specific requirements are currently under development.
⁴ This area is not be confused with the provisions of EQ 4.4 in LEED (Table 4) because the California Air Resources Board (CARB) does not regulate engineered wood product emissions.
 N/A – Not applicable.

TABLES 2 THROUGH 8

Section Number	Section Label	Possible Points	Conditions of Use to Qualify	Advanced Tech Measuring	Advanced Tech Flooring	ZIP Systems Roof Measuring	ZIP Systems Wall Measuring
TABLE 2—SUMMARY OF AREAS OF ELIGIBILITY WITH THE NATIONAL GREEN BUILDING STANDARD (ICC 700-2003)							
605.9	Water-resistant barrier	Measurability	Install a water-resistant barrier under drainage plan system but not exterior corner or water shing.				■
605.1(2)	Two types of finished materials are used, each for more than 1 percent of the project's projected building material cost	6	The exact 6 points products must be at least 1% of the construction material cost AND another two-based product of 1% of material cost must be used. 1 or 3 points are available for greater than 0.5%	■	■	●	■
605.2(1)	Two certified wood-based products are used for major elements of the building, such as all walls, floors or roof	3	The exact 3 points a second certified wood product must also be used as a major element ¹	■	■	●	■
605.2(2)	Two certified wood-based products are used for major elements of the building, such as all walls, floors or roof	4	The exact 4 points a second certified wood product must also be used as a major element ¹	■	■	●	■
605.3	Materials are used for major components of the building that are manufactured using a minimum of 25 percent of the primary manufacturing process-energy derived from renewable resources, sustainable waste sources, or renewable energy credits	2 each 6 max	The exact 6 points the products must be used for at least 3 major components of the building. 2 points may be earned when used for each major component.	■	■	●	■
608.1	Indigenous materials	2 each 10 max	The exact 2 points verify local products are integrated, protected, green industry or occur naturally within 500 miles (825 km) of job site. Regional material calculations based on project location provided by fabricator upon request.	□	□	□	□
703.2.1	Insulation and air sealing	3 15 max	Installers used air sealing to insulation in accordance with all the following, as applicable: (1) Blower-door verification performed 15 jobs, (2) Tight-pipe verifications performed 3 jobs				□
901.4(1)	Glueless physical used for floor, wall, window and sheathing complies with DCEC PG 1 and/or DCEC PG 2. DCEC used for floor, wall, window and sheathing complies with DCEC PG 2. The products are made with recycled-reclaimed materials and the trademark includes the initials are: Exposure 1 or Exterior (physical) and Exposure 1 (DCEC)	Measurability	The record lists a minimum of 85% of CMBS or physical in the building must consist of Huber products	■	■	●	■
901.4(5)	Non-wooding products, which can include structural wood framing	4	Furniture of 85% of product in the building use the identified Huber products	■	■	●	■
□	= Eligible for points						
⊖	= Verified estimate						
■	= This provision does not apply to this product						

Note: Footnotes are located after Table 3.



EXCLUSIVE ENVIRO E LAM TECHNOLOGY NORDIC LAM™

Nordic Lam beams, headers and columns feature our exclusive ENVIRO E LAM technology. Nordic's research and development team has developed this proprietary process, enabling us to utilize fiber previously deemed unviable. ENVIRO E LAM's unique process minimizes waste and converts more of nature's raw material into useful products than ever before. ENVIRO E LAM contributes to natural resource conservation by extracting more valuable fiber from every tree.

Historically, residential and light commercial applications required the use of dimensional lumber and other engineered wood composites that rely heavily upon larger, more environmentally sensitive species. The Nordic Engineered Wood system offers an environmentally responsible choice for residential and light commercial applications. Nordic Lam's products provide price- and performance-based solutions for all your design and building requirements.

Nordic Lam™, Nordic Joist™ and rim board comprise the Nordic Engineered Wood family of products providing compatible, economical and innovative solutions for today's homebuilding systems.



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DIVISION 07 THERMAL AND MOISTURE PROTECTION



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We make Cel-Pak Cellulose Insulation using over-issue newsprint (daily newspapers that went unpurchased), paper drive paper, and other high-quality recycled paper, all refined to cellulose fiber. Unlike other manufacturers, we hand sort our paper to remove glossy inserts like ads and coupons, twine, metal - anything that isn't good, clean uncoated paper stock, making Cel-Pak the cleanest cellulose insulation you can buy.

Along the way, a natural mineral borate (never ammonium sulfate) is added to the cellulose fiber, which provides our Class A fire rating and resistance to mold and pests.

Cel-Pak is the right choice for homes, commercial structures and municipal buildings

Offering proven energy savings, the highest recycled content and the lowest embodied energy (the amount of energy it takes to manufacture) of any insulation choice, National Fiber's Cel-Pak is not only a great choice, it's the greenest choice, too.

- Cel-Pak saves you more on your heating and cooling bills - up to 40% more than fiberglass. See our [Insulation Savings Calculator](#) for more information.
- Cel-Pak has a local recycled content of 82%+. Fiberglass has less than 35%, sprayed foam insulations nearly zero.
- Cel-Pak takes 750 BTU's per pound to manufacture, vs. 12,000 BTU's/lb for fiberglass and up to 40,000 BTU's/lb for foam insulations.
- We make Cel-Pak right here in New England, which means lower emissions as our insulation travels fewer miles before it gets to your home.

<< 1 2 >>

If you live in the Northeast, buying an insulation product like Cel-Pak, that's made in the Northeast, results in a smaller carbon footprint. [\[More \]](#)



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OVERVIEW
 ZIP SYSTEM ROOF SHEATHING
 ZIP SYSTEM WALL SHEATHING
ZIP SYSTEM TAPE

"I like ZIP System roof and wall for easy and fast waterproofing. The product is high quality and I will use again."
 Jose Fernandez, J&J Properties
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ZIP SYSTEM PRODUCTS TAPE
 ESR #1473.
 ESR #1474.
 ESR #2227.

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TECHNICAL INFORMATION

GREEN BUILDING

ZIP System Tape

ZIP System® roof and wall panels provide a tight envelope and curb appeal during the construction process. Once the panels are installed, the seams are sealed with specially designed ZIP System™ tape. This innovative solution eliminates the need for housewrap and felt, saving you valuable time and money while yielding superior moisture management and a tighter building envelope.

ZIP System tape helps reduce air leaks as recommended by ENERGY STAR® and is code-recognized as window and door flashing tape when used with ZIP System wall (ESR-2227). As with ZIP System roof and wall panels, ZIP System tape is backed by our limited 30-year system warranty.

AVAILABLE SIZES
 Seam tape - 3.75" width by 90' length
 Flashing tape - 6" width by 90' length

Tape can be easily installed using one of two methods. The ZIP System™ tape gun is designed to apply ZIP System tape in one easy step and can be used with our 3.75" ZIP System tape. The ZIP System™ tape roller is designed to use when installing the tape by hand. Simply roll over the tape with the roller with enough pressure to ensure a quality seal.

Typical installation will require one 90' roll of ZIP Sytem tape per 7.5 ZIP System roof or wall panels.

Eliminate the need for home wraps and felt forever

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another innovation from **HUBER** ENGINEERED WOODS

FROM THE CREATORS OF **AdvanTech**



Optigreen Modular

Optigreen Modular combines the performance and aesthetics of continuous green roof systems with the simplicity of modular tray systems. Slotted sidewalls encourage plant root growth between modules, creating a natural-looking meadow with invisible boundaries. Slotted flat bottoms permit water to move freely both in and out of the modules with assistance from an underlying water-retaining capillary mat that maintains uniform moisture levels across the roof. Stormwater is carried away in integral drainage channels that double as conduits for drip irrigation. Adjacent modules interlock with easily removable connectors, and a stacking system assures delivery of healthy plants. Fully saturated system weights of 15 lbs/ft² (75 kg/m²) are attainable with 3" of media.

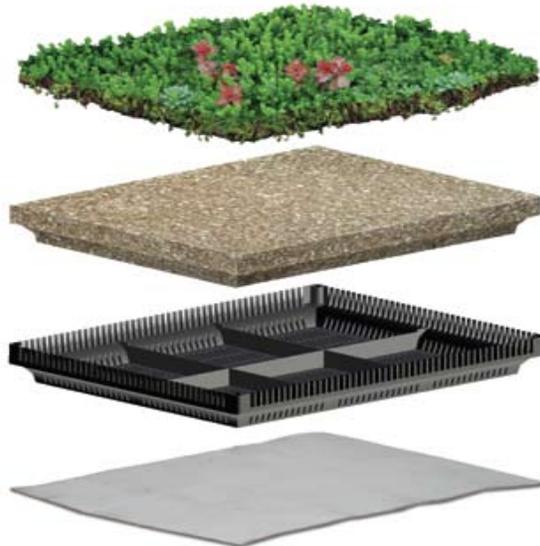


pre-planted module on capillary mat

SYSTEM ANATOMY

The system has four principal components:

- a thick, water-retaining capillary protection mat
- a support tray made from a tough, flexible, recycled polypropylene copolymer with slots in the sidewall and bottom surfaces small enough to retain growing media, yet large enough to allow plant roots and water to pass freely.
- a lightweight, inorganic, water-retaining growing media with minimal fine particles
- a vegetated mat with a thick organic growing media base, planted with drought-resistant sedum

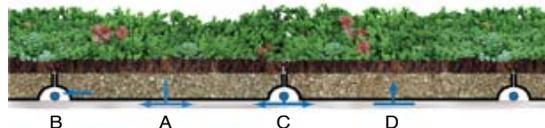


exploded view of system components

The trays are filled with the lightweight growing media, which is then compacted and overlaid with sedum mats cut to the size of the trays. After a month in the nursery, the mats are fully rooted, and the modules are ready to ship. On the rooftop, the modules are laid on capillary protection mat, a heavy-duty water-retaining geotextile that can distribute water in all directions.

WATER MANAGEMENT

Rainwater drains freely through the bottom slots and into the water-retaining capillary mat which spreads the water uniformly across the roof (A). When the mat becomes fully saturated, excess water is carried away through the high-volume semi-circular drainage conduits formed by adjacent tray edges (B). During periods of dry weather, drip irrigation lines passing invisibly through the drainage conduits are used to wet the water storage mat (C). The irrigation water spreads across the mat and rises into the trays by capillarity and by vapor diffusion (D).



cross-section showing water flow



INTERCONNECTION

Adjacent modules are joined with plastic connectors that snap into holes at the corners of the trays: four-prong connectors are used in the center of the roof, and two-prong connectors are used at the edges. The holes that receive the connectors are open at the bottom, so any growth media or plant matter that enters the top falls straight through without blocking the holes. Since the connectors tolerate significant variations in fit, it is not necessary to carefully fit or clean tray edges, and roof surfaces do not need to be perfectly clean or flat. The connectors lock securely in place without tools and can be easily removed with an ordinary flat-blade screwdriver. Since the trays do not overlap, any module can be removed quickly for replacement or for access to the underlying waterproofing.



interconnected modules on capillary mat with drip-irrigation system in drainage channels

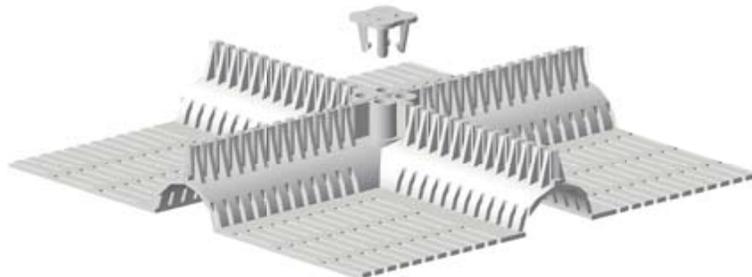
above modules with plants and growing media removed to show tray connection system

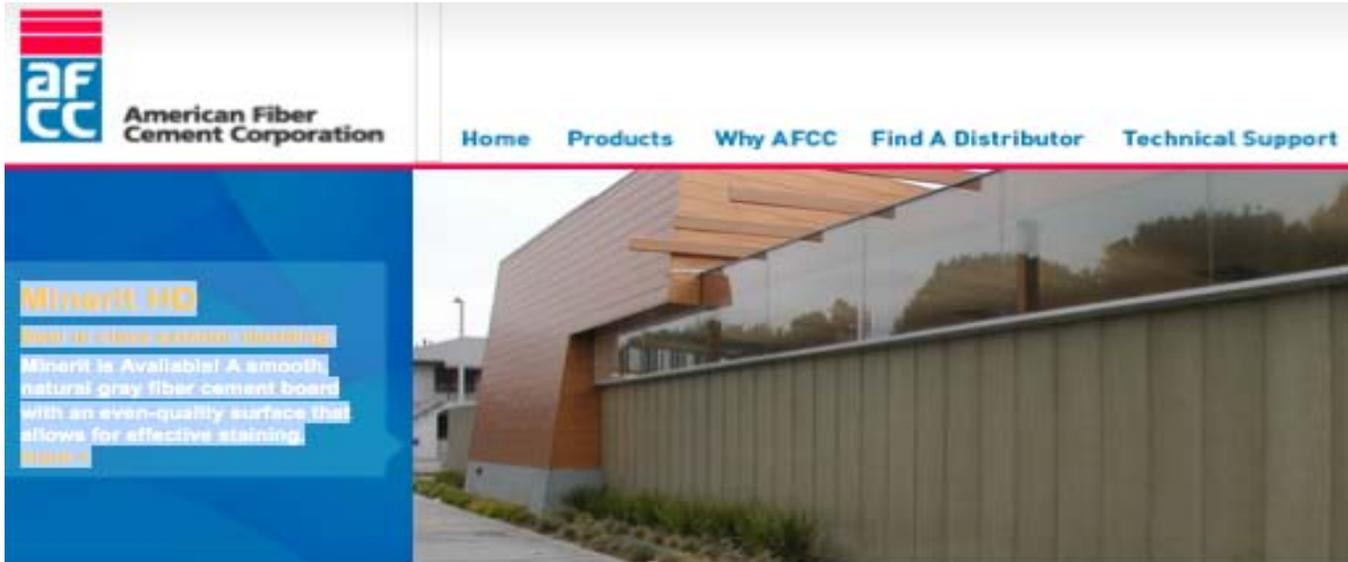


two-prong edge connector at intersection of two trays



four-prong center connector at intersection of four trays





Specially developed for exterior cladding, Heavy Duty (HD) is strong, durable and able to withstand extreme climatic and working conditions. Its smooth, cement gray surface provides the perfect base for a variety of finishes and composite panels.



Standard Sizes: 5/32", 1/4", 5/16", 3/8"; 4' x 8', 4' x 10'

Ideal for any application where the strongest cement boards in the Minerit range are required:

- Exterior Cladding
- Sports and Leisure Centers
- Agricultural Buildings
- Balconies
- Production Facilities
- Prefabricated Units
- Stairways
- Laminated Panels
- Squash Courts
- Fume Hood Liners
- Mechanical Screens

Standards & Performance - Minerit HD Cement Boards

ASTM E 136-81

Minerit Heavy Duty cement board
Non-combustibility test for building materials.

ASTM E 136-81

Minerit Light Weight cement board
Non-combustibility test for building materials.

ASTM E 136-81

Minerit Multi Purpose cement board
Non-combustibility test for building materials.

BS 476: Part 23:1987

Methods for determination of the contribution of components to the fire resistance structure. Loadbearing suspended ceiling (30 minutes) BGSi 5054.

4/89 British Gypsum
Institut Fur Bautechnik Berlin Germany, October 1987

No. PA-111 4.518 for MP & HD
Non-combustibility test for building materials.

Institut Fur Bautechnik Berlin Germany, October 1987

No. PA-III 2.2120 for MP & HD Surface Spread of flame test for building materials

BS 476: Part 21:1987

Methods for determination of the fire resistance of loadbearing elements of constructions.

Loadbearing joists floor system with a ceiling of Light Weight board. Timber joists floor (30 min.)

BGSi 5055 4/89. Timber joists floor (60 min.)

BGSi 5047 11/88.

British Gypsum UK

BS 476: Part 22:1987

Methods for determination of the fire resistance of non-loadbearing elements of constructions.

A fire resistance test on a non-loadbearing metal stud partition faced with Multi Purpose or Light Weight board. 1/2-1 hour fire rating.

A fire resistance test on a non-loadbearing timber stud partition using rock wool insulation and faced with Multi Purpose or Light Weight board. 1/2-2 hours fire rating.

Ceramic Tile Institute Approval for Special Performance board

Uniform Building Code Approval



Single Ply Roofing Systems (EPDM)
Specification
SE4A-(T)/SE6A-(T)/SE9A-(T)

Fully Adhered EPDM Single Ply Roofing System

For use over approved Johns Manville (JM) insulation or approved decks on inclines up to 6:12

For Regions 1, 2 and 3

Materials per 100 sq. ft. (9.3 sq. meters) of roof Area

JM EPDM Membrane	105 sq. ft. (9.8 sq. meters)
JM EPDM Bonding Cement	1.7 gal. (6.44 liters)
JM EPDM Color Coating (Optional)	1 gal. (3.8 liters)

Materials per 100 lin. ft. (30.5 in) of Lap Area (3 in. [80 mm]) lap

JM EPDM Seam Tape	100 lin. ft. (30.5 m)
JM EPDM Tape Primer/Wash	0.15 gal. (0.57 liters)

Approximate installed weight: 37.5 - 40 lbs. (17 - 18 kgs.)/sq.

General

This specification is for use over any type of approved structural deck which is suitable to receive a fully adhered membrane.

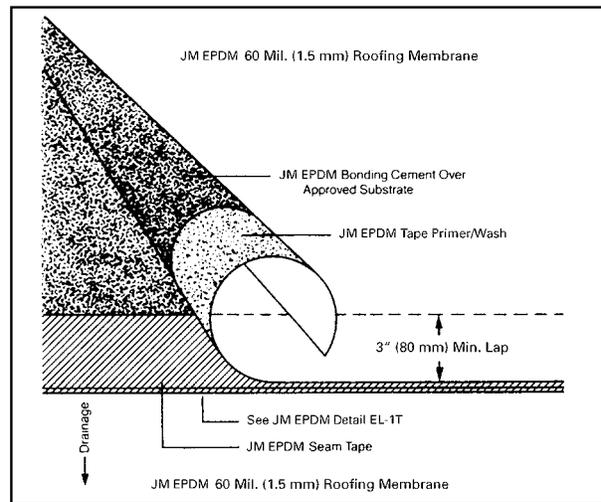
This specification is also for use over certain JM roof insulations which provide a suitable surface for the JM EPDM membrane. Insulation should be installed in accordance with the appropriate JM Insulation Specification detailed in the current JM Single Ply Roofing Systems Manual. This specification can also be used in certain reroofing applications.

Design and installation of the deck and/or roof substrate must result in the roof draining freely, to outlets numerous enough and so located as to remove water promptly and completely. Areas where water ponds for more than 48 hours are unacceptable and will not be eligible for a JM Roofing System Guarantee.

Note: All general instructions contained in the current JM Single Ply Roofing Systems Manual shall be considered part of this specification.

Flashings

Flashing details can be found in **Section 17** of the current JM Single Ply Roofing Systems Manual.



Application

Unroll and unfold the membrane to its fullest width. Move the membrane into place without stretching. When possible, begin the installation at the highest point of the project area, working to the lowest point and making sure the seams do not buck water. Allow a minimum of 30 minutes before fastening or splicing, so that the membrane can relax and release any tension induced by packaging and handling. Visually inspect the membrane for any flaws or damage which would interfere with the acceptable application or performance of the EPDM membrane. Apply the adjoining sheets in the same manner, lapping the edges a minimum of 6" (150 mm). Sheets should be laid out in an offset pattern, with a minimum of 3 feet (0.9 m) between adjacent end laps. Laps should be constructed with the uphill sheet overlapping the adjoining sheet in a shingle manner to avoid any laps opposing natural drainage.

Local wind uplift conditions and characteristics should be considered when designing, specifying, and installing any roofing system. Information from the Single Ply Roofing Industry (SPRI), FM Global, and local building codes can provide guidelines for the designer.

Once the membrane has been properly positioned, fold the sheet back along its entire length so that the underside of half of the sheet is exposed. The membrane should be smooth and free of wrinkles and buckles.



ST strip

sill sealing strip



ST strip

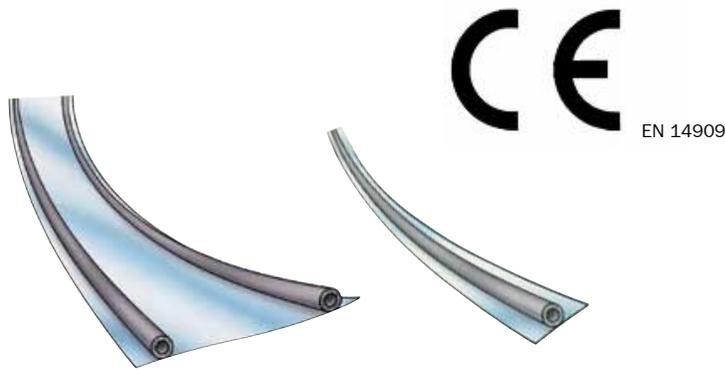
Sealing with rubber strips offers numerous benefits. They seal out moisture, cold, wind and noise. Thanks to the closed cell structure they also provide good thermal insulation and they are water-repellent. These sealing strips have good resistance to settling and excellent ageing resistance. The number of rolls and the placement on the film can be adjusted to suit your needs, for more information contact us.

Fitting the ST strip

The strip is fitted with the vapour barrier upwards. This simplifies the fitting and adjustment of wall sections as the foil has a low friction coefficient.

Rubber strips can be individually positioned on vapour barrier to suit dimensions of wall studs. Vapour barrier widths up to 500 mm provide a barrier to moisture under the full thickness of the wall and allow overlapping with plastic floor barrier.

Recommended when erecting pre-assembled modular wall or roof sections and SIPS.



Product no.	Width x Hight mm	Colour	Pack.	Qty. m	Pack. qty. m
484157908	100 x 10	Black / transp.	Bundle	25	250
484157902	60 x 10	Black / transp.	Bundle	25	400



DIVISION 08

OPENINGS



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[Windows](#) [Sliding sash](#) **Tilt & Turn** [Fixed](#)

Tilt & Turn

Our Tilt & Turn windows offer 3 opening positions. Along with tilting and opening inwards micro-ventilation offers very gentle circulation makes this option best suited to bedrooms.

Of all our opening options, tilt and turn offers the best heat retaining ability.

Click here to see more images from our Tilt and turn [Gallery](#)



phone 056-7723808
email info@doleta.ie

[Site Map](#)



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External Doors

Doleta can make external doors to almost any design and style chosen by you.

Our doors can be made from any of our wood choices. We can produce any of the following styles:

- Tilt and turn door
- Tilt and slide door
- French door
- Passing door
- Wooden garage door
- Aluminium garage door
- Stable "half" door
- Alu-wood doors
- Glass doors
- Folding doors



More Images

phone 056-7723808
email info@doleta.ie

[Site Map](#)

DIVISION 09 FINISHES

CSI#: 09 28 00



DUROCK™ Tile Membrane



Finishing a bathroom to perfection starts with knowing your substrate options.

Cement board, alternative backerboards or tile membrane. Make the best choice.

[Watch the video.](#)

Product Features

[Project Profiles](#)

[Literature & Videos](#)

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DUROCK tile membrane is used under tile in residential and light-commercial applications. It is ideal for floors and walls in bathrooms, kitchens, laundry rooms, and entryways.

The mold- and mildew-resistant membrane rolls out flat, without roll-back memory – no curling! It cuts easily with a scissors or knife without dust or mess, installing quickly without mechanical fasteners.

DUROCK tile membrane also provides an effective crack-isolation system when installed using DUROCK tile membrane adhesive. DUROCK tile membrane may also be installed using Type 1 organic adhesive or latex-modified thin-set mortar, however, installation with these products will not provide crack isolation.

For additional information and to purchase online, go to www.durocktilemembrane.com.



INSTALLATION INSTRUCTIONS
PREFINISHED ENGINEERED HARDWOOD FLOORING
W/G2+ FOLD-DOWN MECHANICAL LOCKING SYSTEM

READ THESE INSTRUCTIONS THOROUGHLY BEFORE BEGINNING INSTALLATION. IN ADDITION TO THESE INSTRUCTIONS, WE RECOMMEND THAT THE INSTALLER FOLLOW ALL INSTALLATION GUIDELINES AS SET FORTH BY THE NATIONAL WOOD FLOORING ASSOCIATION (www.nwfa.org). WHERE THESE INSTRUCTIONS DIFFER FROM NWFA GUIDELINES, THIS DOCUMENT TAKES PRECEDENCE. THESE INSTALLATION INSTRUCTIONS DO NOT APPLY TO ALL ECOTIMBER ENGINEERED FLOORING. OTHER ECOTIMBER PRODUCT LINES ARE COVERED UNDER SEPARATE INSTRUCTIONS. 011711

PRE-INSTALLATION JOBSITE REQUIREMENTS

Carefully examine the flooring prior to installation for grade, color, finish and quality. Ensure adequate lighting for proper inspection. If flooring is not acceptable, contact your distributor immediately and arrange for replacement. EcoTimber cannot accept responsibility for flooring installed with visible defects. Prior to installation of any flooring, the installer must ensure that the jobsite and subfloor meet the requirements of these instructions. EcoTimber is not responsible for flooring failure resulting from unsatisfactory jobsite and/or subfloor conditions.

Hardwood flooring should be one of the last items installed in any new construction or remodel project. All work involving water or moisture should be completed before flooring installation. Water and wood do not mix. Installing onto a wet subfloor may cause permanent damage to the flooring. Permanent HVAC should be on and operational and maintained between 60-75°F with relative humidity of 30%-60% **for a minimum of 14 days prior to installation**, as well as during and after installation. **When installing over radiant heat, additional restrictions apply – see below.** Humidity levels below 30% will most likely cause movement in the flooring, including gapping between pieces and possible cupping and checking in the face.

Store the wood flooring in the UNOPENED boxes at installation area for 24 -72 hours before installation to allow flooring to adjust to room temperature. Do not store the boxes of flooring directly on concrete or close to a wall. These engineered wood floors DO NOT need any moisture equalization prior to installation and should be installed from just-opened boxes. DO NOT OPEN more than a few boxes in advance of installation and only the number of boxes that will be installed within the next few hours. Only open enough boxes to ensure a good mix of lengths and color.

Floors from the EcoPlanet and EcoReserve Collection, EXCLUDING HICKORY (Moab Dusk, On Pointe, Crescendo), are warranted for installation over hydronic radiant heat if installed per these instructions. No EcoTimber flooring is warranted over electric radiant heat systems. Only hydronic systems are approved. Please carefully read the “Radiant Heat” section below before finalizing product selections.

PRE-INSTALLATION SUBFLOOR REQUIREMENTS

Acceptable subfloor types:

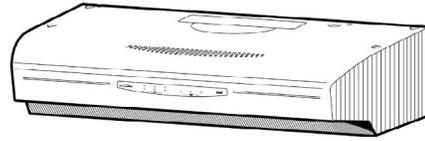
- CDX plywood - at least 5/8” thick for joist spacing up to 16” on center, minimum 3/4” thick for joist spacing greater than 16” on center (19.2” maximum)
- Underlayment grade particleboard (minimum 40 lb. density) - floating/glue-down only
- OSB - at least 3/4” thick, PS 2-92 rated or PS 1-95 rated
- Concrete slab - floating/glue-down only
- Existing wood floor - must be smooth, level, well-adhered and, if gluing new flooring, unfinished
- Ceramic tile – floating only

DIVISION 11 EQUIPMENT



SPECIFICATION SHEET

**ALLURE™
RANGE HOOD
MODELS QS1, QS2, & QS3**



Meeting customer demands for a contemporary styled range hood that is 50% quieter than average hoods, is easy to clean, and brightly lights the cooktop.

FEATURES

- Clean, sleek appearance
- Durable, baked-on polyester finish paint or brushed finish stainless steel
- Over 50% quieter than the average range hood
- Exclusive DuPont Teflon®, non-stick bottom cover for easy cleaning (QS2 & QS3)
- Large, full filter design - dishwasher-safe for easy cleaning
- Dual halogen lights provide focused lighting for unmatched cooktop visibility as well as a soft, night-time level (lamps not included)
- Axial blade (QS1) or centrifugal blower (QS2 & QS3) provides increased performance and quieter operation.
- Flush-mounted controls
- Versatile design allows for 3¼" x 10", 7" round, or non-ducted discharges without re-positioning blower
- Adjustable duct connectors - accommodate off-center ductwork
- CleanSense™ charcoal filters change color when replacement is necessary (for non-ducted installations - purchase separately)
- Available in 30", 36", or 42" widths in White, Biscuit, Almond, Black, and Stainless Steel
- Bi-lingual carton graphics and installation manual (English/Spanish) (English/French Canadian in Canada)
- Broan Heat Sentry™ - automatically turns blower to high (QS2), on or higher (QS3) when excess cooking heat is detected

TYPICAL SPECIFICATION

Range hood shall be Broan QS1 (QS2) (QS3) Series. Unit will have clean, contoured appearance with no sharp edges. Finish to be baked-on polyester paint (matte finish stainless steel). It must have a fully-enclosed bottom and dishwasher-safe, full filters.

Hood to be convertible between 3¼" x 10" and 7" round ducted (using two washable aluminum filters) as well as non-ducted (using two CleanSense™ filters - must be purchased separately). Duct connectors must be adjustable to accommodate off-center ductwork.

Range hood to have an axial blade (centrifugal blower) and twin, 50-watt (max.) halogen flood lights. Blower and lights shall be operated using a specially-designed, adjustable control with 2-speed rocker (3-speed electronic push button) (4-speed electronic, with delayed "off" and filter reminder).

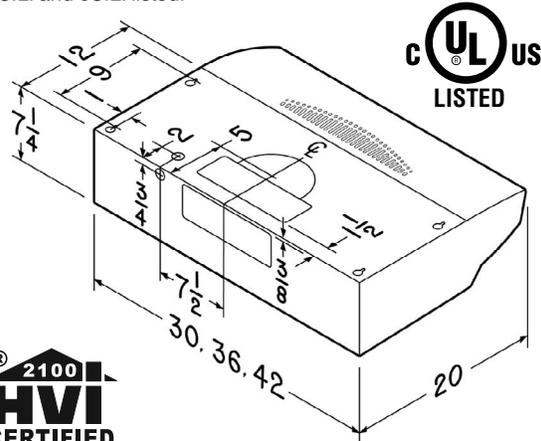
Air delivery shall be no less than 220 cfm (QS1), 300 cfm (QS2), 430 cfm (QS3) when ducted horizontally. Sound level to be no greater than 1.5 Sones/100 cfm - 5.0 Sones/220 cfm (QS1); 0.9 Sones/100 cfm - 4.5 Sones/300 cfm (QS2); 0.4 Sones/100 cfm - 4.5 Sones/300 cfm - 8.0 Sones/430 cfm in "Boost" mode (QS3). Air and sound ratings to be certified by HVI. Unit shall be U.L. and cU.L. listed.

SPECIFICATIONS	MODEL		
	QS1	QS2	QS3
Volts	120	120	120
Hz	60	60	60
Amps	1.8	2.0	3.0
Max. cfm (horizontal)	220	300	300*
Sones (norm.)	1.5	0.9	0.4*
Sones (high)	5.0	4.5	4.5
Controls	2-sp rocker	3-sp electronic	4-sp electronic
Halogen Flood Light	PAR20†	PAR20†	PAR20†
Charcoal Filter	BPSF‡	BPSF‡	BPSF‡
DuPont Teflon®	No	Yes	Yes
Broan Heat Sentry™	No	Yes	Yes

* 430 cfm & 8.0 sones in Boost mode (QS3 only). † 2 bulbs req. (not included). ‡ Purchase separately for non-ducted installation.

Teflon® is a registered trademark of DuPont.

Broan-NuTone LLC Hartford, Wisconsin www.broan.com 800-558-1711
Broan-NuTone Canada Mississauga, Ontario www.broan.ca 877-896-1119



HVI-2100 CERTIFIED RATINGS comply with new testing technologies and procedures prescribed by the Home Ventilating Institute, for off-the-shelf products, as they are available to consumers. Product performance is rated at 0.1 in. static pressure, based on tests conducted in a state-of-the-art test laboratory. Sones are a measure of humanly-perceived loudness, based on laboratory measurements.

REFERENCE	QTY.	REMARKS	Project
			Location
			Architect
			Engineer



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MT4078SPB

A compact microwave that doesn't take up all of your counter space. Enjoy excellent defrosting, reheating and cooking results with 700 Watts and 10 levels of power control. The glass turntable is removable for easy cleaning.

Black-on-Black
Model: MT4078SPB
MSRP: **\$139.00**

White-on-White
Model: MT4078SPQ
MSRP: **\$139.00**

MSRP is Manufacturer's Suggested Retail Price and may not necessarily be the price at which the product is sold in the consumer's area. Dealer alone determines actual price.

PRODUCT FEATURES

Features

- 0.7 cu. ft. Capacity
- 700 Watts Cooking Power
- 10-Level Variable Cooking Power Control
- Non-Sensor Cooking Cycles
- Non-Sensor Reheat, Defrost Cycles
- Staged Cooking
- Electronic Child Lockout Feature
- Removable Glass Turntable
- Under The Cabinet (UTC) Mounting Bracket Included

Dimensions

- Height: 11 Inches
- Depth: 12 3/8 Inches
- Width: 18 Inches

Electrical Requirements

- 15 or 20 Amps. 15 Amps. 60 Hz. 120 V.

SPECIFICATIONS

Capacity

Capacity: 0.7 Cu. Ft.

Whirlpool Customer Support

For shopping assistance call
1-800-253-1301

Performance

- Cooking Power Wattage: 700
- Turntable Material: Glass
- Recessed Turntable: Yes

Dimensions

- Overall Height: 11 Inches
- Overall Width: 18 Inches
- Overall Depth: 12 3/8 Inches

CSI#: 11 31 13

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SHX4AP02UC

24" Ascenta Integra Dishwasher
Dishwasher

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Color option

- [SHX4AP05UC](#)
- [SHX4AP06UC](#)

Accessories

- [SMZ5002UC](#)
- [SGZ1052UC](#)



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W9RXXMFWS



This Resource Saver™ refrigerator is our most energy efficient top mount, exceeding the federal standard by 30%, which helps you save additional resources and money. Auto defrost system provides added convenience for proper freezer maintenance. The easy-to-reach up-front temperature controls make it simple to adjust refrigerator or freezer functions.

Stainless Steel
Model: W9RXXMFWS
MSRP: **\$1049.00**

Black
Model: W9RXXMFWS
MSRP: **\$849.00**

White-on-White
Model: W9RXXMFWS
MSRP: **\$849.00**

MSRP is Manufacturer's Suggested Retail Price and may not necessarily be the price at which the product is sold in the consumer's area. Dealer alone determines actual price.

PRODUCT FEATURES

Features

- Resource Saver™ Refrigerator
- ENERGY STAR® Qualified
- ADA Compliant
- Humidity-Controlled Crispers
- Glass Shelves
- White Door Bins
- Up-Front Temperature Controls
- Interior Lighting
- Meat Pan
- Adjustable Utility Compartment
- Full-Width Fixed Refrigerator Door Storage
- Optional Automatic Ice Maker Sold Separately (Part no. ECKMF94)
- Full-Width Fixed Wire Freezer Shelf
- Full-Width Fixed Freezer Door Storage
- Contoured Door Styling
- Smooth Door Finish (all colors)
- Front Integrated Cup Handles

Dimensions
Height: 66 1/2 Inches
Depth: 31 1/2 Inches
Width: 29 1/2 Inches

Electrical Requirements
15 Amps. 60 Hz. 120 V.

SPECIFICATIONS

Performance



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GFE471LVS

This 5.3 cu. ft. freestanding electric range features a hidden bake element for a quick-clean oven surface. The CleanTop® system with eco-friendly Schott Ceran® cooktop ease cleaning, plus the SteamClean option spot cleans the oven in 20 minutes. TimeSavor™ Plus convection creates fast, flavorful results. A 6"/9"/12" triple radiant cooktop element handles any pot or pan. Energy Save mode conserves energy.

Black
Model: GFE471LVB
MSRP: **\$1149.00**

White
Model: GFE471LVQ
MSRP: **\$1149.00**

Stainless Steel
Model: GFE471LVS
MSRP: **\$1249.00**

MSRP is Manufacturer's Suggested Retail Price and may not necessarily be the price at which the product is sold in the consumer's area. Dealer alone determines actual price.

PRODUCT FEATURES

Features

- 5.3 cu. ft. Capacity
- SteamClean Option
- Hidden Bake Element
- TimeSavor™ Plus True Convection Cooking System
- Energy Save Option
- Eco-Friendly Schott Ceran® Cooktop with CleanTop® Cooking Surface
- Rapid Preheat
- (1) 6"/9" Rapid Boil Element
- (1) 6"/9"/12" Triple Radiant Element
- (1) 6" Warm Zone Element
- (2) 6" Radiant Elements
- Precise Clean™ Cleaning System
- AccuBake® Temperature Management System
- 2 Adjustable Oven Racks
- 1 Adjustable Split Oven Rack
- Sabbath Mode
- Control Bake
- EasyView™ Extra-Large Oven Window
- Delay Bake
- Lower Warming Drawer
- Control Lock

Dimensions

Height: 46 7/8 Inches
Depth: 27 9/16 Inches
Width: 29 7/8 Inches

Electrical Requirements

40 Amps. 60 Hz. 240 V.

CSI#: 11 31 23

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Invented for life



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WTC82100US

Axxis One
Condenser Dryer

- [Overview](#)
- [Technical specs](#)
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-



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Product features

Performance -

- 9 Drying Programs
- 3.9 Cubic Foot Drum
- LED
- High Volume Air Flow and Moderate Heat for Gentle Drying
- Backed by Good Housekeeping Seal, two year limited warranty

Gentle Care -

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WAS20160UC

Bosch Axxis
Stackable Automatic washing machine

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Product features

Efficiency -

- SensoTronic® Plus Analyzes Washer for Appropriate Level and Temperature of Water
- Bosch Washers Exceed Federal Energy Standards by up to 102%
- Exceeds ENERGY STAR® 2011 Guidelines - Uses only 140 kWh/yr
- Bosch is the 2009 ENERGY STAR Partner of the Year
- Up to 1000 rpm max Spin Speed - Ultimate Water Extraction, Less Drying Time & Energy Usage

Performance -

DIVISION 12 CABINETS



INNOVATOR OF PUREBOND®
FORMALDEHYDE-FREE
PLYWOOD TECHNOLOGY

PureBond® Material Data Safety Sheet

November 30, 2010

Supersedes: March 23, 2010

Number of pages: 4

PART I: PRODUCT IDENTIFICATION

Product: Decorative hardwood plywood assembled with cores of all veneer; phenolic¹ particleboard; phenolic medium density fiberboard; phenolic oriented strand board; phenolic combination core construction or MDI¹-resin bonded, medium density fiberboards; in assemblies laminated with Columbia's proprietary, formaldehyde-free, soy-based PureBond assembly process.

Aspen or poplar veneer core lamination blanks and bending plywood without decorative hardwood face and back veneers laminated with Columbia's proprietary, formaldehyde-free, soy-based PureBond assembly process. Decorative rotary veneer also covered by this document.

Synonyms: NAF (No added formaldehyde) or NAUF (No-added urea formaldehyde) decorative hardwood plywood, LEED NC EQ 4.4 compliant hardwood plywood.

Trade Names: PureBond brand and PureBond used together with these additional, proprietary designations: JayCore®, KayCore®, Classic Core® with phenolic MDF crossbands (including Classic Core II, Classic Core IV), CANAM Gold/silver, DesignEdge+™, Europly Plus®, UV Wood® (on PureBond panels), LabCoat™ (on PureBond panels.)

Manufacturer: Columbia Forest Products
7900 Triad Center Drive, Suite 200
Greensboro, NC 27409
www.columbiaforestproducts.com

Contact: Ang Schramm, Technical Services Manager
Emergency phone: 334-616-7745

PART II: HAZARDOUS INGREDIENTS

Component: **Wood dust²** (Generated as waste by-product of further fabrication by user)
CA Prop 65 Notice: Drilling, sawing, sanding or machining wood products generates wood dust, a substance known to the State of California to cause cancer. Avoid inhaling wood dust or use a dust mask or other safeguards for personal protection. California Health and Safety Code Section 25249.6.

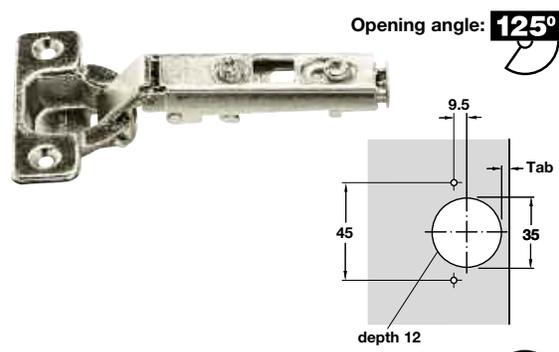
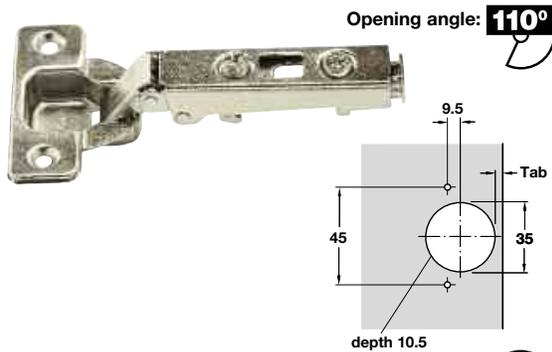
CAS No.: None

Exposure limits:	ACGIH TLV Softwoods and most hardwoods (except Beech, and Oak)	<u>PEL</u> 5 mg/m ³ TWA	<u>STEL</u> 10 mg/m ³
	ACGIH TLV Certain Hardwoods (i.e. Beech and Oak)	(15 min) 1 mg /m ³ TWA	N/A
	OSHA All soft and hard woods (except Western Red Cedar)	5 mg/m ³ TWA	10 mg/m ³
	OSHA Western Red Cedar	2.5 mg/m ³ TWA	N/A

Concealed Hinges

A-Series Clip

- With **clip mount feature**
- Door thickness 14 to 26 mm (9/16"-1")
- Side panel thickness from 16 mm (5/8")
- Self-closing
- Tab: 3 - 6 mm
- Corresponding mounting plates can be found on page 245



Screw-mount

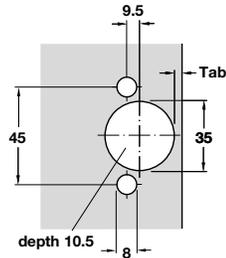
Material: Cup: steel

Hinge arm: steel; Finish: nickel-plated



Mounting	Hinge arm	Hinge type	Item No.
Full overlay		straight	13 311.60.500
Half overlay		8 mm crank	5 311.60.501
Inset mounting		17 mm crank	-3 311.60.502

Packing: 250 pcs.



Press-fit, 45/9.5 hole pattern

Material: Cup: steel

Hinge arm: steel; Finish: nickel-plated

Mounting	Hinge arm	Hinge type	Item No.
Full overlay		straight	13 311.60.560
Half overlay		8 mm crank	5 311.60.561
Inset mounting		17 mm crank	-3 311.60.562

Packing: 250 pcs.



Screw-mount

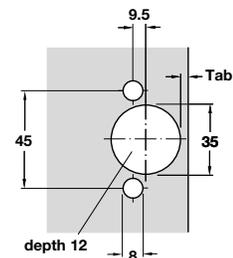
Material: Cup: steel

Hinge arm: steel; Finish: nickel-plated



Mounting	Hinge arm	Hinge type	Item No.
Full overlay		straight	15 311.97.500
Half overlay		8 mm crank	5 311.97.502

Packing: 250 pcs.



Press-fit, 45/9.5 hole pattern

Material: Cup: steel

Hinge arm: steel; Finish: nickel-plated

Mounting	Hinge arm	Hinge type	Item No.
Full overlay		straight	15 311.97.570
Half overlay		8 mm crank	5 311.97.572

Packing: 250 pcs.

Trim Caps for hinge arm

Material: steel; Finish: nickel-plated

	Item No.
with Häfele logo	311.65.700
plain	311.65.710

Packing: 1000 pcs.

Dimensional data not binding. We reserve the right to alter specifications without notice.

Ball Bearing Slide

Full Extension, Telescoping, Side Mounted – Bee Slide C4500

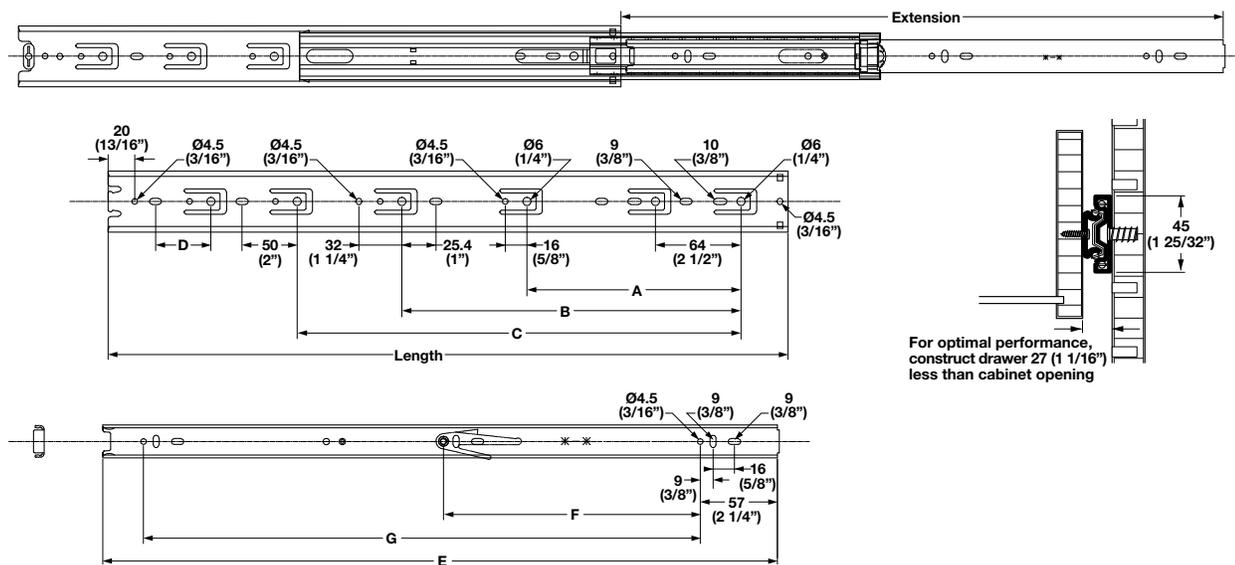


New Item

- Weight capacity: **45 kg** (100 lbs.)/pair
 - Face frame hole
 - 32 mm hole pattern
- Material: steel, bright zinc-plated

Length & Extension	A	B	C	D	E	F	G	Item No.
305 (12")	224 (8 13/16")				301 (11 7/8")	96 (3 3/4")	224 (8 13/16")	420.10.930
356 (14")			224 (8 13/16")	50 (2")	352 (13 7/8")	128 (5 1/16")	256 (10 1/16")	420.10.935
406 (16")	224 (8 13/16")		288 (11 5/16")		402 (15 13/16")	160 (6 5/16")	320 (12 5/8")	420.10.940
457 (18")	224 (8 13/16")	352 (13 7/8")			453 (17 13/16")	160 (6 5/16")	352 (13 7/8")	420.10.945
508 (20")	224 (8 13/16")	352 (13 7/8")	416 (16 3/8")		504 (19 13/16")	192 (7 9/16")	416 (16 3/8")	420.10.950
559 (22")	224 (8 13/16")	352 (13 7/8")	416 (16 3/8")	50 (2")	555 (21 7/8")	224 (8 13/16")	448 (17 5/8")	420.10.955
610 (24")	224 (8 13/16")	352 (13 7/8")	480 (18 7/8")	50 (2")	606 (23 7/8")	256 (10 1/16")	512 (20 3/16")	420.10.960

*Packing: 10 pairs (each pair comes in a polybag, screws not included)



For optimal performance, construct drawer 27 (1 1/16") less than cabinet opening

Dimensional data not binding. We reserve the right to alter specifications without notice.

Ball Bearing Slide

Full Extension, Telescoping, Side Mounted – Bee Slide C4500

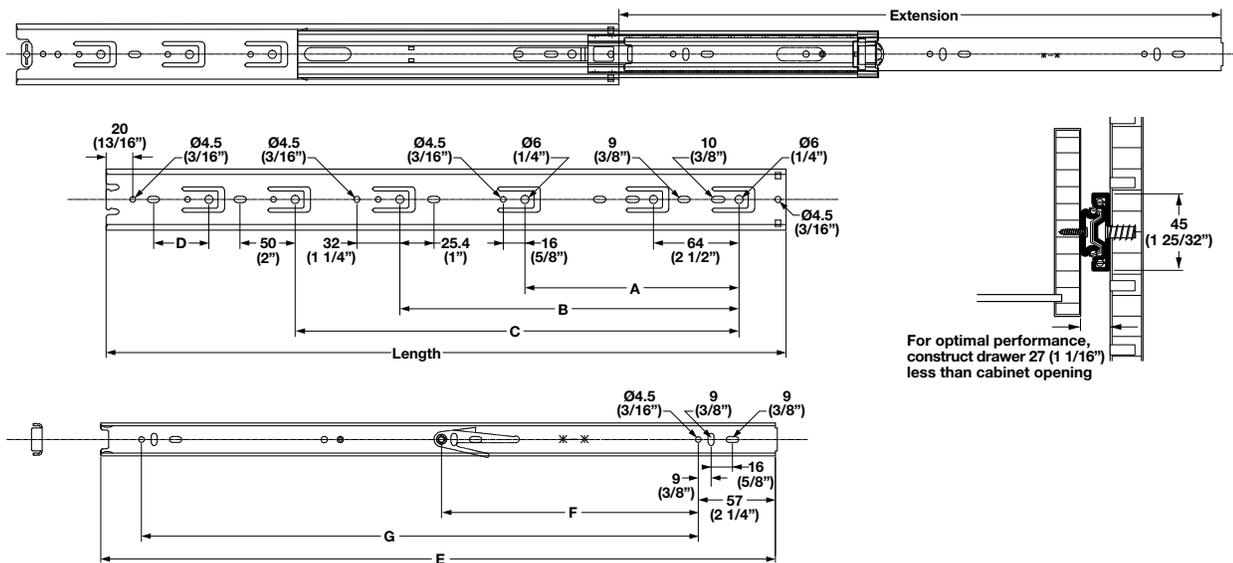


New Item

- Weight capacity: **45 kg** (100 lbs.)/pair
 - Face frame hole
 - 32 mm hole pattern
- Material: steel, bright zinc-plated

Length & Extension	A	B	C	D	E	F	G	Item No.
305 (12")	224 (8 13/16")				301 (11 7/8")	96 (3 3/4")	224 (8 13/16")	420.10.930
356 (14")			224 (8 13/16")	50 (2")	352 (13 7/8")	128 (5 1/16")	256 (10 1/16")	420.10.935
406 (16")	224 (8 13/16")		288 (11 5/16")		402 (15 13/16")	160 (6 5/16")	320 (12 5/8")	420.10.940
457 (18")	224 (8 13/16")	352 (13 7/8")			453 (17 13/16")	160 (6 5/16")	352 (13 7/8")	420.10.945
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610 (24")	224 (8 13/16")	352 (13 7/8")	480 (18 7/8")	50 (2")	606 (23 7/8")	256 (10 1/16")	512 (20 3/16")	420.10.960

*Packing: 10 pairs (each pair comes in a polybag, screws not included)



For optimal performance, construct drawer 27 (1 1/16") less than cabinet opening

Dimensional data not binding. We reserve the right to alter specifications without notice.

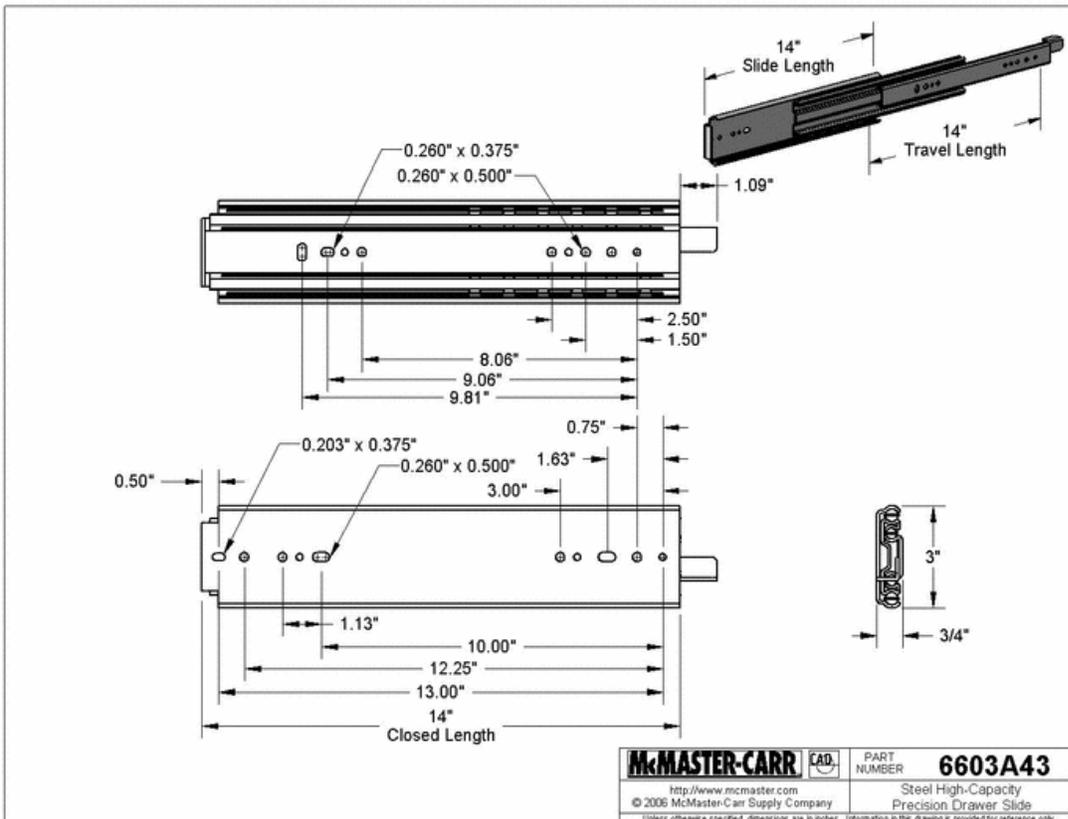


Steel High-Capacity Precision Drawer Slides 1102A63

Mount these high-capacity slides onto storage drawers for heavy tools and equipment as well as onto access drawers for batteries and generators. Made of steel, slides have steel ball bearings and steel raceways (where ball bearings travel) that are manufactured to tight tolerances to ensure smooth movement. Retainers keep ball bearings in place. All slides are full extension, so the drawer will pull out the full closed length of the slide. Once installed, the drawer cannot be removed without disassembling the slides. Require up to 34 mounting screws (not included); use 1/4" hex head cap screws with max. head size of 1/2" Wd. x 0.19" Ht. for clearance. Load rating is based on a drawer with a service life of 10,000 cycles.

Dual-Mount Slides— Side mount or base mount these slides.

Side-Mount Slides with Lock-Open/Closed— For side mounting. Fully open or close these slides and they lock in position. To release the lock, push the lever on the right-hand slide.



CSI#: 12 32 23

Rockler Folding Shelf Brackets

65798



These folding shelf brackets are handy in areas and situations where you want a work surface that can be folded down and out of the way when not in use. Spring-loaded, one-handed release lever keeps hands and fingers from getting pinched. Adjustable to four positions: 90°, 80°, 70° and 0° (closed). Available in two lengths. Zinc-coated steel construction.

Uses for this bracket include

- Laundry Rooms
- Children's Playrooms and Bedrooms
- Craft and Drawing Table Applications
- Garage and Utility/Workshop Areas
- Libraries and Computer Work Stations

Note: The brackets must be fastened to 2 X 4" wood stud on 16" centers.

DIVISION 21

FIRE SUPPRESSION

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Series LFI Residential Flush Horizontal Sidewall Sprinklers 4.2 K-Factor

General Description

The TYCO RAPID RESPONSE Series LFI Residential Flush Horizontal Sidewall Sprinklers (TY2384) are decorative, fast response, fusible solder sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels. When aesthetics is the major consideration, the Series LFI Sprinklers (TY2384) should be the first choice.

The Series LFI Sprinklers (TY2384) are to be used in wet-pipe residential sprinkler systems for one- and two-family dwellings and manufactured homes per NFPA 13D; wet-pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R; or wet-pipe sprinkler systems for the residential portions of any occupancy per NFPA 13.

The Series LFI Sprinklers (TY2384) has a 4.2 (81.6) K-factor that provides the required residential flow rates at reduced pressures, enabling smaller pipe sizes and water supply requirements.

The flush design of the Series LFI Sprinklers (TY2384) features a separable escutcheon providing 3/16 inch (4.8 mm) horizontal adjustment. This adjustment reduces the accuracy to

which the pipe drops to the sprinkler must be cut to help assure a perfect fit installation.

The Series LFI Sprinklers (TY2384) has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

NOTICE

The Series LFI Residential Flush Horizontal Sidewall Sprinklers (TY2384) described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

Owners are responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Model/Sprinkler Identification Number (SIN)

TY2384

Technical Data

Approvals
UL and C-UL Listed

Maximum Working Pressure
175 psi (12.1 bar)



Horizontal Adjustment
3/16 inch (4.8 mm)

Finish
Sprinkler and Escutcheon:
White, Chrome, or Black

Physical Characteristics
Body Copper Alloy
Deflector Copper
Valve Cap Copper Alloy
Orifice Seal PTFE
Heat Collectors Copper

Operation

The sprinkler assembly contains a small fusible solder element. When exposed to sufficient heat from a fire, the solder melts and enables the internal components of the sprinkler to fall away. At this point the sprinkler activates with the deflector dropping into its opened position (Figure 1C), permitting water to flow.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage



Design Criteria

The Series LFI Residential Flush Horizontal Sidewall Sprinklers (TY2384) are UL and C-UL Listed for installation in accordance with the following criteria.

Note: When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP400 for the manufacturer's recommendations that may be acceptable to any authority having jurisdiction.

System Type.
Only wet-pipe systems may be utilized.

Hydraulic Design.
The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A as a function of temperature rating and the maximum allowable coverage area. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Table A for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage area being protected by the four sprinklers.

Obstruction to Water Distribution.
Sprinklers are to be located in accordance with the obstruction rules of NFPA 13 for residential sprinklers as well as with the obstruction criteria described within the TYCO technical data sheet TFP480.

Operational Sensitivity (Horizontal and Sloped Ceilings).
The sprinklers are to be installed in the flush position per Figure 1 with the provided installation.

In addition the top-of-deflector-to-ceiling distance is to be within the range (Refer to Table A) being hydraulically calculated.



ELEVATION

Maximum Coverage Area (F) Width x Length (F) PL x PL (m x m)	Maximum Spacing PL (m)	Minimum Flow (F) and Residual Pressure	
		Top-Of-Deflector - To - Ceiling 4 to 6 inches (100 to 150 mm)	
		TEMPERATURE	
12 x 12 (3,7 x 3,7)	12 (3,7)	18 GPM (68,2 LPM) 8.8 psi (0,60 bar)	
14 x 14 (4,3 x 4,3)	14 (4,3)	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	
18 x 18 (4,9 x 4,9)	18 (4,9)	20 GPM (75,7 LPM) 22.7 psi (1,57 bar)	

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) Width (sidewall where sprinkler is located) x Length (horizontal throw of sprinkler).

(c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

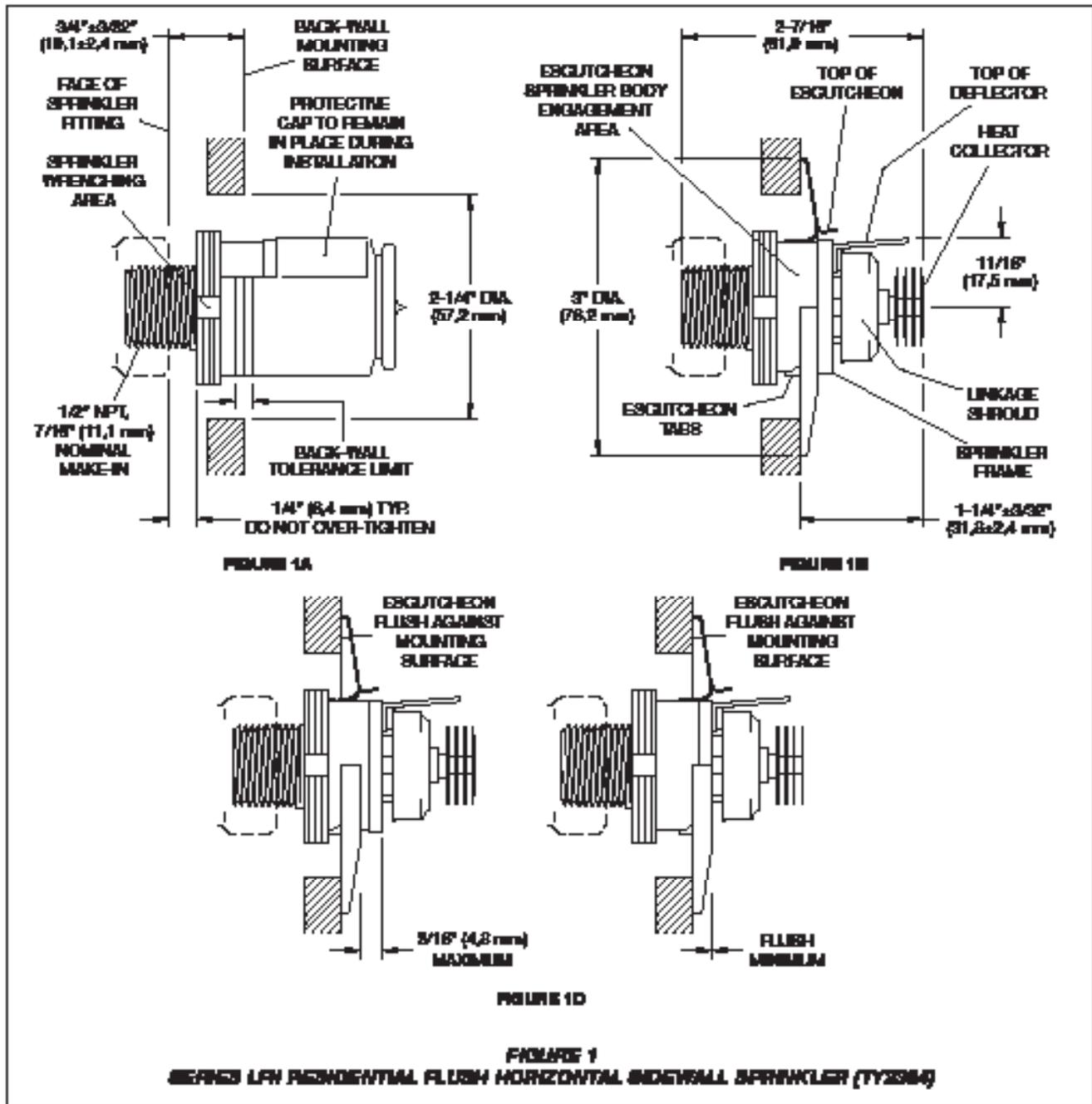
(d) Sidewall sprinklers, when installed under a ceiling with a slope greater than 0 inch rise for a 12 inch run (a slope up to 2 inch rise for 12 inch run, must be located per one of the following:

- Locate the sprinklers at the high point of the slope and positioned to discharge down the slope.
- Locate the sprinklers along the slope and positioned to discharge across the slope.

TABLE A
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA FOR THE SERIES LFI RESIDENTIAL FLUSH HORIZONTAL SIDEWALL SPRINKLERS (TY2384) FOR HORIZONTAL CEILING (Minimum 2 inch Rise for 12 inch Run)

Sprinkler Spacing.
The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (Refer to Table A) being hydraulically calculated (for example, maximum 12

Precautionary Warnings for Corrosive Environments
The Series LFI Residential Flush Horizontal Sidewall Sprinkler (TY2384) must be installed in a non-corrosive environment.
The improper use of corrosive agents

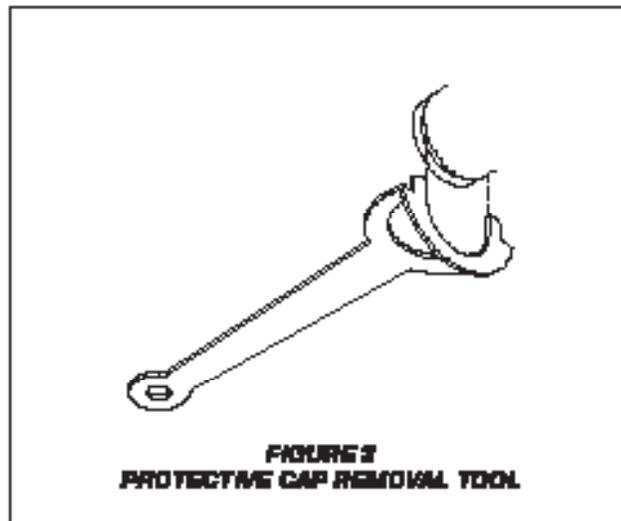
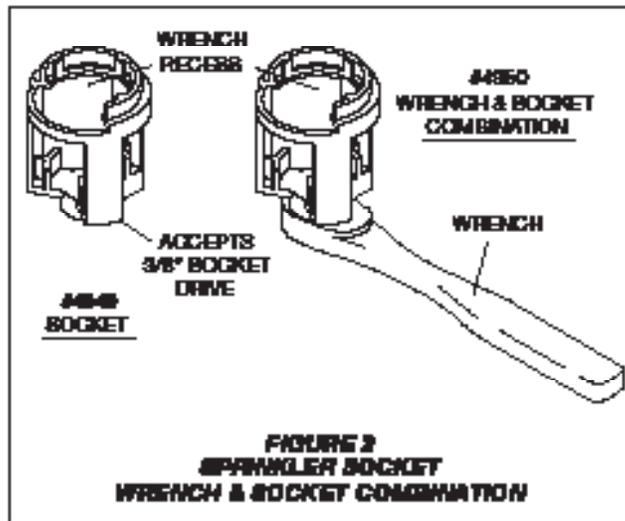


of the sprinkler head, or stress corrosion cracking, which in turn may cause the sprinkler heads to develop leaks, operate unexpectedly, or not operate properly.

Accordingly, it is essential that the Series LFR Residential Flush Horizontal Sidewall Sprinkler (TY2884) be installed only by experienced fire sprinkler engineers, who comply fully with NFPA13,

Copper sprinkler system piping. Any time copper piping is used in any part of a fire sprinkler system, the copper piping must be installed in conformance with all applicable standards and requirements for copper piping, including: NFPA13, 13D, 13R and 25, ASTM B 813, ASTM B 828, and Copper Development Association (CDA). Any soldering in any part of a sprinkler system, either internally or externally, must

The use of improper flux, or the failure to thoroughly remove proper flux, may result in corrosion of the sprinkler head or stress cracking, which in turn may cause the sprinkler heads to develop leaks, operate unexpectedly, or not operate properly.



Installation

The TYGO RAPID RESPONSE Series LFI Residential Flush Horizontal Side-wall Sprinklers (TY2884) must be installed in accordance with the following instructions.

NOTICE

The Protective Cap is to remain on the sprinkler during installation until the ceiling installation is complete. The Protective Cap must be removed to place the sprinkler in service.

Obtain a 1/2 inch NPT sprinkler joint by applying a minimum to maximum torque of 7 to 14 ft.lbs. (9.6 to 18.0 Nm). Higher levels of torque can distort the sprinkler head with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Sprinkler by under- or over-tightening the Sprinkler Support Cup Assembly. Re-adjust the position of the sprinkler fitting to suit.

Each sprinkler must be inspected before installation. Do not use any sprinkler that exhibits any deformations or cracks, including cracks on the protective cap.

1. The Sprinkler must be installed only in the pendent position and with the Sprinkler midway centerline perpendicular to the mounting surface.
2. Install the sprinkler fitting so that the distance from the face of the fitting to the mounting surface will be nominally 26/32 inches (23,0 mm) as shown in Figure 1A.

3. With pipe thread sealant applied to the pipe threads, hand tighten the Sprinkler into the sprinkler fitting.
4. Wrench tighten the Sprinkler using only the Sprinkler Socket or Wrench & Socket Combination (Figure 2). The wrench recess of the Socket is to be applied to the sprinkler wrenching area (Figure 1A).

Note: The Sprinkler Wrench must be correctly aligned to slide over the Protective Cap. After the leading edge of the Sprinkler Wrench passes over the flat portion of the Protective Cap, it must be rotated and realigned to engage with the sprinkler wrenching area. Conversely to remove the Sprinkler Wrench, sufficiently pull the Sprinkler Wrench so that it disengages from the sprinkler wrenching area, and then rotate the Sprinkler Wrench so that it can pass over the Protective Cap.

5. Step 5. Use the "backwall tolerance limit" indicator (Figure 1A) on the Protective Cap to check for proper installation depth. The finished wall surface must line up with- in the 2/16 inch (4,8 mm) range of the "backwall tolerance limit". Figure 1A illustrates the finished wall surface at the mid-point of the "backwall tolerance limit". Relocate the sprinkler fitting as necessary. If desired the Protective Cap may also be used to locate the center of the clearance hole. Apply chalk to the center point of the Cap and then gently touch the wall material against the center point of the Cap.

6. After the wall has been completed with the 2-1/4 inch (57,2 mm) diameter clearance hole, use the Protective Cap Removal Tool (Figure 3) to remove the Protective Cap and then push on the Escutcheon until its flange comes in contact with the wall. If the Escutcheon cannot be engaged sufficiently to contact the wall and/or the Escutcheon cannot be engaged per Figure 1G (that is 3/16 inch (4,8 mm) to flush with respect to the face of the sprinkler body), relocate the sprinkler fitting.

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**Series LFII Residential Sprinklers
Flat-Plate Concealed Pendant
4.9 K-Factor**

**General
Description**

The TYCO RAPID RESPONSE Series II Residential Flat-Plate Concealed Pendant Sprinklers (TY2524) are decorative, fast response, fusible solder sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels.

The Cover Plate/Retainer Assembly conceals the sprinkler operating components above the ceiling. The flat profile of the Cover Plate provides the optimum aesthetically appealing sprinkler design. Additionally, the concealed design of the Series LFII Residential Flat-Plate Concealed Pendant Sprinklers provides 1/2 inch (12,8 mm) vertical adjustment. This adjustment provides a measure of flexibility when cutting fixed pipe drops.

The Series LFII Residential Flat-Plate Concealed Pendant Sprinklers are intended for use in the following systems:

• NFPA 13D, wet pipe residential sprinkler systems for one- and two-family dwellings and mobile homes;

• NFPA 13R, wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height; and

• NFPA 13, wet pipe sprinkler systems for the residential portions of any occupancy.

The Series LFII Residential Flat-Plate Concealed Pendant Sprinkler has a 4.9 (60,5) K-factor that provides the required residential flow rates at reduced pressures, enabling smaller pipe sizes and water supply requirements.

This sprinkler has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

The Series LFII Residential Flat-Plate Concealed Pendant Sprinklers are shipped with a Disposable Protective Cap. The Protective Cap protects the sprinkler during ceiling installation or finish. After ceiling installation is complete, the Protective Cap is removed and the Cover Plate/Retainer Assembly is installed. Removing the Protective Cap is required for proper sprinkler performance.

NOTICE

The Series LFII Residential Flat-Plate Concealed Pendant Sprinklers (TY2524) described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

Owners are responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

**Model/Sprinkler
Identification
Number (SIN)**



**Technical
Data**

Approvals
UL and C-UL Listed
NSF-61 Certified

The Series LFII Residential Flat-Plate Concealed Pendant Sprinklers are only listed with the Series LFII Concealed Cover Plates having a factory-applied finish.

Maximum Working Pressure
175 psi (12,1 bar)

Discharge Coefficient
K=4.9 GPM/psi^{1/2} (70,6 LPM/bar^{1/2})

Temperature Rating
Sprinkler: 160°F (71°C)
Cover Plate: 139°F (59°C)

Vertical Adjustment
1/2 inch (12,7 mm)

Finishes
Refer to the Ordering Procedure section.

Physical Characteristics
• Cover Plate/Retainer Assembly:
Cover Plate Copper

IMPORTANT
Always refer to Technical Data sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage sprinkler system or its components.



Maximum Coverage Area ^(a)	Maximum Spacing	Horizontal Ceiling Minimum Flow ^(b) and Residual Pressure (Maximum 2-inch rise for 12-inch run)	Sloped Ceiling Minimum Flow ^(b) and Residual Pressure (Greater than 2-inch rise up to maximum 4-inch rise for 12-inch run)	Sloped Ceiling Minimum Flow ^(b) and Residual Pressure (Greater than 4-inch rise up to maximum 8-inch rise for 12-inch run)
		160°F (71°C) Sprinkler	160°F (71°C) Sprinkler	160°F (71°C) Sprinkler
12' x 12' (3,7 m x 3,7 m)	12' (3,7 m)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
14' x 14' (4,3 m x 4,3 m)	14' (4,3 m)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
16' x 16' (4,9 m x 4,9 m)	16' (4,9 m)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
18' x 18' (5,5 m x 5,5 m)	18' (5,5 m)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	22 GPM (83,3 LPM) 20.2 psi (1,39 bar)	22 GPM (83,3 LPM) 20.2 psi (1,39 bar)
20' x 20' (6,1 m x 6,1 m)	20' (6,1 m)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	24 GPM (90,8 LPM) 24.0 psi (1,65 bar)	24 GPM (90,8 LPM) 24.0 psi (1,65 bar)

(a) For coverage area dimensions less than or between those indicated, use the minimum required flow for the next highest coverage area for which Hydraulic Design section under the Design Criteria are stated.
 (b) The Minimum Flow requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to "Hydraulic Design" in the Design Criteria section for details.

TABLE A
SERIES LFII RESIDENTIAL FLAT-PLATE CONCEALED PENDENT SPRINKLER (TY2524)
NFPA 13D AND NFPA 13R HYDRAULIC DESIGN CRITERIA
WET PIPE SYSTEMS

- Sprinkler/Support Cup Assembly:
 Body Brass
 Cap Bronze
 Saddle Brass
 Sealing Assembly Beryllium Nickel w/ Teflon¹
 Soldered Link Halves Nickel
 Lever Bronze
 Compression Screw Brass
 Deflector Bronze
 Guide Pin Housing. Bronze
 Guide Pins Bronze
 Support Cup Steel

Operation

When exposed to heat from a fire, the Cover Plate, which is normally soldered to the Retainer at three points, falls away to expose the Sprinkler/Support Cup Assembly. At this point, the Deflector, supported by the Guide Pins, drops down to its operated position.

The Solder Link Element of the Sprinkler/Support Cup Assembly is comprised of two link halves that are soldered together with a thin layer of solder. When the rated temperature is reached, the solder melts and the two link halves separate, allowing the sprinkler to activate and flow water.

Design Criteria

The TYCO RAPID RESPONSE Series LFII Residential Flat-Plate Concealed Pendent Sprinklers (TY2524) are UL and C-UL Listed for installation in accordance with the following criteria.

NOTICE

When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the Authority Having Jurisdiction.

The Series LFII Residential Flat-Plate Concealed Pendent Sprinklers must not be used in applications where the air pressure above the ceiling is greater than that below. Down drafts through the Support Cup can delay sprinkler operation in a fire situation.

System Type

Only wet pipe systems may be utilized.

Hydraulic Design

Table A provides the minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R as a function of temperature rating and the maximum

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- flow rates given in Table A for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area
- minimum discharge of 0.1 GPM/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for actual coverage areas protected by the four sprinklers

Obstruction To Water Distribution

Locate sprinklers in accordance with the obstruction rules of NFPA for residential sprinklers as well as obstruction criteria described within TYCO technical data sheet TFP490.

Operational Sensitivity

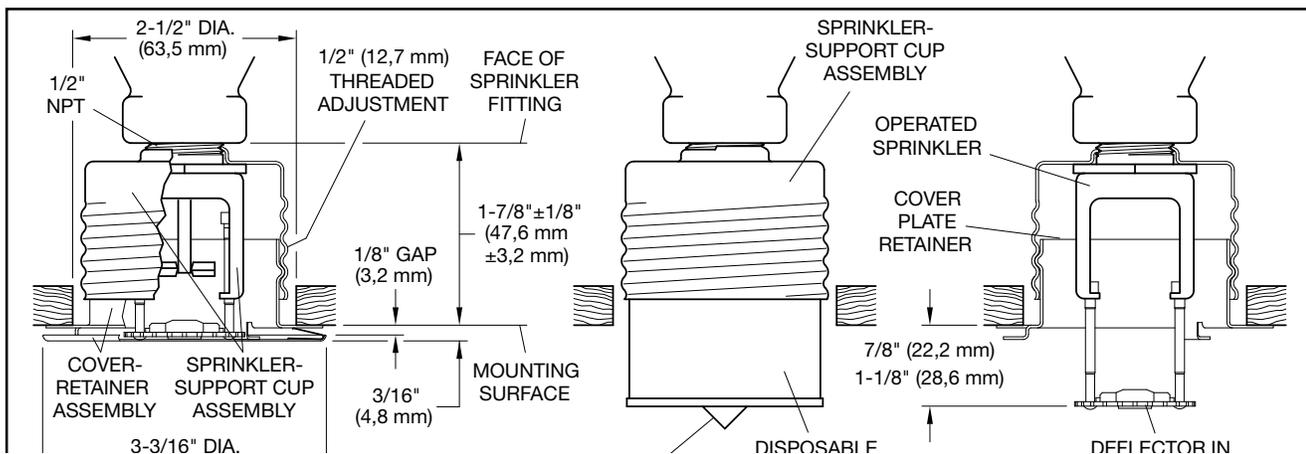
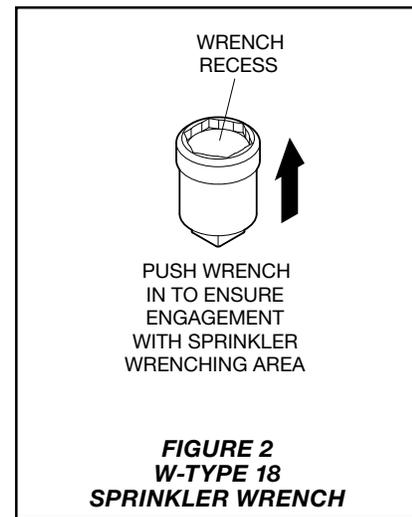
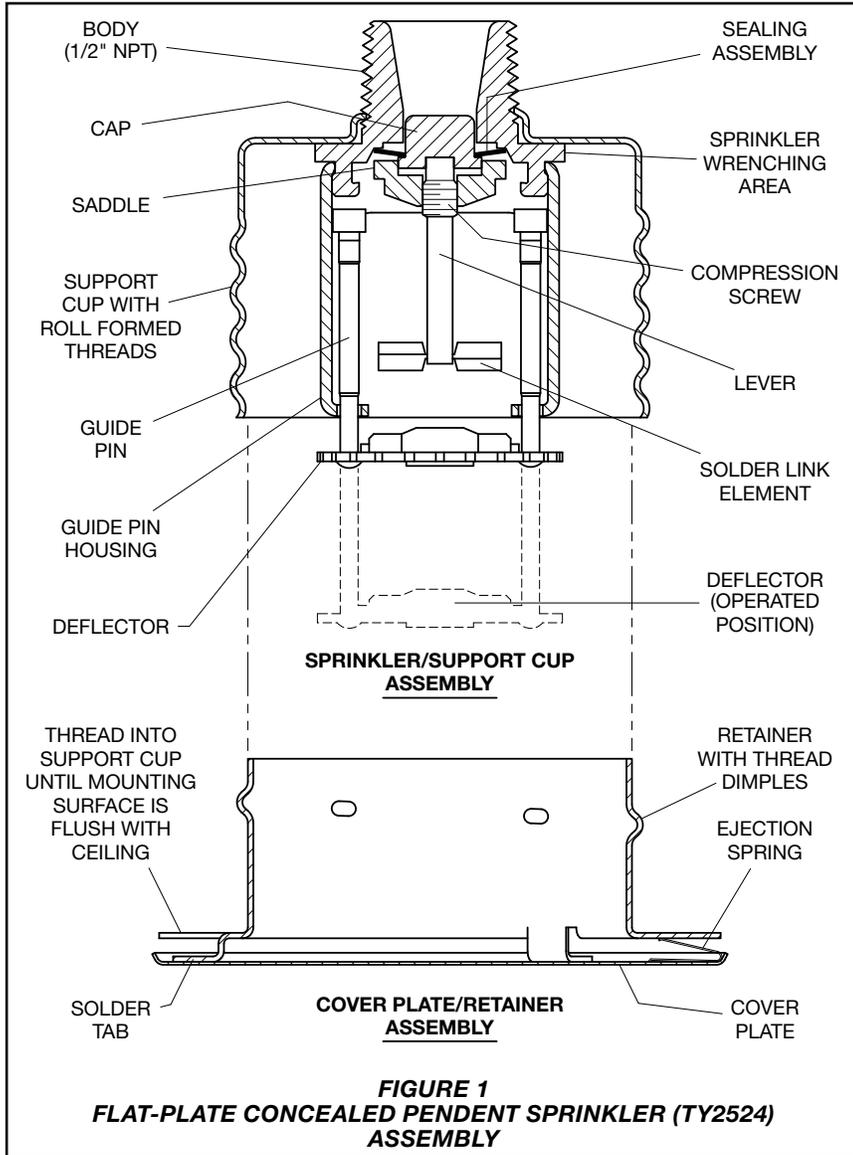
Install sprinklers relative to the ceiling mounting surface as shown in Figure 3.

Sprinkler Spacing

The minimum spacing between sprinklers is 8 feet (2,4 m).

The maximum spacing between sprinklers cannot exceed the length of the





Installation

The TYCO RAPID RESPONSE Series LFII Residential Flat-Plate Concealed Pendent Sprinklers must be installed in accordance with the following instructions.

NOTICE

Damage to the Solder Link Element during installation can be avoided by handling the sprinkler by the Support Cup only; that is, do not apply pressure to the Solder Link Element (Figure 1).

Obtain a leak-tight 1/2 inch NPT sprinkler joint by applying a minimum-to-maximum torque of 7 to 14 ft.-lbs. (9,5 to 19,0 Nm). Higher levels of torque can distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Cover Plate/Retainer Assembly by under- or over-tightening the sprinkler. Re-adjust the position of the sprinkler fitting to suit.

1. Install pendent sprinklers in the pendent position, with the centerline of the sprinkler perpendicular to the mounting surface.
2. Remove the Protective Cap.
3. With pipe-thread sealant applied to the pipe threads, and using the W-Type 18 Wrench shown in Figure 2, install and tighten the Sprinkler/Support Cup Assembly into the fitting. The W-Type 18 Wrench accepts a 1/2 inch ratchet drive.
4. Replace the Protective Cap by pushing it upwards until it bottoms out against the Support Cup. The Protective Cap helps prevent damage to the Deflector and Guide Pins during ceiling installation and/or during application of the finish coating of the ceiling.

NOTICE

As long as the protective Cap remains in place, the system is considered "Out Of Service".

5. After the ceiling has been completed with the 2-1/2 inch (63 mm) diameter clearance hole and in preparation for installing the Cover Plate/Retainer Assembly, remove and discard the Protective Cap, and verify that the Deflector moves up and down freely.

If the Sprinkler has been damaged and the Deflector does not move up and down freely, replace the entire Sprinkler assembly. Do not attempt to

6. Screw on the Cover Plate/Retainer Assembly until its flange contacts the ceiling.

Do not continue to screw on the Cover Plate/Retainer Assembly such that it lifts a ceiling panel out of its normal position.

If the Cover Plate/Retainer Assembly cannot be engaged with the Mounting Cup or the Cover Plate/Retainer Assembly cannot be engaged sufficiently to contact the ceiling, the Sprinkler Fitting must be repositioned.

Care and Maintenance

The TYCO RAPID RESPONSE Series LFII Residential Flat-Plate Concealed Pendent Sprinkler (TY2524) must be maintained and serviced in accordance with the following instructions.

NOTICE

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this action.

When properly installed, there is a nominal 1/8 inch (3,2 mm) air gap between the lip of the Cover Plate and the ceiling, as shown in Figure 3. This air gap is necessary for proper operation of the sprinkler by allowing heat flow from a fire to pass below and above the Cover Plate to help assure appropriate release of the Cover Plate in a fire situation. If the ceiling needs repainting after sprinkler installation, exercise care to ensure that the new paint does NOT seal off any of the air gap. Failure to do so may impair sprinkler operation.

Absence of a Cover Plate can delay the sprinkler operation in a fire situation.

Do not pull the Cover Plate relative to the Enclosure. Separation may result.

Exercise care to avoid damage to sprinklers before, during, and after installation. Never paint, plate, coat, or otherwise alter automatic sprinklers after they leave the factory.

Never repaint factory-painted Cover Plates. When necessary, replace cover plates with factory-painted units. Non-factory applied paint can adversely delay or prevent sprinkler operation in the event of a fire.

Replace sprinklers that:

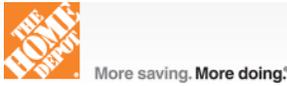
- were damaged by dropping, striking, wrench twisting, wrench slippage, or the like.
- were modified or over-heated.
- are leaking or exhibiting visible signs of corrosion.

Responsibility lies with owners for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (for example, NFPA 25), in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

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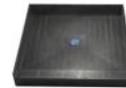
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Redi Base 34 in. D x 48 in. W. Barrier Free Shower ...

\$590.00/Each

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Description

The ADA-compliant Tile Ready Redi Base 38 in. x 48 in. Barrier-Free Center-Drain Shower Base in Black is easy to install and features a seamless, 1-piece design in durable molded polycomposite to resist mold growth and eliminate leaking. The shower base is ready to tile and comes with a set of Redi Poxy to help make installation easy.

- Includes a set of Redi Poxy for tiling the shower pan and a round, polished-chrome drain plate
- Ready for installation using tile
- Molded polycomposite construction with ribs underneath for extra strength
- Single-piece shower base with a built-in drain and side-splash walls for a seamless, sculpted look
- Barrier free for ease of use
- Integrated molded drain is designed for connection to a 2 in. DWV sanitary drain pipe with an adjustable top
- Shower base has no seams and no liners for leak-proof, mold-resistant performance
- Designed for easy installation
- ADA compliant for accessibility
- MFG Brand Name : Tile Ready®

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Faucets

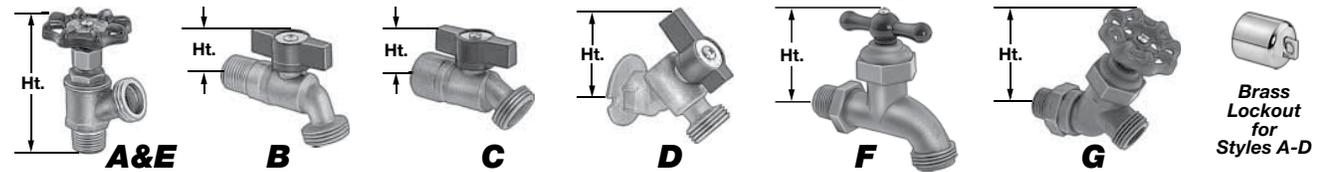
For information about pipe size, see pages 2-3.

Please Note: To choose the correct pipe size, measure the threaded inside diameter (ID) or outside diameter (OD) of your pipe or valve, round up to the nearest threaded ID or OD below, and read down to find the corresponding pipe size.

Threaded ID or OD	3/8"	1/2"	5/8"	3/4"	1"	1 3/8"
Pipe Size	1/8"	1/4"	3/8"	1/2"	3/4"	1"

Faucets with 3/4" Garden Hose Male Outlet

- Max. Pressure for Water: Brass: 125 psi @ 100° F; Acetal Plastic: 150 psi @ 73° F
- Temp. Range: 40° to 180° F



Brass—NPT			Brass—Solder End (Unthreaded)			Acetal Plastic—NPT			
Inlet Pipe Size	Height	Each	Inlet Tube Size	Actual Tube OD	Height	Each	Inlet Pipe Size	Height	Each
A.. 1/2" Female	3 1/4"	4792K33 .. \$7.63	D .. 1/2" ♦	5/8"	2 1/8"	4792K67 .. \$6.49	E.. 1/2" Male	4"	4950K55 .. \$3.35
A.. 1/2" Male	3 1/16"	4792K31 .. 6.86	D .. 3/4" ♦	7/8"	2 3/8"	4792K68 .. 7.84	E.. 3/4" Female	3 3/4"	4950K59 .. 3.71
A.. 3/4" Male	3 3/4"	4792K32 .. 7.31	♦ Tube size is the accepted designation of the copper tubing industry, not the actual OD.			F.. 1/2" Male	4 1/4"	4950K41 .. 3.38	
B.. 1/2" Male	1 1/4"	4792K61 .. 5.87				F.. 3/4" Male	4 1/4"	4950K42 .. 3.44	
B.. 3/4" Male	1 1/4"	4792K62 .. 6.24				G.. 1/2" Male	4 1/4"	4950K47 .. 3.40	
C.. 1/2" Female	1 1/4"	4792K63 .. 5.17				G.. 3/4" Male	4 1/4"	4950K48 .. 3.52	
C.. 3/4" Female	1 1/4"	4792K64 .. 5.72							
D.. 1/2" Female	2 3/8"	4792K65 .. 6.84							
D.. 3/4" Female	2 5/8"	4792K66 .. 7.71							

Brass Lockout for Styles A-D—Accepts padlocks with 1/4" and 9/32" diameter shackles (padlock not included)..... 4642K15 Each \$14.74

Frostproof Outdoor Faucets with Garden Hose Outlet

- Max. Pressure for Water: Through-Wall: 85 psi @ 140° F; Tamper-Resistant Through-Wall and In-Ground: 125 psi @ 140° F
- Temp. Range: Through-Wall and Tamper-Resistant Through-Wall: +35° to +140° F; In-Ground: -40° to +140° F

Also known as frostproof water hydrants, these faucets drain when closed to prevent freezing.

Through-Wall—Body is brass. Inlet is dual-threaded 1/2" NPT male x 3/4" NPT female. Outlet is 3/4" garden hose thread (GHT) male.

Tamper-Resistant Through-Wall—To prevent tampering, these faucets require a key to open and close. Body is chrome-plated brass; pipe is brass. Inlet is dual-threaded 1" NPT male x 3/4" NPT female. Outlet is 3/4" garden hose thread (GHT) male.



Through-Wall				Tamper-Resistant Through-Wall			In-Ground		
Wall Thickness	With Vacuum Breaker	Without Vacuum Breaker	Each	Wall Thickness	Each	Max. Burying Depth	O'all Ht.	Each	
6"	4728K81 .. \$22.69	4728K91 .. \$17.56		4"	47335K431 .. \$222.05	2 ft.	4' 4 3/4"	4728K51 .. \$76.01	
8"	4728K82 .. 23.19	4728K92 .. 18.02		6"	47335K432 .. 222.05	3 ft.	5' 4 1/2"	4728K52 .. 82.18	
10"	4728K83 .. 23.75	4728K93 .. 19.06		8"	47335K433 .. 222.05	4 ft.	6' 5"	4728K53 .. 87.56	
12"	4728K84 .. 24.59	4728K94 .. 19.19		10"	47335K461 .. 216.95	5 ft.	7' 5"	4728K54 .. 91.39	
14"	4728K85 .. 26.90	4728K95 .. 21.65		12"	47335K462 .. 216.95				
				Replacement Key.. 47335K57 .. 2.66					

Air-Shut-Off Brass Stop Cocks

- Max. Pressure: 100 psi @ 150° F
- Temp. Range: 32° to 150° F



NPTF FEMALE x FEMALE				NPTF FEMALE x MALE				NPTF MALE x MALE			
Pipe Size	End-to-End Lg.	Lever	T-Handle	End-to-End Lg.	Lever	T-Handle	Each	End-to-End Lg.	Lever	T-Handle	Each
1/8"	1 5/8"	4793K51 .. \$8.20	4793K75 .. \$7.50	1 3/4"	4793K46 .. \$8.35	4793K71 .. \$7.77		1 3/4"	4793K37 .. \$8.84	4793K59 .. \$8.04	
1/4"	1 15/16"	4793K52 .. 8.70	4793K76 .. 7.96	1 15/16"	4793K47 .. 8.73	4793K72 .. 8.20		1 15/16"	4793K38 .. 9.14	4793K61 .. 8.45	
3/8"	2"	4793K48 .. 10.19	4793K73 .. 9.14	2 1/16"	4793K44 .. 10.43	4793K68 .. 9.79		2"	4793K35 .. 9.30	4793K57 .. 8.94	
1/2"	2 1/2"	4793K49 .. 13.39		2 9/16"	4793K45 .. 13.42			2 9/16"	4793K36 .. 11.83	4793K58 .. 10.08	

Plastic Pipe Fittings and Pipe

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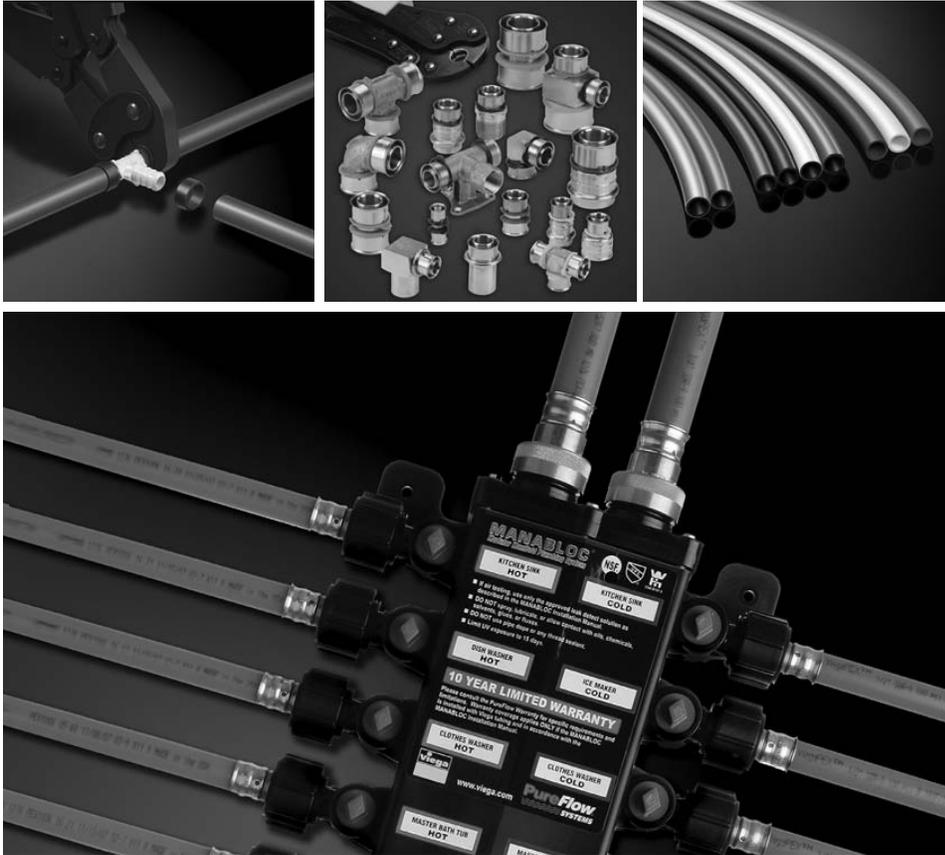
Shape	Pipe
Pipe Type	Unthreaded
Pipe to Pipe Connection	Unthreaded (pipe)
System of Measurement	Inch
Schedule	80
Pipe/Thread Size	1-1/4"
Length	10'
Inside Diameter	1.255"
Outside Diameter	1.66"
Perforation Type	Solid Pipe
Material	PVC
Color	Dark Gray
Maximum Pressure @ 73° F	520 psi
Temperature Range	Up to 140° F
Specifications Met	American Society for Testing and Materials (ASTM), National Sanitation Foundation (NSF)
ASTM Specification	ASTM D1784, ASTM D1785
NSF Specification	NSF 61
WARNING	Never use plastic pipe fittings with compressed air or gas.

CSI#: 22 11 16

PureFlow[®] Water Systems

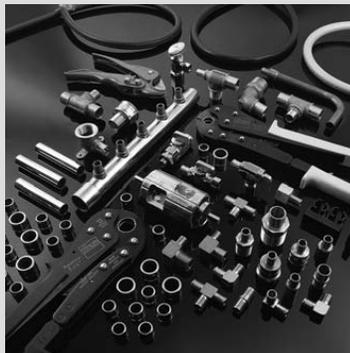


Installation Manual



June 2009





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- Reduced flow noises
- In coils or straight lengths
- FostaPEX form stable tubing ideal for exposed runs
- Listed by NSF to meet the requirements of ANSI 14 and 61 and NSF Protocol P171 (CL-R/CL-TD)
- Listed to ASTM F876/F2023 and F877

IMPORTANT NOTICE

This installation guide is intended for traditional (branch and main) plumbing systems and hybrid plumbing systems using termination manifolds, MANABLOC® and MINIBLOC parallel / manifold plumbing system.

NOTE: References to ViegaPEX™ tubing made throughout this publication include the entire line of Viega cross-linked polyethylene products.

IN THE EVENT OF CONFLICT OR INCONSISTENCY BETWEEN THESE INSTALLATION GUIDELINES AND LOCAL BUILDING OR PLUMBING CODES, LOCAL CODES SHOULD TAKE PRECEDENCE.

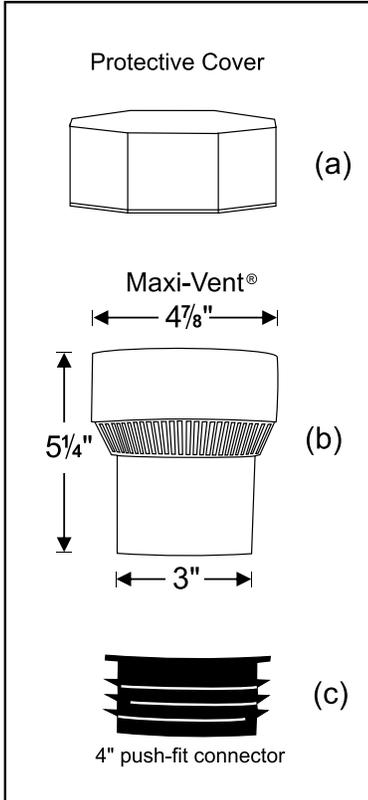
NOTE: Failure to follow the installation instructions will void the Viega Plumbing Warranty. Nothing in this publication is intended to create any warranty beyond Viega's applicable warranty. For additional information, contact Viega at 800-976-9819.



Specification Sheet / Maxi-Vent®

Manufacturer: Studor®, Inc.
Item #: 20302

Model: Maxi-Vent®
Connection Size: 3" or 4"



General:

An air admittance valve shall be acceptable as a vent termination for any individual vent, common vent, circuit vent, loop vent, island fixture vent, vent stack or stack vent that is provided to prevent siphonage of a fixture trap. An Air Admittance Valve can be used as an alternative to extending a vent through the roof (or sidewall) to the open atmosphere.

Location:

- A. The Maxi-Vent should be located a minimum of 4" above the weir of the fixture trap for single fixture and branch venting and 6" above the flood level of the highest fixture for stack venting.
- B. Each valve should be installed in an accessible location.

Installation:

- A. The valve should be connected to the piping in accordance with the manufacturer's installation instructions.
- B. The valve should be installed in the vertical, upright position after rough-in and pressure testing of the DWV system.
- C. A minimum of one vent shall extend to the open atmosphere for every building drainage system.
- D. The valve should not be installed as a vent terminal for any special(chemical) waste system or in supply and return air plenums.
- E. The valve may be installed on sewer ejectors, if installed according to engineer design and prior local code approval.
- F. For installation in areas with temperature ranges between -40°F and +150°F.

Features:

- A. Screening on the inside and outside of the valve to protect the sealing membrane from insects and debris.
- B. Protective cover for the air intake and additional insulation against extreme temperatures.
- C. Ability to divert condensation away from the sealing membrane.
- D. Lifetime Warranty.

Materials:

- (A) Styrofoam cover
- (B) ABS (acrylonitrile butadiene styrene) valve with elastomeric membrane
- (C) Rubber connector

Performance Standards:

- ANSI/ASSE 1051 A & B (revised 2002) single fixture and Branch type AAVs
- ASSE 1050 (1991) Stack Type AAVs
- NSF Standard 14 (Plastic Components)

Code Approvals:

- International Plumbing Code (IPC) 2003 Edition
- Southern Building Code Council International (SBCCI) 1994 Edition
- Building Official Code Administration (BOCA) 1993 Edition
- International Residential Code (IRC) 2003 Edition
- Uniform Plumbing Code (UPC) Section 301.2 Alternative Materials and Methods 2003 Edition

Listings:

- ASSE Seal of Approval
- National Evaluation Services (NER-592)
- NSF International (NSF Standard 14)
- NSF International (ANSI/ASSE Performance Standard 1051 and ASSE 1050)
- IAMPO Classified Marking, file No. C-3803

Sizing Chart

Horizontal Branch Size	Max DFUs
3"	20
4"	160
Stack Size	Max DFUs
3"	72
4"	500



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Integrated

Products AirTap™ is also available as an Energy Star certified integrated or replacement version, integrating heat pump technology into an electric hot water heater.

Retrofit

Integrated AirTap™ Integrated comes in 50 (ATI50) and 66 (ATI66) gallon capacities and offers the following unique features:

Super Anode Rod

- High grade stainless steel tank
- Direct immersion structure provides maximum efficiency
- Equipped with refillable anode rod
- Air inflow and outflow vent adapters
- Automatic controls with multiple operation modes



Integrated models are currently sold out and will be available in Q4 2010.



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Rockton™ 12" Rough-in Round-Front Toilet with Dual Force® Technology

The Rockton toilet with Dual Force technology delivers precision engineered performance and meets strict water conservation standards, providing years of trouble-free operation. The geometric tank design echoes contemporary style in any bath or powder room.

29-3/4" x 15" x 29-7/8"

Product #: 402024

List price: \$290.70 and up

- Dual Force technology allows the choice of .8 gallon flush for liquid or light waste. The 1.6 gallon flush is for bulk or solid waste
- Dual Force technology can save the average family of 4 up to 24,000 gallons of water per year with the .8 gallon option
- Two-button actuator provides easy-to-use flushing options
- Crafted of Grade A vitreous china to provide a durable, non-porous product with a hard, glossy finish
- A sanitary guard helps prevent liquid from getting under the tank
- Round-front bowl requires less space
- Leadership in Energy and Environmental Design (LEED) compliant
- Conforms to ASME A112.19.2/CSA B45.1 National Consensus Standards
- Limited 5-year warranty
- Meets strict flushing performance guidelines established by the EPA (Environmental Protection Agency) WaterSense program
- WaterSense labeled toilets use at least 20% less water than standard 1.6-gallon toilets
- This product can help a building earn Water Efficiency points in the LEED Green Building Rating System™. See specification sheet for water use data.





BRYANT™ ROUND

**SELF-RIMMING LAVATORY
K-2714**

ADA

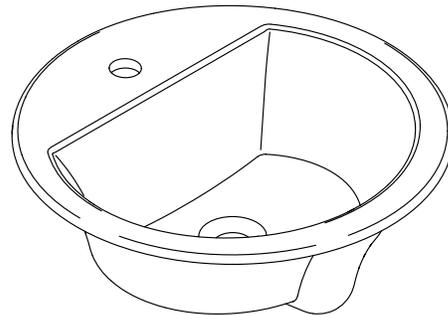
Features

- Vitreous china
- Self-rimming
- With overflow
- 18-7/8" (47.9 cm) diameter

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ADA
- ICC/ANSI A117.1
- ASME A112.19.2/CSA B45.1



Colors/Finishes

- 0: White
- 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	Colors/Finishes	
K-2714-1	Self-rimming lavatory – single-hole	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-2714-4	Self-rimming lavatory – 4" (10.2 cm) centers	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-2714-8	Self-rimming lavatory – 8" (20.3 cm) centers	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____

Recommended Accessories			
K-7107	Decorative drain OR	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-7108	Decorative drain OR	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-7129	Grid drain	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-9018	P-Trap	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____

Product Specification

The self-rimming lavatory shall be made of vitreous china. Lavatory shall be 18-7/8" (47.9 cm) in diameter. Lavatory shall have 8" (20.3 cm) centers (-8), 4" (10.2 cm) centers (-4), or single-hole drilling (-1). Lavatory shall be available with overflow. Lavatory shall be Kohler Model K-2714-_____-_____.





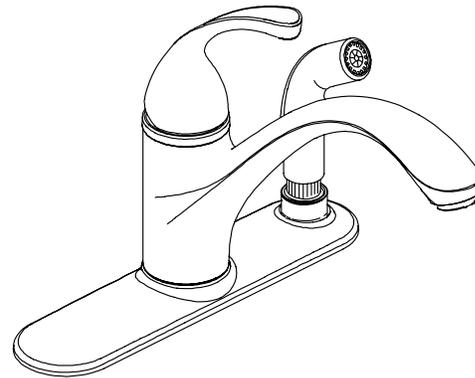
FORTÉ®

**KITCHEN SINK FAUCET
K-10413**

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
- High-temperature limit setting for added safety
- 9-1/16" (23 cm) swing spout reach
- ADA compliant lever handle
- Matching finish sidespray through escutcheon
- Flexible supplies
- Lower flow aerator options are available (refer to the Kohler Price Book)
- 2.2 gpm (8.3 lpm) maximum flow rate



Codes/Standards Applicable

Specified model meets or exceeds the following at date of manufacture:

- ADA
- ASME A112.18.1/CSA B125.1
- ICC/ANSI A117.1
- Energy Policy Act of 1992
- NSF 61
- All applicable US Federal and State material regulations

Colors/Finishes

- CP: Polished Chrome
- BN: Brushed Nickel
- Other: Refer to Price Book for additional colors/finishes

Accessories

- NA: None applicable

Specified Model

Model	Description	Colors/Finishes
K-10413	Kitchen sink faucet	<input type="checkbox"/> CP <input type="checkbox"/> BN <input type="checkbox"/> Other _____
Optional Accessories		
1030920	Sidespray deep roughing-in kit	<input type="checkbox"/> NA

Product Specification

The single-control kitchen sink faucet shall be of metal construction. Product shall have a maximum flow rate of 2.2 gallons (8.3 L) per minute with lower flow aerator options available (refer to the Kohler Price Book). 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 a high-temperature limit setting for added safety, 9-1/16" (23 cm) swing spout reach, ADA compliant lever handle, matching finish sidespray through escutcheon, and flexible supplies. Faucet shall be Kohler Model K-10413-____.





Coralais® single-control centerset lavatory faucet - K-15182-F

Offering convenience, quality and style at a competitive price, this Coralais® single-control centerset lavatory faucet with flexible supplies brings sleek design continuity to the bath. A single-control handle and pop-up drain with 1-1/4" tailpiece complete the look.

- One-piece ceramic valve resists debris and hard water buildup
- High-temperature limit stop allows you to preset a comfortable maximum temperature to eliminate scalding
- Cast brass ensures durability and long life
- For installation on 4" centers
- Pop-up drain with 1-1/4" tailpiece
- Low-flow aerator option available (please see latest price book)



Color Finish: Polished Chrome (-CP)

Model Number: K-15182-F-CP

List Price: \$134.95

Available Colors



Polished
Chrome (-CP)
\$134.95



Brushed
Chrome (-G)
\$193.25

*All prices are Manufacturer's Suggested List Prices in U.S. dollars. The price you pay at your local supply outlet may be different than the Manufacturer's Suggested List Price. These prices supersede previous prices and are subject to change without notice. These prices do not include shipping. Any sales tax applicable will be added to the prices.

KOHLER Co.

M/S 019
444 Highland Drive
Kohler, WI 53044

Phone: 1-800-4KOHLER (1-800-456-4537)
Hours: 7:00 AM - 6:00 PM (Central Time) Monday to Friday

CSI#: 22 21 39

THE BOLD LOOK
OF **KOHLER.**

Fluence® frameless bypass shower door - K-702215-L

The Fluence bypass shower door features a Eurostyle frameless design with Crystal Clear 1/4"-thick tempered glass. Designed to accommodate out-of-plumb installations, this door features a continuous panel guide for smooth, quiet sliding action.

- 44" - 47-1/2"W x 76-1/2"H
- Available in Polished Silver finish
- CleanCoat™ glass coating repels water for easy cleanup



Color Finish: Bright Polished Silver
(-SHP)

Model Number: K-702215-L-SHP

List Price: \$504.35

Available Colors



Bright
Polished
Silver (-SHP)
\$504.35

*All prices are Manufacturer's Suggested List Prices in U.S. dollars. The price you pay at your local supply outlet may be different than the Manufacturer's Suggested List Price. These prices supersede previous prices and are subject to change without notice. These prices do not include shipping. Any sales tax applicable will be added to the prices.

KOHLER Co.

M/S 019
444 Highland Drive
Kohler, WI 53044

Phone: 1-800-4KOHLER (1-800-456-4537)
Hours: 7:00 AM - 6:00 PM (Central Time) Monday to Friday



PURIST®

**MULTI-FUNCTION SHOWERHEAD
K-997**

Features

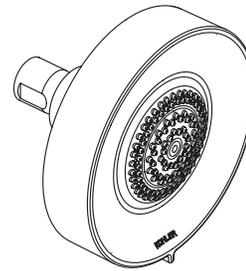
- 3-function showerhead with wide coverage, medium coverage, and concentrated spray options
- 1.75 gpm (6.6 L) per minute flow rate
- 5-1/2" (14 cm) diameter showerhead
- Complements Purist® Suite
- MasterClean™ spray nozzles to prohibit mineral build-up for easy cleaning
- 1/2" - 14 NPT connection



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	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-997	Multi-function showerhead	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
Recommended Accessories			
K-7397	Shower arm and flange – 7-1/2" (13.7 cm) length, 1/2" NPT	<input type="checkbox"/> CP	<input type="checkbox"/> 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-_____.





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Product Details

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Recommended

Middleton® Double-basin Kitchen Sink, 33" x 22"

Offering durable craftsmanship and a deep, 7" basin, the Middleton Double-basin sink is the ideal solution for any kitchen. Sound absorption technology and stainless steel construction ensure years of quality use.

33" x 22" x 7"

Product #: 14707-3

List price: \$156.75 and up



Stainless Steel Bottom Basin Rack for use with Middleton®, Southhaven® or McAllister® Double Basin Kitchen Sinks

Product #: 11861

List Price: \$33.40 and up

[View details](#)

- Self-rimming style with modern deck design
- 7" Basin depth; double equal basins are ideal for handwashing dishes
- 3-5/8" Drain opening
- Three-hole faucet punching
- Made from 21 gauge stainless steel with a durable satin finish
- SilentShield™, an exclusive sound-absorbing system, reduces noise and vibration

N/A

Product #: 14707-3-NA

List Price: \$156.75

*Due to the differences in monitors, technical factors, and characteristics of some of our finishes, the colors shown here cannot be represented with all their true qualities. The color tiles should only be considered a guide *All prices are Manufacturer's Suggested List Prices in U.S. dollars. The price you pay at your local supply outlet may be different than the Manufacturer's Suggested List Price. These prices supersede previous prices and are subject to change without notice. These prices do not include shipping. Any sales tax applicable will be added to the prices.



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Tile Ready® Redi Base 38 in. x 48 in. Barrier-Free Center-Drain Shower Base in Black

Model # 3848CBF-PVC Internet # 100659128

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\$629.00 /EA-Each

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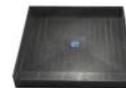
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Redi Base 34 in. D x 48 in. W. Single Threshold Shower ...

\$584.00/Each

+ ADD TO CART



Shampoo - Soap Niche, 16 in. W x 20 in. H x 4 in. ...

\$64.00/Each

+ ADD TO CART



Redi Base 34 in. D x 48 in. W. Barrier Free Shower ...

\$590.00/Each

+ ADD TO CART

Zoom View More Views Product Demo

Description

The ADA-compliant Tile Ready Redi Base 38 in. x 48 in. Barrier-Free Center-Drain Shower Base in Black is easy to install and features a seamless, 1-piece design in durable molded polycomposite to resist mold growth and eliminate leaking. The shower base is ready to tile and comes with a set of Redi Poxy to help make installation easy.

- Includes a set of Redi Poxy for tiling the shower pan and a round, polished-chrome drain plate
- Ready for installation using tile
- Molded polycomposite construction with ribs underneath for extra strength
- Single-piece shower base with a built-in drain and side-splash walls for a seamless, sculpted look
- Barrier free for ease of use
- Integrated molded drain is designed for connection to a 2 in. DWV sanitary drain pipe with an adjustable top
- Shower base has no seams and no liners for leak-proof, mold-resistant performance
- Designed for easy installation
- ADA compliant for accessibility
- MFG Brand Name : Tile Ready®

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No Interest if Paid In Full By Jan 1, 2012*
\$299 Minimum Purchase Required. Minimum Payments Required. Valid 3/17-3/23/2011.

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DIVISION 23

HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

Broadcast Thermostat



Description

- Provides accurate temperature control
- Incorporates advanced features facilitating whole house Economy Mode operation where the HVAC is set back in conjunction with lighting, fan and receptacle loads
- Easily programmed to enable wireless control of HVAC, lighting, occupancy and receptacles from a single switch
- Displays temperature set point with degrees adjustment for °F and °C

For use with: Verve Controllers, Verve Switches, Verve Sensors



Model Number

X4103100W3VN Thermostat

Design Features

Feature	Benefit
Compatibility	Single Stage Heating and Cooling, Heating Only, Cooling Only, Furnace (warm air), Central Air Conditioning, Heat Pump with or without Auxiliary Heat
Wireless Communication	Enables seamless integration of lighting, receptacle control Supports optional wireless switch control for temperature set points Supports optional wireless vacancy /occupancy control
Advanced Capabilities	Supports wireless customizable Economy Mode setback control Integrates with lighting, fans and receptacles to support single switch control facilitating whole house Economy Mode; Equipped with Freeze Protection Setting

Technical Specifications

General	
Temperature Monitor Range	32° to 100° F (0° to 38° C)
Temperature Setpoint Range	60° to 85° F (15° to 30° C)
Accuracy	+/- 1° F (0.5° C)
Material	Flame retardant, high impact plastic
Physical Dimensions	3.5" H x 5.0" W x 1.5" D
Shipping Weight	0.4 lbs.
Mounting	Standard 1 gang junction box
Electrical	
Input Voltage, Frequency	24 VAC
Maximum Load	1.5 amps/circuit
Sampling Rate	Every 5 seconds
Fan Control	Selectable: Auto Cycle, Low, Medium, High, Economy, Off
Heat/Cool Control	1 Heat and 1 Cool circuit, Heat Pump reversing valve circuit
Communication	
Protocol	EnOcean GmbH
RF	315 MHz
Range	100 feet indoors, up to 300 feet in open space
Memory	Stores up to 30 Switch IDs
Environment	
Operating Temperature	14° to 131° F (-10° to 55° C)
Storage Temperature	-4° to 131° F (-20° to 55° C)
Relative Humidity	0 to 95% non-condensing





SUBMITTAL SHEET

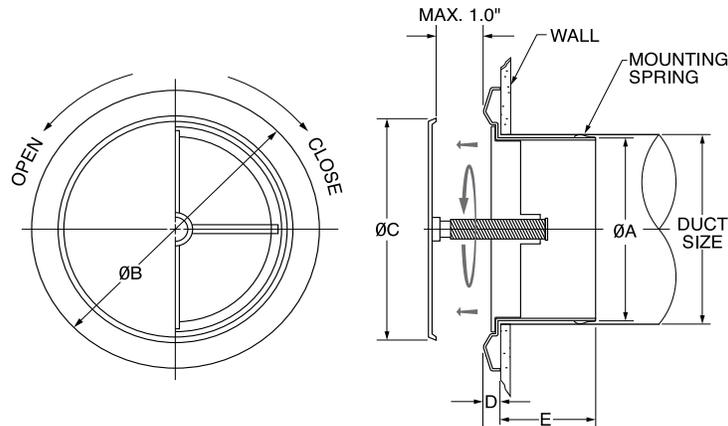
www.seiho.com

Model: JRA

Volume Adjustable Round Grille

- Fresh Air Intake/Exhaust Outlet
- Adjustable Core for Volume Control
- Competitively Priced

- Material: ABS Resin
- Standard Finish: White



MODEL	DUCT SIZE	A	B	C	D	E
JRA 4	4	3 ²⁵ / ₃₂	5 ²⁹ / ₃₂	5 ¹¹ / ₃₂	1/2	1 ³¹ / ₃₂
JRA 6	6	5 ²³ / ₃₂	7 ⁷ / ₈	6 ⁷ / ₃₂	1/2	1 ³¹ / ₃₂

Product information is subject to change without notice. All dimensions in inches.

JOB NAME: _____
 LOCATION: _____
 ARCHITECT: _____
 ENGINEER: _____
 CONTRACTOR: _____

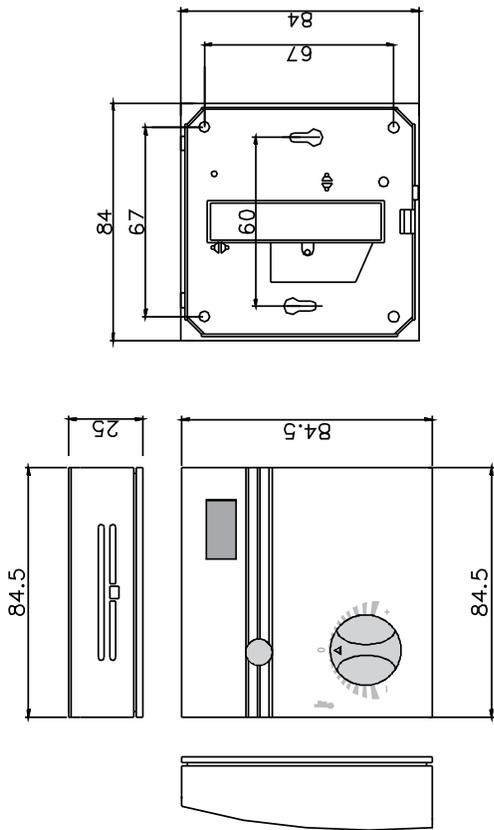
SUBMITTED BY: _____

DATE: _____

Model JRA
Volume Adjustable Round Grille

Form No.392-22

Dimensions (measurements in mm)



Specifications

SR04PTxx	
Technology	Enocean, STM
Transmitting Frequency	315.0 MHz
Antenna	Type: Helix, Gain: -3dBi
Transmitting Range	approx 50-150 feet in buildings
Temperature Detection	0°C to 40°C
Resolution	0.15 K
Absolute Accuracy	typ. +/-0.4K
Range	0-100% rH
Resolution	0.4% rH
Absolute Accuracy	+/-3% range 30%...80%
1 Point Calibration	50%
Optional Humidity Sensor	0 to 270° angle of rotation
Optional Set Point Adjustment P	1.1°
Rotary Switch S	Number of switching steps 5 (A, 0, I, II, III)
Slide Switch MS (optional with button T)	Number of switching steps 2 (O/I)
Measuring Value Detection	Every 100 seconds
Sending Interval (defaults)	...every 100 seconds if changes >0.8K or >3° angle of rotation or switch step rotary switch or slide switch ...every 1000 seconds if changes <0.8K or <3° angle of rotation
Energy Generator	Solar cell, internal goldcap, maintenance-free
Enclosure	ABS (ASA) color pure white similar to RAL 9010
Protection	IP20 according to EN60529
Ambient Temperature	-25°C to 65°C
Transport	-25°C to 65°C / max. 70% rH, non-condensed
Weight	50g



Contains FCC ID: S3N-SR04XX
Contains IC: 7953A-SR04XX

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(i) this device may not cause harmful interference and (ii) this device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications made to this equipment not expressly approved by Thermokon may void the user's authority to operate this equipment.

This device complies with Industry Canada RSS-210 Issue 7.



This device or certain aspects thereof is protected by at least one U.S. or international patent or has at least one such patent application pending.

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NOVUS 300

UNIVERSAL MECHANICAL VENTILATION
HEAT RECOVERY (MVHR) UNIT
• MADE IN GERMANY •

WITH HUMIDITY
RECOVERY



LED control unit
Listed in PEHA switch range



colored TFT touchscreen panel

TECHNICAL DESCRIPTION

The PAUL MVHR unit novus 300 is used for controlled room ventilation (air flow rate: 80 to 300 m³/h). It is equipped with a highly efficient reverse flow duct heat exchanger (European patent). Its broad range of performance allows a use in all residential areas with a living space up to 220 m². The various installation alternatives – vertical or horizontal on mounting base or vertical or horizontal wall mounting – help to save space. A right or left side version of the unit is available for optimizing the routing of air ducts.

The standard heat exchanger can optionally be replaced by a membrane moisture heat exchanger, which can reclaim a high percentage of the air humidity of the extract air. The standard intake and extract air filters are G4 filter class filters. Optionally, the intake air can be cleaned by a F7 pollen filter. An automatic bypass control with motorized 100%-bypass flap ensures the summer bypass mode. The housing consists of galvanized, powder-coated sheet steel. The interior lining, made of high quality polypropylene, assures a high degree of heat- and sound insulation.

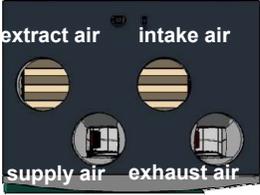
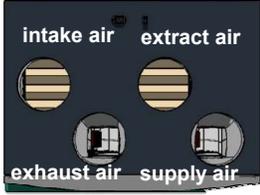
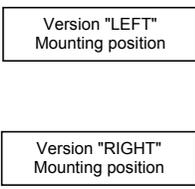
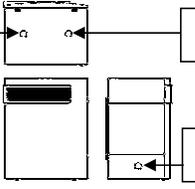
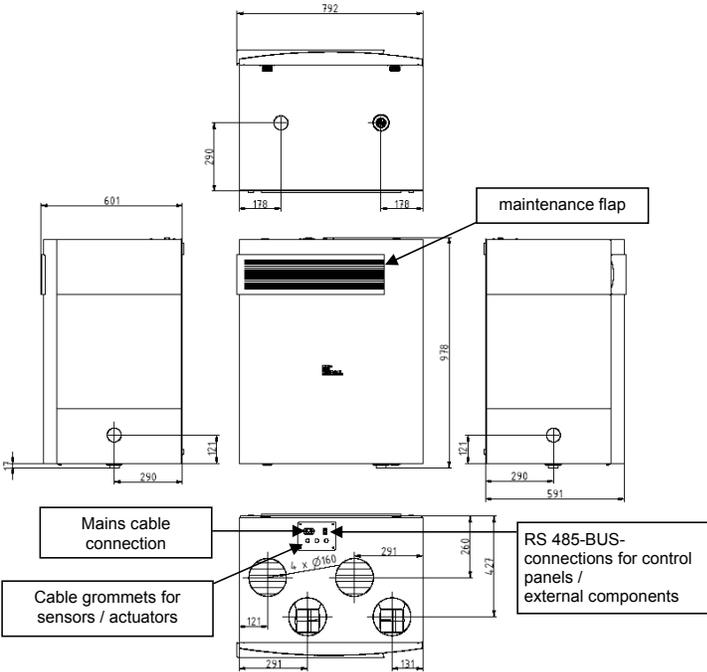
The system can either be controlled by a LED control unit or a colored TFT touchscreen panel with intuitional menu navigation, which assures an ideal communication with the ventilation unit.

The MVHR unit meets the high demands of energy efficiency and comfortable installation both because of the patented PAUL heat exchanger, the constant flow fans and the intuitional colored TFT touchscreen panel.

The intelligent control management offers the following functions:

- Ventilation steps: OFF, ABSENT, STEP 1, STEP 2, STEP 3 *
- Ventilation steps: OFF, ABSENT, STEP 1 to STEP 7 **
- „Only supply air“ or „only exhaust air “ ** („only exhaust air“ with enterprise with fire place closed)
- Individual programming per ventilation step in 1% increments for intake and extract air (60–300 m³/h) *
- Weekly time programmes configurable individually *
- Automatic control system for external air quality sensors *
- Digital communication interface for peripheral equipment
- Filter runtime control
- Freeze protection regulation (including frost protection for downstream hot water duct heater)
- Control internal summer/winter bypass



Date: 02.09.10 Subject to change in the interest of technical progress.	Technical Data Mechanical Ventilation Heat Recovery Unit novus (F) 300	
View:  <p style="font-size: small; margin-top: 10px;"> <i>COMPONENT suitable for PASSIVE HOUSES</i> <i>Dr. Wolfgang Feist</i>  </p>	Versions: <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Version "LEFT"</p> </div> <div style="text-align: center;">  <p>Version "RIGHT"</p> </div> </div> <p style="text-align: center; font-weight: bold; font-size: small;">Position of condensate drain connections:</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Version "LEFT" Mounting position</p> </div> <div style="text-align: center;">  <p>Version "RIGHT" Mounting position</p> </div> </div>	
Mounting positions wall mounting or mounting frame installation:		
Mounting position VERTICAL  <p style="font-size: x-small;">Version "LEFT" or Version "RIGHT" possible</p>	Mounting position HORIZONTAL - LEFT Connections "LEFT" only Version "LEFT" possible 	Mounting position HORIZONTAL - RIGHT Connections "RIGHT" only Version "RIGHT" possible 
Dimensional sketch:		
		



SEZ HEAT PUMP



Model Name	Indoor Unit		SEZ-KD09NA	SEZ-KD12NA	SEZ-KD15NA	SEZ-KD18NA	
	Outdoor Unit		SUZ-KA09NA	SUZ-KA12NA	SUZ-KA15NA	SUZ-KA18NA	
Cooling *1	Rated Capacity	Btu/h	8,100	11,500	14,100	17,200	
	Capacity Range	Btu/h	3,800-10,900	3,800-13,300	3,800-17,000	3,800-19,000	
	Total Input	W	670	920	1,170	1,380	
	Energy Efficiency	SEER	15	16	15.5	17.5	
	Moisture Removal	Pints/h	1.5	2.4	2.6	3.4	
	Sensible Heat Factor		0.80	0.76	0.80	0.79	
Heating at 47° F *2	Rated Capacity	Btu/h	10,900	13,600	18,000	21,600	
	Capacity Range	Btu/h	4,800-14,100	4,800-16,400	4,800-21,100	4,800-24,900	
	Total Input	W	1,020	1,140	1,500	1,700	
	HSPF (IV)	Btu/h/W	10.0				
	Rated Capacity	Btu/h	6,700	9,000	11,900	13,100	
Heating at 17° F *3	Rated Total Input	W	810	920	1,200	1,350	
	Maximum Capacity	Btu/h	7,300	9,800	13,700	15,000	
	Phase, Cycle, Voltage	1 Phase, 60Hz, 208 / 230V *4					
Power Supply	Indoor - Outdoor S1 - S2	AC 208-230V					
	Indoor - Outdoor S2 - S3	DC 12-24V					
	Indoor - Remote Controller	Wired Controller: DC 12V					
Voltage	MCA	A	1				
	Fan Motor	F.L.A.	0.51	0.57	0.74		
	Airflow (Lo-Med-Hi)	DRY (CFM)	194-247-317	247-317-388	353-441-529	423-529-635	
		WET (CFM)	174-222-285	222-285-349	317-396-476	381-476-572	
	External Static Pressure *3	In. W.G.	0.02-0.06-0.14-0.20				
	Sound Pressure Level	dB(A)	23-26-30	23-28-33	30-34-37	30-34-38	
	External Finish	Galvanized-steel Sheets					
	Dimension Unit	W: In.	31-1/8	39			46-7/8
		D: In.	27-9/16				
		H: In.	7-7/8				
	Weight Unit	Lbs.	42	50	54	62	
	Field Drainpipe Size O.D.	In.	1-1/4				
	Indoor Unit	MCA	A	12			14
MOCP		A	15				
Fan Motor		F.L.A.	0.50			0.93	
Compressor		Model(Type)	DC Inverter			DC Inverter Twin Rotary	
		R.L.A.	6.6			7.4	10
		L.R.A.	8.2			9.3	12.5
Airflow (Cooling/Heating)		CFM	1,151/1,225	1,229/1,172	1,243/1,229	1,730/1,659	
Refrigerant Control		Linear Expansion Valve					
Defrost Method		Reverse Cycle					
Sound Pressure Level at Cooling *1		dB(A)	46	49			54
Sound Pressure Level at Heating *2		dB(A)	50	51			56
External Finish Color		Munsell No. 3Y 7.8/1.1					
Dimensions		W: In.	31-1/2	33-1/2			33-1/6
	D: In.	11-1/4					
	H: In.	21-5/8			33-7/16		
Weight	Lbs.	66	77	80	119		
Remote Controller	Type	Wired Controller (PAR-21MAA)					
	Type	R410A					
Refrigerant	Charge	Lbs., Oz.	1, 16	2, 9		3, 16	
	Oil	Type (fl. oz.)	NEO22 (10.8)			NEO22 (15.2)	
	Gas Side O.D.	In.	3/8			1/2	
Refrigerant Pipe	Liquid Side O.D.	In.	1/4				
	Height Difference (Max.)	Ft.	40			50	
Refrigerant Pipe Length	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.

DIVISION 25

AUTOMATED CONTROLS

CAN2GO Universal controller

Building automation's missing link



BACnet, EnOcean and ZigBee.
Controller, gateway and BACnet IP server.
All in one device.

Overview

Networking

- › Ethernet connector for BACnet IP connectivity
- › 802.15.4 wireless mesh
- › Wired serial bus for chain links

Third party Interoperability

- › BACnet
- › EnOcean
- › Zigbee

Inputs/Outputs

- › Inputs: 6 universal
- › Outputs: 4 relay, 2 analog
- › Wireless I/O: unlimited

Introduction

A flexible line of controllers that allows facility managers, contractors and OEM manufacturers to deploy integrated solutions for HVAC, lighting, and more, quickly and efficiently linking multiple devices based many standard protocols.

They are all interoperable with any BACnet compliant building management system.

Control features

- › Programmability with real-time scripting.
- › Control of wired end-devices (5 inputs and 6 outputs).
- › Wireless bidirectional control of EnOcean end-devices (optional).
- › Wireless bidirectional control of ZigBee end-devices (optional).

Applications

Supports any HVAC & lighting application including:

- › Room or Zone controller
- › Unitary equipment such as rooftop HVAC units, Air Handling Units, heat pumps and dehumidification units
- › Mechanical rooms and equipment closets

Embedded gateway

- › Bidirectional EnOcean to BACnet IP gateway - Integrates EnOcean end-devices as BACnet objects (optional).
- › Bidirectional ZigBee to BACnet IP gateway - Integrates ZigBee end-devices as BACnet objects (optional).

Embedded BACnet IP server providing IP web interface

- › The controller hosts a complete BACnet IP building automation web-based interface.
- › Connecting the Ethernet port of one or more controllers to a LAN will make the entire building automation system manageable from a web-browser.
- › No extra software or server required.

Networking between controllers

- › Wireless - ZigBee wireless mesh network (self-forming/healing).
- › Wired - chain-link connections.
- › IP/Ethernet - Ethernet port.

See CAN2GO specifications





Specifications CAN2GO Universal controller

POWER

Voltage	- 24VAC ± 15%; 50/60HZ; Class 2 - 24VDC ± 10%
Protection	1A fuse
Typical Consumption	- 3 VA + Output (VAC) - 1.2W + Output (VDC)

GENERAL

Processor	ARM
Memory	64Mb RAM
Storage	1Gb Flash (2Gb optional)
Real-time clock	Battery backed (10,000 hours)
Communication	- Zigbee, EnOcean, BACnet - CAN bus (250-2500 Kbps) - Ethernet (10/100 Mbps)

ENCLOSURE

Material	Rigid ABS
Dimensions	126mm (5 in) X 126mm (5 in)
Rating	UL94-5VA

ENVIRONMENTAL

Operating Temperature	0°C (32°F) to 60°C (140°F)
Storage Temperature	-20°C (-4°F) to 60°C (140°F)
Relative Humidity	0 to 90% non-condensing

AGENCY APPROVALS

Energy Management Equipment, UL 924, Fourth Edition, December 23, 2006, rev. December 17, 2007
CSA Standard for Signal Equipment C22.2 No. 205-M1989 (12004)
CFR47 FCC Part 15, Subpart B: 2009
ICES-005: Issue 4 (2004)

INPUTS

Quantity	5
Voltage	0-20 volt
Current	±20mA with 240 Ω external resistor
Resistance	1 kΩ to 100 kΩ
Resolution	14-bit

OUTPUTS

Analog (dc)	0-12% nominal 30 mA max each, 12-bit resolution
Relay (ac)	24% 1.1Amp per relay

SOFTWARE

Type	Embedded web interface
Local installation	None necessary
PDA/Smartphone compatible	Yes
Browser compatibility	Firefox

ENOCEAN TRANSCIEVER

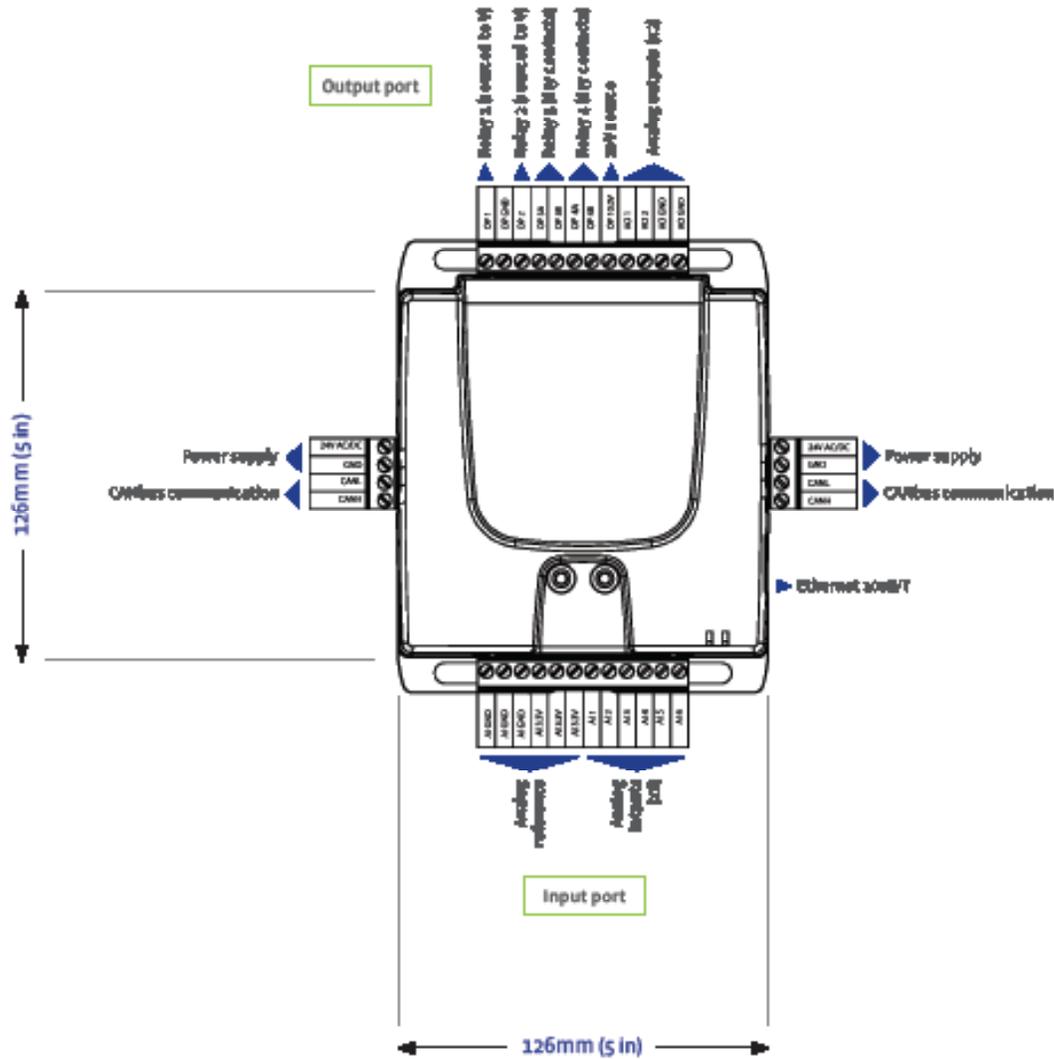
Frequency	915.0 MHz or 868.3 MHz
Data rate / Modulation type	125 kbps or 120 kbps / ASK
Receiver Sensitivity	-95dBm
Conducted Output Power	5dBm
Range	Up to 300m open air / Up to 30m in building

ZIGBEE TRANSCIEVER

Frequency	2400 – 2483.5 MHz, 16 RF channels
Data rate / Modulation type	250 Kbps
Receiver Sensitivity	-100dBm / -105dBm (amplified)
Nominal Output Power	8dBm / 18dBm (amplified)
Encryption	AES-128 bit



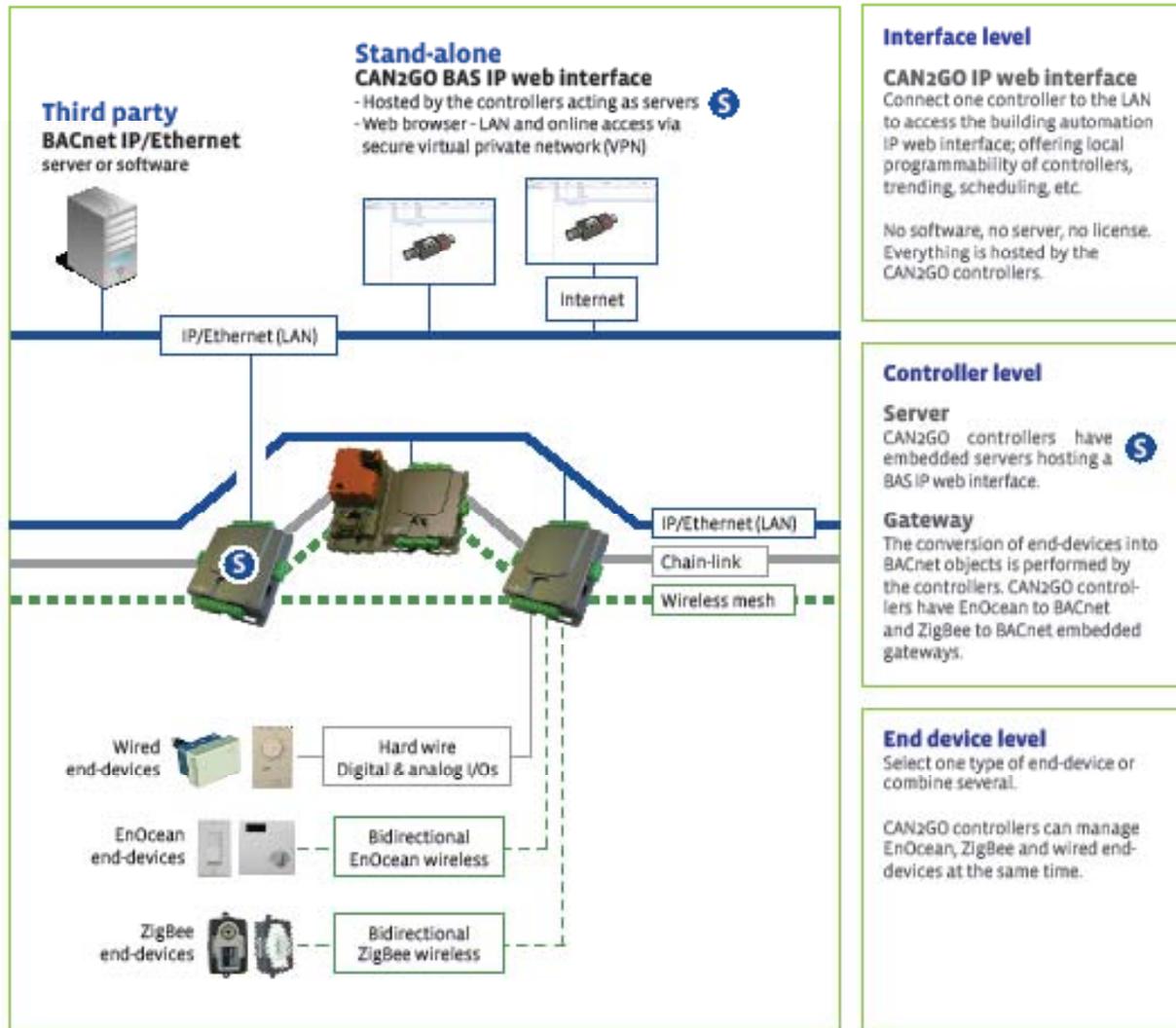
Dimensions & Wiring CAN2GO Universal controller



| CAN2GO Specifications

CAN2GO System architecture

CAN2GO can be used as a stand-alone programmable controller with a front-end interface, and as an extension to third party BACnet IP/Ethernet building automation systems.



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PIR Occupancy & Motion Sensor

MOS-17C



energy conservation - home and office

Overview

The MOS-17C is a wireless, energy harvesting, ceiling mount, Passive Infrared (PIR) occupancy sensor. Used for indoor applications, the detector is optimized for ceiling heights of 8 - 12 feet.

The sensor broadcasts an EnOcean telegram when occupancy is detected and repeats transmissions with a minimum 100 second period between subsequent telegrams.

Powered by six solar cells, the MOS-17C can operate without battery backup for over 60 hours. An efficient power supply and tuned sensor circuitry allows the MOS-17C to provide immediate response to new occupancy states making it an ideal solution for auto-ON applications.

A walk-test feature allows installers to test and verify sensor operation on location without extra tools or software. The LINK button is used to initiate the test sequence while an on-board LED blinks whenever motion is detected. Installers can verify correct sensor placement insuring reproducible operations.

False occupancy state tripping through pet movements or from other elements can be reduced with an on-board slide switch selecting a lower sensitivity setting.



Features

- ⇒ Ceiling mount with 360 ° angle of detection
- ⇒ Walk-Test feature allows installers to test operation and installation location during commissioning
- ⇒ Sends occupied and un-occupied (PIR ON/OFF) telegrams per EnOcean profile 07-07-01
- ⇒ Operates in low light - 30 lux or 3 footcandles
- ⇒ Provides immediate response to motion even in a dark room
- ⇒ Instant sensing for Auto-ON applications
- ⇒ Peel and Stick sensor installation provides exceptional space flexibility options
- ⇒ Eliminates conduit and wiring runs
- ⇒ Solar energy harvesting for no batteries or maintenance burden
- ⇒ Available with 315 and 868 MHz EnOcean radios

Ordering Information

Model # Description

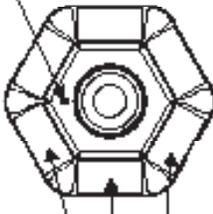
Part #



MOS-17C

Functional Diagram

LINK Button

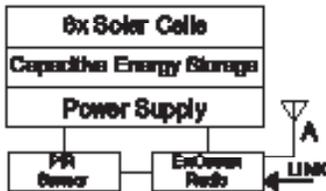


Solar Panels

Dimensional Drawing



Block Diagram



EnOcean Equipment Profiles

EEP: 07-07-01

Occupancy Sensor - PIR ON, PIR OFF

Technical Specifications

Power Supply	Solar cell, optional battery (CR2032) backup
Operational Light Level	30 lux (3 footcandles) minimum
Charging Period	6 hours full charge at 200 lux (19 footcandles)
Initial Operation	60 seconds in 30 lux (3 footcandles)
Full Charge Operation	minimum 60 hours in 0 lux after 6 hour @ 200 lux charging period
Telegram Transmission	on motion or on heartbeat period
Telegram Heartbeat Period	110 seconds ± 20 seconds
Communications	
Radio Type	315 MHz or 868MHz EnOcean radio
Antenna	Integrated whip
Transmission Range	30m (100 ft.) - commercial office space
Inputs	LINK button for assignment to receiver
Outputs	Walk-Test LED

Mechanical Specifications

Operating Temperature	-13°F to 145°F (-25°C to 65°C)
Relative Humidity	5% to 95% RH (non-condensing)
Weight	3.7oz. (104 gms.)
Dimensions	4.8" diameter, 1.5" height (122 mm x 38 mm)
Mounting	mount with screws or tape (Velcro®), not supplied

Agency Listing and Compliance

Radio Frequency FCC Part 15.231 - Remote Control Transmitter



Echoflex Solutions, Inc.

1, 38924 Queens Way | Squamish | British Columbia | Canada | V8B 0K8
 Toll Free (888) ECH-OFLEX (324-6359) | Phone (604) 815-0091 | Fax: (604) 815-0078
 Email: sales@echoflexsolutions.com | www.echoflexsolutions.com

Specifications subject to change without notice.
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ILLUMIA Installation Guide

4-Wire Step Down

E3R-R02-3HO6P (24V)
E3R-R12-3HO6P (120V)
E3R-R24-3HO6P (240V)
E3R-R27-3HO6P (277V)

E3R-R02-3HO7P (24V)
E3R-R12-3HO7P (120V)
E3R-R24-3HO7P (240V)
E3R-R27-3HO7P (277V)

Overview

The ILLUMIA Step Down Transformer is designed to provide a safe, reliable, and efficient power source for your lighting system. It is designed to be installed in a dry, well-ventilated area and should be protected from physical damage.

Compliance

- UL Listed
- ETL Listed
- CE Marked
- RoHS Compliant

General Information

- Input Voltage: 120V, 240V, 277V
- Output Voltage: 24V, 120V, 240V, 277V
- Power Rating: 100W, 500W, 1000W, 1500W
- Dimensions: 4.5" x 3.5" x 2.5"
- Weight: 0.5 lbs

Installation

1. Select a suitable location for the transformer, ensuring it is protected from physical damage and is in a well-ventilated area.

2. Connect the input wires to the transformer terminals according to the wiring diagram.

3. Connect the output wires to the lighting fixture.

4. Test the system to ensure proper operation.

Step 1: Prepare the Selected Transformer

1. Remove the transformer from its packaging and inspect for any damage.

2. Identify the input and output terminals on the transformer.

3. Strip the insulation from the wires as indicated in the wiring diagram.

Step 2: Prepare the Selected Transformer

Model	Input Voltage	Output Voltage	Power Rating	Dimensions	Weight
E3R-R02-3HO6P	120V	24V	100W	4.5" x 3.5" x 2.5"	0.5 lbs
E3R-R12-3HO6P	120V	120V	500W	4.5" x 3.5" x 2.5"	0.5 lbs
E3R-R24-3HO6P	240V	240V	1000W	4.5" x 3.5" x 2.5"	0.5 lbs
E3R-R27-3HO6P	277V	277V	1500W	4.5" x 3.5" x 2.5"	0.5 lbs

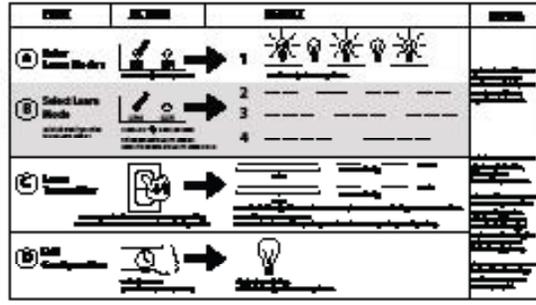
Step 3: Connect the Transformer

1. Turn off the power to the system.

2. Connect the input wires to the transformer terminals according to the wiring diagram.

3. Connect the output wires to the lighting fixture.

4. Turn the power back on and test the system.



Specifications

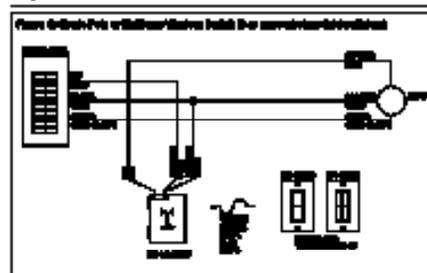
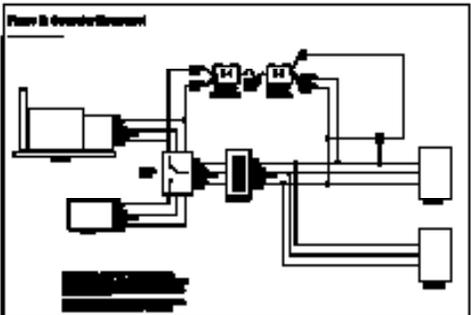
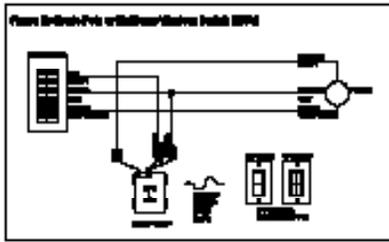
Model	Input Voltage	Output Voltage	Power Rating
E3R-R02-3HO6P	120V	24V	100W
E3R-R12-3HO6P	120V	120V	500W
E3R-R24-3HO6P	240V	240V	1000W
E3R-R27-3HO6P	277V	277V	1500W

Dimensions

4.5" x 3.5" x 2.5"

Weight

0.5 lbs

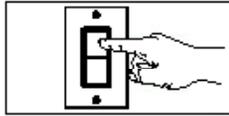


FC

Federal Communications Commission (FCC) Part 15 Class B digital device. This device meets the requirements of Part 15 of the FCC Rules, which govern the operation of Class B digital devices in unlicensed radio frequency bands. This device is designed to operate in the 900 MHz ISM band and is intended for use in residential, commercial, and light industrial environments. This device may cause interference to other devices in the same band. If interference is caused, the user should be advised to stop using the device immediately.

Specifications

	E3X-R12GP E3R-R12GP	E3X-R12GP-Z E3R-R12GP-Z
Range	50-150 feet (typical)	
Frequency	315 MHz	
Power Supply Input Rating	120VAC 60 Hz	
Output Rating	6A 3A 500W N/A	15A 15A 1800W 1/2 HP
Memory	Stores up to 30 unique transmitter IDs	
Operating Temperature	-13° to +140°F (-25° to +60°C)	
Storage Temperature	-40° to +140°F (-40° to +60°C)	
Dimensions	3.26 x 2.07 x 1.42 inches (82 x 53 x 36 mm)	
Radio Certification	FCC (United States): 52V-TCM2XXC I.C. (Canada): 5713A-TCM2XXC	
Safety Approval	ETL (United States): UL244A ETL (Canada): CSAc22.2#14-05	



Contains FCC ID: 52V-TCM2XXC;
Contains IC: 5713A-TCM2XXC.
The enclosed device complies with Part 15 of the
FCC Rules. 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.



ETL (US) – Certified to UL STD 244A. This device
was tested according to and was found to comply with
UL 244A Solid State Controls for Appliances.

ETL (Canada) – Certified to CAN/CSA STD C22.2 No.
14-05. This device was tested according to and was
found to comply with CAN/CSA STD C22.2 No. 14-05.

Diagrams

Figure A: Installing the Plug-in Relay Receiver

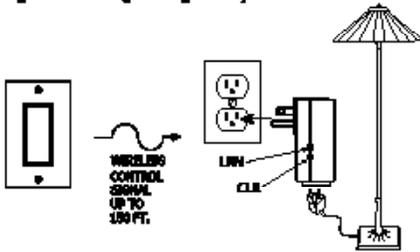


Figure B: Press Transmitter

Always follow local electrical codes when
installing this device. Installation should be
performed by a qualified electrician.

This device or certain aspects thereof is
protected by at least one U.S. or International
patent unless at least one such patent
application pending.



EMPOWERHOUSE is a trademark of All Star
Electronics, LLC. Other trademarks herein are
the property of their respective owners.

DIVISION 26 ELECTRICAL



Installation Guide

E3T-S1AWH
E3T-S1AIV
E3T-S1AAM
E3T-S1ALA
E3T-S1ABK
E3T-S1ABR
E3T-S1AGY
E3T-S2AWH
E3T-S2AIV
E3T-S2AAM
E3T-S2ALA
E3T-S2ABK
E3T-S2ABR
E3T-S2AGY

Colors:
Indicated by last 2 letters in part number. (WH-white, IV-ivory, AM almond, LA-light almond, BK-black, BR-brown, GY-gray)

Single or Dual Rocker Self-powered Wireless Light Switch



Overview

The Single/Dual Rocker Self-Powered Wireless Light Switch is a battery-free wireless transmitter that communicates with a wide variety of receivers. Every time the switch is pressed a radio-generates/pushes a small electrical current that powers a built-in transmitter. This transmitter sends wireless signals that command the receiver to turn a device off or on. With an appropriate receiver, the switch can also be used to control the dimming of lights.

Compatible Devices

- 3-Wire Relay, IFA-3AW-3000W
- 3-Wire Relay, IFA-3AW-6000W
- Plug-In Dimmer/Relay, IRL-D1A0P
- Plug-In Relay, IFA-3LR00
- 4-Channel Low Voltage Receiver, IFA-MCCTP-04
- In-wall Controller, IFA-MCCTP-02
- Many receivers available

Components Included

- The following items are included with this product:
- A – (1) ILLUMRA Single or Dual Rocker Self-Powered Light Switch
 - B – (2) 6-30 x 3/4" Phillips Self-Adhesive Self-Tapping Screws
 - C – (2) 6 x 3/4" Phillips Self-Adhesive Screws
 - D – (1) Neoprene/foam spacer
 - E – (1) Installation Guide

Equipment Needed for Installation

- Utility screwdriver
- Phillips screwdriver
- Double-sided foam-tapping tape (for self-mounting)
- Plastic wall-scuffing and sander (for screw mounting)

Teaching/Learning and Activation

(receiver learns a switch, switch teaches a receiver)

- Step 1:** Do not mount the switch until after it has been taught to all appropriate receivers. Test the range of the wireless light switch before mounting.
- Step 2:** Hide any the switch in within 30 feet (9 meters) of the desired receiver when enabling Receiver Learn mode using range-finding mode.
- Step 3:** Teaching/Learning To teach a wireless light switch with a receiver, simply press the button of the wireless light switch while the receiver is in the desired Learn Mode (see receiver instructions for information on how to teach the receiver).
- Step 4:** Activation Once a wireless light switch has been taught to a receiver, simply press the button on the wireless light switch to control the load.
- Note:**
- 1) Do not attempt to rotate the load while the receiver is in Learn Mode or the receiver may accidentally learn or unlearn the switch.
 - 2) When teaching a switch to a receiver, press only one side of a single switch at a time. The same applies to a dual rocker switch, press only one side of one switch at a time.

Mounting

Wireless light switches can be mounted in a standard switch box or surface-mounted using screws or adhesive.

Screw Surface Mount: (Figure A)

- Step 1:** If necessary, drill pilot-holes into the wall.
- Step 2:** Use switch covers (not included) to mount the wireless light switch to the wall.
- Step 3:** Attach the switch to the Back Plate using the included 6 x 3/4" screws (C).
- Step 4:** Attach the template after the switch has been attached to the wall (foam spacers are included).

Adhesive Surface Mount: (Figure B)

- Step 1:** Attach the switch to the Back Plate using the included 6 x 3/4" screws (C).
- Step 2:** Attach the template to the switch and Back Plate assembly (foam spacers are included).
- Step 3:** Apply adhesive tape to the Back Plate of the switch.
- Step 4:** Affix the switch to the wall.

Switch Box Mount: (Figure C)

- Step 1:** Remove the Back Plate. It is not needed for this installation.
- Step 2:** Attach the switch into the cover holes on the switch box using the 6-30 x 3/4" machine screws (B).
- Step 3:** Attach the template after the switch has been attached to the switch box (foam spacers are included).

Specifications

	E3T-S1Axx	E3T-S2Axx
Range	50-150 feet (typical)	
Frequency	315 MHz	
Power Supply	Self-generated when switch is pressed	
Buttons	2 Buttons (1 rocker)	4 Buttons (2 rockers)
Output Channels	Only limited by number of receivers in range	
Dimensions	2.75 (W) x 4.5 (H) x 0.62 (D) Inches	
FCC Certification	FCC (United States): SZV-PTM200C IC (Canada): 5713A-PTM200C	
Anti-cloning	Factory self unique ID (1 of 4 billion)	

Diagrams

Figure A: Screw Surface Mount



Figure B: Adhesive Surface Mount



Figure C: Switch Box Mount



Contains FCC ID: SZV-PTM200C
Contains IC: 5713A-PTM200C

The enclosed device complies with Part 15 of the FCC Rules. 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.

Always follow local electrical codes when installing this device. Installation should be performed by a qualified electrician.

This device or certain aspects thereof is protected by at least one US or international patent or law or at least one such patent application pending.



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CSI#: 26 05 26

2011 MARCH 22

SCREW: SEE CHART	MATERIAL: ALUMINUM, XINGE3	TOLERANCES UNLESS OTHERWISE SPECIFIED 2 PL. DEC. A.030 3 PL. DEC. A.030	DWG. NO. G0918
CAT. NO.: SEE CHART	PLATING: EL-TIN	TWE CL. A.025 ANNEAL A1	SHEET 1 OF 1
MASS: .014 LBS.	MACHINES: 11503, G918	DRAWN BY: CLH	SCALE: 3:1
SURFACE AREA: 2.546 IN ²	4-14, AL9CU, Ⓢ	DATE: 7/29/2007	SIZE: A
STUFFER SHIT: FORM 12	CELL: NDM	REV.	DESCRIPTION

Cat #: SEE CHART FOR COMPLETE Cat #

SCALE 2:1

Cat #	CAT. NO.	SCREW
-22	G8L-4	E0702
-22	G8L-4-B2	E0702
-23	G8L-6SS	E1447

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Project Manual PRODUCT CUTSHEETS

U.S. D.O.E. SOLAR DECATHLON COMPETITION 2011
TEAM PARSONS NEW SCHOOL STEVENS

EMPOWERHOUSE

CSI#: 26 05 26

Product Data Sheet

PK23GTA
LOAD CENTER EQUIPMENT GROUND BAR
ASSY



by Schneider Electric

List Price \$21.30 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Application	Load Centers
Circuit Breaker Type	PK
Marketing Trade Name	QO and Homeline

Shipping and Ordering

Category	00102 - Load Centers, Accessories, Type QO
Discount Schedule	DE3A
GTIN	00785901026433
Package Quantity	20
Weight	0.22 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.



Lightsensor Wireless
43-160



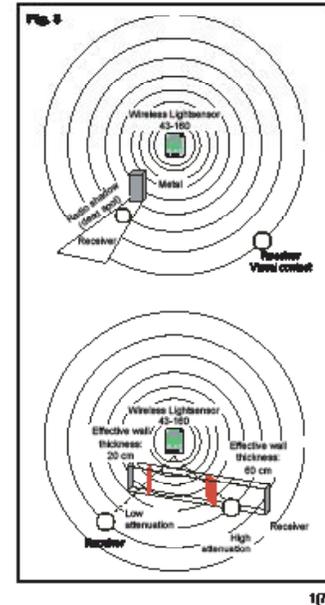
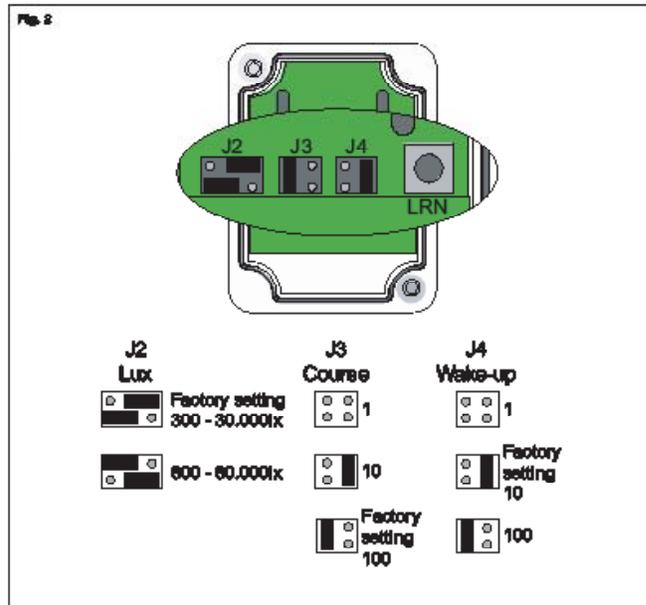
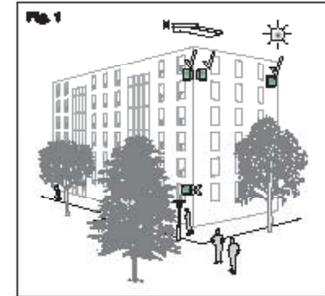
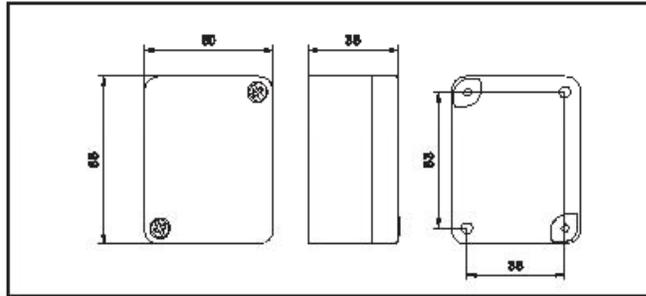
Advarsel: Indbygning og montering af elektriske apparater må kun foretages af udt. elektriker.
Ved fejl eller driftsforstyrrelser kontakt den udt. elektriker.
I Ret til ændringer forbeholdes!

Warning: Installation and assembly of electrical equipment must be carried out by qualified electricians.
Contact a qualified electrician in the event of fault or breakdown.
I Reserving the right to make changes!

Achtung: Einbau und Montage elektrischer Geräte dürfen nur durch Elektrofachkräfte erfolgen.
Wenden Sie sich bei Störungen bzw. Ausfall an einen Elektrofachmann.
I Änderungen vorbehalten!

Avvertimento: L'installazione e il montaggio d'apparecchi elettrici devono esclusivamente être eseguiti per un elettricista agiato.
En cas de défaut ou de perturbation du fonctionnement, contacter un installateur électricien agréé.
I Sous réserve de modifications!

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Tel.: +45 7442 4726 • Fax: +45 7442 4036
www.servodan.dk • E-mail: info@servodan.dk



GB

Wireless Light Sensor 43-160
Wiring and operating instructions

1. Areas of application.

The wireless light sensor model 43-160 is a light sensor based on wireless technology that measures the light level in lux lux ranges: 300-30,000 lx or 600-60,000 lx. The light sensor transmits an RF telegram to a receiver module, which using the correct function software can catch the light in the premises on or off.

Areas of application:

- Signal transmitter to measure lux level for lighting, barriers and blind systems.
- Wireless transmission of the light level to a system receiver.
- Flexible installation with no wires.
- Own power supply from solar cell and backup capacity.

2. Function.

The light sensor measures the light level continuously and compares it with the RF telegram transmitted earlier. In the event of a change in the light level of more than 4 steps (1 step = 117 lx in the default lux range, otherwise 234 lx), a relevant RF telegram will be transmitted within 10 seconds.

In normal operation a current RF telegram will be transmitted approx. every 17 minutes. This telegram contains information on the sensor's light level, address code and learn mode information. This RF telegram can register a resolution down to 1 step, which corresponds to 117 lx in the default lux range.

Measurement range:

The light sensor is designed to be installed outdoors on a typical facade wall. We recommend installation higher than 2.5 metres in order to reduce inconvenient lighting, distracting shadows, vandalism, etc. There are lux lux ranges to choose between, making the measurement range more dynamic for specific purposes.

3. Installation.

Location of the light sensor:

As the power supply is generated by the internal solar cell, the light sensor must see a minimum of 400 lx for more than 5 hours in order for there to be sufficient energy to transmit the necessary RF telegrams, even throughout the night.

Please note

In order to achieve optimal transmission of the RF signal, the light sensor should not be installed on large metal surfaces, etc. These will drastically reduce the RF signal between transmitter and receiver. Please refer to section on RF wireless information.

Installation:

Optimal daylight measurement is achieved by locating the light sensor onto the front facing towards the daylight, e.g. on a facade or gate end. Fig. 1

Connection:

Simple, flexible installation without the use of wires or batteries.

4. Settings.

Factory setting:

Lux: 300 - 30,000 lx
T_course: 100
T_scale up: 10 sec. See Fig. 2.

Setting receiving:

The light sensor is equipped with an LFN mode function, which is used for wireless system coding towards a relevant receiver.

LFN button mode:

If you press this pushbutton (learn), a status RF telegram will immediately be sent to a unique address code and a lux level to the receiver. Fig. 2.

PS: The receiver must also be set to "Learn mode", please refer to the receiver's software description of the learning method.

5. RF wireless information.

The light sensor has an integrated RF transmitter model STM100 (EnOcean). The transmitter's signal has a frequency of 868 MHz. With a transmission frequency of approx. every 1,000 sec. and a transmission output of less than 10 mW, an RF environment is guaranteed that is typically at least 100 times less than conventional wireless systems.

RF transmitter distance:

As an RF signal transmits electromagnetic oscillations/waves (of a certain field strength), these are suppressed on the way to the receiver. The RF signal's field strength weakens proportionally by the square of the distance between transmitter and receiver (E,H = 1/r²). Fig. 3.

However, this natural reduction of the field strength as a function of distance is not the only suppression that affects the distance. Metal parts, e.g. in connection with reinforcements in wall and ceiling elements, metal foil in stamp barriers or UV-colour films through metal foil will all reflect, distort or suppress the RF signal on its way to the receiver.

Below is a list (approximate) of penetration rates for commonly used building materials:

The penetrative strength of RF signals:

Material	Penetration
wood, plaster and glass without surface foil	90...100%
brick, MDF and chipboard panels	65...95%
concrete reinforcement	10...30%
metal, aluminium panels, etc.	0...10%

In practice this means that the choice of material has a decisive influence on the distance between transmitter and receiver. As a guideline, the following distances can be used in typical wall constructions:

Wall-to-wall distance between transmitter and receiver:
Typically 30 m in wall-to-wall, up to 100 m in large rooms, e.g. sports halls.

Plaster/wooden wall:
Typically 30 m distance through max. 5 walls.

Reinforced concrete wall:
Typically 20 m distance through max. 3 walls.

Steel-reinforced wall/ceiling (floor structures):
Typically 10 m distance through max. 1 ceiling/floor.

If there is any doubt, check the distance before securing to the building.

Other sources of noise for wireless RF signal transmitter: Devices that also operate with high-frequency signals, such as computers, audio/video appliances, various wireless systems, mobile phones, electronic transformers, connection units and frequency converters are considered to be a source of noise for a wireless RF signal. We recommend a minimum distance of 0.5 metres from such devices.

RF transmitter rate of occurrence:

The light sensor transmits an RF telegram as a function of an event-controlled process, but also in a fixed, time-controlled process.

Measurement principle and telegram delivery:

The generation of a time-controlled process (T_course) takes place by activating the pushbutton labelled "LFN", which starts the internal micro-processor, gathers the status of the light sensor, and transmits its value and address immediately via an RF telegram to the receiver.

cessation of an event process (time-controlled). At a suitable interval every 10 sec. (T_scale up), the micro-processor is started and the status of the light sensor is registered. If there is no change, for every 100 events (event-controlled) an RF telegram will be transmitted to the receiver. This status is defined when the light sensor does not register any change in light of more than 4-5 steps, typically in darkness or at a stable light level.

Recommended setup of STM100 transmitter:

T_scale up: 10 sec.
T_course: 100
T_send: 10 sec x 100 = approx. 17 min.

A taller T_send will place a load on the power capacity of the backup condenser, and a longer T_send will reduce the resolution of the light level transmitted.

Description of the RF telegram:

2 byte Light Sensor: EnOcean transmitter STM100.
CRC (address code): 7 digits (EnOcean type designation "1107")
Data_byte3: Coding EXMC = 14 (232)
Data_byte2: Coding EXMC = 300-30,000 lx (0...255)
Data_byte1: Coding EXMC = 600-60,000 lx (0...255)
Data_byte0: BR DL_3 for LFN pushbutton.

6. Maintenance.

Dirt affects the operation of the sensor and the front of the sensor must therefore be kept clean. Use a damp cloth for cleaning. Use water with a standard detergent.

7. Technical data.

Supply voltage: Two 3V solar cells + internal backup capacity

RF transmitter system: EnOcean STM100.

Transmission frequency: 868 MHz.

Transmission output: <10 mW.

Transmission rate of occurrence of default setting: An RF telegram is transmitted every 17 min. at light changes of less than 4 steps. At light changes of more than 4-5 steps, less than 10 sec. will pass before an RF telegram is transmitted.

RF range: 300 metres in open space, approx. 30 metres indoors, see section "RF wireless information".

Lux range 1: 300-30,000 lx, 117 luxstep STM100

Lux range 2: 600-60,000 lx, 234 luxstep STM100

Protection class: IP 54

Ambient temperature: -20°C...+65°C.





Installation Guide

E3T-S1AWH
E3T-S1AIV
E3T-S1AAM
E3T-S1ALA
E3T-S1ABK
E3T-S1ABR
E3T-S1AGY
E3T-S2AWH
E3T-S2AIV
E3T-S2AAM
E3T-S2ALA
E3T-S2ABK
E3T-S2ABR
E3T-S2AGY

Colors:
Indicated by last 2 letters in part number. (WH-white, IV-ivory, AM almond, LA-light almond, BK-black, BR-brown, GY-gray)

Single or Dual Rocker Self-powered Wireless Light Switch



Overview

The High/Low Voltage Self-Powered Wireless Light Switch is a battery-free wireless transmitter that communicates with a wide variety of receivers. It may cause the switch to pass a radio-gateway/payload a small electrical current that causes a built-in transmitter. This transmitter sends wireless signals that command the receiver to turn a device off or on. With an appropriate receiver, the switch can also be used to control the dimming of lights.

Compatible Devices

- 3-Wire Relay, IFA-3A-3000W
- 2-Wire Relay, IFA-2A-3000W
- Plug-In Dimmer/Relay, IRL-D1A0P
- Plug-In Relay, IFA-1A-3000W
- 4-Channel Low Voltage Receiver, IFA-MCCTP-04
- Relay Controller, IFA-MCCTP-02
- Many receivers available

Components Included

- The following items are included with this product:
- A - (1) ILLUMRA Single or Dual Rocker Self-Powered Light Switch
 - B - (2) 6-30 x 3/4" Phillips Self-Drill self-tapping screws
 - C - (2) 6 x 3/8" Phillips Self-Drill screws
 - D - (1) Neoprene/foam gasket
 - E - (1) Installation Guide

Equipment Needed for Installation

- Utility screwdriver
- Phillips screwdriver
- Double-sided foam-taping tape (for self-mounting)
- Plastic wall anchors and washers (for screw mounting)

Teaching/Learning and Activation

(receiver learns a switch, switch teaches a receiver)

- Step 1:** Do not mount the switch until after it has been taught to all appropriate receivers. Test the range of the wireless light switch before mounting.
- Step 2:** Make sure the switch is within 30 feet (9 meters) of the desired receiver when enabling Receiver Learn mode using Range Learning mode.
- Step 3:** Teaching/Learning To teach a wireless light switch with a receiver, simply press the button of the wireless light switch while the receiver is in the desired Learn Mode (see receiver instructions for information on how to teach the receiver).
- Step 4:** Activation Once a wireless light switch has been taught to a receiver, simply press the button on the wireless light switch to control the load.
- Note:**
- 1) Do not attempt to rotate the load while the receiver is in Learn Mode or the receiver may accidentally learn or unlearn the switch.
 - 2) When teaching a switch to a receiver, press only one side of a single switch at a time. The same applies to a dual rocker switch, press only one side of one switch at a time.

Mounting

Wireless light switches can be mounted in a standard switch box or surface-mounted using screws or adhesive.

Standard Surface Mount (Figure A)

- Step 1:** If necessary, drill pilot holes into the wall.
- Step 2:** Use switch screws (not included) to mount the wireless light switch to the wall.
- Step 3:** Attach the switch to the Back Plate using the included 6 x 3/8" screws (C).
- Step 4:** Attach the gaskets after the switch has been attached to the wall (foam/gaskets screws are included).

Adhesive Surface Mount (Figure B)

- Step 1:** Attach the switch to the Back Plate using the included 6 x 3/8" screws (C).
- Step 2:** Attach the gaskets to the switch and Back Plate assembly (foam/gaskets screws are included).
- Step 3:** Apply adhesive tape to the Back Plate of the switch.
- Step 4:** Affix the switch to the wall.

Switch Box Mount (Figure C)

- Step 1:** Remove the Back Plate. It is not needed for this installation.
- Step 2:** Attach the switch into the cover holes on the switch box using the 6-30 x 3/4" machine screws (B).
- Step 3:** Attach the gaskets after the switch has been attached to the switch box (foam/gaskets screws are included).

Specifications

	E3T-S1Axx	E3T-S2Axx
Range	50-150 feet (typical)	
Frequency	315 MHz	
Power Supply	Self-generated when switch is pressed	
Buttons	2 Buttons (1 rocker)	4 Buttons (2 rockers)
Output Channels	Only limited by number of receivers in range	
Dimensions	2.75 (W) x 4.5 (H) x 0.62 (D) Inches	
FCC Certification	FCC (United States): SZV-PTM200C IC (Canada): 5713A-PTM200C	
Anti-cloning	Factory set unique ID (1 of 4 billion)	

Diagrams

Figure A: Screw Surface Mount



Figure B: Adhesive Surface Mount



Figure C: Switch Box Mount



Contains FCC ID: SZV-PTM200C
Contains IC: 5713A-PTM200C

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) the device may not cause harmful interference and (2) the device must accept any interference received, including interference that may cause undesired operation.

Always follow local electrical codes when installing this device. Installation should be performed by a qualified electrician.

This device or certain aspects thereof is protected by at least one US or international patent or law or at least one such patent application pending.



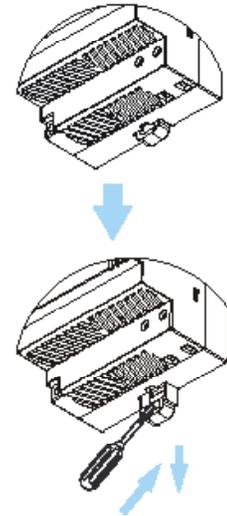
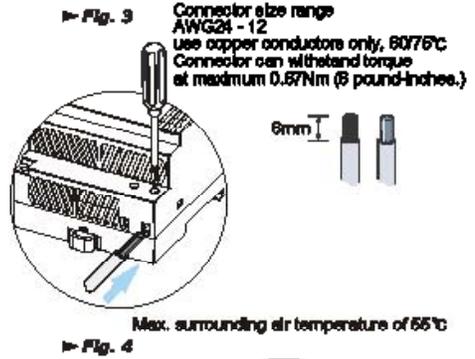
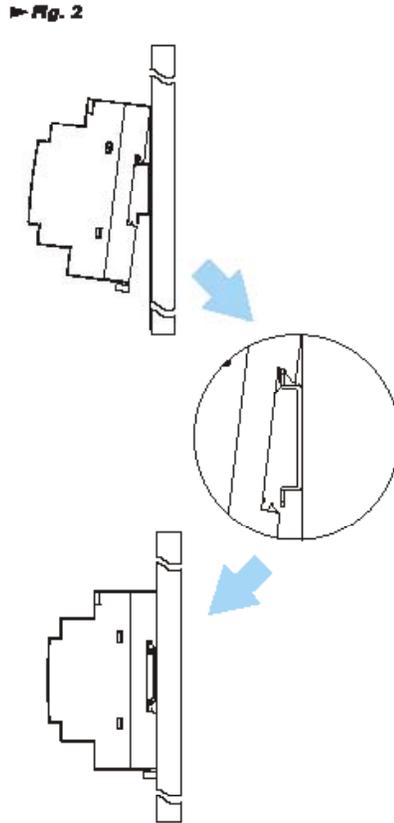
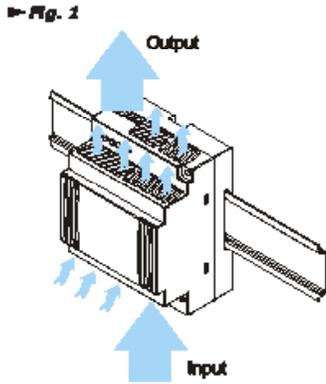
ILLUMRA is a trademark of Ad-Blue Electronics, LLC. Other trademarks herein are the property of their respective owners.

TDK-Lambda

DSP30 Series Din Rail Power



Technical Data
Installation and Operation



Safety notes

Read Instructions!
Before working with this unit, read these instructions carefully and completely. Make sure that you have understood all the information!
This unit complies with UL1910* for the requirements of NEC Class 2 power only.

Disconnect system from supply network
Before any installation, maintenance or modification work: Disconnect your system from the supply network. Ensure that it cannot be re-connected inadvertently!

Before start of operation
Ensure appropriate installation
Warning! Improper installation / operation might safety and result in operational difficulties or complete failure of the unit. The unit must be installed and put into service appropriately by qualified personnel. Compliance with the relevant regulations must be ensured. Before operation is begun the following conditions must be ensured, in particular:
- Connection to main power supply in compliance with VDE0100 and EN50178.
- With stranded wires: all strands must be secured in the terminal blocks (potential danger of short circuit).
- Unit and power supply cables must be properly fixed; if necessary a secondary grounded disconnecting element must be used to discharge from supply main.
- All output lines must be rated for the power supply output current and must be connected with the correct polarity.
- Sufficient air-cooling must be ensured.
- Pollution Degree 2 environment.

In operation: No modifications!
As long as the unit is in operation, do not modify the installation! The source supplies also to the secondary side. Risk of electric arcs and electric shock (shock)!
Only connect / disconnect when the power is off!

Convection cooling (See Fig. 1)
Do not cover any ventilation holes!
Leave sufficient space around the unit for cooling!

Warning: High voltage! Store energy!
The unit contains unprotected conductors carrying a lethal high voltage, and components storing substantial amounts of energy. Improper handling may result in an electric shock or serious harm!
* The unit must not be opened except appropriately trained personnel!
* Do not introduce any object into the unit!
* Keep away from fire and water!

Installation

Mounting (See Fig. 1)
Permissible mounting position: keep ventilation holes clear, leave space for cooling! Recommended to have 2.5cm free space at all sides:

Snap on support rail (See Fig. 2)

- Fit the unit slightly rearwards.
- Fit the unit over top of rail.
- Slide it downwards until it hits the stop.
- Press against the bottom front side for locking.
- Slide the unit slightly to check the locking action.

Connection (See Fig. 3)

- Use only commercial cables designed for the indicated voltage and current values!
- With flexible cables: make sure that all stranded cables are secured in the terminal.
- Ensure proper polarity at output terminals!

Removal from DIN Rail (See Fig. 4)
Push the slider downwards (unlock). Gently lift lower front edge of the unit (tipping) and remove.

Description	Model No.			
	DSP10-05	DS P10-12	DSP10-15	DSP10-24
Input				
Rated Input Voltage	100Vac ~ 240 Vac			
AC Voltage Range	80Vac ~ 254Vac			
DC Voltage Range	120-375 Vdc			
Frequency	47-63Hz			
Rated Input Current (max)	500mA		800mA	
Inrush Current (100ac/230Vac)	< 25A (< 50A)			
Efficiency (Typ)	>74%	>82%	>83%	>83%
Power Factor Correction	meet EN61000-3-2 class A			
Output				
Overvoltage protection	120-145%			
Line regulation	<1.0 %			
Load regulation	<1.0 %			
DC ON Indicate (Green LED)	>3V	>6V	>11V	>20V
Ripple	<30mVpp			
Nominal Current	3A	2.1A	3A	1.3A
Rated over load protection	110% ~ 150%			
Current Limit	Fold Forward (Current limit, voltage drops to maintain constant power during overload)			
Holdup Time (230Vac)	> 30ms			
General				
Temperature	Storage: -25 to +85 °C, Operation: -25 to +71 °C			
Densiting (115/230 VAC)	2.5% / °C from 55°C to 71 °C			
Humidity	20%-90% RH			
Case	Plastic			
MAX. Required free space	25mm in all sides			
Dimensions	3.58 (ø) x 2.19			
H x W x D (inches (mm))	(ø) 1.53 x 55.6)			
Weight (Typ)	200g			
Approvals And Standard				
UL / cUL	UL508 Listed UL1310 Listed Class 2 power, UL 60950-1 Recognized			
TUV	EN60950-1 EN61000-3-3, EN61022 Class A			
CE	EN61000-3-2, EN61000-3-3 EN61000-3-2, EN61024, EN61000-4-2, EN61000-4-3, EN61000-4-4 EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11			

* The unit has to be tested in Direct Flush Power Units and full compliance to UL1910 is required. Inrush current is tested in an IEC 61000-4-8 conforming to the requirements of UL1910.

Warning: This is a Class A product. In a residential environment or other residential environment it may cause radio interference. This product is not intended to be installed in a residential environment. In a commercial and industrial environment, the user may be required to take specific measures to reduce interference. **DR132-1.4**

TDK-Lambda

DSP30 Series Din Rail Power



Technical Data
Installation and Operation

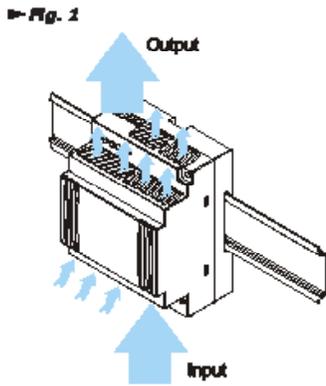


Fig. 2

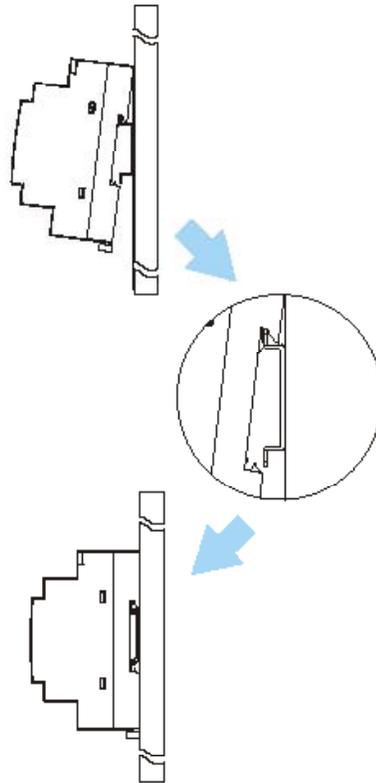
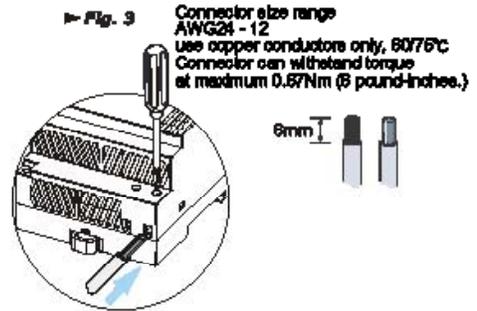
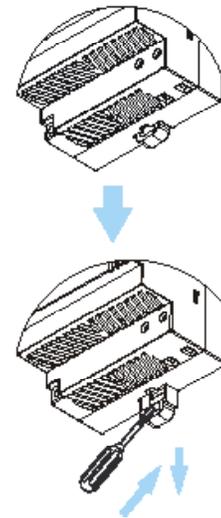


Fig. 3



Max. surrounding air temperature of 55°C
Fig. 4



Safety notes

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- All output lines must be rated for the power supply output current and must be connected with the correct polarity.
- Sufficient air-cooling must be ensured.
- Pollution Degree 2 environment.

In operation: No modifications!
As long as the unit is in operation, do not modify the installation! The source supplies also to the secondary side. Risk of electric arcs and electric shock (shock)!
Only connect / disconnect when the power is off!

Convection cooling (See Fig. 1)
Do not cover any ventilation holes!
Leave sufficient space around the unit for cooling!

Warning: High voltage! Store energy!
The unit contains unprotected conductors carrying a lethal high voltage, and components storing substantial amounts of energy. Improper handling may result in an electric shock or serious harm!
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* Keep away from fire and water!

Installation

Mounting (See Fig. 1)
Permissible mounting position: keep ventilation holes clear, leave space for cooling! Recommended to have 2.5cm free space at all sides:

Snap on support rail (See Fig. 2)

- Fit the unit slightly rearwards.
- Fit the unit over top of rail.
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- Slide the unit slightly to check the locking action.

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Removal from DIN Rail (See Fig. 4)
Push the slider downwards (unlock). Gently lift lower front edge of the unit (tipping) and remove.

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	DSP10-05	DS P10-12	DSP10-15	DSP10-24
Input				
Rated Input Voltage	100Vac ~ 240 Vac			
AC Voltage Range	80Vac ~ 254Vac			
DC Voltage Range	120-375 Vdc			
Frequency	47-63Hz			
Rated Input Current (max)	500mA			800mA
Inrush Current (10Vac/200Vac)	< 25A / < 50A			
Efficiency (Typ)	>74%	>82%	>83%	>83%
Power Factor Correction	meet EN61000-3-2 class A			
Output				
Overvoltage protection	120-145%			
Line regulation	<1.0 %			
Load regulation	<1.0 %			
DC ON Indicate (Green LED)	>3V	>6V	>11V	>20V
Ripple	<30mVpp			
Nominal Current	3A	2.1A	3A	1.3A
Rated over load protection	110%~150%			
Current Limit	Fold Forward (Current limit, voltage drops to maintain constant power during overload)			
Holdup Time (230Vac)	> 30ms			
General				
Temperature	Storage: -25 to +85 °C, Operation: -25 to +71 °C			
Densiting (115/230 VAC)	2.5% / °C from 55°C to 71°C			
Humidity	20%-90% RH			
Case	Plastic			
MAX. Required free space	25mm in all sides			
Dimensions	3.58 (ø) x 2.19			
H x W x D (inches (mm))	(ø) 1.53 x 55.6)			
Weight (Typ)	200g			
Approvals And Standard				
UL / cUL	UL508 Listed UL1310 Listed Class 2 power, UL 60950-1 Recognized			
TUV	EN60950-1 EN61000-3-3, EN61022, Class A			
CE	EN61000-3-2, EN61000-3-3 EN61000-3-2, EN61024, EN61000-4-2, EN61000-4-3, EN61000-4-4 EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11			

* The unit has to be tested in Direct Flush Power Units and full compliance to UL1910 is required. Inrush current is limited in an optional 100mA/100ms conforming to the requirements of UL1910.

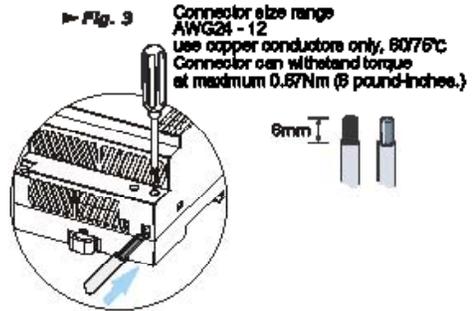
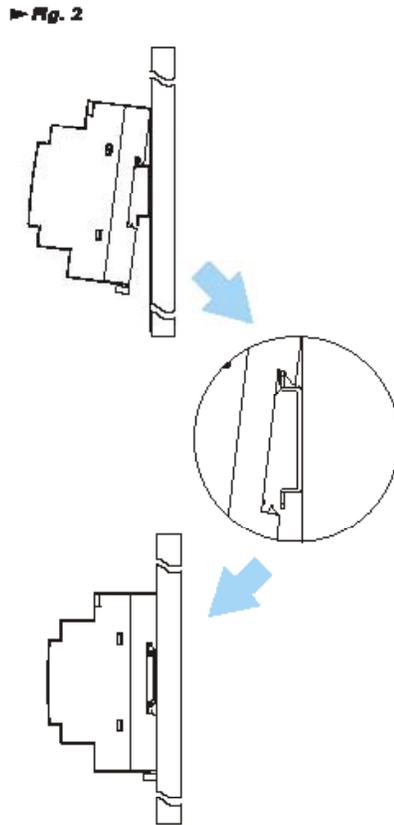
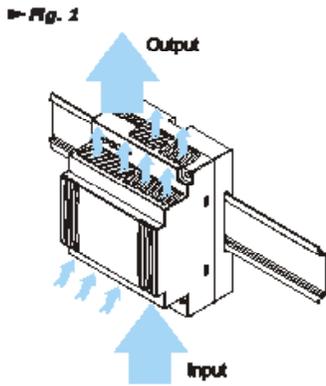
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TDK-Lambda

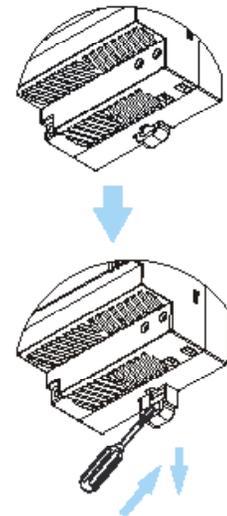
DSP30 Series Din Rail Power



Technical Data
Installation and Operation



Max. surrounding air temperature of 55°C



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- All output lines must be rated for the power supply output current and must be connected with the correct polarity.
- Sufficient air-cooling must be ensured.
- Pollution Degree 2 environment.

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Only connect / disconnect when the power is off!

Convection cooling (See Fig. 1)
Do not cover any ventilation holes!
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* Keep away from fire and water!

Installation

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DC Voltage Range	120-375 Vdc			
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Inrush Current (10Vac/200Vac)	< 25A / < 50A			
Efficiency (Typ)	>74%	>82%	>83%	>83%
Power Factor Correction	meet EN61000-3-2 class A			
Output				
Overvoltage protection	120-145%			
Line regulation	<1.0 %			
Load regulation	<1.0 %			
DC ON Indicate (Green LED)	>3V	>6V	>11V	>20V
Ripple	<30mVpp			
Nominal Current	3A	2.1A	3A	1.3A
Rated over load protection	110% ~ 150%			
Current Limit	Fold Forward (Current limit, voltage drops to maintain constant power during overload)			
Holdup Time (230Vac)	> 30ms			
General				
Temperature	Storage: -25 to +85 °C, Operation: -25 to +71 °C			
Densiting (115/230 VAC)	2.5% / °C from 55°C to 71 °C			
Humidity	20%-90% RH			
Case	Plastic			
MAX. Required free space	25mm in all sides			
Dimensions	3.58 (ø) x 2.19			
H x W x D (inches (mm))	(ø) 1.41 x 5.51 x 2.19			
Weight (Typ)	200g			
Approvals And Standard				
UL / cUL	UL508 Listed UL1310 Listed Class 2 power, UL 60950-1 Recognized			
TUV	EN60950-1 EN61000-3-2, EN61000-3-3, EN61000-3-3			
CE	EN61000-3-2, EN61000-3-3, EN61000-4-2, EN61000-4-3, EN61000-4-4 EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11			

* The unit has to be tested in Dry, Damp, and Wet conditions to UL1910 in respect. In addition it has to be tested in an IEC 60068-2-27 conforming to the requirements of UL1910.

Warning: This is a Class A product. In a residential environment or other residential environment it may cause radio interference. This product is not intended to be used in a residential environment. In a commercial and industrial environment the user may be required to take specific measures to reduce interference. **DR132-1.4**

CSI#: 26 24 16

Product Data Sheet

QO140M200

LOAD CENTER QO MB 240V 200A 1PH 40SP



by Schneider Electric

List Price \$1,034.00 USD

Availability Stock item: This item is normally stocked in our distribution facility.

Technical Characteristics

Ampere Rating	200A
Application	Designed to meet residential, commercial and industrial requirements to protect electrical systems, equipment and people.
Approvals	UL Listed
Enclosure Type	Indoor
Cover Type	Order separately
Bus Material	Tin Plated Copper
Box Number	10
Short Circuit Current Rating	22kA
Maximum Tandem Circuit Breakers	0
Phase	1-Phase
Spaces	40
Main Type	Convertible Mains - Breaker
Enclosure Rating	NEMA 1
Maximum Single Pole Circuits	40
Grounding Bar	Order separately
Voltage Rating	120/240 Vac
Wiring Configuration	3-Wire
Wire Size	#4 to 250 AWG/kcmil(Al/Cu)

Notes: 22kA main circuit breaker UL Listed for use ahead of QO, QOT and QO-PL 10kA branch circuit breakers to permit their application on systems with up to 22kA available fault current.

Shipping and Ordering

Category	00001 - Load Centers, Indoor, 1 phase 12-42 CKT,NEMA1
Discount Schedule	DE3A
GTIN	00785901867654
Package Quantity	1
Weight	20.97 lbs.
Availability Code	Stock item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US



CSI#: 26 24 16 A1

Product Data Sheet

QOC40US
LOAD CENTER QO COVER SURFACE



SQUARE D

by Schneider Electric

List Price \$87.00 USD

Availability Stock item: This item is normally stocked in our distribution facility.

Technical Characteristics

Shipping and Ordering

Category	00001 - Load Centers, Indoor, 1 phase 12-42 CKT,NEMA1
Discount Schedule	DE3A
GTIN	00785901746041
Package Quantity	1
Weight	10.86 lbs.
Availability Code	Stock item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

Product Data Sheet

UTRS213A

METER SOCKET RINGLESS UG 200A



by Schneider Electric

List Price \$212.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Approvals	UL Listed
Box Number	5R
Ampere Rating	200A
Wiring Configuration	3-Wire
Depth	4.38 Inches
Height	15.00 Inches
Width	11.00 Inches
Closing Plate	Solid Top
Bypass	None
Enclosure Material	Steel
Hub Opening	Solid Top
Includes	Bonded Neutral
Socket Type	Ringless
Ground Wire Size	#14 to #2 AWG (Al/Cu)
Enclosure Rating	NEMA 3R
Enclosure Type	Rainproof & Ice/Sleet Proof (Indoor/Outdoor)
Jaw Release	No
Line/Load/Neutral Wire Size	#1/0 to 350 AWG/kcmil (Al/Cu)
Voltage Rating	600VAC
Number of Jaws	4
Number of Sockets	1
Phase	1-Phase
Service Feed Location	UG
Type	Individual
Wire Binding	1/2 Inch Hex

Shipping and Ordering

Category	00039 - Meters, Individual Socket & Hub
Discount Schedule	DE4
GTIN	00785901627814
Package Quantity	1
Weight	12.89 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.





www.hammfg.com

C-Box Screw Cover with Knockouts
NEMA 1



Commercial Enclosures

Application

- Designed for general purpose indoor commercial use as a junction, pull or switch box.

Standards

- UL-50 Type 1
- cUL Type 1
- Complies with:
 - NEMA Type 1
 - IEC 60629, IP20

Construction

- Formed and spot welded from 18 or 14 gauge steel depending on size.
- Flat steel covers fastened with plated steel screws.
- Keyhole slots permit cover to be lifted off without removing screws entirely.
- Easily removed knockouts on all 4 sides (see drawings for sizes and locations).
- Through holes in back for wall mounting.
- Grounding location embossed in body.

Finish

- Enclosure and cover are finished in ANSI #1 gray powder coating.

Junction Boxes

Part No.	Overall Dimensions			Mtg. Centers				Knockout Pattern Sides		Knockout Pattern Top & Bottom	Ship Wt. lbs.
	A	B	C	D	E	F	G	H			
CSKO443	4	4	3	2.25	3.00	0.88	0.50	B - C	0.28	A - B	2
CSKO485	6	6	3	3.00	5.00	1.50	0.80	B - C - D	0.28	B - C - D	3
CSKO663	8	6	3	5.00	5.00	1.50	0.50	F - G - H - I	0.28	B - C - D	3
CSKO18143	16	14	3	13.00	13.00	1.50	0.80	B - C - D - E - F - G - H	0.28	B - C - D - E - F - G - H	12
CSKO18143	18	14	3	15.00	13.00	1.50	0.50	A - B - C - D - E - F - G - H - I	0.28	B - C - D - E - F - G - H	13
CSKO20143	20	14	3	17.00	13.00	1.50	0.80	A - B - C - D - E - F - G - H - I	0.28	B - C - D - E - F - G - H	13
CSKO444	4	4	4	2.25	3.00	0.88	0.50	B - C	0.28	A - B	2
CSKO644	6	4	4	3.00	3.00	1.50	0.80	B - C - D	0.28	A - B	3
CSKO664	6	6	4	3.00	5.00	1.50	0.50	B - C - D	0.28	B - C - D	3
CSKO864	8	6	4	5.00	5.00	1.50	0.80	F - G - H - I	0.28	B - C - D	5
CSKO884	8	8	4	5.00	7.00	1.50	0.50	F - G - H - I	0.28	F - G - H - I	5
CSKO1084	10	8	4	7.00	7.00	1.50	0.80	F - G - H - I	0.28	F - G - H - I	6
CSKO10104	10	10	4	7.00	9.00	1.50	0.50	F - G - H - I	0.28	C - D - E - F - G	6
CSKO1284	12	8	4	9.00	7.00	1.50	0.80	C - D - E - F - G	0.28	F - G - H - I	7
CSKO12104	12	10	4	9.00	9.00	1.50	0.50	C - D - E - F - G	0.28	C - D - E - F - G	8
CSKO12124	12	12	4	9.00	11.00	1.50	0.80	C - D - E - F - G	0.28	C - D - E - F - G	9
CSKO16124	16	12	4	13.00	11.00	1.50	0.50	B - C - D - E - F - G - H	0.28	C - D - E - F - G	12
CSKO18124	18	12	4	15.00	11.00	1.50	0.80	A - B - C - D - E - F - G - H - I	0.28	C - D - E - F - G	12
CSKO18184	18	18	4	15.00	17.00	1.50	0.50	A - B - C - D - E - F - G - H - I	0.28	A - B - C - D - E - F - G - H - I	16
CSKO24244	24	24	4	21.00	23.00	1.50	0.80	C - D - E - F - G	0.28	C - D - E - F - G	28

Chart continued on next page...

Technical references and DXF downloads available at www.hammfg.com

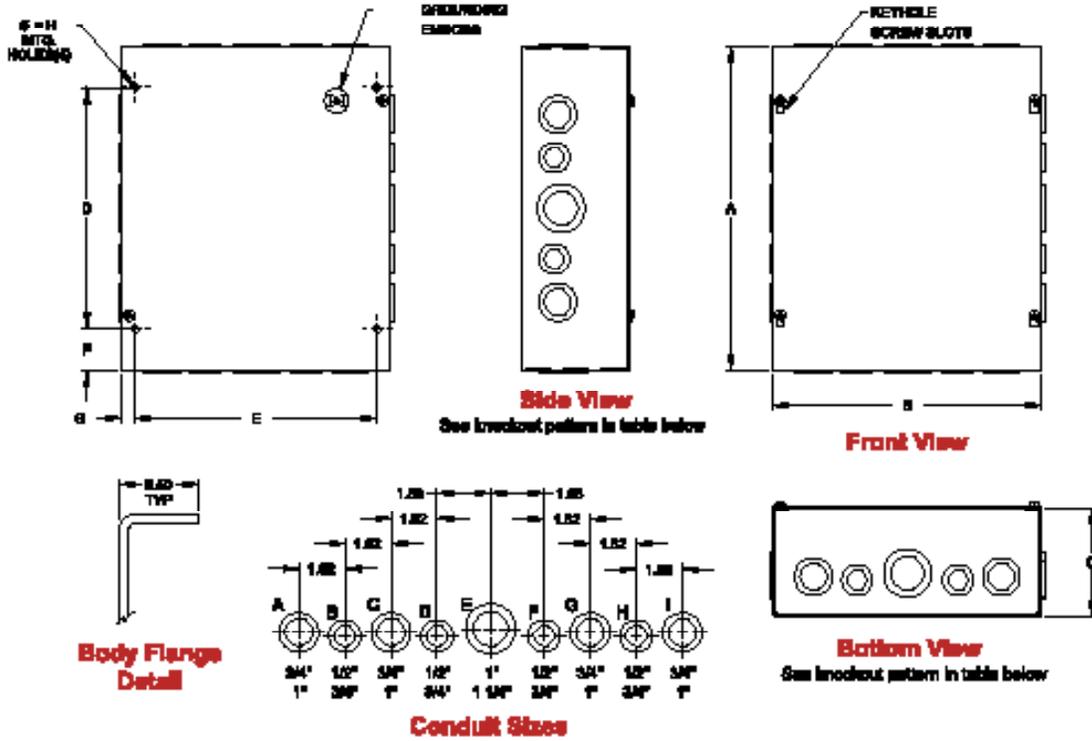
All dimensions in inches unless specified otherwise





www.hammfg.com

C-Box Screw Cover with Knockouts
NEMA 1



Commercial Enclosures

Part No.	Overall Dimensions			Mig. Centers				Knockout Pattern Sides		Knockout Pattern Top & Bottom	Ship Wt. lbs.
	A	B	C	D	E	F	G	H			
CSKO866	6	6	6	3.00	5.00	1.50	0.50	B - C - D	0.28	B - C - D	4
CSKO866	8	8	6	5.00	7.00	1.50	0.50	F - G - H - I	0.28	F - G - H - I	6
CSKO1086	10	8	6	7.00	7.00	1.50	0.50	F - G - H - I	0.28	F - G - H - I	7
CSKO10108	10	10	6	7.00	9.00	1.50	0.50	F - G - H - I	0.28	C - D - E - F - G	8
CSKO12106	12	10	6	9.00	9.00	1.50	0.50	C - D - E - F - G	0.28	C - D - E - F - G	9
CSKO12128	12	12	6	9.00	11.00	1.50	0.50	C - D - E - F - G	0.28	C - D - E - F - G	10
CSKO16126	16	12	6	13.00	11.00	1.50	0.50	B - C - D - E - F - G - H	0.28	C - D - E - F - G	13
CSKO16168	16	16	6	13.00	16.00	1.50	0.50	B - C - D - E - F - G - H	0.28	B - C - D - E - F - G - H	16
CSKO18126	18	12	6	15.00	11.00	1.50	0.50	A - B - C - D - E - F - G - H - I	0.28	C - D - E - F - G	14
CSKO18168	18	16	6	15.00	17.00	1.50	0.50	A - B - C - D - E - F - G - H - I	0.28	A - B - C - D - E - F - G - H - I	19
CSKO24186	24	18	6	21.00	17.00	1.50	0.50	A - B - C - D - E - F - G - H - I	0.28	A - B - C - D - E - F - G - H - I	26
CSKO24246	24	24	6	21.00	22.50	1.50	0.75	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	37
CSKO30246	30	24	6	27.00	22.50	1.50	0.75	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	45
CSKO30306	30	30	6	27.00	22.50	1.50	0.75	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	57
CSKO12128	12	12	8	9.00	11.00	1.50	0.50	C - D - E - F - G	0.28	C - D - E - F - G	12
CSKO16168	16	16	8	13.00	16.00	1.50	0.50	B - C - D - E - F - G - H	0.28	B - C - D - E - F - G - H	20
CSKO24248	24	24	8	21.00	22.50	1.50	0.75	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	44
CSKO303010	30	30	10	27.00	19.00	1.50	0.75	A - B - C - D - E - F - G - H - I	0.28	A - B - C - D - E - F - G - H - I	57
CSKO242410	24	24	10	21.00	22.50	1.50	0.50	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	52
CSKO303010	30	30	10	27.00	16.80	1.50	0.75	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	60
CSKO362410	36	24	10	33.00	22.50	1.50	0.75	A - B - C - D - E - F - G - H - I	0.44	A - B - C - D - E - F - G - H - I	75

Junction Boxes

Technical references and DXF downloads available at www.hammfg.com

All dimensions in inches unless specified otherwise

IDS-17-3

Amphenol®



HELIOS H4

Industrial Operations (AIO) offers products and solutions for all segments of the solar electric system. AIO understands the need for efficient (low loss) power transfer, highly reliable, and cost effective solutions that are required to be competitive in this industry. We can provide panel manufacturers, installers, and OEM's with connectivity products for both thin film and crystalline silicon technologies. **Amphenol** has a broad range of technologies to help minimize the cost of inverters and power conditioners. **Amphenol** Industrial can help you power the planet with the sun. The Helios H4 connector is just one of the solar connector solutions **Amphenol** Industrial has to offer.

H4 Features:

- UL and TÜV dual approval
- Fully intermateable with industry standard
- Meets all new NEC 2008 requirements
- Quick and easy secure snap lock mating
- Simple unlocking tool meets NEC requirements
- Long-term UV and Ozone resistance
- Highest current rating in industry
- RoHS compliant
- Complete Cable Assemblies available
- Low contact resistance means low power loss
- Ready for field assembly

Helios H4

Amphenol solar connector

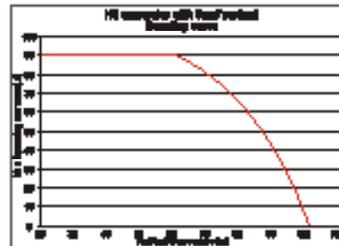
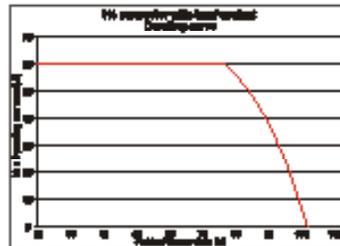
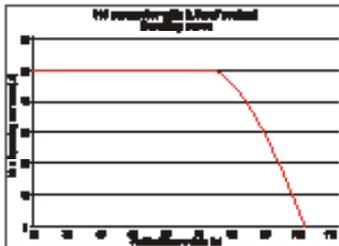


RADSOK® Contact

Technical Data	
Rated current	36A(2.5mm ² ,AWG14),45A(4.0mm ² ,AWG12),52A(6.0mm ² ,AWG10),60A(10.0mm ² ,AWG8)
Rated voltage	1000V (IEC/CE), 600V(UL)
Test voltage	6kV for 1 minute, 10kV/impulse (1.2/50µs)(IEC)
Typical contact resistance	0.25mΩ
Contact material	Copper, tin plated
Contact system	Mechanical contact carried with RADSOK® insert
Insulation material	PC
Locking mechanism	Snap-lock, special unlock tool required to re-use as required by NEC6006
Cable strain relief	Compression gland with ratcheting gland nut
Degree of protection	IP68 (1 meter, 1 hour) rated
Safety class	II (IEC61140)
Pollution degree	2 (IEC60664)
Overvoltage category	III (IEC60664)
Flame class	UL94-V0
Ambient temperature range	-40°C --- +90°C



Derating curves



How to order

1	2	3	4	5	6	7	8	
H	4	C	F	C	2	D	I	Variation
Product line	Product type	Product	Gender	Cable entry	Cable size	Approval	Package	
Helios solar line	H4 solar connector	C Connector P Protective cap Y Branch connector	F Female + (standard) M Male - (standard) P mated pair G female - N male +	C cable gland M bulkhead M12 N bulkhead M14 O over-mold	2 2.5mm ² (AWG14) 4 4.0mm ² (AWG12) 6 6.0mm ² (AWG10) 8 10.0mm ² (AWG8)	T TUV approved U UL approved D dual approval	I Single C Bulk pack, 100 purchase D Bulk pack, 500 purchase M Bulk pack, 1000 purchase N Bulk pack, 2000 purchase (default package)	

How to order assembly tools

Description	Ordering code
H4 Strip tool	H4TS0000
H4 Crimp Tool	H4TC0000
H4 Wrench Tool	H4TW0000
H4 Ring Tool	H4TR0000
H4 Universal Unlocking Tool	H4TU0000

Tooling part numbers



For further information on your individual application requirements contact: Amphenol Corporation

CSI#: 26 27 26 A1

PRODUCT SPECIFICATIONS / INFO



TWR15-W

UPC Code: 07847738184

Country of Origin: Mexico - **Eligible for AFRA funded projects > \$7,443,000*



**Disclaimer*

Description
15 Amp, 125 Volt, NEMA 5-15R, 2P, 3W, Duplex Receptacle, Tamper & Weather Resistant, Straight Blade, Industrial Grade, Self Grounding, Back & Side Wired, Nickel Plated Brass Strap – WHITE

Product Features

NEMA: 5-15R
Color: White

Color: White



NEMA: 5-15R



CSI#: 26 27 26 A1

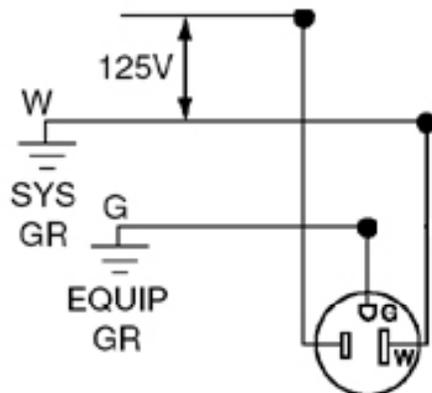
AC Horsepower Ratings	
At Rated Voltage	1/2 HP
Environmental Specifications	
Flammability	Rated V-2 per UL94
Operating Temperature	-40C to 60C
Mechanical Specifications	
Terminal ID	Brass-Hot, Green-Ground, Silver-Neutral
Terminal Accom.	14-10 AWG
Product ID	Rating permanently marked on device

Electrical Specifications	
Grounding	Self Grounding
Amperage	15 Amp
Voltage	125 Volt
NEMA	5-15R
Pole	2
Wire	3
Dielectric Voltage	Withstands 2000V per UL498
Current Limiting	Full Rated Current
Temperature Rise	Max 30C after 100 cycle OL at 150 percent rated current

Material Specifications	
Face Material	Nylon
Body Material	Nylon
Strap Material	Nickel Plated Brass
Line Contacts	Brass Triple-Wipe .040 Thick
Terminal Screws	Brass 10-32
Grounding Screw	Brass 8-32
Mounting Screws	Stainless Steel
Clamp Nuts	Zinc-Plated Steel
Ground Clips	Brass-Plated
Shutter Mechanism	Dakim® Acetal
Color	White

Standards and Certifications	
NEMA	WD-2 WD-6
ANSI	C-73
UL 498	File E13300
CSA C22.2 No. 42	File 152105
NCM	057
Warranty	2-Year Limited

Wiring Diagram



CSI#: 26 27 26 A2

PRODUCT SPECIFICATIONS / INFO

TWR20-W

UPC Code: 07847738185

Country of Origin: Mexico - **Eligible for AFRA funded projects > \$7,443,000*

LEVITON



**Disclaimer*

Description

20 Amp, 125 Volt, NEMA 5-20R, 2P, 3W, Duplex Receptacle, Tamper & Weather Resistant, Straight Blade, Industrial Grade, Self Grounding, Back & Side Wired, Nickel Plated Brass Strap – WHITE

Product Features

NEMA: 5-20R

Color: White

Color: White



NEMA: 5-20R



CSI#: 26 27 26 A2

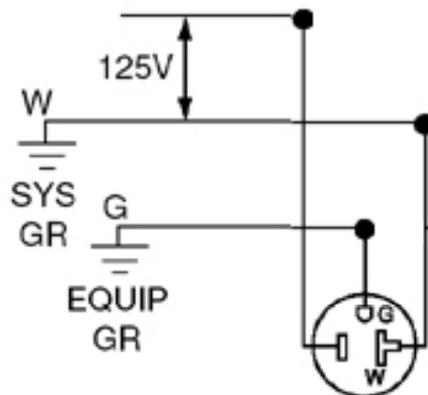
AC Horsepower Ratings	
At Rated Voltage	1 HP
Environmental Specifications	
Flammability	Rated V-2 per UL94
Operating Temperature	-40C to 60C
Mechanical Specifications	
Terminal ID	Brass-Hot, Green-Ground, Silver-Neutral
Terminal Accom.	14-10 AWG
Product ID	Rating permanently marked on device
Termination	Side

Electrical Specifications	
Grounding	Self Grounding
Amperage	20 Amp
Voltage	125 Volt
NEMA	5-20R
Pole	2
Wire	3
Dielectric Voltage	Withstands 2000V per UL498
Current Limiting	Full Rated Current
Temperature Rise	Max 30C after 100 cycle OL at 150 percent rated current

Material Specifications	
Face Material	Nylon
Body Material	Nylon
Strap Material	Nickel Plated Brass
Line Contacts	Brass Triple-Wipe .040 Thick
Terminal Screws	Brass 10-32
Grounding Screw	Brass 8-32
Mounting Screws	Stainless Steel
Clamp Nuts	Zinc-Plated Steel
Ground Clips	Brass-Plated
Shutter Mechanism	Dakim® Acetal
Color	White

Standards and Certifications	
NEMA	WD-2 WD-6
ANSI	C-73
UL 498	File E13300
CSA C22.2 No. 42	File 152105
NCM	057
Warranty	2-Year Limited

Wiring Diagram



PRODUCT SPECIFICATIONS / INFO



Color: Light Almond



NEMA: 5-20R



7899-T

UPC Code: 07847730832

Country of Origin: Please Contact Customer Service

Description

20 Amp, 125 Volt Receptacle, 20 Amp Feed-Through, Monochromatic, SmartLock Pro GFCI, back and side wired, nylon wallplate and screws included - Light Almond

Product Features

- Grounding: Green Ground Screw
- Feature: SmartLock, Buttons Match Face Color
- Amperage: 20 Amp
- Voltage: 125 Volt
- NEMA: 5-20R
- Pole: 2
- Wire: 3

Trip Level: Class A, 5mA plus or minus 1mA

Termination: Back & Side

Face Material: Thermoplastic Nylon

Body Material: Polycarbonate

Strap Material: Steel

Color: Light Almond

Standards and Certifications: UL/CSA

Warranty: 2-Year Limited

Notes: w/ Wallplate

Features and Benefits

- Automatically test the GFCI every time the RESET button is pushed in. The GFCI will not reset if the GFCI circuit is not functioning properly.
- By blocking reset of the GFCI if protection has been compromised, SmartLockPRO reduces the possibility of end-users incorrectly assuming that a reset GFCI outlet is providing ground fault protection when it actually is not.
- A line-load reversal diagnostic feature is provided which prevents the GFCI from being reset and stops power from being fed to the GFCI receptacle face or through to downstream devices. A green LED indicator on the GFCI's face also illuminates to alert the installer to the line-load wiring reversal.
- The trip latch mechanism in SmartLockPro GFCIs is a one piece "T" design for efficient operation.
- There are 4 sets of contacts for load terminals and face. SmartLockPRO GFCIs use a patented bifurcated bridge contact for efficient operation.
- Trip threshold meets or exceeds UL requirements for tripping time.
- Improved immunity to high-frequency noise reduces nuisance tripping.
- Advanced electronics design provides superior resistance to electrical surges and over-voltages.
- Expanded wiring options with nine back-wire holes. Two for each line and load connection plus one for ground with an internal clamp.
- Silver alloy contacts.
- Compatible with all Decora devices and wallplates; available in select Decora colors.

CSI#: 26 27 26 A3

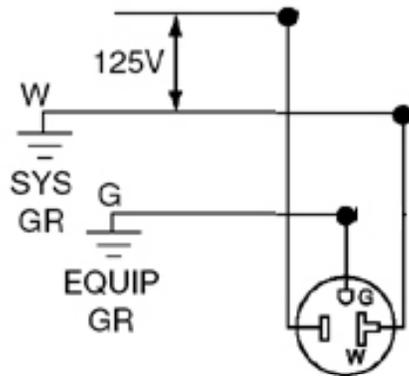
AC Horsepower Ratings	
At Rated Voltage	1 HP
Environmental Specifications	
Flammability	Rated V-2 per UL94
Operating Temperature	-35C to +60C
Mechanical Specifications	
Terminal ID	Brass-Hot, Green-Ground, Silver-Neutral
Terminal Accom.	14-10 AWG
Product ID	Partings are permanently marked on device

Electrical Specifications	
Dielectric Voltage	Withstands 2000V per UL498
Short Circuit Current Rating	10KA
Temperature Rise	Max 30C after 100 cycles OL at 150 percent rated current

Material Specifications	
Face Material	Thermoplastic Nylon
Body Material	Polycarbonate
Line Contacts	Brass Triple-Wipe
Terminal Screws	Plated Steel
Grounding Screw	Plated Steel
Yoke	Zinc-Plated Steel
Clamp Nuts	Zinc-Plated Steel
Notes	w/ Wallplate

Standards and Certifications	
NEMA	WD-B
ANSI	C-73
UL498	File E13300
CSA C22.2 No. 42	File LR-57811
NCM	057
UL 143	File E48300

Wiring Diagram



5-20R

SPECIFICATION SUBMITTAL

JOB NAME:	CATALOG NUMBERS:	
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JOB NUMBER:	<input type="text"/>	<input type="text"/>

CSI#: 26 27 26 A4

PRODUCT SPECIFICATIONS / INFO



Color: Brown



NEMA: 6-15R



5651

UPC Code: 07847713030

Country of Origin: United States - **Eligible for ARRA funded projects*

Description
15 Amp, 250 Volt, NEMA 6-15R, 2P, 3W, Industrial Series Heavy Duty Specification Grade, Single Receptacle, Straight Blade, Self Grounding, Side Wired, Steel Strip, - BROWN

Product Features

NEMA: 6-15R
Color: Brown



**Disclaimer*

CSI#: 26 27 26 A4

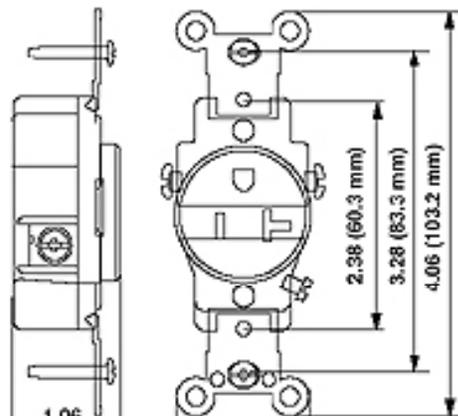
AC Horsepower Ratings	
At Rated Voltage	1-1/2 HP
Environmental Specifications	
Flammability	Rated V-2 per UL94
Operating Temperature	-40C to 60C
Mechanical Specifications	
Terminal ID	Brass-Hot, Green-Ground, Silver-Neutral
Terminal Accom.	14-10 AWG
Product ID	Ratings are permanently marked on device
Torque Range	14-18 inch pounds

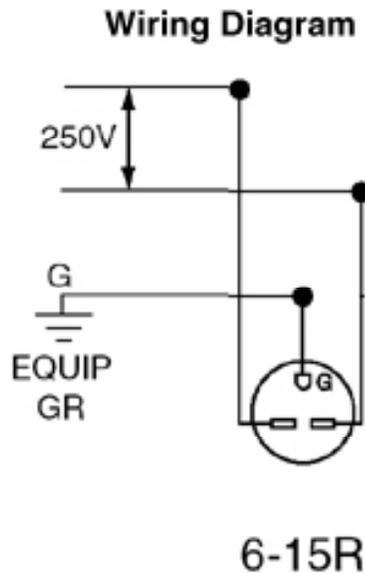
Electrical Specifications	
Grounding	Self Grounding
Amperage	15 Amp
Voltage	250 Volt
NEMA	B-15R
Pole	2
Wire	3
Dielectric Voltage	Withstands 2000V per UL498
Current Limiting	Full Rated Current
Temperature Rise	Max 30C after 250 cycle OL at 200 percent rated current

Material Specifications	
Face Material	Nylon
Body Material	Polypropylene
Line Contacts	Phosphor Bronze
Terminal Screws	Plated Brass
Grounding Screw	Plated Steel
Strap Material	Galvanized Steel with Riveted Ground Contacts
Clamp Nuts	Zinc-Plated Steel
Ground Clips	Brass
Color	Brown

Standards and Certifications	
NEMA	WD-B
ANSI	C-73
UL988	File E13309
UL Field Spec WC-598	File E13309
CSA C22.2 No. 42	File 152105
NCM	057
Warranty	10 Year Limited

Dimensional Diagram





SPECIFICATION SUBMITTAL

JOB NAME: <input style="width: 95%;" type="text"/>	CATALOG NUMBERS: <input style="width: 95%;" type="text"/>
JOB NUMBER: <input style="width: 95%;" type="text"/>	<input style="width: 95%;" type="text"/>

Leviton Manufacturing Co., Inc.
 201 North Service Road, Melville, NY 11747
 Telephone: 1-800-323-8920 · FAX: 1-800-832-9538 · Tech Line (8:30AM-7:30PM E.S.T. Monday-Friday): 1-800-824-3005

Leviton Manufacturing of Canada, Ltd.
 185 Hymus Boulevard, Pointe Claire, Quebec H9R 1E9 · Telephone: 1-800-489-7890 · FAX: 1-800-824-3005 · www.leviton.com/canada

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CSI#: 26 27 26 A5

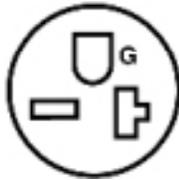
PRODUCT SPECIFICATIONS / INFO



Color: Brown



NEMA: 6-20R



5461

UPC Code: 07847748880

Country of Origin: United States - **Eligible for ARRA funded projects*

Description
20 Amp, 250 Volt, NEMA 6-20R, 2P, 3W, Industrial Series Heavy Duty Specification Grade, Single Receptacle, Straight Blade, Self Grounding, Back & Side Wired, Steel Strap - BROWN

Product Features

NEMA: 6-20R
Color: Brown



**Disclaimer*

CSI#: 26 27 26 A5

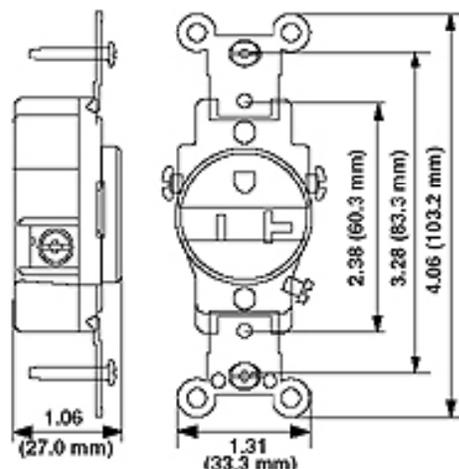
AC Horsepower Ratings	
At Rated Voltage	2 HP
Environmental Specifications	
Flammability	Rated V-2 per UL94
Operating Temperature	-40C to 60C
Mechanical Specifications	
Terminal ID	Brass-Hot, Green-Ground, Silver-Neutral
Terminal Accom.	14-10 AWG
Product ID	Ratings are permanently marked on device
Torque Range	14-18 inch pounds

Electrical Specifications	
Grounding	Self Grounding
Amperage	20 Amp
Voltage	250 Volt
NEMA	B-20R
Pole	2
Wire	3
Dielectric Voltage	Withstands 2000V per UL498
Current Limiting	Full Rated Current
Temperature Rise	Max 30C after 250 cycle OL at 200 percent rated current

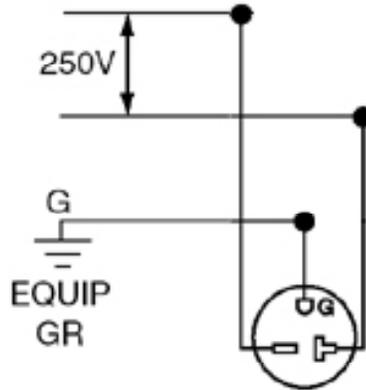
Material Specifications	
Face Material	Nylon
Body Material	Nylon
Line Contacts	Brass Triple-Wipe
Terminal Screws	Plated Brass
Grounding Screw	Plated Steel
Strap Material	Zinc-Plated Steel
Clamp Nuts	Galvanized Steel
Ground Clips	Brass
Color	Brown

Standards and Certifications	
NEMA	WD-B
ANSI	C-73
UL498	File E13300
UL Fail Spec WC-506	File E13300
CSA C22.2 No. 42	File 152105
NCM	057
Warranty	10 Year Limited

Dimensional Diagram



Wiring Diagram



6-20R

SPECIFICATION SUBMITTAL

JOB NAME: <input type="text"/>	CATALOG NUMBERS: <input type="text"/>	
JOB NUMBER: <input type="text"/>	<input type="text"/>	<input type="text"/>

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 201 North Service Road, Melville, NY 11747
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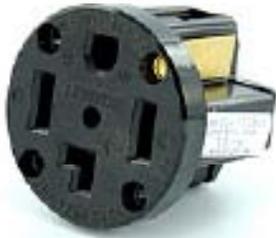


CSI#: 26 27 26 A6

PRODUCT SPECIFICATIONS / INFO



**Disclaimer*



278-PM

UPC Code: 07847732773

Country of Origin: Mexico - **Eligible for AFRA funded projects > \$7,443,000*

Description
30 Amp, 125/250 Volt, NEMA 14-30R, 3P, 4W, Panel Mtg Receptacle, Straight Blade, Industrial Grade, Grounding, . . Side Wired, Snap, - Black

Color: Black

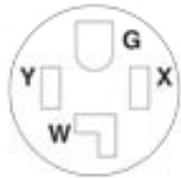


NEMA: 14-30R

Product Features

NEMA: 14-30R

Color: Black



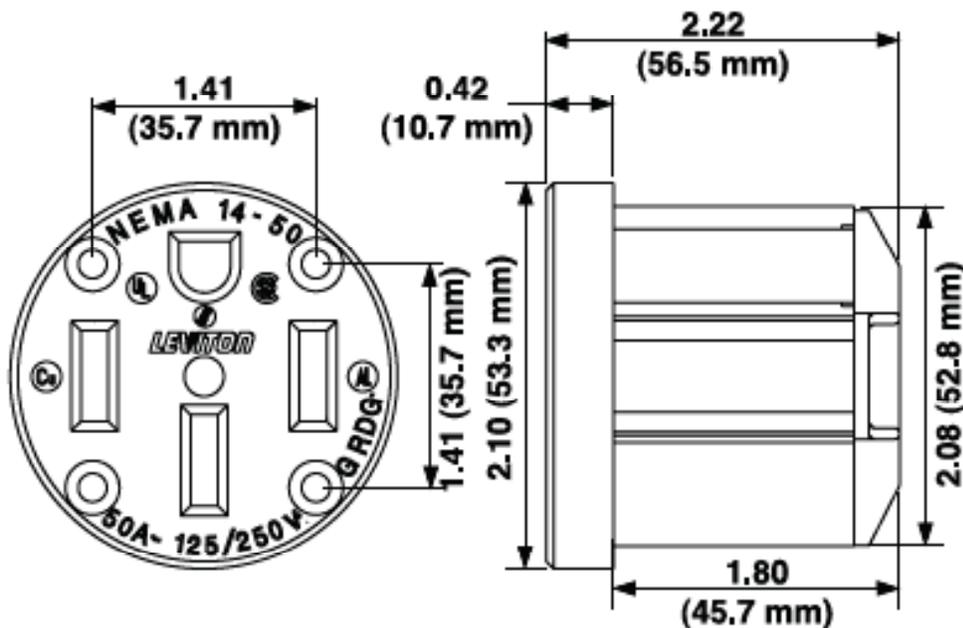
CSI#: 26 27 26 A6

AC Horsepower Ratings	
At Rated Voltage	2 HP
Environmental Specifications	
Flammability	Rated V-2 per UL94
Operating Temperature	-40C to 60C
Mechanical Specifications	
Terminal ID	Brass-Hot, Green-Ground, Silver-Neutral
Terminal Accom.	Up to 4 AWG
Product ID	Ratings are permanently marked on device

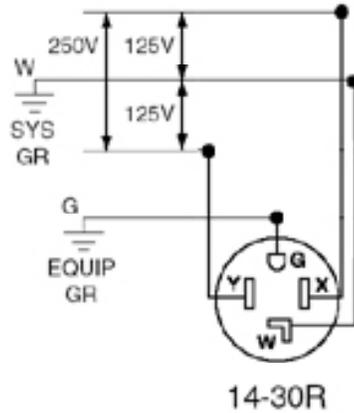
Electrical Specifications	
Grounding	Grounding
Amperage	30 Amp
Voltage	125/250 Volt
NEMA	14-30R
Pole	3
Wire	4
Dielectric Voltage	Withstands 2000V per UL498
Current Limiting	Full Rated Current
Temperature Rise	Max 30C after 50 cycle OL at 150 percent rated current

Material Specifications	
Face Material	Nylon
Body Material	Nylon
Line Contacts	Brass Double-Wipe
Strap Material	Galvanized Steel
Color	Black

Standards and Certifications	
NEMA	WD-B
ANSI	C-73
UL498	File E13309
CSA C22.2 No. 42	File 152105
NCM	057
Warranty	10 Year Limited



Wiring Diagram



SPECIFICATION SUBMITTAL

JOB NAME: <input type="text"/>	CATALOG NUMBERS: <input type="text"/>
JOB NUMBER: <input type="text"/>	<input type="text"/>

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CSI#: 26 28 16 B1

Product Data Sheet

QO115

Miniature Circuit Breaker (QO) Standard, 15A,
1-Pole, 120/240 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$29.10 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Approvals	UL Listed - CSA Certified
Circuit Breaker Type	Standard
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
Ampere Rating	15A
Features	VISI-TRIP trip Indication
HACR Rated	Yes
General Application	Provides overload and short circuit protection
Wire Size	#14 to #8 AWG(Al/Cu)
Phase	1-Phase
Height	3.00 inches
Width	0.75 inches
Marketing Trade Name	QO
Short Circuit Current Rating	10kA
Depth	2.91 inches
Voltage Rating	120/240VAC
Space Required	1
Switching Duty Rated	Yes
Mounting Type	Plug-On
Terminal Type	Pressure Plate
Number of Poles	1-Pole
Type	QO

Shipping and Ordering

Category	00004 - Circuit Breakers, 1 Pole: 10 - 30 Amp, 2 Pole: 10 - 60 Amp, Type QO & QOT
Discount Schedule	DE2A
GTIN	00785901400066
Package Quantity	10
Weight	0.27 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.

Product Data Sheet

QO115AFI

Miniature Circuit Breaker (QO-AFI) ARC-Fault, 15A, 1-Pole, 120 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$240.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Approvals	UL Listed - CSA Certified
Circuit Breaker Type	ARC-Fault
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
Ampere Rating	15A
Features	VISI-TRIP trip indication
HACR Rated	Yes
General Application	Provides overload and short circuit protection
Specific Application	Designed to detect arc faults
Wire Size	#12 to #8 AWG(Al) - #14 to #8 AWG(Cu)
Phase	1-Phase
Height	3.00 Inches
Width	0.75 Inches
Marketing Trade Name	QO
Short Circuit Current Rating	10kA
Depth	2.91 Inches
Voltage Rating	120VAC
Space Required	1
Mounting Type	Plug-On
Terminal Type	Pressure Plate
Number of Poles	1-Pole
Type	QO-AFI

Shipping and Ordering

Category	06303 - Circuit Breakers, Arc Fault, 1 Pole: 15-20 Amp, Type QO
Discount Schedule	DE2A
GTIN	00785901301295
Package Quantity	1
Weight	0.55 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.

Product Data Sheet

QO120

Miniature Circuit Breaker (QO) Standard, 20A,
1-Pole, 120/240 Vac, 1-Phase, 10kA



List Price \$29.10 USD

Availability **Stock Item:** This item is normally stocked in our distribution facility.

Technical Characteristics

Approvals	UL Listed - CSA Certified
Circuit Breaker Type	Standard
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
Ampere Rating	20A
Features	VISI-TRIP trip indication
HACR Rated	Yes
General Application	Provides overload and short circuit protection
Type	QO
Number of Poles	1-Pole
Wire Size	#14 to #8 AWG(Al/Cu)
Phase	1-Phase
Height	3.00 Inches
Width	0.75 Inches
Marketing Trade Name	QO
Short Circuit Current Rating	10kA
Depth	2.91 Inches
Voltage Rating	120/240VAC
Space Required	1
Switching Duty Rated	Yes
Mounting Type	Plug-On
Terminal Type	Pressure Plate

Shipping and Ordering

Category	00004 - Circuit Breakers, 1 Pole: 10 - 30 Amp, 2 Pole: 10 - 60 Amp, Type QO & QOT
Discount Schedule	DE2A
GTIN	00785901400103
Package Quantity	1
Weight	0.28 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.

Product Data Sheet

QO120AFI

Miniature Circuit Breaker (QO-AFI) ARC-Fault, 20A, 1-Pole, 120 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$240.00 USD

Availability Stock item: This item is normally stocked in our distribution facility.

Technical Characteristics

Approvals	UL Listed - CSA Certified
Circuit Breaker Type	ARC-Fault
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
Ampere Rating	20A
Features	VISI-TRIP trip indication
HACR Rated	Yes
General Application	Provides overload and short circuit protection
Specific Application	Designed to detect arc faults
Type	QO-AFI
Number of Poles	1-Pole
Wire Size	#12 to #8 AWG(Al) - #14 to #8 AWG(Cu)
Phase	1-Phase
Height	3.00 inches
Width	0.75 inches
Marketing Trade Name	QO
Depth	2.91 inches
Short Circuit Current Rating	10kA
Voltage Rating	120VAC
Space Required	1
Mounting Type	Plug-On
Terminal Type	Pressure Plate

Shipping and Ordering

Category	06303 - Circuit Breakers, Arc Fault, 1 Pole: 15-20 Amp, Type QO
Discount Schedule	DE2A
GTIN	00785901301301
Package Quantity	1
Weight	0.55 lbs.
Availability Code	Stock item: This item is normally stocked in our distribution facility.



CSI#: 26 28 16 B5

Product Data Sheet

QO215

Miniature Circuit Breaker (QO) Standard, 15A,
2-Pole, 120/240 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$67.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Circuit Breaker Type	Standard
Features	VISI-TRIP trip indication
Ampere Rating	15A
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
General Application	Provides overload and short circuit protection
HACR Rated	Yes
Marketing Trade Name	QO
Approvals	UL Listed - CSA Certified
Wire Size	#14 to #8 AWG(Al/Cu)
Phase	1-Phase
Depth	2.91 inches
Short Circuit Current Rating	10kA
Voltage Rating	120/240VAC
Width	1.50 inches
Space Required	2
Mounting Type	Plug-On
Terminal Type	Pressure Plate
Height	3.00 inches
Number of Poles	2-Pole
Type	QO

Shipping and Ordering

Category	00004 - Circuit Breakers, 1 Pole: 10 - 30 Amp, 2 Pole: 10 - 60 Amp, Type QO & QOT
Discount Schedule	DE2A
GTIN	00785901400301
Package Quantity	1
Weight	0.52 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y

Product Data Sheet

QO220

Miniature Circuit Breaker (QO) Standard, 20A,
2-Pole, 120/240 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$67.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Circuit Breaker Type	Standard
Features	VISI-TRIP trip indication
Ampere Rating	20A
General Application	Provides overload and short circuit protection
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
HACR Rated	Yes
Marketing Trade Name	QO
Approvals	UL Listed - CSA Certified
Wire Size	#14 to #8 AWG(Al/Cu)
Depth	2.91 inches
Phase	1-Phase
Short Circuit Current Rating	10kA
Voltage Rating	120/240VAC
Space Required	2
Mounting Type	Plug-On
Terminal Type	Pressure Plate
Height	3.00 inches
Width	1.50 inches
Number of Poles	2-Pole
Type	QO

Shipping and Ordering

Category	00004 - Circuit Breakers, 1 Pole: 10 - 30 Amp, 2 Pole: 10 - 60 Amp, Type QO & QOT
Discount Schedule	DE2A
GTIN	00785901400363
Package Quantity	1
Weight	0.53 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y

Product Data Sheet

QO230

Miniature Circuit Breaker (QO) Standard, 30A,
2-Pole, 120/240 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$67.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Circuit Breaker Type	Standard
Features	VISI-TRIP trip indication
Ampere Rating	30A
General Application	Provides overload and short circuit protection
For Use With	QO Load Centers, NQ & NQOD Panelboards/interiors and Speed-D switchboard distribution panels
HACR Rated	Yes
Approvals	UL Listed - CSA Certified
Wire Size	#14 to #8 AWG(Al/Cu)
Depth	2.91 Inches
Phase	1-Phase
Height	3.00 Inches
Marketing Trade Name	QO
Short Circuit Current Rating	10kA
Voltage Rating	120/240VAC
Space Required	2
Mounting Type	Plug-On
Terminal Type	Pressure Plate
Width	1.50 Inches
Number of Poles	2-Pole
Type	QO

Shipping and Ordering

Category	00004 - Circuit Breakers, 1 Pole: 10 - 30 Amp, 2 Pole: 10 - 60 Amp, Type QO & QOT
Discount Schedule	DE2A
GTIN	00785901400424
Package Quantity	1
Weight	0.53 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y

CSI#: 26 28 16 B8

Product Data Sheet

QO240

Miniature Circuit Breaker (QO) Standard, 40A,
2-Pole, 120/240 Vac, 1-Phase, 10kA



by Schneider Electric

List Price \$67.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Circuit Breaker Type	Standard
Features	VISI-TRIP trip Indication
Ampere Rating	40A
For Use With	QO Load Centers, NQ & NQOD Panelboards/Interiors and Speed-D switchboard distribution panels
General Application	Provides overload and short circuit protection
HACR Rated	Yes
Approvals	UL Listed - CSA Certified
Wire Size	#8 to #2 AWG(Al/Cu)
Depth	2.91 Inches
Phase	1-Phase
Height	3.12 Inches
Marketing Trade Name	QO
Short Circuit Current Rating	10kA
Voltage Rating	120/240VAC
Space Required	2
Mounting Type	Plug-On
Terminal Type	Box Lugs
Width	1.50 Inches
Number of Poles	2-Pole
Type	QO

Shipping and Ordering

Category	00004 - Circuit Breakers, 1 Pole: 10 - 30 Amp, 2 Pole: 10 - 60 Amp, Type QO & QOT
Discount Schedule	DE2A
GTIN	00785901400486
Package Quantity	1
Weight	0.57 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y

Product Data Sheet

QOM2150VH

Miniature Circuit Breaker (QOM2) Standard, 150A, 2-Pole, 240VAC, 1-Phase, 22kA



by Schneider Electric

List Price \$468.00 USD

Availability Stock item: This item is normally stocked in our distribution facility.

Technical Characteristics

General Application	Load Center Main Breaker
Approvals	UL Listed - CSA Certified
Circuit Breaker Type	Standard
For Use With	QO and Homeline Load Centers
Voltage Rating	240VAC
Mounting Type	Bolt-On
Number of Poles	2-Pole
Ampere Rating	150A
Short Circuit Current Rating	22kA
Terminal Type	Box Lugs
Type	QOM2
Wire Size	#4-300AWG/kcmil(Al/Cu)
Depth	3.60 inches
Height	5.60 inches
Width	5.07 inches
Phase	1-Phase

Shipping and Ordering

Category	00100 - Circuit Breakers, Main, Type QOM-VH
Discount Schedule	DE3A
GTIN	00785901004059
Package Quantity	1
Weight	2.6 lbs.
Availability Code	Stock item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	US

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

3110DHD4D1RM410
 DGZ810
 Lexington, KY, USA

Data Bulletin

Replaces 3110DHD4D1RM505 11/2009

Direct Current and Photovoltaic Systems

Applying Heavy Duty Safety Switches (Fusible and Non-Fusible) on dc and Photovoltaic Systems

Retain for future use.

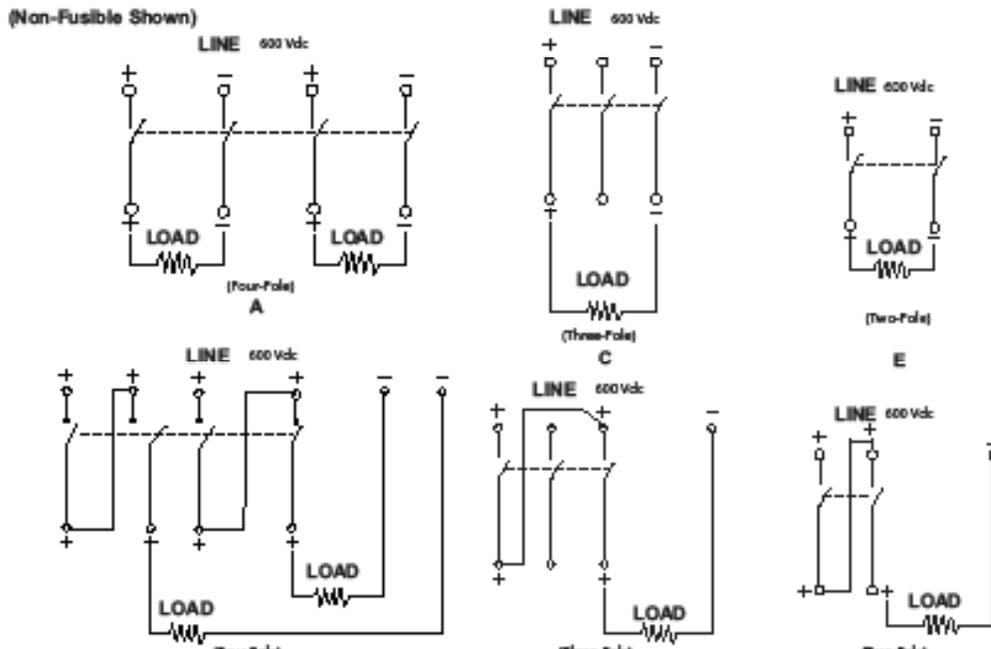
General dc and Photovoltaic Systems, UL® Listed, CSA® Certified (Files E2875 and E154282)

NOTE: Heavy duty safety switches may be used on photovoltaic systems with a grounded feed. Refer to Figures 1B, 1D, 1F and 2 (negative grounding shown; positive grounded systems are similarly allowed). For ungrounded systems, see National Electrical Code® (NEC®) 690.35 (NEC 2008, NFPA 70).

All heavy duty safety switches with dc ratings (2-, 3- and 4-pole fusible and non-fusible) are Underwriters Laboratories® (UL®) Listed and CSA® Certified for use on dc applications when wired as shown in Figure 1 (A, B, C, D, E, and F). Additionally:

- Heavy duty safety switches are rated for 600 Vdc maximum open circuit voltage.
- Non-fusible safety switches may carry 100 percent of the nameplate current rating.
- Fusible safety switches may carry 80 percent of nameplate current rating (continuous use).
- Heavy duty safety switches are dc horsepower rated as indicated on the safety switch wiring diagram.
- Heavy duty safety switches have a 10,000 ampere dc short-circuit rating at 600 Vdc unless otherwise stated on the switch wiring diagram. Consult factory for short circuit current ratings at 250 Vdc.
- Refer to current Square D® Digest for lug wire range of heavy duty safety switches.
- Photovoltaic systems using ungrounded arrays must use two poles of the disconnect as shown in Figure 1 (A, C, and E) where one pole is placed in each of the two ungrounded conductors.
- Applications 1A, 1C, and 1E (see Figure 1) are for ungrounded photovoltaic arrays only.

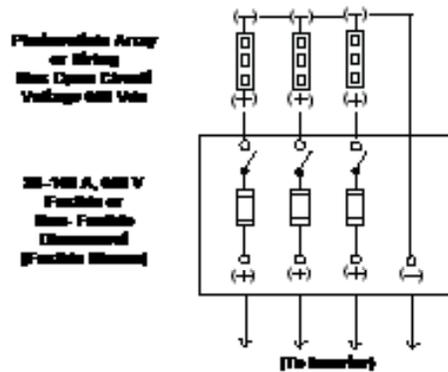
Figure 1: General dc and Photovoltaic Systems, Fusible and Non-Fusible Wiring Diagram



Alternate Photovoltaic System Wiring, Evaluated and Self-Certified by Schneider Electric

Not UL Listed

Figure 2: Grounded Feed per NEC® Article 690



- These photovoltaic connections are to be used only with grounded photovoltaic systems where the grounded conductor-to-ground bond is made inside the inverter by the dc ground-fault protection system. Do not duplicate this existing bond in the field.
- Positive grounded systems are similarly allowed.
- For ungrounded systems, see NEC 690.35 (NEC2008, NFPA70).

Current Ratings

Non-Fusible			
Catalog Number	Switch Maximum 600 V	Switch dc Rating per Pole †	Photovoltaic Short-Circuit Current (I _{sc})
NOTE: The non-fusible disconnect is rated for carrying 100% of the load current, which makes the rated current 1.25 x I _{sc} .			
HLE61	30 A	20 A	16 A (200.25)
HLE62	60 A	60 A	48 A (600.25)
HLE63	100 A	100 A	80 A (1000.25)

† The switch per pole rating is I_{sc} multiplied by 125%.

‡ The switch per pole rating must be at least the photovoltaic maximum circuit current multiplied by 125%.

§ From NEC 2008 and NFPA 70, Article 690.8: the photovoltaic maximum circuit current is I_{sc} multiplied by 125%.

- If a non-fusible disconnect is used, the inverter must not be capable of backfeeding currents into a short circuit or fault in the photovoltaic array or string.
- If a fusible disconnect is used, 600 Vdc rated fuses may be required.
- One inverter may be connected to each pole of the switch.
- Refer to the current Square D Digest for lug wire range of heavy duty safety switches.

Fusible				
Catalog Number	Switch Maximum 600 V	Switch dc Rating per Pole †	Photovoltaic Maximum Circuit Current ‡	Photovoltaic Short-Circuit Current (I _{sc})
NOTE: Fusible disconnects since the time used be rated: 1.25 x 1.25 x I _{sc} = 1.56 x I _{sc}				
H361	30 A	20 A	16 A dc per pole	12.8 A (200.56)
H362	60 A	60 A	48 A dc per pole	38 A (600.56)
H363	100 A	100 A	80 A dc per pole	64 A (1000.56)

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Lexington, KY 40511 USA
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The Mark 70-10V series of dimmable electronic ballasts offer maximum versatility by incorporating separate control leads for use with a wide array of controllers, including occupancy sensors, daylight harvesting controls, and building management systems from more than 30 manufacturers.

When paired with linear fluorescent and 4-pin compact fluorescent lamps, these ballasts optimize the benefits of such popular sustainable lighting techniques as daylight harvesting, occupancy sensors, and load shedding to satisfy the need for an affordable, flexible and versatile controllable lighting solution. Newer CFL models provide operation for up to six lamp types from any line voltage. This flexibility is achieved through design breakthroughs, such as lamp recognition — the ability to “sense” and operate the lamp at optimal performance.

These ballasts are ideal for such applications as conference rooms, auditoriums, educational facilities, hotels, restaurants, and department stores as well as other new construction or retrofit installations where dimming is desired.

In addition, the 0-10V DC operation of the ballast reduces the number of controls required and allows for a single control to operate across multiple branch circuits. For a complete list of compatible controls, visit www.philips.com/advance.

Full range continuous dimming

- Provides task appropriate comfort only where necessary to increase potential energy savings while supporting LEED performance standards

Independent Light Operation (4-Lamp Tri-Only)

- Helps reduce maintenance costs as more lamps remain on when lamps reach end-of-life minimizing wasteful re-lamping

Programmable start operation

- Potentially extends lamp life in frequent switching applications such as occupancy sensors and daylight harvesting

PHILIPS
ADVANCE

For 36-80W FTS Lamps

No. of Lamps	Input Volts	Starting Method	Ballast Family	Catalog Number	Max/Min		Full Light Output		Min. Starting Temp (F/C)	Dim.	Wiring Diagram
					Input Power ANSI (Watts)	Ballast Factor	THD %	Line Current (Amps)			
FT36W/2G11 - 36/39W Long Twin Tube Lamp (PL-L36W, F39B2/RS, FT36DL)											
2	120-277	PS	Mark 7 0-10V	I2T-2TTS40-SC	75/16	1.00/0.83	10	0.64-0.27	50/10	B	59A
FT48W/2G11/RS - 48W Long Twin Tube Lamp (PL-L48W, F48B2, FT48DL/RS)											
2	120-277	PS	Mark 7 0-10V	I2T-2TTS40-SC	76/16	1.00/0.83	10	0.64-0.28	50/10	B	59A
FT65W/2G11 - 65W Long Twin Tube Lamp (PL-L65W, F65B2, FT65DL)											
1	120	PS	Mark 7 0-10V	R2T-154	59/13	0.90/0.83	10	0.50	50/10	D	59A
	277			Y2T-154				0.22			
2	120	PS	Mark 7 0-10V	R2T-2554	114/24	0.90/0.83	10	0.96	50/10	D	59A
	277			Y2T-2554				0.42			
FT80W/2G11 - 80W Long Twin Tube Lamp (PL-L80W, FT80DL)											
1	120-277	PS	Mark 7 0-10V	I2T-180-D*	86/16	1.00/0.83	10	0.73-0.30	50/10	D	59A

*Ballast wiring points to connectors can accept wire gauge AWG 14-20.

Some lamp manufacturers recommend burning in new lamps. HB hours at full light output prior to dimming. Consult lamp manufacturer.

*Consult factory for availability. Current specifications are subject to change please contact your local sales representative for further details.

For 14W-28W T5 Lamps

No. of Lamps	Input Volts	Starting Method	Ballast Family	Catalog Number	Max/Min		Full Light Output		Min. Starting Temp (F/C)	Dim.	Wiring Diagram
					Input Power ANSI (Watts)	Ballast Factor	THD %	Line Current (Amps)			
F14T5 (14W)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	19/6	1.00/0.83	10	0.15-0.07	50/10	D	55B
				I2T-2528-D*	34/9			0.29-0.12			56B
F21T5 (21W)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	25/6	1.00/0.83	10	0.20-0.09	50/10	D	55B
				I2T-2528-D*	49/10			0.42-0.18			56B
F28T5 (28W/RS)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	30/7	1.00/0.83	10	0.25-0.11	50/10	D	55B
				I2T-2528-D*	59/12			0.51-0.21			56B
F28T5 (28W)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	32/7	1.00/0.83	10	0.27-0.12	50/10	D	55B
				I2T-2528-D*	63/12			0.57-0.22			56B

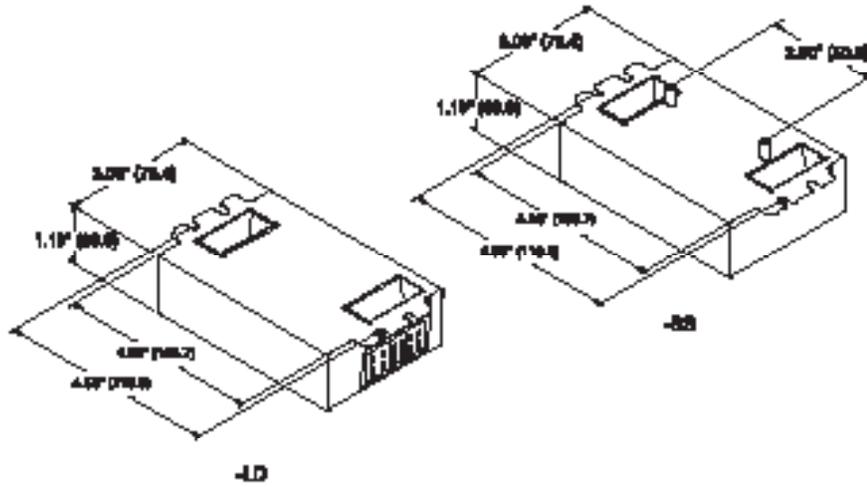
*Ballast wiring points to connectors can accept wire gauge AWG 14-20.

Some lamp manufacturers recommend burning in new lamps. HB hours at full light output prior to dimming. Consult lamp manufacturer.

*Consult factory for availability. Current specifications are subject to change please contact your local sales representative for further details.

CSI#: 26 51 00 B2

Dimensions



Size 5 Enclosure

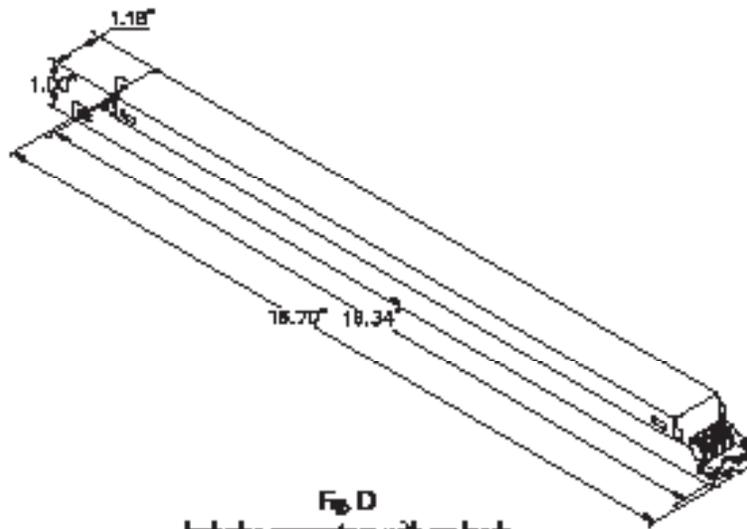
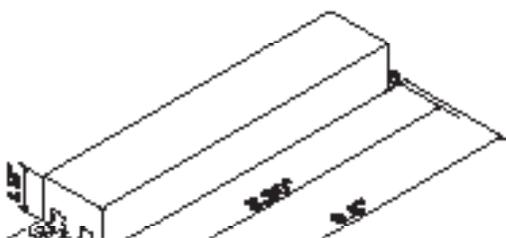


Fig. D
Includes connectors with no leads



Wiring Diagrams

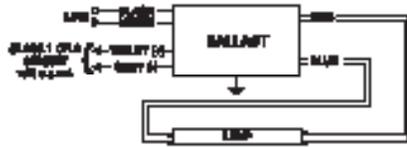


Diagram 55A

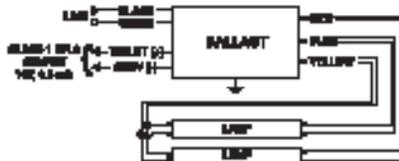


Diagram 56A

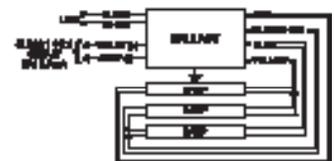


Diagram 57A

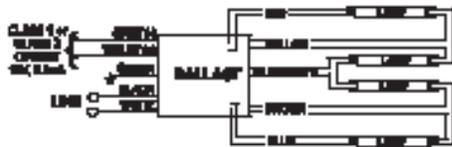


Diagram 16A

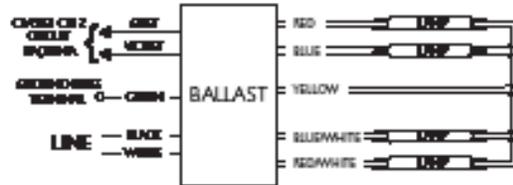


Diagram 174

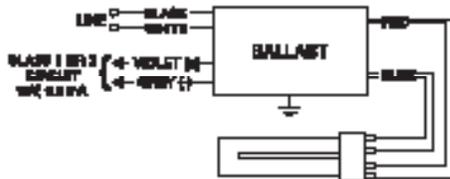


Diagram 58A

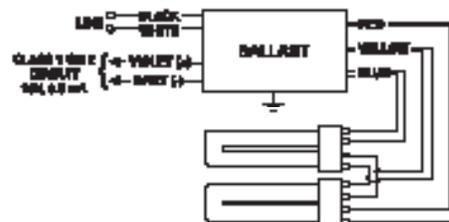


Diagram 59A



Ballast Specification

Section I - Physical Characteristics

- 1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.
- 1.2 Ballast shall be available in a plastic/metal can or all metal can construction to meet all plenum requirements.
- 1.3 Ballast shall be provided with poke-in wire trap connectors or integral leads color coded per ANSI C82.11.

Section II - Performance Requirements

- 2.1 Ballast shall be Programmed Start.
- 2.2 Model VZT-4PSP2-G shall provide Independent Lamp Operation (ILO) allowing remaining lamp(s) to maintain full light output when one or more lamps fail.
- 2.3 Ballast shall be provided with integral protection circuitry to withstand connection of low voltage control leads to mains power supply. In this event, ballast shall default to minimum light output.
- 2.4 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
- 2.5 Ballast shall operate from 50/60Hz input source of 120V or 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast. IntelliVolt models shall operate from 50/60Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.
- 2.6 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42kHz to avoid interference with infrared devices and eliminate visible flicker.
- 2.7 Ballast shall have a Power Factor greater than 0.98 at full light output and greater than 0.90 throughout the dimming range for primary lamp.
- 2.8 Ballast shall have a minimum ballast factor of _____ at maximum light output and _____ at minimum light output for primary lamp.
- 2.9 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less throughout the dimming range in accordance with lamp manufacturer recommendations.
- 2.10 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.
- 2.11 Ballast shall have a Class A sound rating.

- 2.12 Ballast shall have a minimum starting temperature of 10° C (50° F) for primary lamp.
- 2.13 Ballast shall provide Lamp EOL Protection Circuit for all T5, T5/HO, and CFL lamps.
- 2.14 Ballast shall control lamp light output from 100% - 3% relative light output for T8 and CFL lamps (PSP Model 100% to 10%) and 100% - 1% relative light output for T5/HO lamps.
- 2.15 Ballast shall ignite the lamps at any light output setting without first going to another output setting.
- 2.16 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

- 3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).
- 3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.
- 3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.
- 3.4 Ballast shall comply with ANSI C82.11 where applicable.
- 3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

- 4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.
- 4.2 Ballast shall carry a _____ limited warranty from date of manufacture against defects in material or workmanship. This warranty is conditioned upon operation at a maximum case temperature of _____, among other items. (Go to our website for up-to-date warranty information, www.phillips.com/advancewarranty).
- 4.3 Manufacturer shall have a twenty year history of producing electronic ballasts for the North American market.
- 4.4 Ballast shall be controlled by a Class 1 or Class 2 low voltage 0-10VDC controller.
- 4.5 Ballast shall be Philips Advance part # _____ or approved equal.



Maximum dimming versatility

Philips Advance Mark 70-10V dimming ballasts provide maximum versatility with low voltage dimming

The Mark 70-10V series of dimmable electronic ballasts offer maximum versatility by incorporating separate control leads for use with a wide array of controllers, including occupancy sensors, daylight harvesting controls, and building management systems from more than 30 manufacturers.

When paired with linear fluorescent and 4-pin compact fluorescent lamps, these ballasts optimize the benefits of such popular sustainable lighting techniques as daylight harvesting, occupancy sensors, and load shedding to satisfy the need for an affordable, flexible and versatile controllable lighting solution. Newer CFL models provide operation for up to six lamp types from any line voltage. This flexibility is achieved through design breakthroughs, such as lamp recognition — the ability to “sense” and operate the lamp at optimal performance.

These ballasts are ideal for such applications as conference rooms, auditoriums, educational facilities, hotels, restaurants, and department stores as well as other new construction or retrofit installations where dimming is desired.

In addition, the 0-10V DC operation of the ballast reduces the number of controls required and allows for a single control to operate across multiple branch circuits. For a complete list of compatible controls, visit www.philips.com/advance.

Full range continuous dimming

- Provides task appropriate comfort only where necessary to increase potential energy savings while supporting LEED performance standards

Independent Light Operation (4-Lamp Tri-Only)

- Helps reduce maintenance costs as more lamps remain on when lamps reach end-of-life minimizing wasteful re-lamping

Programmed start operation

- Potentially extends lamp life in frequent switching applications such as occupancy sensors and daylight harvesting

**PHILIPS
ADVANCE**

For 36-80W FTS Lamps

No. of Lamps	Input Volts	Starting Method	Ballast Family	Catalog Number	Max/Min		Full Light Output		Min. Starting Temp (F/C)	Dim.	Wiring Diagram
					Input Power ANSI (Watts)	Ballast Factor	THD %	Line Current (Amps)			
FT36W/2G11 - 36/39W Long Twin Tube Lamp (PL-L36W, F39B2/RS, FT36DL)											
2	120-277	PS	Mark 7 0-10V	I2T-2TTS40-SC	75/16	1.00/0.83	10	0.64-0.27	50/10	B	59A
FT48W/2G11/RS - 48W Long Twin Tube Lamp (PL-L48W, F48B2, FT40DL/RS)											
2	120-277	PS	Mark 7 0-10V	I2T-2TTS40-SC	76/16	1.00/0.83	10	0.64-0.28	50/10	B	59A
FT65W/2G11 - 65W Long Twin Tube Lamp (PL-L65W, F65B2, FT65DL)											
1	120	PS	Mark 7 0-10V	R2T-154	59/13	0.90/0.83	10	0.50	50/10	D	59A
	277			Y2T-154				0.22			
2	120	PS	Mark 7 0-10V	R2T-2554	114/24	0.90/0.83	10	0.96	50/10	D	59A
	277			Y2T-2554				0.42			
FT80W/2G11 - 80W Long Twin Tube Lamp (PL-L80W, FT80DL)											
1	127-277	PS	Mark 7 0-10V	I2T-180-D*	86/16	1.00/0.83	10	0.73-0.30	50/10	D	59A

*Ballast wiring points to connectors can accept wire gauge AWG 14-20.

Some lamp manufacturers recommend burning in new lamps. HP hours at full light output prior to dimming. Consult lamp manufacturer.

*Consult factory for availability. Current specifications are subject to change please contact your local sales representative for further details.

For 14W-28W T5 Lamps

No. of Lamps	Input Volts	Starting Method	Ballast Family	Catalog Number	Max/Min		Full Light Output		Min. Starting Temp (F/C)	Dim.	Wiring Diagram
					Input Power ANSI (Watts)	Ballast Factor	THD %	Line Current (Amps)			
F14T5 (14W)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	19/6	1.00/0.83	10	0.15-0.07	50/10	D	55B
				I2T-2S28-D*	34/9			0.29-0.12			56B
F21T5 (21W)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	25/6	1.00/0.83	10	0.20-0.09	50/10	D	55B
				I2T-2S28-D*	49/10			0.42-0.18			56B
F28T5 (28W/35)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	30/7	1.00/0.83	10	0.25-0.11	50/10	D	55B
				I2T-2S28-D*	59/12			0.51-0.21			56B
F35T5 (35W)											
1	120-277	PS	Mark 7 0-10V	I2T-128-D*	32/7	1.00/0.83	10	0.27-0.12	50/10	D	55B
				I2T-2S28-D*	63/12			0.57-0.22			56B

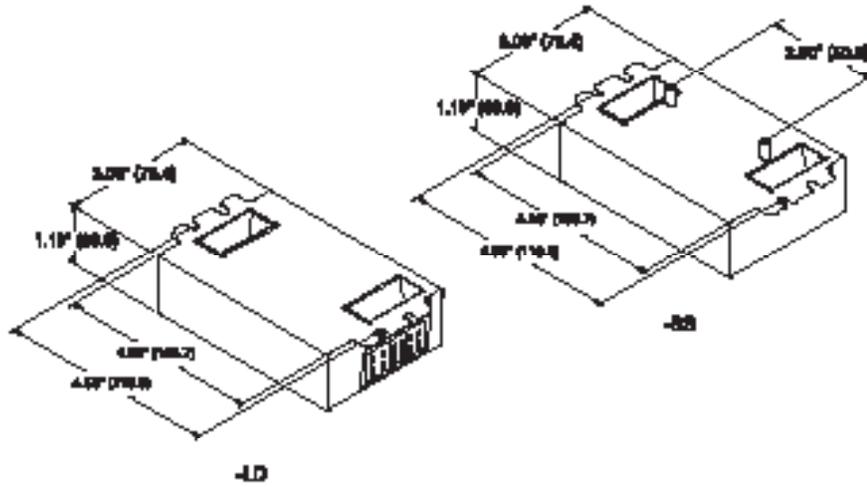
*Ballast wiring points to connectors can accept wire gauge AWG 14-20.

Some lamp manufacturers recommend burning in new lamps. HP hours at full light output prior to dimming. Consult lamp manufacturer.

*Consult factory for availability. Current specifications are subject to change please contact your local sales representative for further details.

CSI#: 26 51 00 B2

Dimensions



Size 5 Enclosure

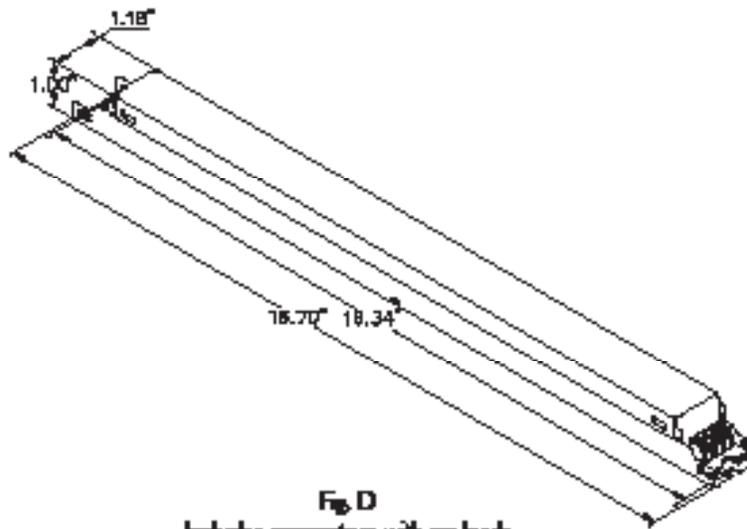
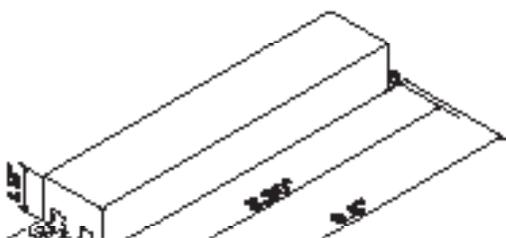


Fig. D
Includes connectors with no leads



Wiring Diagrams

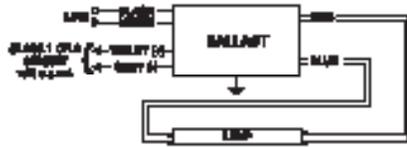


Diagram 55A

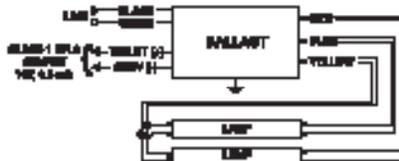


Diagram 56A

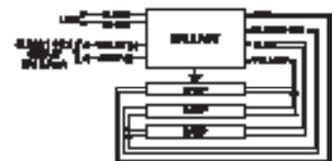


Diagram 57A

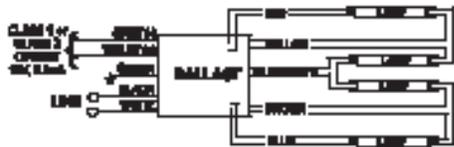


Diagram 16A

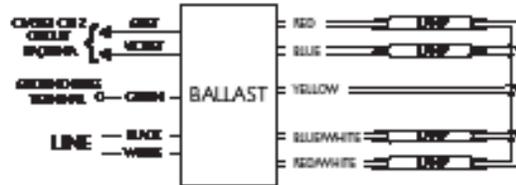


Diagram 174

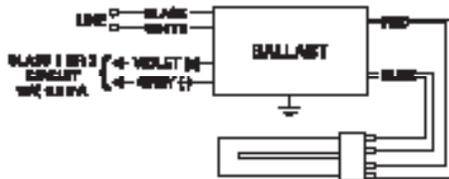


Diagram 58A

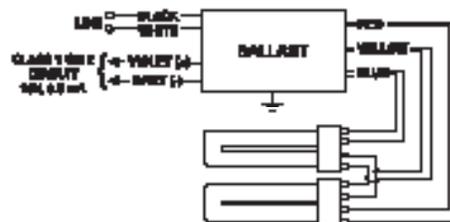


Diagram 57A



Ballast Specification

Section I - Physical Characteristics

- 1.1 Ballast shall be physically interchangeable with standard electromagnetic or standard electronic ballasts, where applicable.
- 1.2 Ballast shall be available in a plastic/metal can or all metal can construction to meet all plenum requirements.
- 1.3 Ballast shall be provided with poke-in wire trap connectors or integral leads color coded per ANSI C82.11.

Section II - Performance Requirements

- 2.1 Ballast shall be Programmed Start.
- 2.2 Model VZT-4PSP2-G shall provide Independent Lamp Operation (ILO) allowing remaining lamp(s) to maintain full light output when one or more lamps fail.
- 2.3 Ballast shall be provided with integral protection circuitry to withstand connection of low voltage control leads to mains power supply. In this event, ballast shall default to maximum light output.
- 2.4 Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
- 2.5 Ballast shall operate from 50/60Hz input source of 120V or 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast. IntelliVolt models shall operate from 50/60Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast.
- 2.6 Ballast shall be high frequency electronic type and operate lamps at a frequency above 42kHz to avoid interference with infrared devices and eliminate visible flicker.
- 2.7 Ballast shall have a Power Factor greater than 0.98 at full light output and greater than 0.90 throughout the dimming range for primary lamp.
- 2.8 Ballast shall have a minimum ballast factor of _____ at maximum light output and _____ at minimum light output for primary lamp.
- 2.9 Ballast shall provide for a Lamp Current Crest Factor of 1.7 or less throughout the dimming range in accordance with lamp manufacturer recommendations.
- 2.10 Ballast input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.
- 2.11 Ballast shall have a Class A sound rating.

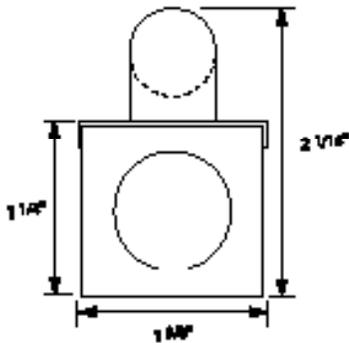
- 2.12 Ballast shall have a minimum starting temperature of 10° C (50° F) for primary lamp.
- 2.13 Ballast shall provide Lamp EOL Protection Circuit for all T5, T5/HO, and CFL lamps.
- 2.14 Ballast shall control lamp light output from 100% - 3% relative light output for T8 and CFL lamps (PSP Model 100% to 10%) and 100% - 1% relative light output for T5/HO lamps.
- 2.15 Ballast shall ignite the lamps at any light output setting without first going to another output setting.
- 2.16 Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.

Section III - Regulatory Requirements

- 3.1 Ballast shall not contain any Polychlorinated Biphenyl (PCB).
- 3.2 Ballast shall be Underwriters Laboratories (UL) listed, Class P and Type 1 Outdoor; and Canadian Standards Association (CSA) certified where applicable.
- 3.3 Ballast shall comply with ANSI C62.41 Category A for Transient protection.
- 3.4 Ballast shall comply with ANSI C82.11 where applicable.
- 3.5 Ballast shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

Section IV - Other

- 4.1 Ballast shall be manufactured in a factory certified to ISO 9002 Quality System Standards.
- 4.2 Ballast shall carry a _____ limited warranty from date of manufacture against defects in material or workmanship. This warranty is conditioned upon operation at a maximum case temperature of _____, among other items. (Go to our website for up-to-date warranty information, www.phillips.com/advancewarranty).
- 4.3 Manufacturer shall have a twenty year history of producing electronic ballasts for the North American market.
- 4.4 Ballast shall be controlled by a Class 1 or Class 2 low voltage 0-10VDC controller.
- 4.5 Ballast shall be Philips Advance part # _____ or approved equal.



BFL281

type:

LINEAR T5 FLUORESCENT

low profile T5 fluorescent fixture

- SPECIFICATIONS:**
- Fully assembled housing is formed and welded, 20 ga. steel, chemically treated to resist corrosion and enhance paint adhesion
 - Standard finish is high reflective white powder coat, applied post production
 - Knock-outs accept standard electrical fittings (by other)
 - Rotational locking lamp holders
 - Available for T5 6W, 8W, 13W, 14W, 21W, 28W, 35W and high output 24W, 29W, 54W, 80W linear fluorescent lamps
 - Standard 120V, 277V or Universal electronic high power factor ballast is pre-wired to the lamp holders
 - Dimming ballast options available (consult factory for availability and system compatibility)
 - UL and ULC listed for dry and damp locations
 - BEW

NOTE: Includes program rapid start ballast except for 35W and 13W models which include an instant start ballast.



EMPOWERHOUSE LIGHTING

SPECIFICATION / ORDER FORMAT				DIMENSIONAL INFO.	
model no.	voltage	wiring method	options	lamp	overall length
BFL281-6	/120		Dimming - (consult factory)	6w T5	9-3/16"
BFL281-8	/277		/DL - damp location	8w T5	12-13/16"
BFL281-13	/120V	/MS	/CU - custom finish (consult factory)	13w T5	21-1/4"
BFL281-14				14w T5	22-1/2"
BFL281-21				21w T5	34-1/4"
BFL281-28				28w T5	46-1/16"
BFL281-35				35w T5	57-15/16"
BFL281-24				24w T5 HO	22-1/2"
BFL281-29				29w T5 HO	34-1/4"
BFL281-54				54w T5 HO	46-1/16"
BFL281-80				80w T5 HO	57-15/16"

022811

BFL281 | ACCESSORIES

type:

LENS | Two-piece system consisting of polycarbonate channel and etched acrylic cover



MELNP Clear lens polycarbonate acrylic lens with mounting clips (sold by the foot) ___ft.
MELNCF Frosted acrylic lens with mounting clips (sold by the foot) ___ft.

TUBE GUARD |

TG Tube Guard (sold by the foot) ___ft.

WIRE GUARD |

W/G Wire Guard

CABLE KIT |

BAC-4N-W Aircraft suspension kit, 4', white
BAC-4P-W Aircraft suspension kit w/ power lead, 4', white

MOUNTING CLIP | (consult factory for possible alternate applications)

MC281 Fixture mounting clip
NOTE: Two to three required per fixture

RECEPTACLES | 20 ga. steel construction, white powder coat finish (consult factory for optional color finishes and finishes)

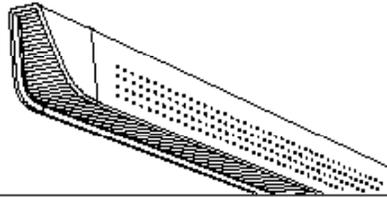
	SYMMETRICAL	for fixtures available	
	281-R1-6	BFL281-6	
	281-R1-8	BFL281-8	
	281-R1-12	BFL281-12	
	281-R1-14/24	BFL281-14	BFL281-24
	281-R1-21/39	BFL281-21	BFL281-39
	281-R1-28/54	BFL281-28	BFL281-54
	281-R1-35/80	BFL281-35	BFL281-80
	ASYMMETRICAL		
	281-R2-6	BFL281-6	
	281-R2-8	BFL281-8	
	281-R2-12	BFL281-12	
	281-R2-14/24	BFL281-14	BFL281-24
	281-R2-21/39	BFL281-21	BFL281-39
	281-R2-28/54	BFL281-28	BFL281-54
	281-R2-35/80	BFL281-35	BFL281-80
	INVERSE ASYMMETRICAL		
	281-R3-6	BFL281-6	
	281-R3-8	BFL281-8	
	281-R3-12	BFL281-12	
	281-R3-14/24	BFL281-14	BFL281-24
	281-R3-21/39	BFL281-21	BFL281-39
	281-R3-28/54	BFL281-28	BFL281-54
	281-R3-35/80	BFL281-35	BFL281-80
	ELLIPTICAL		
	281-R4-6	BFL281-6	
	281-R4-8	BFL281-8	
	281-R4-12	BFL281-12	
	281-R4-14/24	BFL281-14	BFL281-24
	281-R4-21/39	BFL281-21	BFL281-39
	281-R4-28/54	BFL281-28	BFL281-54
	281-R4-35/80	BFL281-35	BFL281-80

T5
 LIGHTING

CSI#: 26 51 00 L4

Jump™

Suspended
Semi-Direct
ITS - FlatParf
  



Project Name	
Spec. Type	
Notes	

Order Guide

Some combinations of product options may not be available. Consult factory for assistance with your specification.

I201	F10							
Product Series & Type: Jump Suspended Semi-Direct	Lamping: ITS	Lower Optics: Q MicroOptics® Beaded Lens	Upper Optics: E Sculpt® P FlatParf S SplitParf	Run Length: Enter the total run length in feet (R.F. increments) See reverse	Wiring: 1 1 ext. 2 1 ext. w/ Emergency ext. 3 1 ext. w/ Battery Pack 7 1 ext. Dimming	Voltage: 1 120V 2 277V 3 347V	Ballast: E Standard Ballast <small>Consult website for ballast manufacturer information</small>	Color & Finish: B Black T Brushed Silver W White X Custom Color
Lamping Please indicate with check mark.		Parianization Options		Mounting Hardware				
<input type="checkbox"/> Lamps Supplied (not installed)		<input type="checkbox"/> Lamps Installed		<input type="text"/>				
Endcaps Please indicate with check mark.		 		<input type="text"/>				
<input type="checkbox"/> Luminesc Sculpted Endcap (standard)		<input type="checkbox"/> Flat Endcap (non-luminesc)		Mount Type: <input type="text"/> Consult website for complete list of standard wiring options.				
Integrated Controls Please indicate with check mark.				Suspension Length: <input type="text"/> Enter distance from ceiling to top of fixture in inches.				
<input type="checkbox"/> Response® Daylight Sensor (Integrated Controls) For details visit ledalite.com/integrated								

© 2011 PhilipsLuminaire Philips #04288481 Inc#004455332 ledalite.com

Fluores I201 F10 Q Opt For L4

Photometry Optics QP Ribbed MesaOptics® Lens (Down) / PbaPerf (Up)

Report Summary

Efficiency: 82% Input: 990160
 Efficiency: 70.8 lum/W Photometric: EN 18909:05
 Total Lumens: 2459 lm Ballast: Power L10

Meets NF-101 recommendations for VDT Normal spaces

Candela Distribution

Vertical Angle	Horizontal Angle					Total Lumens
	0	22.5	45	67.5	90	
0	838	834	834	834	834	834
5	829	832	842	854	865	82
15	791	813	835	858	881	267
25	767	753	827	839	889	389
35	577	681	726	752	805	694
45	432	632	523	534	528	129
55	308	388	238	239	256	104
65	185	174	105	124	108	100
75	105	74	42	77	32	38
85	28	16	21	16	20	23
90	2	3	6	1	9	7
95	2	3	6	1	10	7
105	3	2	7	11	13	8
115	4	5	8	11	14	8
125	4	6	8	11	12	8
135	5	8	9	11	12	8
145	5	9	11	12	13	8
155	4	10	12	13	14	8
165	4	9	13	14	14	4
175	7	7	8	9	9	9
180	7	7	7	7	7	9

Coefficients of Utilization (CU)

Cavity Hgt. (ft)	10'				7'				5'				3'			
	20	30	31	40	20	30	31	40	20	30	31	40	20	30	31	40
0	81	80	81	81	75	75	75	75	71	71	71	71	66	66	66	66
1	71	67	64	61	68	65	62	58	79	77	73	70	60	57	54	51
2	53	47	42	38	58	53	47	42	64	60	56	52	40	37	34	31
3	37	30	25	21	41	37	32	27	48	45	42	39	28	25	22	19
4	21	14	10	7	25	22	19	16	32	30	27	24	18	16	14	12
5	15	10	7	5	18	16	14	12	24	22	20	18	14	12	10	9
6	10	7	5	4	13	12	10	8	18	17	15	14	11	9	8	7
7	7	5	4	3	10	9	8	7	14	13	12	11	9	8	7	6
8	5	4	3	2	8	7	6	5	11	10	9	8	7	6	5	4
9	4	3	2	2	6	5	4	3	8	7	6	5	4	3	2	2
10	3	2	2	2	5	4	3	2	6	5	4	3	2	2	2	2

Avg. Luminance (cd/m²)

Vertical Angle	Horizontal Angle		
	0	45	90
0	428	524	384
5	352	288	178
15	289	149	108
25	204	89	75

IES files for this and other photometric options can be downloaded online at ledlight.com

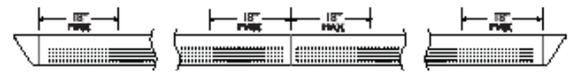


Suspended • Semi-Direct • ITS - PbaPerf

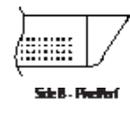
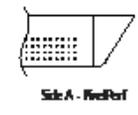
Additional Information

Variable Position Mounting

Variable position mounts are supplied for each joint and end. The mounts can be installed up to 18" from joints and end locations.



Upper Optics



Specifications

Due to mounting product improvements, Philips Lighting reserves the right to change specifications without notice.

Mounting
 20 gauge cold-rolled steel, precision formed and welded with optional perforated pattern.

Weight
 Maximum 15 lb-ft.

Optical System
 The optical lens assembly consists of an acrylic enclosure with an interdigital tilted profile holding a layer of MesaOptics® which efficiently controls high angle glare. The reflector system comprises Pba Silver reflectors optimized to work with the MesaOptics® to simultaneously homogenize light while creating a hazy distribution in the lower hemisphere.

Encaps
 Encaps are offered aluminum available in luminous sculpted (standard) or flat (optional).

Joints
 Self-aligning joining system with knock-free pre-joining wire access.

Mounting
 Variable position mounts are supplied for each joint and end. The mounts can be installed up to 18" from joints and end locations. Impact-resistant aircraft cable gripper provides infinite vertical adjustment capability. Aircraft cable, clamp and cable gripper are independently tested to meet stringent safety requirements.

Electrical
 Factory pre-wired to standard ends with quick-wire connection.

Ballast
 Electronic.

Approvals
 Certified to UL and CSA standards.

Finish
 Standard finish is textured matte-White, Black or Titanium Silver.





Changing the way the world experiences light.



Benefits

- Low Energy Consumption.**
 - 7 (w/ft, w/305mm).
- Free of UV and IR emissions.**
 - No product and packaging discoloration.
- Lower Maintenance Cost.**
 - 50,000 hour life.
- Environmentally Friendly.**
 - No mercury or other hazardous materials.
 - Fully Recyclable

Symetrie Flat

The Flat is a low profile, linear LED fixture featuring high lumen output and high quality illumination ideal for display cases, showcases, exhibits, under shelves, cove, alcoves and other venues.

Features

Typical Lumens	
Warm White	270 (lm/ft, lm/305mm)
Neutral White	280 (lm/ft, lm/305mm)
Cool White	340 (lm/ft, lm/305mm)
Power Consumption¹	
Warm White	7 (w/ft, w/305mm)
Neutral White	6 (w/ft, w/305mm)
Cool White	7 (w/ft, w/305mm)
Efficacy²	
Warm White	39 (lm/w)
Neutral White ²	47 (lm/w)
Cool White	49 (lm/w)
Color Temperature (CCT)	
Warm White	2950K
Neutral White	4100K
Cool White	5200K
Color Rendering Index (CRI)²	
Warm White	78
Neutral White	70
Cool White	70
Rated Life	50,000 Hours @ 70% Lumen Maintenance
Housing	
Standard	Natural Aluminum
Optional	Black
Mounting	All Options Included
Connections	Available with multiple series of fixtures.
Lens	Prismatic Diffused Acrylic
Beam Spread	55°
Operating Temperature	-40°C to +40°C
Voltage	20 Volts DC (24VDC Max.)
Warranty	3 Year Limited
Standards	UL48, UL2108
Certification	
Environment	

¹ Fixture power consumption for 24.0 VDC is 7 watts per foot max.
² Engineering data, pending photometric testing.



StepLite Series

InDiglo-5 / InDiglo-9 / InDiglo-13



Catalog Number

model	color temperature	finish	options	accessories
IDG-5	2K - Warm White	2K - Black	EO - E-Coat	EMR - Emergency Backup-Fluores (120V)
IDG-9	4K - Cool White	2Z - Bronze		
IDG-13		CC - Custom Color		
		EL - Silver		
		WH - White		

Specifications

Item	specification	details
Output	beam spread	asymmetrical (avail. on IDG9 and IDG13 only)
	lumens	IDG-5 - 180 IDG-9 - 670 IDG-13 - 920
	LEDs	IDG-5 - 2 IDG-9 - 6 IDG-13 - 8
	driver efficiency	94%
	lifetime	> 60,000 hours / L70 or better
lumen maintenance	LM80 Energy Effic^{lm} lumen maintenance supplement	
Color	color consistency / CRI	≤ 4 step MacAdam Ellipse, color corrected / CRI: ≥ 80
	color temperature	2K/4K/4K-001
Electrical	input voltage	120-277VAC
	power consumption	IDG-5 - 6W IDG-9 - 16W IDG-13 - 20W
	RFI	EMC (compatible and resistant)
recess/pole/pendant		Ingrate
Control	power supply	by others
Physical	dimensions (H x W x D)	IDG-5 - 69" x 29 1/2" x 2 1/2" IDG-9 - 85 1/2" x 32" x 2 1/2" IDG-13 - 99"
	weight	IDG-5 - 4 lbs IDG-9 - 6 lbs IDG-13 - 8 lbs
	fastening	available at site cost additional
	lens	tempered glass
	storage temperature	0°C to 50°C
Documentation	operating temperature	-20°C to 50°C
	certification	ETL/cETL
Warranty	standards	UL-Class II, IES LM-79, LM-80
	IP rating	IP65



Construction

Marine grade, corrosion resistant, heavy wall, high pressure die cast aluminum construction. Capable stainless steel lamp resistant fasteners with channelled silicone gasket for recess seal. IP65 rating. Lens is 1/8" thick tempered, clear, heat resistant glass. Emergency battery backup mode up to 26V also available.

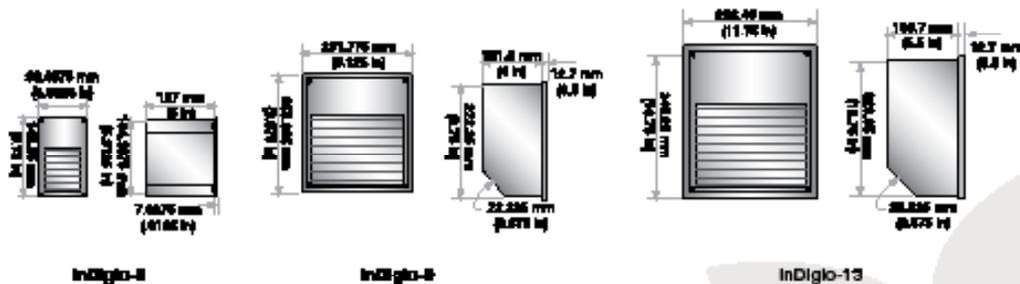
Power Supply Requirements

Ingrate Glass II power supply with variable input from 120 to 277VAC.



Minimum 4'-0"

Dimensions



- Linear
- Power/Control
- Downlite
- Deco
- StepLite
- InGrade
- SiteLite

177

CSI#: 26 51 00 L7



PDQ WET
1ft PDQ-WET

LRL-OD-1-WW

WW= Warm White 2900K

LRL-OD-1-CW

CW= Cool White 5000K

LRL-OD-1-AB

AB= Amber

LRL-OD-1-BL

BL= Blue

LRL-OD-1-GR

GR= Green

LRL-OD-1-RD

RD= Red

1ft PDQ-WET Strip Light
Field cuttable every 4 inch, cut on convenient markings

Ultra-compact strip light, 1/2" W x 3/16" H



12VDC system - 1.52 watts per foot. Field cuttable every 2" - cut on convenient markings.
Fast easy installation.

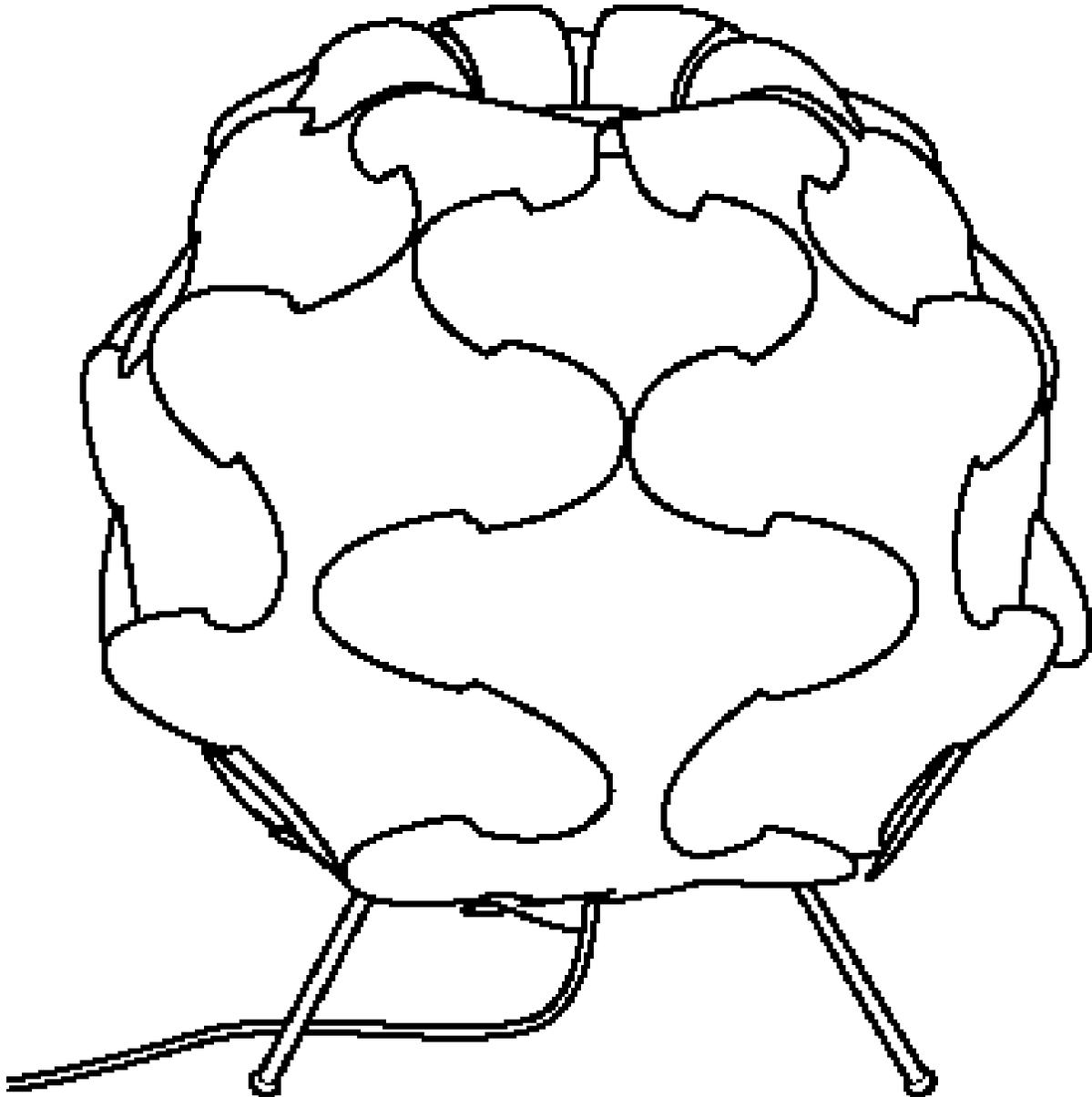
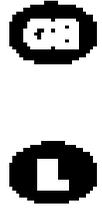


CSL LIGHTING - A Division of Troy-CSL Lighting, Inc.
14625 East Clark Ave., City of Industry CA, USA (91745) Phone: 626-336-4511 www.CSLLighting.com



CSI#: 26 51 00 L8

FILLSTA



**Product Bulletin for
Fluorescent Ceiling Lampholder 9862**



**Energy-Efficient Fluorescent
Ceiling Lampholder...
Now Available with Pull Chain**



**Ideal for Closets, Garages and Utility Rooms
Meets NFPA 70, NEC Section 410.116 Requirement**

Leviton has expanded its line of Compact Fluorescent Ceiling Lampholders for closets and closed spaces to include this pull chain version. Fluorescent lighting is the energy-efficient alternative to incandescent fixtures. Our new Pull Chain Fluorescent Ceiling Lampholder incorporates today's most wanted features and meets NFPA 70, NEC Section 410.116 Requirements. Designed to reduce the risk of fire in closets, it can also be utilized in open spaces. Suitable for all areas of the home, it works with just a pull of the chain and is easy to install with pigtail leads and knockout holes for multiple box configurations. Available with 1.5W lamp and lamp guard.



Applications

- Install in closets, garages, basements, utility rooms and attics
- Suitable for indoor use only



CSI#: 26 51 00 L9

Features and Benefits:

- 13W G24 Squat Base Lamp
- Pull Chain Bi-Pin Compact Fluorescent Lampholder
- Pull Chain ON/OFF – no wall switch required
- Built of tough thermoplastic
- Polycarbonate lamp guard
- Pigtail leads provide easy installation
- Knockout holes on box enable multiple configurations
- Thread-cutting screws facilitate installation of lamp guard
- Backed by a Limited Two-Year Warranty on Lampholder and Guard

Notes: Not intended for use with incandescent lamps, dimmers or occupancy sensors.

Agency Standards:

Energy Star Qualified



Meets NFPA 70, NEC Section 410.16 Requirements. Can be utilized in closets and open spaces.

Meets Canadian Electric Code Requirements for use in closets with lamp guard.

Rating:

120V-250VAC, 60 Hz

Specifications:

Lamp Output = 900 lumens

Lamp Color = 2700 K

Lamp Life = 10,000 hours

Notes: Supply conductors must have minimum 90°C rating

Ordering Information:

Fluorescent Ceiling Lampholder with Pull Chain

Cat. No.	Description	UPC Number	Standard Pack
008-9863-PC-F	Lampholder with 13W Lamp and Lamp Guard	0784774520 8	1/Box, 25/ Carton
C20-9863-0PC*	Lampholder with 13W Lamp and Lamp Guard	07847745524 1	1/Clamshell, 3/Box 18/ Carton

Original Fluorescent Ceiling Lampholder Still Available. Ordering Information below:

Fluorescent Ceiling Lampholder for use with Wall Switch

Cat. No.	Description	UPC Number	Standard Pack
001-9866-001	Lampholder	07847721528 5	1/Box, 50/ Carton
002-9860-002*	Lampholder with 13W Lamp	07847731530 2	1/Box, 50/ Carton
008-9866-1HE*	Lampholder with 13W Lamp and Lamp Guard	07847722288 8	1/Box, 25/ Carton
102-9860-002*	Lampholder with 13W Lamp and Lamp Guard	07847726088 5	1/Clamshell, 2/Box, 18/ Carton
004-9866-004	Lamp Guard	07847721533 2	1/Box, 50/ Carton
000-9866-13W	13W Replacement Bulb	07847721548 8	1/Box, 50/ Carton

* Energy Star Qualified

Caution: CFL Lamps contain mercury (Hg). Dispose of according to local, state and federal law. See www.lamprecycling.org for information.

Lawton Manufacturing Co., Inc.

201 North Service Road, Malville, NY 11747-9198
 Telephone: 1-800-823-8820 FAX: 1-800-832-9538
 Tech Line (9:30AM-7:30PM E.S.T. Monday-Friday): 1-800-824-3005

Lawton Manufacturing of Canada, Ltd.

165 Hymus Boulevard, Pointe Claire, Quebec H9R 1E9
 Telephone: 1-800-488-7890 FAX: 1-800-563-1863

Lawton S. de R.L. de C.V.



DIVISION 28

ELECTRONIC SAFTEY AND SECURITY



120V AC Wire-In Smoke Alarm

Slide Load Front Battery Door, Alkaline Battery, 10 Yr Warranty

Model I5000

- Ionization Sensing Technology
- Battery Backup (batteries included)
- Hush® Button
- Alarm Memory Indicator
- New 360° Mounting Plate with Tamper Resistance
- Front Load Battery Door



Description

The Kidde I5000 is an AC/DC powered, ionization smoke alarm that operates on a 120V power source with 9V alkaline battery backup.

This alarm uses ionization sensing technology. Ionization sensing alarms may detect invisible fire particles (associated with flaming fires) sooner than photoelectric alarms. Photoelectric sensing alarms may detect visible particles (associated with smoldering fires) sooner than ionization alarms.

Kidde strongly recommends that both ionization and photoelectric smoke alarms be installed to help insure maximum detection of the various types of fire that can occur within the home.

The front-loading battery door allows user to change the battery without removing the alarm from the mounting bracket making battery replacement easy and convenient. This smoke alarm is available in a 6-piece cut case with tray for easy display as well as a 6-piece bulk pack for contractors and property owners. This unit is a UL Listed product with a 10-year limited warranty.

Install Confidence:

Easy Installation

- Front battery pull tab allows battery activation without removing alarm from mounting bracket.
- Large mounting base makes mounting easier, protects surface paint from dirt and covers imperfections.
- Pre-stripped wiring harness with easy off cap does not require stripper tool. Tinned strands increase conductivity and wire nut grip.

Fewer Callbacks

- Large centrally located Test/Hush® alarm control button.
- Dust cover protects sensor from contaminants during construction reducing nuisance alarms.

User-Friendly Features

- Easy access front loading battery door.
- Battery backup provides protection in case of power failure.
- Interconnectable with up to 24 devices (of which 18 can be initiating) including smoke, CO and heat alarms. See user's guide for complete instructions.



120V AC Wire-In Smoke Alarm
Slide Load Front Battery Door

Model I5000

Architectural and Engineering Specifications

The smoke alarm shall be Kidde Model 5000 or approved equal. It shall be powered by a 120VAC, 60Hz source along with a 9V alkaline battery backup. The unit shall incorporate an ionization sensor with minimum sensitivity of 0.50 to 5.0PAH. The temperature operating range shall be between 40°F and 100°F (4°C and 38°C) and the humidity operating range shall be up to 85% relative humidity.

The smoke alarm can be installed on any standard single gang electrical box, up to a 4" octagon junction box. The electrical connections (to the alarm) shall be made with a plug-in connector. A maximum of 24 Kidde devices can be interconnected in a multiple station arrangement. The interconnect system must not exceed the NFPA (National Fire Protection Association) limit of 18 initiating devices, of which 12 can be smoke alarms. With 18 initiating devices (Smoke, heat, CO, etc.) interconnected, it is still possible to interconnect 6 strobe lights and/or relay modules. The alarm shall provide optional tamper resistance that detects removal of the unit from the wall or ceiling. No additional pieces shall be required to activate this feature.

The alarm shall include an easy access battery compartment that is opened and closed by sliding the battery door. The 9V battery cover will ensure proper battery backup protection by not allowing the battery door to close if the battery is placed in the unit incorrectly or if a battery is not present.

The unit shall include a piezoelectric horn that is rated at 85 decibels at 10 feet. The unit shall include the Smart Hush™ feature that silences the unit for approximately 8 minutes if a nuisance condition occurs.

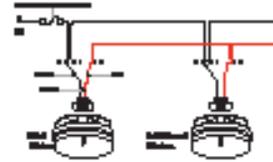
The unit shall incorporate red and green LED indicators. The green LED (when illuminated) indicates the presence of AC power. The red LED (located under the TEST/Hush button) has four modes of operation:

Steadily Flashing The red LED will flash every 30-40 seconds to indicate that the smoke alarm is operating properly. **Alarm Condition:** When the alarm senses products of combustion and goes into alarm the red LED will flash one flash per second. The flashing LED and pulsating alarm will continue until the air is cleared. When units are interconnected, only the red LED of the alarm that senses the smoke or is being tested (the originating unit) will flash. All other units in the interconnected system will sound an alarm but their red LEDs will NOT flash. **Alarm Memory:** This smoke alarm is equipped with an alarm memory, which provides a sound indication when an alarm has been activated. The red LED will illuminate for about 1.5 seconds every 16 seconds to indicate the memory condition. **Smart Hush™ Mode:** The red LED will illuminate for 1.5 seconds every 8 seconds, indicating the smoke alarm is in the Smart Hush™ mode.

The unit shall at a minimum meet the requirements of UL217, NFPA72, and (chapter 11), The State of California Fire Marshal, NFPA101 (Due and ten family dwellings), Federal Housing Authority (FHA), Housing and Urban Development (HUD).

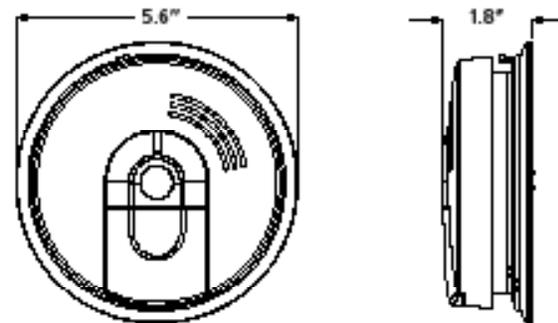
Installation of Smoke Alarm

The smoke alarm should be installed to comply with all local codes including but not limited to, Article 760 of the National Electric Code, and NFPA 72. Make certain all alarm are wired in a single continuous (non-switched) power line, which is not protected by a ground fault interrupter. A maximum of 1000ft. of wire can be used in the interconnect system. Use standard 18 AWG household wires as signaling cable.



Technical Specifications

Model:	I5000
UPC:	0-47871-07582-9
Power Source:	120VAC (FEMA/MAF)
Sensor:	Ionization
Audio Alarm:	85dB at 10ft
Temperature Range:	40°F (4.4°C) to 100°F (37.8°C)
Humidity Range:	Up to 85% relative humidity (RH)
Size:	5.6" in diameter x 1.8" depth
Weight:	.5lbs
Interconnects:	Up to 24 Kidde devices
LED:	Green, receiving ac power Red, 4 modes of operation
Warranty:	10 year limited



Ordering Information

Ordering Number	UPC	EFSS	Pack Quantity	Dimensions (for a 4 in box)	Weight	ESL
I5000	21007582	0-47871-07582-9	100-47871-07582-6	Cut Case (6 units)	6.63 x 13.25 x 6.25	3 lbs 1008

Not for sale by individual unit



1016 Concrete Park Drive



Distributed by:





120V AC Wire-In Smoke Alarm

Slide Load Front Battery Door, Alkaline Battery, 10 Yr Warranty

Model I5000

- Ionization Sensing Technology
- Battery Backup (batteries included)
- Hush® Button
- Alarm Memory Indicator
- New 360° Mounting Plate with Tamper Resistance
- Front Load Battery Door



Description

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This alarm uses ionization sensing technology. Ionization sensing alarms may detect invisible fire particles (associated with flaming fires) sooner than photoelectric alarms. Photoelectric sensing alarms may detect visible particles (associated with smoldering fires) sooner than ionization alarms.

Kidde strongly recommends that both ionization and photoelectric smoke alarms be installed to help insure maximum detection of the various types of fire that can occur within the home.

The front-loading battery door allows user to change the battery without removing the alarm from the mounting bracket making battery replacement easy and convenient. This smoke alarm is available in a 6-piece cut case with tray for easy display as well as a 6-piece bulk pack for contractors and property owners. This unit is a UL Listed product with a 10-year limited warranty.

Install Confidence:

Easy Installation

- Front battery pull tab allows battery activation without removing alarm from mounting bracket.
- Large mounting base makes mounting easier, protects surface paint from dirt and covers imperfections.
- Pre-stripped wiring harness with easy off cap does not require stripper tool. Tinned strands increase conductivity and wire nut grip.

Fewer Callbacks

- Large centrally located Test/Hush® alarm control button.
- Dust cover protects sensor from contaminants during construction reducing nuisance alarms.

User-Friendly Features

- Easy access front loading battery door.
- Battery backup provides protection in case of power failure.
- Interconnectable with up to 24 devices (of which 18 can be initiating) including smoke, CO and heat alarms. See user's guide for complete instructions.



120V AC Wire-In Smoke Alarm
Slide Load Front Battery Door

Model I5000

Architectural and Engineering Specifications

The smoke alarm shall be Kidde Model 5000 or approved equal. It shall be powered by a 120VAC, 60Hz source along with a 9V alkaline battery backup. The unit shall incorporate an ionization sensor with nominal sensitivity of 0.50 to 0.25%/ft. The temperature operating range shall be between 40°F and 100°F (4°C and 38°C) and the humidity operating range shall be up to 85% relative humidity.

The smoke alarm can be installed on any standard single gang electrical box, up to a 4" octagon junction box. The electrical connections (to the alarm) shall be made with a plug-in connector. A maximum of 24 Kidde devices can be interconnected in a multiple station arrangement. The interconnect system must not exceed the NFPA (National Fire Protection Association) limit of 18 initiating devices, of which 12 can be smoke alarms. With 18 initiating devices (Smoke, heat, CO, etc.) interconnected, it is still possible to interconnect 6 strobe lights and/or relay modules. The alarm shall provide optional tamper resistance that detects removal of the unit from the wall or ceiling. No additional pieces shall be required to activate this feature.

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The unit shall include a piezoelectric horn that is rated at 85 decibels at 10 feet. The unit shall include the Smart Hush™ feature that silences the unit for approximately 8 minutes if a nuisance condition occurs.

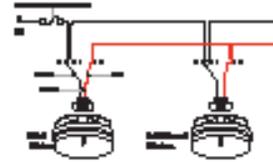
The unit shall incorporate red and green LED indicators. The green LED (when illuminated) indicates the presence of AC power. The red LED (located under the TEST/Hush button) has four modes of operation:

Steadily Cautious: The red LED will flash every 30-40 seconds to indicate that the smoke alarm is operating properly. **Alarm Condition:** When the alarm senses products of combustion and goes into alarm the red LED will flash one flash per second. The flashing LED and pulsating alarm will continue until the air is cleared. When units are interconnected, only the red LED of the alarm that senses the smoke or is being tested (the originating unit) will flash. All other units in the interconnected system will sound an alarm but their red LEDs will NOT flash. **Alarm Memory:** This smoke alarm is equipped with an alarm memory, which provides a sound indication when an alarm has been activated. The red LED will illuminate for about 1.5 seconds every 16 seconds to indicate the memory condition. **Smart Hush™ Mode:** The red LED will illuminate for 1.5 seconds every 8 seconds, indicating the smoke alarm is in the Smart Hush™ mode.

The unit shall at a minimum meet the requirements of UL217, NFPA72, and (chapter 11), The State of California Fire Marshal, NFPA101 (Due and ten family dwellings), Federal Housing Authority (FHA), Housing and Urban Development (HUD).

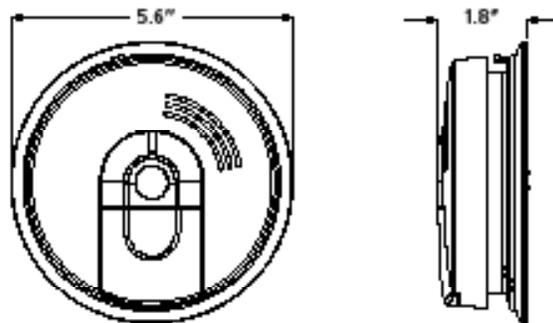
Installation of Smoke Alarm

The smoke alarm should be installed to comply with all local codes including but not limited to, Article 760 of the National Electric Code, and NFPA 72. Make certain all alarm are wired in a single continuous (non-switched) power line, which is not protected by a ground fault interrupter. A maximum of 1800ft. of wire can be used in the interconnect system. Use standard 18 AWG household wires as signaling cable.



Technical Specifications

Model:	I5000
UPC:	0-47871-07582-9
Power Source:	120VAC (FEMA/MA) 9V
Sensor:	Ionization
Audio Alarm:	85dB at 10ft
Temperature Range:	40°F (4.4°C) to 100°F (37.8°C)
Humidity Range:	Up to 85% relative humidity (RH)
Size:	5.6" in diameter x 1.8" depth
Weight:	.5lbs
Interconnects:	Up to 24 Kidde devices
LED:	Green, receiving ac power Red, 4 modes of operation
Warranty:	10 year limited



Ordering Information

Ordering Number	UPC	SKU	Pack Quantity	Dimensions (for a 4 in 1/2 inch)	Weight	ESL
I5000	21007582	0-47871-07582-9	100-47871-07582-6	Out Case (6 units)	6.63 x 13.25 x 6.25	3 lbs 1008

Not for sale by individual unit



1016 Concrete Park Drive



Distributed by:



DIVISION 48

ELECTRICAL POWER

GENERATION



Panda 265 SERIES

- YL265C-30b
- YL264C-30b
- YL255C-30b
- YL254C-30b
- YL245C-30b



COMPANY

Yingli Green Energy (NYSE:YGE) is one of the world's largest fully vertically integrated PV manufacturers. With over 2 GW of modules installed globally, we are a leading solar energy company built upon proven product reliability and sustainable performance. Founded in 1998, Yingli Green Energy serves customers through our U.S. subsidiary, Yingli Americas, co-headquartered in New York and San Francisco. We are the first renewable energy company and the first Chinese company to sponsor the FIFA World Cup™.

HIGH PERFORMANCE

- Yingli Solar Panda is a new monocrystalline module technology with n-type solar cells that have average efficiencies higher than 18.5%. Combined with high transmission glass, module efficiencies are up to 16.2%.
- Compared to traditional modules with p-type solar cells, Panda modules have lower initial degradation and higher performance under both high temperature and low irradiation conditions.
- Ideal for residential or commercial applications where high efficiency is essential.

QUALITY & RELIABILITY

- Robust, corrosion resistant aluminum frame: independently tested to withstand wind and snow loads of up to 50 psf and 112 psf, respectively, ensuring a stable mechanical life.
- Manufactured in-house in our new state-of-the-art, fully automated production line.
- Manufacturing facilities certified to TÜV Rheinland standards.

WARRANTIES

- Extensive 5-year limited product warranty
- Limited power warranty* = 90% of the minimum rated power output for 10 years, 80% of the minimum rated power output for 25 years
- * In compliance with our warranty terms and conditions.

QUALIFICATIONS & CERTIFICATES

- Pending: UL 1703 and IEC 61215, CEC, FREC
- ISO 9001:2008, ISO 14001:2004, BS OHSAS 18001:2007, SA8000



Provisional data sheet. Subject to modification and error.

Panda 265 SERIES



ELECTRICAL PERFORMANCE

Electrical parameters at Standard Test Conditions (STC)

Module name			Panda 265	Panda 300	Panda 335	Panda 370	Panda 395
Module type			YL265C-600	YL300C-600	YL335C-600	YL370C-600	YL395C-600
Power output	P_{max}	W	265	300	335	370	395
Power output tolerance	ΔP_{max}	%	±3				
Module efficiency	η_m	%	16.2	16.8	15.6	16.3	16.0
Voltage at P_{max}	V_{mp}	V	21.0	24.0	23.6	26.8	26.4
Current at P_{max}	I_{mp}	A	8.25	8.48	8.24	8.88	8.87
Open-circuit voltage	V_{oc}	V	29.0	30.8	30.2	33.1	32.1
Short-circuit current	I_{sc}	A	8.95	9.01	8.85	9.71	9.68

STC: 1000W/m² irradiance, 25°C module temperature, AM1.5 spectrum irradiance according to IEC 60904-2
Air. efficiency tolerance of ±0.4% at STC level according to IEC 60904-2

Electrical parameters at Nominal Operating Cell Temperature (NOCT)

Power output	P_{max}	W	182.4	198.0	190.2	194.0	177.0
Voltage at P_{max}	V_{mp}	V	26.1	27.5	27.7	27.6	27.6
Current at P_{max}	I_{mp}	A	6.98	6.79	6.88	6.88	6.48
Open-circuit voltage	V_{oc}	V	33.8	35.2	34.2	36.1	35.1
Short-circuit current	I_{sc}	A	7.28	7.18	7.28	7.62	6.88

NOCT: open-circuit module operating temperature at 800W/m² irradiance, 25°C ambient temperature, 1 m/s wind speed

THERMAL CHARACTERISTICS

Nominal operating cell temperature	T_{NOCT}	°C			45 ± 2
Temperature coefficient of P_{max}	γ	%/°C			-0.48
Temperature coefficient of V_{oc}	β_{Voc}	%/°C			-0.28
Temperature coefficient of I_{sc}	α_{Isc}	%/°C			0.04

OPERATING CONDITIONS

Max. system voltage	600Vdc
Max. system fuse rating	30A
Limiting reverse current	Do not apply external voltage larger than V_{oc} of the module
Operating temperature range	-40 to 104°F (-40 to 40°C)
Max. static load, front (e.g., snow and wind)	150 psf (5400 Pa)
Max. static load, back (e.g., wind)	20 psf (940 Pa)
Maximum impact	1 lb (0.45kg) at 21 mph (34km/h)

GENERAL CHARACTERISTICS

Module: inch (mm)	
Dimension (Length/Width/Height)	64.00 (1626)/36.00 (914)/1.57 (40)
Weight	42.7 lb (19.4 kg)

PACKAGING SPECIFICATIONS

Module: inch (mm)	
Number of modules per pallet	20
Number of pallets per 40' container	30
Packaging box dimension (Length/Width/Height)	67 (1703)/36 (914)/2 (51.0)
Box weight	698 lb (317 kg)

- The specifications in this document are not guaranteed and are subject to change without prior notice.
- This document complies with EN 50324:2003 requirements.

Yingli Green Energy Americas, Inc.
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Tel: +1 (888) 686-8820

YINGLISOLAR.COM | NYSE:YGE

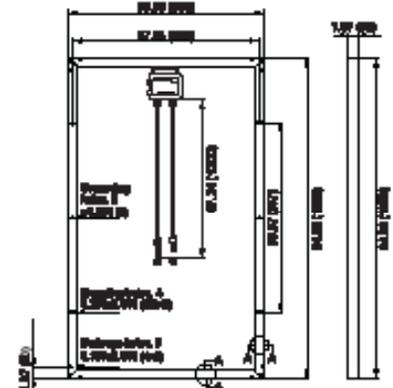
CONSTRUCTION MATERIALS

Module: inch (mm)	
Front cover (material/typical thickness)	Low iron glass (approx. 2.8mm)
Cell (quantity/material/typical dimensions)	60 poly-silicon cells (approx. 150mm x 75mm) 100mm x 75mm x 0.2mm
Encapsulation (material)	ethylene vinyl acetate (EVA)
Frame (material/color/oxidation color)	anodized aluminum alloy (black)
Junction box (quantity/degree)	1/0°
Cable (type/length/cross-sectional area)	PV 1x6/42.54 (1200)/16/2.5
Plug connector (quantity/degree)	Angland/144/90°

Module: inch (mm)



Warning: Read the instruction manual in its entirety before handling, installing, and operating Yingli modules.



Our Partners



Certificate of Compliance

Certificate Number 280111-E320066 - A
Report Reference E320066, 2010 Oct. 13
Issue Date 2011 January 28

Page 1 of 1



Issued to: YINGLI ENERGY (CHINA) CO LTD

3399 N Chaoyang Rd
Baoding, Hebei 071051
China

This is to certify that representative samples of

Photovoltaic Modules and Panels

USL/CNL - (YLxxxC-30b series) YL225C-30b, YL230C-30b, YL235C-30b, YL240C-30b, YL245C-30b, YL250C-30b, YL255C-30b, YL260C-30b; (YLxxxC-27b series) YL205C-27b, YL210C-27b, YL215C-27b, YL220C-27b, YL225C-27b, YL230C-27b; (YLxxxC-24b series) YL180C-24b, YL185C-24b, YL190C-24b, YL195C-24b, YL200C-24b, YL205C-24b.

Have been investigated by Underwriters Laboratories in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: UL 1703 - STANDARD FOR FLAT-PLATE PHOTOVOLTAIC MODULES AND PANELS - Edition 3 -Revision Date 2008-04-08
ULC/ORD C1703 - STANDARD FOR FLAT-PLATE PHOTOVOLTAIC MODULES AND PANELS, FIRST EDITION, REVISED OCTOBER 2001

Only those products bearing the UL Listing Mark for the US and Canada should be considered as being covered by UL's Listing and Follow-Up Service meeting the appropriate requirements for US and Canada.

The UL Listing Mark for the US and Canada generally includes: the UL in a circle symbol with "C" and "US" identifiers:

 the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name (product identifier) as indicated in the appropriate UL Directory.

Additional Information: See UL On-line Certification Directory at WWW.UL.COM for additional information.

Look for the UL Listing Mark on the product

William R. Carney
Director, North American Certification Programs

Underwriters Laboratories Inc.
Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.





FRONIUS IG

GRID-TIED INVERTERS FOR PHOTOVOLTAIC SYSTEMS

Light Weight

At 42 lbs, the FRONIUS IG inverters are the lightest grid-connected inverters making them both easy and cost-effective to install.

More Energy

MDX™ Concept allows your system to output more energy under part-load conditions.

Lower Cost

Integrated UL approved DC & AC disconnects which reduce installation time and complexity - often eliminating the need for additional disconnects.

LCD Display

User-friendly and comes standard with every FRONIUS IG; tracks more than 20 critical system performance parameters.

Powerful

At 4000, 4500 and 5100 watts, these inverters deliver more power output for higher performance installations.

Reliable

Fronius has been in business for over 60 years and has more than 200,000 FRONIUS IG inverters installed worldwide.

Warranty

10 year Premium Warranty.



FRONIUS IG

FRONIUS IG 4000 / 5100 / 4500-LV - Specifications

DC Input Data	FRONIUS IG 4000	FRONIUS IG 5100	FRONIUS IG 4500-LV
Recommended PV power	3000 – 5000 Wp	4000 – 6500 Wp	3800 – 6500 Wp
Max. DC input voltage	500 V	500 V	500 V
Operating DC voltage range	150 – 450 V	150 – 450 V	150 – 450 V
Max. usable DC input current	28.1 A	33.2 A	28.2 A
AC Output Data	FRONIUS IG 4000	FRONIUS IG 5100	FRONIUS IG 4500-LV
Maximum output power @40° C	4000 W	5100 W	4500 W
Nominal AC output voltage	240 V		
Utility AC voltage range	212 – 264 V (240 V +10% / -12%)		
Maximum AC current	18.7 A	21.3 A	21.6 A
Maximum utility back feed current	0.0 A	0.0 A	0.0 A
Operating frequency range	50.5 – 60.5 Hz (60 Hz nom)		
Total harmonic distortion	< 5 %		
Power Factor (cos phi)	1		
General Data	FRONIUS IG 4000	FRONIUS IG 5100	FRONIUS IG 4500-LV
Max. efficiency	85.2 %	85.2 %	84.4 %
Consumption in stand-by	< 0.15 W (typical)		
Consumption during operation	15 W		
Enclosure	NEMA 3R		
Size (h x w x l)†	28.4 x 16.5 x 8.8 in. (720 x 418 x 223 mm)		
Weight	42 lbs. (19 kg)		
Ambient temperature range	-5 to 122 °F (-20 to +50 °C)		
Cooling	controlled forced ventilation		
Integrated DC and AC disconnect	standard UL approved DC & AC disconnects		
Protections			
Ground fault protection	Internal GFDI, in accordance with UL 1741		
DC reverse polarity protection	Internal diode		
Islanding protection	Internal, in accordance with UL 1741, IEEE 1547		
Over temperature	Output power derating		
Surge Protection	Internal DC & AC protection, tested to 6 kV		
Compliance			
Safety	UL 1741		
EMI	FCC Part 15; Class A & B		
Anti-islanding protection	UL 1741, IEEE 1547		
Ground fault detector and interrupter	Compliant with NEC Art. 680 requirements, UL 1741		
Miscellaneous			
Maximum AC over current protection	Two-pole, 30 A circuit breaker		
AC wire sizing	Use minimum AWG # 184°F (80 °C) copper wire		
DC wire sizing	Use minimum AWG # 184°F (80 °C) copper wire		
AC disconnect	32 A		
DC disconnect	40 A		
Warranty	10-year PowerMax Warranty is Standard		

*Standard / Maximum available on some active topology (VLT). We reserve the right to make product changes. The accuracy of not depicted or otherwise reproduced, in whole or in part, in this drawing. Structures require prior written consent of Fronius International GmbH.

Distributed by



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www.fronius-usa.com



Certificate of Compliance

Certificate: 1878274

Master Contract: 203213

Project: 2077183

Date Issued: 2008/09/04

Issued to: Fronius International GmbH
Guenter Fronius Strasse 1
Wels-Thalheim, 4600
Austria
Attention: Mr. Josef Feichtinger

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US'



Issued by: Ernesto Lopez, ASCT.

Authorized by: Lindsay Clark, Product Group Manager

PRODUCTS

- CLASS 5311 09 - POWER SUPPLIES - Distributed Generation Power Systems Equipment
- CLASS 5311 89 - POWER SUPPLIES - Distributed Generation - Power Systems Equipment
- Certified to U.S. Standards

PART A:

Utility Interactive Inverter, Models IG 2000 NEG, IG 2000 POS, IG 3000 NEG, IG 3000 POS, IG 2500-LV NEG, and IG 2500-LV POS, permanently connected. The following system ratings are for Models IG 2000, IG 3000 and IG 2500-LV, unless otherwise indicated:

INPUT RATINGS:

The 'C' and 'US' indicators adjacent to the CSA Mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards, for use in Canada and the U.S., respectively. This 'US' indicator includes products eligible to bear the 'NRTL' indicator. NRTL, i.e., National Recognized Testing Laboratory, is a designation granted





Certificate: 1878274

Master Contract: 203213

Project: 2077183

Date Issued: 2008/09/04

1. Utility Interconnection Default Voltage and Frequency Trip Limits and Trip Times: Voltage and frequency limits for utility interaction.

Simulated utility source - Voltage (V): Condition (A) $< 0.50 V_{nom}$; (B) $0.50 V_{nom} \leq V < 0.88 V_{nom}$; (C) $1.10 V_{nom} < V < 1.20 V_{nom}$; (D) $1.20 V_{nom} \leq V$; (E) Rated; (F) Rated; (G) Rated

Simulated utility source - Frequency (Hz): Condition (A) Rated; (B) Rated; (C) Rated; (D) Rated; (E) $f > 60.5$; (F) $f < (59.8 - 57.0)$ (Adjustable Set Point); (G) $f < 57.0$

Maximum time (sec) at 60 Hz before cessation of current to the simulated utility: Condition (A) 0.16; (B) 2; (C) 1; (D) 0.16; (E) 0.16; (F) 0.16; (G) 0.16

2. Utility interactive evaluations were conducted with the following firmware:

Device: Software Version

Main Controller Microprocessor: 2.06.00

Power Board (DSP): 2.03.01

GFDI Board: 1.00.00

PART B:

Utility Interactive Inverter, Models IG 4000 NEG, IG 4000 POS, IG 5100 NEG, IG 5100 POS, IG 4500-LV NEG, and IG 4500-LV POS, permanently connected. The following system ratings are for Models IG 4000, IG 5100 and IG 4500-LV, unless otherwise indicated:

INPUT RATINGS:

Maximum input voltage: 500 V

Range of input operating voltage: 150-450 V

Maximum input current (ac or dc): 26.1 A (IG 4000), 33.2 A (IG 5100), 29.3 A (IG 4500-LV)

Maximum input short circuit current: 40.0 A

Maximum input source backfeed current to input source: 0

OUTPUT RATINGS:



Certificate: 1878274

Master Contract: 203213

Project: 2077183

Date Issued: 2008/09/04

Notes:

1. Utility Interconnection Default Voltage and Frequency Trip Limits and Trip Times: Voltage and frequency limits for utility interaction

Simulated utility source - Voltage (V): Condition (A) $< 0.50 V_{nom}$; (B) $0.50 V_{nom} \leq V < 0.83 V_{nom}$; (C) $1.10 V_{nom} < V < 1.20 V_{nom}$; (D) $1.20 V_{nom} \leq V$; (E) Rated; (F) Rated; (G) Rated

Simulated utility source - Frequency (Hz): Condition (A) Rated; (B) Rated; (C) Rated; (D) Rated; (E) $f > 60.5$; (F) $f < (59.8 - 57.0)$ (Adjustable Set Point); (G) $f < 57.0$

Maximum time (sec) at 60 Hz before cessation of current to the simulated utility:
Condition (A) 0.16; (B) 2; (C) 1; (D) 0.16; (E) 0.16; (F) 0.16; (G) 0.16

2. Utility interactive evaluations were conducted with the following firmware:

Device: Device Version

Main Controller Microprocessor: 2.09.00

Power Board (DSP): 2.03.01

GFDI Board: 1.00.00

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No. 0-M91 - General Requirements - Canadian Electrical Code - Part II

CAN/CSA-C22.2 No. 0-4-04 - Bonding of Electrical Equipment

CAN/CSA-C22.2 No. 107.1-01 - General Use Power Supplies

UL Std No. 1741-First Edition - Static Inverters and Charge Controllers for Use in Photovoltaic Power Systems (Including Revisions through and including November 7, 2005)



Supplement to Certificate of Compliance

Certificate: 1878274

Master Contract: 203213

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
2020258	2008/03/12	Update Report to include corrections.
1996777	2008/02/06	Update report to include alternate construction.
1878274	2007/03/30	Utility Interactive Inverters, Models IG 2000 NEG, IG 2000 POS, IG 3000 NEG, IG 3000 POS, IG 2500-LV NEG, IG 2500-LV POS, IG 4000 NEG, IG 4000 POS, IG 5100 NEG, IG 5100 POS, IG 4500-LV NEG, IG 4500-LV POS. (C/US)