



# ECOHABIT

STEVENS SOLAR DECATHLON 2013

U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2013

**Stevens Institute of Technology**

As-Built Project Manual

August 22nd , 2013

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Project Manual for

**U.S. D.O.E. Solar Decathlon 2013**

# **ECOHABIT**

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**Appendix A** : Construction Specifications

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

## August 22, 2013 As-Built revision

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

### Fire Protection:

#### *DWG. Changes*

- Changed sidewall sprinkler in Flex room to recessed sprinkler centered in room. – F-101

#### *P.M. Changes*

- -

### Plumbing:

#### *DWG. Changes*

- Hot water tank was changed from 66-gallon to 80-gallon – P-602
- Studor Mini-vents were removed from the project – P-102 & P-601

#### *P.M. Changes*

- Studor Mini-vent cut sheets removed from P.M.

### Mechanical:

#### *DWG. Changes*

- Trane air handler & condenser unit was changed to a Daikin unit – M-601
- Location of Condensate misting tank was to outside thermal envelope – M-603
- ERV was changed from Panasonic to Fantech and moved from Bathroom to Hallway – M-601
- Duct trunk in Flex room was removed & changed to side wall vent – M-101
- Fan in Flex Room was removed – M-101
- All wall transfer grilles were removed from project – M-601 & M-602

#### *P.M. Changes*

- Added Daikin Air Handler & Condenser Unit cut sheets
- Added Fantech ERV cut sheets

### Electrical:

#### *DWG. Changes*

- Removed Outdoor grill & Car Charger circuit – E-601
- Changed Living room & Flex Room lighting from up-light in soffit tray to recessed LED hi-hats – E-103
- Updated size of solar shingle array – E-602
- Location of PV inverters was moved from West wall of Mechanical room to South wall – E-401

#### *P.M. Changes*

- Updated all lighting cut sheets in section 26 51 13
- Summary of Unlisted Electrical Components

### Telecom:

#### *DWG. Changes*

- Updated location of smart sensor units – T-101
- Updated wiring diagrams for control modules – T-602

### Civil:

#### *DWG. Changes*

- Ground contact plan was updated per new footing layout – C-101

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

## August 22, 2013 As-Built revision

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

### Structural:

#### *DWG. Changes*

- Updated footer locations for new deck and ramp design – S-101
- Framing plan was updated for new deck layout – S-105
- Framing Elevations were removed from Drawing set – S-201 & S-202

#### *P.M. Changes*

- Updated calculations for Dry Module 13' Span Header
- Updated calculations for Dry Module Exterior Roof System
- Updated calculations for Dry Module NanaWall Header
- Updated calculations for Dry Module Wall System
- Updated calculations for Wet Module NanaWall Header

### Architectural:

#### *DWG. Changes*

- Changed exit ramp from south side to east side at 1:21 slope – A-101
- Removed light try from Living Room ceiling – A-121
- Removed soffit condition in Flex Room – A-121
- Removed planter boxes along south façade of Wet Module – A-101
- Removed waterfall countertops from Kitchen – A-701 – A-703
- Changed laundry room doors from full swing to bi-fold doors - A-601
- Changed bathroom vanity & faucet – A-602
- Floor finish was changed to white oak hardwood floor – A-602
- Tile selections were updated for bathroom & kitchen backsplash – PM page 09-???
- Painted black steel handrails were added for all decks and ramps – A-101 & A-111
- Updated exterior millwork drawings – A-450 & 451
- Added drawings for aluminum & cedar rainscreen panels – A-???
- Updated millwork drawings to reflect as-built conditions – A-701 – A-710
- Changed soffit condition of main solar roof from aluminum panel to 1x6 T&G cedar – A-571 & 572
- Updated RCP to reflect change in lighting for all rooms – A-121
- Changed Nanawall door in master bedroom to a single inward swing Pella door – A-601
- Scupper was changed to a 6K black round – A-113
- Laundry room ceiling was changed from drywall to acoustical lay-in tiles – A-602 & A-121
- Wall paint finish & color was changed – A-602

#### *P.M. Changes*

- Changed laundry room doors cut sheets in section 08 71 00
- Changed bathroom vanity & faucet cut sheets in section 22 41 16
- Changed floor finish floor cut sheets in section 09 00 00
- Updated waterproofing membrane to W.R. Grace in section 07 25 00

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

### **August 22, 2013 As-Built revision**

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

Operations:

*DWG. Changes*

- Truck Loading plans were updated per new site information – O-103

*P.M. Changes*

-



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

## April 05, 2013 CD-Resubmission revision

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

### Fire Protection:

#### *DWG. Changes*

- Revised sheet F-101 so that it is compliant

#### *P.M. Changes*

- -

### Plumbing:

#### *DWG. Changes*

- -

#### *P.M. Changes*

- -

### Mechanical:

#### *DWG. Changes*

- -

#### *P.M. Changes*

- -

### Electrical:

#### *DWG. Changes*

- C-103-Organizer Utility Panel was moved to a proper locations.
- E-401-DC Disconnect Switches were added for the Inverters.
- E-601-One Line Diagram was updated to reply to comments that were received.
- E-602-Three Line Diagram was updated to reply to comments that were received.
- E-603-Schedule was updated to specify MLO

#### *P.M. Changes*

- Specification 26 24 16 was updated to specify MLO

### Structural:

#### *DWG. Changes*

- S-001: Notes & Symbols Updated
- S-101: New Foundation Plan
- S-102: New Floor Framing; Trus Joist
- S-103: New Roof Framing
- S-701: New Foundation Details

#### *PM Changes*

- Updated Structural Calculations to reflect change from SIPs to conventional framing

### Architectural:

#### *DWG. Changes*

- -

#### *PM Changes*

- -

## Summary of Changes

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

### November 26, 2012 Revision

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

- See Appendix C for DOE Review Comments & Responses

#### Fire Protection:

- No major changes to the drawings
- Updated product cut sheets in P.M. to include sprinkler heads

#### Plumbing:

- Updated plumbing one-line diagrams ( P-602 & P603 )

#### Structural:

##### *DWG. Changes*

- Added Shear wall diagrams to S-001
- P.M. Changes
- Added lateral forces narrative
- Revised structural calcs. from Class III to Class II

#### Architectural:

##### *DWG. Changes*

- Changed layout to laundry room & mech. room to allow for proper code clearance for elec. equipment
- P.M. Changes
- Added more technical info for SIPS & PCM building materials

#### Electrical:

##### *DWG. Changes*

- Inverters and competition PA enclosure move to outside Mech. room
- All calculations were updated on E-603
- Panel schedule on E-603 was fully updated
- E-401 was updated to show clearance requirements

##### *P.M. Changes*

- Added full inverter cut sheets
- Removed Sunny Boy inverter cut sheet (was not used in project)
- Added OCPD cut sheets
- Added MCB cut sheets

#### Mechanical:

##### *DWG. Changes*

- Added sheet M-603 to clarify condensate misting system
- Removed ceiling fan from flex room

## Summary of Changes

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

### February 14, 2013 Revision

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

#### Fire Protection:

##### *DWG. Changes*

- Revised sheet F-101

##### *P.M. Changes*

- Added Quick Response sprinkler cut sheet
- Appended smoke/CO detector cut sheet

#### Plumbing:

##### *DWG. Changes*

- Added sheets P-201, P-202, P-203, and P-901
- Revised sheets P-601, P-602, P-603

##### *P.M. Changes*

- Added water conditioner cut sheet

#### Mechanical:

##### *DWG. Changes*

- Added sheets M-102, M-202, and M-604

##### *P.M. Changes*

- Added air handler TAM8A0A24V21CB cut sheet
- Added split system heat pump XL20i 4TWZ0024 cut sheet
- Added Grainger register cut sheet
- Removed Titus diffuser cut sheet
- Removed Fujitsu cut sheet
- Added equipment pad cut sheet
- Removed solar thermal cut sheets
- Added damper cut sheet

#### Electrical:

##### *DWG. Changes*

- Inverters and Team Organizer Panel moved back into the mechanical room
- Load calculations updated on sheet E-603
- Panel schedule on E-603 was fully updated
- Drawing E-102 was added for "Hardwire Distribution Plan"
- E-101 was updated according to changes
- E-103 was updated according to changes

##### *P.M. Changes*

- Update of Breaker set up to be Schneider
- Update of Sensors for the Automation Module
- Inclusion of Receptacle types

## Summary of Changes

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

### February 14, 2013 Revision

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

#### Electrical con't:

P.M. Changes

- Inclusion of INSTEON system
- Update to Lighting
- Change from Roofing Nail to Roofing Screw

#### Structural:

DWG. Changes

- Updated general notes, design loads, and wood material properties in S-001
- Recalculated size of footings and finalized placement in S-101
- Redesigned wood joists and columns in S-102
- Created roof framing plan in S-103
- Updated SIPs-dry module roof connection and also roof-column connection in S-105
- Redesigned deck joists in S-106
- Created elevation wall framing views in S-200 and S-201

PM Changes

- Updated Lateral Forces Overview to reflect new baseplate size and footing connections
- Added calculations for column headers and NanaWall headers
- Updated deck framing and calculations
- Resized base plate
- Checked for footing overturning due to uplift and shear
- Added Simpson connections

#### Architectural:

DWG. Changes

- Redesigned Kitchen layout
- Wood Rainscreen added to dry module
- Changed window layout in dining room & flex room
- Added Wall Type Dwg. A-551
- Added Millwork Dwg. pgs. A-701 - A-710
- Added Roof Details pgs. A-562, A-561, A-571, A-572
- Added Exterior Porch & Benches Dwg. A-450

PM Changes

- Added door hardware
-

## 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	0-102
Rule 4-2	Construction Equipment	Specifications for heavy machinery	0-101
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	S-101 , S-701
Rule 4-4	Impact within the Solar Envelope	Drawing(s) showing the location, contact area, and bearing pressure of every component resting directly within the solar envelope	G-201, G-202
Rule 4-5	Generators	Specifications for generators (including sound rating)	PROJECT MANUALpg. 97
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	H-101
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	PROJECT MANUAL pg 226-228 & 230.231
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-701
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	G-201, G202
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 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, S-104,S-105, S-200,S-301, S-611, S-701 Project Manual pg. 16

## Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 6-2	Finished Square Footage	Drawing(s) showing all information needed by the rules officials to measure the finished square footage electronically	G-101
Rule 6-2	Finished Square Footage	Drawing(s) showing all movable components that may increase the finished square footage if operated during contest week	N/A
Rule 6-3	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route	G-103
Rule 7-1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	L-101, L-102, L-103, L-602
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	P-103
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	PROJECT MANUAL PG.# 286-289
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	M-101, PROJECT MANUAL PG.# 264,265
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	N/A
Rule 8-5	Village Grid	Completed interconnection application form	PROJECT MANUAL PG.# 82
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	E-602
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	PROJECT MANUAL PG.# 286,289
Rule 8-5	Village Grid	One-line electrical diagram	E-601
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	E-603

## Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	C-103
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	E -401
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	H-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. PDT or between 8 a.m. and 4 p.m. solar time on October 1	H-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	N/A
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	L-102
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	H-101, C-103
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	PROJECT MANUAL pg 221-223 & 230,231
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	H-101, C-103
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	PROJECT MANUAL pg 221-223 & 230,231
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	G-103

## Project Overview

The structural design must accommodate multiple phases of loading, including construction, transportation, and reassembly. Because of the nature of the competition and the location, the house was designed in modular components, wet and dry. The building must be transportable on US highways from Hoboken, New Jersey to Irvine, California. Further investigation is being done as to additional supports that will be provided during shipping to ensure there is enough rigidity and frame support. The service loads account for a three week duration at Orange County Great Park with elevated load criteria and a permanent location in Southern California close to the competition site, using conservative values. A change in final geographic location will require re-evaluation.

## Structural Calculations

This project manual provides an evaluation of construction methods and structural calculations as stipulated by ASCE 7-10 and the Department of Energy for the 2013 Solar Decathlon. The objective of the Structures Team is to create a safe and sensible structural design that maximizes efficiency and minimizes the use of materials that require high energy during production. By using the ASD method to determine the governing load case, the team calculated the roof loads for the wet and dry module, the floor loads and also designed the baseplate and the footings. After working with the Architecture Team to choose appropriate building materials, the group designed the floor beams using Trus Joists at traditional 16" spacing. The dimensions of the house were constrained by the chosen transportation company and additional structural analysis was performed for the connections between the modules and also the roof-wall. The majority of the calculations were done in Microsoft Excel and SMath Studio to provide the designers with flexibility throughout the process and to make alterations easy to implement and check.

## Lateral forces Overview

The lateral forces on the walls supplied through either seismic or wind forces will be supported by the designated shear walls. The plywood sheathing provide shear resistance through their typical construction, and following typical connections will be able to support lateral forces without any additional bracing. These forces will be transferred to the footings by a 6"x6" post that will be connected between the footing and the bottom of the house with a gusset plate, providing a moment support.

The base of the foundation will be layered 16"x24"x3/4" plywood sheets. A CCO Column Cap by Simpson will be shop welded to the steel plate, filed shim as necessary for post. A 6"x6" timber post will connect to the CCO Column Cap. These foundations will be anchored to the ground with two 1" diameter steel rods per footing.



## Structural Calculations

### Load Summary

- **General**

Occupancy Category: II (ASCE 7-10 Table 1.5-1)

- **Construction Loads**

Construction Live Load = 50 psf

- **Transportation Loads**

Wind Load: Service wind load assumed to control (See load calculations below)

Traveling Speed,  $V_{\text{trailer}} = 65 \text{ mph}$

Deceleration rate,  $a = 11.2 \text{ ft/s}^2$

Species	Grade	Bending $F_B$	Compressive Stress $F_C$	Shear $F_V$	Modulus of Elasticity $E$
Douglas Fir Dimensional Lumber	1	1100 psi	1550 psi	180 psi	1800000 psi
Douglas Fir Dimensional Lumber	2	900 psi	1350 psi	180 psi	1600000 psi
Nordic Engineered Wood	20F-1.6E	2000 psi	450 psi	250 psi	1500000 psi
Nordic Engineered Wood	24F-1.9E	2400 psi	460 psi	250 psi	1800000 psi
PLYWOOD		2000 psi		50 psi	700000 psi

West Coast Lumber Inspection Bureau AP-1 (2002)

Nordic Engineered Wood Residential Design Construction Guide

## Structural Calculations

### Load Summary

Load Description	Load (PSF)	Units
<b>A. Live Assembly Load - Roof</b>	0	PSF
Live Assembly Load - Floor	50	PSF
Live Exterior Load - Floor	100	PSF
<b>B. Dead Load</b>		
Timber	5	PSF
Nordic Wood Joists/Headers	2	PSF
Phase Change Material (PCM)	1	PSF
Deck	4	PSF
Misc./Mechanical	5	PSF
Green Wall	35	PSF
Rain Screen	2	PSF
<b>C. Wind Load</b>		
Basic Wind Speed	110	MPH
Importance Factor	II	PSF
Exposure	C	PSF
<b>D. Snow Load</b>	10.5	PSF
Maximum Drift Snow Load	15.95	PSF
<b>E. Seismic Load</b>		
IRC Design Category	D2	PSF
%g*	1.0	
<b>F. Roof Dead Load</b>		
Solar Shingles	3.4	PSF
Rain Garden	15	PSF

For temporary pad footings at temporary site location in Irvine, CA.  
Notify engineer of any change to site location.

\*Reference: IRC, Figure R301.2(2) Seismic Design Categories Site Class D

## Structural Calculations

### Wind Load

	SD2013 Minimum	Wet Module - Northward/Southward	Wet Module Components & Cladding - Northward/Southward	Wet Module - Eastward/Westward	Wet Module Components & Cladding - Eastward/Westward
Risk Category		II	II	II	II
Building Definition		(Gust), Partially Enclosed	Low-Rise, Rigid (Gust), Partially Enclosed	(Gust), Partially Enclosed	Low-Rise, Rigid (Gust), Partially Enclosed
Wind Speed (MPH)	85	110	110	110	110
Wind Directionality Factor, Kd		0.85	0.85	0.85	0.85
Exposure Category	C	C	C	C	C
Topographic Factor Kzt		1	1	1	1
Gust Effect		0.90	0.90	0.89	0.89
gQ		3.40	3.40	3.40	3.40
Iz		0.23	0.23	0.23	0.23
Q		0.95	0.95	0.93	0.93
gV		3.40	3.40	3.40	3.40
c		0.20	0.20	0.20	0.20
zbar		15.00	15.00	15.00	15.00
L, Parallel		27.00	27.00	13.00	13.00
B, Normal		13.00	13.00	27.00	27.00
h		15.42	15.42	15.42	15.42
Lz		427.06	427.06	427.06	427.06
l		500.00	500.00	500.00	500.00
epsilonbar		0.20	0.20	0.20	0.20
Internal Pressure Coefficient, GCpi		0.55	0.55	0.55	0.55
Internal Pressure Coefficient, GCpi		-0.55	-0.55	-0.55	-0.55
Velocity Pressure, Kz		0.85	0.85	0.85	0.85
Velocity Pressure, Kh		0.85	0.85	0.85	0.85
Velocity Pressure, qz = 0.00256*Kz*Kzt*Kd*V <sup>2</sup> (PSF)		22.38	22.35	22.38	22.35
Velocity Pressure, qz = 0.00256*Kh*Kzt*Kd*V <sup>2</sup> (PSF)		22.38	22.38	22.38	22.38
p=q*G*Cp-qi*(GCpi) (PSF) Windward Wall		-22.35	-22.34	-18.29	-18.28
p=q*G*Cp-qi*(GCpi) (PSF) Windward Wall		2.27	2.28	6.33	6.34
p=q*G*Cp-qi*(GCpi) (psf) Leeward Wall, Roof		-18.33	-18.33	-18.29	-18.29
p=q*G*Cp-qi*(GCpi) (psf) Leeward Wal, Roof		6.28	6.28	6.33	6.33
Cp Windward Wall		-0.5	-0.5	-0.3	-0.3
L/B		0.48	0.48	2.08	2.08
Cp Leeward Wall		-0.3	-0.3	-0.3	-0.3
Theta (°)		0	0	0	0
p, Windward Wall [Adjusted] (psf)		-22.35	-22.34	-18.29	-18.28
p, Windward Wall [Adjusted] (psf)		2.27	2.28	6.33	6.34
p, Leeward Wall, Roof [Adjusted] (psf)		-18.33	-18.33	-18.29	-18.29
p, Leeward Wall, Roof [Adjusted] (psf)		6.28	6.28	6.33	6.33

## Structural Calculations

### Wind Load con't

	Dry Module - Northward/Southward	Dry Module Components & Cladding - Northward/Southward	Dry Module - Eastward/Westward	Dry Module Components & Cladding - Eastward/Westward
Risk Category	II	II	II	II
Building Definition	Low-Rise, Rigid (Gust), Partially Enclosed	Low-Rise, Rigid (Gust), Partially Enclosed	Low-Rise, Rigid (Gust), Partially Enclosed	Low-Rise, Rigid (Gust), Partially Enclosed
Wind Speed (MPH)	110	110	110	110
Wind Directionality Factor, Kd	0.85	0.85	0.85	0.85
Exposure Category	C	C	C	C
Topographic Factor Kzt	1	1	1	1
Gust Effect	0.89	0.89	0.89	0.89
gQ	3.40	3.40	3.40	3.40
Iz	0.23	0.23	0.23	0.23
Q	0.93	0.93	0.93	0.93
gV	3.40	3.40	3.40	3.40
c	0.20	0.20	0.20	0.20
zbar	15.00	15.00	15.00	15.00
L, Parallel	26.00	26.00	36.00	36.00
B, Normal	36.00	36.00	26.00	26.00
h	15.42	15.42	15.42	15.42
Lz	427.06	427.06	427.06	427.06
l	500.00	500.00	500.00	500.00
epsilon bar	0.20	0.20	0.20	0.20
Internal Pressure Coefficient, GCpi	0.55	0.55	0.55	0.55
Internal Pressure Coefficient, GCpi	-0.55	-0.55	-0.55	-0.55
Velocity Pressure, Kz	0.85	0.85	0.85	0.85
Velocity Pressure, Kh	0.85	0.85	0.85	0.85
Velocity Pressure, qz = 0.00256*Kz*Kzt*Kd*V <sup>2</sup> (PSF)	22.38	22.35	22.38	22.35
Velocity Pressure, qz = 0.00256*Kh*Kzt*Kd*V <sup>2</sup> (PSF)	22.38	22.38	22.38	22.38
p=q*G*Cp-qi*(GCpi) (PSF) Windward Wall	-20.24	-20.23	-22.27	-22.26
p=q*G*Cp-qi*(GCpi) (PSF) Windward Wall	4.38	4.39	2.34	2.36
p=q*G*Cp-qi*(GCpi) (psf) Leeward Wall, Roof	-18.26	-18.26	-18.29	-18.29
p=q*G*Cp-qi*(GCpi) (psf) Leeward Wal, Roof	6.36	6.36	6.33	6.33
Cp Windward Wall	-0.4	-0.4	-0.5	-0.5
L/B	1.38	1.38	0.72	0.72
Cp Leeward Wall	-0.3	-0.3	-0.3	-0.3
Theta (°)	9	9	9	9
p, Windward Wall [Adjusted] (psf)	18.44	18.43	20.30	20.28
p, Windward Wall [Adjusted] (psf)	-3.99	-4.00	-2.13	-2.15
p, Leeward Wall, Roof [Adjusted] (psf)	16.64	16.64	16.66	16.66
p, Leeward Wall, Roof [Adjusted] (psf)	-5.79	-5.79	-5.77	-5.77

## Structural Calculations

### Snow Loads

Snow Load - Wet Module		
Exposure Factor $C_e$	1.0	
Thermal Factor $C_t$	1.0	
Importance Factor $I_s$	1	PSF
Ground Snow Loads $p_g$	15.0	PSF
Roof Slope	0.00	°
Flat Roof Snow Load	10.5	PSF

Snow Load - Dry Module		
Flat Roof Snow Load	10.5	PSF
Roof Slope	9.00	°
Roof Slope Factor $C_s$	1.0	
Ground Snow Loads $p_g$	15.0	PSF
Sloped Roof Snow Load	0.00	°

### Seismic Loads

	Wet Module	Dry Module	Interior Floor Framing	Exterior Deck Framing
Redundancy factor, $\rho$	1.3	1.3	1.3	1.3
Short period site coefficient, $F_a$	1.0	1.0	1.0	1.0
Mapped $MCE_R$ , $S_s$	150%	150%	150%	150%
$MCE_R$ 5%, $S_{MS}$	1.5	1.5	1.5	1.5
Design 5% damped, $S_{DS}$	1.0	1.0	1.0	1.0
Dead Load (PSF)	27.35	12.35	12.35	16.35
Effects of Horizontal Seismic, $Q_e$	0.27	0.12	0.12	0.16
Effects of Horizontal Earthquake Induced Forces, $E_H$	0.351	0.156	0.156	0.208
Effects of Vertical Earthquake Induced Forces, $E_v$	5.4	2.4	2.4	3.2

**Structural Calculations**

**Load Combination: Wet Module Roof**

<b>Load Cases: Wet Module Roof</b>					
<b>Northward/Southward Wind</b>			<b>Eastward/Westard Wind</b>		
Live load, L	0	PSF	Live load, L	0	PSF
Dead load, D	27	PSF	Dead load, D	27	PSF
Wind Load 1, W1	-22.3	PSF	Wind Load 1, W1	6.3	PSF
Wind Load 2, W2	2.3	PSF	Wind Load 2, W2	-18.3	PSF
Snow load, S	10.5	PSF	Snow load, S	10.5	PSF
Roof live load, Lr	20	PSF	Roof live load, Lr	20	PSF
Seismic 1, E1	5.4	PSF	Seismic 1, E1	5.4	PSF
Seismic 2, E2	-5.4	PSF	Seismic 2, E2	-5.4	PSF
Note: Since the snow load is less than the minimum roof live load of 20 PSF, we will use the 20 PSF live load					
Max of Lr or S or R	20	PSF			
<b>Basic Combinations for Wet Module</b>			<b>Basic Combinations for Wet Module</b>		
1.4D	37.8	PSF	1.4D	37.8	PSF
1.2D + 1.6L + 0.5(Lr or S or R)	42.4	PSF	1.2D + 1.6L + 0.5(Lr or S or R)	42.4	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	53.2	PSF	1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	67.6	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	65.5	PSF	1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	55.3	PSF
1.2D+ 1.0W1 + L +0.5(Lr or S or R)	20.1	PSF	1.2D+ 1.0W1 + L +0.5(Lr or S or R)	48.7	PSF
1.2D+ 1.0W2 + L +0.5(Lr or S or R)	44.7	PSF	1.2D+ 1.0W2 + L +0.5(Lr or S or R)	24.1	PSF
1.2D + 1.0E1 + L + 0.2S	39.9	PSF	1.2D + 1.0E1 + L + 0.2S	39.9	PSF
1.2D + 1.0E2 + L + 0.2S	29.1	PSF	1.2D + 1.0E1 + L + 0.2S	29.1	PSF
0.9D + 1.0W1	-2.5	PSF	0.9D + 1.0W1	26.1	PSF
0.9D + 1.0W2	22.1	PSF	0.9D + 1.0W2	1.5	PSF
0.9D + 1.0E1	25.2	PSF	0.9D + 1.0E1	25.2	PSF
0.9D + 1.0E2	14.4	PSF	0.9D + 1.0E2	14.4	PSF
Maximum Load	65.5	PSF	Maximum Load	67.6	PSF
Minimum Load	-2.5	PSF	Minimum Load	1.5	PSF
<b>Governing Case</b>					
Maximum Load	67.6	PSF			
Minimum Load	-2.5	PSF			

**Structural Calculations**

**Load Combination: Dry Module Roof**

Northward/Southward Wind			Eastward/Westard Wind		
Live load, L	0	PSF	Live load, L	0	PSF
Dead load, D	15.4	PSF	Dead load, D	15.4	PSF
Wind Load 1, W1	-4.0	PSF	Wind Load 1, W1	-2.1	PSF
Wind Load 2, W2	16.6	PSF	Wind Load 2, W2	16.7	PSF
Snow load, S	10.5	PSF	Snow load, S	10.5	PSF
Roof live load, Lr	20	PSF	Roof live load, Lr	20	PSF
Seismic 1, E1	5.4	PSF	Seismic 1, E1	5.4	PSF
Seismic 2, E2	-5.4	PSF	Seismic 2, E2	-5.4	PSF
Note: Since the snow load is less than the minimum roof live load of 20 PSF, we will use the 20 PSF live load					
Max of Lr or S or R	20	PSF			
Basic Combinations for Dry Module			Basic Combinations for Dry Module		
1.4D	21.6	PSF	1.4D	21.6	PSF
1.2D + 1.6L + 0.5(Lr or S or R)	28.5	PSF	1.2D + 1.6L + 0.5(Lr or S or R)	28.5	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	48.5	PSF	1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	49.4	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	58.8	PSF	1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	58.8	PSF
1.2D+ 1.0W1 + L +0.5(Lr or S or R)	24.5	PSF	1.2D+ 1.0W1 + L +0.5(Lr or S or R)	26.3	PSF
1.2D+ 1.0W2 + L +0.5(Lr or S or R)	45.1	PSF	1.2D+ 1.0W2 + L +0.5(Lr or S or R)	45.1	PSF
1.2D + 1.0E1 + L + 0.2S	26.0	PSF	1.2D + 1.0E1 + L + 0.2S	26.0	PSF
1.2D + 1.0E2 + L + 0.2S	15.2	PSF	1.2D + 1.0E1 + L + 0.2S	15.2	PSF
0.9D + 1.0W1	5.4	PSF	0.9D + 1.0W1	7.2	PSF
0.9D + 1.0W2	26.0	PSF	0.9D + 1.0W2	26.0	PSF
0.9D + 1.0E1	14.8	PSF	0.9D + 1.0E1	14.8	PSF
0.9D + 1.0E2	4.0	PSF	0.9D + 1.0E2	4.0	PSF
Maximum Load	58.8	PSF	Maximum Load	58.8	PSF
Minimum Load	4.0	PSF	Minimum Load	4.0	PSF
Governing Case					
Maximum Load	58.8	PSF			
Minimum Load	4.0	PSF			

**Structural Calculations**

**Load Combinations: Interior Floor Framing**

<b>Interior - Floor Framing</b>		
Live load, L	50	PSF
Dead load, D	12	PSF
Wind Load 1, W1	0	PSF
Wind Load 2, W2	0	PSF
Snow load, S	0	PSF
Roof live load, Lr	0	PSF
Seismic 1, E1	2.4	PSF
Seismic 2, E2	-2.4	PSF
<b>Basic Combinations for Interior Floor Framing</b>		
1.4D	16.8	PSF
1.2D + 1.6L + 0.5(Lr or S or R)	94.4	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	64.4	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	64.4	PSF
1.2D + 1.0W1 + L + 0.5(Lr or S or R)	64.4	PSF
1.2D + 1.0W2 + L + 0.5(Lr or S or R)	64.4	PSF
1.2D + 1.0E1 + L + 0.2S	66.8	PSF
1.2D + 1.0E2 + L + 0.2S	62.0	PSF
0.9D + 1.0W1	10.8	PSF
0.9D + 1.0W2	10.8	PSF
0.9D + 1.0E1	13.2	PSF
0.9D + 1.0E2	8.4	PSF
Maximum Load	94.4	PSF
Minimum Load	10.8	PSF



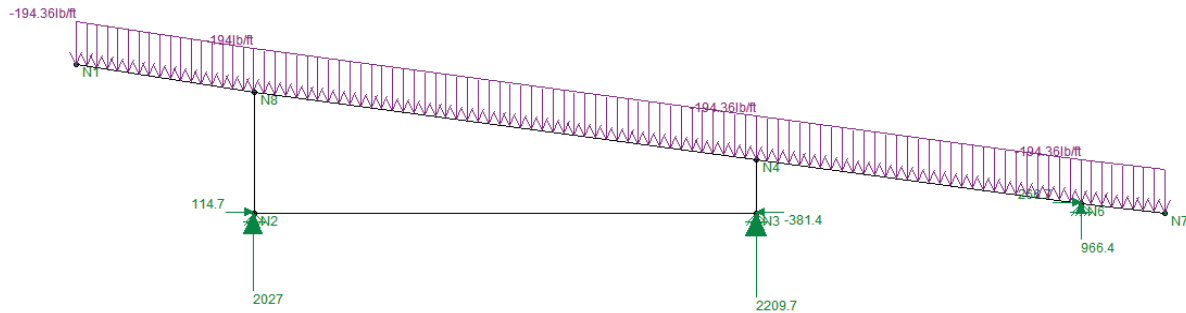
**Structural Calculations**

**Load Combinations: Exterior Deck Framing**

<b>Exterior - Deck Framing</b>					
<b>Northward/Southward Wind</b>			<b>Eastward/Westard Wind</b>		
Live load, L	100	PSF	Live load, L	100	PSF
Dead load, D	9.0	PSF	Dead load, D	9	PSF
Wind Load 1, W1	4.4	PSF	Wind Load 1, W1	2.4	PSF
Wind Load 2, W2	-18.2	PSF	Wind Load 2, W2	-18.3	PSF
Snow load, S	20.0	PSF	Snow load, S	20.0	PSF
Roof live load, Lr	0.0	PSF	Roof live load, Lr	0.0	PSF
Seismic 1, E1	3.2	PSF	Seismic 1, E1	3.2	PSF
Seismic 2, E2	-3.2	PSF	Seismic 2, E2	-3.2	PSF
Basic Combinations for Exterior Deck Framing			Basic Combinations for Exterior Deck Framing		
1.4D	12.6	PSF	1.4D	12.6	PSF
1.2D + 1.6L + 0.5(Lr or S or R)	170.8	PSF	1.2D + 1.6L + 0.5(Lr or S or R)	170.8	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	110.8	PSF	1.2D + 1.6(Lr or S or R) + (L or 0.5W1)	110.8	PSF
1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	110.8	PSF	1.2D + 1.6(Lr or S or R) + (L or 0.5W2)	110.8	PSF
1.2D + 1.0W1 + L + 0.5(Lr or S or R)	115.2	PSF	1.2D + 1.0W1 + L + 0.5(Lr or S or R)	113.2	PSF
1.2D + 1.0W2 + L + 0.5(Lr or S or R)	102.6	PSF	1.2D + 1.0W2 + L + 0.5(Lr or S or R)	102.5	PSF
1.2D + 1.0E1 + L + 0.2S	118.0	PSF	1.2D + 1.0E1 + L + 0.2S	118.0	PSF
1.2D + 1.0E2 + L + 0.2S	111.6	PSF	1.2D + 1.0E2 + L + 0.2S	111.6	PSF
0.9D + 1.0W1	12.5	PSF	0.9D + 1.0W1	10.5	PSF
0.9D + 1.0W2	-10.1	PSF	0.9D + 1.0W2	-10.2	PSF
0.9D + 1.0E1	11.3	PSF	0.9D + 1.0E1	11.3	PSF
0.9D + 1.0E2	4.9	PSF	0.9D + 1.0E2	4.9	PSF
Maximum Load	170.8	PSF	Maximum Load	170.8	PSF
Minimum Load	-10.1	PSF	Minimum Load	-10.2	PSF
Governing Case					
Maximum Load	170.8	PSF			
Minimum Load	-10.2	PSF			

## Structural Calculations

### Dry Module Exterior Roof Design



Middle Span Governs: (Longest Unbraced Length)

Check Long Span for Deflection:

double beam roof rafter  
span:= 12.363 ft Using (2) 1.75"x11.875" 2.0E LVL

(2) 1.75"x11.875" Properties

Geometric Properties

$$w_{2\_175 \times 11875} := 2 \cdot 1.75 \text{ in} \quad t_{2\_175 \times 11875} := 11.875 \text{ in}$$

$$A_{2\_175 \times 11875} := w_{2\_175 \times 11875} \cdot t_{2\_175 \times 11875} \quad A_{2\_175 \times 11875} = 41.5625 \text{ in}^2$$

$$I_{2\_175 \times 11875} := \left( \frac{1}{12} \right) \cdot w_{2\_175 \times 11875} \cdot t_{2\_175 \times 11875}^3 \quad I_{2\_175 \times 11875} = 488.4135 \text{ in}^4$$

$$S_{2\_175 \times 11875} := \frac{I_{2\_175 \times 11875}}{\frac{t_{2\_175 \times 11875}}{2}} \quad S_{2\_175 \times 11875} = 82.2591 \text{ in}^3$$

Material Properties

$$f_{bTJ} := 2600 \text{ psi}$$

$$f_{vTJ} := 285 \text{ psi}$$

Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vTJ} \cdot A_{2\_175 \times 11875}) \quad V_{\text{capacity}} = 8883.9844 \text{ lbf}$$

Shear Strength Applied

1178.6 at 0 ft



-1197.9 at 12.363 ft

$$V_{\text{max}} := 1197.9 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 7.4163$$

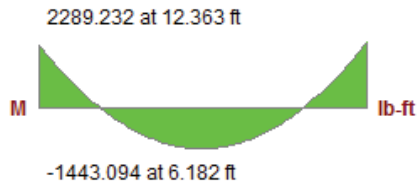
## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{bTJ} S_{2\_175 \times 1187})$$

$$M_{\text{capacity}} = 16040.5273 \text{ lbf ft}$$

### Flexural Strength Applied



$$M_{\text{max}} := 2289.232 \text{ lbf ft}$$

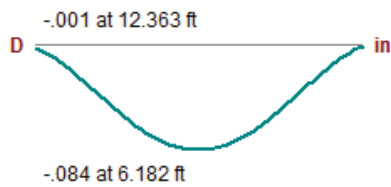
$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 7.0069$$

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{360}$$

$$\delta_{\text{allowable}} = 0.4121 \text{ in}$$



$$\Delta := 0.084 \text{ in}$$

```

if (Δ < δ_allowable)
  Deflection := "OK"
else
  Deflection := "NG"

```

$$\text{Deflection} = \text{"OK"}$$

## Structural Calculations

### Middle Span Governs:

single beam roof rafter  
span:= 12.363 *ft* Using (1) 1.75"x11.875" 2.0E LVL

### 1.75"x11.875" Properties

Geometric Properties

$$w_{175 \times 11875} := 1.75 \text{ in} \quad t_{175 \times 11875} := 11.875 \text{ in}$$

$$A_{175 \times 11875} := w_{175 \times 11875} \cdot t_{175 \times 11875}$$

$$A_{175 \times 11875} = 20.7812 \text{ in}^2$$

$$I_{175 \times 11875} := \left( \frac{1}{12} \right) \cdot w_{175 \times 11875} \cdot t_{175 \times 11875}^3$$

$$I_{175 \times 11875} = 244.2067 \text{ in}^4$$

$$S_{175 \times 11875} := \frac{I_{175 \times 11875}}{\frac{t_{175 \times 11875}}{2}}$$

$$S_{175 \times 11875} = 41.1296 \text{ in}^3$$

Material Properties

$$f_{bTJ} := 2600 \text{ psi}$$

$$f_{vTJ} := 285 \text{ psi}$$

### Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vTJ} \cdot A_{175 \times 11875})$$

$$V_{\text{capacity}} = 4441.9922 \text{ lbf}$$

### Shear Strength Applied

1178.6 at 0 ft



-1197.9 at 12.363 ft

$$V_{\text{max}} := 1197.9 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 3.7081$$

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{bTJ} \cdot S_{175 \times 11875})$$

$$M_{\text{capacity}} = 8020.2637 \text{ lbf ft}$$

### Flexural Strength Applied

2289.232 at 12.363 ft



-1443.094 at 6.182 ft

$$M_{\text{max}} := 2289.232 \text{ lbf ft}$$

$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

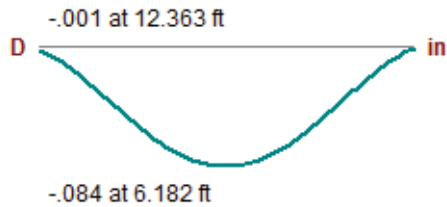
$$FS_M = 3.5035$$

## Structural Calculations

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{360}$$

$$\delta_{\text{allowable}} = 0.4121 \text{ in}$$



$$\Delta := 0.084 \text{ in}$$

```

if (Δ < δallowable)
  Deflection = "OK"
else
  Deflection = "NG"

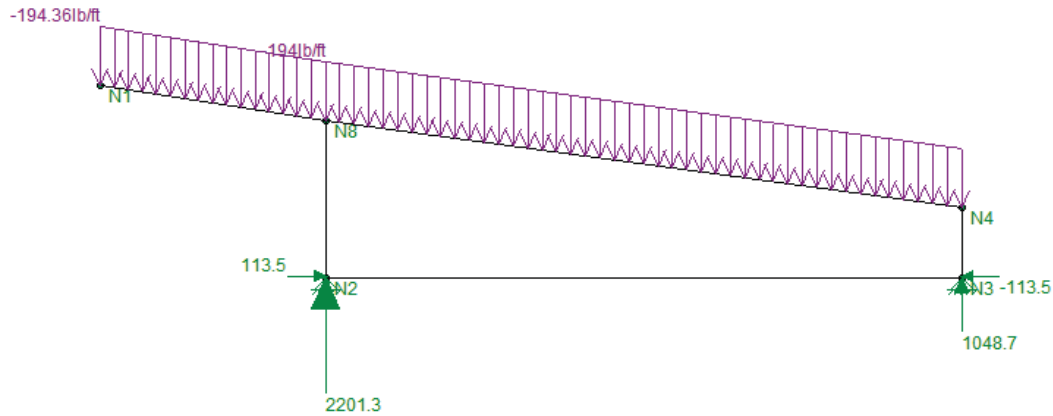
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Deflection = "OK"

## Structural Calculations

10/20/2013 12:29:29 Structural Calculations - Design and Analysis.rvt

### Dry Module Exterior Roof Design



Middle Span Governs: (Longest Unbraced Length)

Check Long Span for Deflection:

double beam roof rafter  
span:=12.363 ft Using (2) 1.75"x11.875" 2.0E LVL

(2) 1.75"x11.875" Properties

Geometric Properties

$$w_{2\_175 \times 11875} := 2 \cdot 1.75 \text{ in} \quad t_{2\_175 \times 11875} := 11.875 \text{ in}$$

$$A_{2\_175 \times 11875} := w_{2\_175 \times 11875} \cdot t_{2\_175 \times 11875}$$

$$A_{2\_175 \times 11875} = 41.5625 \text{ in}^2$$

$$I_{2\_175 \times 11875} := \left( \frac{1}{12} \right) \cdot w_{2\_175 \times 11875} \cdot t_{2\_175 \times 11875}^3$$

$$I_{2\_175 \times 11875} = 488.4135 \text{ in}^4$$

$$S_{2\_175 \times 11875} := \frac{I_{2\_175 \times 11875}}{\frac{t_{2\_175 \times 11875}}{2}}$$

$$S_{2\_175 \times 11875} = 82.2591 \text{ in}^3$$

Material Properties

$$f_{bTJ} := 2600 \text{ psi}$$

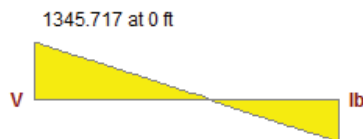
$$f_{vTJ} := 285 \text{ psi}$$

Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vTJ} \cdot A_{2\_175 \times 11875})$$

$$V_{\text{capacity}} = 8883.9844 \text{ lbf}$$

Shear Strength Applied



$$V_{\text{max}} := 1345.7 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 6.6018$$

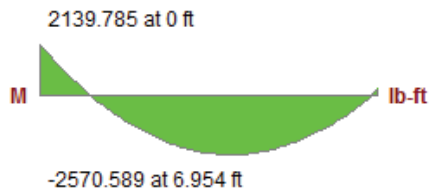
## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{bTJ} \cdot S_{2\_175 \times 11875})$$

$$M_{\text{capacity}} = 8020.2637 \text{ lbf ft}$$

### Flexural Strength Applied



$$M_{\text{max}} := 2570.6 \text{ lbf ft}$$

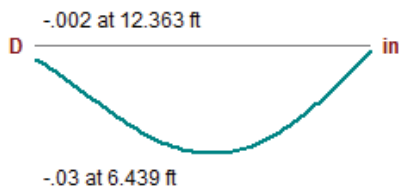
$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 3.5035$$

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{360}$$

$$\delta_{\text{allowable}} = 0.4121 \text{ in}$$



$$\Delta := 0.03 \text{ in}$$

```

if (Δ < δ_allowable)
  Deflection = "OK"
else
  Deflection = "NG"

```

$$\text{Deflection} = \text{"OK"}$$

## Structural Calculations

### Check Long Span for Deflection:

single beam roof rafter

span = 12.363 ft Using (1) 1.75"x11.875" 2.0E LVL

#### 1.75"x11.875" Properties

Geometric Properties

$$w_{175 \times 11875} := 1.75 \text{ in}$$

$$t_{175 \times 11875} := 11.875 \text{ in}$$

$$A_{175 \times 11875} := w_{175 \times 11875} \cdot t_{175 \times 11875}$$

$$A_{175 \times 11875} = 20.7812 \text{ in}^2$$

$$I_{175 \times 11875} := \left(\frac{1}{12}\right) \cdot w_{175 \times 11875} \cdot t_{175 \times 11875}^3$$

$$I_{175 \times 11875} = 244.2067 \text{ in}^4$$

$$S_{175 \times 11875} := \frac{I_{175 \times 11875}}{\frac{t_{175 \times 11875}}{2}}$$

$$S_{175 \times 11875} = 41.1296 \text{ in}^3$$

Material Properties

$$f_{bTJ} := 2600 \text{ psi}$$

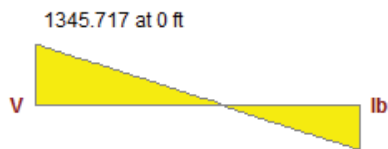
$$f_{vTJ} := 285 \text{ psi}$$

#### Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vTJ} \cdot A_{175 \times 11875})$$

$$V_{\text{capacity}} = 4441.9922 \text{ lbf}$$

#### Shear Strength Applied



$$V_{\text{max}} := 1345.7 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

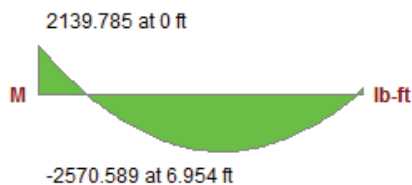
$$FS_V = 3.3009$$

#### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{bTJ} \cdot S_{175 \times 11875})$$

$$M_{\text{capacity}} = 16040.5273 \text{ lbf ft}$$

#### Flexural Strength Applied



$$M_{\text{max}} := 2570.6 \text{ lbf ft}$$

$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 6.24$$

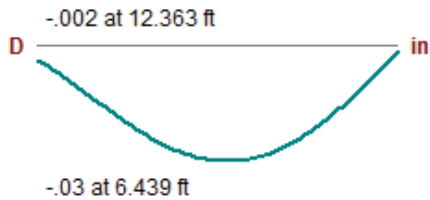


## Structural Calculations

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{360}$$

$$\delta_{\text{allowable}} = 0.4121 \text{ in}$$



$$\Delta := 0.03 \text{ in}$$

```

if (Δ < δallowable)
  Deflection= "OK"
else
  Deflection= "NG"

```

Deflection= "OK"

## Structural Calculations

Check 4x4 Exterior Column for Compression:

### Load Properties

$$P_{\text{Axial}} := 966.4 \text{ lbf} \quad (\text{maximum})$$

### 4" x 4" Dimensional Lumber Geometric Properties

$$L_{4x4} := 12 \text{ ft} \quad (\text{maximum})$$

$$w_{4x4} := 3.5 \text{ in} \quad d_{4x4} := 3.5 \text{ in}$$

$$A_{4x4} := w_{4x4} \cdot d_{4x4}$$

$$A_{4x4} = 12.25 \text{ in}^2$$

$$I_{4x4} := \frac{1}{12} \cdot w_{4x4} \cdot d_{4x4}^3$$

$$I_{4x4} = 12.5052 \text{ in}^4$$

$$S_{4x4} := \frac{I_{4x4}}{\frac{d_{4x4}}{2}}$$

$$S_{4x4} = 7.1458 \text{ in}^3$$

### Material Properties

$$F'_c := f_{\text{cdimlumb}}$$

$$F'_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F'_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{\text{min}} := E_{\text{dimlumb}} \cdot C_M \cdot C_t$$

$$0.822 \cdot E'_{\text{min}}$$

$$E'_{\text{min}} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{\text{min}}}{\left( \frac{L_{4x4}}{\frac{w_{4x4}}{\text{in}}} \right)^2 \cdot \min \left( \frac{w_{4x4}}{\text{in}}, \frac{d_{4x4}}{\text{in}} \right)}$$

$$F_{cE} = 776.9676 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \left( \frac{F_{cE}}{F_{cstar}} \right)}$$

$$C_P = 0.3277$$

$$F'_c := F'_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 707.938 \text{ psi}$$

$$\text{if } \frac{P_{\text{Axial}}}{A_{4x4}} \leq F'_c$$

ColumnCompression = "OK"

ColumnCompression = "OK"

else

ColumnCompression = "NG"

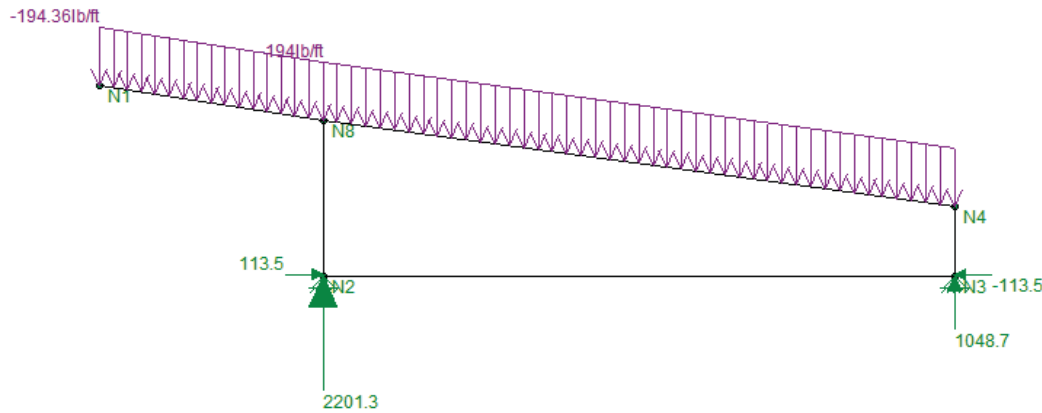
$$FS_{\text{Column}} := \frac{F'_c}{\left( \frac{P_{\text{Axial}}}{A_{4x4}} \right)}$$

$$FS_{\text{Column}} = 8.9738$$

Therefore, Use 4" x 4" Dimensional Lumber Exterior Column for the Solar Roof

## Structural Calculations

### Dry Module Exterior Roof Design



#### Check Long Span for Deflection:

span = 12.363 ft Using (2) 2x10

#### 2x10 Properties

Geometric Properties

$$w_{2 \times 10} := 2.925 \text{ in}$$

$$t_{2 \times 10} := 3.5 \text{ in}$$

$$A_{2 \times 10} := w_{2 \times 10} \cdot t_{2 \times 10}$$

$$A_{2 \times 10} = 64.75 \text{ in}^2$$

$$I_{2 \times 10} := \left(\frac{1}{12}\right) \cdot w_{2 \times 10} \cdot t_{2 \times 10}^3$$

$$I_{2 \times 10} = 66.099 \text{ in}^4$$

$$S_{2 \times 10} := \frac{I_{2 \times 10}}{\frac{t_{2 \times 10}}{2}}$$

$$S_{2 \times 10} = 37.7708 \text{ in}^3$$

Material Properties

$$f_{b2 \times 10} := 900 \text{ psi}$$

$$f_{v2 \times 10} := 180 \text{ psi}$$

#### Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{v2 \times 10} \cdot A_{2 \times 10})$$

$$V_{\text{capacity}} = 8741.25 \text{ lbf}$$

#### Shear Strength Applied

1345.717 at 0 ft



-1030.783 at 12.363 ft

$$V_{\text{max}} := 1345.7 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 6.4957$$

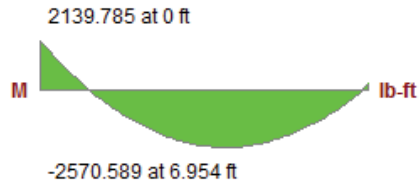
## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{b2\_2x10} \cdot S_{2\_2x10})$$

$$M_{\text{capacity}} = 2549.5312 \text{ lbf ft}$$

### Flexural Strength Applied



$$M_{\text{max}} := 2570.6 \text{ lbf ft}$$

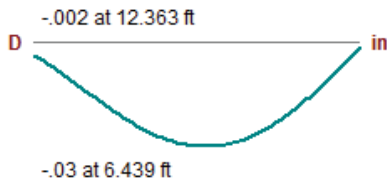
$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 0.9918$$

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{360}$$

$$\delta_{\text{allowable}} = 0.4121 \text{ in}$$



$$\Delta := 0.03 \text{ in}$$

```

if (Δ < δ_allowable)
  Deflection = "OK"
else
  Deflection = "NG"

```

Deflection = "OK"

## Structural Calculations

### Wet Module Roof System Design

(1) 1-3/4" x 7-1/4" LVL Joist, 16" On Center

$$\text{span} = 13 \text{ ft}$$

$$\text{spacing} = 16 \text{ in}$$

### 1-3/4" x 7-1/4" LVL Geometric Properties

$$w_{\text{LVL}} = 1.75 \text{ in} \quad d_{\text{LVL}} = 7.25 \text{ in}$$

$$A_{\text{LVL}} = w_{\text{LVL}} \cdot d_{\text{LVL}}$$

$$A_{\text{LVL}} = 12.6875 \text{ in}^2$$

$$I_{\text{LVL}} = \frac{1}{12} \cdot w_{\text{LVL}} \cdot d_{\text{LVL}}^3$$

$$I_{\text{LVL}} = 55.5739 \text{ in}^4$$

$$S_{\text{LVL}} = \frac{I_{\text{LVL}}}{\frac{d_{\text{LVL}}}{2}}$$

$$S_{\text{LVL}} = 15.3307 \text{ in}^3$$

$$A_{\text{total}} = A_{\text{LVL}}$$

$$A_{\text{total}} = 12.6875 \text{ in}^2$$

$$I_{\text{total}} = I_{\text{LVL}}$$

$$I_{\text{total}} = 55.5739 \text{ in}^4$$

$$S_{\text{total}} = S_{\text{LVL}}$$

$$S_{\text{total}} = 15.3307 \text{ in}^3$$

### Shear Strength Capacity

$$V_{\text{capWMRoof}} = 0.75 \cdot (f_{\text{vTJ}} \cdot A_{\text{LVL}})$$

$$V_{\text{capWMRoof}} = 2711.9531 \text{ lbf}$$

### Flexural Strength Capacity

$$M_{\text{capWMRoof}} = 0.9 \cdot (f_{\text{bTJ}} \cdot S_{\text{LVL}})$$

$$M_{\text{capWMRoof}} = 2989.4922 \text{ lbf ft}$$

### Live Load Deflection Limit

$$\delta_{\text{L}} = \frac{\text{span}}{360}$$

$$\delta_{\text{L}} = 0.4333 \text{ in}$$

### 0.5 Dead + Live Deflection Limit

$$\delta_{\text{DL}} = \frac{\text{span}}{240}$$

$$\delta_{\text{DL}} = 0.65 \text{ in}$$

## Structural Calculations

### Load Conditions

$$\text{Dead}_{\text{WMRoof}} := 27.35 \text{ psf} \quad \text{Live}_{\text{WMRoof}} := 20 \text{ psf} \quad \text{Wind}_{\text{WMRoof}} := 6.3 \text{ psf}$$

$$\text{FactoredLoad}_{\text{WMRoof}} := \text{Dead}_{\text{WMRoof}} + 0.75 \cdot \text{Live}_{\text{WMRoof}} + 0.75 \cdot \text{Wind}_{\text{WMRoof}}$$

$$\text{FactoredLoad}_{\text{WMRoof}} = 47.075 \text{ psf}$$

$$w_{\text{DeadWMRoof}} := \text{Dead}_{\text{WMRoof}} \cdot \text{spacing}$$

$$w_{\text{DeadWMRoof}} = 36.4667 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{LiveWMRoof}} := \text{Live}_{\text{WMRoof}} \cdot \text{spacing}$$

$$w_{\text{LiveWMRoof}} = 26.6667 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{WindWMRoof}} := \text{Wind}_{\text{WMRoof}} \cdot \text{spacing}$$

$$w_{\text{WindWMRoof}} = 8.4 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{totWMRoof}} := \text{FactoredLoad}_{\text{WMRoof}} \cdot \text{spacing}$$

$$w_{\text{totWMRoof}} = 62.7667 \frac{\text{lbf}}{\text{ft}}$$

### Shear Strength Applied

$$V_{\text{WMRoof}} := w_{\text{totWMRoof}} \cdot \frac{\text{span}}{2}$$

$$V_{\text{WMRoof}} = 407.9833 \text{ lbf}$$

### Flexural Strength Applied

$$M_{\text{WMRoof}} := w_{\text{totWMRoof}} \cdot \frac{\text{span}^2}{8}$$

$$M_{\text{WMRoof}} = 1325.9458 \text{ lbf ft}$$

### Live Load Deflection

$$\Delta_L := \frac{5 \cdot w_{\text{LiveWMRoof}} \cdot \text{span}^4}{384 \cdot E \cdot \text{dimlumb}(I_{\text{total}})}$$

$$\Delta_L = 0.1927 \text{ in}$$

### Dead Load Deflection

$$\Delta_D := \frac{5 \cdot w_{\text{DeadWMRoof}} \cdot \text{span}^4}{384 \cdot E \cdot \text{dimlumb}(I_{\text{total}})}$$

$$\Delta_D = 0.2635 \text{ in}$$

### 0.5 Dead + Live Deflection

$$\Delta_{DL} := 0.5 \cdot \Delta_D + \Delta_L$$

$$\Delta_{DL} = 0.3245 \text{ in}$$

### Factors of Safety

$$FS_V := \frac{V_{\text{capWMRoof}}}{V_{\text{WMRoof}}}$$

$$FS_V = 6.6472$$

$$FS_M := \frac{M_{\text{capWMRoof}}}{M_{\text{WMRoof}}}$$

$$FS_M = 2.2546$$

$$\text{if } (FS_V > 1) \wedge (FS_M > 1)$$

Strength= "OK"

else

Strength= "NG"

$$\text{Strength} = \text{"OK"}$$

### Check Deflection

$$\text{if } (\Delta_L < \delta_L) \wedge (\Delta_{DL} < \delta_{DL})$$

Deflection= "OK"

else

Deflection= "NG"

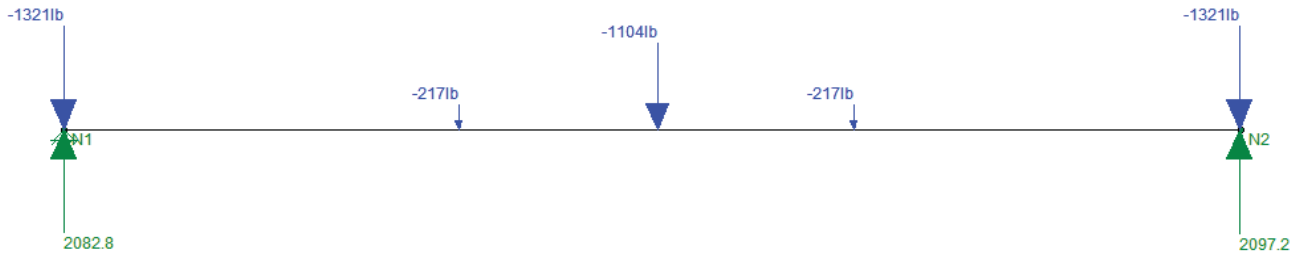
$$\text{Deflection} = \text{"OK"}$$

Therefore, use (1) 1-3/4" x 7-1/4" LVL Joist, Spaced 16" On Center for the Wet Module.

## Structural Calculations

### Dry Module Wall

4' Section Model (worst case scenario - North wall):



Check (2) 2x6 Column for Compression:

#### Load Properties

$$P_{\text{AxialDM}} := 1321.35 \text{ lbf} \quad (\text{maximum})$$

#### 2" x 6" Dimensional Lumber Geometric Properties

$$L_{2 \times 6} := 12 \text{ ft} \quad (\text{maximum})$$

$$w_{2 \times 6} := 2 \cdot 1.5 \text{ in}$$

$$d_{2 \times 6} := 5.5 \text{ in}$$

$$A_{2 \times 6} := w_{2 \times 6} \cdot d_{2 \times 6}$$

$$I_{2 \times 6} := \frac{1}{12} \cdot w_{2 \times 6} \cdot d_{2 \times 6}^3$$

$$S_{2 \times 6} := \frac{\frac{I_{2 \times 6}}{d_{2 \times 6}}}{2}$$

$$A_{2 \times 6} = 16.5 \text{ in}^2$$

$$I_{2 \times 6} = 41.5938 \text{ in}^4$$

$$S_{2 \times 6} = 15.125 \text{ in}^3$$

## Structural Calculations

### Material Properties

$$F_c := f_{cdimlumb}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{CE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{min} := E_{dimlumb} \cdot C_M \cdot C_t$$

$$E'_{min} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{min}}{\left( \frac{L_{2x6}}{\frac{w_{2x6}}{in}} \right)^2 \cdot \min \left( \left( \frac{w_{2x6}}{in} \right), \left( \frac{d_{2x6}}{in} \right) \right)}$$

$$F_{cE} = 570.8333 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \left( \frac{F_{cE}}{F_{cstar}} \right)}$$

$$C_P = 0.2479$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 535.5251 \text{ psi}$$

$$\text{if } \frac{P_{AxialDM}}{A_{2x6}} \leq F'_c$$

ColumnCompression = "OK"

else

ColumnCompression = "NG"

ColumnCompression = "OK"

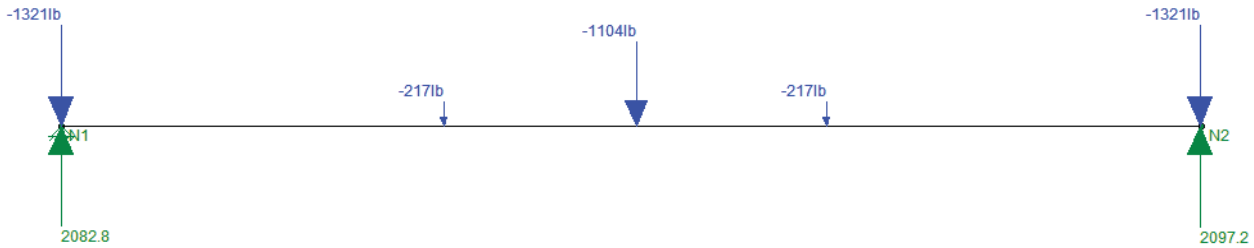
$$FS_{Column} := \frac{F'_c}{\left( \frac{P_{AxialDM}}{A_{2x6}} \right)}$$

$$FS_{Column} = 6.6872$$

**Therefore, Use 2" x 6" Dimensional Lumber Column, spaced 16" on center for wall framing in the Dry Module. Every 4', use (2) 2" x 6" Dimensional Lumber Columns to support the load of the Exterior Roof Columns.**



## Structural Calculations



### Check Long Span for Deflection:

span:= 4 ft Using (2) 2"x8" Dimensional Lumber

#### (2) 2"x8" Properties

##### Geometric Properties

$$w_{2\_2x8} := 2.1.5 \text{ in} \quad t_{2\_2x8} := 7.25 \text{ in}$$

$$A_{2\_2x8} := w_{2\_2x8} \cdot t_{2\_2x8}$$

$$A_{2\_2x8} = 21.75 \text{ in}^2$$

$$I_{2\_2x8} := \left(\frac{1}{12}\right) \cdot w_{2\_2x8} \cdot t_{2\_2x8}^3$$

$$I_{2\_2x8} = 95.2695 \text{ in}^4$$

$$S_{2\_2x8} := \frac{I_{2\_2x8}}{\frac{t_{2\_2x8}}{2}}$$

$$S_{2\_2x8} = 26.2812 \text{ in}^3$$

##### Material Properties

$$f_{bdimlumb} := 900 \text{ psi}$$

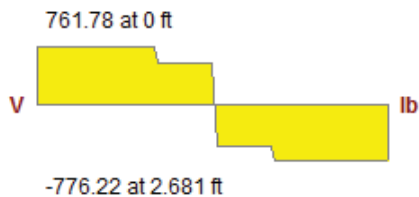
$$f_{vdimlumb} := 180 \text{ psi}$$

### Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vdimlumb} \cdot A_{2\_2x8})$$

$$V_{\text{capacity}} = 2936.25 \text{ lbf}$$

### Shear Strength Applied



$$V_{\text{max}} := 776.22 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 3.7828$$

## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{\text{bdimlumb}} \cdot S_{2\_2 \times 8})$$

$$M_{\text{capacity}} = 1773.9844 \text{ lbf ft}$$

### Flexural Strength Applied



-1367.275 at 1.98 ft

$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$M_{\text{max}} := 1367.275 \text{ lbf ft}$$

$$FS_M = 1.2975$$

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{720}$$

$$\delta_{\text{allowable}} = 0.0667 \text{ in}$$



-0.02 at 1.98 ft

if ( $\Delta < \delta_{\text{allowable}}$ )  
Deflection:= "OK"  
else  
Deflection:= "NG"

$$\Delta := 0.02 \text{ in}$$

Deflection= "OK"

## Structural Calculations

### Material Properties

$$F_c := f_{cdimlumb}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{min} := E_{dimlumb} \cdot C_M \cdot C_t$$

$$E'_{min} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{min}}{\left( \frac{L_{2x6}}{\text{in}} \right)^2 \cdot \min \left( \left( \frac{w_{2x6}}{\text{in}} \right), \left( \frac{d_{2x6}}{\text{in}} \right) \right)}$$

$$F_{cE} = 142.7083 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \left( \frac{F_{cE}}{F_{cstar}} \right)}$$

$$C_P = 0.0652$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 140.7463 \text{ psi}$$

$$\text{if } \frac{P_{AxialWM}}{A_{2x6}} \leq F'_c$$

ColumnCompression= "OK"

else

ColumnCompression= "NG"

$$\text{ColumnCompression} = \text{"OK"}$$

$$FS_{Column} := \frac{F'_c}{\left( \frac{P_{AxialWM}}{A_{2x6}} \right)}$$

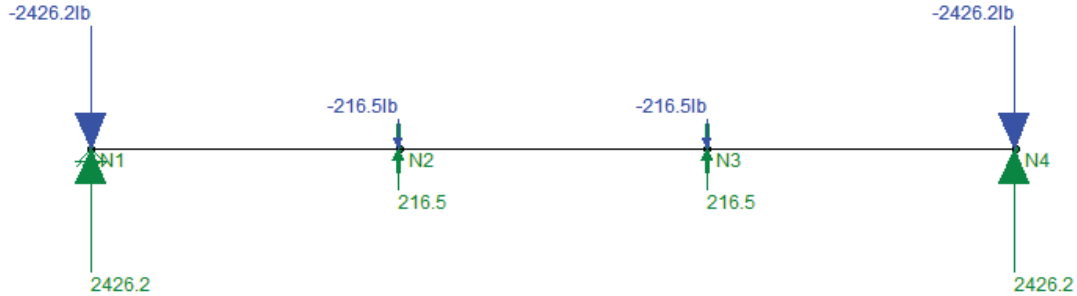
$$FS_{Column} = 2.8461$$

Therefore, Use 2" x 6" Dimensional Lumber Column, spaced 16" on center for wall framing in the Wet Module.

## Structural Calculations

### Dry Module Wall

4' Section Model:



Check (2) 2x6 Column for Compression:

#### Load Properties

$$P_{\text{AxialDM}} := 2426.2 \text{ lbf} \quad (\text{maximum})$$

#### 2" x 6" Dimensional Lumber Geometric Properties

$$L_{2x6} := 12 \text{ ft} \quad (\text{maximum})$$

$$w_{2x6} := 2 \cdot 1.5 \text{ in}$$

$$d_{2x6} := 5.5 \text{ in}$$

$$A_{2x6} := w_{2x6} \cdot d_{2x6}$$

$$A_{2x6} = 16.5 \text{ in}^2$$

$$I_{2x6} := \frac{1}{12} \cdot w_{2x6} \cdot d_{2x6}^3$$

$$I_{2x6} = 41.5938 \text{ in}^4$$

$$S_{2x6} := \frac{I_{2x6}}{\frac{d_{2x6}}{2}}$$

$$S_{2x6} = 15.125 \text{ in}^3$$

## Structural Calculations

### Material Properties

$$F_c := f_{cdimlumb}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{min} := E_{dimlumb} \cdot C_M \cdot C_t$$

$$E'_{min} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{min}}{\left( \frac{L_{2x6}}{\text{in}} \right)^2 \cdot \min \left( \frac{w_{2x6}}{\text{in}}, \frac{d_{2x6}}{\text{in}} \right)}$$

$$F_{cE} = 570.8333 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \frac{F_{cE}}{F_{cstar} \cdot c}}$$

$$C_P = 0.2479$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 535.5251 \text{ psi}$$

$$\text{if } \frac{P_{AxialDM}}{A_{2x6}} \leq F'_c$$

ColumnCompression= "OK"

else

ColumnCompression= "NG"

$$\text{ColumnCompression} = \text{"OK"}$$

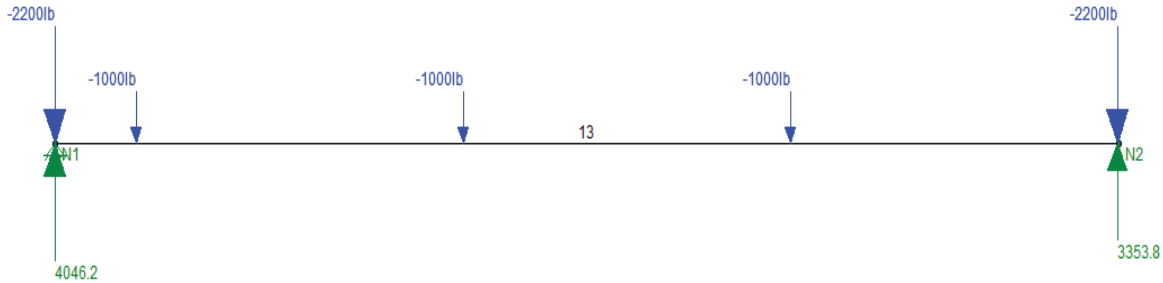
$$FS_{Column} := \frac{F'_c}{\left( \frac{P_{AxialDM}}{A_{2x6}} \right)}$$

$$FS_{Column} = 3.642$$

Therefore, Use 2" x 6" Dimensional Lumber Column, spaced 16" on center for wall framing in the Dry Module. Every 4', use (2) 2" x 6" Dimensional Lumber Columns to support the load of the Exterior Roof Columns.

## Structural Calculations

### Dry Module 13' Span Header



#### Check Long Span for Deflection:

span:= 13 ft      Using (3) 1.75"x7.25" 2.0E LVL

#### (3) 1.75"x7.25" Properties

##### Geometric Properties

$$w_{3\_175 \times 725} := 3 \cdot 1.75 \text{ in} \quad t_{3\_175 \times 725} := 7.25 \text{ in}$$

$$A_{3\_175 \times 725} := w_{3\_175 \times 725} \cdot t_{3\_175 \times 725}$$

$$A_{3\_175 \times 725} = 38.0625 \text{ in}^2$$

$$I_{3\_175 \times 725} := \left( \frac{1}{12} \right) \cdot w_{3\_175 \times 725} \cdot t_{3\_175 \times 725}^3$$

$$I_{3\_175 \times 725} = 166.7217 \text{ in}^4$$

$$S_{3\_175 \times 725} := \frac{I_{3\_175 \times 725}}{\frac{t_{3\_175 \times 725}}{2}}$$

$$S_{3\_175 \times 725} = 45.9922 \text{ in}^3$$

##### Material Properties

$$f_{bTJ} := 2600 \text{ psi}$$

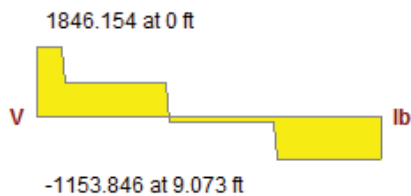
$$f_{vTJ} := 285 \text{ psi}$$

#### Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vTJ} \cdot A_{3\_175 \times 725})$$

$$V_{\text{capacity}} = 8135.8594 \text{ lbf}$$

#### Shear Strength Applied



$$V_{\text{max}} := 1846.2 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 4.4068$$

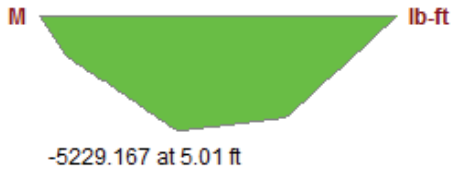
## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{\text{bTJ}} \cdot S_{3\_175 \times 725})$$

$$M_{\text{capacity}} = 8968.4766 \text{ lbf ft}$$

### Flexural Strength Applied



$$M_{\text{max}} := 5529.2 \text{ lbf ft}$$

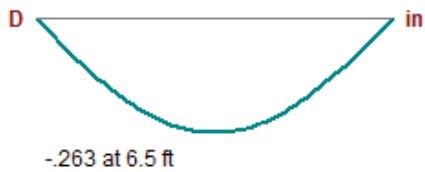
$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 1.622$$

### Approximate Deflection Limit

$$\delta_{\text{approx}} := \frac{\text{span}}{300}$$

$$\delta_{\text{approx}} = 0.52 \text{ in}$$



$$\Delta := 0.263 \text{ in}$$

```

if (Δ < δapprox)
  Deflection= "OK"
else
  Deflection= "NG"

```

$$\text{Deflection} = \text{"OK"}$$

## Structural Calculations

Check 2x6 Column for Compression:

### Load Properties

$$P_{\text{Axial}} := 4046.2 \text{ lbf} \quad (\text{maximum})$$

### (2) 2" x 6" Dimensional Lumber Geometric Properties

$$L_{2x6} := 12 \text{ ft} \quad (\text{maximum})$$

$$w_{2x6} := 2 \cdot 1.5 \text{ in} \quad d_{2x6} := 5.5 \text{ in}$$

$$A_{2x6} := w_{2x6} \cdot d_{2x6}$$

$$A_{2x6} = 16.5 \text{ in}^2$$

$$I_{2x6} := \frac{1}{12} \cdot w_{2x6} \cdot d_{2x6}^3$$

$$I_{2x6} = 41.5938 \text{ in}^4$$

$$S_{2x6} := \frac{I_{2x6}}{\frac{d_{2x6}}{2}}$$

$$S_{2x6} = 15.125 \text{ in}^3$$

### Material Properties

$$F_c := f_{\text{cdimlumb}}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{\text{min}} := E_{\text{dimlumb}} \cdot C_M \cdot C_t$$

$$E'_{\text{min}} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{\text{min}}}{\left( \frac{L_{2x6}}{\frac{d_{2x6}}{2}} \right)^2 \cdot \min \left( \frac{w_{2x6}}{\frac{d_{2x6}}{2}}, \frac{d_{2x6}}{2} \right)}$$

$$F_{cE} = 570.8333 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \left( \frac{F_{cE}}{F_{cstar}} \right) \cdot \frac{1}{c}}$$

$$C_P = 0.2479$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 535.5251 \text{ psi}$$

$$\text{if } \frac{P_{\text{Axial}}}{A_{2x6}} \leq F'_c$$

ColumnCompression = "OK"

ColumnCompression = "OK"

else

ColumnCompression = "NG"

$$FS_{\text{Column}} := \frac{F'_c}{\left( \frac{P_{\text{Axial}}}{A_{2x6}} \right)}$$

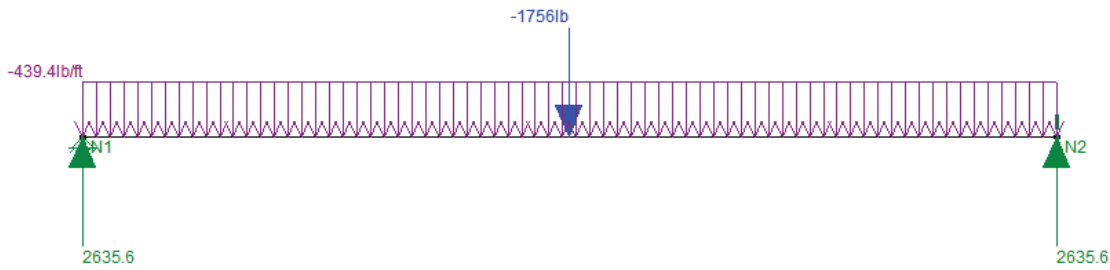
$$FS_{\text{Column}} = 2.1838$$

Therefore, use (2) 2" x 6" Dimensional Lumber Column, spaced 16" on center for wall framing in the Wet Module.



## Structural Calculations

### Wet Module NanaWall Header



#### Check Long Span for Deflection:

span = 8 ft Using (3) 1.75"x11.875" 2.0E LVL

#### (3) 1.75"x11.875" Properties

##### Geometric Properties

$$w_{3\_175 \times 11875} = 3 \cdot 1.75 \text{ in } t_{3\_175 \times 11875} = 11.875 \text{ in}$$

$$A_{3\_175 \times 11875} = w_{3\_175 \times 11875} \cdot t_{3\_175 \times 11875}$$

$$A_{3\_175 \times 11875} = 62.3438 \text{ in}^2$$

$$I_{3\_175 \times 11875} = \left( \frac{1}{12} \right) \cdot w_{3\_175 \times 11875} \cdot t_{3\_175 \times 11875}^3$$

$$I_{3\_175 \times 11875} = 732.6202 \text{ in}^4$$

$$S_{3\_175 \times 11875} = \frac{I_{3\_175 \times 11875}}{t_{3\_175 \times 11875}}$$

$$S_{3\_175 \times 11875} = 123.3887 \text{ in}^3$$

##### Material Properties

$$f_{bTJ} = 2600 \text{ psi}$$

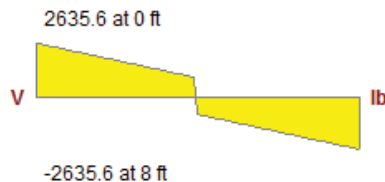
$$f_{vTJ} = 285 \text{ psi}$$

#### Shear Strength Capacity

$$V_{\text{capacity}} = 0.75 \cdot (f_{vTJ} \cdot A_{3\_175 \times 11875})$$

$$V_{\text{capacity}} = 13325.9766 \text{ lbf}$$

#### Shear Strength Applied



$$V_{\text{max}} = 2635.6 \text{ lbf}$$

$$FS_V = \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 5.0561$$

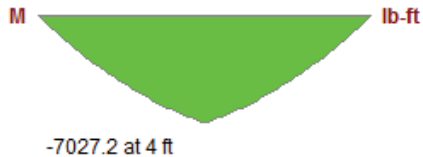
## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{bTJ} \cdot S_{3\_175 \times 1187})$$

$$M_{\text{capacity}} = 24060.791 \text{ lbf ft}$$

### Flexural Strength Applied



$$M_{\text{max}} := 7027.2 \text{ lbf ft}$$

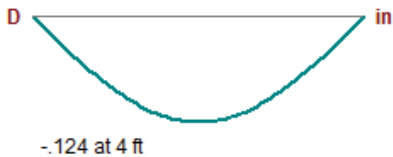
$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 3.424$$

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{720}$$

$$\delta_{\text{allowable}} = 0.1333 \text{ in}$$



$$\Delta := 0.124 \text{ in}$$

```
if (Δ < δ allowable)
  Deflection = "OK"
else
  Deflection = "NG"
```

Deflection = "OK"

## Structural Calculations

Check 2x6 Column for Compression:

### Load Properties

$$P_{\text{Axial}} := 2635.6 \text{ lbf} \quad (\text{maximum})$$

### (2) 2" x 6" Dimensional Lumber Geometric Properties

$$L_{2x6} := 12 \text{ ft} \quad (\text{maximum})$$

$$w_{2x6} := 2 \cdot 1.5 \text{ in} \quad d_{2x6} := 5.5 \text{ in}$$

$$A_{2x6} := w_{2x6} \cdot d_{2x6}$$

$$A_{2x6} = 16.5 \text{ in}^2$$

$$I_{2x6} := \frac{1}{12} \cdot w_{2x6} \cdot d_{2x6}^3$$

$$I_{2x6} = 41.5938 \text{ in}^4$$

$$S_{2x6} := \frac{I_{2x6}}{\frac{d_{2x6}}{2}}$$

$$S_{2x6} = 15.125 \text{ in}^3$$

### Material Properties

$$F_c := f_{\text{cdimlumb}}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{\text{min}} := E_{\text{dimlumb}} \cdot C_M \cdot C_t$$

$$0.822 \cdot E'_{\text{min}}$$

$$E'_{\text{min}} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{E'_{\text{min}}}{\left( \frac{L_{2x6}}{\frac{in}{in}} \right)^2 \cdot \min \left( \frac{w_{2x6}}{\frac{in}{in}}, \frac{d_{2x6}}{\frac{in}{in}} \right)}$$

$$F_{cE} = 570.8333 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \frac{F_{cE}}{c}}$$

$$C_P = 0.2479$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 535.5251 \text{ psi}$$

$$\text{if } \frac{P_{\text{Axial}}}{A_{2x6}} \leq F'_c$$

ColumnCompression = "OK"

ColumnCompression = "OK"

else

ColumnCompression = "NG"

$$FS_{\text{Column}} := \frac{F'_c}{\frac{P_{\text{Axial}}}{A_{2x6}}}$$

$$FS_{\text{Column}} = 3.3526$$

## Structural Calculations

### Dry Module NanaWall Header



#### Check Long Span for Deflection:

span:= 11 ft Using (3) 1.75"x11.875" 2.0E LVL

#### 1.75"x11.875" Properties

##### Geometric Properties

$$w_{3\_175 \times 11875} := 3 \cdot 1.75 \text{ in} \quad t_{3\_175 \times 11875} := 11.875 \text{ in}$$

$$A_{3\_175 \times 11875} := w_{3\_175 \times 11875} \cdot t_{3\_175 \times 11875}$$

$$A_{3\_175 \times 11875} = 62.3438 \text{ in}^2$$

$$I_{3\_175 \times 11875} := \left( \frac{1}{12} \right) \cdot w_{3\_175 \times 11875} \cdot t_{3\_175 \times 11875}^3$$

$$I_{3\_175 \times 11875} = 732.6202 \text{ in}^4$$

$$S_{3\_175 \times 11875} := \frac{I_{3\_175 \times 11875}}{\frac{t_{3\_175 \times 11875}}{2}}$$

$$S_{3\_175 \times 11875} = 123.3887 \text{ in}^3$$

##### Material Properties

$$f_{bTJ} := 2600 \text{ psi}$$

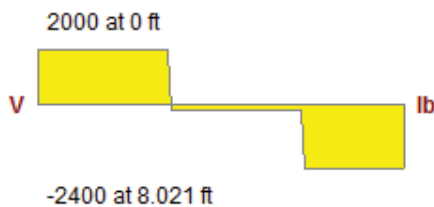
$$f_{vTJ} := 285 \text{ psi}$$

#### Shear Strength Capacity

$$V_{\text{capacity}} := 0.75 \cdot (f_{vTJ} \cdot A_{3\_175 \times 11875})$$

$$V_{\text{capacity}} = 13325.9766 \text{ lbf}$$

#### Shear Strength Applied



$$V_{\text{max}} := 2400 \text{ lbf}$$

$$FS_V := \frac{V_{\text{capacity}}}{V_{\text{max}}}$$

$$FS_V = 5.5525$$

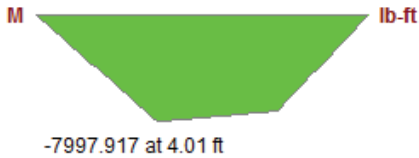
## Structural Calculations

### Flexural Strength Capacity

$$M_{\text{capacity}} := 0.9 \cdot (f_{bTJ} \cdot S_{3\_175 \times 1187})$$

$$M_{\text{capacity}} = 24060.791 \text{ lbf ft}$$

### Flexural Strength Applied



$$M_{\text{max}} := 7997.9 \text{ lbf ft}$$

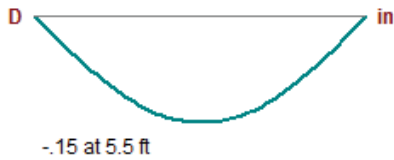
$$FS_M := \frac{M_{\text{capacity}}}{M_{\text{max}}}$$

$$FS_M = 3.0084$$

### Allowable Deflection Limit

$$\delta_{\text{allowable}} := \frac{\text{span}}{720}$$

$$\delta_{\text{allowable}} = 0.1833 \text{ in}$$



$$\Delta := 0.15 \text{ in}$$

```

if (Δ < δ_allowable)
  Deflection = "OK"
else
  Deflection = "NG"

```

Deflection = "OK"

## Structural Calculations

Check 2x6 Column for Compression:

### Load Properties

$$P_{\text{Axial}} := 4600 \text{ lbf} \quad (\text{maximum})$$

### (2) 2" x 6" Dimensional Lumber Geometric Properties

$$L_{2x6} := 12 \text{ ft} \quad (\text{maximum})$$

$$w_{2x6} := 2 \cdot 1.5 \text{ in}$$

$$d_{2x6} := 5.5 \text{ in}$$

$$A_{2x6} := w_{2x6} \cdot d_{2x6}$$

$$A_{2x6} = 16.5 \text{ in}^2$$

$$I_{2x6} := \frac{1}{12} \cdot w_{2x6} \cdot d_{2x6}^3$$

$$I_{2x6} = 41.5938 \text{ in}^4$$

$$S_{2x6} := \frac{I_{2x6}}{\frac{d_{2x6}}{2}}$$

$$S_{2x6} = 15.125 \text{ in}^3$$

### Material Properties

$$F_c := f_{\text{cdimlumb}}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{\text{min}} := \frac{E_{\text{dimlumb}} \cdot C_M \cdot C_t}{0.822 \cdot E'_{\text{min}}}$$

$$E'_{\text{min}} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{E'_{\text{min}}}{\left( \frac{\frac{L_{2x6}}{\text{in}}}{\min \left( \left( \frac{w_{2x6}}{\text{in}} \cdot \frac{d_{2x6}}{\text{in}} \right) \right)} \right)^2}$$

$$F_{cE} = 570.8333 \text{ psi}$$

$$C_P := \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} - \sqrt{\left( \frac{1 + \left( \frac{F_{cE}}{F_{cstar}} \right)}{2 \cdot c} \right)^2 - \frac{F_{cE}}{c}}$$

$$C_P = 0.2479$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 535.5251 \text{ psi}$$

$$\text{if } \frac{P_{\text{Axial}}}{A_{2x6}} \leq F'_c$$

ColumnCompression = "OK"

ColumnCompression = "OK"

else

ColumnCompression = "NG"

$$FS_{\text{Column}} := \frac{F'_c}{\left( \frac{P_{\text{Axial}}}{A_{2x6}} \right)}$$

$$FS_{\text{Column}} = 1.9209$$

Therefore, use (2) 2" x 6" Dimensional Lumber Column, spaced 16" on center for wall framing in the Wet Module.

## Structural Calculations

$$A_{total} := A_{TJI}$$

$$A_{total} = 9.9375 \text{ in}^2$$

$$I_{total} := I_{TJI}$$

$$I_{total} = 129.9883 \text{ in}^4$$

$$S_{total} := S_{TJI}$$

$$S_{total} = 27.366 \text{ in}^3$$

### Shear Strength Capacity

$$V_{capWMFloor} := 1900 \text{ lbf} \quad (\text{from Design Properties})$$

$$V_{capWMFloor} = 1900 \text{ lbf}$$

### Flexural Strength Capacity

$$M_{capWMFloor} := 4990 \text{ lbf ft} \quad (\text{from Design Properties})$$

$$M_{capWMFloor} = 4990 \text{ lbf ft}$$

### Live Load Deflection Limit

$$\delta_L := \frac{\text{span}}{360}$$

$$\delta_L = 0.4333 \text{ in}$$

### 0.5 Dead + Live Deflection Limit

$$\delta_{DL} := \frac{\text{span}}{240}$$

$$\delta_{DL} = 0.65 \text{ in}$$

### Load Conditions

$$\text{Dead}_{WMFloor} := 12.35 \text{ psf} \quad \text{Live}_{WMFloor} := 50 \text{ psf}$$

$$\text{FactoredLoad}_{WMFloor} := 1.2 \cdot \text{Dead}_{WMFloor} + 1.6 \cdot \text{Live}_{WMFloor}$$

$$\text{FactoredLoad}_{WMFloor} = 94.82 \text{ psf}$$

$$w_{\text{DeadWMFloor}} := \text{Dead}_{WMFloor} \cdot \text{spacing}$$

$$w_{\text{DeadWMFloor}} = 16.4667 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{LiveWMFloor}} := \text{Live}_{WMFloor} \cdot \text{spacing}$$

$$w_{\text{LiveWMFloor}} = 66.6667 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{totWMFloor}} := \text{FactoredLoad}_{WMFloor} \cdot \text{spacing}$$

$$w_{\text{totWMFloor}} = 126.4267 \frac{\text{lbf}}{\text{ft}}$$

### Shear Strength Applied

$$V_{WMFloor} := w_{\text{totWMFloor}} \cdot \frac{\text{span}}{2}$$

$$V_{WMFloor} = 821.7733 \text{ lbf}$$

### Flexural Strength Applied

$$M_{WMFloor} := w_{\text{totWMFloor}} \cdot \frac{\text{span}^2}{8}$$

$$M_{WMFloor} = 2670.7633 \text{ lbf ft}$$

## Structural Calculations

### Live Load Deflection

$$\Delta_L := \frac{5 \cdot w_{\text{LiveWMFloor}} \cdot \text{span}^4}{384 \cdot E_{\text{dimlumb}}(I_{\text{total}})}$$

$$\Delta_L = 0.206 \text{ in}$$

### Dead Load Deflection

$$\Delta_D := \frac{5 \cdot w_{\text{DeadWMFloor}} \cdot \text{span}^4}{384 \cdot E_{\text{dimlumb}}(I_{\text{total}})}$$

$$\Delta_D = 0.0509 \text{ in}$$

### 0.5 Dead + Live Deflection

$$\Delta_{DL} := 0.5 \cdot \Delta_D + \Delta_L$$

$$\Delta_{DL} = 0.2314 \text{ in}$$

### Factors of Safety

$$FS_V := \frac{V_{\text{capWMFloor}}}{V_{\text{WMFloor}}}$$

$$FS_V = 2.3121$$

$$FS_M := \frac{M_{\text{capWMFloor}}}{M_{\text{WMFloor}}}$$

$$FS_M = 1.8684$$

$$\text{if } (FS_V > 1) \wedge (FS_M > 1)$$

Strength= "OK"

Strength= "OK"

else

Strength= "NG"

### Check Deflection

$$\text{if } (\Delta_L < \delta_L) \wedge (\Delta_{DL} < \delta_{DL})$$

Deflection= "OK"

Deflection= "OK"

else

Deflection= "NG"

**Therefore, use (1) 2-1/2" x 9-1/2" TJI s31, @ 16" on center**

### Wet Module Floor Girder Design

(2) 1-3/4" x 9-1/2" Laminated Veneer Lumber

$$\text{wallheight} = 10 \text{ ft}$$

$$\text{span} = 6 \text{ ft}$$

### 1-3/4" x 9-1/2" LVL Geometric Properties

$$w_{\text{LVL}} := 2.175 \text{ in} \quad d_{\text{LVL}} := 9.5 \text{ in}$$

$$A_{\text{LVL}} := w_{\text{LVL}} \cdot d_{\text{LVL}}$$

$$A_{\text{LVL}} = 33.25 \text{ in}^2$$

$$I_{\text{LVL}} := \frac{1}{12} \cdot w_{\text{LVL}} \cdot d_{\text{LVL}}^3$$

$$I_{\text{LVL}} = 250.0677 \text{ in}^4$$

$$S_{\text{LVL}} := \frac{I_{\text{LVL}}}{\frac{d_{\text{LVL}}}{2}}$$

$$S_{\text{LVL}} = 52.6458 \text{ in}^3$$



## Structural Calculations

### Shear Strength Capacity

$$V_{\text{capFloorGirder}} := 0.75 \cdot (f_{vTJ} \cdot A_{LVL})$$

$$V_{\text{capFloorGirder}} = 7107.1875 \text{ lbf}$$

### Flexural Strength Capacity

$$M_{\text{capFloorGirder}} := 0.9 \cdot \left( f_{bTJ} \cdot \left( \frac{12 \text{ in}}{d_{LVL}} \right)^{0.136} \right) \cdot S_{LVL}$$

$$M_{\text{capFloorGirder}} = 10597.3397 \text{ lbf ft}$$

### Live Load Deflection Limit

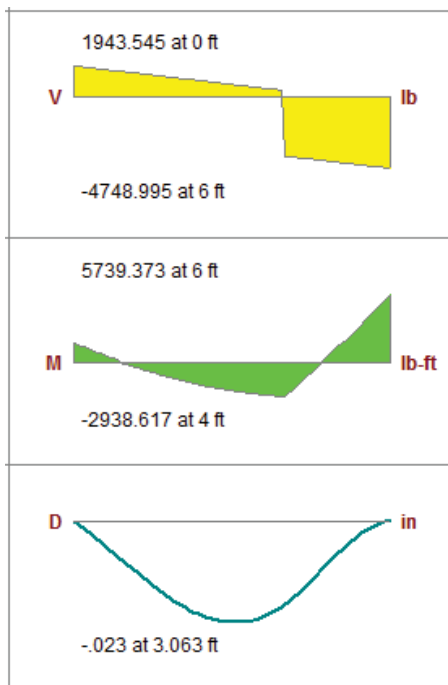
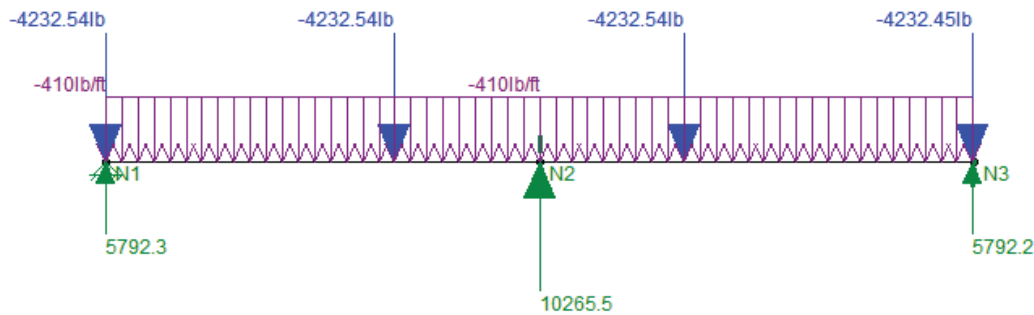
$$\delta_L := \frac{\text{span}}{360}$$

$$\delta_L = 0.2 \text{ in}$$

### 0.5 Dead + Live Deflection Limit

$$\delta_{DL} := \frac{\text{span}}{240}$$

$$\delta_{DL} = 0.3 \text{ in}$$



$$V_{\text{max}} := 4749.995 \text{ lbf}$$

$$M_{\text{max}} := 5739.373 \text{ lbf ft}$$

$$\Delta_{\text{max}} := 0.023 \text{ in}$$

## Structural Calculations

### Factors of Safety

$$FS_V := \frac{V_{capFloorGirder}}{V_{max}}$$

$$FS_V = 1.4963$$

$$FS_M := \frac{M_{capFloorGirder}}{M_{max}}$$

$$FS_M = 1.8464$$

if  $(FS_V > 1) \wedge (FS_M > 1)$

Strength= "OK"

Strength= "OK"

else

Strength= "NG"

### Check Deflection

if  $(\Delta_{max} < \delta_L) \wedge (\Delta_{max} < \delta_{DL})$

Deflection= "OK"

Deflection= "OK"

else

Deflection= "NG"

Therefore, use (2) 1-3/4" x 9-1/2" LVL.

## Structural Calculations

### Dry Module Floor System Design

(1) TJI 2-1/2" x 9-1/2" s31

$$\text{span} := 13 \text{ ft}$$

$$\text{spacing} := 16 \text{ in}$$

### TJI 2-1/2" x 9-1/2" Geometric Properties

$$t_{\text{TJI}} := 9.5 \text{ in}$$

$$w_{\text{TJIf1}} := 2.5 \text{ in}$$

$$w_{\text{TJIweb}} := 0.375 \text{ in}$$

$$t_{\text{TJIf1}} := 1.5 \text{ in}$$

$$t_{\text{TJIweb}} := t_{\text{TJI}} - 2 \cdot t_{\text{TJIf1}}$$

$$t_{\text{TJIweb}} = 6.5 \text{ in}$$

$$A_{\text{TJI}} := 2 \cdot (w_{\text{TJIf1}} \cdot t_{\text{TJIf1}}) + w_{\text{TJIweb}} \cdot t_{\text{TJIweb}}$$

$$A_{\text{TJI}} = 9.9375 \text{ in}^2$$

$$I_{\text{TJI}} := 2 \cdot \left( \frac{1}{12} \cdot (w_{\text{TJIf1}} \cdot t_{\text{TJIf1}})^3 + (w_{\text{TJIf1}} \cdot t_{\text{TJIf1}}) \cdot \left( \frac{t_{\text{TJI}}}{2} - \frac{t_{\text{TJIf1}}}{2} \right)^2 \right) + \frac{1}{12} \cdot w_{\text{TJIweb}} \cdot t_{\text{TJIweb}}^3$$

$$I_{\text{TJI}} = 129.9883 \text{ in}^4$$

$$S_{\text{TJI}} := \frac{I_{\text{TJI}}}{\frac{t_{\text{TJI}}}{2}}$$

$$S_{\text{TJI}} = 27.366 \text{ in}^3$$

$$A_{\text{total}} := A_{\text{TJI}}$$

$$A_{\text{total}} = 9.9375 \text{ in}^2$$

$$I_{\text{total}} := I_{\text{TJI}}$$

$$I_{\text{total}} = 129.9883 \text{ in}^4$$

$$S_{\text{total}} := S_{\text{TJI}}$$

$$S_{\text{total}} = 27.366 \text{ in}^3$$

### Shear Strength Capacity

$$V_{\text{capDMFloor}} := 1900 \text{ lbf} \quad (\text{from Design Properties})$$

$$V_{\text{capDMFloor}} = 1900 \text{ lbf}$$

### Flexural Strength Capacity

$$M_{\text{capDMFloor}} := 4990 \text{ lbf ft} \quad (\text{from Design Properties})$$

$$M_{\text{capDMFloor}} = 4990 \text{ lbf ft}$$

### Live Load Deflection Limit

$$\delta_L := \frac{\text{span}}{360}$$

$$\delta_L = 0.4333 \text{ in}$$

### 0.5 Dead + Live Deflection Limit

$$\delta_{\text{DL}} := \frac{\text{span}}{240}$$

$$\delta_{\text{DL}} = 0.65 \text{ in}$$

## Structural Calculations

### Load Conditions

$$\text{Dead}_{\text{DMFloor}} := 12.35 \text{ psf} \quad \text{Live}_{\text{DMFloor}} := 50 \text{ psf}$$

$$\text{FactoredLoad}_{\text{DMFloor}} := 1.2 \cdot \text{Dead}_{\text{DMFloor}} + 1.6 \cdot \text{Live}_{\text{DMFloor}}$$

$$\text{FactoredLoad}_{\text{DMFloor}} = 94.82 \text{ psf}$$

$$w_{\text{DeadDMFloor}} := \text{Dead}_{\text{DMFloor}} \cdot \text{spacing}$$

$$w_{\text{DeadDMFloor}} = 16.4667 \frac{\text{lb}}{\text{ft}}$$

$$w_{\text{LiveDMFloor}} := \text{Live}_{\text{DMFloor}} \cdot \text{spacing}$$

$$w_{\text{LiveDMFloor}} = 66.6667 \frac{\text{lb}}{\text{ft}}$$

$$w_{\text{totDMFloor}} := \text{FactoredLoad}_{\text{DMFloor}} \cdot \text{spacing}$$

$$w_{\text{totDMFloor}} = 126.4267 \frac{\text{lb}}{\text{ft}}$$

### Shear Strength Applied

$$V_{\text{DMFloor}} := w_{\text{totDMFloor}} \cdot \frac{\text{span}}{2}$$

$$V_{\text{DMFloor}} = 821.7733 \text{ lb}$$

### Flexural Strength Applied

$$M_{\text{DMFloor}} := w_{\text{totDMFloor}} \cdot \frac{\text{span}^2}{8}$$

$$M_{\text{DMFloor}} = 2670.7633 \text{ lb ft}$$

### Live Load Deflection

$$\Delta_L := \frac{5 \cdot w_{\text{LiveDMFloor}} \cdot \text{span}^4}{384 \cdot E_{\text{dimlumb}} \cdot (I_{\text{total}})}$$

$$\Delta_L = 0.206 \text{ in}$$

### Dead Load Deflection

$$\Delta_D := \frac{5 \cdot w_{\text{DeadDMFloor}} \cdot \text{span}^4}{384 \cdot E_{\text{dimlumb}} \cdot (I_{\text{total}})}$$

$$\Delta_D = 0.0509 \text{ in}$$

### 0.5 Dead + Live Deflection

$$\Delta_{\text{DL}} := 0.5 \cdot \Delta_D + \Delta_L$$

$$\Delta_{\text{DL}} = 0.2314 \text{ in}$$

### Factors of Safety

$$\text{FS}_V := \frac{V_{\text{capDMFloor}}}{V_{\text{DMFloor}}}$$

$$\text{FS}_V = 2.3121$$

$$\text{FS}_M := \frac{M_{\text{capDMFloor}}}{M_{\text{DMFloor}}}$$

$$\text{FS}_M = 1.8684$$

$$\text{if } (\text{FS}_V > 1) \wedge (\text{FS}_M > 1)$$

Strength= "OK"

Strength= "OK"

else

Strength= "NG"

### Check Deflection

$$\text{if } (\Delta_L < \delta_L) \wedge (\Delta_{\text{DL}} < \delta_{\text{DL}})$$

Deflection= "OK"

Deflection= "OK"

else

Deflection= "NG"

## Structural Calculations

### Dry Module Floor Girder Design

(2) 1-3/4" x 9-1/2" Laminated Veneer Lumber

wallheight=10 ft

span=6 ft

#### 1-3/4" x 9-1/2" LVL Geometric Properties

$$w_{LVL} := 2 \cdot 1.75 \text{ in} \quad d_{LVL} := 9.5 \text{ in}$$

$$A_{LVL} := w_{LVL} \cdot d_{LVL}$$

$$A_{LVL} = 33.25 \text{ in}^2$$

$$I_{LVL} := \frac{1}{12} \cdot w_{LVL} \cdot d_{LVL}^3$$

$$I_{LVL} = 250.0677 \text{ in}^4$$

$$S_{LVL} := \frac{I_{LVL}}{\frac{d_{LVL}}{2}}$$

$$S_{LVL} = 52.6458 \text{ in}^3$$

#### Shear Strength Capacity

$$V_{capWMFloorGirder} := 0.75 \cdot (f_{vTJ} \cdot A_{LVL})$$

$$V_{capWMFloorGirder} = 7107.1875 \text{ lbf}$$

#### Flexural Strength Capacity

$$M_{capWMFloorGirder} := 0.9 \cdot \left( f_{bTJ} \cdot \left( \frac{12 \text{ in}}{d_{LVL}} \right)^{0.136} \right) \cdot S_{LVL}$$

$$M_{capWMFloorGirder} = 10597.3397 \text{ lbf ft}$$

#### Live Load Deflection Limit

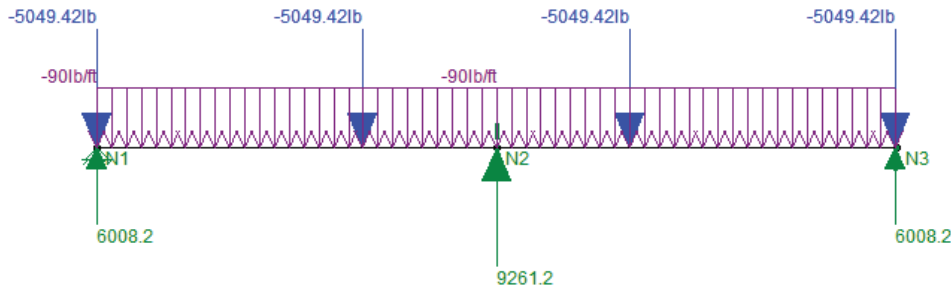
$$\delta_L := \frac{\text{span}}{360}$$

$$\delta_L = 0.2 \text{ in}$$

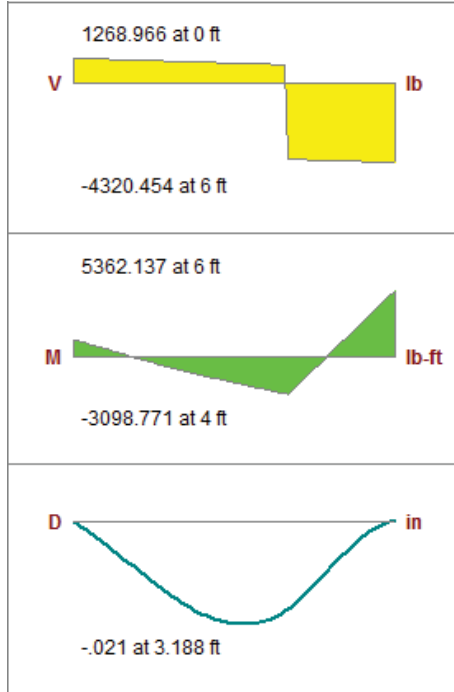
#### 0.5 Dead + Live Deflection Limit

$$\delta_{DL} := \frac{\text{span}}{240}$$

$$\delta_{DL} = 0.3 \text{ in}$$



## Structural Calculations



$$V_{\max} := 4320.454 \text{ lbf}$$

$$M_{\max} := 5362.137 \text{ lb-ft}$$

$$\Delta_{\max} := 0.021 \text{ in}$$

### Factors of Safety

$$FS_V := \frac{V_{\text{capWMFloorGirder}}}{V_{\max}}$$

$$FS_V = 1.645$$

$$FS_M := \frac{M_{\text{capWMFloorGirder}}}{M_{\max}}$$

$$FS_M = 1.9763$$

```
if (FS_V > 1) ^ (FS_M > 1)
  Strength = "OK"
else
  Strength = "NG"
```

Strength = "OK"

### Check Deflection

```
if (Δ_max < δ_L) ^ (Δ_max < δ_DL)
  Deflection = "OK"
else
  Deflection = "NG"
```

Deflection = "OK"

## Structural Calculations

26 Mar 2013 14:57:15 - Deck Floor System.sm

### Deck Framing

Note: All Deck Framing Calculations were completed using the ASD Method and a flexural bending capacity of 1100 psi for the Douglas Fir, Gr 1.

#### Deck Joists

2x10 Dimensional Lumber

Conservatively, use the longest span of deck found on the east side of the house.

$$\text{span} := 10 \text{ ft}$$

$$\text{spacing} := 16 \text{ in}$$

#### 2x10 Geometric Properties

$$w_{2x10} := 1.5 \text{ in}$$

$$t_{2x10} := 9.25 \text{ in}$$

$$A_{2x10} := w_{2x10} \cdot t_{2x10}$$

$$A_{2x10} = 13.875 \text{ in}^2$$

$$I_{2x10} := \left(\frac{1}{12}\right) \cdot w_{2x10} \cdot t_{2x10}^3$$

$$I_{2x10} = 98.9316 \text{ in}^4$$

$$S_{2x10} := \frac{I_{2x10}}{\frac{t_{2x10}}{2}}$$

$$S_{2x10} = 21.3906 \text{ in}^3$$

#### Shear Strength Capacity

$$V_{\text{capDeck}} := 1.0 \cdot (f_{\text{vdimlumb}} \cdot A_{2x10})$$

$$V_{\text{capDeck}} = 2497.5 \text{ lbf}$$

#### Flexural Strength Capacity

$$M_{\text{capDeck}} := 1.0 \cdot (f_{\text{bdimlumb}} \cdot S_{2x10})$$

$$M_{\text{capDeck}} = 2254.9284 \text{ lbf ft}$$

#### Live Load Deflection Limit

$$\delta_L := \frac{\text{span}}{360}$$

$$\delta_L = 0.3333 \text{ in}$$

#### 0.5 Dead + Live Deflection Limit

$$\delta_{DL} := \frac{\text{span}}{240}$$

$$\delta_{DL} = 0.5 \text{ in}$$

#### Load Conditions

$$\text{Dead}_{\text{Deck}} := 12 \text{ psf}$$

$$\text{Live}_{\text{Deck}} := 100 \text{ psf}$$

$$\text{Wind}_{\text{Deck}} := 4.4 \text{ psf}$$

$$\text{FactoredLoad}_{\text{Deck}} := 1.0 \cdot \text{Dead}_{\text{Deck}} + 1.0 \cdot \text{Live}_{\text{Deck}} + 0.5 \cdot \text{Wind}_{\text{Deck}}$$

$$\text{FactoredLoad}_{\text{Deck}} = 114.2 \text{ psf}$$

$$w_{\text{DeadDeck}} := \text{Dead}_{\text{Deck}} \cdot \text{spacing}$$

$$w_{\text{DeadDeck}} = 16 \frac{\text{lbf}}{\text{ft}}$$

## Structural Calculations

26 Mar 2013 14:57:15 - Deck Floor System.sm

### Flexural Strength Applied

$$M_{Deck} := w_{totDeck} \cdot \frac{span^2}{8}$$

$$M_{Deck} = 1903.3333 \text{ lbf ft}$$

### Live Load Deflection

$$\Delta_L := \frac{5 \cdot w_{LiveDeck} \cdot span^4}{384 \cdot E_{dimlumb} \cdot (I_{2x10})}$$

$$\Delta_L = 0.1685 \text{ in}$$

### Dead Load Deflection

$$\Delta_D := \frac{5 \cdot w_{DeadDeck} \cdot span^4}{384 \cdot E_{dimlumb} \cdot (I_{2x10})}$$

$$\Delta_D = 0.0202 \text{ in}$$

### 0.5 Dead + Live Deflection

$$\Delta_{DL} := 0.5 \cdot \Delta_D + \Delta_L$$

$$\Delta_{DL} = 0.1786 \text{ in}$$

### Factors of Safety

$$FS_V := \frac{V_{capDeck}}{V_{Deck}}$$

$$FS_V = 3.2804$$

$$FS_M := \frac{M_{capDeck}}{M_{Deck}}$$

$$FS_M = 1.1847$$

if  $(FS_V > 1) \wedge (FS_M > 1)$   
Strength= "OK"  
else  
Strength= "NG"

Strength= "OK"

### Check Deflection

if  $(\Delta_L < \delta_L) \wedge (\Delta_{DL} < \delta_{DL})$   
Deflection= "OK"  
else  
Deflection= "NG"

Deflection= "OK"

Therefore, use 2x10 Douglas Fir, Gr. 1, 16 inches on center.



## Structural Calculations

26 Mar 2013 14:57:15 - Deck Floor System.sm

Deck Beam

(2) 2x10 Dimensional Lumber conservatively use

$$\begin{aligned} \text{span} &= 6 \text{ ft} \\ \text{joistspan} &= 10 \text{ ft} \\ \text{joistspacing} &= 16 \text{ in} \end{aligned}$$

### 2x10 Geometric Properties

$$w_{2\_2x10} := 2.1.5 \text{ in} \qquad t_{2\_2x10} := 9.25 \text{ in}$$

$$A_{2\_2x10} := w_{2\_2x10} \cdot t_{2\_2x10}$$

$$A_{2\_2x10} = 27.75 \text{ in}^2$$

$$I_{2\_2x10} := \left(\frac{1}{12}\right) \cdot w_{2\_2x10} \cdot t_{2\_2x10}^3$$

$$I_{2\_2x10} = 197.8633 \text{ in}^4$$

$$S_{2\_2x10} := \frac{I_{2\_2x10}}{\frac{t_{2\_2x10}}{2}}$$

$$S_{2\_2x10} = 42.7812 \text{ in}^3$$

### Shear Strength Capacity

$$V_{\text{capDeckBeam}} := 1.0 \cdot (f_{\text{vdimlumb}} \cdot A_{2\_2x10})$$

$$V_{\text{capDeck}} = 2497.5 \text{ lbf}$$

### Flexural Strength Capacity

$$M_{\text{capDeckBeam}} := 1.0 \cdot (f_{\text{bdimlumb}} \cdot S_{2\_2x10})$$

$$M_{\text{capDeck}} = 2254.9284 \text{ lbf ft}$$

### Live Load Deflection Limit

$$\delta_L := \frac{\text{span}}{360}$$

$$\delta_L = 0.2 \text{ in}$$

### 0.5 Dead + Live Deflection Limit

$$\delta_{DL} := \frac{\text{span}}{240}$$

$$\delta_{DL} = 0.3 \text{ in}$$

### Load Conditions

As an approximation, distribute Deck Joist loads:

$$w_{\text{DeadDeckBeam}} := w_{\text{DeadDeck}} \cdot \frac{\text{joistspan}}{2} \cdot \frac{1}{\text{joistspacing}}$$

$$w_{\text{DeadDeckBeam}} = 60 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{LiveDeckBeam}} := w_{\text{LiveDeck}} \cdot \frac{\text{joistspan}}{2} \cdot \frac{1}{\text{joistspacing}}$$

$$w_{\text{LiveDeckBeam}} = 500 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{WindDeckBeam}} := w_{\text{WindDeck}} \cdot \frac{\text{joistspan}}{2} \cdot \frac{1}{\text{joistspacing}}$$

$$w_{\text{WindDeckBeam}} = 22 \frac{\text{lbf}}{\text{ft}}$$

$$w_{\text{totDeckBeam}} := 1.0 \cdot w_{\text{DeadDeckBeam}} + 1.0 \cdot w_{\text{LiveDeckBeam}} + 0.5 \cdot w_{\text{WindDeckBeam}}$$

$$w_{\text{totDeckBeam}} = 571 \frac{\text{lbf}}{\text{ft}}$$

## Structural Calculations

26 Mar 2013 14:57:15 - Deck Floor System.sm

### Shear Strength Applied

$$V_{\text{DeckBeam}} := w_{\text{totDeckBeam}} \cdot \frac{\text{span}}{2}$$

$$V_{\text{DeckBeam}} = 1713 \text{ lbf}$$

### Flexural Strength Applied

$$M_{\text{DeckBeam}} := w_{\text{totDeckBeam}} \cdot \frac{\text{span}^2}{8}$$

$$M_{\text{DeckBeam}} = 2569.5 \text{ lbf ft}$$

### Live Load Deflection

$$\Delta_L := \frac{5 \cdot w_{\text{LiveDeckBeam}} \cdot \text{span}^4}{384 \cdot E_{\text{dimlumb}} \cdot (I_{2\_2 \times 10})}$$

$$\Delta_L = 0.0409 \text{ in}$$

### Dead Load Deflection

$$\Delta_D := \frac{5 \cdot w_{\text{DeadDeckBeam}} \cdot \text{span}^4}{384 \cdot E_{\text{dimlumb}} \cdot (I_{2\_2 \times 10})}$$

$$\Delta_D = 0.0049 \text{ in}$$

### 0.5 Dead + Live Deflection

$$\Delta_{DL} := 0.5 \cdot \Delta_D + \Delta_L$$

$$\Delta_{DL} = 0.0434 \text{ in}$$

### Factors of Safety

$$FS_V := \frac{V_{\text{capDeckBeam}}}{V_{\text{DeckBeam}}}$$

$$FS_V = 2.9159$$

$$FS_M := \frac{M_{\text{capDeckBeam}}}{M_{\text{DeckBeam}}}$$

$$FS_M = 1.7551$$

$$\text{if } (FS_V > 1) \wedge (FS_M > 1)$$

Strength= "OK"

Strength= "OK"

else

Strength= "NG"

### Check Deflection

$$\text{if } (\Delta_L < \delta_L) \wedge (\Delta_{DL} < \delta_{DL})$$

Deflection= "OK"

Deflection= "OK"

else

Deflection= "NG"

Therefore, use (2) 2x10 Douglas Fir, Gr. 1 beams.

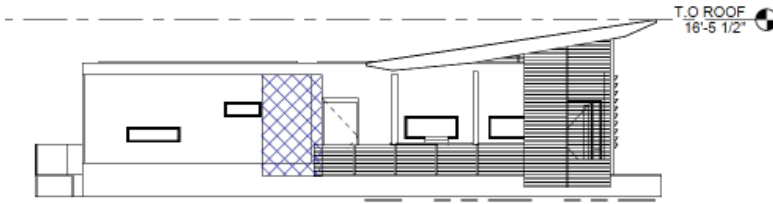
## Structural Calculations

<b>Load At Supports &amp; Footings</b>						
<b>Dry Module</b>						
Total (See Calculations)	9261	lb	per footing			
Base Plate Size (B)	16	in				
(L)	24	in				
(Effective) Base Plate Area	256	in <sup>2</sup>				
	1.78	ft <sup>2</sup>				
Check Diagonal	24.70	in				
Allowable PSF	6000	PSF				
Actual PSF	5209.31	PSF				
Check:	<b>OK</b>					
<b>Wet Module</b>						
			<b>Wet Module (Water Tank Side)</b>			
Total (See Calculations)	10265.5	lb	per footing	Total	10265.5	lb per footing
Base Plate Size (B)	16	in		Base Plate Size (B)	16	in
(L)	24	in		(L)	24	in
(Effective) Base Plate Area	256	in <sup>2</sup>		(Effective) Base Plate Area	256	in <sup>2</sup>
	1.78	ft <sup>2</sup>			1.78	ft <sup>2</sup>
Check Diagonal	24.70	in		Check Diagonal	24.70	in
Allowable PSF	6000	PSF		Allowable PSF	6000	PSF
Actual PSF	5774.34	PSF		Actual PSF	5774.34	PSF
Check:	<b>OK</b>			Check:	<b>OK</b>	
<b>Deck (with Columns)</b>			<b>Deck (w/o Columns)</b>			
Exterior Roof Column Reaction	2209.7	lb				
Deck Beam (4' Span)	1142	lb		Deck Beam (6' Span)	1713	lb
Total	3351.7	lb	per footing	Total	1713	lb per footing
Base Plate Size (B)	16	in		Base Plate Size (B)	16	in
(L)	24	in		(L)	24	in
(Effective) Base Plate Area	256	in <sup>2</sup>		(Effective) Base Plate Area	256	in <sup>2</sup>
	1.78	ft <sup>2</sup>			1.78	ft <sup>2</sup>
Check Diagonal	24.70	in		Check Diagonal	24.70	in
Allowable PSF	6000	PSF		Allowable PSF	6000	PSF
Actual PSF	1885.33	PSF		Actual PSF	963.56	PSF
Check:	<b>OK</b>			Check:	<b>OK</b>	

## Structural Calculations

### Footing Overturning Check

Eastward/Westward Direction

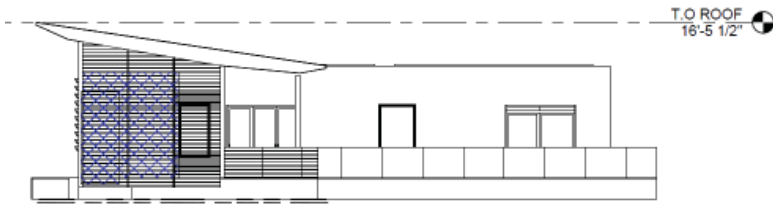


#### Geometric Properties

height:= 12.5 ft  
width:= 49 ft

### B6 EAST ELEVATION SHEAR WALL

1/8" = 1'-0"



#### Load Conditions

WindLoad:= 20 psf

(Controls over Seismic)

### A6 WEST ELEVATION SHEAR WALL

1/8" = 1'-0"

EWArea:= height · width

$$\boxed{\text{EWArea} = 612.5 \text{ ft}^2}$$

EWWindForce:= EWArea · WindLoad

$$\boxed{\text{EWWindForce} = 12250 \text{ lbf}}$$

#### Footing Properties

NumFootings:= 7 per side

NumBolts:= 2 per footing

#### Bolt Properties

AllowableShear:= 1500 lbf

AllowableUplift:= 1250 lbf

Assume that the near side footings resist shear. (Conservative)

$$\text{Shear}_{\text{perfooting}} := \frac{\text{EWWindForce}}{\text{NumFootings}}$$

$$\boxed{\text{Shear}_{\text{perfooting}} = 1750 \text{ lbf}}$$

$$\text{Shear}_{\text{perbolt}} := \frac{\text{Shear}_{\text{perfooting}}}{\text{NumBolts}}$$

$$\boxed{\text{Shear}_{\text{perbolt}} = 875 \text{ lbf}}$$

$$\text{Uplift} := \frac{\text{EWWindForce} \cdot \frac{\text{height}}{2}}{13 \text{ ft}}$$

$$\boxed{\text{Uplift} = 5889.4231 \text{ lbf}}$$

$$\text{Uplift}_{\text{perfooting}} := \frac{\text{Uplift}}{\text{NumFootings}}$$

$$\boxed{\text{Uplift}_{\text{perfooting}} = 841.3462 \text{ lbf}}$$

$$\text{Uplift}_{\text{perbolt}} := \frac{\text{Uplift}_{\text{perfooting}}}{\text{NumBolts}}$$

$$\boxed{\text{Uplift}_{\text{perbolt}} = 420.6731 \text{ lbf}}$$

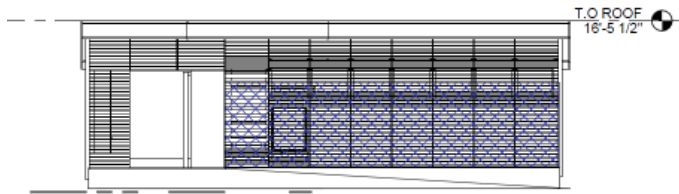
$$\boxed{\frac{\text{Uplift}_{\text{perbolt}}}{\text{AllowableUplift}} + \frac{\text{Shear}_{\text{perbolt}}}{\text{AllowableShear}} = 0.9199}$$

< 1 -- OK

## Structural Calculations

### Footing Overturning Check

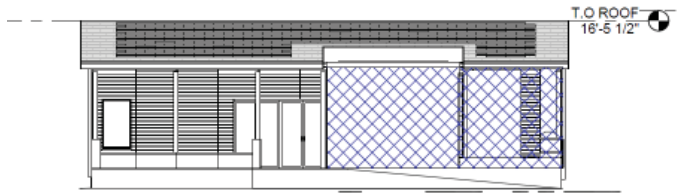
Northward/Southward Direction



**B4** NORTH ELEVATION SHEAR WALL  
1/8" = 1'-0"

#### Geometric Properties

height:= 12.5 ft  
width:= 36 ft



**A4** SOUTH ELEVATION SHEAR WALL  
1/8" = 1'-0"

#### Load Conditions

WindLoad:= 20 psf  
(Controls over Seismic)

$$NSArea = \text{height} \cdot \text{width}$$

$$NSArea = 450 \text{ ft}^2$$

$$NSWindForce = NSArea \cdot \text{WindLoad}$$

$$NSWindForce = 9000 \text{ lbf}$$

#### Footing Properties

NumFootings= 6 per side

NumBolts= 2 per footing

#### Bolt Properties

AllowableShear= 1500 lbf

AllowableUplift= 1250 lbf

Assume that the near side footings resist shear. (Conservative)

$$\text{Shear}_{\text{perfooting}} = \frac{NSWindForce}{\text{NumFootings}}$$

$$\text{Shear}_{\text{perfooting}} = 1500 \text{ lbf}$$

$$\text{Shear}_{\text{perbolt}} = \frac{\text{Shear}_{\text{perfooting}}}{\text{NumBolts}}$$

$$\text{Shear}_{\text{perbolt}} = 750 \text{ lbf}$$

$$\text{Uplift} = \frac{NSWindForce \cdot \text{height}}{2 \cdot 13 \text{ ft}}$$

$$\text{Uplift} = 4326.9231 \text{ lbf}$$

$$\text{Uplift}_{\text{perfooting}} = \frac{\text{Uplift}}{\text{NumFootings}}$$

$$\text{Uplift}_{\text{perfooting}} = 721.1538 \text{ lbf}$$

$$\text{Uplift}_{\text{perbolt}} = \frac{\text{Uplift}_{\text{perfooting}}}{\text{NumBolts}}$$

$$\text{Uplift}_{\text{perbolt}} = 360.5769 \text{ lbf}$$

$$\frac{\text{Uplift}_{\text{perbolt}}}{\text{AllowableUplift}} + \frac{\text{Shear}_{\text{perbolt}}}{\text{AllowableShear}} = 0.7885$$

< 1 -- OK

## Structural Calculations

### Footing Post Design

$$P_{\text{Axial}} := 10265.5 \text{ lbf} \quad (\text{maximum})$$

#### Check 6x6 Post for Compression:

##### Geometric Properties

$$L_{\text{post}} := 2 \text{ ft} \quad (\text{maximum})$$

$$b_{\text{post}} := 5.5 \text{ in}$$

$$h_{\text{post}} := 5.5 \text{ in}$$

$$A_{\text{post}} := b_{\text{post}} \cdot h_{\text{post}}$$

$$A_{\text{post}} = 30.25 \text{ in}^2$$

$$I_{\text{post}} := \frac{1}{12} \cdot b_{\text{post}} \cdot h_{\text{post}}^3 \quad (\text{minimum})$$

$$I_{\text{post}} = 76.2552 \text{ in}^4$$

$$S_{\text{post}} := \frac{1}{6} \cdot b_{\text{post}} \cdot h_{\text{post}}^2 \quad (\text{minimum})$$

$$S_{\text{post}} = 27.7292 \text{ in}^3$$

##### Material Properties

$$F_c := f_{\text{cdimlumb}}$$

$$F_c = 1350 \text{ psi}$$

$$C_D := 1.6 \quad (\text{Wind and Seismic Load Duration})$$

$$C_M := 1$$

$$C_t := 1$$

$$K_{cE} := 0.3 \quad c := 0.8 \quad (\text{visually graded lumber})$$

$$F_{cstar} := F_c \cdot C_D \cdot C_M \cdot C_t$$

$$F_{cstar} = 2160 \text{ psi}$$

$$E'_{\text{min}} := E_{\text{dimlumb}} \cdot C_M \cdot C_t$$

$$E'_{\text{min}} = 1.6 \cdot 10^6 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{\text{min}}}{\frac{L_{\text{post}}}{\text{in}} \cdot \min\left(\frac{b_{\text{post}}}{\text{in}}, \frac{h_{\text{post}}}{\text{in}}\right)}$$

$$F_{cE} = 3.014 \cdot 10^5 \text{ psi}$$

$$C_P := \frac{1 + \left(\frac{F_{cE}}{F_{cstar}}\right)}{2 \cdot c} - \sqrt{\left(\frac{1 + \left(\frac{F_{cE}}{F_{cstar}}\right)}{2 \cdot c}\right)^2 - \left(\frac{F_{cE}}{F_{cstar}}\right) \cdot \frac{1}{c}}$$

$$C_P = 0.9986$$

$$F'_c := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_P$$

$$F'_c = 2156.8907 \text{ psi}$$

$$\text{if } \frac{P_{\text{Axial}}}{A_{\text{post}}} \leq F'_c$$

ColumnCompression= "OK"

else

ColumnCompression= "NG"

ColumnCompression= "OK"

## Structural Calculations

Since the timber post will likely fail before the steel anchor bolts, check the timber capacity:

### Shear Strength Capacity

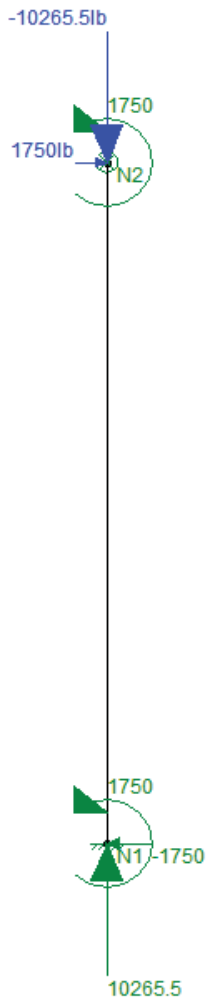
$$V_{\text{capFooting}} := 0.75 \cdot (f_{\text{vdimlumb}} \cdot A_{\text{post}})$$

$$V_{\text{capFooting}} = 4083.75 \text{ lbf}$$

### Flexural Strength Capacity

$$M_{\text{capFooting}} := 0.9 \cdot (f_{\text{bdimlumb}} \cdot S_{\text{post}})$$

$$M_{\text{capFooting}} = 2152.4766 \text{ lbf ft}$$



$$V_{\text{Max}} := 1750 \text{ lbf}$$

$$M_{\text{Max}} := 1750 \text{ lbf ft}$$

$$FS_V := \frac{V_{\text{capFooting}}}{V_{\text{Max}}}$$

$$FS_V = 2.3336$$

$$FS_M := \frac{M_{\text{capFooting}}}{M_{\text{Max}}}$$

$$FS_M = 1.23$$

Since the Factor of Safety for Shear and the Factor of Safety for Flexure are both greater than 1, the Footing is OK.

## Structural Calculations

### Footing Base Design

#### Geometric Properties

$$b_{\text{footing}} := 16 \text{ in}$$

$$l_{\text{footing}} := 24 \text{ in}$$

$$d_{\text{plywood}} := \frac{3}{4} \text{ in}$$

#### Load Conditions

$$P_{\text{Axial}} = 10265.5 \text{ lbf} \quad (\text{maximum})$$

Assume that the load is distributed in a 16" x 16" square on the footing, and the extra length is used only to meet the 2' minimum distance requirement between the 1" diameter steel anchor bolts.

$$w := \frac{P_{\text{Axial}}}{\min(b_{\text{footing}} l_{\text{footing}})}$$

$$w = 7699.125 \frac{\text{lbf}}{\text{ft}}$$

#### Determine Number of Plywood Sheets (Strength Based):

##### Section Modulus Required:

$$M_{\text{max}} := \frac{w \cdot \min(b_{\text{footing}} l_{\text{footing}})^2}{2}$$

$$M_{\text{max}} = 6843.6667 \text{ lbf ft}$$

$$S_{\text{req}} := \frac{M_{\text{max}}}{f_{\text{plywood}}}$$

$$S_{\text{req}} = 41.062 \text{ in}^3$$

##### Depth Required:

$$\text{depth} := \sqrt[6]{\frac{S_{\text{req}}}{\min(b_{\text{footing}} l_{\text{footing}})}}$$

$$\text{depth} = 3.9241 \text{ in}$$

$$n_{\text{sheets}} := \frac{\text{depth}}{d_{\text{plywood}}}$$

$$n_{\text{sheets}} = 5.2321$$

Therefore, use at least 3 sheets of 3/4" plywood for the base of the footing.

#### Check Allowable Bearing Contact:

$$\text{if } \frac{P_{\text{Axial}}}{\min(b_{\text{footing}} l_{\text{footing}})^2} < 6000 \text{ psf}$$

BearingContact = "OK"

else

BearingContact = "NG"

$$\text{BearingContact} = \text{"OK"}$$



## Structural Calculations

### Determine Number of Plywood Sheets (Deflection Based):

Limit deflection at end:  $\delta := \frac{1}{16} \text{ in}$

#### Moment of Inertia Required:

$$I_{\text{req}} := \frac{w \cdot \left( \frac{\min(b_{\text{footing}}, l_{\text{footing}})}{2} \right)^4}{8 \cdot E_{\text{plywood}} \cdot \delta}$$

$$I_{\text{req}} = 5.2039 \text{ in}^4$$

#### Depth Required:

$$\text{depth} := \sqrt[3]{12 \cdot \frac{I_{\text{req}}}{\left( \frac{\min(b_{\text{footing}}, l_{\text{footing}})}{2} \right)^2}}$$

$$\text{depth} = 1.9837 \text{ in}$$

$$n_{\text{sheets}} := \frac{\text{depth}}{d_{\text{plywood}}}$$

$$n_{\text{sheets}} = 2.6449$$

Therefore, use at least 3 sheets of 3/4" plywood for the base of the footing.

### Check Allowable Bearing Contact:

if  $\frac{P_{\text{Axial}}}{\min(b_{\text{footing}}, l_{\text{footing}})^2} < 6000 \text{ psf}$   
 BearingContact= "OK"  
 else  
 BearingContact= "NG"

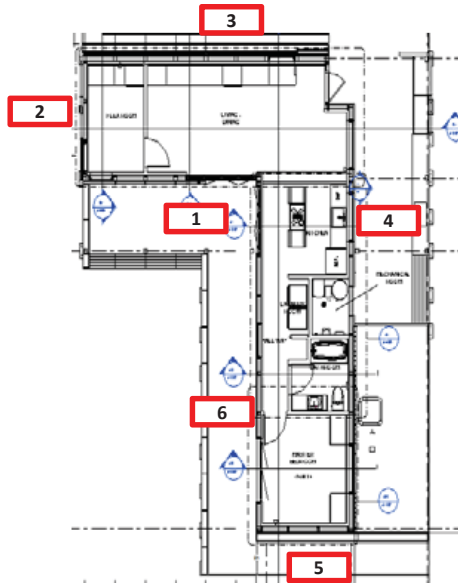
$$\text{BearingContact} = \text{"OK"}$$

**Structural Calculations**

<b>Load Cases: Lateral</b>					
<b>Northward Direction</b>			<b>Eastward Direction</b>		
Wind Load	-22.3	PSF	Wind Load	-22.3	PSF
Seismic 1 Roof	5.4	PSF	Seismic 1 Roof	5.4	PSF
Seismic 2 Roof	-5.4	PSF	Seismic 2 Roof	-5.4	PSF
Seismic 1 Floor	2.4	PSF	Seismic 1 Floor	2.4	PSF
Seismic 2 Floor	-2.4	PSF	Seismic 2 Floor	-2.4	PSF
Wet Module SF	136.5	SF	Wet Module SF	378.0	SF
Dry Module SF	241.5	SF	Dry Module SF	136.5	SF
<b>Wet Module</b>			<b>Wet Module</b>		
Wind Load	3044.0	lb	Wind Load	8429.4	lb
Seismic 1 Roof	737.1	lb	Seismic 1 Roof	2041.2	lb
Seismic 2 Roof	737.1	lb	Seismic 2 Roof	2041.2	lb
Seismic 1 Floor	327.6	lb	Seismic 1 Floor	907.2	lb
Seismic 2 Floor	327.6	lb	Seismic 2 Floor	907.2	lb
<b>Max Value</b>	<b>3044.0</b>	<b>lb</b>	<b>Max Value</b>	<b>8429.4</b>	<b>lb</b>
<b>Dry Module</b>			<b>Dry Module</b>		
Wind Load	5385.5	lb	Wind Load	3044.0	lb
Seismic 1 Roof	1304.1	lb	Seismic 1 Roof	737.1	lb
Seismic 2 Roof	1304.1	lb	Seismic 2 Roof	737.1	lb
Seismic 1 Floor	579.6	lb	Seismic 1 Floor	327.6	lb
Seismic 2 Floor	579.6	lb	Seismic 2 Floor	327.6	lb
<b>Max Value</b>	<b>5385.5</b>	<b>lb</b>	<b>Max Value</b>	<b>3044.0</b>	<b>lb</b>
<b>Total Force Applied</b>	<b>8429.4</b>	<b>lb</b>	<b>Total Force Applied</b>	<b>11473.4</b>	<b>lb</b>
<b>Southward Direction</b>			<b>Westward Direction</b>		
Wet Module SF	0.0	SF	Wet Module SF	378.0	SF
Dry Module SF	378.0	SF	Dry Module SF	136.5	SF
<b>Wet Module</b>			<b>Wet Module</b>		
Wind Load	0.0	lb	Wind Load	8429.4	lb

## Structural Calculations

### Shear Wall Calculations



Wall	Max. Undisturbed Wall (ft)	Nail Spacing (in)
1	9.66	3
2	8.50	3
3	24	6
4	4.75	2
5	13.00	4
6	8.33	4

#### NORTHWARD: 2 Cases

Wet Module					
Nail spacing at panel edges (in)	Factored Shear Resistance of Shear Walls (lb/ft)	Lateral Load /Shear (ft)	Shear Span (lb)	Reactions at Walls 6 and 4 (lb)	Spacing per wall (ft)
6	264.49	11.51	3043.95	1521.98	5.75
4	383.71	7.93	3043.95	1521.98	3.97
3	489.92	6.21	3043.95	1521.98	3.11
2	635.18	4.79	3043.95	1521.98	2.40

Dry Module					
Nail spacing at panel edges (in)	Factored Shear Resistance of Shear Walls (lb/ft)	Lateral Load /Shear (ft)	Shear Span (lb)	Reactions at Walls 2 and 6 (lb)	Spacing per wall (ft)
6	264.49	20.36	5385.45	2692.73	10.18
4	383.71	14.04	5385.45	2692.73	7.02
3	489.92	10.99	5385.45	2692.73	5.50
2	635.18	8.48	5385.45	2692.73	4.24

#### EASTWARD: 2 Cases

Wet Module					
Nail spacing at panel edges (in)	Factored Shear Resistance of Shear Walls (lb/ft)	Lateral Load /Shear (ft)	Shear Span (lb)	Reactions at Walls 1 and 5 (lb)	Spacing per wall (ft)
6	264.49	31.87	8429.40	4214.70	15.94
4	383.71	21.97	8429.40	4214.70	10.98
3	489.92	17.21	8429.40	4214.70	8.60
2	635.18	13.27	8429.40	4214.70	6.64

Dry Module					
Nail spacing at panel edges (in)	Factored Shear Resistance of Shear Walls (lb/ft)	Lateral Load /Shear (ft)	Shear Span (lb)	Reactions at Walls 1 and 3 (lb)	Spacing per wall (ft)
6	264.49	11.51	3043.95	1521.98	5.75
4	383.71	7.93	3043.95	1521.98	3.97
3	489.92	6.21	3043.95	1521.98	3.11
2	635.18	4.79	3043.95	1521.98	2.40

#### SOUTHWARD

Nail spacing at panel edges (in)	Factored Shear Resistance of Shear Walls (lb/ft)	Lateral Load /Shear (ft)	Shear Span (lb)	Reactions at Walls 2 and 4 (lb)	Spacing per wall (ft)
6	264.49	31.87	8429.40	4214.70	15.94
4	383.71	21.97	8429.40	4214.70	10.98
3	489.92	17.21	8429.40	4214.70	8.60
2	635.18	13.27	8429.40	4214.70	6.64

## Detailed Water Budget

EVENT	# OF EVENTS	WATER USE (GAL)	COMPETITION TOTAL (GAL)	DESCRIPTION
Dinner	1	3	3	Dinner cooked for up to 8 guests
Clothes Washing	6	9.6	57.6	Energy Star Max Allowable Water Draw
Dishwashing	5	4.25	21.25	Energy Star Max Allowable Water Draw
Hot Water Draw	16	15	240	15 gallon hot water draw
Movie	1	2	2	Water for guests
Cooking	6	0.6	3.6	Boiling 5 lbs of water
COMPETITION USAGE			327.45	
Testing	2	35	70	Checking water systems
Water Vaporization	5	1	5	Losses
Vegetable Garden	1	50	50	Not including wall / roof
Aesthetic Purpose	1	50	50	
Fire Protection	1	250	250	In case of use
Condensate Misting Tank	9	15	135	15 gal/day x 8 days (+1 day)
MISC. WATER USAGE			560	
Roof Garden + Green Wall	1	185	185	135 gallons for roof garden 50 for green wall
INITIAL FILL ITEMS			185	
Heat Pump Tank	1	66	66	Initial System Fill
Fire Protection	1	1.25	1.25	Initial System Fill
Piping	1	5	5	Initial System Fill
Expansion Tank	1	2.1	2.1	Initial System Fill
Water Conditioner	1	10	10	Initial System Fill
INITIAL FILL ITEMS			84.35	
GALLONS			1156.8	
SAFETY FACTOR			115.68	10% safety factor
TOTAL (GALLONS)			1272.48	WATER REQUIRED

## Summary of Unlisted Electrical Components

The Ecohabit House contains two unlisted electric components which has been detailed below.

### Special House Controls – Smart Monitoring System

The “Special House Controls - Smart Monitoring System” is a custom, master-slave module system that will enable the Smart House to monitor the state of the house and make decisions based on user preference and state data in order to maximize the energy efficiency of the house. The “Special House Controls - Smart Monitoring System” uses cheap, off the shelf products to control and monitor all of the rooms in the home separately and independently through a single tablet application. We will be using DNR18US05, 5V with a maximum current of 3Amps, below the limitation of 8Amps as per Table 11(A), Chapter 9

- Monitoring
  - o Temperature
  - o Humidity
  - o Motion (True/False)
  - o Power usage of all appliances and mechanical systems, convenience receptacles and lights
- Control
  - o Lights
  - o Security

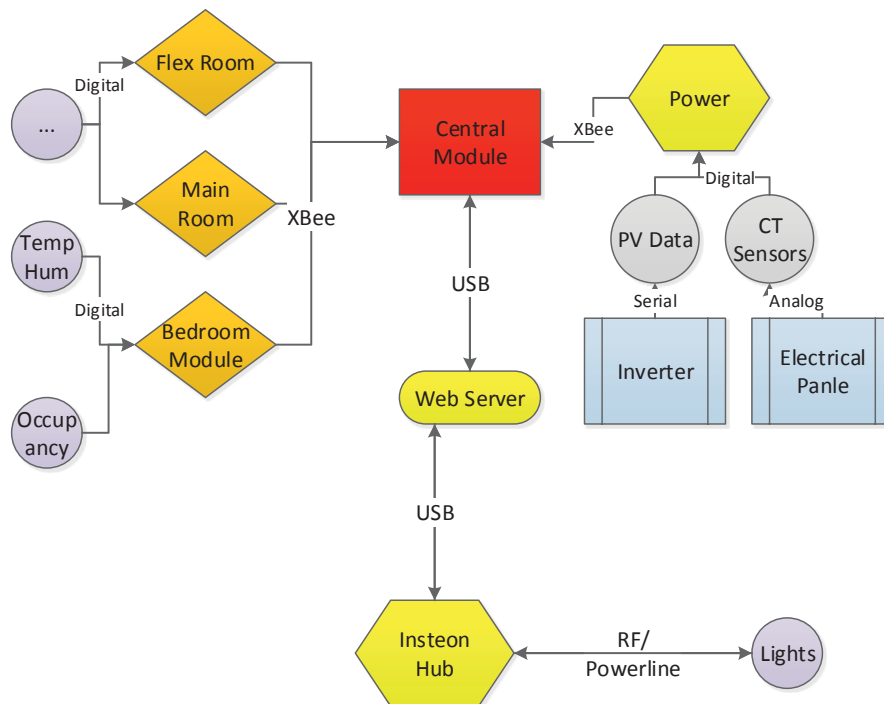


Fig. 1.1 Hardware Flow Chart

## Summary of Unlisted Electrical Components

### Hardware: Monitoring System

#### Master Module

The Master module is the main control center for the monitoring system of the house. This module is where all sensor information is sent. The master is where the monitoring system connects to the main server hub through a USB. After passing the data along to the main server, the master module then waits for the decisions from the server. Once it receives the instructions, the master module then sends out commands to control the homes systems (lighting, IR, etc).

- Technical Specifications
  - o Arduino Pro Mini microcontroller based on the Atmel's ATmega 168
    - 5 Volts
      - XP-Power DNR10US05 power supply
      - 18AWG
    - 16Mhz oscillator
    - 14 GPIO with 6 that support PWM
  - o XBee 1mW Wire Antenna - Series 1 (802.15.4)
  - o USB interface to the computer server in the mech. Room

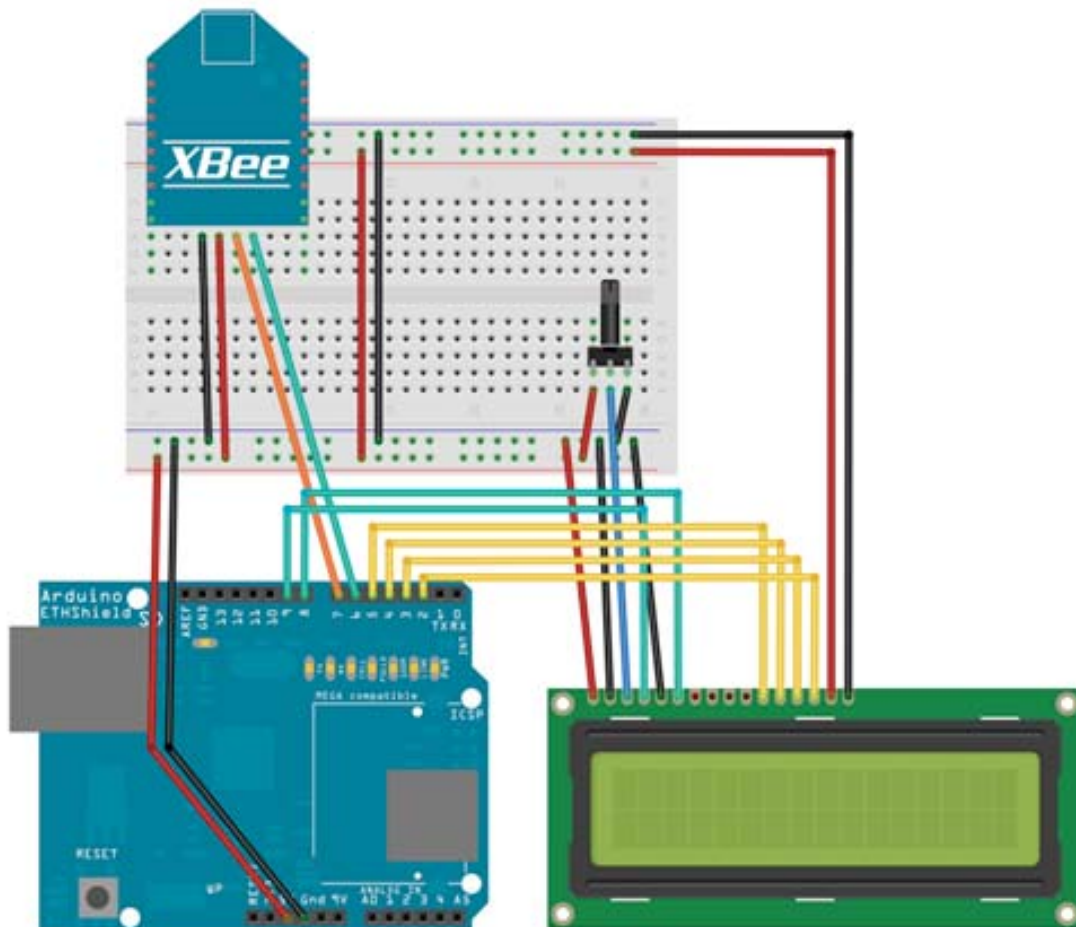


Fig. 1.2 Master Module Breadboard Schematics

## Summary of Unlisted Electrical Components

### Slave Module for Ambient Conditions

The Slave modules are sensory modules put into three rooms, the bedroom, main room, and flex room. These modules contain a temperature and humidity sensor, a motion sensor, and a light sensor (photoresistor) and collect data on the state of the house. This data is then transferred to the master module through a mesh communication network.

- Technical Specifications
  - o Arduino Pro Mini microcontroller based on the Atmel's ATmega 168
    - 5 Volts
      - XP-Power DNR10US05 power supply
      - 18AWG
    - 16Mhz oscillator
    - 14 GPIO with 6 that support PWM
  - o XBee 1mW Wire Antenna - Series 1 (802.15.4)
  - o Temperature/Humidity
    - Sensiron SHT1
  - o Motion Sensor
    - Honeywell DT7435 dual tech.
      - PIR and Microwave
      - 12V at 25mA
  - o Photoresistor
    - Perkinelmer VT900
      - 5V
      - 12K Ohm typical

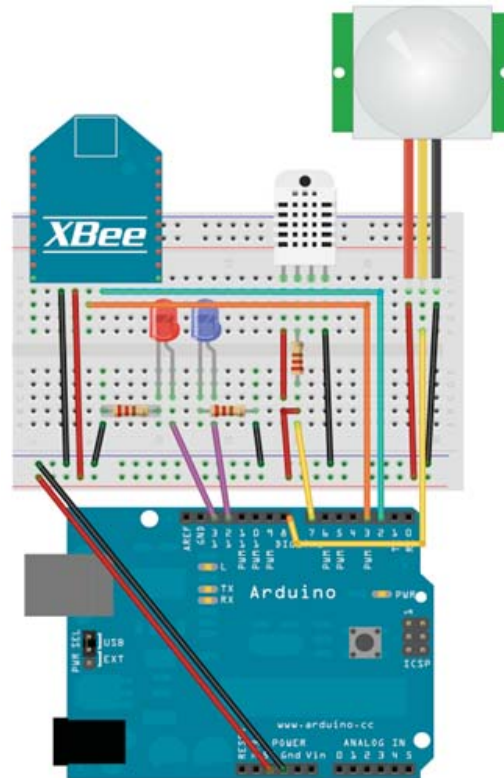


Fig. 1.3 Slave Module for Ambient Conditions Breadboard Schematics

## Summary of Unlisted Electrical Components

### Slave Module for Power Monitoring

The power sensor modules include CT sensors put on the circuits coming off of the breakers. Since the voltage of the breakers is known, using the current the power being used off each circuit can be calculated. This information can then be passed to the house server, which can then be communicated to the user via the mobile application.

- Technical Specifications
  - o CT Sensor
    - Brultec Micro-40 \* 38
    - Brultec Split 200 \*1



## Summary of Unlisted Electrical Components

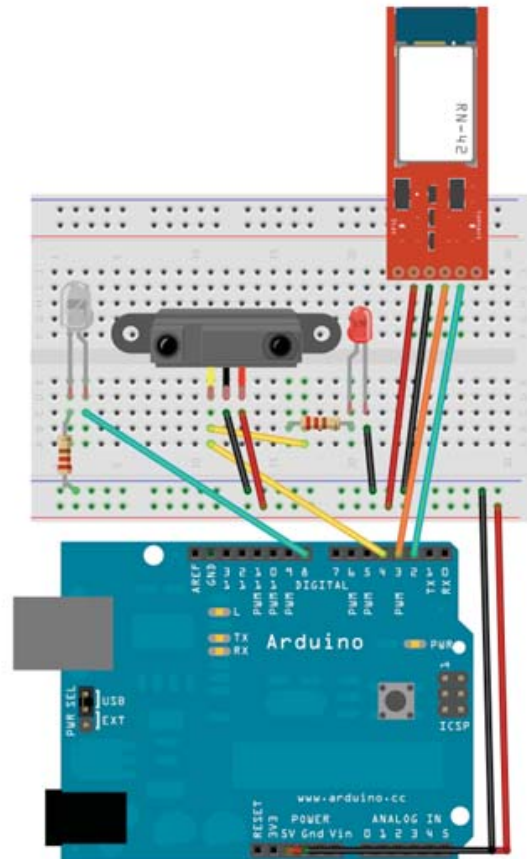


Fig. 1.4 Slave Module for Ambient Conditions Breadboard Schematics

### Safety test of the components

To ensure safe operation during the public event the team will complete the following minimum testing on the “Special House Controls - Smart Monitoring System” and submit the results to the Organizers:

- 1) In Progress- Prototype Test: The module prototypes are constructed and set up in a prototypical environment. This allows the team to make sure the modules are functioning and safe for use for in a living situation.
- 2) Future- Load test- Set up the actual sensor modules similar to how they will be deployed in the house. Test the interface with the home server and lighting control systems in order to track the performance of the system.
- 3) Future-Full Scale Testing: After construction in the Spring, have a full week of real time testing to make sure the system is safe for the California Competition.

## Interconnection Application Form

ECO HABIT / LOT # 102

### PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
DOW POWERHOUSE Solar Shingles	Shingles per string / # strings: 126/2 , 120/1, 117/1 total shingles count is : 489 Total Sq. Ft. Roof Area / Solar Array Area: 1199.7 / 808.7	5868 Watts

Total DC power of all arrays is 6.34 kW (in tenths)

### INVERTERS

Module Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
DOW POWERHOUSE	362589	Max: 550V MPPT: 150-420V	3.725 KW	2

Total AC power of all inverters is 7.45kVA or kW (in whole numbers)

Required Information	Location
One-Line Electrical Schematic	E-601
Calculations of service/feeder net computed load and neutral load (NEC 220)	E-603
Plan view of the lot showing the house, decks, ramps, tour paths, the service point, and the distribution panel or load center	E-101

### Stevens House Team Electrical Engineer

Dimitri Koshkin  
dimitri.koshkin@gmail.com

## Summary of Reconfigurable Features



The Ecohabit House is equipped with one reconfigurable feature affecting Rule 6-2. The reconfigurable element pertain to the millwork in the Flex Room will be demonstrated to the Architecture, Market Appeal and Engineering Juries only during their walkthroughs. The team will not be demonstrating the reconfigurable wall during the Communications Jury walkthrough and therefore not demonstrating the reconfigurable wall during any of the public tours.



## Energy Analysis Results and Discussion

### Introduction

Energy analysis is the basis for the design of a zero-energy house. Accurate models are needed to ensure the success of Ecohabit during the competition and as a permanent home.

During the design process, numerous energy analyses were performed in order to optimize the one family home. As the design of Ecohabit progressed, so did the energy analyses and models. An optimization program was utilized for the initial design of the house. A basic load model using ASHRAE load calculations, was then created to get a more accurate model. These basic calculations were performed each time an updated design was presented. With each redesign, the energy models also improved. Energy analyses were performed in order to complete the initial design, re-design, HVAC system design, an annual electricity demand prediction, determination size of PV, and finally to predict Stevens House's performance in the competition.

### Tools Utilized

The tools used varied as a result of the progression of the design. Models were used to optimize dimensions, optimize orientation, pick materials, determine mechanical systems, and determine electric systems. The tools used are as follows:

#### Rhinoceros / Grasshopper / Diva / Galapagos

Based on dimensions, orientation, and window to wall ratio, the Grasshopper plug-in Diva, was utilized to perform optimization calculations. The initial optimization calculations led to the design utilized for the schematic design submission; however construction and transportation logistics required the redesign of the house. The house changed from an angled "L" shape to a much more easily transported and constructed true "L" shape.

#### ASHRAE Calculations

ASHRAE load calculations provide the minimum requirements for a system to have an energy efficient design, specifically for low-rise residential buildings. Each outer wall, window, roof and floor component is associated with its dimensional, heat resistance, and emissivity properties. Standard ASHRAE tables are then referenced to compile a calculation for maximum heating and cooling loads for the climate conditions in the specified location.

#### Manual J8 Load Calculations

Using Manual J8 calculations the wall, window, roof, and floor sections are individually defined by their length dimensions and thermal resistance values. This method creates a matrix of elements that aid in the calculations of heat movement through the boundaries of the house. The Manual J8 calculation determines the maximum heating and cooling loads necessary for the house to cover 99% of the coldest days in the year and the top 1% of the hottest days. The Manual J8 calculations allowed for initial growth and re-design as the Ecohabit progressed.

#### McQuay Air-conditioning Duct Sizer program

This tool is used to calculate proper duct sizing for rectangular and radial ducts. The program takes into account varying air temperatures and relative humidity. It uses the parameters volumetric flow rate, head loss, velocity, and duct diameter to aide in properly sizing ducts.

## Energy Analysis Results and Discussion

### SolidWorks Flow Simulation

SolidWorks Flow Simulation was used for Ecohabit to verify duct parameters. The flow simulation was used to calculate the air properties such as volumetric flow rate, velocity, and pressure loss at cross sections throughout the duct work.

### IES VE Pro

IES VE Pro is an energy modeling program known for its accuracy. Among other things, it combines solar shading calculations, internal gains, geometry, orientation, and climate in order to calculate accurate heating and cooling loads. IES provided Team Stevens with a refined energy model, capable of accurately predicting the performance of Ecohabit based on the design. Once the model is constructed, the weather data, the internal loads, with schedule, and the construction materials are all selected. Additionally, IES VE Pro takes into account solar shading, gathering information on solar energy based on shading constructed in the model. This information is then utilized to calculate loads for the pre-determined timespan.

## Energy Analysis

The energy analysis presented below is the combination of results utilizing the tools listed above. First, data related to the house was collected, including weather data for Irvine, California, material attributes, and predicted internal loads. Next, the load calculations for Ecohabit were performed using IES VE Pro. The loads calculated were then used in to size the air distribution unit. Finally, the electrical loads and expected power output from the Photovoltaic were calculated.

### Weather Analysis

Weather data for Irvine, California was gathered and put in a usable form. The energy model considered average temperatures, maximum temperatures, and humidity. This information can be seen in the graphs below.

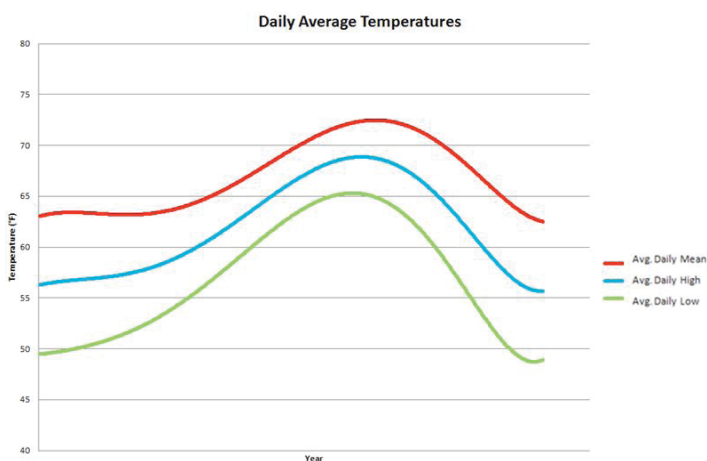


Fig. 5.1 Daily Average Temperature

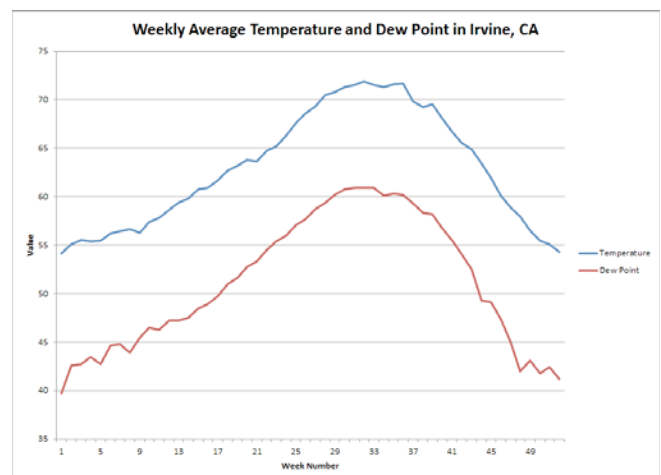


Fig. 5.2 Weekly Average Temp. & Dew Point in Irvine, CA

## Energy Analysis Results and Discussion

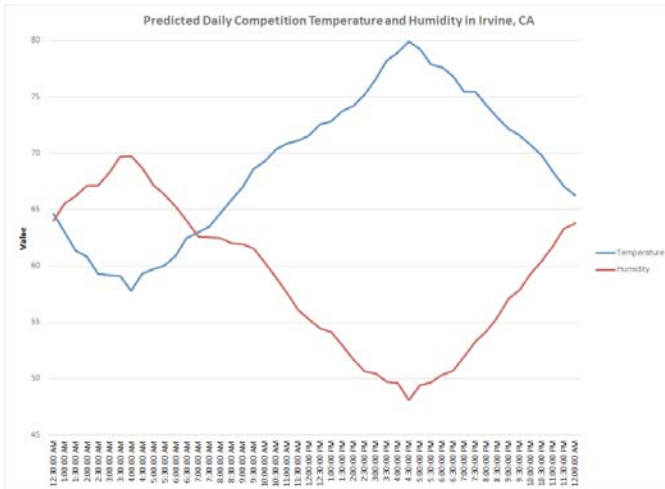


Fig. 5.3 Predicted Daily Competition Temp. & Humidity in Irvine, CA

Fig. 5.3 displays the daily temperature and humidity values for Irvine, California during the competition. This chart assisted in predicted the total usage of the internal systems of the house for the competition.

### U/R Values

Construction materials were picked based on their aesthetics, usability, and thermal properties. The chart below, describes the thermal resistance (R-Value) and heat transfer coefficient (U-Factor) for the materials to be used on the Ecohabit. These properties were obtained from Factory Specs and utilized for the energy analysis.

	Surface	Windows	
	R-Value	NFRC U-factor	SHGC
<b>NORTH</b>		0.49	0.51
Long Wall	23.92		
Short Wall	23.92		
<b>SOUTH</b>			
Dry Module	23.92	0.53	0.5
Wet Module	38.40		
<b>EAST</b>		0.55	0.26
Long Wall	38.40		
Shorth Wall	23.92		
<b>WEST</b>			
Dry Module	23.92		
Wet Module	38.40	0.41	0.28
<b>FLOOR</b>	34		
<b>ROOF</b>	46		

Fig. 5.4 R-Values per. orientation

## Energy Analysis Results and Discussion

### Internal Gains

Preliminary calculations for the internal loads were needed for the initial cooling and heating load calculations and simulations. The internal load calculations were generated by referencing ASHRAE handbook tables for standard residential appliances. Internal heat generation affects the load calculations by putting a larger load on the air-conditioning system during the cooling season and lessening the load during the heating season.

The ASHRAE manuals give standard sensible and latent heat loads created by people, plants, and appliances so a generic model can be made to calculate the internal loads created in the house. Each appliance is defined by its type and size to be referenced to its heat contribution. The major heat contributions to the space come from people and lights. The appliances that create large amounts of heat such as the dryer and stove/oven, are vented to a place where the heat is not objectionable and therefore do not significantly affect the internal loads. Figure 5.5 shows the predicted heat gain per day due to the heat generation rate and the amount of time used per day. Three people in the house for 16 hours a day produces 16.8 KBtu of energy per day. This represents the largest internal heat gain for the house. By implementing these figures, the cooling and heating loads can be more accurately represented.

	# OF Elements	Sensible Heat Per Element (BTU/h)	Latent Heat Per Element (BTU/h)	Total Heat (BTU/h)	Element Action (hours/day)	Total Heat Gain (KBtu)
People	3	245	105	1050	16	16.80
Plants	7	20	0	140	24	3.36
Computer	1	256	0	256	10	2.56
Fridge/Freezer	1	150	0	150	24	3.60
Dishwasher	1	170	370	540	1	0.54
Oven	1	147	0	147	1	0.15
TV	1	600	0	600	4	2.40
Dryer	1	547	29	576	1	0.58
Clothes Washer	1	390	0	390	1	0.39
Lighting	12	246	0	2952	4	11.81
<b>Total</b>						<b>42.18</b>

Fig. 5.5 Predicated Heat Gain due to Internal Loads

## Energy Analysis Results and Discussion

### Daily Internal Load Contribution

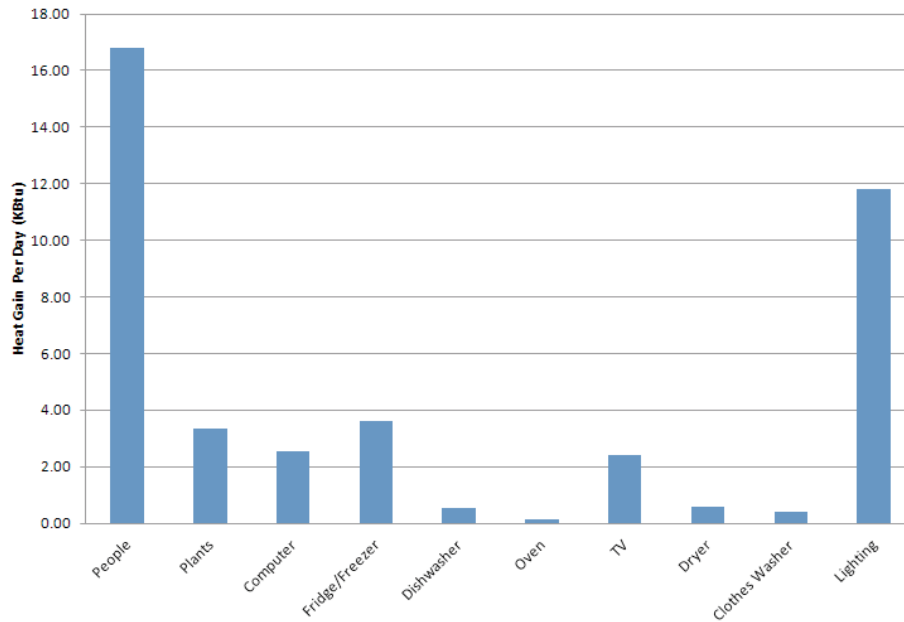


Fig. 5.6 Daily Internal Load Contribution

### Loads Calculated

As stated before, the heating and cooling loads were calculated multiple times throughout the design process. IES VE Pro was used to accurately estimate the expected loads based on the input variables discussed above. As seen in Fig. 5.7 the maximum cooling load calculated is 21.52 kBtu/h and occurs in the month of September. Similarly, the maximum heating load calculated is 7.15 kBtu/h and occurs in the month of December.

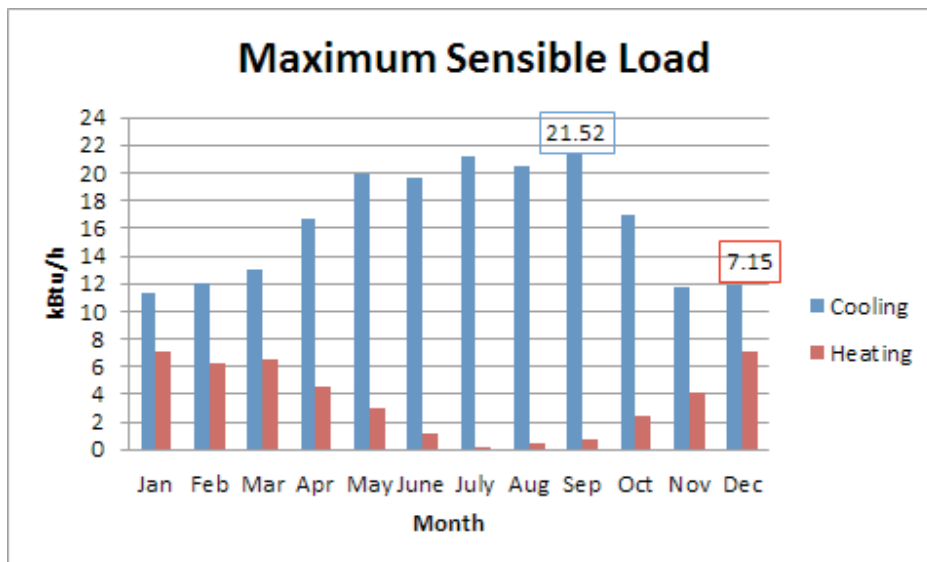


Fig. 5.7 Maximum Sensible Load

As part of the load calculation performed by IES VE Pro, a solar shading and solar energy analysis was performed. Below, Fig 5.8 provides a visual representation of the shading benefit the roof provides on October 12, at 0900. The solar energy analysis shown in the image provides the data for an entire year.



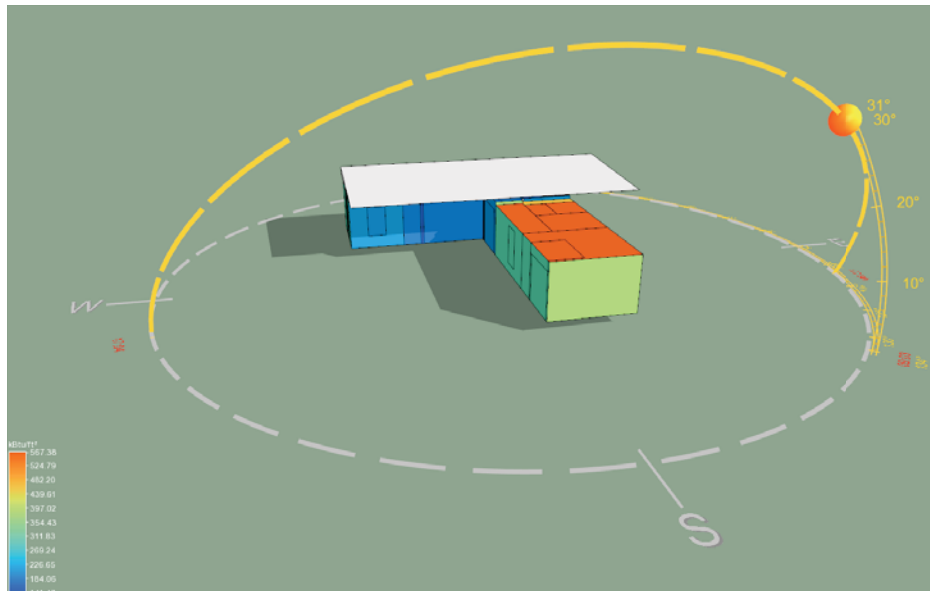


Fig. 5.8 IES VE Pro Screen capture

### Determination of Air Distribution System

Using loads calculated by IES VE Pro, and supported by the Manual J8 and ASHRAE calculations, an air handler system was selected to not only meet, but exceed the extreme heating and cooling needs. Daikin Heat Pump and Daikin Sky Air indoor air handler is the system being implemented in Ecohabit. The unit has favorable energy, air distribution, and architectural qualities. The unit carries a heating and cooling load of 24,000 BTU/h Therefore, the calculated heating and cooling minimums are met for the house and the qualitative goal of a hidden system is achieved.

To meet competition requirements, Ecohabit must maintain a temperature zone between 71°F and 76°F. The system chosen meets the minimum requirements for the loads determined using the IES model, but to ensure proper circulation and air distribution, the Stevens team chose a ducted system rather than a ductless system. Additionally, the ducted system is centralized making it easier to control and maintain the required temperature

The flow analysis on the ducts shows that that the max static pressure loss through the ducts is 0.265 w.g. The pressure losses come from the friction associated with the duct lengths and the components such as bends and tees. These major and minor head losses, respectively, make the ducted system less efficient; however, proper airflow in the house outweighs the energy loss. Additionally, using the McQuay Air-conditioning Duct Sizer program, in combination with calculated volumetric flow, the ducts were properly sized and balanced. The system was designed to have velocities no higher than 600 ft/min and to have static pressure loss less than 0.9 w.g. for the air handler to operate as designed.

## Energy Analysis Results and Discussion

Diffuser Zone	Calculated Goal CFM	Actual CFM	CFM % Perfect Difference	Max Exit Velocity (ft/min)	Static Pressure Loss To Register (wc)
Bathroom	125	114	9%	342	0.096
Master Bedroom	150	148	1%	538	0.124
East Kitchen	97.5	102	5%	460	0.196
West Kitchen	97.5	100	3%	454	0.197
East Living Room	101	100	1%	545	0.248
West Living	101	91	10%	511	0.249
Flex Room	112	116	4%	265	0.265

Fig. 5.9 Room Diffuser Values

A computational fluid analysis was performed using Solidworks Flow Simulation to ensure the standards were met. As seen in Fig. 5.9, the maximum exit velocity for all of the registers is 545 ft/min which is under 600 ft/min, the high limit velocity. All of the actual volumetric flow rates, outputted by the CFD are within 10% of the calculated goal flow rates. Therefore the flow simulation verifies that the duct work will perform as designed.



Fig. 6.0 Velocity flow of air through the duct work

Fig. 6.0 displays the velocity flow of air through the duct work. The exhaust and supply are labeled. The analysis shows velocity gradients and concentrations of high velocity at points of minor head loss or geometric changes in the duct work. By analyzing the ductwork in this way, the pressure losses can be minimized to an acceptable level.

## Energy Analysis Results and Discussion

### Determination of Electrical System

As seen in Fig 6.2, seen below, the total yearly energy usage is predicted to be 6490kWh. This was predicted using data provided by Energy Star as well as historical data for southern California. Using the same conditions, it is predicted that the usage for the house during the competition period will be 130kWh. The usage breakdown for the competition period follows the same breakdown as the yearly usage shown in Fig 6.1

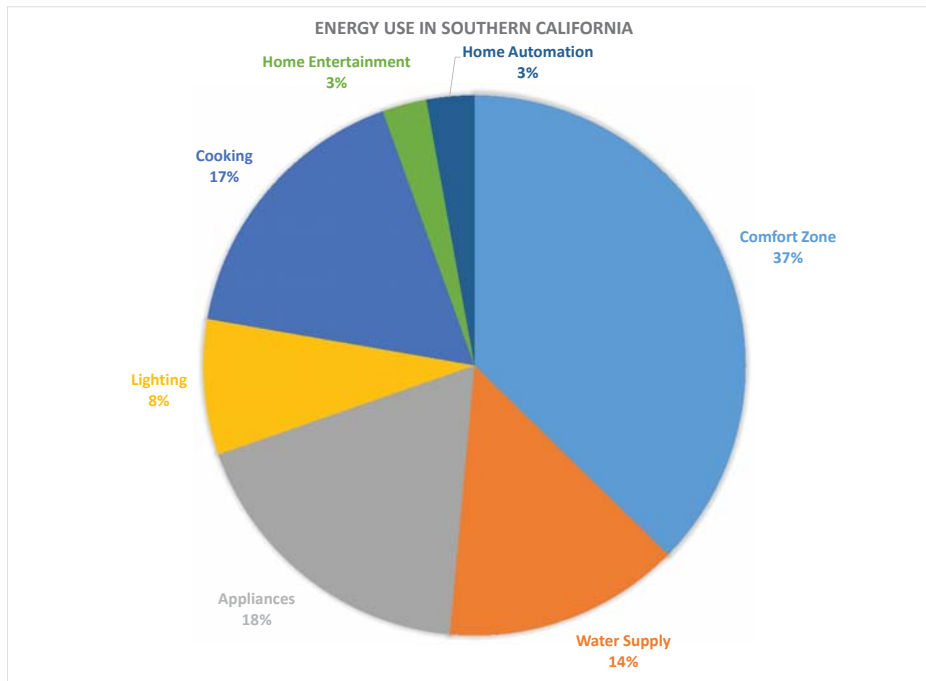


Fig. 6.1 Household Energy Usage

## Energy Analysis Results and Discussion

### Electrical Loads

	Yellow Tag	Full Load	Cycle Load	Hours	Tasks	Competition	Annual
<b>Comfort Zone</b>							
HVAC	-	-	-	-	-	38282Wh	1570 kWh
ERV	-	-	-	-	-	2000 Wh	183 kWh
Humidity Control	-	-	-	-	-	10000 Wh	456 kWh
<b>Hot Water</b>							
Water Heater	-	-	-	-	-	18000 Wh	1232 kWh
Water Pump	-	-	-	-	-	1000 Wh	46 kWh
<b>Appliances</b>							
Refrigerator/Freezer	396 kWh	45.21 W	-	191.5	766	8657 Wh	395 kWh
Clothes Washer	97 kWh	-	247.45 W	24	8	1980 Wh	90 kWh
Clothes Dryer	400 kWh	-	1020.41 W	24	8	8163 Wh	372 kWh
Dishwasher	245 kWh	-	1139.53 W	12.5	5	5698 Wh	260 kWh
<b>Home Entertainment</b>							
Lighting	-	419.8 W	-	26	52	10915 Wh	593 kWh
Cooking	-	4400 W	1926.17Wh	12	6	11557 Wh	527 kWh
Dinner Party	-	-	-	4	2	-	-
Range	-	4400 W	-	2	-	8800 Wh	402 kWh
Lighting	-	100 W	-	4	-	2000 Wh	198 kWh
Audio	-	100 W	-	2	-	200 Wh	9 kWh
Moive Night					1		
TV	-	58.63 W	-	2.5	-	147 Wh	7 kWh
Audio	-	100.00 W	-	2.5	-	250 Wh	11 kWh
Microwave	-	1500 W	-	0.1	-	150 Wh	7 kWh
<b>Home Electronics</b>							
TV	107 kWh	58.63 W		34	-	1993 Wh	91 kWh
Computer	-	30 W		34	-	1020 Wh	47 kWh
<b>Energy Balance</b>							
PV Production	8.15%	0.77	65			163705 Wh	8777 kWh
<b>MISC</b>							
Home Automation		20 W		192	-	3840 Wh	175 kWh
Consumption Total						142254.4Wh	6670 kWh
Net Total						29054 Wh	2467 kWh

Fig. 6.2

## Energy Analysis Results and Discussion

Using the predicted usage of 6670 kWh annual energy consumption and 134.7kWh competition consumption, it was determined that the house needed a 6.4kWh photovoltaic system. In designing the system, the team decided to use DOW Powerhouse Solar Shingles. The decision to use this product is based on more than just energy balances. The shingles are building integrated, meaning they appear to be regular shingles and protect the roof as regular shingles do. Additionally, the shingles snap together, making the installation easier than the average solar panel installation.

Based on the current roof design, the team calculated an ability to implement 489 shingles. Each shingle is projected to produce 12 Watts leading to a total DC power production of 5.8kW. Based on this, the total predicted energy production is 8,687 kWh annually. Using the same weather and solar data for Southern California, the predicted production for the competition period is 163.7kWh, 18% more than the predicted usage.

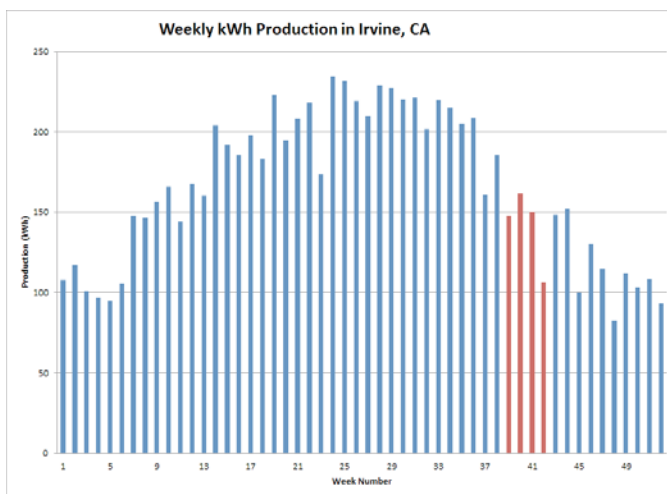


Fig. 6.3 Weekly kWh Production in Irvine,CA

Fig. 6.3 displays the average weekly energy production in Irvine, CA that would be produced using the 5.8 kW DC Dow Powerhouse solar shingles. In order to examine the production for the competition, the time span for the Solar Decathlon, September 24 and October 18, is highlighted in red. Using the data provided by NREL, the average annual production is calculated to be almost 8687kWh.

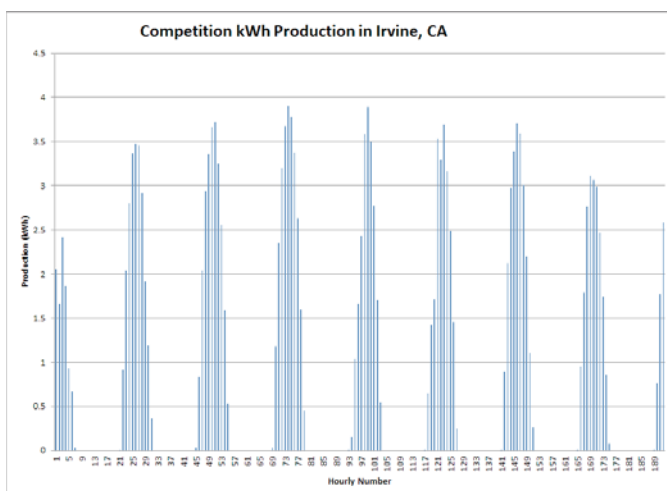


Fig. 6.4 Competition kWh Production in Irvine ,CA

Fig. 6.4 displays the predicted solar production for the 192 hours of the measured competition time. The competition period starts October 3, at 1100 and ends on October 11, at 1100. The total predicted energy production for the competition period is 163.7 kWh.

## Cut Sheets

- Division 00 Procurement and Contracting Requirements**
- Division 01 - General Requirements**
- Division 02 – Existing Conditions**
- Division 03 – Concrete**
- Division 04 – Masonry**
- Division 05 – Metals**
- Division 06 – Wood, Plastics, and Composites**
- Division 07 – Thermal and Moisture Protection**
- Division 08 – Openings**
- Division 09 – Finishes**
- Division 10 – Specialties**
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- Division 14 – Conveying Equipment**
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- Division 27 – Communications**
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- Division 31 – Earthwork**
- Division 32 – Exterior Improvements**
- Division 33 – Utilities**
- Division 34 – Transportation**

# Division 00

## Procurement and Contracting Requirements



# Division 01

## General Requirements





CSI #: 01 54 00

# SUPER QUIET

## SPECIFICATIONS

	EU1000iA2	EU2000iA/ EU2000iA Companion†	EU3000is	Handl EU3000i	EU6500isA
Engine	Honda GXH50	Honda GX100	Honda GX200	Honda GX160	Honda GX390
	Single cylinder, overhead valve, air-cooled	Single cylinder, overhead cam, air-cooled	Single cylinder, overhead valve, air-cooled	Single cylinder, overhead valve, air-cooled	Single cylinder, overhead valve, air-cooled
Displacement	50cc	98.5cc	196cc	163cc	389cc
AC output	120V 1000W max. (8.3A) 900W rated (7.5A)	120V 2000W max. (16.7A) 1600W rated (13.3A)	120V 3000W max. (25A) 2800W rated (23.3A)	120V 3000W max. (25A) 2600W rated (21.7A)	120/240V 6500W max. (54.1/27.1A) 5500W rated (45.8/22.9A)
iAVR AC output	N/A	N/A	N/A	N/A	N/A
Receptacles	B	C / F, J†	C, F	C, F	C, F, H
DC output	12V, 96W (8A)	12V, 96W (8A)	12V, 144W (12A)	12V, 100W (8.3A)	N/A
Starting system	Recoil	Recoil	Recoil, electric	Recoil	Recoil, electric
Fuel tank capacity	0.6 gal.	1.1 gal. / .95gal.‡	3.4 gal.	1.56 gal.	4.5 gal.
Run time per tankful	3.8 hrs. @ rated load, 8.3 hrs. @ 1/4 load	4hrs. @ rated load, 9.6 hrs. @ 1/4 load	7.2 hrs. @ rated load, 20.0 hrs. @ 1/4 load	3.6 hrs. @ rated load, 7.7 hrs. @ 1/4 load	4.7 hrs. @ rated load, 14.0 hrs. @ 1/4 load
Dimensions (L x W x H)	17.7" x 9.4" x 15.0"	20.1" x 11.4" x 16.7"	25.8" x 18.9" x 22.4"	24.5" x 14.9" x 19.3"	33.5" x 26.4" x 27.5"
Noise level	59 dB @ rated load 53 dB @ 1/4 load 86 LwA††	59 dB @ rated load 53 dB @ 1/4 load 89 LwA††	58 dB @ rated load 49 dB @ 1/4 load 90 LwA††	65 dB @ rated load 57 dB @ 1/4 load 91 LwA††	60 dB @ rated load 53 dB @ 1/4 load 91 LwA††
Dry weight	29 lbs.	46.3 lbs. / 45.9 lbs.‡	134 lbs.	78 lbs.	253 lbs.

## FEATURES

	EU1000iA2	EU2000iA/ EU2000iA Companion†	EU3000is	Handl EU3000i	EU6500isA
Honda OHV engine	•	•	•	•	•
Electric start/Remote start option					•
Oil Alert®	•	•	•	•	•
Auto Throttle®					
Eco-Throttle™ (load dependent operation)	•	•	•	•	•
Electronic ignition	•	•	•	•	•
Simultaneous AC/DC use	•	•	•	•	
Circuit breakers	Electronic	Electronic	Electronic	Electronic	Electronic
Fuel gauge			•	•	•
i-Monitor					•
Wheel kit standard		OPT	OPT	•	•
iAVR					
DAVR					
CycloConverter™					
Inverter	•	•	•	•	•
One switch for engine/fuel valve on/off	•	•		•	
Full tubing frame for protection					
USDA-qualified spark arrester/muffler	•	•	•	•	•
Fully enclosed for quieter operation	•	•	•	•	•
120/240V selector switch					•
GFCI/neutral bond					
Residential warranty	2 Years	3 Years	3 Years	3 Years	3 Years
Commercial warranty	1 Year	3 Years	3 Years	3 Years	3 Years

† Indicates a specification for EU2000iA Companion model only.

††LwA is an International noise level measurement that uses a weighting factor to reflect noise "tonality" in addition to the sound power (dBA) level.

### Receptacle Key

RECEPTACLE	DESCRIPTION	PLUG #	RECEPTACLE	DESCRIPTION	PLUG #
B	15A 125V Duplex	5-15P	D	20A 125V GFCI Duplex	5-20P
C	20A 125V Duplex	5-15P or 5-20P	E	20A 125V Locking Plug	L5-20P

# Division 02

## Existing Conditions

# Division 03

## Concrete

# Division 04

## Masonry



# Division 05

## Metals

CSI #: 05 05 23

Solid Sawn Joist Hangers

**LUS/HUS** Double Shear Joist Hangers



This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

See Hanger tables on pages 71-76. See Hanger Options on pages 215-224 for hanger modifications, which may result in reduced loads.

All hangers in this series have double shear nailing. This innovation distributes the load through two points on each joist nail for greater strength. It also allows the use of fewer nails, faster installation, and the use of standard nails for all connections. (Do not bend or remove tabs.)

**MATERIAL:** See tables, pages 71-76.

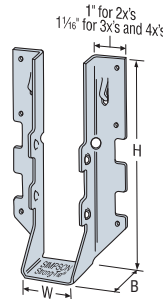
**FINISH:** Galvanized. Some products available in stainless steel or ZMAX® coating; see Corrosion Information, page 14-15.

**INSTALLATION** • Use all specified fasteners. See General Notes.

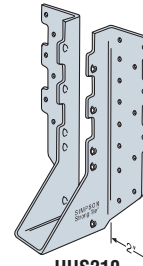
- Nails must be driven at an angle through the joist or truss into the header to achieve the table loads.
- Not designed for welded or nailer applications.
- 16d sinkers (0.148" dia. x 3 3/4" long) may be used where 10d commons are specified with no reduction in load. Where 16d commons are specified, 10d commons or 16d sinkers (0.148" dia. x 3 3/4" long) may be used at 0.85 of the table load.
- With 3x carrying members, use 16d x 2 1/2" nails into the header and 16d commons into the joist with no load reduction.
- With 2x carrying members, use 10d x 1 1/2" nails into the header and 10d commons into the joist, reduce the load to 0.64 of the table value.
- Use stainless-steel (SS) nails with stainless-steel (SS) hangers.

**OPTIONS:** • LUS hangers cannot be modified.

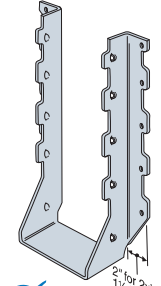
- HUS hangers available with the header flanges turned in for 2-2x (3/8") and 4x only, with no load reduction. See the HUSC Concealed Flange illustration.



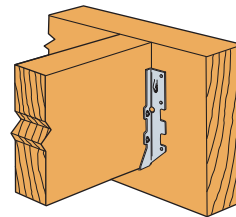
LUS28



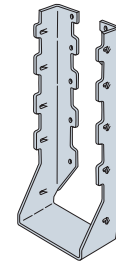
HUS210  
(HUS26, HUS28, and HHUS similar)



HUS412



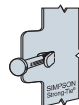
Typical LUS28 Installation  
use 0.148x3" (10d common)  
or 0.148x3 3/4" (16d sinker) nail



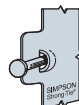
HUSC  
Concealed Flanges  
(not available for HHUS,  
HGUS and HUS2x)



Double-Shear Nailing Top View



Double-Shear Nailing Side View  
Do not bend tab



Dome Double-Shear Nailing Side View  
(available on some models)  
U.S. Patent 5,603,580

**LOAD TABLE EXPLANATION**

This icon identifies products approved for installation with the Simpson Strong-Tie Strong-Drive® SD structural-connector screw. See page 27 for more information.

**Min/Max:** Refers to min. or max. nailing for products with round and triangle holes. Min. nailing uses round holes, and max. nailing uses round and triangle holes to achieve maximum load.

**Load Duration:** Assumed duration factor used to determine the allowable load.

**Allowable Design Loads:** The maximum load that a connection is designed to provide. There may be multiple design loads acting in different directions (up, down, lateral, perpendicular, etc.) imposed on a connection.

**Code Ref.:** See page 13 for the Code Reference Key Chart, to determine which code reports include this product.

**Joist Size:** This shows the size of joist member.

**Model No.:** This is the Simpson Strong-Tie product name.

**Gauge:** Product material

**Nails:** This shows the fastener quantity and type required to achieve the table loads.

**Uplift**

**Floor, Snow, Roof**

**Installed Cost Index:** This indicates the products relative installed cost (combined cost and installation cost).

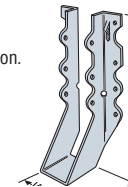
This icon identifies products that are available with additional corrosion protection. See pages 14-15 for additional information.

**Dimensions W, H, B:** This shows the product dimensions (width, height and base in this case.) referenced in the product drawing.

**NAILS:** 16d = 0.162" dia. x 3 3/4" long.  
10d x 1 1/2" = 0.148" dia. x 1 1/2" long.  
See page 22-23 for other nail sizes and information.

Throughout this catalog a footnote will typically be provided indicating the required nail diameter and length.

All installations should be designed only in accordance with the allowable



**Product Drawing:** Provides a graphic presentation of the product with dimensional information (often cross referenced to the table)

CATALOG DEFINITION:

Joist Size	Model No.	Ga	Dimensions				Min/Max	Fasteners			DF/SP Allowable Loads					Installed Cost Index (ICI)	Code Ref.	
			W	H	B	Header		Joist	DF/SP Allowable Loads									
									10d	16d	Uplift	Floor (100)	Snow (115)	Roof (125)				
DBL 2x6	LUS26-2	18	3 3/8	4 7/8	2	—	4-16d	4-16d	1165	—	1030	—	1180	—	1280	Lowest	I7, L17, F6	
	U26-2	16	3 3/8	5	2	—	8-10d	8-16d 4-10d	740	975	1150	1100	1305	1185	1410	+65%		
	HUS26-2	14	3 3/8	5 7/16	2	—	—	4-16d	4-16d	1235	—	1065	—	1210	—	1305		+172%
	HU26-2/HUC26-2	14	3 3/8	5 3/8	2 1/2	Min	—	8-16d 4-10d	760	—	1190	—	1345	—	1445	+233%		
		14	3 3/8	5 3/8	2 1/2	Max	—	12-16d 6-10d	1135	—	1785	—	2015	—	2145	+254%		

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CSI #: 05 05 23

Caps & Bases

**CC/ECC/ECCU** Column Caps



Column caps provide a high-capacity connection for column-beam combinations.  
**MATERIAL:** CC3¼, CC4, CC46, CC48, CC4.62, ECC64, CC66, CC68, CC6-7½, ECC3¼, ECC44, ECC46, ECC48, ECC4.62, ECC64, ECC66, ECC68, ECC6-7½—7 gauge; all others—3 gauge

**FINISH:** Simpson Strong-Tie® gray paint; may be ordered HDG; CCO, ECCO—no coating  
**INSTALLATION:** • Use all specified fasteners. See General Notes.

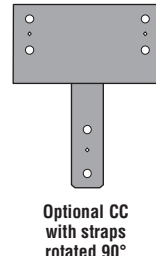
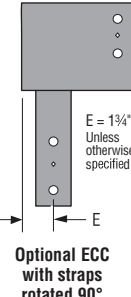
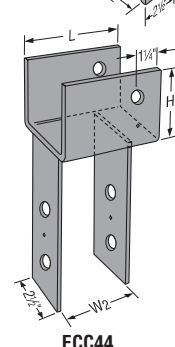
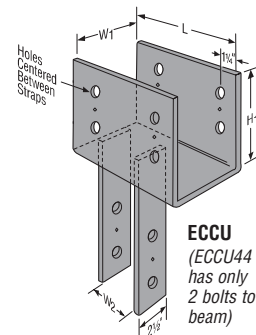
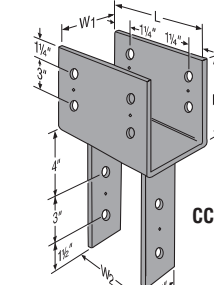
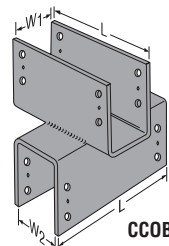
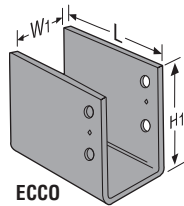
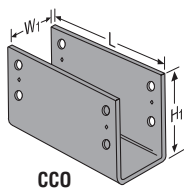
- Bolt holes shall be a minimum of ½" to a maximum of ¼" larger than the bolt diameter (per 2005 NDS, section 11.1.2).
- Contact engineered wood manufacturers for connections that are not through the wide face.

**OPTIONS:** • Straps may be rotated 90° where  $W_1 \geq W_2$  (see illustration) and for CC5¼-6.

- For special, custom, or rough cut lumber sizes, provide dimensions. An optional  $W_2$  dimension may be specified with any column size given (note that the  $W_2$  dimension on straps rotated 90° is limited by the  $W_1$  dimension).
- **CCO/ECCO**—Column cap only (no straps) may be ordered for field-welding to pipe or other columns. CCO/ECCO dimensions are the same as CC/ECC.
- **CCOB**—Any two CCOs may be specified for back-to-back welding to create a cross beam connector. Use the table loads; the load is no greater than the lesser element employed.

**CODES:** See page 13 for Code Reference Key Chart.

Caps & Bases



These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Model No. (CC shown ECC/ECCU similar)	Beam Width	Dimensions							Machine Bolts				Allowable Loads (DF/SP)				Code Ref.	CCO Model No. (No Legs)	ECCO Model No. (No Legs)
		L							Beam				Down		Uplift				
		W1	W2	CC	ECC	ECCU	H1	Size	CC	ECC	ECCU	Post	CC	ECC/ ECCU	CC (160)	ECCU (160)			
CC3¼-4	3½	3¼	3½	11	7½	9½	6½	¾	4	2	4	2	16980	6125	3640	1010	I12, L4, F11	CC03¼	ECC03¼
CC3¼-6	3½	3¼	5½	11	7½	9½	6½	¾	4	2	4	2	19250	9625	3640	1010		CC04	ECC04
CC44	4x	3½	3½	7	5½	6½	4	¾	2	1	2	2	15310	7655	1465	205		CC04/6	ECC04/6
CC46	4x	3½	5½	11	8½	9½	6½	¾	4	2	4	2	24060	12030	2800	740		CC04.62	ECC04.62
CC48	4x	3½	7½	11	8½	9½	6½	¾	4	2	4	2	24060	16405	2800	740	160		
CC4.62-3.62	4½	4½	3½	11	8½	9½	6½	¾	4	2	4	2	19020	7655	2800	740	170		
CC4.62-4.62	4½	4½	4½	11	8½	9½	6½	¾	4	2	4	2	24450	9845	2800	740		CC04.62	ECC04.62
CC4.62-5.50	4½	4½	5½	11	8½	9½	6½	¾	4	2	4	2	28585	12030	2800	740			
CC5¼-4	5½	5¼	3½	13	9½	10½	8	¾	4	2	4	2	26635	10045	7530	2735	I12, L4, F11	CC05¼	ECC05¼
CC5¼-6	5½	5¼	5½	13	9½	10½	8	¾	4	2	4	2	28190	15785	7530	2735			
CC5¼-8	5½	5¼	7½	13	9½	10½	8	¾	4	2	4	2	37310	21525	7530	2735			
CC64	6x	5½	3½	11	7½	9½	6½	¾	4	2	4	2	28586	12030	4040	1165			
CC66	6x	5½	5½	11	7½	9½	6½	¾	4	2	4	2	30250	18905	4040	1165	CC06	ECC06	
CC68	6x	5½	7½	11	9½	9½	6½	¾	4	2	4	2	37810	25780	4040	1165		ECC068	
CC6-7½	6x	5½	7½	11	9½	9½	6½	¾	4	2	4	2	37810	24060	4040	1165	160		
CC74	6½	6½	3½	13	10½	10½	8	¾	4	2	4	2	33490	13230	7525	3605	170		
CC76	6½	6½	5½	13	10½	10½	8	¾	4	2	4	2	37125	20790	7525	3605	I12, L4, F11	CC07	ECC07
CC77	6½	6½	6½	13	10½	10½	8	¾	4	2	4	2	49140	25515	7525	3605			
CC78	6½	6½	7½	13	10½	10½	8	¾	4	2	4	2	49140	28350	7525	3605			
CC7½-4	7	7½	3½	13	10½	10½	8	¾	4	2	4	2	34736	18375	7510	4855	160	CC07½	ECC07½
CC7½-6	7	7½	5½	13	10½	10½	8	¾	4	2	4	2	58500	28875	7585	4855			
CC7½-7½	7	7½	7½	13	10½	10½	8	¾	4	2	4	2	57750	36750	7585	4855			
CC7½-8	7	7½	7½	13	10½	10½	8	¾	4	2	4	2	52500	36750	7585	4855			
CC86	8x	7½	5½	13	10½	10½	8	¾	4	2	4	2	41250	23100	7440	2625	I12, L4, F11	CC08	ECC08
CC88	8x	7½	7½	13	10½	10½	8	¾	4	2	4	2	54600	31500	7440	2625			
CC96	8½	8½	5½	13	10½	10½	8	¾	4	4	4	2	48125	26950	7515	4670	CC09	ECC09	
CC98	8½	8½	7½	13	10½	10½	8	¾	4	4	4	2	63700	36750	7515	4670			
CC106	10x	9½	5½	13	10½	10½	8	¾	4	4	4	2	52250	29260	7515	3325	CC010	ECC010	

1. Uplift loads have been increased for wind or earthquake with no further increase allowed; reduce where other loads govern.
2. Down loads may not be increased for short-term loading and shall not exceed the post capacity. See pages 226-227 for common post allowable loads.
3. CC uplift loads do not apply to splice conditions.
4. Splice conditions with CC's must be detailed by the Designer to transfer tension loads between spliced members by means other than the column cap.

6. Structural composite lumber columns have sides that show either the wide face or the edges of the lumber strands/veneers. Values in the tables reflect installation into the wide face. See technical bulletin T-SCLCOLUMN for values on the narrow face (edge) (see page 232 for details).
7. Beam depth must be at least as tall as  $H_1$ .
8. For 5¼" engineered lumber, use 5½" models.
9. CCO welded to steel column will achieve same load as CC. Steel column width

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**CSI #: 05 05 23**

*Straps & Ties*

**H/TSP** Seismic & Hurricane Ties



Simpson Strong-Tie® hurricane ties provide a positive connection between truss/rafter and the wall of the structure to resist wind and seismic forces. New additions to the line provide even more options.

- H10AR – The heavy-duty design of the H10A available with a 2" wide throat to accommodate rough lumber
- H10A-2 – The H10A design with a 3" throat for double 2x members
- H2ASS, H2.5ASS and H10ASS – Popular ties now available in stainless steel.

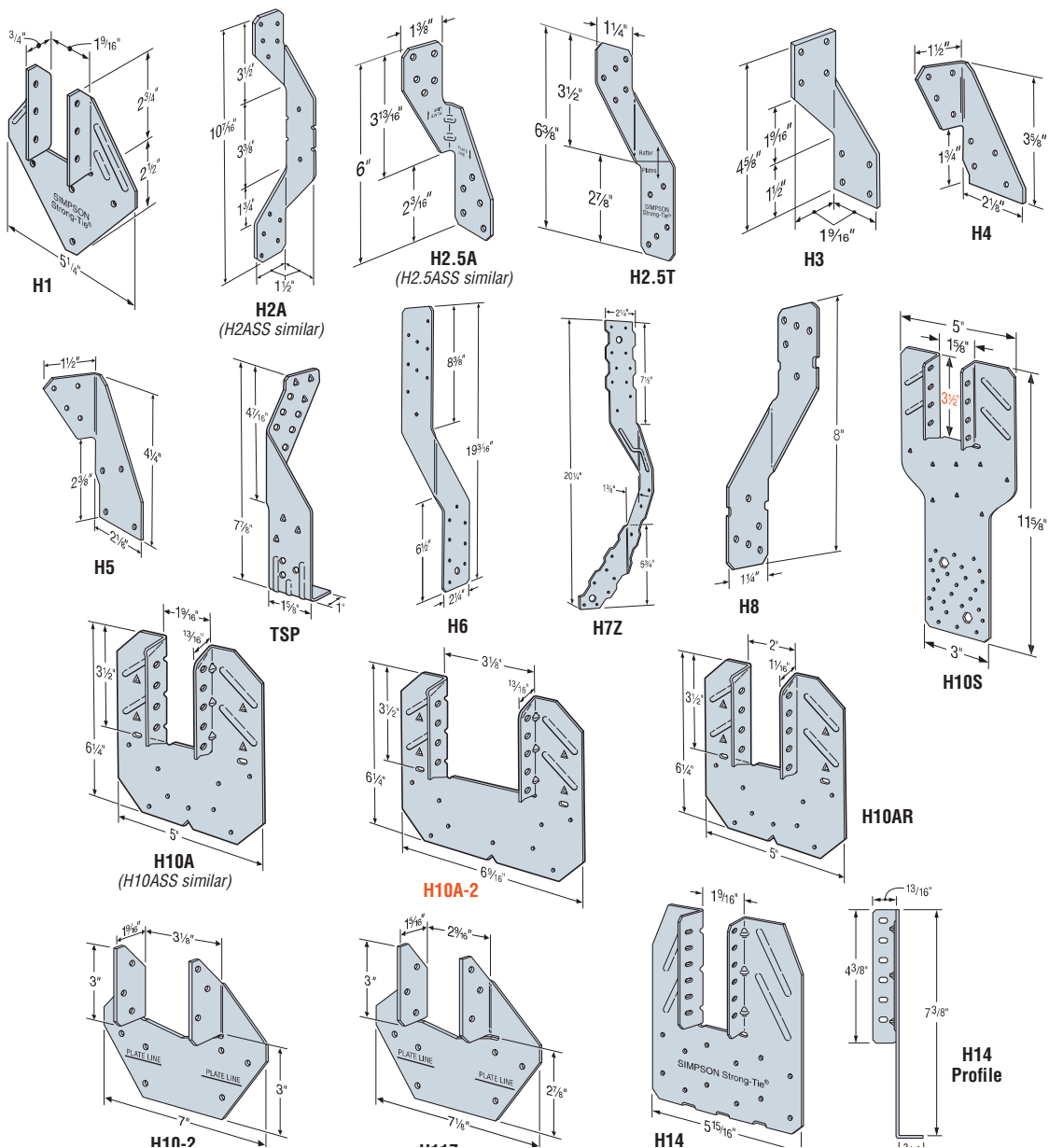
**MATERIAL:** See table.

**FINISH:** Galvanized. H7Z and H11Z—ZMAX® coating. Some models available in stainless steel or ZMAX; see Corrosion Information, page 14-15 or visit [www.strongtie.com](http://www.strongtie.com).

**INSTALLATION:** • Use all specified fasteners. See General Notes.

- H1 can be installed with flanges facing inward (reverse of H1 installation drawing; number 1).
- H2.5T, H3, H4, H5 and H6 ties are shipped in equal quantities of right and left versions (right versions shown).
- Hurricane ties do not replace solid blocking.
- When installing ties on plated trusses (on the side opposite the truss plate) do not fasten through the truss plate from behind. This can force the truss plate off of the truss and compromise truss performance.
- H10A optional nailing to connect shear blocking, use 8d nails. Slots allow maximum field bending up to a pitch of 6:12; use H10A sloped loads for field bent installation.

**CODES:** See page 13 for Code Reference Key Chart.



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Straps & Ties



CSI #: 05 05 23

Caps & Bases

**ECCLQ/CCCQ/CCTQ** Column Caps



The ECCLQ, CCCQ and CCTQ column caps provide high-capacity, multiple beam-to-column connector options. The design uses Simpson Strong-Tie® Strong-Drive® screws (SDS) to provide faster installation and a lower profile compared to standard through bolts. Screws are configured to provide high uplift design values.

**MATERIAL:** 7 gauge

**FINISH:** Simpson Strong-Tie® gray paint, also available in HDG

**INSTALLATION:**

- Install Simpson Strong-Tie SDS ¼"x2½" wood screws, which are provided, in all round holes. (Lag screws will not achieve the same load.)
- No additional welding is allowed.

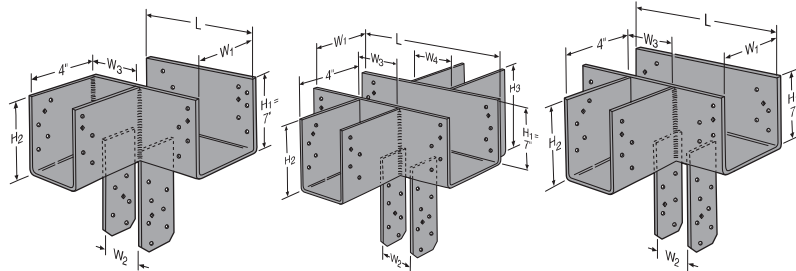
**OPTIONS:**

- Many combinations of beam and post sizes can be manufactured (refer to worksheet T-CCQLTC-WS).
- Available in widths up to 8" wide.
- ECCLQ is available in left or right side beam orientations. Specify ECCLLQ or ECCLRQ.
- Straps may be rotated where  $W_1 > W_2$ .
- Column caps may be ordered without the column straps for field welding to a column. No loads apply. Specify CCCOQ/CCTOQ/ECCLQO.

**ORDERING:**

- The L dimension varies depending on the width of the side stirrup ( $W_3$  or  $W_4$ ). Contact Simpson Strong-Tie for exact dimensions.
- Main beam stirrup height ( $H_1$ ) is 7". Side beam stirrups ( $H_2$  or  $H_3$ ) can vary in height with the minimum height of 7". Specify the side stirrup height from the top of the cap.
- Example Order: 4x Main Beam, 6x Post, 4x Side Beam (oriented to the left) is ordered as an ECCLLQ464SDS

**CODES:** See page 13 for Code Reference Key Chart.



**ECCLLQ-SDS2.5**

(Left direction shown)

**CCCQ-SDS2.5**

**CCTQ-SDS2.5**

Order ECCLRQ-SDS2.5 for right direction

Series	Allowable Loads (DF/SP)					Code Ref.
	Uplift (160)			Download (100)		
	Main Beam	Side Beam	Total <sup>3</sup>	Side Beam	Total	
ECCLQ-SDS2.5	2835	1840	3795	6780	Refer to note #5	F24
CCCQ-SDS2.5	4780	2390 <sup>2</sup>	4780	7000		
CCTQ-SDS2.5	4910	2350	5315	7000		

1. Uplift loads have been increased for wind or seismic; reduce where other loads govern. Downloads may not be increased.
2. Allowable load is per seat. Side beams must be loaded symmetrically for the CCCQ.
3. The combined uplift loads applied to all beams in the connector must not exceed the total allowable uplift load listed in the table.
4. The ECCLQ side beam may use a side beam uplift load up to 2350 lbs. The deflection of this load may exceed the standard ¼" deflection by an additional ¼".
5. The combined download for all of the carried beams shall not exceed the allowable download for the unmodified product on page 63 (CCQ load for CCCQ and CCTQ, or ECCQ load for ECCLQ). The download for each side beam shall not exceed the lesser of 35% of the allowable download or 9265 lbs. for the unmodified product.
6. The download to each side beam shall not exceed the allowable load shown, nor 35% of the allowable load for the unmodified product, whichever is lower.
7. Column width in the direction of the beam width must be the same as the main beam width ( $W_1$ ).

Caps & Bases

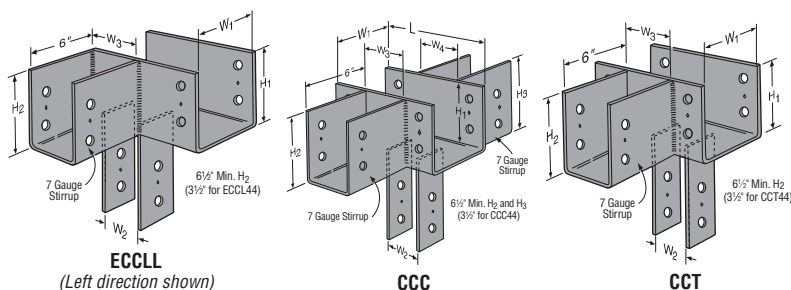
**ECCL/CCC/CCT** Column Caps

Column-to-beam connections often have multiple beams framing on top of a column. L, T, and Cross column caps provide design solutions for this application. Many combinations of beam and post sizes can be manufactured (refer to worksheet T-CCLTC-WS for details) with the following criteria applied:

- The download capacity shall be determined from the capacity for the unmodified product (see page 64). The side beam can take a maximum of 40% of the download and shall not exceed 10,665 lbs. The sum of the loads for the side beam(s) and main beam can not exceed the table load.
- Uplift loads do not apply for ECCL caps. For CCC and CCT, uplift loads from table apply for main beam only.
- The column width in the direction of the main beam width must be the same as the main beam width ( $W_1$ ).
- Specify the stirrup height from the top of the cap. The minimum side stirrup heights ( $H_2$  or  $H_3$ ) is 6½" (¾" for 44's).
- The L dimension may vary depending on the width of the side stirrup ( $W_3$  or  $W_4$ ).
- Column caps may be ordered without the column straps for field welding to a column. No loads apply. Specify CCOC/CCOT/ECCL.

**Ordering Examples:**

- A CCC66 with  $W_3 = 5½"$ ,  $H_2$  and  $H_3 = 6½"$  is a CC66 column cap with 5½" beams on each side with all beam seats flush.
- An ECCLR66 with  $W_3 = 3¾"$ ,  $H_2 = 7½"$  is an ECCL66 end column cap with a 4x beam on the right side (specify direction left (which is shown) or right for stirrup) and stirrup seat 1" below the cap seat

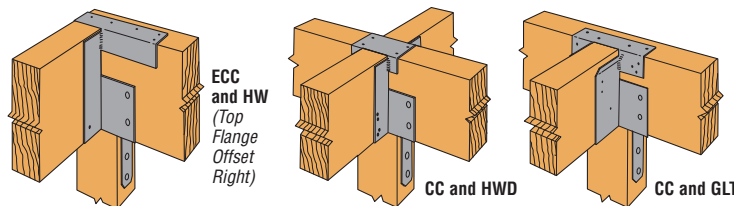


**ECCL**  
(Left direction shown)  
Order ECCLR for right direction

**CCC**

**CCT**

There are cost-effective alternatives for replacing column caps by using a combination of connectors. Here is an example. Designer must specify the options required.



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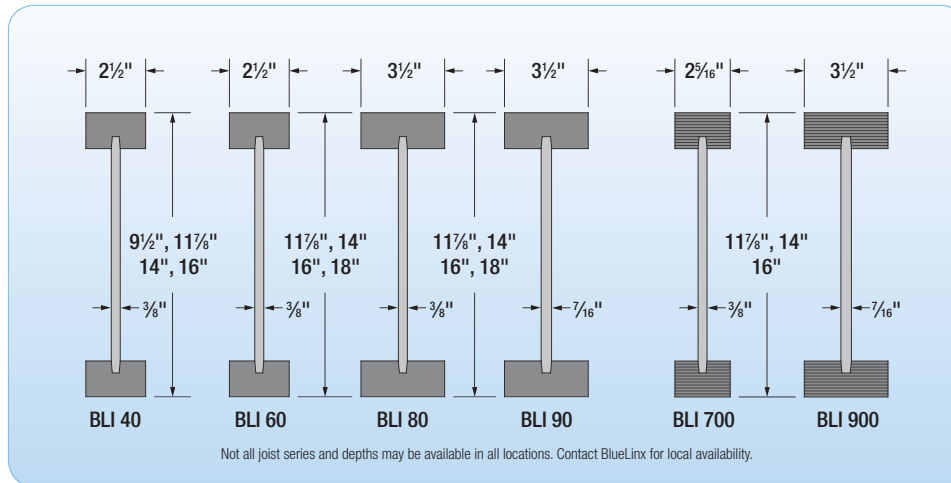
# Division 06

## Wood, Plastics, and Composites



CSI #: 06 18 13

## DESIGN PROPERTIES



### Design Properties for BLI Joists

Joist Series	Joist Depth	EI (10 <sup>6</sup> in <sup>2</sup> -lbs)	Maximum Moment <sup>a,b</sup> (ft.-lbs)	Maximum Shear <sup>b</sup> (lbs)	1 1/4" End Reaction <sup>b,c,d</sup> (lbs)	3 1/2" Intermediate Reaction <sup>b,c</sup> (lbs)	Weight (plf)
BLI 40	9 1/2"	193	2735	1120	1080	2160	2.6
	11 7/8"	330	3545	1420	1200	2500	2.9
	14"	482	4270	1710	1200	2500	3.3
	16"	657	4950	1970	1200	2500	3.6
BLI 60	11 7/8"	396	4900	1420	1200	2500	3.2
	14"	584	5895	1710	1200	2500	3.4
	16"	799	6835	1970	1200	2500	3.7
	18"	1046	7895	2250	1250	2500	3.9
BLI 80	11 7/8"	547	6940	1420	1280	2760	3.7
	14"	802	8360	1710	1280	3020	3.9
	16"	1092	9690	1970	1280	3100	4.1
	18"	1413	11000	2300	1250	3100	4.3
BLI 90	11 7/8"	601	8515	1420	1280	2760	3.9
	14"	877	10255	1710	1280	3020	4.1
	16"	1187	11895	1970	1280	3265	4.3
	18"	1546	13455	2450	1250	3200	4.5
BLI 700	11 7/8"	420	6595	1420	1160	2335	2.9
	14"	613	7865	1710	1160	2335	3.2
	16"	841	9010	1970	1160	2335	3.5
BLI 900	11 7/8"	661	10255	1925	1400	3355	4.1
	14"	965	12235	2125	1400	3355	4.4
	16"	1306	14020	2330	1400	3355	4.7

- No increase permitted for repetitive member use factor.
- Tabulated values for maximum moment, shear, and reactions are for normal load duration and may be increased for other load durations in accordance with applicable building codes.
- Tabulated maximum reactions are without bearing stiffeners. For maximum reactions with bearing stiffeners or with other bearing lengths, visit [www.buildonCENTER.com](http://www.buildonCENTER.com).
- For the maximum end reaction with an end bearing length of 4", use the tabulated maximum shear value. Maximum reactions for end bearing lengths between 1 3/4" and 4" may be determined by interpolation. Bearing stiffeners are required for end reactions exceeding 1550 lbs.

$$\text{Approximate Deflection (inches)} = \frac{22.5wL^4}{EI} + \frac{2.308wL^2}{d \times 10^5}$$

$w$  = uniform load (plf)  
 $L$  = span (feet)  
 $EI$  = stiffness constant (in<sup>2</sup>-lbs)  
 $d$  = joist depth (inches)

CSI #: 06 18 13

## FLOOR LOAD TABLE (PLF)

BLI 100%

Joist Series	Joist Depth	Load Type / Deflection	Clear Span																									
			6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'	21'	22'	23'	24'	25'	26'					
BLI 40	9½"	Live L/600				179	136	106	83	67	54	45	37	31	27													
		Live L/480					170	132	104	84	68	56	47	39	33													
		Total L/240	286	244	214	190	171	155	142	125	108	94	83	73	65													
	11½"	Live L/600						172	137	110	90	75	62	53	45	38	33	29	25	22								
		Live L/480								138	113	93	78	66	56	48	41	36	31	28								
		Total L/240	334	285	249	221	198	180	165	152	140	122	107	95	85	76	69	62	57	52								
	14"	Live L/600										128	106															
		Live L/480											112	94	81	69	60	52	46	40	35	31	28					
		Total L/240	336	287	250	222	199	181	165	153	142	132	124	115	102	92	83	75	69	63	58	53	49					
	16"	Live L/600																										
		Live L/480												119	101	86	74	64	56	49	43	38	34	30				
		Total L/240	338	288	251	222	200	181	166	153	142	132	124	117	110	104	96	87	80	73	67	62	57					
BLI 60	11½"	Live L/600									159	129	106	88	73	62	53	45	39	34	30	26						
		Live L/480										132	110	92	78	66	57	49	43	37	33							
		Total L/240	336	286	250	221	199	181	165	153	142	132	124	116	110	104	95	86	75	66								
	14"	Live L/600											126	106	89	76	66	57	50	43	38	34	30	27				
		Live L/480												112	96	82	71	62	55	48	42	38	34					
		Total L/240	339	288	251	223	200	181	166	153	142	132	124	117	110	104	99	94	90	86	80	74	68					
	16"	Live L/600																102	88	77	67	59	52	46	41	36		
		Live L/480																	96	84	74	65	58	51	46			
		Total L/240	341	290	253	224	201	182	166	153	142	133	124	117	110	104	99	94	90	86	83	79	76					
	18"	Live L/600																										
		Live L/480																					86	76	67	59	53	47
		Total L/240	343	292	254	225	201	182	167	154	143	133	124	117	110	105	99	95	90	86	83	79	76					
BLI 80	11½"	Live L/600																										
		Live L/480														138	117	101	87	76	66	58	51	45				
		Total L/240	375	319	278	246	221	201	184	169	157	146	137	129	122	115	109	104	99	90								
	14"	Live L/600																										
		Live L/480																							46	41	36	
		Total L/240	415	353	307	271	243	220	202	186	172	161	150	141	134	126	120	114	109	104	100	96	92					
	16"	Live L/600																										
		Live L/480																								61	55	49
		Total L/240	416	355	309	273	244	221	202	186	173	161	151	142	134	127	120	114	109	104	100	96	92					
	18"	Live L/600																										
		Live L/480																								98	87	78
		Total L/240	406	349	306	273	246	224	205	190	176	165	154	145	137	130	124	118	112	107	103	99	95					
BLI 90	11½"	Live L/600																										
		Live L/480																										
		Total L/240	377	321	279	247	222	201	184	169	157	147	137	129	122	115	110	104	100	95								
	14"	Live L/600																										
		Live L/480																										
		Total L/240	416	354	308	272	244	221	202	186	173	161	151	142	134	127	120	114	109	104	100	96	92					
	16"	Live L/600																										
		Live L/480																										
		Total L/240	416	358	314	279	252	229	210	194	180	169	158	149	141	133	127	121	115	110	106	101	97					
	18"	Live L/600																										
		Live L/480																										
		Total L/240	406	349	306	273	246	224	205	190	176	165	154	145	137	130	124	118	112	108	103	99	95					

**NOTES:**

1. Refer to General Notes on page 9.
2. Live load deflection of L/480 is recommended. For allowable live load at L/360 deflection (minimum code requirement), multiply L/480 values by 1.33. Refer to page 6 for framing system design considerations.

CSI #: 06 18 13

## FLOOR LOAD TABLE (PLF)

# BLI 100%

Joist Series	Joist Depth	Load Type / Deflection	Clear Span																							
			6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'	21'	22'	23'	24'	25'	26'			
BLI 700	11½"	Live L/600										135	111	92	77	65	56	48	41	36	32	28				
		L/480											116	97	82	70	60	52	45	40	35					
	Total L/240	314	268	234	207	186	169	155	143	132	123															
	14"	Live L/600													110	93	80	69	60	52	45	40	35	32	28	
		L/480															100	86	75	65	57	50	44	40	35	
	Total L/240	317	270	235	208	187	169	155	143	133	124															
16"	Live L/600																									
	L/480																									
Total L/240	319	272	236	209	188	170	156	143	133	124																
BLI 900	11½"	Live L/600																								
		L/480													194	161	135	114	97	83	72	63	55	48	42	
	Total L/240	455	391	340	301	270	245	224	206	191	178															
	14"	Live L/600																								
		L/480															160	137	118	102	89	78	69	61	54	48
	Total L/240	455	391	343	303	272	246	225	207	192	179															
16"	Live L/600																									
	L/480																	134	117	103	91	81	72	64	57	
Total L/240	455	391	343	305	273	247	226	208	193	180																

**NOTES:**

1. Refer to General Notes on page 9.
2. Live load deflection of L/480 is recommended. For allowable live load at L/360 deflection (minimum code requirement), multiply L/480 values by 1.33. Refer to page 6 for framing system design considerations.



CSI #: 06 18 13

## onCENTER™ LVL DESIGN PROPERTIES

### Edgewise Design Values

Grade	Width	Design Property	Depth								
			7¼"	9¼"	9½"	11¼"	11½"	14"	16"	18"	24"
2.0E	1¾"	EI (10 <sup>6</sup> in <sup>2</sup> lbs)	111	231	250	415	488	800	1195	1701	4032
		Allowable Moment (ft-lbs)	4280	6711	7049	9631	10642	14320	18210	22511	37782
		Allowable Shear (lbs)	2411	3076	3159	3741	3948	4655	5320	5985	7980
		Weight (plf)	3.4	4.4	4.5	5.3	5.6	6.6	7.6	8.5	11.4
1.9E	1¾"	EI (10 <sup>6</sup> in <sup>2</sup> lbs)	106	219	238	395	464	760	1135	1616	3830
		Allowable Moment (ft-lbs)	4105	6464	6793	9310	10297	13959	17864	22207	37782
		Allowable Shear (lbs)	2411	3076	3159	3741	3948	4655	5320	5985	7980
		Weight (plf)	3.3	4.2	4.3	5.1	5.4	6.4	7.3	8.2	10.9

1. Allowable moment and shear values are for 100% load duration and may be adjusted for other load durations.
2. Table assumes beam has lateral support at bearing points and at 24" o.c. or less along the span.
3. 1¾" wide beams 16" and deeper must only be used in multiple-ply members.
4. Not all grades and depths may be available in all locations. Contact BlueLinX for local availability.

### Allowable Edgewise Design Stresses <sup>a</sup>

	onCENTER 2.0E LVL	onCENTER 1.9E LVL
E (Modulus of Elasticity) <sup>b</sup>	2.0 x 10 <sup>6</sup> psi	1.9 x 10 <sup>6</sup> psi
G (Shear Modulus of Elasticity) <sup>b</sup>	NA	118,750 psi
F <sub>b</sub> (Flexural Stress)	3100 psi <sup>c,d</sup>	3000 psi <sup>c,e</sup>
F <sub>v</sub> (Horizontal Shear)	285 psi	285 psi
F <sub>cl</sub> (Compression Perpendicular to Grain) <sup>b</sup>	750 psi	750 psi
F <sub>cl</sub> (Compression Parallel to Grain)	2750 psi	2500 psi
F <sub>t</sub> (Tension Parallel to Grain) <sup>f</sup>	1640 psi	1640 psi
SG (Equivalent Specific Gravity) <sup>g</sup>	0.50	0.43

- a. Allowable design stresses apply to depths as small as 3½" ripped from any depth of beam.
- b. No increase is allowed to E, G or F<sub>cl</sub> for duration of load.
- c. A factor of 1.04 may be applied for repetitive members as defined in the 2005 NDS.
- d. For depth (d) of 12". For 3.5" ≤ d < 12", multiply F<sub>b</sub> by (12/d)<sup>0.154</sup>. For d > 12", multiply F<sub>b</sub> by (12/d)<sup>0.2</sup>.
- e. For depth (d) of 12". For 3.5" ≤ d < 12", multiply F<sub>b</sub> by (12/d)<sup>0.1361</sup>. For d > 12", multiply F<sub>b</sub> by (12/d)<sup>0.1527</sup>.
- f. F<sub>t</sub> has been adjusted for a length effect suitable for most common applications.
- g. For calculating lateral load capacity of bolts, lag screws, nails, and wood screws in the wide face. For nails and wood screws in the wide face of 1.9E onCENTER LVL, use 0.50.

**CSI #: 06 18 13**

**SECTION 2. DIMENSION LUMBER BASE VALUES<sup>1</sup> - DOMESTIC SPECIES**

GRADE	Extreme fiber in bending F <sub>b</sub>	Tension parallel to grain F <sub>t</sub>	Compression parallel to grain F <sub>c</sub>	Compression perpendicular to grain F <sub>c</sub>	Horizontal shear F <sub>v</sub>	Modulus of Elasticity E
<b>SPECIES: DOUGLAS FIR</b>						
Select Structural	1,500	1,000	1,700	625	180	1,900,000
No. 1 & Btr.	1,200	800	1,550	625	180	1,800,000
No. 1	1,000	675	1,500	625	180	1,700,000
No. 2	900	575	1,350	625	180	1,600,000
No. 3	525	325	775	625	180	1,400,000
Construction	1,000	650	1,650	625	180	1,500,000
Standard	575	375	1,400	625	180	1,400,000
Utility	275	175	900	625	180	1,300,000
Stud	700	450	850	625	180	1,400,000
<b>SPECIES: HEM-FIR</b>						
Select Structural	1,400	925	1,500	405	150	1,600,000
No. 1 & Btr.	1,100	725	1,350	405	150	1,500,000
No. 1	975	625	1,350	405	150	1,500,000
No. 2	850	525	1,300	405	150	1,300,000
No. 3	500	300	725	405	150	1,200,000
Construction	975	600	1,500	405	150	1,300,000
Standard	550	325	1,300	405	150	1,200,000
Utility	250	150	850	405	150	1,100,000
Stud	675	400	800	405	150	1,200,000
<b>SPECIES: SPRUCE-PINE-FIR - South</b>						
Select Structural	1,300	575	1,200	335	135	1,300,000
No. 1	875	400	1,050	335	135	1,200,000
No. 2	775	350	1,000	335	135	1,100,000
No. 3	450	200	575	335	135	1,000,000
Construction	875	400	1,200	335	135	1,000,000
Standard	500	225	1,000	335	135	900,000
Utility	225	100	675	335	135	900,000
Stud	600	275	625	335	135	1,000,000
<b>SPECIES: WESTERN WOODS</b>						
Select Structural	900	400	1,050	335	135	1,200,000
No. 1	675	300	950	335	135	1,100,000
No. 2	675	300	900	335	135	1,000,000
No. 3	375	175	525	335	135	900,000
Construction	775	350	1,100	335	135	1,000,000
Standard	425	200	925	335	135	900,000
Utility	200	100	600	335	135	800,000
Stud	525	225	575	335	135	900,000
<b>SPECIES: WESTERN CEDARS</b>						
Select Structural	1,000	600	1,000	425	155	1,100,000
No. 1	725	425	825	425	155	1,000,000
No. 2	700	425	650	425	155	1,000,000
No. 3	400	250	375	425	155	900,000
Construction	800	475	850	425	155	900,000
Standard	450	275	650	425	155	800,000
Utility	225	125	425	425	155	800,000
Stud	550	325	400	425	155	900,000
<b>SPECIES: PORT ORFORD CEDAR</b>						
Select Structural	1,250	700	1,150	470	165	1,600,000
No. 1	1,050	575	1,050	470	165	1,500,000
No. 2	875	475	875	470	165	1,400,000
No. 3	500	275	500	470	165	1,300,000
Construction	975	550	1,100	470	165	1,300,000
Standard	550	300	900	470	165	1,200,000
Utility	250	150	600	470	165	1,100,000
Stud	675	375	550	470	165	1,300,000

See footnotes page 7

**CSI #: 06 41 13**

trendsetting texture

# tafisa

			
L530 Latitude North	L531 Latitude South	L532 Latitude West	L533 Latitude East
			
L540 Summer Breeze	L541 Winter Cherry	L542 Autumn Leaves	L543 Spring Blossom
		<h1 style="font-size: 4em; margin: 0;">10</h1> <p style="font-size: 2em; margin: 0;">new colors</p>	
L550 Beachwood	L551 Boardwalk		

**alto** by tafisa

**TAFISA CANADA**  
4660, Villeneuve Street, Lac-Mégantic, Quebec CANADA G6B 2C3  
Customer Service: 1-888-882-3472 [tafisa.ca](http://tafisa.ca)



A company of the group  
 **SONAE INDUSTRIA**



CSI #: 06 41 16

## Laminate by FORMICA®

THE ORIGINAL HIGH PRESSURE LAMINATE



### USE & CARE

Before selecting the surface material, consider the type of use it will receive, as well as its texture, color, and reflective values. A rough-textured surface has different advantages, depending upon use, than a smooth-textured surface. High gloss finish laminates for example, are not recommended for use in heavy-duty applications such as countertops.

**SCRATCH AND IMPACT PROTECTION:** Laminate by Formica is resistant to scratches and impacts under normal use conditions. Use cutting boards, chopping blocks, or other protective surfaces.

- A) Do not chop, slice, pound, or hammer on any laminate surface.
- B) Knives or other sharp utensils may slice or scratch the surface.
- C) Heavy blows from a hammer or meat tenderizer may crack or gouge the surface.
- D) Use place mats, dollies, and trivets on laminate surfaces when necessary.

Ceramics and abrasive objects can cause scratching and premature wear – do not slide these items across surface.

Follow recommendations for cleaning – do not use abrasive cleaners, powders, steel wool, sandpaper, or Scotch-Brite® scouring pads (see Cleaning section below).

**HOT OBJECTS:** Cookware still hot from the stove or oven, as well as electric skillets, waffle irons, curling irons, and hot rollers, etc., should not be placed directly on laminate surfaces. Prolonged exposure to temperatures of 140°F (60°C) or higher may cause the laminate to separate from the core material.

Avoid ironing or placing a hot iron on laminate surfaces. Do not place lighted cigarettes directly on laminate surfaces.

Use a trivet, insulated hot pad or other protective device beneath all hot cookware, heat generating appliances, or other heated objects. Laminate by Formica can withstand heat up to 275°F (135°C) for short periods of time.

**ORDINARY CLEANING:** Laminate by Formica is very easy to clean.

- A) In most cases, you only need to use a clean, damp, non-abrasive cotton cloth and a mild liquid detergent or household cleaner.
- B) Rinse with clean water, using a clean, non-abrasive cotton cloth.
- C) Do not flood the laminate, especially near seams, since water can penetrate and cause the substrate to swell.
- D) Dry the surface with a soft, clean, non-abrasive cotton cloth.

**CLEANING SPECIFIC FINISH TYPES:** For specific types of surfaces, use the following care guidelines. Sculptured and Dimensional Finish Laminate: These surfaces may require special attention to clean the depressed areas. Use a nylon-bristled hand or vegetable brush, along with a mild liquid detergent-and-water solution or household cleaner. Clean the soiled area, using a rotating motion. Rinse and dry the surface as indicated.

**CHEMICAL DAMAGE:** Never use cleaners containing acid, alkali, or sodium hypochlorite. These cleaners will mar, etch, corrode, and permanently discolor the laminate surface. Also, make sure that bottles, rags, and other materials contaminated with these cleaners never contact the laminate surface. Examples of cleaners containing acid, alkaline, or sodium hypochlorite include, but are not limited to: drain cleaners, rust removers, coffeepot cleaners, metal cleaners, tub and tile cleaners, chlorine bleach, oven cleaners, toilet bowl cleaners, lime scale removers, ceramic cooktop cleaners, some disinfectants and some countertop cleaners.

# Division 07

## Thermal and Moisture Protection

CSI #: 07 13 26

# VERSASHIELD® UNDERLAYMENT

Fire Resistant Roof Deck Protection

## Property Owner's Best Choice

- **Superior Protection...** The best protection against fire spread and penetration.
- **Looks Better...** Fiberglass reinforced, so it lays flatter for a better-looking roof.
- **Peace Of Mind...** 20 year limited warranty against manufacturing defects.

## Professional's Best Choice

- **Increased Productivity...** Fire resistant slip sheet AND roof deck protection in one roll.
- **Convenient...** Will upgrade the UL fire classification of almost any type of roof.\*
- **Safer For Installers...** Slip resistant walking surface improves traction on steep slopes.
- **Easier To Use...** Light color provides a cooler working surface.
- **Flexibility...** Helps provide temporary moisture resistance; can be left exposed for up to 60 days if necessary.

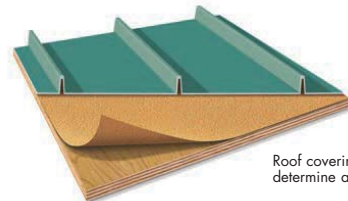


### Specifications (nom.)

- 3.5 squares (350 gross square feet or 32.5m<sup>2</sup> per roll)
- 42" (1.07m) wide, 100 ft. (30.48m) long
- 52.5 lbs. per roll
- Meets or exceeds ASTM D146, D226 Type II, D828, D4869 Type IV, D6757 Type I or Type II
- UL Listed
- Dade County Product Approval
- Florida Building Code Approval
- LA City: RR25424
- ICC ESR-2053
- ICC AC-160

\*Please refer to Underwriters Laboratories Certifications Directory for actual assemblies.

## TYPICAL APPLICATIONS FOR COMBUSTIBLE DECKS



Roof covering will determine actual assembly\*

## VERSASHIELD® UNDERLAYMENT PHYSICAL/PERFORMANCE PROPERTIES

Tensile		
MD	ASTM D146/D828	60 lb./in. width
CMD		30 lb./in. width
Tear		
MD	ASTM D1922	400 grams
CMD		550 grams
Water Vapor Transmission		
Permeance	ASTM E96	3 perms minimum
Liquid Water Transmission Test		
	ASTM D4896	Pass

## VERSASHIELD® UNDERLAYMENT CLASS A RATING LAYER REQUIREMENTS\*

Roofing Material	Roof Type	Min. Thickness	15/32" Plywood	Existing Wood Shake/Shingle	Spaced Sheathing
UL Listed Stone Coated Steel	Direct to deck shingle	0.013"	1 Layer	N/A	1 Layer
UL Classified or Listed Steel	Direct to deck shingle	0.013"	1 Layer + 30 Felt	N/A	1 Layer + 30 Felt
Any UL Classified or Listed Steel	Batten required shingle	0.013"	1 Layer	2 Layers	1 Layer
Any UL Classified or Listed Steel	Panel of standing seam	0.015"	1 Layer	N/A	1 Layer
Any UL Classified or Listed Copper	Panel of standing seam	0.016"	1 Layer	N/A	1 Layer
Any UL Classified or Listed Copper	Shingle	0.016"	1 Layer + 30 Felt	2 Layers	1 Layer + 30 Felt
Any UL Classified or Listed Aluminum	Panel or shingle	0.018"	2 Layers	N/A	N/A

When installed in accordance with section 4.2.1 of GAF-ELK's ESR-2053, VersaShield underlayment can be used over existing wood shakes or shingles as an alternative to the covering materials specified in section 1510.4 of the IBC, section R907.4 of the IRC, or section T513.3 of Chapter 15 Appendix to the UBC.

## VERSASHIELD® UNDERLAYMENT PACKAGING AND STORAGE

25 rolls per pallet
24 pallets per truck, single stacked, 600 rolls/truck
Do <b>NOT</b> double stack
Protect from precipitation, moisture, sunlight, and extreme temperatures while in storage



visit [www.gaf.com](http://www.gaf.com)  
Quality You Can Trust Since 1886...From  
North America's Largest Roofing Manufacturer!™

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CSI #: 07 21 00



- Products
- M27 BioPCM™
  - M51 BioPCM™
  - M91 BioPCM™

- Back to M27
- Testing
- Installation
- Modeling
- Submittal Form
- Application

## M27 bioPCmat™ Specifications

**Width:** 16.5 inches (.42m)

**Length:** 48 inches (1.22m) or 96 inches (2.44m)

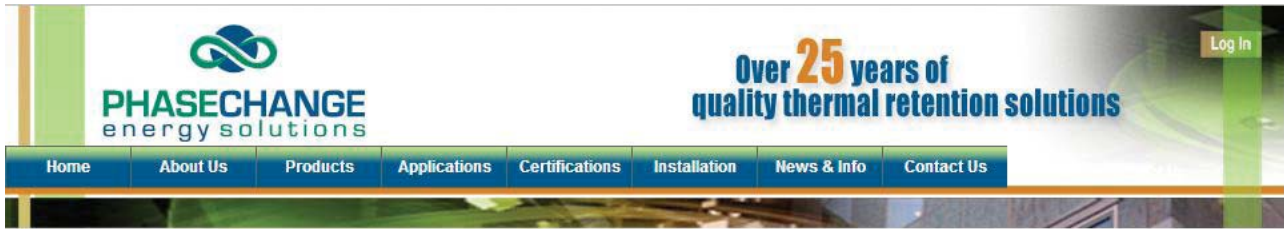
This product is stocked in 16.5 inch width material, and is available in two different lengths as a stock item. You can get it in 4 Ft. (48 inch) and 8 Ft. (96 inch) lengths depending on the final usage of the product. It is also available in non-permeable and permeable configurations. Please note that this product can be ordered in a wide variety of temperatures to meet your specific needs. It is stocked in 23C, 25C, 27C and 29C options. It is also possible to manufacture other temperature products to meet custom demand. Feel free to contact us to discuss your product needs.

### CUSTOM ORDER SIZES available by special order:

We can manufacture this product in custom sizes should that be deemed necessary. Pricing for custom product will vary depending on the exact specifications and will be quoted per your request. Lead times will vary depending on work flow and availability of raw materials at the time of purchase. Call us today to request a quote on your custom product.



CSI #: 07 21 00



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Over **25** years of  
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- Products**
- M27 BioPCM™
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  - M91 BioPCM™

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[Testing](#)
[Installation](#)
[Modeling](#)
[Submittal Form](#)
[Application](#)

## M51 bioPCM™ Specifications

**Width:** 16.5 inches (.42m)

**Length:** 48 inches (1.22m) or 96 inches (2.44m)

This product is stocked in 16.5 inch width material, and is available in two different lengths as a stock item. You can get it in 4 Ft. (48 inch) and 8 Ft. (96 inch) lengths depending on the final usage of the product. It is also available in non-permeable and permeable configurations. Please note that this product can be ordered in a wide variety of temperatures to meet your specific needs. It is stocked in 23C, 25C, 27C and 29C options. It is also possible to manufacture other temperature products to meet custom demand. Feel free to contact us to discuss your product needs.

### CUSTOM ORDER SIZES available by special order:

We can manufacture this product in custom sizes should that be deemed necessary. Pricing for custom product will vary depending on the exact specifications and will be quoted per your request. Lead times will vary depending on work flow and availability of raw materials at the time of purchase. Call us today to request a quote on your custom product.



CSI #: 07 21 00



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  - M51 BioPCM™
  - M91 BioPCM™

## Typical Phase Change Applications in Building Environments

### Trombe Wall Application

Taking advantage of the normal tracking of the sun is becoming all the more necessary as we look for ways to reduce our carbon footprint. Placing phase change material in trombe walls which are exposed to the sun at critical times during day allows you to take full advantage of the transition of the phase change to decrease the heating load of the structure.



image courtesy of Sam Cremin

### Drop Ceiling Application

Placing Biopcm™ into the ceiling cavity of a structure whether new or retrofit, is one of the easiest, most cost effective applications of phase change possible. In numerous studies of actual structures, we consistently see significant savings on HVAC expenditures. These savings are repeatable year-over-year for many years which equates to huge savings over the life of the product.

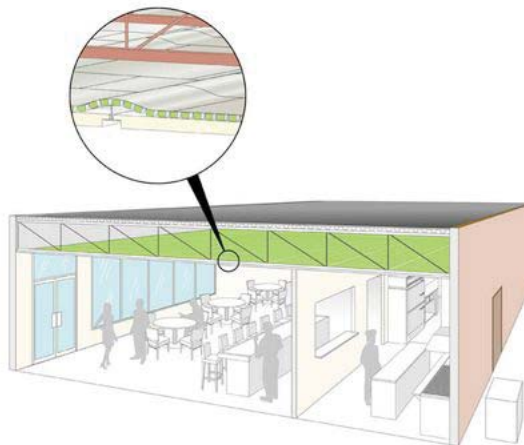


image courtesy of Sam Cremin

**CSI #: 07 21 00**

Project No. 100366711SAT-001A  
Phase Change Energy Solutions, Inc.

March 30, 2011  
Page 2 of 9

**ABSTRACT**

Specimen I. D. "901.25QFGA 30 M27"

Test Standard: ASTM E84-10b TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS (UL 723, UBC 8-1, NFPA 255)


Test Date: March 30, 2011

Client: Phase Change Energy Solutions, Inc.

Test Results:


<b>FLAME SPREAD INDEX</b>	<b>0</b>
<b>SMOKE DEVELOPED INDEX</b>	<b>130</b>

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\_\_\_\_\_  
Darrell Gonzales  
Technician 3

March 30, 2011

Reviewed and approved:

  
\_\_\_\_\_  
Servando Romo  
Project Manager

April 9, 2011



CSI #: 07 21 00



Fabral Inc  
100243380MID-001

October 19, 2010  
Page 6 of 8

## Testing and Evaluation Results

### 4.4. RESULTS AND OBSERVATIONS

Data for the ASTM E 800 – 07 Smoke Toxicity

#### Sample: Phasechange Energy Solutions Phasechange Material

##### Radiant Heat

Gas Compound	Maximum Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	89	50	3500
Carbon Dioxide	1500	500	90000
Oxides of Nitrogen	0	25	100
Sulfur Dioxide	0	10	100
Hydrogen Chloride	0	55	500
Hydrogen Fluoride	0	35	100
Hydrogen Bromide	0	75	100
Hydrogen Cyanide	0	15	100
Nitrous Oxide	0	25	NA

##### Radiant Heat and Flame

Gas Compound	Maximum Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	0	50	3500
Carbon Dioxide	1700	500	90000
Oxides of Nitrogen	0	25	100
Sulfur Dioxide	0	10	100
Hydrogen Chloride	0	55	500
Hydrogen Fluoride	0	35	100
Hydrogen Bromide	0	75	100
Hydrogen Cyanide	0	15	100
Nitrous Oxide	0	25	NA

Critical Concentration limits are taken from the SMP 800C



CSI #: 07 21 00



Fabral Inc  
100243380MID-001

October 19, 2010  
Page 6 of 8

## Testing and Evaluation Results

### 4.4. RESULTS AND OBSERVATIONS

Data for the ASTM E 800 – 07 Smoke Toxicity

Sample: Phasechange Energy Solutions Phasechange Material

#### Radiant Heat



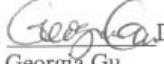
Gas Compound	Maximum Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	89	50	3500
Carbon Dioxide	1500	500	90000
Oxides of Nitrogen	0	25	100
Sulfur Dioxide	0	10	100
Hydrogen Chloride	0	55	500
Hydrogen Fluoride	0	35	100
Hydrogen Bromide	0	75	100
Hydrogen Cyanide	0	15	100
Nitrous Oxide	0	25	NA

#### Radiant Heat and Flame

Gas Compound	Maximum Observed (ppm)	Analysis Detection Limits (ppm)	Critical Concentrations (ppm)
Carbon Monoxide	0	50	3500
Carbon Dioxide	1700	500	90000
Oxides of Nitrogen	0	25	100
Sulfur Dioxide	0	10	100
Hydrogen Chloride	0	55	500
Hydrogen Fluoride	0	35	100
Hydrogen Bromide	0	75	100
Hydrogen Cyanide	0	15	100
Nitrous Oxide	0	25	NA

Critical Concentration limits are taken from the SMP 800C

CSI #: 07 21 00

<b>Job Number: 109257</b>		 <p><b>TESTING SERVICE</b> 7500 Mendelssohn Avenue North Minneapolis, MN 55428, USA Phone: 763-493-6370 Fax: 763-493-6358</p>		
<p>Phase Change Energy Attn: Pete Horwath 123 East Pritchard Street Asheboro, NC 27203</p>				
		<p><b>Water Vapor Transmission Rate Results</b> We are pleased to submit the results of our transmission rate measurements of your material submitted under:</p>		
		<p><b>PO #: 2010-00002</b> Dated: 9/22/10</p>		
<b>Test Conditions:</b>				
<b>Test Gas</b>	<b>Water Vapor</b>	<b>Test Temperature</b>	23C	
Test Gas Concentration	NA	Carrier Gas	Nitrogen	
Test Gas Humidity	100 % RH (Wet cup)	"Dry" Side Gas Humidity	50 % RH	
<b>Test Results:</b>				
<b>Sample Identification</b>	<b>Water Vapor Transmission Rate</b>			
	<b>gm/(100in<sup>2</sup>·day)</b>		<b>Perm grain/(ft<sup>2</sup>·hr·inHg)</b>	
	<b>Replicate #1</b>	<b>Replicate #2</b>	<b>Replicate #1</b>	<b>Replicate #2</b>
No Hole Sample	0.040	0.036	0.090	0.080
Small Hole Sample	1.78	3.07	3.99	6.88
Large Hole Sample	4.58	4.51	10.3	10.1
<p>Note: Above samples were analyzed using ASTM E-96 methodology that has a wet (water filled cup) providing 100%RH, while the exterior of the cup is contained within a 23C, 50%RH test environment.</p>				
<p>Remarks: A photo of the Small Hole and Large Hole samples are enclosed with this certificate. The Small Hole Replicate #1 appears to have a "more occluded" opening than Replicate #2.</p>				
Test Operator: Joel Fischer		Date: 11/20/10		
Test Operator: 		Date: 11/20/10		
		Reviewed By: 		Date: 11/22/10
		Georgia Gu Senior Scientist		
<p>This information represents our best judgement based on work done, but the company (MOCON) assumes no liability whatsoever in connection with the use of information or findings contained herein.</p>				

CSI #: 07 21 00



NO. 724-B

CSI Code: 07 27 26



AUGUST 2010  
(Supersedes February 2009)

## AIR-SHIELD™ LMP

Liquid Membrane Vapor Permeable Air Barrier

### DESCRIPTION

AIR-SHIELD LMP is a water-based air/liquid moisture barrier that cures to form a tough, seamless, elastomeric membrane. AIR-SHIELD LMP exhibits excellent resistance to air leakage. When properly applied as a drainage plane, AIR-SHIELD LMP prohibits liquid water intrusion into the substrate.

### USES

AIR-SHIELD LMP has been specifically formulated to act as an air and liquid moisture barrier, allowing vapor to pass through it. It may be applied to most common surfaces and integrated into various wall systems. AIR-SHIELD LMP is suitable for both new construction and retrofit applications.

### FEATURES/BENEFITS

- High permeability - allows the transmission of moisture vapor through porous building materials.
- Highly flexible - bridges cracks, which may form in the substrate.
- UV resistant – gray membrane can be left exposed up to six months. Black membrane can be exposed for an indefinite period and is ideal for exposed applications, such as beneath rain screen panels.

- User friendly – single-component, water-based technology allows for simple, safe application and easy cleanup.
- Liquid applied - simplifies detailing and assures a monolithic, seamless membrane when applied to a rough or smooth surface.
- Sprayable - with appropriately configured airless spray equipment - low application costs.
- Excellent adhesion - remains firmly bonded to the substrate, even when applied over damp surfaces.
- Self-sealing – Nails and fasteners can be used without compromising performance.
- Low VOC content – <100 g/L.

### PACKAGING

5 Gallon (18.93 Liter) Pails  
55 Gallon (208.20 Liter) Drums

### SPECIFICATIONS

- Exceeds Air Barrier Association of America (ABAA) Section 07263 Liquid-Applied Vapor Permeable Air Barrier System.
- Exceeds ABAA maximum assembly air leakage requirements when tested in accordance with ASTM E 2357.
- Exceeds the requirements of the Massachusetts Commercial Energy Code for Building Envelope Systems.
- 2005 National Building Code of Canada
- Complies with all current federal, state, and local maximum allowable VOC requirements, including U.S. EPA, LADCO, SCAQMD, and OTC.
- Complies with Canada VOC Concentration Limits for Architectural Coatings Regulations.

### Air Leakage

Test Method	ASTM E 283 & ASTM E 2178-01	ASTM E 2357
Pressure	75 Pa (1.57 lb./ft. <sup>2</sup> )	75 Pa (1.57 lb./ft. <sup>2</sup> )
ABAA Requirements	0.004 cfm/ft. <sup>2</sup> (0.02 L/S/M <sup>2</sup> )	0.04 cfm/ft. <sup>2</sup> (0.2 L/S/M <sup>2</sup> )
AIR-SHIELD LMP Results	<0.004 cfm/ft. <sup>2</sup> (0.02 L/S/M <sup>2</sup> )	<0.04 cfm/ft. <sup>2</sup> (0.2 L/S/M <sup>2</sup> )

\*Independent tests available upon request.

CONTINUED ON REVERSE SIDE...

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CSI #: 07 25 00



NO. 724-B

CSI Code: 07 27 26



AUGUST 2010  
(Supersedes February 2009)

## AIR-SHIELD™ LMP

Liquid Membrane Vapor Permeable Air Barrier

### DESCRIPTION

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- 2005 National Building Code of Canada
- Complies with all current federal, state, and local maximum allowable VOC requirements, including U.S. EPA, LADCO, SCAQMD, and OTC.
- Complies with Canada VOC Concentration Limits for Architectural Coatings Regulations.

### Air Leakage

Test Method	ASTM E 283 & ASTM E 2178-01	ASTM E 2357
Pressure	75 Pa (1.57 lb./ft. <sup>2</sup> )	75 Pa (1.57 lb./ft. <sup>2</sup> )
ABAA Requirements	0.004 cfm/ft. <sup>2</sup> (0.02 L/S/M <sup>2</sup> )	0.04 cfm/ft. <sup>2</sup> (0.2 L/S/M <sup>2</sup> )
AIR-SHIELD LMP Results	<0.004 cfm/ft. <sup>2</sup> (0.02 L/S/M <sup>2</sup> )	<0.04 cfm/ft. <sup>2</sup> (0.2 L/S/M <sup>2</sup> )

\*Independent tests available upon request.

CONTINUED ON REVERSE SIDE...

**W. R. MEADOWS, INC.**  
P.O. Box 338 • HAMPSHIRE, IL 60140-0338  
Phone: 847/214-2100 • Fax: 847/683-4544  
1-800-342-5978  
[www.wrmeadows.com](http://www.wrmeadows.com)

HAMPSHIRE, IL / CARTERSVILLE, GA / YORK, PA  
FORT WORTH, TX / BENICIA, CA / POMONA, CA  
GOODYEAR, AZ / MILTON, ON / ST. ALBERT, AB

CSI #: 07 25 00

## PHYSICAL PROPERTIES (TYPICAL)

Solids Content, %:	58
Color:	Gray (Black – special order only)
Flexibility @ -26° C (-15° F), (ASTM C 836):	PASS
Elongation (ASTM D 412), %:	1200
Water Vapor Permeance (ASTM E 96, Procedure B) Perms:	12
Service Temperature:	Not to exceed 175° F (80° C)
Nail Sealability (ASTM D 1970):	Pass
Storage and Application Temperature of AIR-SHIELD LMP For Roller Application: For Spray Application:	40 - 90° F (4 - 32° C) 60 - 90° F (16 - 32° C)
Air/Substrate Temperature (At Time of Application):	> 40° F (4° C)

## LEED INFORMATION

May help contribute to LEED credits:

- EA Credit 1: Optimize Energy Performance
- IEQ Credit 3.1: Construction IAQ Management Plan: During Construction
- IEQ Credit 4.2: Low-Emitting Materials: Paints & Coatings
- IEQ Credit 7.1: Thermal Comfort - Design
- MR Credit 2: Construction Waste Management
- MR Credit 5: Regional Materials

## APPLICATION

**Surface Preparation ...** All surfaces must be clean (free of all coatings and curing compounds), free of frost, structurally sound and relatively smooth. AIR-SHIELD LMP can be applied to “green” or damp concrete if there is no liquid water on the surface. Prepare substrate per manufacturer’s instruction prior to membrane application.

**Exterior Sheathing Panels ...** Exterior sheathing panels are to be installed and fastened per manufacturer’s recommendation. Joints <1/4” should be filled with AIR-SHIELD JOINT FILLER in order for the material to create a continuous film when applied. Joints >1/4” in exterior sheathing panels (drywall and glass-faced) should be filled with AIR-SHIELD JOINT FILLER and then covered with 3” (76.2 mm) wide REINFORCING FABRIC HCR from W. R. MEADOWS. For optimum performance, REINFORCING FABRIC HCR and AIR-SHIELD JOINT FILLER should be utilized on all joints. For plywood and oriented strand board (OSB), use AIR-SHIELD self-adhesive membrane over all joints.

**Details and Protrusions ...** Before application of AIR-SHIELD LMP, apply a 6” (152 mm) minimum wide strip (lapped 3” on each side) of AIR-SHIELD where joints between dissimilar building materials occur, i.e. details around doors and windows, as well as protrusions. Architectural details are available online at [www.wrmeadows.com](http://www.wrmeadows.com) or by calling 1-800-342-5976.

**Concrete Masonry Units ...** Before applying AIR-SHIELD LMP to CMU surfaces, patch all cracks, protrusions, small voids, offsets, details, irregularities and small deformities with MEADOW-PATCH® 5 or MEADOW-PATCH 20 at least two hours before application.

**Appearance ...** AIR-SHIELD LMP (gray) will dry gray in color. AIR-SHIELD LMP (black) appears dark gray in the container, but the dried film will be black.

**Temperature/Conditions ...** Apply AIR-SHIELD LMP at air and surface temperatures of 40° F and higher. Curing/drying times are dependent on air temperature, airflow, relative humidity, substrate temperature, etc., specific to each individual application. Typical results are:

Tack-Free Time: 2 hours  
Full Cure: 48 hours



NO. 718-D

MasterFormat:  
04 05 23  
07 65 26



NOVEMBER 2011  
(Supersedes April 2010)

## AIR-SHIELD™ 25 MIL FLASHING TAPE

Flexible Flashing, 25 Mils Thick

### DESCRIPTION

AIR-SHIELD 25 MIL FLASHING TAPE is a self-adhering, flexible membrane flashing. It is a roll-type product that is nominally 25 mils thick. This material is an air, vapor, and liquid moisture barrier. When properly applied, the product reduces the risk of rot and mold development.

### USES

AIR-SHIELD 25 MIL FLASHING TAPE provides protection against water infiltration in critical detail areas, such as window and door openings, deck-to-wall intersections, corner boards, wall-to-wall tie-ins, foundation sill plates, sheathing panel seams, under stucco finishes, masonry walls, and other non-roof detail areas.

### FEATURES/BENEFITS

- Easy to install.
- Reduces the risk of rot and mold development.
- Superior adhesion.
- Seals around fasteners.
- Watertight.

### TECHNICAL DATA

**Thickness** 25 mils  
**Roll Sizes** Available in cut sizes  
Also available in cut rolls of 4", 6", 9", and 12"  
(102, 152, 224, 326 mm) wide. NOTE: Some  
sizes require lead time. All rolls are 75' (22.9 m)  
long.

### APPLICATION

**Surface Preparation ...** Apply AIR-SHIELD 25 MIL FLASHING TAPE in fair weather conditions when the air, surface and membrane are at temperatures of 25° F (-4° C) or higher. After precipitation, allow a minimum of 24 hours for drying before installation. Install directly onto a clean and dry surface. Remove dust, dirt, and loose nails. Protrusions must be removed. Surfaces should have no voids or damaged/unsupported areas. Repair surfaces before installing. Surfaces should be free of scale, rust, grease, and oil and conditioned with MEL-PRIME™ or MEL-PRIME W/B from W. R. MEADOWS.

**Application Method ...** Cut AIR-SHIELD 25 MIL FLASHING TAPE to desired length. Peel back the release paper to expose adhesive. Align the membrane and press into place with heavy hand pressure. Laps must be a minimum of 3" (75 mm). Mechanically fasten the membrane at all vertical terminations. Use only smooth shank fasteners. Consistent with good construction practice, install the membrane so that all laps shed water (following the shingle principle). The top membrane layer should go over the bottom layer. Always work from low point to high point.

### PRECAUTIONS

Do not leave the product permanently exposed to sunlight. Maximum recommended exposure time is 30 days.

CSI #: 07 25 00

## Grace Construction Products

**GRACE**

# GRACE ICE & WATER SHIELD®

## Self-adhered roofing underlayment

### Product Description

Grace Ice & Water Shield® is a premier membrane composed of two waterproofing materials—an aggressive rubberized asphalt adhesive backed by a layer of high density cross laminated polyethylene. The rubberized asphalt surface is backed with a foldless release paper that protects its adhesive quality. During application, the release paper is easily removed, allowing the rubberized asphalt to bond tightly to the roof deck. In addition, embedded in the membrane is a split release on demand feature called Ripcord®.

The membrane is supplied in two roll sizes. See the Product Data chart for product information.

Membrane strips are also available in 75 ft (22.9 m) long rolls at widths of 6 in. (150 mm), 9 in. (225 mm), 12 in. (300 mm) and 18 in. (450 mm).

### Features & Benefits

**Easy to handle and apply**—The self-adhesive membrane bonds firmly to the roof deck without heat or special adhesives.

Ripcord is a unique, patented feature that makes Grace Ice & Water Shield easier to apply by giving the applicator a split release on demand. Faster application of the membrane in the straight-aways, as well as ease of membrane positioning in detailed areas (valleys, around dormers, etc.), are just some of the benefits.

**Foldless release paper**—The foldless release paper provides multiple performance enhancements: fewer edge catches, 180° pull-back, ease of membrane cutting (single cuts) and membrane positioning, quicker “one-man installs” resulting in an easier, more productive release.

**Seals around nails**—The rubberized asphalt layer in Grace Ice & Water Shield seals around roofing nails, resisting leakage caused by water back-up behind ice dams, or from wind-driven rain.

**Dual barrier protection**—Rubberized asphalt and polyethylene are combined to form two waterproofing barriers providing maximum protection.

**Membrane will not crack, dry out or rot**—Grace Ice & Water Shield resists attacks from fungus and bacteria; maintains its integrity for long lasting protection.

### Protects under all standard sloped roof coverings

—Grace Ice & Water Shield protects under slate, tile, cedar shakes or metal, as well as under conventional asphalt shingles.

**Slip resistant surface**—Grace Ice & Water Shield has a slip resistant embossed surface to maximize traction and safety for applicators.

**Proven track record**—Grace Ice & Water Shield is the name brand in roofing underlayments with a 30-year track record of protecting roofs from ice dams and wind-driven rain.

**Reroofable**—Unlike some granular surfaced membranes, Grace Ice & Water Shield will not adhere to the underside of the exposed roof covering. Grace Ice & Water Shield can be applied over the old Grace underlayment (except over Grace Basik® except over Grace Basik®, Grace Tri-Flex® and Grace Tri-Flex® Xtreme™), in retrofit applications, making reroofing easier, less costly (since there is no need for removing the existing underlayment), more durable and environmentally friendly (as the structural deck remains intact avoiding the need to purchase additional wood decking).

**Grace technical support**—Grace Ice & Water Shield is backed by a team of local technical support personnel that help ensure every application goes smoothly.



**CSI #: 07 25 00**

**Guidelines for Use**

Grace Ice & Water Shield is used as an underlayment for sloped roofs to resist water penetration due to water back-up behind ice dams or wind-driven rain. Grace Ice & Water Shield also offers leak protection in trouble prone spots like valleys, skylights, protrusions and other flashing areas.

**Ice Dams**

Grace Ice & Water Shield should be used in conjunction with designs which minimize ice dam formation. In cold climates, it is particularly important to provide proper insulation and ventilation to reduce the size of ice dams and to avoid interior condensation. Cathedral ceilings must include ventilation between rafters to allow for air flow to a ridge vent. Well ventilated cold roof designs are particularly important in alpine regions to reduce the size of ice dams which could contribute to structural damage.

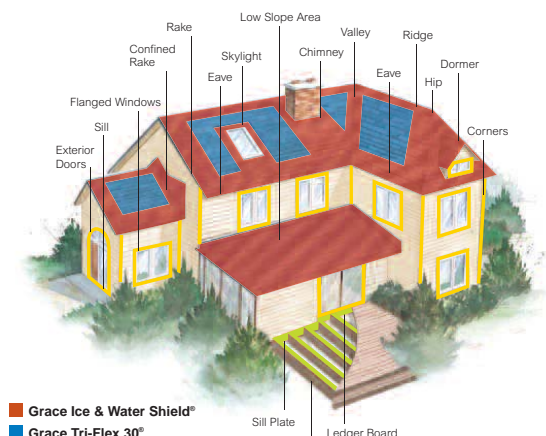
Several variables will influence the height of ice dams and the membrane coverage required.

1. **Climate**—The annual snow fall will affect the amount of membrane needed.
2. **Slope**—On a low slope, ice dams will extend farther inward from the roof edge.
3. **Overhang**—A wide overhang will require more membrane to reach the appropriate point on the roof.
4. **Insulation and ventilation**—A very well insulated building with a cold, well ventilated attic will have smaller ice dams.
5. **Valleys**—Any valleys formed by projections such as dormers or roof direction changes are likely to trap more snow and cause larger ice dams.
6. **Exposure**—A northern exposure or shaded areas will generally contribute to larger ice dams. While gutters may make it easier for an ice dam to start, large dams can occur on roofs with no gutters.

Removing snow from a roof edge or installing heat cables may not prevent ice dam formation, but may shift the location of the ice dam. Under certain conditions, a dam can form at the edge of the remaining snow.

Local building codes should be consulted for specific requirements.

**Use Grace Ice & Water Shield on all of these critical areas**



**Installation Procedure**

**Surface Preparation**

Install Grace Ice & Water Shield directly on a clean, dry, continuous structural deck. Some suitable deck materials include plywood, wood composition, wood plank, metal, concrete, or gypsum sheathing. Remove dust, dirt, loose nails, and old roofing materials. Protrusions from the deck area must be removed. Decks shall have no voids, damaged, or unsupported areas. Wood planks should be closely butted together. Repair deck areas before installing the membrane.

Prime concrete, masonry surfaces and DensGlass Gold® with Perm-A-Barrier® WB Primer. Prime wood composition and gypsum sheathing with Perm-A-Barrier WB Primer if adhesion is found to be marginal (refer to Technical Letter 12, *Use on Oriented Strand Board (OSB) Roof Sheathing*). Apply Perm-A-Barrier WB Primer at a rate of 250–350 ft<sup>2</sup>/gal (6–8 m<sup>2</sup>/L). Priming is not required for other suitable surfaces provided that they are clean and dry.

**Membrane Installation**

Apply Grace Ice & Water Shield in fair weather when the air, roof deck, and membrane are at temperatures of 40°F (5°C) or higher. Apply roof covering material at temperatures of 40°F (5°C) or higher.

Cut the membrane into 10–15 ft (3–5 m) lengths and reroll loosely. Peel back 1–2 ft (300–600 mm) of release liner, align the membrane, and continue to peel the release liner from the membrane. Press the membrane in place with heavy hand pressure. Side laps must be a minimum of 3.5 in. (90 mm) and end laps a minimum of 6 in. (150 mm). For valley and ridge application, peel the release liner, center the sheet over the valley or ridge, drape, and press it in place. Work from the center of the valley or ridge outward in each direction and start at the low point and work up the roof.

Alternatively, starting with a full roll of membrane, unroll a 3–6 ft (1–2 m) piece of membrane leaving the release liner in place. Align the membrane and roll in the intended direction of membrane application. Carefully cut the release liner on top of the roll in the cross direction being careful not to cut the membrane. Peel back about 6 in. (150 mm) of the release liner in the opposite direction of the intended membrane application exposing the black adhesive. Hold the release liner with one hand and pull the roll along the deck with the release liner, leaving the applied membrane behind. Use the other hand to apply pressure on the top of the roll. Stop frequently to press the membrane in place with heavy hand pressure. When finished with the roll go back to the beginning, reroll and pull the remaining release paper from the material, finishing the installation.

For successive membrane courses, align the edge of the release liner with the dashed line provided on the surface of the membrane to achieve the 3.5 in. (90 mm) side lap.

Consistent with good roofing practice, install the membrane such that all laps shed water. Always work from the low point to the high point of the roof. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. The membrane may be installed either vertically or horizontally.

Use smooth shank, electro-plated galvanized nails for fastening shingles to get the best seal. Hand nailing generally provides a better seal than power-activated nailing. If nailing of the membrane is necessary on steep slopes



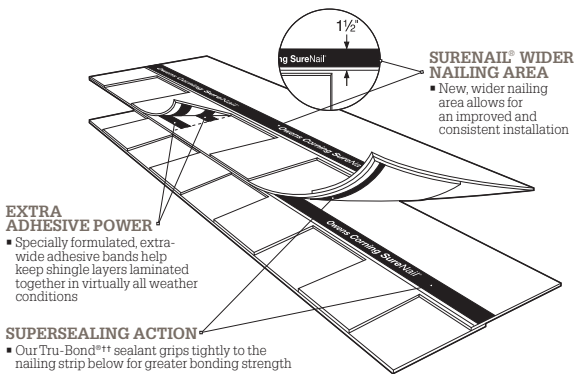
**CSI #: 07 31 13**

## Meet energy standards with Duration® Premium Cool shingles

- Help reduce environmental impact by keeping roofs cool\*\*—less energy needed to cool a home means less energy consumption
- Extend the life of the roof—thanks to solar-reflecting granules that reduce shingle temperature and subsequently slow asphalt aging
- Include a Limited Lifetime Warranty\* and 130-MPH Wind Resistance Limited Warranty\*
- Backed by an Algae Resistance Limited Warranty\* **NEW**
- Meet 2009 California Title 24, Part 6, requirements which call for a Cool Roof or equivalent improvement. For more information, visit [www.roofing.owenscorning.com](http://www.roofing.owenscorning.com)
- Are rated by the Cool Roof Rating Council (CRRC)

## Provide greater bonding strength

As part of the Duration Series shingle line, Duration Premium Cool shingles also come with SureNail® Technology, offering:



## Offer a new color palette

Duration Premium Cool shingles feature unique lighter colors—that correspond with Owens Corning™ Hip & Ridge shingles—and have a three-dimensional look for maximum curb appeal.



Harbor Fog†



Frosted Oak†



Sunrise†



Sage†

\* See actual warranty for complete details, limitations and requirements.

\*\* Estimated roof surface temperature reduction based on 1998 NIST study, *Analytical Study of Residential Buildings with Reflective Roofs*. A temperature reduction is representative of a change from a typical roof to a Cool Roof (solar reflectance 10 to 25) in most climates.

† Owens Corning strives to accurately reproduce photographs of shingles. Due to manufacturing variances, the limitations of the printing process and the variations in natural lighting, actual shingle colors and granule blends may vary from the photo. The pitch of your roof can also impact how a shingle looks on your home. We suggest that you view a roofing display or several shingles to get a better idea of the actual color. To accurately judge your shingle and color choice, we recommend that you view it on an actual roof with a pitch similar to your own roof prior to making your final selection. Color availability subject to change without notice. Ask your professional roofing contractor for samples of colors available in your area.

†† Tru-Bond is a proprietary premium weathering-grade asphalt sealant that is blended by Owens Corning Roofing & Asphalt, LLC.

CSI #: 07 46 00

## Minerit HD

**Minerit HD**, for exterior applications, has a smooth, cement gray surface that requires no surface or edge treatment. Can be stained or painted.

Applications: Exterior cladding, agricultural buildings, balconies, stairways, sports centers, production facilities.



## Minerit LW

**Minerit LW** is suitable for interior applications, has excellent sound insulation, and is shock and wear resistant.

Building Material emissions class M1.

Applications: Schools, hospitals, day care centers, nursing homes, public office buildings, hotels, ceilings, fire barriers/doors.



## Technical Properties & Dimensions

### Natura TC, Natura Pro, Pictura, Textura

	Untrimmed sizes		Trimmed sizes	
Thickness	8 mm or 12 mm		8 mm or 12 mm	
Width	1,280 mm	1,280 mm	1,250 mm	1,250 mm
Length	2,530 mm	3,130 mm	2,500 mm	3,100 mm

### Eter-Color

	Untrimmed sizes		Trimmed sizes	
Thickness	8 mm		8 mm	
Width	1,240 mm	1,240 mm	1,220 mm	1,220 mm
Length	2,520 mm	3,070 mm	2,500 mm	3,050 mm

### Minerit HD

	Trimmed sizes		
Thickness	3.2 mm, 4 mm, 6 mm or 8 mm		10 mm
Width	1,218 mm	1,218 mm	1,218 mm
Length	2,440 mm	3,050 mm	2,440 mm

### Minerit LW

	Trimmed sizes
Thickness	6 mm, 9 mm, or 12 mm
Width	1,218 mm
Length	2,440 mm

**Color Charts:** The color charts give an impression of the available colors. Reproduction of the exact color is restricted by the printing process. For an exact color match, samples are available upon request.

**Note:** Non-standard colors are available with a required minimum order of 100 sheets.

CSI #: 07 46 00

## Physical Properties - Minerit HD Cement Boards

Physical Properties	HD
Density, dry, pcf	105
Moisture Content, normal, %	5
Modulus of Rupture, psi, MD	3200
CMD	2500
Modulus of Elasticity, psi x10 <sup>6</sup>	1.4
Tensile Strength, psi, MD	2300
(Parallel to surface) CMD	1600
Compressive Strength, psi	11,600
Impact Strength, lb-ft/ft <sup>2</sup>	230
Water Absorption, %, oven dry - saturation	6-18
Thermal Conductivity, BTU-in/ft <sup>2</sup> , hr, °F	2.1
Coefficient of Thermal Expansion, in/in, °F, x10 <sup>-6</sup>	5.0
68 °F - 212 °F	
Moisture Movement, in/ft	.04
Oven dry - saturation	
Surface Burning Characteristics, Class I	
Flame spread	0
Smoke developed	0
Continuous Maximum Temperature, °F	250
Non-combustible	ASTM E 136

Properties based on 1/4" material

**CSI #: 07 46 00**

## Wind Load/Fastening Schedule - Minerit HD

Wind Load lbs/ft <sup>2</sup>	Board Thickness (in)	Fastener Type	24" O.C.			16" O.C.			
			P	C	P	P	C	C	P
20	1/4"	Screw	8"	12"	8"	12"	16"	16"	12"
40	5/16"	Screw	8"	12"	8"	12"	16"	16"	12"
>40	3/8" 1/2"	Screw	Must be calculated for each system.						

Fasteners must never be positioned closer than 1/2" from the edge, or 3" from the corner of a panel.

Use stainless steel screws with 3/8" diameter washer head. Holes must be predrilled into sheet with clearance around screw threads.

## Technical Information Sheet

### RubberCover™ EPDM membrane

#### 1. Description

The Firestone RubberCover™ EPDM membrane is a 100% cured single-ply roofing membrane made of a synthetic rubber Ethylene-Propylene-Diene Terpolymer.

#### 2. Preparation

Substrates need to be clean, smooth, dry and free of sharp edges, loose or foreign materials, oil, grease and other materials that may damage the membrane. All surface voids greater than 5 mm wide shall be properly filled with an acceptable fill material.

#### 3. Application

Allow the membrane to relax for approximately 30 minutes before adhering it to the substrate. Install the RubberCover™ EPDM membrane in accordance with the installation instructions and details.

#### 4. Coverage

The dimensions of the membrane are calculated to cover the substrate and possible upstands. Provide an additional length (150 mm) at upstands for easy manipulation.

#### 5. Characteristics

<b>Physical</b>	■	Elastomeric membrane with a good combination of high elasticity and tensile strength.		
	■	Excellent resistance to U.V. and ozone.		
	■	Retains its flexibility at low temperature (-45°C).		
	■	Resists to temperature shocks up to 250°C.		
	■	Excellent resistance to alkali rains.		
	■	Less resistant to oil products. Contact with mineral and vegetable oils, petroleum based products, hot bitumen and grease must be avoided.		
<b>Technical</b>	<b>Property</b>	<b>Test Method</b>	<b>Declared value</b>	
	■ Thickness	EN 1849-2	1.0 mm	
	■ Watertightness	EN 1928 (B)	Pass	
	■ Tensile strength (L/T)	EN 12311-2 (B)	≥ 6 N/mm <sup>2</sup>	
	■ Elongation (L/T)	EN 12311-2 (B)	≥ 300 %	
	■ Resistance to impact - hard substrate	EN 12691 (A)	≥ 200 mm	
	■ Resistance to static load - hard substrate	EN 12730 (B)	≥ 25 kg	
	■ Tear resistance (L/T)	EN 12310-2	≥ 30 N	
	■ Dimensional stability	EN 1107-2	≤ 0.5 %	
	■ Foldability at low temperature	EN 495-5	≤ - 45°C	
	■ UV exposure	EN 1297	Pass	

*Note: As European standards continue to develop, please contact Firestone Technical Services or check Firestone RubberCover™ Website for latest updates on physical properties.*

#### 6. Packaging / Storage / Shelf Life

Thickness (mm)	Width (m)	Length (m)	Weight (kg/m <sup>2</sup> )
1.0	3.05 - 4.57 - 6.10	7.62	1.17

*Note: Special sizes are available upon request.*

**Storage:** Store away from sources of punctures and physical damage. Store away from ignition sources and open flame.

**Shelf Life:** Unlimited.

CSI #: 07 55 63

## Hydrotech MM6125

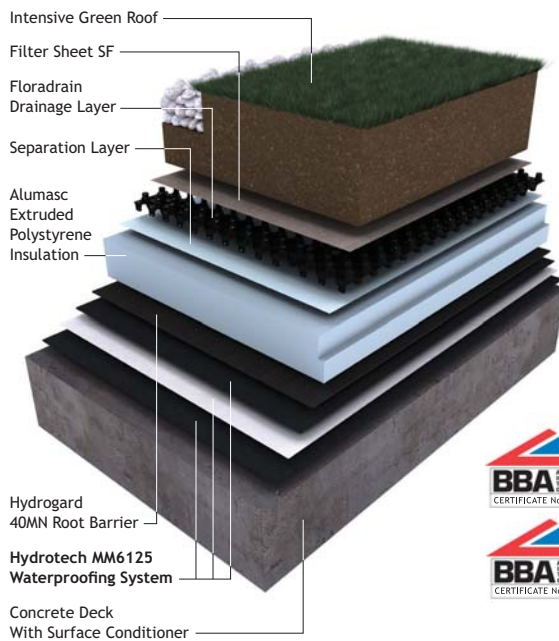
**ALUMASC**

ROOFING SYSTEMS

### Hot-Melt Structural Waterproofing - Green Roof

#### When to Specify

The Hydrotech Monolithic Membrane 6125 inverted green roof system offers the benefit of a lifetime insulated waterproofing solution for concrete structures, supporting a range of soft landscapes and with the additional benefit of being certificated for use at zero falls, and the associated time, weight and cost savings.



#### Warranties

Alumasc offers a comprehensive range of warranty options. The typical warranty period for Hydrotech MM6125 is 20 years. Installed exclusively by Hydrotech Approved Contractors and underpinned by Alumasc's extensive project support service, Alumasc warranties cover both product and installation. Independent insurance backed latent product defect warranties are also available through FSA licensed brokers.

#### Key Features

##### Lifespan

Hydrotech MM6125 is approved by the British Board of Agrément, who state "...when fully protected and subjected to normal service conditions, Hydrotech will provide an effective barrier to the transmission of liquid water and water vapour for the design life of the structure/roof in which it is incorporated".

##### Durability

Applied in a liquid state to the deck, and including a polyester reinforcement, the bond of Hydrotech MM6125 is 100% absolute. There is no risk whatsoever of water tracking below the membrane and, because it is monolithic, no possibility of lap failure.

##### Performance

Hydrotech MM6125, the original hot-melt, rubberised bitumen membrane, is designed to last for the lifetime of the building or structure to which it is applied, which means long-term waterproofing integrity and no future replacement costs. Hydrotech root barriers conform to EN 13948.

##### Quality

Hydrotech MM6125 is the only 6mm hot melt rubberised bitumen waterproofing system to hold European Technical Approval (05/0152), which confirms compliance with the EC Construction Products Directive, in addition to BBA Certification and FM approval.

##### Environment

Hydrotech MM6125 hot melt roofing and structural waterproofing is manufactured utilising hydro-electric power as a primary energy source, and manufacturing procedures are independently audited to the BS EN ISO 9001:2008 Quality Management System. Importing materials under Alumasc's ISO 14001:2004 Environmental Management System ensures that upstream production processes are monitored for their environmental impact, and that due consideration is taken for all aspects of packaging, transport and disposal, in order to deliver as sustainable a construction product as practicable.

##### Green Roofs

Green roofs bring many additional benefits including water retention, localised temperature reduction, recreational space, and natural habitat for flora and fauna.

CSI #: 07 55 63

# Hydrotech MM6125

**ALUMASC**

ROOFING SYSTEMS

## Hot-Melt Structural Waterproofing - Green Roof

### Application

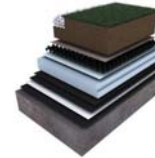
1. Surfaces must be cleaned of all contaminants such as unapproved curing compounds, form release agents, oils, dirt, laitance etc. Alumasc Bitumen Primer is spray applied to the cleaned surface and left to thoroughly dry.
2. Regular bond tests must be executed to ascertain the suitability of the concrete substrate to accept the membrane. The concrete must be wood float finished, or similar, and cured for at least 14, but preferably, 28 days.
3. Before Hydrotech MM6125 can be applied, whether for forming detail work or applying to the main horizontal roof areas, the material must first be melted and heated to the required temperature and mixed to develop its full physical properties. The rubber content of the membrane makes it necessary to use indirect heat, as obtained with an oil or air type double jacketed melter.
4. Upstand details are completed first, before the waterproof membrane is applied to the main horizontal roof area. Flex-Flash UN (uncured neoprene) is used as reinforcement where minor movement in detail work is anticipated.
5. The first coat of Hydrotech MM6125 is applied to a nominal thickness of 3mm.
6. Flex-Flash F fabric reinforcement is embedded whilst the Hydrotech remains warm and tacky.
7. A second coat of Hydrotech MM6125 is applied, also to a nominal thickness of 3mm, fully encapsulating the fabric reinforcement within the membrane.
8. A protecting root barrier of Hydrogard 40MN is laid over the completed Hydrotech membrane.
9. On completion, the integrity of the waterproofing must be tested by means of a WITA affiliated electronic detector system to prove that the waterproofing is 100% free from punctures and defects. The issue of the Hydrotech MM6125 warranty is conditional upon the provision of a leak test certificate.
10. The waterproofing system is then covered with the specified extruded polystyrene inverted insulation (thickness calculated to meet the required thermal value), separator sheet, drainage layer, filter sheet, growing medium and vegetation, of sufficient weight to resist wind uplift and flotation.

**NB:** Hydrotech structural waterproofing systems are exclusively installed by a nationwide network of Hydrotech Approved Contractors.

*The company pursues a policy of constant product development and information contained in this publication is therefore subject to change without notice.  
The customer is responsible for ensuring that each product is fit for its intended purpose and that the conditions for use are suitable. All quoted data is nominal and subject to production tolerances.*

### System Components

- The build-up of drainage layer, filter sheet and growing medium is specified to support soft landscapes such as the intensive type depicted (i.e. roof garden), and also extensive (e.g. sedum, rockery, alpine), biodiverse, and semi-intensive variants.
- The Alumasc polyethylene separator reduces the cooling effect of rainwater on the insulation below, and therefore reduces the thickness of insulant required to meet the target thermal value.
- Alumasc Extruded Polystyrene provides not only high performance thermal insulation, but also protection from mechanical damage and UV degradation, further enhancing the membrane's lifespan.
- Hydrogard 40MN root barrier/protection sheet gives a high level of protection to the Hydrotech membrane, and allows immediate access to waterproofed areas.
- Hydrotech MM6125 is a seamless, self-healing, monolithic membrane, made from 100% solids, providing waterproofing integrity for the lifetime of the structure in which it is incorporated.



### Technical Support

Alumasc Technical Services provide an extensive project support service that includes site surveys, project specifications, performance calculations (e.g. U-values, condensation risk analysis), CAD detail drawings and general technical advice.

Contact Alumasc Technical Services via:

☎ +44 (0) 1744 648400

✉ [waterproofing@alumasc-exteriors.co.uk](mailto:waterproofing@alumasc-exteriors.co.uk)

Online resources are available on our website or via the embedded links below:

#### Web Links

📄 [Brochures & Datasheets](#)

📄 [NBS Specifications](#)

📄 [CAD Drawings for typical details](#)

[www.alumascwaterproofing.co.uk](http://www.alumascwaterproofing.co.uk)

8/22/13

Reverse Half Round Single Bead Aluminum Gutter - Gutter Supply



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SHOP BY MATERIAL

Aluminum

- Aluminum Gutters
- Aluminum Downspouts
- Aluminum Elbows
- Aluminum Miter
- Aluminum End Caps
- Aluminum Gutter Leaf Guards
- Aluminum Conductor Heads
- Aluminum Rain Chains
- Aluminum Hangers
- Aluminum Shanks
- Aluminum Outlets
- Aluminum Downspout Brackets
- Aluminum Fasteners
- Aluminum Offsets
- Aluminum Drives/Rack & Key
- Aluminum Soffit & Trim
- Aluminum Flashing/Baby Tins
- Aluminum Gutter Wedges
- Funnels/Diversers
- Paint/Sealant/Solder/Polish
- Splashblocks
- Tile Adapters
- Flex-A-Spouts/Flex Elbows/Gusher Guards
- Mill Finish Aluminum
- Copper
- Copper Penny Aluminum
- CopperPlus
- Euro Copper
- Galvalume
- Galvanized Steel
- Designer Copper Aluminum
- Lead Coated Copper
- Paint Grip Steel
- Preweathered Zinc
- Vinyl Gutter Systems

PRODUCTS ON SALE

- Copper Alternatives**  
- 15% Off Entire Line
- Rain Chains**  
- 25% Off

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SHOP BY PRODUCT LINE

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- [Gutter Machines](#)
- [Gutter Guards](#)
- [Snow Guards](#)
- [Gutters](#)
- [Downspouts](#)
- [Leader Heads](#)
- [Rain Barrels](#)
- [Half Round Gutter Products](#)
- [K Style Gutter Products](#)
- [Coil & Sheet Goods](#)
- [Van Mark Brakes](#)
- [Ornamental Products](#)
- [Weathervanes](#)
- [Finials/Spires](#)
- [Gutter Accessories](#)



Product Catalog -> Aluminum -> Aluminum Gutters -> Half Round Aluminum Gutters

Reverse Half Round Single Bead Aluminum Gutter

Image 1 | Image 2



Click for a Larger View

Reverse Half Round Single Bead Gutter

Capture the craftsmanship of more traditional times with our superior product of today. The reverse bead enables the use of a Half Round Hidden Hanger for a sophisticated, clean look.

Our reverse half round bead gutter will work with all other 6" Half Round Hangers as well.

**Customize Your Order!**

We can ship any length up to 20 feet (10 foot min. order per size and color)

[More info on Reverse Half Round Single Bead Aluminum Gutter...](#)

Products In This Category:

Product Code	Description	Material	Retail Price	Qty.
ALRBG6XA032	6 Rev Bead Half Round Gutter	Almond Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
BLRBG6XA032	6 Rev Bead Half Round Gutter	Black Alum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
BRRBG6XA032	6 Rev Bead Half Round Gutter	Heritage Bronze Alum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
NCRBG6XA032	6 Rev Bead Half Round Gutter	Natural Clay Alum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
HCRBG6XA032	6 Rev Bead Half Round Gutter	Heritage Cream Alum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
GGRBG6XA032	6 Rev Bead Half Round Gutter	Greecian Green Alum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
HBRBG6XA032	6 Rev Bead Half Round Gutter	Herringbone Alum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
HGRBG6XA032	6 Rev Bead Half Round Gutter	HG White Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
LMRBG6XA032	6 Rev Bead Half Round Gutter	Light Maple Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
MBRBG6XA032	6 Rev Bead Half Round Gutter	Musket Brown Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
PGRBG6XA032	6 Rev Bead Half Round Gutter	Pearl Gray Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
RBRBG6XA032	6 Rev Bead Half Round Gutter	Royal Brown Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
RERBG6XA032	6 Rev Bead Half Round Gutter	Red Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
TGRBG6XA032	6 Rev Bead Half Round Gutter	Tuxedo Gray Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
WHRBG6XA032	6 Rev Bead Half Round Gutter	White Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
SWRBG6XA032	6 Rev Bead Half Round Gutter	Savannah Wicker Aluminum .032	\$2.53 / FT	1 <a href="#">Add To Cart</a>
CPRBG6XA027	6 Rev Bead Half Round Gutter	Copper Penny Aluminum Designer Copper	<del>\$3.20 / FT</del> \$2.72 / FT	1 <a href="#">Add To Cart</a>

[www.guttersupply.com/m-aluminum-gutter-half-round-seamless.gstml](http://www.guttersupply.com/m-aluminum-gutter-half-round-seamless.gstml)

questions? call us toll-free:  
**1-888-909-RAIN**  
(7246)

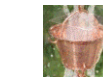
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[Shopping Cart](#)



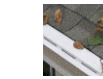
Color Chart

May We Also Recommend:



[Rain Chains - 25% Off](#)

25% Off Rain Chains Off...



[Gutter Guards](#)

Gutter Guards, Gutter Screens, ...



[Rain Barrels](#)

"Free Shipping" A Rain Barrel is a...



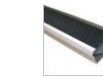
[Weathervanes](#)

Our weathervanes are hand-crafted out of solid copper and brass...



[Finials/Spires](#)

Finials/Spires A copper finial puts the finishing...



[Gutter Screens & Gutter Covers](#)

Gutter Guards, Gutter Screens, ...



CSI #: 07 71 23

2/6/13

2x3x3 Flush Downspout Tile Adapter - Gutter Supply



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- Aluminum
- Copper
- Copper Penny Aluminum
- CopperPlus
- Euro Copper
- Galvalume
- Galvanized Steel
- Designer Copper Aluminum
- Lead Coated Copper
- Freedom Gray Copper
- Paint Grip Steel
- Preweathered Zinc
- Vinyl Gutter Systems

PRODUCTS ON SALE

- Rain Chains - 25% Off
- 10% Off Snow Guards - Select Styles Only

PRODUCTS ON CLOSEOUT

- Filtrate Gutter Guard
- Rectangular Offsets - High Gloss Aluminum

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- Gutter Guards
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- Gutters
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- Leader Heads
- Rain Barrels
- Half Round Gutter Products
- K Style Gutter Products
- Coil & Sheet Goods
- Van Mark Brakes
- Ornamental Products
- Weather Vanes
- Finials/Spires
- Gutter Accessories
- Gutter Screens & Gutter Covers
- Funnels/Diverter
- Fasteners
- Gutter Wedges
- Hangers
- Offsets
- Soffit & Trim
- Paint/Sealant/Solder/Polish
- Soldering Irons/Tools
- Tools (Gutter Tools)
- Splashblocks
- Tile Adapters

- 2x3x4 Flex Downspout Adapter
- 3x4x4 Flex Downspout Adapter
- 2x3x4 Offset Downspout Adapter
- 3x4x4 Offset Downspout Adapter
- 2x3x3 Offset Downspout Adapter



Product Catalog -> Tile Adapters

2x3x3 Flush Downspout Tile Adapter

Image 1



Click for a Larger View

2x3x3 Flush Downspout Adapter

To connect a 2x3 downspout into 3" pvc pipe.

White tile adapters are compatible with the solid white and green drain tile (also known as SDR 26 or SDR 35).

Adapter inside dimensions:  
Approx. 3 1/2" x 2 9/16"

Pipe inside dimensions 3 3/16"

Products In This Category:

Product Code	Description	Material	Retail Price	Qty.
TA233DSAWH	2x3x3 Flush Downspout Adapter	White PVC Plastic	\$5.85 / EACH	1

[Add To Cart](#)

questions? call us toll-free:  
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May We Also Recommend:



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Huge Price Breaks on Ironman's and New...



[Gutter Guards](#)  
Gutter Guards, Gutter Screens, Gutter...



[Downspouts](#)  
Downspouts are vertical pipes that are used to divert rain...



[Rain Barrels](#)  
"Free Shipping" A Rain...



[Ornamental Products](#)  
When the Details make the Difference When the...



[Tools \(Gutter Tools\)](#)  
Tools (Gutter Tools) When you're on the job...

www.guttersupply.com/p-tile-adapter-2x3x3-Flush-Downspout-Ad.gstml

1/2

2/7/13

Aluminum Elbows - Rectangular A Elbow - Gutter Supply



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SHOP BY MATERIAL

Aluminum

- Aluminum Gutters
- Aluminum Downspouts
- Aluminum Elbows
- Aluminum Miters
- Aluminum End Caps
- Aluminum Gutter Leaf Guards
- Aluminum Conductor Heads
- Aluminum Rain Chains
- Aluminum Hangers
- Aluminum Shanks
- Aluminum Outlets
- Aluminum Downspout Brackets
- Aluminum Fasteners
- Aluminum Offsets
- Aluminum Drives/Rack & Key
- Aluminum Coil
- Aluminum Soffit & Trim
- Aluminum Flashing/Baby Tins
- Aluminum Gutter Wedges
- Funnels/Diverters
- Paint/Sealant/Solder/Polish
- Splashblocks
- Tile Adapters
- Flex-A-Spouts/Flex Elbows/Gusher Guards

Copper

- Copper Penny Aluminum
- CopperPlus
- Euro Copper
- Galvalume
- Galvanized Steel
- Designer Copper Aluminum
- Lead Coated Copper
- Freedom Gray Copper
- Paint Grip Steel
- Preweathered Zinc
- Vinyl Gutter Systems

PRODUCTS ON SALE

- Rain Chains - 25% Off
- 10% Off Snow Guards - Select Styles Only

PRODUCTS ON CLOSEOUT

- Filtrate Gutter Guard
- Rectangular Offsets - High Gloss Aluminum

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- Gutter Machines
- Gutter Guards
- Snow Guards
- Gutters
- Downspouts
- Leader Heads
- Rain Barrels
- Half Round Gutter Products
- K Style Gutter Products



Product Catalog -> Aluminum -> Aluminum Elbows

Rectangular A Elbow

Image 1



An "A" style elbow refers to an elbow that, when attached to a downspout, angles the downspout frontwards and backwards.

Products In This Category:

Product Code	Description	Material	Retail Price	Qty.
ALAEX23A019	2x3 A Elbow	Almond Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
BBAEX23A019	2x3 A Elbow	Buckskin Brown Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
BLAEX23A019	2x3 A Elbow	Black Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
BRAEX23A019	2x3 A Elbow	Bronze Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
BVAEX23A019	2x3 A Elbow	Beaver Brown Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
CBAEX23A019	2x3 A Elbow	CB Gray Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
CLAEX23A019	2x3 A Elbow	Clay Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
CRAEX23A019	2x3 A Elbow	Cream Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
GGAEX23A019	2x3 A Elbow	Greclan Green Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
HBAEX23A019	2x3 A Elbow	Herringbone Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
HGAEX23A019	2x3 A Elbow	HG White Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
IVAEX23A019	2x3 A Elbow	Ivory Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
LNAEX23A019	2x3 A Elbow	Linen Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
MBAEC23A019	2x3 A Elbow	Musket Brown Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
PGAEX23A019	2x3 A Elbow	Pearl Gray Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
RBAEX23A019	2x3 A Elbow	Royal Brown Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
REAEX23A019	2x3 A Elbow	Red Aluminum .019	\$0.95 / EACH	<input type="text" value="1"/> <a href="#">Add To Cart</a>
		Tuxedo		

www.guttersupply.com/m-aluminum-elbows-rectangular-A.gstml

1/3

questions? call us toll-free:  
**1-888-909-RAIN**  
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Color Chart

May We Also Recommend:



[Rain Chains - 25% Off](#)  
25% Off Rain Chains Off Selected...



[Gutter Machines](#)  
Huge Price Breaks on Ironman's and New...



[Sealants](#)  
Please use the following guide for determining the correct...



[Gutter Guards](#)  
Gutter Guards, Gutter Screens, Gutter...



[Snow Guards](#)  
Snow Guards - Snow and Ice Protection ...



[Rain Barrels](#)  
"Free Shipping" A Rain...

# Division 08

## Openings

**CSI #: 08 11 00**



According to data from the Spray Polyurethane Foam Alliance, doors represent 11% of the overall leakage in a building. When the Trio-E from Ceco is combined with thermally broken frames and thresholds, it becomes a sustainable building solution that can eliminate infiltration and exfiltration in the door opening and guarantee that the building envelope is tightly sealed, even in the harshest environment.



**Features and Options**

Standard Features:

- 18 gage face sheets, 16 gage optional
- 16 gage inverted end channels welded to both face sheets for added strength.
- 14 gage closer reinforcement

Available Sizes:

- 4'0" x 8'0" maximum single, 8'0" x 8'0" maximum pair

Material:

- Cold rolled or galvalneal steel

Core:

- 22 gage steel stiffeners spaced every 6" apart with injected polyurethane foam

Edge Construction:

- Mechanically interlocked, hemmed vertical edge seams
- Seamless edges available

Hardware Reinforcements:

- Reinforcing for most lock preps, including concealed hardware
- 7 gage steel hinge reinforcements

Paint:

- Electrostatically applied prime base coat
- Optional Colorstyle factory pre-finish

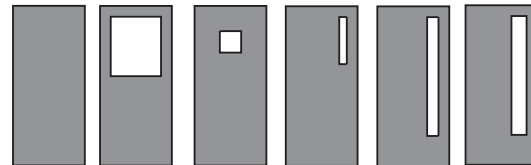
Ceco Door  
9159 Telecom Drive • Milan, TN 38358  
Tel (888) 232-6366 • Fax (888) 232-6462  
[archhelp@cecodoor.com](mailto:archhelp@cecodoor.com)  
[www.cecodoor.com](http://www.cecodoor.com)

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**Performance**

- Thermal Insulation: Fully operable U-Factor 0.34, R-Value 2.9 (ASTM C1363), For test data regarding ASTM C518 and ASTM E 283, please refer to our website under Energy Efficiency.
- Physical endurance testing: Meets ANSI A250.4 performance test, level A (1,000,000 cycles) class 1 stiffness
- Fire rating: Up to and including 90 minutes 4'0" x 8'0" singles only (UL10C) UL & WH agencies

**Door Designs**



Steel SlimTrim kits

 **Ceco Door**

**ASSA ABLOY**

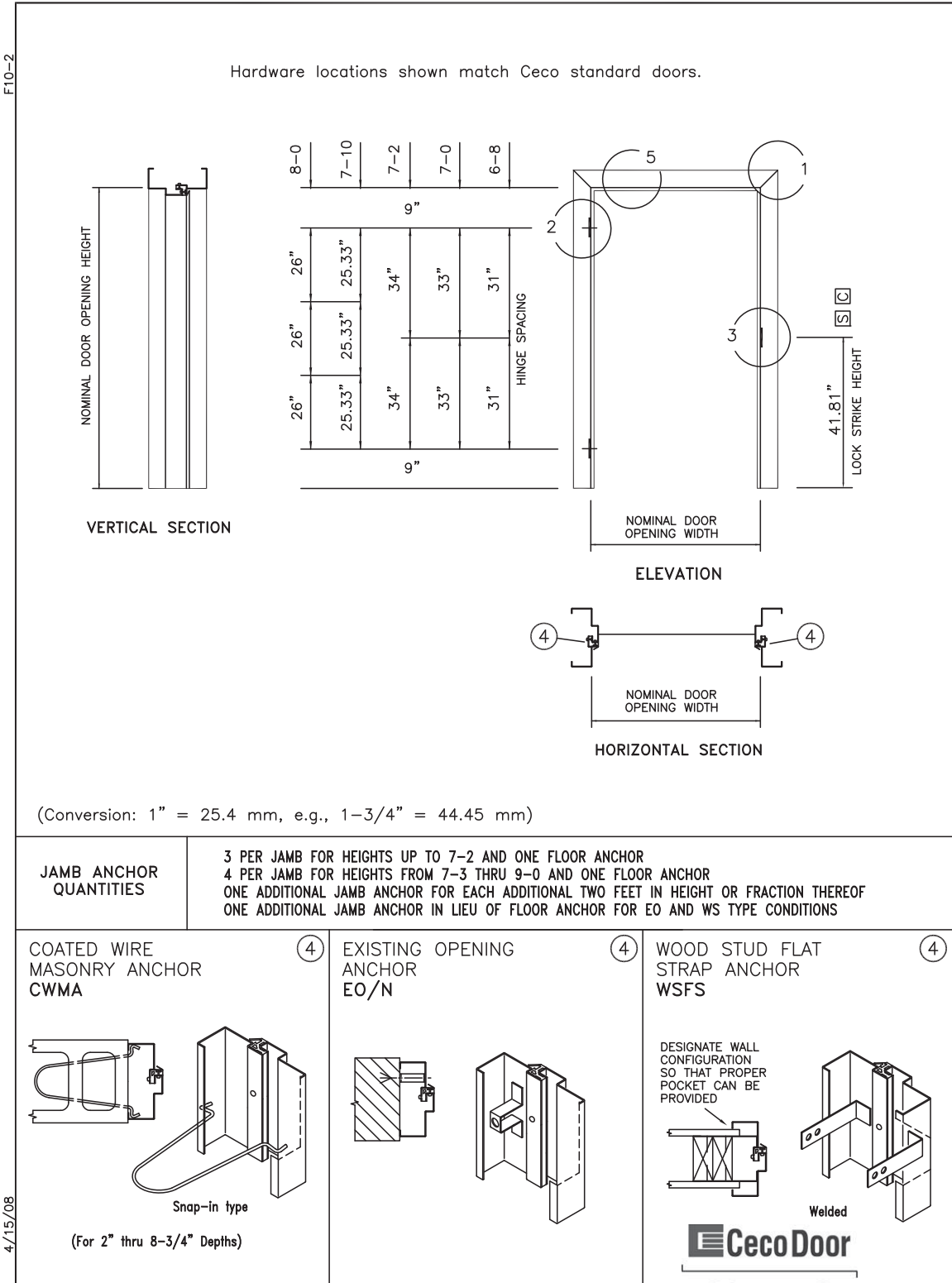
ASSA ABLOY, the global leader in door opening solutions  
50310-8/10

Hardwiring Made Easy™  


CSI #: 08 11 00

# TECH-DATA

## SERIES SQT AND SRT THERMAL BREAK FRAMES



CSI #: 08 13 16

Architect Series® Pella® Encompass by Pella®



**SIZE TABLES**

Out-Swing Door/Sidelight Combination Assemblies  
3' 0" Doors



	(991) (972)	(1 302) (1 283)	(1 353) (1 334)	(1 403) (1 384)	(1 613) (1 594)	(1 715) (1 695)	(1 816) (1 797)
Opening	3' 3"	4' 3 1/4"	4' 5 1/4"	4' 7 1/4"	5' 3 1/2"	5' 7 1/2"	5' 11 1/2"
Frame	3' 0 1/4"	4' 2 1/2"	4' 4 1/2"	4' 6 1/2"	5' 2 3/4"	5' 6 3/4"	5' 10 3/4"
(2 030) (2 019) 6' 7 1/8"							
(2 081) (2 069) 6' 9 7/16"							
(2 183) (2 170) 7' 17/16"							
(2 488) (2 475) 8' 1 1/8"							

NOTE: Door frame height with ADA low profile sill is 1/2" shorter.

**Masonry Opening Dimensions**

CLAD EXTERIOR UNITS: Use frame dimension plus dimensions below.

FRAME	ROUGH		MASONRY	
	Width	Height	Width	Height
Brickmould STD	+ 3/4"	+ 1/2"	+ 2-3/8"	+ 1-3/16"

WOOD EXTERIOR UNITS: Use frame dimension plus dimensions below.

FRAME	ROUGH		MASONRY	
	Width	Height	Width	Height
Brickmould STD	+ 3/4"	+ 1/2"	+ 2-3/8"	+ 1-3/16"
3-1/2"	+ 3/4"	+ 1/2"	+ 5-3/8"	+ 2-11/16"

Not to scale.

CSI #: 08 13 16

Architect Series\*

Pella®

Encompass by Pella®



ENTRY DOOR

**SIZE TABLES**

Out-Swing Sidelights and Single-Doors



	(330) (311)	(375) (362)	(425) (413)	(889) (870)	(991) (972)	(1 143) (1 124)	(1 737) (1 718)	(1 940) (1 921)	(2 245) (2 226)
Opening	1' 1"	1' 3"	1' 5"	2' 11"	3' 3"	3' 9"	5' 8 <sup>3</sup> / <sub>8</sub> "	6' 4 <sup>3</sup> / <sub>8</sub> "	7' 4 <sup>3</sup> / <sub>8</sub> "
Frame	1' 0 <sup>1</sup> / <sub>4</sub> "	1' 2 <sup>1</sup> / <sub>4</sub> "	1' 4 <sup>1</sup> / <sub>4</sub> "	2' 10 <sup>1</sup> / <sub>4</sub> "	3' 2 <sup>1</sup> / <sub>4</sub> "	3' 8 <sup>1</sup> / <sub>4</sub> "	5' 7 <sup>5</sup> / <sub>8</sub> "	6' 3 <sup>5</sup> / <sub>8</sub> "	7' 3 <sup>5</sup> / <sub>8</sub> "
(2 081) (2 069)									
(2 488) (2 475)									
6' 9 <sup>15</sup> / <sub>16</sub> "									
6' 9' 7 <sup>16</sup> / <sub>16</sub> "									
8' 1 <sup>15</sup> / <sub>16</sub> "									
8' 1 <sup>7</sup> / <sub>16</sub> "									
	10' x 6' 8"	1' 0" x 6' 8"	1' 2" x 6' 8"	2' 8" x 6' 8"	3' 0" x 6' 8"	3' 6" x 6' 8"	5' 4" x 6' 8"	6' 0" x 6' 8"	7' 0" x 6' 8"
		1' 0" x 8' 0"	1' 2" x 8' 0"		3' 0" x 8' 0"	3' 6" x 8' 0"		6' 0" x 8' 0"	7' 0" x 8' 0"

NOTE: Door frame height with ADA low profile sill is 1/2" shorter.

**Masonry Opening Dimensions**

CLAD EXTERIOR UNITS: Use frame dimension plus dimensions below.

FRAME	ROUGH		MASONRY	
Brickmould	Width	Height	Width	Height
STD	+ 3/4"	+ 1/2"	+ 2-3/8"	+ 1-3/16"

WOOD EXTERIOR UNITS: Use frame dimension plus dimensions below.

FRAME	ROUGH		MASONRY	
Brickmould	Width	Height	Width	Height
STD	+ 3/4"	+ 1/2"	+ 2-3/8"	+ 1-3/16"
3-1/2"	+ 3/4"	+ 1/2"	+ 5-3/8"	+ 2-11/16"

Not to scale

CSI #: 08 13 16

40  
Entry Door Offering  
from Pella

## LOW-E GLASS

A delightful collection of styles to light up your entryway.



ARCHITECT SERIES® Entry Doors



**Mahogany-Grain Fiberglass**

- 3/4 Light
- 3/4 Arch Light
- Twin 3/4 Light
- Deluxe 3 Panel Oval
- 8' European 3/4 Light

**Mahogany-Grain and Oak-Grain Fiberglass**

- Full Light
- 1/2 Light
- Center Arch Light

**Oak-Grain Fiberglass**

- 3 Panel Scroll Top Oval
- Fan Light
- European 3/4 Light

**Transoms:**

- 1/2 Circle Transom
- Arch Head Transom
- Elliptical Transom
- Rectangular Transom

**Other Styles:**

- Craftsman Light (Hemlock-Grain Fiberglass)
- Full Light Sidelight (Mahogany-Grain, Oak-Grain, Hemlock-Grain and Rustic-Grain Fiberglass)
- 3/4 Light Sidelight (Mahogany-Grain Fiberglass)
- 1/2 Light Sidelight (Oak-Grain Fiberglass)

Go to [pella.com/entrydoors](http://pella.com/entrydoors) to see all combinations of panels, glass, grains and stains.



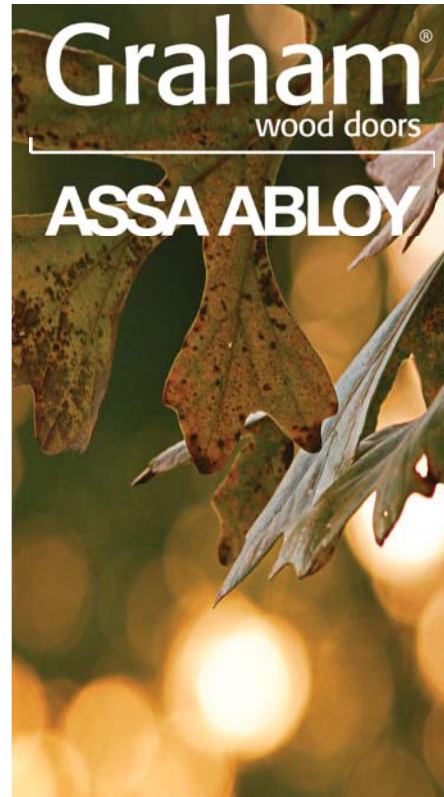
**CSI #: 08 14 16**

**EARTH DOOR™**  
ENVIRONMENTAL SOLUTIONS

**G**raham offers several choices in architectural flush wood doors to help you meet the rising demand of “building green” while continuing to fulfill your security, life-safety, and aesthetic requirements.

Experience the natural beauty of Graham’s Earth Doors™:

- FSC certified (Chain of custody)
- No added urea-formaldehyde
- Fire rated
- Wide variety of species
- LEED contribution



Graham’s Earth Doors™ contribute to the following LEED credits:

Materials and Resources (MR)	
MR Credit 4.1	Recycled Content
MR Credit 4.2	Recycled Content
MR Credit 5.1	Regional Materials
MR Credit 5.2	Regional Materials
MR Credit 6	Rapidly Renewable Materials
MR Credit 7	Certified Wood

Indoor Environmental Quality (EQ)	
EQ Credit 4.4	Low-Emitting Materials

A variety of core types allows for choice as you balance construction requirements with green strategy:

- Particleboard (PC)
- Agrifiber
- Mineral
- Stave Lumber (SL)
- Engineered Composite (EC)



ASSA ABLOY, the global leader in door opening solutions

CSI #: 08 14 16

Graham wood doors ASSA ABLOY	Description of Project Application	Percentage of door value that contributes to LEED					
		PC	PC FSC	Agrifiber	SL	Mineral	EC
LEED MR Credit 4.1	Recycled Content: Use materials with recycled content such that recycled content (post-consumer recycled content + ½ pre-consumer recycled content) constitutes at least 10% of the total value of material in the project.	Pre 70% Post 0% Total 35%	Pre 40% Post 0% Total 20%	Pre 70% Post 0% Total 35%			
LEED MR Credit 4.2	Recycled Content: Same as MR 4.1, except recycled content must constitute at least 20% of the total value of material in the project.	Pre 70% Post 0% Total 35%	Pre 40% Post 0% Total 20%	Pre 70% Post 0% Total 35%			
LEED MR Credit 5.1	Regional Materials: Use materials that have been extracted/harvested/recovered and manufactured within 500 miles of project site, for a minimum of 10% of the total value of material in the project.			70%			
LEED MR Credit 5.2	Regional Materials: Same as MR 5.1, except regional material must constitute a minimum of 20% of the total value of the material in the project.			70%			
LEED MR Credit 6	Rapidly Renewable Materials: Use rapidly renewable building materials for 2.5% of the total value of the material in the project.			70%			
LEED MR Credit 7	Certified Wood: Use a minimum of 50% of wood-based materials that are certified in accordance with FSC principles and criteria.		78%	18%	78%	12%	
LEED EQ Credit 4.4	Low Emitting Materials: Composite wood and agrifiber products used on the interior of the building shall contain no added urea-formaldehyde resins.	✓	✓	✓	✓	✓	✓
Fire Rating	20 minute	✓	✓	✓	✓		✓
Fire Rating	45 minute			✓		✓	
Fire Rating	60 minute			✓		✓	
Fire Rating	90 minute					✓	

Footnotes:

- Data based on 1-3/4" x 3' 0" x 7' 0" door
- MR credits 5.1/5.2 are applicable to project sites that are within 500 miles of Mason City, Iowa and Mankato, Minnesota. Projects in Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, and Wisconsin may be eligible.
- In order to meet Chain of Custody requirements set forth by the USBGC, your company may be required to obtain FSC certification.
- 87% of the wood in our agrifiber core door is FSC certified; wood makes up 21% of the door which results in a contribution to MR Credit 7 of 18%.
- 82% of the wood in our mineral core door is FSC certified; wood makes up 15% of the door which results in a contribution to MR Credit 7 of 12%.
- Doors must be specified as no added urea-formaldehyde to meet EQ credit 4.4.
- Information provided as per LEED-NC 2.2 rating system, although most of the information applies directly to other LEED rating systems as well.



Graham Wood Doors  
525 9th St. SE  
Mason City, IA 50401  
Phone 641-423-2444  
[www.grahamdoors.com](http://www.grahamdoors.com)

Graham Premium Doors pictured with Corbin Russwin® Vineyard™ Collection Tuscany Lever

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GEDS0409

**NanaWall® SL60**

**The Standard Thermally Broken Aluminum Framed Folding System**

The SL60 is a thermally broken, aluminum folding panel system designed to provide an opening glass wall for openings up to 39 feet wide. It is appropriate for mostly residential applications where high levels of resistance to air and water infiltration are desired.

For benefits of all NanaWall® systems, see the "General Introduction" section. For features common to aluminum folding systems, see the "Aluminum Folding Systems" Introduction.

**High Weather Resistance**

The system is engineered to provide high weather resistance and structural performance. The inward-opening unit with raised sill tested to AAMA HGD- LC45 915x2600 with no water entry, even at 15 psf. See the "Performance and Testing Results" section for more details.

**NFRC-Approved Thermal Performance / Energy Star**

The SL60 has been rated, certified and labeled in accordance with NFRC 100 and 200; see the "Performance and Testing Results" section for more details.

**Florida Approval**

The SL60 system is Florida statewide approved with Product Approval number FL 8349. This information with limitations can be viewed at <http://www.floridabuilding.org>.

**Acoustical Performance**

The SL60 system has been tested by an independent acoustic lab for acoustical performance. The SL60 with raised sill and STC 38 laminated glass achieved STC and Rw values of 38.

**Superior Thermal Break**

The system is thermally broken with a wide polyamide plastic reinforced with glass fibers. This thermal barrier provides increased strength, superior humidity control, improved acoustics, and energy savings.

**Top-Hung or Floor-Mounted**

On the top-hung SL60/o, the main weight is carried by the head track. On the floor-mounted SL60/u, the lower running carriages ride on top of the sill track. Variable interlocking profiles minimize expansion problems.

**Especially for High Rises: Easy Cleaning Feature**

For balcony applications, there is an easy hinge removal option, facilitating glass cleaning from the inside.

**Dual Color Option**

The option of different finishes on the inside and outside is available; see the "Color Selection" section in General Introduction.

**Hardware Options**

For the main entry panel, several locking options are available. The profile locking cylinder (if any) on the main entry panel is Schlage-compatible.



**SL60 | Technical Description**

**Technical Description**

The SL60 is a thermally broken aluminum folding panel system designed to provide an opening glass wall or storefront for openings up to 39' wide; see Maximum Size Chart. It is available in various configurations utilizing one to twelve panels; see elevation drawings. The option exists for swing entry/exit panel(s); note the further panel size constraints with a swing panel not hinged to a side jamb. Units can be either inward-opening or outward-opening; see details in section drawings. The SL60/o system is the top-hung system and the SL60/u system is the floor-mounted system.

**Frame and Panels**

The nominal extruded aluminum frame and panel thickness is 2 3/8" (60 mm), thermally broken with a wide polyamide plastic; see section drawings. In addition to the choices from the NanaWall Powder Coating Finish Chart, the full range of RAL high gloss and matte powder coatings are available. Anodized finishes are also available; see "Aluminum Finish Options" in the General Introduction. It is possible to have different finishes on the interior and exterior surfaces.

Panel stiles and rails are connected by special cast-alloy, thermally broken corner fittings that incorporate hinge components, with finish that will be closest powder coat match to finish of frame and panels. Panels are pre-assembled, and all pins and screws needed to assemble frames are provided.

Besides the more weather resistant raised sill in profile matching finish, various thermally broken aluminum flush sills (shown in section drawings) are available as an option in a clear or dark bronze anodized finish.

**Glazing**

Units can be supplied either glazed with 15/16" (24 mm) clear insulating tempered or insulating Low-E tempered glass or other high performing safety glass such as Heat Mirror, Triple Glazed, acoustic, special tint, etc., or other glass on request.

See "Glazing" in the General Introduction for other glass thickness possible.

**Weatherstripping**

All weather-stripping (consisting of EPDM or brush seals) is provided for sealing between panels and between panel and frame; see section drawings.

**Sliding/Folding Hardware**

For sliding and folding of each pair of panels for the SL60/o system, attached to the upper corner of the panel (as indicated on the section drawings) is an upper load-bearing running carriage. Attached as a guide to the lower corner of that panel is a lower-running carriage. The double pair, twin-tandem, upper-running

carriage is constructed to insure even distribution of pressure on all four rollers. For the SL60/u system, a floor supported, two-wheeled, lower-running carriage is attached to the lower corner of a panel, and an upper-running carriage is attached to the upper corner of that panel as a guide. Rollers have sealed bearings and are coated with toughened Polyamide to ensure quiet running and optimal resistance to extreme temperature. Hinges at the corners of each panel are provided to connect panels together and to connect panels to frames.

**Locking Hardware and Handle Options**

For each pair of folding panels (except for the pair to be opened first in a unit with no swing panels), provided is two point locking hardware consisting of top and bottom Polyamide capped locking bolts operated by a 180° turn of a flat handle on the inside only.

For a unit with a **swing panel**, on the primary swing panel, provided is **multi-point locking** consisting of lever handles on both sides, a Schlage compatible lockset, lockable latch, deadbolt and rods at the top and the bottom. After turn of key or thumb-turn, depression of handles withdraws latch, lifting of handles engages rods and turn of key or thumbturn engages deadbolt and locks.

For a unit with a **secondary swing panel**, available are matching dummy lever handles on both sides and concealed flush bolts that operate the rods at the top and the bottom.

For a unit with **no swing panel**, on the folding pair to be opened first, provided is two point locking hardware consisting of top and bottom Polyamide capped locking rods operated by a 180 ° turn on the inside of a L-shaped handle for an inward opening unit and a flat handle for an outward opening unit. In both cases, there will be a flat handle on the outside. Lockable with a lockset. Turn of key or thumb turn operates lock. Please note that for an outward opening unit, locking from the inside will need to be with a key that may not meet egress requirements.

For a unit where locking/handles on the inside only is desired, like in window applications, on all swing panels or pair of folding panels to be opened first, provided is two point locking with a flat handle on the inside only.

**Handle finish schemes:**

Standard – Stainless steel lever, flat and L shaped handles in brushed satin or black titanium finish.

Optional – Brass lever handles in oil rubbed, satin nickel or white finish, flat handles closest powdercoat match to panel aluminum finish and nylon L shaped handles in dark brown, gray or white finish.

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**SL60 | Performance Testing Results**

RAISED SILL														
TYPE OF TEST			INWARD OPENING UNITS						OUTWARD OPENING UNITS					
*Air Infiltration: ASTM E-283, ft <sup>3</sup> /min./ft. In accordance with NFRC 400			@1.57 psf (75 Pa): 0.02 + A3 (.25 (m <sup>3</sup> /h)/m)						@1.57psf (75 Pa): 0.02 +A3 (.1(m <sup>3</sup> /h)/m)					
			@6.24 psf (300 Pa): 0.06						@6.24psf (300 Pa): 0.04					
*Water Penetration: ASTM E-547 and E-331			No uncontrolled water entry @15 psf (715 Pa) + B7						Standard Unit: No uncontrolled water entry @2.9 psf (140 Pa)  Unit with weepholes and gasket (not standard unit): No uncontrolled water entry up to 9.82 psf (470 Pa) +B4					
*Structural Load Deflection ASTM E-330: pass  <b>See design windload charts for other sized panels</b>  <i>Note that the structural test pressures were 50% higher than the design pressures.</i>			Design Pressure Positive @45 psf (2160 Pa) Design Pressure Negative @45 psf (2160 Pa)  +Windload Resistance: C4 (1920 Pa) Blow-out: C3 (3240 Pa)						Design Pressure Positive @45 psf (2160 Pa) Design Pressure Negative @45 psf (2160 Pa)  +Windload Resistance: C4 (1680 Pa) Blow-out: C3 (3240 Pa)					
*Forced Entry			In accordance with AAMA-1304 requirements											
Thermal Performance:			Rated, certified and labeled in accordance with NFRC 100 + 200											
			FLOOR MOUNTED			TOP HUNG			FLOOR MOUNTED			TOP HUNG		
TYPE OF GLASS (1 LEVEL)	CENTER OF GLASS U-FACTOR	GLASS THICKNESS	UNIT U FACTOR	SHGC	2010 ENERGY STAR	UNIT U FACTOR	SHGC	2010 ENERGY STAR	UNIT U FACTOR	SHGC	2010 ENERGY STAR	UNIT U FACTOR	SHGC	2010 ENERGY STAR
Double IG Clear (air filled)	.48	15/16"	.51	.49	-	.52	.49	-	.52	.50	-	.52	.49	-
Double IG Low E (argon filled)	.26	15/16"	.37	.28	-	.37	.28	-	.37	.28	-	.38	.28	-
Double IG Low E (air filled)	.30	15/16"	.39	.28	-	.40	.28	-	.40	.28	-	.41	.28	-
Double IG Low E on #2/#4 surfaces (argon filled)	.21	15/16"	.33	.26	-	.34	.25	-	.34	.26	-	.34	.25	-
Double IG Low E on #2/#4 surfaces (air filled)	.24	15/16"	.35	.26	-	.36	.25	-	.35	.26	-	.36	.25	-
Double IG Heat Mirror TC88 (argon filled)	.14	1 3/8"	.31	.33	-	.31	.33	-	.31	.33	-	.32	.33	-
Double IG Heat Mirror TC88 with Low E (argon filled)	.13	1 3/8"	.30	.23	✓	.31	.22	✓	.31	.23	✓	.31	.21	✓
Double IG Heat Mirror TC88 x2 (krypton filled)	.08	1 3/8"	.26	.27	✓	.27	.27	✓	.27	.27	✓	.28	.27	✓
Triple IG Low E x2 (argon filled)	.13	1 3/8"	.27	.23	✓	.28	.23	✓	.28	.23	✓	.29	.23	✓
Triple IG Low E x2 (air filled)	.16	1 3/8"	.30	.23	✓	.30	.23	✓	.30	.23	✓	.31	.23	✓
** Acoustical Performance			With STC 38 laminated glass achieved STC and Rw values of 38											
NOTES														
*Excerpts of results of 9'5" W x 8'2 1/2" H three panel units tested by Architectural Testing, Inc., Fresno, CA, an independent testing laboratory in August 2006.									SHGC = Solar Heat Gain Coefficient					
** Excerpts of results of 13'7" W x 8'8" H five panel unit with raised sill tested by Nusing Mobile Trennwandtechnik, Munster, Germany, an independent testing laboratory in November 2005.									✓ 2010 Energy Star Qualification Criteria: U-Factor ≤.32, SHGC ≤.30 for doors in all climate zones.					
Call NanaWall for U-Factor & SHGC for other glass types														
+Results per Canadian CSA A440-00														

CSI #: 08 35 13

SLIDING AND FOLDING HARDWARE

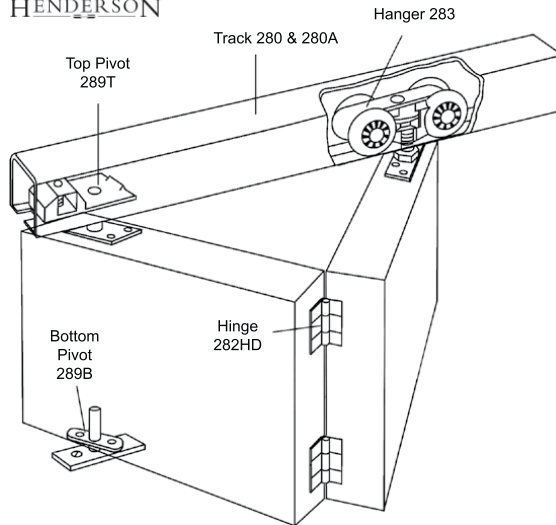


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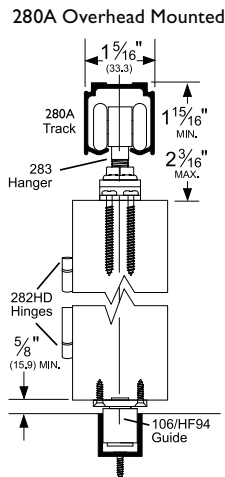
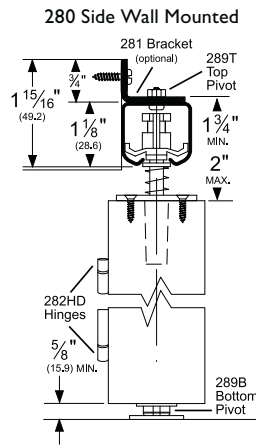
## Folding 100 Series

For Folding Doors and Room Dividers up to 100 Lbs.  
For Doors up to 24" Wide x 96" Tall  
Manufactured by P.C. Henderson

HENDERSON



NOTE: Allow  $\frac{1}{4}$ " clearance at pivot jambs and  $\frac{1}{8}$ " in between hinged doors if hinges are semi mortised. Allow  $\frac{3}{16}$ " between hinged doors if hinges are surface mounted. Allow  $\frac{1}{8}$ " between doors meeting in the center of the opening on HF4 kits and allow  $\frac{1}{8}$ " between wall and end panel on HF2 kits.



High quality hardware makes medium weight folding doors efficient and easy to use. Two and four leaf kits are available.

### Two Panel:

#### HF2/100A Kits Include:

- 1 ea 280A Mill Finished Aluminum Track
- 1 ea 283 Hanger
- 1 ea 289T Top Pivot
- 1 ea 289B Bottom Pivot
- 3 ea 282HD Hinges
- 1 ea 106HF/94 Roller Guide
- 1 ea 94A Aluminum Guide Channel
- 1 ea Adjusting Wrench and Mounting Hardware

### Four Panel:

#### HF4/100A Kits Include:

- 1 ea 280A Mill Finished Aluminum Track
- 2 ea 283 Hangers
- 2 ea 289T Top Pivots
- 2 ea 289B Bottom Pivots
- 6 ea 282HD Hinges
- 2 ea 106HF/94 Roller Guide
- 1 ea 94A Aluminum Guide Channel
- 1 ea Adjusting Wrench and Mounting Hardware

### STANDARD KIT SIZES

Part Number	Material	# of Panels	Track Length
HF2/100A/2	Aluminum	2	24"
HF2/100A/2'6	Aluminum	2	30"
HF2/100A/3	Aluminum	2	36"
HF2/100A/4	Aluminum	2	48"
HF4/100A/4	Aluminum	4	48"
HF4/100A/5	Aluminum	4	60"
HF4/100A/6	Aluminum	4	72"
HF4/100A/8	Aluminum	4	96"
HF2/100/4*	Steel	2	48"
HF4/100/8*	Steel	4	96"

\*Steel kits include the same components as above, except track is 1ea 280 galvanized steel.

### Options: See page SF-25

Mounting Bracket **281** available as 5 pack only, **2815**  
Threshold **971A**

SF-22

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in door opening solutions

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CSI #: 08 50 00

Architect Series® Designer Series® Pella® ProLine




























AWNING

























**SIZE TABLES**  
Aluminum-Clad Wood



Vent and Fixed Units

	(908) (889)	(1 060) (1 041)	(1 213) (1 194)	(1 365) (1 346)	(1 518) (1 499)
Opening	2' 11 <sup>3</sup> / <sub>4</sub> "	3' 5 <sup>3</sup> / <sub>4</sub> "	3' 11 <sup>3</sup> / <sub>4</sub> "	4' 5 <sup>3</sup> / <sub>4</sub> "	4' 11 <sup>3</sup> / <sub>4</sub> "
Frame	2' 11"	3' 5"	3' 11"	4' 5"	4' 11"
(451) (432)					
(552) (533)					
(603) (584)					
(654) (635)					
(756) (737)					

Fixed Units

(1 060) (1 041)				
(1 213) (1 194)				
(1 365) (1 346)				
(1 518) (1 499)				
(1 670) (1 651)				
(1 822) (1 803)				

Special Size Frame Dimensions\*

	MINIMUM	MAXIMUM
VENT	2'11" W x 1'5" H (889 x 432)	4'5" W x 2'5" H (1 346 x 737)
FIXED	2'11" W x 1'5" H (889 x 432)	4'11" W x 5'11" H (1 499 x 1 803)

\* Available within size range shown.  
Keep frame dimensions to the nearest 1/4" increment. Frame height cannot exceed frame width on special size vent units.

Not to scale.

Ⓢ Fixed Units only

CSI #: 08 50 00

Architect Series® Designer Series® Pella® ProLine



DOUBLE-HUNG

**SIZE TABLES**

Aluminum-Clad Wood

Fixed and Transoms with Removable Grilles



Fixed Units

	(1 060) (1 041)				(1 213) (1 194)				(1 365) (1 346)				(1 517) (1 499)							
	Opening 3' 5 <sup>3</sup> / <sub>4</sub> "				3' 11 <sup>3</sup> / <sub>4</sub> "				4' 5 <sup>3</sup> / <sub>4</sub> "				4' 11 <sup>3</sup> / <sub>4</sub> "							
	Frame 3' 5"				3' 11"				4' 5"				4' 11"							
(908) (889)	2' 11 <sup>3</sup> / <sub>4</sub> "				2' 11 <sup>3</sup> / <sub>4</sub> "				2' 11 <sup>3</sup> / <sub>4</sub> "				2' 11 <sup>3</sup> / <sub>4</sub> "							
(1 060) (1 041)	3' 5"				3' 5"				3' 5"				3' 5"							
(1 213) (1 194)	3' 11"				3' 11"				3' 11"				3' 11"							
(1 365) (1 346)	4' 5"				4' 5"				4' 5"				4' 5"							
(1 467) (1 448)	4' 9"				4' 9"				4' 9"				4' 9"							
	4135	4735	5335	5935	4141	4741	5341	5941	4147	4747	5347	5947	4153	4753	5353	5953	4157	4757	5357	5957
	4159	4759	5359	5959	4165	4765	5365	5965	4171	4771	5371	5971								

Transoms

	(552) (533)		(654) (635)		(755) (737)		(857) (838)		(959) (940)		(1 060) (1 041)																					
	Opening 1' 9 <sup>3</sup> / <sub>4</sub> "		2' 1 <sup>3</sup> / <sub>4</sub> "		2' 5 <sup>3</sup> / <sub>4</sub> "		2' 9 <sup>3</sup> / <sub>4</sub> "		3' 1 <sup>3</sup> / <sub>4</sub> "		3' 5 <sup>3</sup> / <sub>4</sub> "																					
	Frame 1' 9"		2' 1"		2' 5"		2' 9"		3' 1"		3' 5"																					
(374) (356)	1' 2 <sup>3</sup> / <sub>4</sub> "		1' 2 <sup>3</sup> / <sub>4</sub> "		1' 2 <sup>3</sup> / <sub>4</sub> "		1' 2 <sup>3</sup> / <sub>4</sub> "		1' 2 <sup>3</sup> / <sub>4</sub> "		1' 2 <sup>3</sup> / <sub>4</sub> "																					
(451) (432)	1' 5 <sup>3</sup> / <sub>4</sub> "		1' 5 <sup>3</sup> / <sub>4</sub> "		1' 5 <sup>3</sup> / <sub>4</sub> "		1' 5 <sup>3</sup> / <sub>4</sub> "		1' 5 <sup>3</sup> / <sub>4</sub> "		1' 5 <sup>3</sup> / <sub>4</sub> "																					
(552) (533)	1' 9"		1' 9"		1' 9"		1' 9"		1' 9"		1' 9"																					
(654) (635)	2' 1"		2' 1"		2' 1"		2' 1"		2' 1"		2' 1"																					
(756) (737)	2' 5 <sup>3</sup> / <sub>4</sub> "		2' 5 <sup>3</sup> / <sub>4</sub> "		2' 5 <sup>3</sup> / <sub>4</sub> "		2' 5 <sup>3</sup> / <sub>4</sub> "		2' 5 <sup>3</sup> / <sub>4</sub> "		2' 5 <sup>3</sup> / <sub>4</sub> "																					
	2114	2514	2914	3314	3714	4114	2117	2517	2917	3317	3717	4117	2121						2125	2525	2925	3325	3725	4125	2929							

Not to scale



CSI #: 08 50 00

Architect Series® Designer Series® Pella® ProLine



CASEMENT

**SIZE TABLES**  
Aluminum-Clad Wood



**Fixed Transoms**

Opening	(451) (432)	(552) (533)	(603) (584)	(654) (635)	(755) (737)	(908) (889)
1' 5 3/4"	1714	2114	2314	2514	2914	3514
1' 9 3/4"	1717	2117	2317	2517	2917	3517
1' 11 3/4"		2121	2323			
2' 1 3/4"	1725	2125	2325	2525	2925	3525
2' 5 3/4"					2929	
Frame	1' 5"	1' 9"	1' 11"	2' 1"	2' 5"	2' 11"

**Fixed Units**

Opening	(1060) (1041)	(1213) (1194)	(1365) (1346)	(1517) (1498)
3' 5 3/4"	4141	4741	5341	5941
3' 11 3/4"	4147	4747	5347	5947
4' 5 3/4"	4153	4753	5353	5953
4' 11 3/4"	4159	4759	5359	5959
5' 5 3/4"	4165	4765	5365	5965
5' 11 3/4"	4171	4771	5371	5971
Frame	3' 5"	3' 11"	4' 5"	4' 11"

**Vent and Fixed Units**

Opening	(908) (889)	(1060) (1041)	(1213) (1194)	(1365) (1346)	(1517) (1498)	(1670) (1651)	(1822) (1803)
2' 11 3/4"	1735	2135	2335	2535	2935 E3	3535 E1	
3' 5 3/4"	1741	2141	2341	2541 E3	2941 E2	3541 E	
3' 11 3/4"	1747	2147	2347	2547 E2	2947 E	3547 E	
4' 5 3/4"	1753	2153	2353	2553 E2	2953 E	3553 E	
4' 11 3/4"	1759	2159	2359	2559 E2	2959 E	3559 E	
5' 5 3/4"	1765	2165	2365	2565 E2	2965 E	3565 E	
5' 11 3/4"	1771	2171	2371	2571 E2	2971 E	3571 E	
Frame	2' 11"	3' 5"	3' 11"	4' 5"	4' 11"	5' 5"	5' 11"

**Egress Notes:**

Check all applicable local codes for emergency egress requirements.

- E = Window meets minimum clear opening of 24" height, 20" width, and 5.7 ft<sup>2</sup>.
- E1 = Window meets minimum clear opening of 24" height, 20" width, and 5.0 ft<sup>2</sup>.
- E2 = With optional side pivot hardware, window meets minimum clear opening of 24" height, 20" width, and 5.7 ft<sup>2</sup>.
- E3 = With optional side pivot hardware, window meets minimum clear opening of 24" height, 20" width, and 5.0 ft<sup>2</sup>.

See Design Data pages in this section for clear opening dimensions.

Not to scale.  
T Tempered glass is standard.

**CSI #: 08 71 00**

2/12/13

Contemporary Deadbolt (8244S.320)

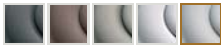


---

## CONTEMPORARY DEADBOLT

MODEL #: 8244S.324

AVAILABLE FINISHES



*Shown: Satin Stainless Steel*



[Click Image to Zoom](#)

[Enlarge Image](#)

[Product Highlights](#)

[Technical Information](#)

[Warranty](#)

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[Installation Guide](#)

[Exploded View](#)

[Warranty Document](#)

*Do not use prints made from this website to mark distances.*

*Due to individual printers, dimensions on installation instructions may not print at an accurate scale.*

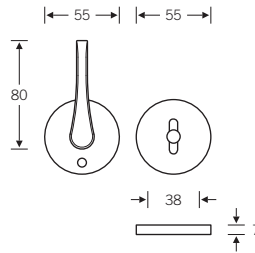
## CRAFTSMANSHIP

The tradition of craftsmanship and commitment to quality run deep at Baldwin. Since 1946, skilled artisans have forged Baldwin Estate hardware by hand, meticulously operating forges and hand-polishing each intricate knob, lever, and handleset. We still use time-tested techniques, such as heat forging, metal plating, and hand polishing. While many hardware manufacturers use the casting technique, Baldwin uses forging to create the flawless look that

**FSB**

**ADA Turn and Release Sets**

● FSB North American Stock Items  
(stocked in Natural Color Aluminum  
and Satin Stainless Steel only)

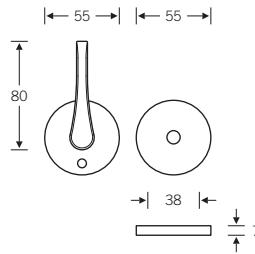


**1744 9002** 

- Aluminum ●
- AluGrey
- Stainless Steel ●

ADA Privacy Set with Thumb-turn and Emergency Release (with Indicator)

With 3/16" (5 mm) diamond spindle.



**1744 9003** 

- Aluminum ●
- AluGrey
- Stainless Steel ●

ADA Privacy Set with Thumb-turn and Emergency Release (without Indicator)

With 3/16" (5 mm) diamond spindle.

Standard spindle projection valid for door thickness 1 3/8" to 2 1/4". Extended length spindles available on request.

CSI #: 08 71 00



**SINGLE-DOOR MULTIPOINT HARDWARE**

The multipoint lock system secures the door in three places – for superior durability and performance. Additional handle set styles are available from Rocky Mountain® Hardware.

**W&F® Handle Options**

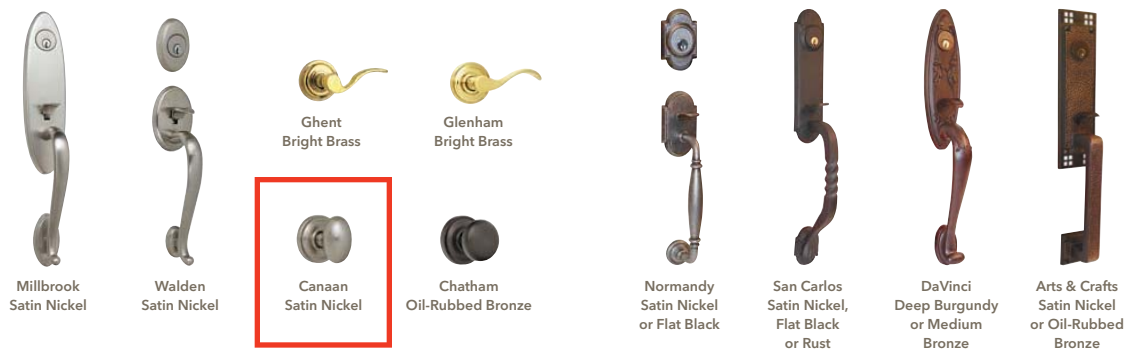


**Emtek® Handle Options**



**STANDARD HARDWARE**

Choose an elegant handle from our beautiful standard hardware collection to complete the look of your new entry door.



CSI #: 08 71 00



800-824-3018  
[www.pemko.com](http://www.pemko.com)

SLIDING AND FOLDING HARDWARE

## Bypass Track Series

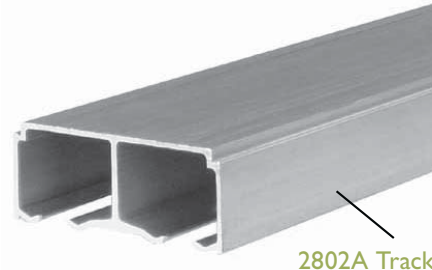
For Bypass Panels up to 200 lbs.  
Manufactured by PEMKO

- Fits 1 $\frac{3}{8}$ " and 1 $\frac{3}{4}$ " doors
- Needle-bearing wheels for ultra smooth performance
- Load capacity 200 lbs. per door panel (2 hangers)
- Extruded aluminum track

### HBP200A Kits Include:

- 1 ea 2802A Mill Finished Aluminum Track
- 4 ea 284 White Hangers
- 2 ea 102N White Nylon Mortise Guide
- 4 ea 286 Stops
- 1 ea Adjusting Wrench and Mounting Hardware

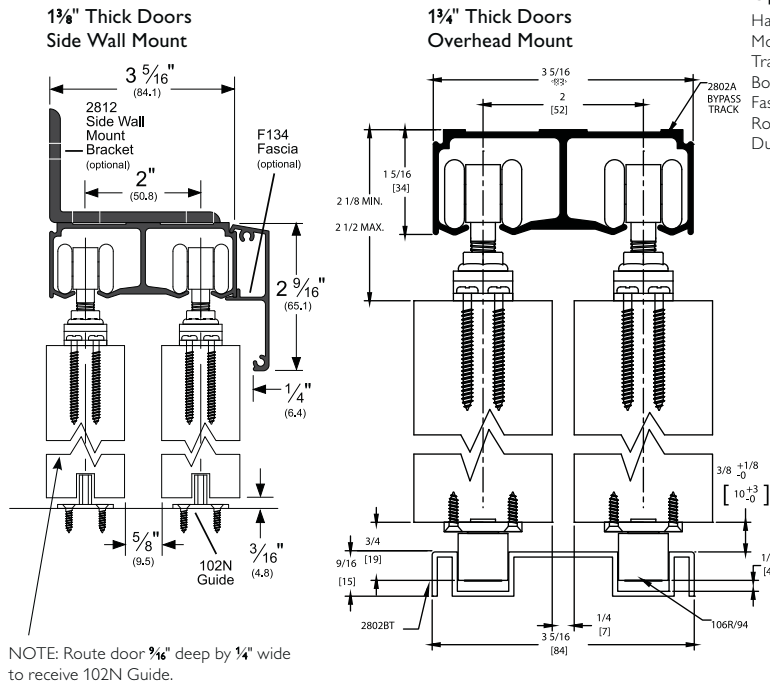
Standard Kit Sizes		
Part Number	Track Length	Door Width
HBP200A/4	48"	2 @ 24"
HBP200A/5/4	64"	2 @ 32"
HBP200A/6	72"	2 @ 36"
HBP200A/7	84"	2 @ 42"
HBP200A/8	96"	2 @ 48"
HBP200A/10	120"	2 @ 60"
HBP200A/12	144"	2 @ 72"



\* Side Wall mounting: use one (1) 2812 Kit per 3 ft. of track.

Options: See page SF-25

- Hardware Kit H100/200 pack
- Mounting Bracket 2812
- Track Stop (bumper) 287HD
- Bottom Channel 94A
- Fascia, Snap-On F134
- Roller Guide 106R/94
- Dual Guide Channel 2802BT



AVAILABLE FINISHES FOR PRODUCTS SHOWN ON THIS PAGE (see General Information section for finish chart)  
A (Mill Finish Aluminum) C (Clear Anodized)

ASSA ABLOY, the global leader  
in door opening solutions

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SF-6

**CSI #: 08 71 00**

8/15/13

Rockwood Manufacturing



ASSA ABLOY, the global leader  
in door opening solutions.

### 440 - Low Dome Stop



#### Available Finishes:

- ▶ US26D/626
- ▶ US26/625
- ▶ US15/619
- ▶ US10B/613
- ▶ US10/612
- ▶ US4/606
- ▶ US3/605

#### Specifications:

Material: Solid Cast Brass with DuraFlex Bumper

Options: Exterior Pack screw packs; stainless steel plated to match - use EXP suffix (440 x EXP) when ordering.

Fastener: #12 x 1-1/4 FH WS, plastic anchor

Base: 1/4" h x 1-7/8" dia.

Height: 1-1/8"

Weight: 2.1 lbs./10

ANSI A156.16: L02141

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**CSI #: 08 71 00**

8/15/13

Rockwood Manufacturing



ASSA ABLOY, the global leader  
in door opening solutions.

### 872 - Cast Flush Pull



#### Available Finishes:

- ▶ US26D/626
- ▶ US10B/613
- ▶ US3/605

#### Specifications:

Material: Cast Brass

Fastener: 2 ea. #4 x 5/8 OH WS

Size: 1-5/16" x 3-1/8"

Weight: 0.2 lbs.

ANSI A156.14: D0781

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CSI #: 08 71 00



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Yale lever profiles echo your design statement whether you require sleek and contemporary or dramatic vibrancy to create a unique architectural environment. Now it's possible to flow design sensibility across the entire facility, unifying all openings.

**These lever selections with the R3 rose ship within 1 week.**

The complete family of Reflections® levers and roses in all 14 finishes will continue to be available within an 5-12 week lead time.

available finish

626 | US26D  
Satin Chrome Plated



hudson



thames



victoria



rose

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[www.reflectionsbyyale.com](http://www.reflectionsbyyale.com)

contact

your local ASSA ABLOY  
Door Security Solutions team

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YALE, with its unique global reach and range of products, is the world's favorite lock.

ASSA ABLOY is the global leader in door opening solutions, dedicated to satisfying end-user needs for security, safety and convenience. 42745 - 2/12R



# Division 09

## Finishes

**CSI #: 09 29 00**

**Gold Bond® BRAND Gypsum Board Products**

National Gypsum Company features a wide variety of gypsum board products and accessories including regular gypsum board, Fire-Shield fire resistant board, 1/4" High Flex Gypsum Board, 1/2" High Strength Ceiling Gypsum Board, Hi-Impact Gypsum Board, Gridstone Ceiling Boards, Gypsum Sheathing, Fire-Shield Shaftliner, Durasan Prefinished Gypsum Board, Exterior Soffit Board, and Joint Treatment products.

Our concentration isn't on building products alone, however. At the National Gypsum Research and Testing Center, we develop complete construction systems. In such systems, products are evaluated together as complete building assemblies—walls, partitions, floors and ceilings.

We have included in this section details and application instructions for many of those assemblies: Steel Frame Partitions, Steel Frame Ceilings/Furring Channels or Studs, Wood

Frame Wall and Ceilings, Gypsum Board Over Foam Insulated Masonry and Solid Laminated Partitions.

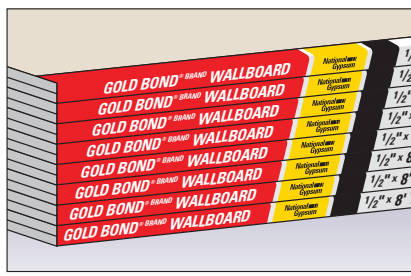
Before a National Gypsum System is released to the building industry, it is thoroughly tested, and results are correlated and charted to make it easier for the builder or specifier to match a system to their needs or to the building codes.

The drywall construction systems referred to in this catalog are designed primarily with materials manufactured by National Gypsum

Company. Substitution of any product or other brands in a tested system is not recommended.

Field installation of tested systems must be identical to laboratory installation to produce optimum performance of these systems. Performance tests are conducted in accordance with accepted national standards under controlled laboratory conditions to minimize variances and to permit comparison of test results with all types of systems, similar and dissimilar.

**DESCRIPTION**

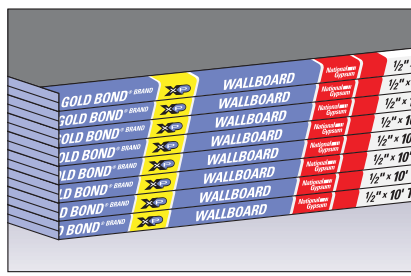


**Description**

**Gold Bond BRAND Gypsum Board** with tapered edge permits smooth joint treatment; surface takes any decoration. Basic recommendations: 1/2" board for single layer; 3/8" board for 2-layer; 1/4" board is regular gypsum board used in remodeling and for sound control in double layer applications. Refer to page 65.

Core	Thickness/Type	Width/Edge	Lengths
Regular	1/4" (6.3 mm) 3/8" (9.5 mm) 1/2" (12.7 mm)*	4' (1219 mm) Square or Tapered	6' (1828 mm) thru 16' (4876 mm)

Note: 1/2" gypsum board available in 54" widths.



**Gold Bond BRAND XP Gypsum Board** is designed to provide extra protection against mold and mildew compared to standard gypsum board products. Tapered edge permits smooth joint treatment. Refer to page 70.

Regular	1/2" (12.7 mm)	4' (1219 mm) Square or Tapered	8' (2438 mm) 10' (3048 mm) 12' (3657 mm)
---------	----------------	---	--



**Gold Bond BRAND Fire-Shield Gypsum Board** is manufactured with a type X core to achieve fire resistance ratings when used in recommended systems. Refer to page 66.

**Gold Bond BRAND Fire-Shield C Gypsum Board** has a specially formulated type X core to achieve superior performance when used in specific fire rated assemblies. May be used in designs requiring Fire-Shield Gypsum Board (type X core). Refer to page 66.

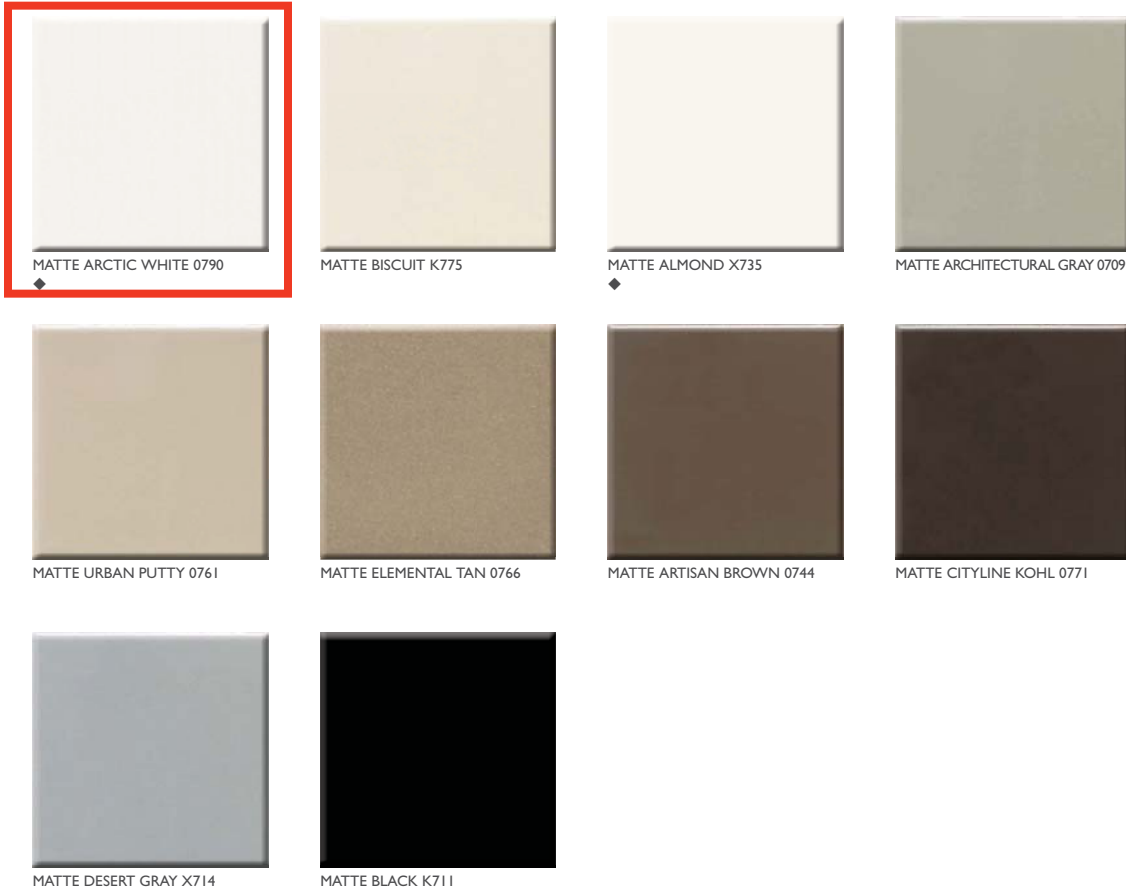
Type X	5/8" (15.9 mm) FSW*	4' (1219 mm) Square or Tapered	6' (1828 mm) thru 16' (4876 mm)
Type X	1/2" (12.7 mm) FSW-C	4' (1219 mm) Square or Tapered	6' (1828 mm) thru 16' (4876 mm)
Type X	5/8" (15.9 mm) FSW-C	4' (1219 mm) Square or Tapered	8' (2438 mm) thru 14' (4267 mm)

Note: 5/8" Fire-Shield gypsum board available in 54" widths.

\* Available with Foil Backing. Refer to page 86.  
Reference [www.nationalgypsum.com](http://www.nationalgypsum.com) for fire safety information.

**CSI #: 09 30 13**

*Matte Field/Accent Tile (Price Group 4)*



*Made-to-Order Colors*



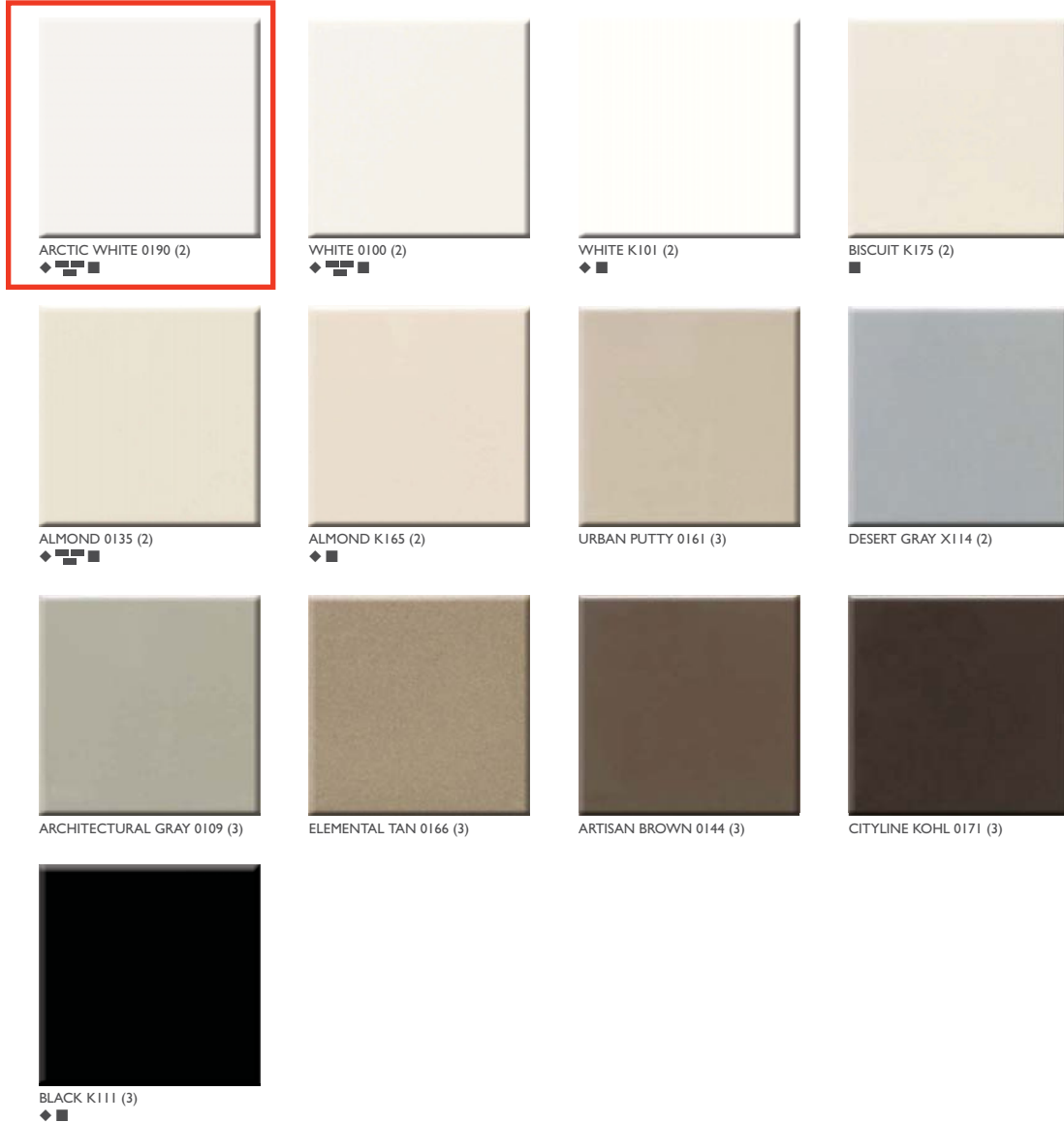
★ Subject to crazing; black grout not recommended.

CSI #: 09 30 13

# RITTENHOUSE SQUARE™ GLAZED WALL & COUNTER

wall • countertop

*Semi-Gloss Field/Accent Tile*



(1), (2), (3) and (4) indicate Price Groups. (1) being the least expensive.

All colors available in 3 x 6.

◆ Harlequin available

■ Brick-joint available

■ Shelf Rail available

CSI #: 09 30 23

8/15/13

loft super white polished 1x1 glass tiles - shop glass tiles at glasstilestore.com

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**LOFT SUPER WHITE POLISHED 1 X 1 GLASS TILE**



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Loft Super White Polished 1 x 1 Glass Tile  
Move your mouse over image or click to enlarge

More Views



**LIVE EXPERTS  
STANDING BY**  
« [CLICK TO CHAT NOW!](#) »

Specs

**Chip Size:** Squares      **Color:** Super White      **Material:** Glass  
**Finish:** Polish      **Sold By The Sheet**      **Sheet Size:** 12" x12"



[Product Details](#)   [Grouting](#)   [Installation](#)   [Recommended Accessories](#)   [Additional Information](#)



Mother Of Pearl O  
White Tile  
**Our Price:** \$



Ice White Polished  
Tile  
**Closeout Price:**  
\$8.50



Seaspray Blend S  
1/2" X 1/2" Marble  
Tiles  
**Our Price:** \$



Tao Super White G  
**Our Price:** \$

CSI #: 09 60 00

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### 1-1/4 x 6 x 12 S4S Western Red Cedar Decking Board

Model # MR0510512

**Not available in your currently localized store**

Enter zip code to check item availability

[▶ CHECK](#)

Store Only

Buy Online, Pick Up In Store Today

**Check Store Inventory**

## PRODUCT OVERVIEW

If you're planning on rebuilding your home's deck, consider using the 1-1/4 in. x 6 in. x 12 ft. Western Red Cedar S4S Decking Board. This untreated wood can be stained or painted to match your home's existing decking decor.

California residents: see [Proposition 65 information](#)

- Made of Western cedar
- Select deck lumber grade
- Can be stained or painted
- 1 in. x 5-1/2 in. x 12 ft.
- Note: Product may vary by store.
- MFG Model # : MR0510512
- MFG Part # : D5406SR4U-12

## SPECIFICATIONS

Actual product thickness (in.)	1	Actual product width (in.)	5.5
Assembled Depth (in.)	1 in	Assembled Height (in.)	144 in
Assembled Width (in.)	5.5 in	Manufacturer Warranty	None
Pressure Treated	No	Primed	No

CSI #: 09 64 00

8/15/13

Unfinished Hardwood Flooring and Wood Paneling, Your High-end Hardwood Floors



[> home](#) [> hardwood flooring](#) [> unfinished collection](#)



Site map:

## Unfinished Hardwood Flooring and Wood Paneling

White Oak

[Back to unfinished collection](#)



### Specifications

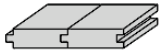
- Width: 2 1/4", 3 1/4", 4 1/4", 5 1/4" and wider upon request
- Thickness: 3/4" Solid Wood
- Length: Random, up to 8 feet

### Features

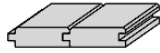
- Our hardwood flooring and wood paneling is slowly and carefully milled to a precise fit, ensuring trouble free installation of hardwood floors.
- Our own kiln-drying facilities ensure that all lumber has been properly dried, equalized and fully conditioned for hardwood flooring and wood paneling use.
- Our hardwood flooring and wood paneling is easy to install and easy to order.

- Hardwood Flooring
- Prefinished Flooring
- Handscraped Prefinished Flooring
- Unfinished Flooring
  - Vents
  - Accessories
  - Distributors
- Handscraped Flooring
- Special Cut Flooring
- Care & Maintenance
- Warranty
- MSDS

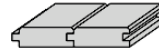
### Milling Choices



Square Edge (Plain Milling)



Beveled Edge (V-Groove)



Micro-bevel available in large quantity orders only

### Grade Choices

We offer two grades of unfinished hardwood flooring and paneling:



Our **Clear grade** is free of knots, mineral streaks and wormholes. It is ideal for a formal appearance. Furniture grades of lumber (FAS) are used along with 1/COM and "Selects" to produce clear grade hardwood flooring and wood paneling with a good length average.



**Character grade** hardwood flooring and wood paneling is milled from 2/COM lumber. To produce a quality product, we cut out loose knots, leaving natural color variations and tight knots for a rustic appearance.

Note: Character grade generally has more short pieces mixed in with the longer planks.

### Sheoga hardwood flooring offers herringbone flooring



Sheoga hardwood flooring offers herringbone flooring in a wide variety of wood species and sizes. Herringbone is precisely milled to our standards. Our double-end-grooved herringbone offers flexibility for a unique design or pattern in your home or office.

Select your state

For that rustic look: [Handscraped Prefinished Floors... More...](#)

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FSC available upon request.



BBB  
Rating: A+  
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1/2

CSI #: 09 91 23

**TECHNICAL DATA SHEET**



**INTERIOR CEILING PAINT**  
**NO. 558 ULTRA PURE WHITE®**



**PRODUCT INFORMATION**

BEHR PREMIUM PLUS® Ceiling Paint No. 558 is a tough acrylic latex flat finish formulated to resist splatter when applied to interior textured, popcorn and acoustic style ceilings. This flat helps to hide minor surface imperfections and provides great coverage.

**RECOMMENDED USES:**

Use on properly prepared, interior ceilings including drywall, plasterboard, and cured plaster.

COMPLIES WITH THE BELOW AS OF 3/22/2011			
OTC	YES	CARB	YES
SCAQMD	YES	MPI #	53

**PRODUCT SPECIFICATIONS:**

**Tint Bases/Max Tint Load:**

No. 558 Ultra Pure White Base 128 oz / 2 oz

**PRE-MIXED COLORS:**

Custom colors plus computer color matching available.

**Sheen:** 3 @ 85°

**Vehicle Type:** 100% Acrylic

**\*Weight per Gallon:** 11.5 lbs at +/- 2%

**\*% Solids:**

By Volume: 35% at +/- 2%

By Weight: 52% at +/- 2%

**VOC:** <50 (g/l), meets the requirements for LEED credits, as the product meets VOC limits as established by Green Seal Standards GS-11, First Edition, May 20, 1993.

**Flash Point:** Not Applicable

**Viscosity:** 102-112 KU

**\*Recommended Film Thickness:**

Wet: 6.4 Dry: 2.2 mils @ 250 SFPG

Wet: 4.0 Dry: 1.4 mils @ 400 SFPG

**\*Coverage:** 250-400 SFPG, depending on application method and substrate porosity. Does not include the loss of material from spraying.

**APPLICATION:**

**Brush:** Nylon/polyester

**Roller:** Use 3/8"-1/2" nap cover on smooth surfaces and 1/2"-3/4" on rough, porous surfaces.

**Airless Spray:** At packaged consistency

**Tip:** .015"-.019"

**Filter:** 60 mesh

**Thinning:** (If required) No more than 1/2 pint of water per gallon.

**† Dry Time:** @ 77° & 50% RH

Longer dry time may be required in cooler temperatures and higher humidity.

† To Touch: 2 hours

† To Recoat: 4 hours

† Full Cure: 2 weeks

**RECOMMENDED PRIMER / SYSTEMS:**

**PROPERLY PREPARED NEW SURFACES:**

**Gypsum Wallboard:**

- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75
- BEHR PREMIUM PLUS® Interior Drywall Primer & Sealer No. 73

**Plaster:**

- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75

**Wood:**

- BEHR PREMIUM PLUS® Interior/Exterior Oil-Based Primer & Sealer No. 434
- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75

**Tannin/Stainblocking:**

- BEHR PREMIUM PLUS® Interior/Exterior Oil-Based Primer & Sealer No. 434
- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75

**Masonry:**

- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75

**Galvanized Metal, Metal & Aluminum:**

- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75

**PREVIOUSLY PAINTED SURFACES:**

- BEHR PREMIUM PLUS® Interior/Exterior Oil-Based Primer & Sealer No. 434
- BEHR PREMIUM PLUS® Interior Enamel Undercoater Primer & Sealer No. 75

**CAUTIONS/LIMITATIONS:**

- Protect from freezing.
- Do not use on floors.
- For best results, apply at temperatures between 50°F - 90°F. Temperatures above 90°F may affect the application such as drying too fast. Avoid painting in direct sun. NOTE: If the surface is hot to the touch it should be considered too hot to apply this coating.
- Allow two weeks before washing or cleaning for full cure.
- Shelf life under normal conditions is two years unopened.

**CLEAN UP:**

Clean all tools and equipment with clean water. For disposal of empty containers and unused product, contact your household refuse collection service.

**† WARNING!** If you scrape sand or remove old paint, you may release lead dust. **LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE.** Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting the National Lead Information Hotline at 1-800-424-LEAD or log on to [www.epa.gov/lead](http://www.epa.gov/lead). **WARNING!** This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **WARNING!** Sanding or scraping pressure treated lumber may be hazardous; wear appropriate protection.

\*This information is provided "as is" and no representations or warranties, either expressed or implied, or merchantability, fitness for a particular purpose or of any other nature are made with respect to this information or to any product referred to in this information.

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CSI #: 09 91 23

**TECHNICAL DATA SHEET**



**INTERIOR/EXTERIOR HI-GLOSS ENAMEL**  
**NO. 8050 ULTRA PURE WHITE®**



**PRODUCT INFORMATION**

BEHR PREMIUM PLUS® Interior/Exterior Hi-Gloss Enamel has a brilliant, glass-like sheen and is the perfect choice when exceptional durability and easy stain removal is desired. Hi-Gloss Enamel is excellent for highlighting trim, railing, shutters and molding. This 100% acrylic latex, mildew resistant finish offers exceptional hide and maximum moisture resistance.

**RECOMMENDED USES:**

Use on previously painted or primed interior or exterior surfaces. Ideal for kitchens, bathrooms, ceilings, cabinets, shutters, doors, furniture, garage doors, windows and trim.

**PRODUCT SPECIFICATIONS:**

**Tint Bases/Max Tint Load:**

- \*\*No. 8050 Ultra Pure White® Base 128 oz / 2 oz
- No. 8400 Medium Base 120 oz / 10 oz
- No. 8300 Deep Base 116 oz / 14 oz

**PRE-MIXED COLORS:**

- \*\*\*No. 8610 Red
- \*\*\*No. 8620 Black

**Gloss:** 45+ @ 20°; 75+ @ 60°

**Vehicle Type:** 100% Acrylic Latex

**\*\*Weight Per Gallon:** 10.5 +/- 0.2 lbs. /gal

**\*\*% Solids:**

- By Volume: 35 +/- 2%
- By Weight: 49.6 +/- 2%

**VOC:** <150 (g/l)

**Flash Point:** Not Applicable

**Viscosity:** 95-105 KU

**\*\*Recommended Film Thickness:**

- Wet: 6.4 mils / Dry: 2.2 mils @ 250 SFPG
- Wet: 4.0 mils / Dry: 1.4 mils @ 400 SFPG

**\*\*Coverage:** 250-400 Square Feet Per Gallon, depending on application method and substrate porosity. Does not include the loss of material from spraying.

**APPLICATION:**

**Brush:** Nylon/polyester

**Roller:** Use 3/8"-1/2" nap cover on smooth surfaces and 1/2"-3/4" on rough, porous surfaces

**Airless Spray:** At packaged consistency

**Tip:** .015" - .019"

**Filter:** 60 mesh

**Thinning:** (If required) No more than 1/2 pint of water per gallon.

† **Dry Time:** @ 77° & 50% RH

Longer dry time may be required in cooler temperatures and higher humidity.

† To Touch: 1 hour

† To Recoat: 2-4 hours

† Full Cure: 2 weeks (UPW base);

4 weeks (Medium and Deep base)

**RECOMMENDED PRIMER / SYSTEMS:**

**PROPERLY PREPARED NEW SURFACES:**

**Gypsum Wallboard:**

- BEHR PREMIUM PLUS® Interior Stain-Blocking Primer & Sealer No. 75
- BEHR PREMIUM PLUS Interior Drywall Primer & Sealer No. 73

**Plaster:**

- BEHR PREMIUM PLUS Interior Stain-Blocking Primer & Sealer No. 75

**Wood: Cedar, Redwood, Shakes & Shingles**

- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436
- BEHR PREMIUM PLUS Interior/Exterior Oil-Based Primer & Sealer No. 434

**Tannin/Stainblocking:**

- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436
- BEHR PREMIUM PLUS Interior/Exterior Oil-Based Primer & Sealer No. 434
- BEHR PREMIUM PLUS Interior Stain-Blocking Primer & Sealer No. 75

**Masonry: Stucco, Cinder Block, Cut Masonry Unit's (CMUs), Split Face Block**

- BEHR PREMIUM® Concrete & Masonry Protector & Waterproofer No. 980 (Do not use on smooth or nonporous concrete.)
- BEHR PREMIUM Concrete & Masonry Bonding Primer No. 880
- BEHR PREMIUM Interior/Exterior Basement & Masonry Waterproofer No. 875 or BEHR PREMIUM Interior/Exterior Concrete & Masonry Waterproofer No. 870 (can also be used as a block filler.)
- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436

**Masonry: Cement Composition Panels/Siding, Exterior Insulation and Finish Systems (EIFS) or Synthetic Stucco**

- BEHR PREMIUM Concrete & Masonry Bonding Primer No. 880
- BEHR PREMIUM Interior/Exterior Basement & Masonry Waterproofer No. 875 or BEHR PREMIUM

COMPLIES WITH BELOW AS OF 3/22/2011			
OTC	YES	MPI X-GREEN	n/a
SCAQMD	NO	GREENGUARD CERTIFIED	YES
CARB	YES		
MPI #	119	CHPS	YES
NAHB	YES	LEED®: R/NC	YES
LEED®: R/CI	YES	LEED®: SC	YES
LEED®: HC	YES	LEED®: H	YES
LEED®: CS	YES		

Interior/Exterior Concrete & Masonry Waterproofer No. 870 (can also be used as a block filler).

- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436

**Masonry with pH Levels up to 13.0:**

- BEHR PREMIUM Interior/Exterior Basement & Masonry Waterproofer No. 875 or BEHR PREMIUM Interior/Exterior Concrete & Masonry Waterproofer No. 870
- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436

**Galvanized Metal, Metal & Aluminum:**

- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436

**Vinyl Siding, Architectural Plastics:**

- BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436

**PREVIOUSLY PAINTED SURFACES:**

- Use a full coat or spot prime with BEHR PREMIUM PLUS Exterior Multi-Surface Primer & Sealer No. 436, or use BEHR PREMIUM PLUS® Interior/Exterior Oil-Based Primer & Sealer No. 434 on properly prepared surfaces.

**CAUTIONS/LIMITATIONS:**

- Protect from freezing.
- Do not use on floors.
- For best results, apply at temperatures between 50°F - 90°F. Temperatures above 90°F may affect the application such as drying too fast. Avoid painting in direct sun. NOTE: If the surface is hot to the touch it should be considered too hot to apply this coating.
- Avoid heavy traffic for 24 hours.
- Allow four weeks before washing or cleaning for full cure.
- Shelf life under normal conditions is two years unopened.

**CLEAN UP:**

Clean all tools and equipment with clean water. For disposal of empty containers and unused product, contact your household refuse collection service.

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\*As long as you reside in your home. See label for details.  
\*\*This information is provided "as is" and no representations or warranties, either expressed or implied, or merchantability, fitness for a particular purpose or of any other nature are made with respect to this information or to any product referred to in this information.  
\*\*\*Not 100% Acrylic



CSI #: 09 91 23

**TECHNICAL DATA SHEET**



**INTERIOR FLAT PAINT**  
**NO. 1050 ULTRA PURE WHITE®**



**PRODUCT INFORMATION**

BEHR PREMIUM PLUS® ZERO VOC \*, Self-Priming Interior Flat is 100% acrylic and provides a mildew resistant finish. This easy-clean flat provides excellent touch-up, ultimate durability, exceptional hide and a non-reflective, matte appearance. Formula is also low odor.

**RECOMMENDED USES:**

Use on properly prepared uncoated, primed or previously painted interior surfaces. Ideal for family rooms, living rooms, dining rooms, bedrooms, and ceilings.

**PRODUCT SPECIFICATIONS:**

**Tint Bases/Max Tint Load:**

- \*No. 1050 Ultra Pure White® Base 128 oz / 2 oz
- No. 1400 Medium Base 120 oz / 10 oz
- No. 1300 Deep Base 116 oz / 14 oz

**PRE-MIXED COLORS:**

- No. 1012 Swiss Coffee
- No. 1473 Off White
- No. 1070 Linen White
- No. 1422 Navajo White
- No. 1052 White

**Sheen:** 0-4 @ 85°

**Vehicle Type:** 100% Acrylic Latex

**\*Weight per Gallon:** 12.0 +/- 0.2 lbs./gal

**\*% Solids:**

- By Volume: 42.5% +/- 2%
- By Weight: 60% +/- 2%

**VOC:** <5 (g/L) \*

**Flash Point:** Not Applicable

**Viscosity:** 100-110 KU

**\*Recommended Film Thickness:**

- Wet: 6.4 mils / Dry: 2.6 mils @ 250 SFPG
- Wet: 4.0 mils / Dry: 1.6 mils @ 400 SFPG

**\*Coverage:** 250-400 Square Feet Per Gallon, depending on application method and substrate porosity. Does not include the loss of material from spraying.

**APPLICATION:**

**Brush:** Nylon/polyester

**Roller:** Use 3/8-1/2" nap cover on smooth surfaces and 1/2-3/4" on rough, porous surfaces.

**Airless Spray:** At packaged consistency

**Tip:** .015-.019"

**Filter:** 60 mesh

**Thinning:** (If required) No more than 1/2 pint of water per gallon.

**† Dry Time:** @ 77° & 50% RH

Longer dry time may be required in cooler temperatures and higher humidity.

- † To Touch: 1 hour
- † To Recoat: 2 hours
- † Full Cure: 4 weeks

**RECOMMENDED PRIMER / SYSTEMS:**

**PREVIOUSLY PAINTED SURFACES:**

- Although BEHR PREMIUM PLUS® Zero VOC\* Paint is Self-Priming over most properly prepared surfaces, it is recommended for optimum performance to follow the primer recommendations provided below

**PROPERLY PREPARED NEW SURFACES:**

**Gypsum Wallboard:**

- BEHR PREMIUM PLUS® Stain-Blocking Primer & Sealer No. 75
- BEHR PREMIUM PLUS® Interior Drywall Primer & Sealer No. 73

**Plaster:**

- BEHR PREMIUM PLUS® Stain-Blocking Primer & Sealer No. 75

**Wood:**

- BEHR PREMIUM PLUS® Stain-Blocking Primer & Sealer No. 75
- BEHR PREMIUM PLUS® Interior/ Exterior Oil-Based Primer & Sealer No. 434

**Tannin/Stainblocking:**

- BEHR PREMIUM PLUS® Stain-Blocking Primer & Sealer No. 75
- BEHR PREMIUM PLUS® Interior/Exterior Oil-Based Primer & Sealer No. 434

**Masonry:**

- BEHR PREMIUM® Concrete & Masonry Bonding Primer No. 880
- BEHR PREMIUM® Basement & Masonry Waterproofer No. 875 or BEHR PREMIUM® Concrete & Masonry Waterproofer No. 870
- BEHR PREMIUM PLUS® Stain-Blocking Primer & Sealer No. 75

**Masonry with pH Levels up to 13.0:**

- BEHR PREMIUM® Basement & Masonry Waterproofer No. 875 or BEHR PREMIUM® Concrete & Masonry Waterproofer No. 870

**Galvanized Metal, Metal & Aluminum:**

- BEHR PREMIUM PLUS® Stain-Blocking Primer & Sealer No. 75

COMPLIES WITH THE BELOW AS OF 3/22/2011			
OTC	YES	MPI X-GREEN	YES
SCAQMD	YES	GREENGUARD Certified	YES
CARB	YES	MPI #	53
CHPS	YES	NAHB	YES
LEED®: R/CI	YES	LEED®: R/NC	YES
LEED®: SC	YES	LEED®: HC	YES
LEED®: H	YES	LEED®: CS	YES

**CAUTIONS/LIMITATIONS:**

- Protect from freezing.
- Do not use on floors.
- For best results, apply at temperatures between 50°F - 90°F. Temperatures above 90°F may affect the application such as drying too fast, whereas temperatures less than 50°F can cause slow drying or prevent proper film formation.
- Avoid heavy traffic for 24 hours.
- Allow four weeks before washing or cleaning for full cure.
- Shelf life under normal conditions is two years unopened.

**CLEAN UP:**

Clean all tools and equipment with clean water. For disposal of empty containers and unused product, contact your household refuse collection service.

**† WARNING!** If you scrape sand or remove old paint, you may release lead dust. **LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE.** Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting the National Lead Information Hotline at 1-800-424-LEAD or log on to [www.epa.gov/lead](http://www.epa.gov/lead). **WARNING!** This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **WARNING!** Sanding or scraping pressure treated lumber may be hazardous; wear appropriate protection.

\*This information is provided "as is" and no representations or warranties, either expressed or implied, or merchantability, fitness for a particular purpose or of any other nature are made with respect to this information or to any product referred to in this information.

† Some colors may not be zero V.O.C. after tinting.

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CSI #: 09 93 00

**TECHNICAL DATA SHEET**

**BEHR** TRANSPARENT WATERPROOFING  
WOOD FINISH  
NO. 400 SERIES



**PRODUCT INFORMATION**

This product, due to its durable waterproofing formula, lasts up to 2 years on decks and 4 years on fences and siding. The 100% acrylic formula is available in 3 transparent colors that accent wood grain. For UV protection, the product is enhanced with silicone. Cleans up easily with soap and water and is also mildew resistant.

**RECOMMENDED USES:**

"For wood substrates only." Recommended for properly prepared new to slightly weathered, unsealed exterior wood surfaces (0-5 years exposure) such as: Decks, Railings, Shakes, Shingles, Siding, Roofs, Fences and Wood Patio Furniture.

COMPLIES WITH BELOW AS OF 3/22/2011			
OTC	YES	CARB	YES
SCAQMD	YES	MPI #	33

**PRODUCT SPECIFICATIONS:**

**Pre-Mixed Colors:**

- 400 Natural
- 401 Cedar Naturaltone
- 402 Redwood

**Vehicle Type:** 100% Acrylic

**Weight Per Gallon:** 8.61 +/- 0.2 lbs./gal

**% Solids:**

- By Volume: 18.8 +/- 2%
- By Weight: 21.2 +/- 2%

**VOC:** <275 (g/l)

**Flash Point:** Not Applicable

**Viscosity:** 20-45 sec #2 Zahn Cup

**Recommended Film Thickness:**

- Wet: 5.3 Dry: 1.0 mils @ 300 ft<sup>2</sup>/gal
- Wet: 2.6 Dry: 0.5 mils @ 600 ft<sup>2</sup>/gal

**Coverage:** 300-700 ft<sup>2</sup>/gal, depending on application method and substrate porosity. Does not include the loss of material from spraying.

**APPLICATION:**

- MUST PREP BEFORE STAINING
- Wood surface must be completely dry prior to staining
- Intermix multiple containers to ensure color uniformity
- Avoid applying too heavily
- Temperature Range: 40-90°F (4.5-32°C)
- Application methods:
  - Pad applicator (for larger areas)
  - Nylon/polyester brush (for areas requiring more accuracy)
  - 3/8" nap roller (rough surfaces only)
  - Airless sprayer with 0.015-0.019" tip\*
- \*Follow spraying immediately with back brushing or back rolling for a uniform appearance.
- Work in small sections lightly saturating the surface and immediately back-brush or use pad applicator to eliminate puddling; remove excess and evenly distribute the finish. Maintain a wet edge when applying.
- Dry Time\*: Recoat after 1-2 hours  
Wait 24-48 hours before light foot traffic.  
72 hours for full cure.
- \*Cool temperatures and/or high humidity will require additional drying time.
- 2 coats required (must apply second coat thinner than the first coat)
- For optimum performance, coat all six sides of wood

**CAUTIONS/LIMITATIONS:**

- Protect from freezing
- Do not use if rain is expected within 24 hours
- DO NOT THIN PRODUCT
- Avoid applying stain in direct sunlight or to hot surfaces
- Test product for color on a small hidden area before proceeding
- Over application of stain will lead to surface failure including peeling & cracking
- Stained surfaces may become slippery when wet.
- Shelf life under normal conditions is 2 years (unopened containers)

**CLEAN UP:**

Brushes and other equipment can be cleaned with warm, soapy water. For disposal of empty containers and unused product, contact your household refuse collection service.

**† WARNING!** If you scrape sand or remove old paint, you may release lead dust. **LEAD IS TOXIC. EXPOSURE TO LEAD DUST CAN CAUSE SERIOUS ILLNESS, SUCH AS BRAIN DAMAGE, ESPECIALLY IN CHILDREN. PREGNANT WOMEN SHOULD ALSO AVOID EXPOSURE.** Wear a NIOSH-approved respirator to control lead exposure. Clean up carefully with a HEPA vacuum and a wet mop. Before you start, find out how to protect yourself and your family by contacting the National Lead Information Hotline at 1-800-424-LEAD or log on to [www.epa.gov/lead](http://www.epa.gov/lead). **WARNING!** This product contains chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **WARNING!** Sanding or scraping pressure treated lumber may be hazardous; wear appropriate protection.

\*This information is provided "as is" and no representations or warranties, either expressed or implied, or merchantability, fitness for a particular purpose or of any other nature are made with respect to this information or to any product referred to in this information.

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# Division 10

## Specialties



CSI #: 10 28 00

8/21/13

St. Paul Del Mar 30 in. W Vanity with AB Engineered Composite Top in White-DMSD30P2COM-W at The Home Depot

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### St. Paul Del Mar 30 in. W Vanity with AB Engineered Composite Top in White



Model # DMSD30P2COM-W Internet # 100672710  
Store SKU # 670826

**\$199.00 / each**

This item cannot be shipped to the following state(s): GU,PR,VI

Free shipping is not available for this item

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## PRODUCT OVERVIEW

The Del Mar Collection from WoodCrafters combines a contemporary mix between a classic shaker-style vanity and a Euro-style vanity top. This vanity and top combination are sure to add a modern look to any bathroom. The vanity has a furniture style toe kick for that added flare.

- 30 in. W x 12.5 in. D x 36 in. H vanity cabinet
- AB engineered composite vanity top included with integral sink and 1 in. H backsplash
- Included vanity top is pre-drilled for 4 in. centerset faucet
- Includes brushed nickel cabinet hardware
- Vanity constructed of laminated engineered wood
- Vanity doors feature 6-way adjustable European concealed hinges
- Vanity features a furniture-style toe kick
- Alternative vanity cabinet sizes available; see coordinating items section
- Matching mirrors sold separately Model # DMMC20COM-W
- Sidesplash not available
- Faucet not included
- Note: Product may vary by store
- MFG Model # : DMSD30P2COM-W
- MFG Part # : DMSD30P2COM-W

## Info & Guides

### Specification

### Warranty

You will need Adobe® Acrobat® Reader to view PDF documents. [Download](#) a free copy from the Adobe Web site.

## SPECIFICATIONS

Adjustable hinges	Yes	Adjustable levelers	No
Assembled Depth (in.)	18.8 in	Assembled Height (in.)	36.4 in
Assembled Width (in.)	30 in	Assembly Required	No
Backsplash height (in.)	2.5	Backsplash included	Yes
Basin Depth (in.)	5	Basin Length (in.)	11.5
Basin Width (in.)	19	Basin color	White
Basin included	Yes	Basin material	Composite

CSI #: 10 28 00

8/21/13

Erias Home Designs Somerset 36 in. x 30 in. Beveled Wall Mirror-201240 at The Home Depot

**FREE SHIP TO STORE<sup>®</sup> OR HOME<sup>™</sup>. NOW AVAILABLE ON OVER 400,000 ITEMS.**



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### Erias Home Designs Somerset 36 in. x 30 in. Beveled Wall Mirror

Model # 201240 Store SKU # 103649

**\$29.99 / each**

This item cannot be shipped to the following state(s): AK, HI

**Store Only**

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## PRODUCT OVERVIEW

The ERIAS HOME DESIGNS Somerset 36 in. x 30 in. Beveled Wall Mirror is a rectangular mirror that features elegant beveled edges. The mirror is ready for horizontal or vertical wall mounting.

- Beveled edges
- Rectangular design
- Horizontal or vertical hanging
- For wall mounting
- Wall opening: 14 in. x 24 in. x 3-1/2 in.
- MFG Model # : 201240
- MFG Part # : 20-1240

## SPECIFICATIONS

Assembled Depth (in.)	.25 in	Assembled Height (in.)	36 in
Assembled Width (in.)	30 in	Attached shelf	No
Fog Free	No	Light	No
Magnifying	No	Mirror type	Single
Mount Location	Wall	Orientation	Vertical / Horizontal
Product Height (in.)	36	Product Width (in.)	30
Telescoping	No		

**CSI #: 10 28 13**

10/6/12

KOHLER | K-37050 | Alteo 18-Inch Towel Bar

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OF KOHLER.

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**Alteo®**  
18" towel bar

Like 0  
K-37050-CP



**Alteo®**

Streamlined for contemporary style, Alteo accessories complement Alteo faucets to provide a coordinated look for your bathroom. This elegant 18-inch towel bar offers a sleek setting for your towels.

**Features**

- Premium metal construction for durability.
- KOHLER finishes resist corrosion and tarnish.
- Coordinates with Alteo faucets and accessories.

**Installation**

- Tools and installation template included.

**Parts, Service & Support**

- [Care & Cleaning Tips](#)
- [Warranty Information](#)

Have a question or concern about this product? If you don't find your answer, we're always here to help.

Call 1-800-4KOHLER (1-800-456-4537) or [send us a question or request](#).

**Standard Options**

Color / Finish **Polished Chrome**

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List Price:

**\$29.60**

Total **\$29.60** QTY: 1

[www.us.kohler.com/us/Alteo-18-towel-bar/productDetail/Towel-Bars/428402.htm?brandId=641143&sk...](http://www.us.kohler.com/us/Alteo-18-towel-bar/productDetail/Towel-Bars/428402.htm?brandId=641143&sk...)

1/2

**CSI #: 10 28 13**

10/6/12

KOHLER | K-37055 | Alteo Robe Hook

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**Alteo®**  
robe hook

Like 0  
K-37055-CP



**Alteo®**

Streamlined for contemporary style, Alteo accessories match Alteo faucets to provide a coordinated look for your bathroom. Constructed of durable metal, this robe hook makes a practical and stylish addition to a variety of bathroom decors.

**Features**

- Premium metal construction for durability.
- KOHLER finishes resist corrosion and tarnish.
- Coordinates with Alteo faucets and accessories.

**Installation**

- Tools and installation template included.

**Parts, Service & Support**

- [Care & Cleaning Tips](#)
- [Warranty Information](#)

Have a question or concern about this product? If you don't find your answer, we're always here to help.

Call 1-800-4KOHLER (1-800-456-4537) or [send us a question or request](#).

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Color / Finish **Polished Chrome**



List Price:

**\$17.00**

Total **\$17.00** QTY: 1



**CSI #: 10 28 13**

10/6/12

KOHLER | K-37054 | Alteo Toilet Tissue Holder

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**Alteo®**  
pivoting toilet tissue holder

Like 0  
K-37054-CP



**Alteo®**

Streamlined for contemporary style, Alteo accessories match Alteo faucets to provide a coordinated look for your bathroom. Constructed of durable metal, this toilet tissue holder uses an innovative pivot mechanism that simplifies changing tissue rolls.

**Features**

- Pivoting holder makes changing toilet tissue quick and simple.
- Premium metal construction for durability.
- KOHLER finishes resist corrosion and tarnish.
- Coordinates with Alteo faucets and accessories.

**Installation**

[My Kohler Sign In or Register](#)

[My Folders](#)

[My Comparisons](#)

**Parts, Service & Support**

- [Care & Cleaning Tips](#)
- [Warranty Information](#)

Have a question or concern about this product? If you don't find your answer, we're always here to help.

Call 1-800-4KOHLER (1-800-456-4537) or [send us a question or request](#).

**Standard Options**

Color / Finish **Polished Chrome**



List Price:

**\$29.00**

Total **\$29.00** QTY: 1

[www.us.kohler.com/us/Alteo-pivoting-toilet-tissue-holder/productDetail/.../428404.htm?skuld=410400...](http://www.us.kohler.com/us/Alteo-pivoting-toilet-tissue-holder/productDetail/.../428404.htm?skuld=410400...)

1/2

# Division 11

## Equipment

**CSI #: 11 31 00**

## GE® 0.7 Cu. Ft. Capacity Countertop Microwave Oven



Model# JE740DRWW



- 0.7 cu. ft. capacity - 700 Watts (IEC-705 test procedure)
- Optional hanging kit - Frees up counter space
- Convenience cooking controls - Operating made quick and easy
- Auto and time defrost - Defrosting times and power levels are programmed automatically or manually for optimal results
- Turntable - Rotates food throughout the cycle
- Instant on controls - One-touch instant operation
- Control lockout - Helps prevent accidental activation
- Kitchen timer - Minute timer helps keep you on track
- Cooking complete reminder - Know when your food is ready

### FEATURES

Control Type	Electronic Touch
Cooking Modes	Microwave
Cooking Technology	Microwave
Microwave Watts (IEC-705)	700.0
Power Levels	10
Turntable	Glass
Turntable Size	9.625
Microwave Convenience Cooking Controls	Beverage (Instant-On) Pizza (Instant-On) Popcorn (Instant-On) Potato (Instant-On) Reheat (3 Codes) Vegetables (4 Codes)
Control Features	Add 30 Seconds (Instant-On) Auto & Time Defrost Clear/Off Clock - 12 Hr. Control Lock Cooking Complete Reminder Start/Pause Kitchen Timer Time Cook I & II

Have more questions? Please contact 1-800-626-2005

CSI #: 11 31 00

Fully Integrated Dishwasher w/ TrueSteam™ Technology

**LDF8072ST**



## STOP WASHING YOUR DISHES, BEFORE YOU WASH YOUR DISHES.

Don't waste time pre-washing your dishes for the dishwasher. Let our TrueSteam™ technology do the work. Our powerful, yet gentle TrueSteam™ generator virtually eliminates the need to pre-wash dishes. It also includes our EasyRack™ Plus with a Height Adjustable 3rd Rack allowing you to change the racks around easily to fit any load. Finally, there's a dishwasher that gets the job done.

### SPECIFICATIONS

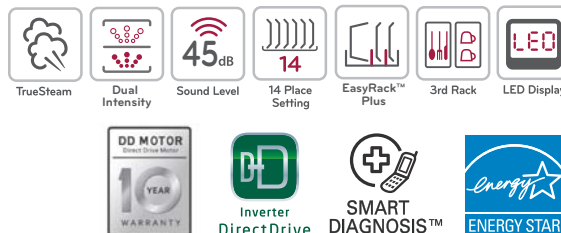
- 14 Place Settings
- 7 Cycles
- Stainless Steel Tub
- 3-Stage Filtration System
- BPA-Free Nylon Coated Tines
- ENERGY STAR Qualified

### STYLISH DESIGN

- Hidden SmoothTouch™ Controls with LED Display
- 4 SignalLight™ LED Cycle Indicator Lights
- Matching Commercial Handle

### INNOVATIONS

- TrueSteam™
- Steam Power Cycle
- EasyRack™ Plus with Fully Adjustable Color-coded Tines
- Height Adjustable 3rd Rack
- One-touch Height Adjustable Upper Rack
- 45 dB LoDecibel™ Quiet Operation
- Slim DirectDrive Motor
- Safety Water Overflow Detector
- 19-Hour Delay Start
- LoDecibel™ Quiet Operation
- SenseClean™ Wash System
- Variable Spray Intensities
- Dual Wash Mode
- NSF-Certified Sanitary Rinse
- Hybrid Condensing Drying System



### TrueSteam™ Generator

Powerful yet gentle TrueSteam™ virtually eliminates the need to pre-wash. The built-in TrueSteam™ generator also enables gentle cleaning for fragile items (like stemware), and can be selected on other cycles for heavy-duty cleaning.

### EasyRack™ Plus w/ Height Adjustable 3rd Rack

The newly-enhanced EasyRack™ Plus system provides outstanding flexibility and convenience, adjusting to just about any load of dishes to ensure optimal cleaning performance. Easy to adjust on-the-fly, this racking system can shift to handle any challenge your dishes can serve up.

The **Height Adjustable 3rd Rack** gives you more space to fit everything from long flatware to small espresso cups.

### LoDecibel™ Operation

LG's technological advances, like the Inverter DirectDrive motor and the advanced 3-stage filtration system, were designed with quiet in mind. At **45dB**, this dishwasher is among the quietest dishwashers in its class.

CSI #: 11 31 00

Fully Integrated Dishwasher w/ TrueSteam™ Technology

# LDF8072ST



## CAPACITY

Total Place Settings	14
Upper Rack Dish Height Limit	12"
Lower Rack Dish Height Limit	14"

## RACKS AND BASKETS

Cutlery Baskets	3-in-1 Detachable Baskets
Stemware Holders	•
Racks and Tines	Nylon Coated with Rounded Tips
EasyRack™ Plus System	•
Upper Rack Color-Coded Foldable Tines	•
Lower Rack Color-Coded Foldable Tines	•
Height Adjustable Upper Rack	•

## STYLE AND DESIGN

Electronic Controls	Hidden SmoothTouch™ Controls with LED Display
Time Remaining Indicator	•
Rinse-Aid Indicator	•
Signalight™ Cycle Indicator Lights	4: Wash, Rinse, Dry, Clean
Tub Material	Stainless Steel
Handle	Matching Commercial Handle
Available Colors	Stainless Steel (ST)

## FEATURES

TrueSteam™	•
LoDecibel™ Quiet Operation	•
Slim Direct Drive Motor	•
Overflow Detector	•
120°F Inlet Water Capability	•
3-Stage Filtration System	•
Delay Start	Up To 19 Hours
Child Lock	•

## PERFORMANCE

Number of Wash Cycles	7
Wash Cycles	Steam Power, Normal, Quick & Dry, Quick Wash, Rinse Only, SteamDelicate™, Steam Dual
SenseClean™ Wash System	•
Dual Spray Intensity Feature	•
Variable Spray Intensities	Strong/Medium/Soft
TrueSteam™ Cycles	•
Steam Power Cycle	•
Steam Delicate Cycle	•
Steam Dual Cycle	•
Sanitary Rinse Cycle	•
Extra Rinse Option	•
Multi-Level Water Direction	5
Hybrid Condensing Drying System	•
Noise Level	45 dB

## POWER SOURCE/RATING

Ratings/Requirements/Type	UL Listed/120 V, 12 Amps/60 Hz
Circuit Breaker Size	15 Amps
Energy Star	•

## DIMENSIONS

Unit Dimensions (WxHxD)	23 3/4" x 33 1/2" x 24 5/8"
Required Clearances (WxHxD)	24" x 24" x 33 1/2"
Carton Dimensions (WxHxD)	27 1/5" x 35 1/10" x 29 3/5"
Weight (Unit/Carton)	110.2 lbs / 116.4 lbs

## LIMITED WARRANTY

1 Year Labor, 2 Year Parts, 5 Years on Control Board and Rack Parts, 10 Years Direct Drive Motor Lifetime on the Stainless Steel Tub and Door Liner
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## UPC CODES

LDF8072ST (Stainless Steel)	048231 012041
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**CSI #: 11 31 00**

Ultra Large Capacity SteamDryer™

**DLEX2650\_/DLGX2651\_**



## WITNESS THE POWER OF STEAM

Convenience comes standard when you bring home this ultra-capacity SteamDryer. Enjoy innovative features like steam technology that will have you ironing much less, or SteamFresh™, a 20-minute drying cycle, that refreshes your favorite shirt in time for the big party. And, when you add ultra-large capacity to the mix, the result is a powerful duo—steam and capacity—that can make your life much easier and deliver a dryer that makes a difference.

### SPECIFICATIONS

- 7.3 cu. ft. Ultra Large Capacity with Aluminized Alloy Steel Drum
- 9 Drying Programs
- 5 Temperature Settings

### STYLISH DESIGN

- Upfront Electronic Control Panel with Dual LED Display and Dial-A-Cycle™
- Chrome Rimmed Glass Door
- Reversible Door
- Stackable with Matching Washer (Stacking Kit sold separately)
- Optional Matching Drawer Pedestal

### INNOVATIONS

- TrueSteam™ Technology
- SteamFresh™ Cycle
- SteamSanitary™ Cycle
- ReduceStatic™ Option
- EasyIron™ Option
- Sensor Dry System
- Precise Temperature Control with Variable Heat Source
- LoDecibel™ Quiet Operation
- SmartDiagnosis™
- 3 Minute Installation Check
- FlowSense™ Duct Clogging Indicator
- Wrinkle Care Option
- Anti-Bacterial Option
- Damp Dry Signal



### Ultra Large Capacity

Do laundry a little less often. With **7.3 cubic feet of capacity**, this dryer handles really large loads, saving you time and energy.

### Steam Technology

A lot of those drying headaches can be a thing of the past. Our **TrueSteam™ Technology** generates real steam to reduce wrinkles and odors, and practically eliminates the need for ironing.

### SteamFresh™ Cycle

Late for the party and no time to iron your favorite outfit? The **SteamFresh™ Cycle** refreshes and reduces wrinkles in up to five garments at a time with one 20-minute dryer cycle.

CSI #: 11 31 00

Ultra Large Capacity SteamDryer™

# DLEX2650\_/DLGX2651\_



## CAPACITY

Capacity	7.3 cu. ft.
----------	-------------

## APPEARANCE

Design Look	Front Control
Intelligent Electronic Controls with Dual LED Display	
Dial-A-Cycle™	

## DRYING PROGRAMS

No. of Programs	9
Programs (Sensor Dry)	Cotton/Normal, Perm. Press, Towels, Delicates, Heavy Duty, SteamFresh™, SteamSanitary™
Programs (Manual Dry)	Speed Dry, Air Dry
No. of Options	10
Options	More Time, Less Time, Custom Program, Damp Dry Signal, Wrinkle Care, Child Lock, ReduceStatic™, EasyIron™, Rack Dry, End of Cycle Signal
Temperature Settings	High, Medium High, Medium, Low, Ultra Low
Drying Levels	Very Dry, More Dry, Normal Dry, Less Dry, Damp Dry
Manual Dry Times	60 min., 50 min., 40 min., 30 min., 20 min., More Time/Less Time

## FABRIC CARE FEATURES

SteamFresh™ Cycle	
SteamSanitary™ Cycle	
ReduceStatic™ Option	
EasyIron™ Option	
Sensor Dry	
Precise Temperature Control and Variable Heater	

## CONVENIENCE FEATURES

LoDecibel™ Quiet Operation	
SmartDiagnosis™	
FlowSense™ Duct Clogging Indicator	
Wrinkle Care Option	
Remaining Time Display/Status Indicator(s)	
End of Cycle Signal	
Child Lock	
Drying Rack	
Drum Light	
Reversible Door	
Leveling Legs	4 Adjustable Legs
Venting Option	Electric: 4 Way Venting / Gas: 3 Way Venting
3 Minute Installation Check	

## MATERIALS AND FINISHES

Aluminized Alloy Steel Drum	
Cabinet	Painted Steel
Control Panel	Plastic
Top Plate	Painted Steel
Transparent Glass Door	
Door Rim	Chrome Rimmed Glass Door
Available Colors	White (W), Wild Cherry Red (R)

## POWER SOURCE

Ratings	CSA Listed
Electrical Requirements	120V, 15 Amps (Gas) / 240V, 30 Amps (Electric)
Type	Gas/Electric

## OPTIONS

Pedestal	WDP4W/WDP4R
Pedestal (WxHxD)	27" x 13 3/5" x 28 2/5"
Stacking Kit	KSTK1
LP Conversion Kit	383EEL3002D
Side Venting Kit	3911EZ9131X

## DIMENSIONS

Product (WxHxD)	27" x 38 11/16" x 29 3/4" (51" D with door open)
Carton (WxHxD)	29 1/2" x 42 1/4" x 31 1/4"
Weight (Product/Carton)	129lbs./144lbs.

## LIMITED WARRANTY

1 Year Parts and Labor

## UPC CODES

DLEX2650R Electric Dryer (Wild Cherry Red)	048231 013048
DLGX2651R Gas Dryer (Wild Cherry Red)	048231 013055
DLEX2650W Electric Dryer (White)	048231 012973
DLGX2651W Gas Dryer (White)	048231 012980
WM2650HRA Washer (Wild Cherry Red)	048231 012652
WM2650HWA Washer (White)	048231 012621
WDP4R Pedestal (Wild Cherry Red)	048231 011204
WDP4W Pedestal (White)	048231 011211
KSTK1 Stacking Kit (Chrome)	048231 013024

Optional washer & pedestals sold separately.



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Customer Service and Technical Support: (800) 243-0000

[LG.com](http://LG.com)

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CSI #: 11 31 00

Extra Large Capacity SteamWasher™ with ColdWash™

**WM2650H\_A**



## TOUGH ON STAINS. GENTLE ON FABRICS.

So long to dirt, odors, and household allergens and experience a level of clean you have never experienced before. Our steam technology powerfully penetrates fabrics for advanced cleaning, while being oh-so gentle to even your most delicate fabrics. This washer also features the Allergiene™ Cycle, which helps remove those unwanted household allergens like dust mites and pet dander. That's right...now you can take it easy – This washer has it all under control.

### SPECIFICATIONS

- 3.6 cu. ft. Extra Large Capacity with NeveRust™ Stainless Steel Drum
- Direct Drive Motor with 10-Year Limited Warranty
- 1,200 RPM
- 9 Washing Programs
- 5 Temperature Settings (All Cold Rinses)

### STYLISH DESIGN

- Upfront Electronic Control Panel with Dual LED Display and Dial-A-Cycle™
- Chrome Rimmed Glass Door
- Stackable with Matching Dryer (Stacking Kit Sold Separately)
- Optional Matching Drawer Pedestal

### INNOVATIONS

- Steam™ Technology
- AAFA Certified Allergiene™ Cycle
- NSF Certified Sanitary Cycle
- ColdWash™ Option
- 6Motion™ Technology
- SmartDiagnosis™
- TrueBalance™ Anti-Vibration System
- Magnet Ventilation
- ENERGY STAR Most Efficient 2012
- LoDecibel™ Quiet Operation
- SenseClean™
- Delay Wash (Up to 19 Hours)
- 10° TiLTub™



### Steam Technology

There's no clean like a steam clean. Our **Steam Technology** gently but powerfully penetrates fabrics to virtually eliminate dirt, odors and wrinkles.

### ColdWash™ Technology

Now using the cold cycle on your washer doesn't have to mean compromising. **ColdWash™ Technology** uses cold water and enhanced washing motions to penetrate deep into fabrics, giving you cold water savings with warm water performance.

### 6Motion™ Technology

Get your clothes clean and experience a smarter way to wash with our innovative **6Motion™ Technology**. Each wash cycle combines up to 6 different wash motions to provide a revolutionary cleaning experience.



CSI #: 11 31 00

Extra Large Capacity SteamWasher™ with ColdWash™

# WM2650H\_A



## CAPACITY

Capacity	3.6 cu. ft.
----------	-------------

## APPEARANCE

Design Look	Front Control
Intelligent Electronic Controls with Dual LED Display	•
Dial-A-Cycle™	•

## ENERGY

Energy Star	•
2012 ENERGY STAR MOST EFFICIENT	•

## WASH PROGRAMS

No. of Programs	9
Wash Programs	Cotton/Normal, Bulky/Large, Perm. Press, Delicates, Hand Wash/Wool, Speed Wash, Sanitary, Allergiene™, Tub Clean
No. of Options	9
Options	Prewash, Rinse+Spin, Delay Wash, Water Plus, Extra Rinse, Child Lock, ColdWash™, Signal On/Off, Steam
No. of Wash/Rinse Temps	Extra Hot, Hot, Warm, Cold, Tap Cold (All Cold Rinses)
Spin Speeds	Extra High (1,200 max.), High, Medium, Low, No Spin
No. of Water Levels	Automatically adjusts to the size of load
No. of Soil Levels	5

## FABRIC CARE FEATURES

Steam	•
ColdWash™ Option	•
Allergiene™ Cycle	•
SenseClean™ System	•

## CONVENIENCE FEATURES

4 Tray Dispenser	Prewash, Main Wash (with liquid detergent cup), Bleach, Fabric Softener
TrueBalance™ Anti-Vibration System	•
SmartDiagnosis™	•
LoadSense	•
Status Indicator(s)	•
End of Cycle Signal	•
Child Lock	•
Auto Suds Removal	•
Forced Drain System	•
Internal Water Heater	•
LoDecibel™ Quiet Operation	•
Leveling Legs	4 Adjustable Legs
Easy Loading Tilt™	•

## MOTOR AND AGITATOR

Motor Type	Direct Drive Motor
Motor Speed	Variable
Max RPM	1,200
Axis	Horizontal

## MATERIALS AND FINISHES

NeveRust™ Stainless Steel Drum	•
Cabinet	PCM
Control Panel	Plastic
Top Plate	Painted
Transparent Glass Door	•
Door Rim	Chrome Rimmed Glass Door
Available Colors	White (W), Wild Cherry Red (R)

## POWER SOURCE

Ratings	UL Listed
Electrical Requirements	120V, 10 Amps
Type	Electric

## OPTIONS

Pedestal	WDP4W, WDP4R
Pedestal (WxHxD)	27" x 13 3/5" x 28 2/5"
Stacking Kit	KSTK1

## DIMENSIONS

Product (WxHxD)	27" x 38 11/16" x 29 3/4" (51" D with door open)
Carton (WxHxD)	29 1/2" x 42 1/4" x 31 1/4"
Weight (Product/Carton)	181.8 lbs/192.9 lbs

## LIMITED WARRANTY

	1 Year Parts and Labor, 10 Years Motor Lifetime on Drum
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## UPC CODES

WM2650HRA Washer (Wild Cherry Red)	048231 012652
WM2650HWA Washer (White)	048231 012621
DLEX2650R Electric Dryer (Wild Cherry Red)	048231 013048
DLGX2651R Gas Dryer (Wild Cherry Red)	048231 013055
DLEX2650W Electric Dryer (White)	048231 012973
DLGX2651W Gas Dryer (White)	048231 012980
WDP4R Pedestal (Wild Cherry Red)	048231 011204
WDP4W Pedestal (White)	048231 011211
KSTK1 Stacking Kit (Chrome)	048231 013024



Optional dryer & pedestals sold separately.

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COOKTOP

LCE30845



## INDUCTION COOKTOP



### LCE30845

#### Cooking Performance

- 4 Cooking Elements with Bridge
- 100% Induction Bridge Element

#### Style and Design

- Premium Stainless Steel Trim

#### Convenience Features

- SmoothTouch™ Controls
- Premium Grade Griddle Included



LGusa.com

CSI #: 11 31 00



## INDUCTION COOKTOP

### How Does Induction Work?

The electromagnetic energy generated by an induction coil reacts only with iron-like metals, not with ceramic surfaces. The pot absorbs the electromagnetic energy, and converts it into heat. Only the bottom of the pot is heated, which guarantees even heating, safety and energy savings.

### Bridge Element with 100% Induction Cooking

In addition to being used separately, the left front and left rear elements can be joined by the bridge element to evenly heat longer pans and griddles; perfect for your pancakes and French toast. Unlike most manufacturers, LG's induction cooktop features a bridge element that uses 100% induction, with no need for a traditional heating element.

### SmoothTouch™ Controls

Activate and control the temperature setting with the touch of a finger.



### Cooking Zone Layout

Accommodates all kinds of cooking needs from large pan to the supplied griddle.

### Streamlined Design

Elegant ceramic glass with a premium stainless steel trim will complement any kitchen décor.

LCE30845	
Type	Electric Induction
Size	30"
<b>CONFIGURATION</b>	
No. of Cooking Zones	4 (Plus Bridge)
Cooking Zone Configuration	
Large: Right Rear	1 – 10" Induction
Small: Right Front	1 – 6" Induction
Standard: Left Side	2 – 7" Induction
Bridge: Left Side	1 – 7" x 16 5/8" Induction
Power Boost*	All Cooking Zones (Minus Bridge)
Warming Function	All Cooking Zones
<b>CONTROLS</b>	
Type	Electronic Glass Touch
Location	Front
Touch Pads	18
Kitchen Timer	1 – 99 min.
<b>SAFETY FEATURES</b>	
Automatic Shut-Off	17 Hours
Child Lock	•
Hot Surface Indication	•
<b>COLOR</b>	
Surface / Trim	Black / Stainless Steel
<b>MATERIALS/FINISHES</b>	
Control Panel	Ceramic Glass
Cooking Surface	Ceramic Glass
Frame (Trim)	Stainless Steel
<b>POWER SOURCE</b>	
Electric Supply	240V/208V, 60Hz AC
Max. Amp Load	32 Amp
Power Cable Location	Left Rear
Total Connected Load	7.4kW @ 240V / 6.7kW @ 208V
Power Source	Electric
<b>DIMENSIONS</b>	
Depth	21 1/2" (54.5cm)
Height	2 3/16" (5.5cm)
Width	30 3/16" (78.3cm)
Product Weight	40.1 lbs (18.2 Kg)
Shipping Weight	52.3 lbs (23.7 Kg)
<b>CUTOUTS</b>	
Depth (Opening)	20 1/4" Min (51.4cm)
Width (Opening)	29 3/8" Min (74.6cm)
<b>ACCESSORIES</b>	
Griddle Pan	•
<b>WARRANTY</b>	
	1 Year Parts and Labor
	5 Years Parts on Cooktop and Induction Coils
<b>UPC CODE</b>	
LCE30845	048231 316033

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\*Power Boost is available on one cooking zone per side at a time.

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Printed in October 2007 SS-LCE30845

**CSI #: 11 31 00**

Top Mount refrigerator with factory installed ice system

**LTC20380**



## STYLE TO SPARE.

This large capacity top-mount refrigerator with 20 cubic feet of space at 30 inches wide has a lot to offer. The built-in ice maker and sophisticated styling transforms this traditional style refrigerator into a leader in its category. Meanwhile, the electronic temperature control system helps keep your food fresh by keeping temperature and humidity levels where they need to be.

### STYLE AND DESIGN

- 20 cu.ft.
- Premium Finishes in Stainless Steel, Smooth White, and Smooth Black Finishes
- Contoured Doors with Pocket Handles
- Premium LED Interior Lights (Refrigerator/Freezer)

### ORGANIZATION

- Full Width Pantry Drawer
- 2 Full Tempered Glass Shelves
- 2 Humidity Crispers
- 3 Door Bins
- 1 Dairy Bin

### PERFORMANCE

- Factory Installed Ice Maker
- Electronic Temperature Controls
- LoDecibel™ Quiet Operation



### Great Space in Style

Get the space you need in a refrigerator that's right for your kitchen. With **20 cu. ft.** of space, this top mount refrigerator offers a large capacity in its category at 30" wide.

### Fresher is Better

**Electronic Temperature Controls** designed to maintain humidity and temperature levels to help keep your food fresher, longer. Digital sensors constantly monitor conditions within the refrigerator to keep things cool.

### Premium LED Light

**Bright LED panels** on the rear of the refrigerator give you excellent light every time you look in the fridge. And they're not just convenient – they also save energy over traditional lighting.

**CSI #: 11 31 00**

Top Mount refrigerator with factory installed ice system

# LTC20380



## CAPACITY

Refrigerator	14.73 cu. ft.
Freezer	5.48 cu. ft.
Total	20.21 cu. ft.

## FEATURES

Energy Rating	Energy Star
Freezer Door Type	Top Swing Door
Temperature Controls	Electronic
Temperature Sensors	•
LoDecibel™ Quiet Operation	•

## REFRIGERATOR

No. of Shelves	2 Full
Shelf Construction	Tempered Glass
Crisper Bins	2 Humidity Crispers
Full Width Pantry Drawer	•
Gallon Storage	2 Gallons
Refrigerator Light	Premium LED

## REFRIGERATOR DOOR

No. of Door Bins	3
Dairy Bin	1
Tall Item Retainer	•

## FREEZER

No. of Shelves	1
Shelf Construction	Tempered Glass
No. of Door Bins/Shelves	2
Auto Defrost	•
Freezer Light	Premium LED

## MATERIALS AND FINISHES

Contour Door	•
Reversible Door	•
Surface	Coated Metal, Stainless Steel
Back	Flush & Metal cover over mechanical parts
Available Colors	Stainless Steel (ST), Smooth White (SW)

## DIMENSIONS/CLEARANCES/WEIGHT

Dimensions (W case x H top of hinge x D with handles)	29 3/4" x 66 1/8" x 33 3/8"
Depth with Door	33 3/8"
Depth without Door	29"
Depth (Total with Door Open)	60"
Height to Top of Case	65 1/2"
Height to Top of Door Hinge	66 1/8"
Width	29 3/4"
Installation Clearance	Sides 1/8", Top 1", Back 2"
Weight (Unit/Carton)	217 lbs./222 lbs.
Carton Dimensions (WxHxD)	31 3/4" x 69 13/16" x 38 1/8"

## RATINGS

Amps	20 Amp
UL Listed	•
Requirements	120V, 60Hz, 15 Amp

## LIMITED WARRANTY

1 Year Parts and Labor, 7 Years on the Sealed System

## UPC CODES

LTC20380ST Stainless Steel	048231 784481
LTC20380SW Smooth White	048231 784498
LTC20380SB Smooth Black	048231 784504



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**CSI #: 11 31 00**

## COOKING

# LWS3010ST

Single Built-In  
Wall Oven

### HIGHLIGHTS

Crisp Convection  
Self-Cleaning  
SmoothTouch™ Controls



### COOKING PERFORMANCE

- 4.7 cu. ft. Oven Capacity
- Convection Bake
- Convection Roast
- Crisp Convection

### STYLE AND DESIGN

- Premium Stainless Steel Finish
- Brilliant Blue Interior
- WideView™ Window

### CONVENIENCE

- SmoothTouch™ Glass Controls
- Convection Conversion
- Self-Cleaning
- 5 Heavy-Duty Racks with 5 Positions
- 3D Lighting
- Broil Pan



## THE SIMPLE RECIPE FOR SUCCESS

Get it right again and again with a Built-In Wall Oven that's sure to bring out your inner chef. Enjoy the handiness of LG's SmoothTouch™ glass controls to operate your oven with the touch of a finger. Plus, reach the ideal cooking temperature 30% faster with a Crisp Convection Oven. As you can see, no matter how you look at it, you'll find the perfect balance between style and performance.

CSI #: 11 31 00

COOKING

LWS3010ST



**CAPACITY**

Oven Capacity 4.7 cu.ft.

**FEATURES**

Configuration	Single Electric Wall Oven
Control Type	SmoothTouch™
Display	White VFD
Bake Element	2500W / 8 Pass (Hidden Bake)
Broil Element	2500W Inner / 1500W Outer / 8 Pass
Oven Cooking Technology	Crisp Convection
Cooking Modes	Bake, Broil, Convection Bake, Convection Broil, Warm, Proof, Favorites, Crisp Convection
Control Features	Delay Bake, Delay Clean, Automatic Shut-Off, Favorites
Self-Cleaning	•
Oven Light	•
No. of Racks	3 Heavy Duty Racks
Large WideView™ Window	•

**MATERIALS/FINISHES**

Available Colors	Stainless Steel (ST)
Handle	Matching Stainless
Door	Full Stainless Steel Wrap

**DIMENSIONS**

Overall Depth	24 3/8"
Overall Height	29 5/16"
Overall Width	29 3/4"
Cutout Depth	23 1/2"
Cutout Height	29"
Cutout Width	28 1/2"
Shipping Weight	179 lbs.

**POWER/RATINGS**

Amp Rating @208V	120/208 VAC
Amp Rating @240V	120/240 VAC
KW Rating @208V	3kW
KW Rating @240V	4.1kW

**ACCESSORIES**

Broiling Pan

**WARRANTY**

1 Year Parts and Labor

**UPC CODE**

LWS3010ST	Stainless Steel	048231 317092
-----------	-----------------	---------------



CSI #: 11 31 00

# XOBI Spec Sheet

Island Hood

**Model:** XOBI36S, XOBI42S

**Sizes:** 36" 42" **Depth:** 23 5/8"

**Features and Benefits:**

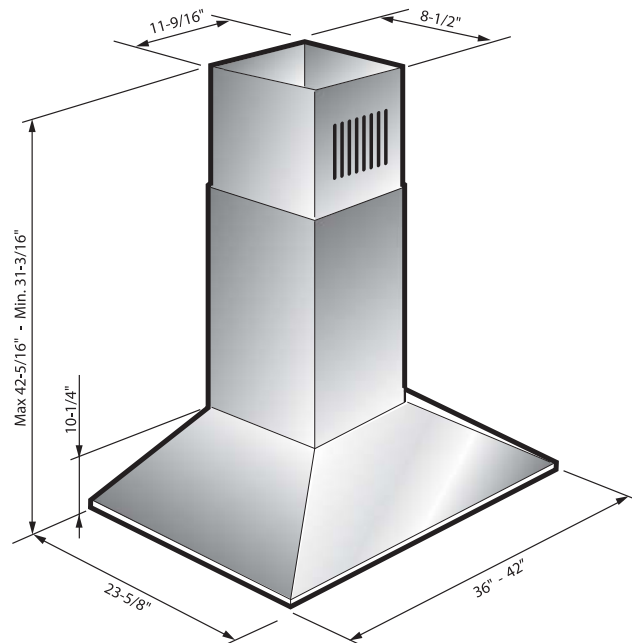
- 600 CFM high velocity blower optimally removes Smoke, Grease and Odors
- 3 speed electronic illuminated controls
- 15 Minute delay off
- Two 50 W Halogen Lights - Provide brilliant illumination over the cooking surface
- High quality Stainless Steel with incomparable handcrafted Italian finish
- Aluminum Mesh Filters - Trap airborne smoke and grease particles. They can be easily be removed for dishwasher-safe cleaning
- Standard Chimney fits ceilings up to 9 ft tall
- Mounting Height from cooking surface 27"-32"

**Duct Options and Electrical Requirements:**

- 6 inch duct required
- Ductless Option for applications where no ducting is available
- AC 115v—60hz (4amp)

**Options:**

- Optional duct cover extension is available for ceiling heights up to 10 ft tall  
**Model XOEDCBI**
- Optional recirculation kit available  
**Model XORFK04**



**XO**

[www.xoappliance.com](http://www.xoappliance.com)

XO is Exclusively Distributed by:  
Eastern Marketing Corp 24 Eisenhower Parkway Roseland,  
New Jersey 07068 800-966-8300  
[www.easternmarketingcorp.com](http://www.easternmarketingcorp.com)

All XO hoods are UL approved. 

DESIGNED & CRAFTED IN  
**ITALY**



# Division 12

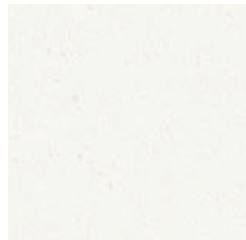
## Special Construction



CSI #: 12 36 51



Blizzard 2141



Pure White 1141



Ocean Foam 6141



Eggshell 3141



Misty Carrera \* 4141



Organic White 4600



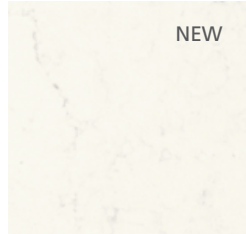
Quartz Reflections \* 7141



Nougat 6600



London Grey 5000



Frosty Carrina 5141



Belgian Moon 4100



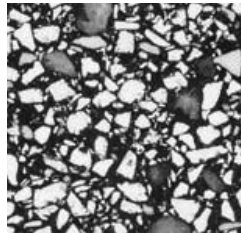
Atlantic Salt 6270



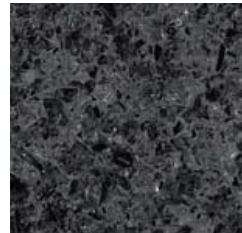
Cinder 2020



Haze 2030



Carbone \* 7150



Smoky Ash \* 6140

CSI #: 12 50 00

8/15/13

Linen Solid Linen - Linen - Home Fabrics

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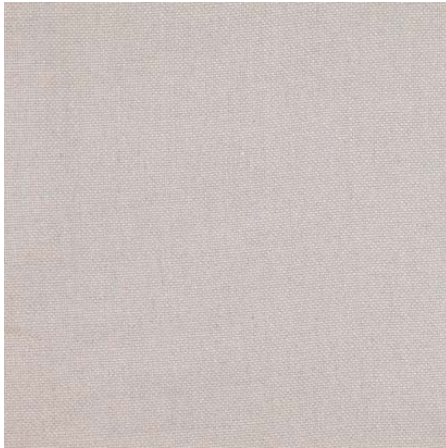
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201-933-7565

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## Linen Solid Linen

Product #: HL21503

**Price: \$30.00 /Yard**

(0 review s)

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Availability: **In stock** **R**

Returnable: Yes

QTY:  -

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### Product Details

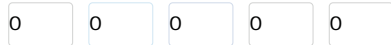
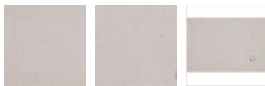
### Reviews (0)

This is a medium weight basket weave linen with a very subtle luster. Great for drapery and smaller upholstery projects.



Color: LINEN  
Width: 54"  
Content: LINEN

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# Division 13

## Special Construction



# Division 14

## Conveying Equipment



# Division 21

## Fire Suppression



### DISCOVER THE BLAZEMASTER CPVC DIFFERENCE

Only BlazeMaster Fire Sprinkler Systems offer all of the following:

#### APPROVALS AND LISTINGS

- UL Listed for exposed open solid wood and composite wood joist basements
- Approved for extended coverage sprinkler heads
- Approved for exposed installations (see manufacturer's installation instructions)

#### PRODUCT QUALITY AND PERFORMANCE

- BlazeMaster systems are made with the industry's only fully pressure-rated CPVC compounds and achieve a higher Hydrostatic Design Basis (HDB) at elevated temperatures compared to other CPVC fire protection systems; above the industry standards, pipes meet an HDB of 1250 psi at 180°F and fittings meet an HDB of 1000 psi at 180°F

#### SERVICE

- World-recognized installer training program
- Unmatched technical service and problem-solving team
- FBC™ System Compatible Program – the industry's only chemical compatibility testing program



### FEATURES AND BENEFITS

- Corrosion free for more than 50 years of service life, even in salt air environments
- Unable to sustain combustion with exceptional flame and smoke resistance with a flash ignition temperature of 900°F—significantly higher than most common construction materials
- Industry's first fully pressure-rated pipe and fitting compounds per Plastic Pipe Institute® with high impact and temperature resistance
- Meet and exceed regulatory requirements, including NSF International standards for potable water safety
- Reduced installation time with safe and dependable joining systems that eliminate the need for torches or complicated heat-fusion techniques
- Lower total installation costs due to superior solvent-weld methods, lightweight material, and extensive application area Listings and approvals
- Lower life-cycle costs over metallic systems that require continual maintenance
- Universally approved for use in both stand-alone and multipurpose fire sprinkler systems, unlike PE-X, which is only approved for multipurpose systems
- Meet all the requirements of National Fire Protection Association (NFPA) 13, 13R and 13D, as well as pertinent plumbing codes



**CSI #: 21 00 00**

**STAND-ALONE VS. MULTIPURPOSE SYSTEMS**

There are two options when designing a fire sprinkler system for one- and two-family homes (NFPA 13D applications). Each option has distinct advantages that should be considered when choosing the best system for a specific application.

**STAND-ALONE SYSTEMS**

A fire sprinkler system is installed separately and works independently from a plumbing system in this design. This ensures the integrity of both water systems by allowing the plumbing system to be shut off independently from the fire sprinkler system, reducing risk during maintenance. Stand-alone systems are universally approved in all U.S. jurisdictions, removing any guesswork regarding code approvals.

**MULTIPURPOSE SYSTEMS**

In this design, BlazeMaster fire sprinkler pipe and fittings are connected to a FlowGuard Gold CPVC plumbing system. BlazeMaster and FlowGuard Gold pipe and fittings are easily joined together and can be installed by a contractor. Combination systems also frequently require less pipe than stand-alone systems, which translates to environmental benefits and potential material cost savings.

Stand-alone systems are the only option approved for multi-family residences (NFPA 13R applications) and multipurpose piping systems are not approved in all jurisdictions, so always check local code requirements before beginning installation.

Stand-alone systems can easily become a multipurpose system.



**COMPARING STAND-ALONE AND MULTIPURPOSE SYSTEMS**

Feature	Stand-Alone System	Multipurpose System
Future Plumbing Components (water softeners, filters, etc.)	Easily incorporated in design	May affect original hydraulic design
Water Flow Alarm	Easily incorporated in design	If a water flow switch is required/desired, a special expensive flow switch is required to determine the source
Codes and Requirements*	Approved in all jurisdictions	Not universally accepted by all jurisdictions
Can Shut Off Plumbing System Independently of Fire Sprinkler System	Yes	No
Plumbing System Pressure Reducing Valves	No effect on fire sprinkler system	May require increased pipe sizes
Visible Signage	Not required	Must be posted indicating multipurpose system is installed
Material	PE-X is not permitted**	PE-X may be used
Installer*	Typically a fire sprinkler contractor	Plumber or fire sprinkler contractor

\*Verify local code requirements  
\*\*As of the date of this printing



**CSI #: 21 13 00**

February 3, 2012

Sprinkler 153a

**VIKING**

**TECHNICAL DATA**

**FREEDOM® RESIDENTIAL  
CONCEALED HORIZONTAL  
SIDEWALL SPRINKLER VK480**

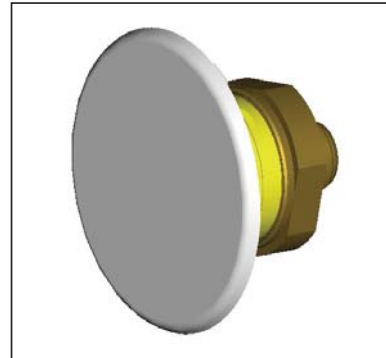
The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

## 1. DESCRIPTION

Viking Freedom® Residential Concealed Horizontal Sidewall Sprinkler VK480 is a small high-sensitivity solder link and lever residential sprinkler designed for installation on concealed pipe systems, where the appearance of a smooth wall is desired. The sprinkler orifice design, with a K-Factor of 4.0 (57.7 metric\*), allows the sprinkler's efficient use of available water supplies for the hydraulically designed fire-protection system. The operating element and special deflector characteristics meet the challenges of residential sprinkler standards.

The sprinkler is hidden from view by a low profile, small diameter cover plate installed flush to the wall. The cover plate is available in several decorative finishes to meet design requirements. The two-piece design allows installation and testing of the sprinkler prior to installation of the cover plate. After the system has been tested and wall finish has been applied, the push-on design of the cover plate assembly allows easy installation of the cover plate with up to 1/4" (6.4 mm) adjustment. Sprinkler VK480 is provided with a pipe guide to properly locate the sprinkler and allow the 1/4" adjustment of the cover plate.



## 2. LISTINGS AND APPROVALS



**cULus Listed:** Category VKKW (VK480)

Refer to the Approval Chart and Design Criteria on page 153c for cULus Listing requirements that must be followed.

## 3. TECHNICAL DATA

### Specifications:

Available since 2010.

Minimum Operating Pressure: Refer to the Approval Chart.

Maximum Working Pressure: 175 psi (12 bar). Factory tested hydrostatically to 500 psi (34.5 bar).

Thread size: 1/2" (15 mm) NPT

Nominal K-Factor: 4.0 U.S. (57.7 metric\*)

\* Metric K-factor measurement shown is in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Available Cover Plate Horizontal Adjustment: 1/4" (6.4 mm)

Overall Length (Sprinkler Body): 2" (50 mm)

Patents Pending

### Material Standards:

Sprinkler Body: QM Brass and Brass UNS-C84400

Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape

Seat: Brass UNS-C31400

Deflector Ring: Brass UNS-C23000

Deflector Pins: Stainless Steel UNS-S30200

Halo: Brass UNS-C31400 or Phosphor Bronze UNS-C51000

Flow Shaper: Phosphor Bronze UNS-C51000

Lever Bar Ring: Brass UNS-C31400 or Brass UNS-C84400

Compression Screw: 18-8 Stainless Steel

Fusible Link Assembly: Nickel Alloy and Eutectic Solder

Fusible Link Levers: Stainless Steel UNS-S31600

Guide Pin: Stainless Steel UNS-S43000

Shipping Cap: Polyethylene

### Cover Assembly Materials:

Cover Plate Assembly: Copper UNS-C11000 and Brass UNS-C26800

Spring: Beryllium Nickel

Solder: Eutectic

**Ordering Information:** (Also refer to the current Viking price list.)

Viking Freedom® Residential Concealed HSW Sprinkler VK480 and Cover Plate Assembly must be ordered separately:

**Sprinkler:** Part No. 16116AC (includes a 165 °F (74 °C) rated sprinkler with a protective plastic cap covering the unit).

Viking Technical Data may be found on  
The Viking Corporation's Web site at  
<http://www.vikinggroupinc.com>.  
The Web site may include a more recent  
edition of this Technical Data Page.

Form No. F\_121609

Replaces page 153a-f, dated August 4, 2011. (Revised sprinkler materials and added reference to TIA 1028R.)

**CSI #: 21 13 00**

Sprinkler 153b

February 3, 2012



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

**Cover Plate Assembly:** Base Part No. 16207 (3-5/16" diameter)

Specify finish and temperature rating of the cover plate assembly by adding the appropriate suffixes for the finish and the cover temperature rating to the base part number:

Finish Suffix: Painted White = M-/W

Temperature Suffix: 135 °F (57 °C) = A

For example, cover 16207 with a White Painted finish and a 135 °F (57 °C) temperature rating = 16207MA/W.

**Available Finishes And Temperature Ratings:** Refer to Table 1.

**Accessories:** (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

**Sprinkler Wrenches\*\*:**

A. Heavy Duty Wrench Part No. 16208W/R\*\* (available since 2010)

B. Head Cabinet Wrench Part Number 16267\*\*\* (available since 2010)

C. Optional Large Concealed Cover Plate Installer Tool Part No. 14867 (available since 2007)

\*\*Requires a ½" ratchet (not available from Viking).

\*\*\*Ideal for sprinkler cabinets.

**Sprinkler Cabinet:** Part No. 01731A (available since 1971)

#### 4. INSTALLATION

Refer to appropriate NFPA Installation Standards. For NFPA 13D horizontal ceiling criteria and slopes, refer to TIA 1028R for slope ceiling criteria exceptions.

#### 5. OPERATION

During fire conditions, when the temperature around the sprinkler approaches its operating temperature, the cover plate detaches. Continued heating of the exposed sprinkler causes the fusible element to disengage, releasing the sealing assembly. Water flowing through the sprinkler orifice strikes the flow shaper, forming a uniform spray pattern over a specific area of coverage determined by the water supply pressure at the sprinkler to extinguish or control the fire.

#### 6. INSPECTIONS, TESTS AND MAINTENANCE

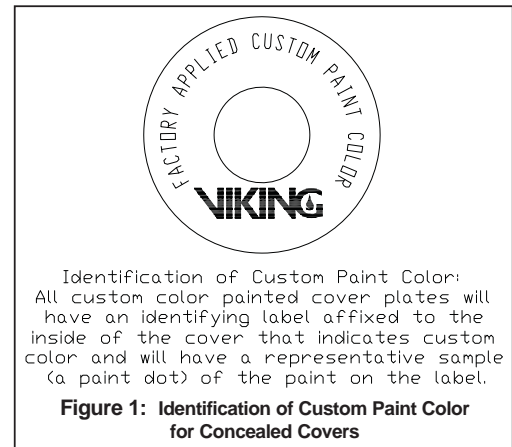
Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

#### 7. AVAILABILITY

Viking Freedom® Residential Concealed Horizontal Sidewall Sprinkler VK480 is available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

#### 8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.



**TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES**

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating <sup>1</sup>	Maximum Ambient Ceiling Temperature <sup>2</sup>	Temperature Rating of the Cover Assembly (Required)	Cover Plate Base Part Number <sup>3</sup>
Ordinary	165 °F (74 °C)	100 °F (38 °C)	135 °F (57 °C)	16207

Cover Plate Finish: Painted White

#### Footnotes

<sup>1</sup> The sprinkler temperature rating is stamped on the inlet.

<sup>2</sup> Based on NFPA-13, NFPA 13R, and NFPA 13D. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

<sup>3</sup> Part number shown is the base part number. For complete part number, refer to current Viking price list schedule.

**CSI #: 21 13 00**

February 3, 2012

Sprinkler 153c

<h1>VIKING</h1>	<h2>TECHNICAL DATA</h2>	<b>FREEDOM® RESIDENTIAL CONCEALED HORIZONTAL SIDEWALL SPRINKLER VK480</b>
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The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: [techsvcs@vikingcorp.com](mailto:techsvcs@vikingcorp.com)

<b>Approval Chart</b>						
Residential Concealed Horizontal Sidewall Sprinkler VK480						
For systems designed to NFPA 13D <sup>7</sup> or NFPA 13R.						
For systems designed to NFPA 13, refer to the design criteria below.						
Sprinkler Part Number <sup>1</sup>	SIN	NPT Thread Size		Nominal K-Factor		Maximum Water Working Pressure
		Inches	mm	U.S.	metric <sup>2</sup>	
16116AC	VK480	1/2	15	4.0	57.7	175 psi (12 bar)
Maximum Areas of Coverage <sup>6</sup> Width x Length		Minimum Water Supply Requirements <sup>6</sup>			Listings and Approvals <sup>3</sup> (Refer also to Design Criteria below.)	
					cULus <sup>4</sup>	NYC
<b>Installed below smooth, flat, horizontal ceilings, includes ceilings with slopes up to and including 2/12 (9.5°). With the centerline of the sprinkler located between 4-3/8" and 6-3/8" (112 mm and 162 mm) below the ceiling.</b>						
12 ft. x 12 ft. (3.7 m x 3.7 m)		11 gpm @ 7.6 psi (41.7 L/min @ 0.52 bar)			AX1	See Footnote 5. --
14 ft. x 14 ft. (4.3 m x 4.3 m)		13 gpm @ 10.6 psi (49.3 L/min @ 0.73 bar)			AX1	See Footnote 5. --
16 ft. x 16 ft. (4.9 m x 4.9 m)		16 gpm @ 16 psi (60.6 L/min @ 1.1 bar)			AX1	See Footnote 5. --
16 ft. x 18 ft. (4.9 m x 5.5 m)		17 gpm @ 18.1 psi (64.4 L/min @ 1.25 bar)			AX1	See Footnote 5. --
<b>Installed below smooth, flat, horizontal ceilings, includes ceilings with slopes up to and including 2/12 (9.5°). With the centerline of the sprinkler located between 6-3/8" and 12-3/8" (162 mm and 314 mm) below the ceiling.</b>						
12 ft. x 12 ft. (3.7 m x 3.7 m)		12 gpm @ 9 psi (45.5 L/min @ 0.62 bar)			AX1	See Footnote 5. --
14 ft. x 14 ft. (4.3 m x 4.3 m)		14 gpm @ 12.3 psi (53 L/min @ 0.84 bar)			AX1	See Footnote 5. --
16 ft. x 16 ft. (4.9 m x 4.9 m)		16 gpm @ 16 psi (60.6 L/min @ 1.1 bar)			AX1	See Footnote 5. --
16 ft. x 18 ft. (4.9 m x 5.5 m)		18 gpm @ 20.3 psi (68.1 L/min @ 1.4 bar)			AX1	See Footnote 5. --
Sprinkler Temperature Rating A - 165 °F (74 °C)		Cover Temperature Rating X - 135 °F (57 °C) Cover Part No. 16207 <sup>1</sup>			Cover Plate Finish 1 - Painted White <sup>8</sup>	

**Footnotes**

- <sup>1</sup> For complete part number, also refer to current Viking price list schedule.
- <sup>2</sup> Metric K-factor measurement shown is when pressure is measured in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.
- <sup>3</sup> This chart shows the listings and approvals available at the time of printing. Other approvals may be in process. Check with the manufacturer for any additional approvals.
- <sup>4</sup> Sprinkler VK480 is Listed by Underwriter's Laboratories for use in the U.S. and Canada.
- <sup>5</sup> Meets New York City requirements, effective July 1, 2008.
- <sup>6</sup> For areas of coverage smaller than shown, use the "Minimum Water Supply Requirement" for the next larger area listed. Flows and pressures listed are per sprinkler. The distance from sprinklers to walls shall not exceed one-half the sprinkler spacing indicated for the "Minimum Water Supply Requirement" used.
- <sup>7</sup> Refer to TIA 1028R slope ceiling criteria exceptions.
- <sup>8</sup> Other paint colors are available on request with the same listings as the standard finish colors. Listings and approvals apply for any paint manufacturer. Contact Viking for additional information. Custom colors are indicated on a label inside the cover assembly. Refer to Figure 1.

**DESIGN CRITERIA**

(Also refer to the Approval Chart above.)

**cULus Listing Requirements:**

When using Viking Residential Concealed Horizontal Sidewall Sprinkler VK480 for systems designed to NFPA 13D or NFPA 13R, apply the listed areas of coverage and minimum water supply requirements shown in the Approval Chart above.

For systems designed to NFPA 13: The number of design sprinklers is to be the four contiguous 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 the Approval Chart above for NFPA 13D and NFPA 13R applications for each listed area of coverage, **or**
- Calculated based on a minimum discharge of 0.1 gpm/sq. ft. over the "design area" in accordance with sections 8.5.2.1 or 8.6.2.1.2 of NFPA 13.
- **THE TOP OF THE SPRINKLER BODY AND THE TOP OF THE INSTALLATION WRENCH ARE MARKED "TOP"**. Orient the top of the sprinkler element parallel with the ceiling as shown in Figure 3.
- Minimum distance between residential sprinklers: 8 ft. (2.4 m).

**NOTE: Concealed sprinklers must be installed in neutral or negative pressure plenums only.**

**IMPORTANT: Always refer to Bulletin Form No. F\_091699 - Care and Handling of Sprinklers. Also refer to pages RES1-17 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA and any other similar Authorities Having Jurisdiction, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable. Final approval and acceptance of all residential sprinkler installations must be obtained from the Authorities Having Jurisdiction.**

**CSI #: 21 13 00**

February 3, 2012

Sprinkler 63h

	<p><b>TECHNICAL DATA</b></p>	<p><b>QUICK RESPONSE CONCEALED HORIZONTAL SIDEWALL SPRINKLER VK481</b></p>
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The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058


Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

### 1. DESCRIPTION

Viking Quick Response Concealed Horizontal Sidewall Sprinkler VK481 is a small solder link and lever spray sprinkler designed for installation on concealed pipe systems. The sprinkler is hidden from view by a low profile, small diameter cover plate installed flush with the wall.

The two-piece design allows installation and testing of the sprinkler prior to installation of the cover plate. The "push-on", "pull-off" design of the concealed cover plate assembly allows easy installation of the cover plate after the system has been tested and finish has been applied to the wall, while also permitting up to 1/4" (6.4 mm) of horizontal adjustment. The cover assembly can be removed and reinstalled, allowing access behind the wall without taking the sprinkler system out of service and removing the sprinkler.

### 2. LISTINGS AND APPROVALS

 **cULus Listed:** Category VNIV  
Refer to the Approval Chart on page 63j and Design Criteria on page 63k for cULus Listing requirements that must be followed.



#### SPECIAL FEATURES:

- Designed for Light Hazard and Ordinary Hazard Occupancies

### 3. TECHNICAL DATA

#### Specifications:

Available since 2012.

Minimum Operating Pressure: 7 psi (0.5 bar)

Rated to 175 psi (1 207 kPa) water working pressure.

Thread size: 1/2" (15 mm) NPT

Nominal K-Factor: 5.6 U.S. (80.6 metric†)

† Metric K-factor measurement is shown in Bar. When pressure is measured in kPa, divide the metric K-factor shown by 10.0.

Available Cover Plate Horizontal Adjustment: 1/4" (6.4 mm)

Overall Length (Sprinkler Body): 2" (50 mm)

Patents Pending

#### Material Standards:

Sprinkler Body: QM Brass and Brass UNS-C84400

Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with Teflon Tape

Seat: Brass UNS-C31400

Deflector Ring: Brass UNS-C23000

Deflector Pins: Stainless Steel UNS-S30200

Halo: Brass UNS-C31400 or UNS-C31600 or Phosphor Bronze UNS-C51000

Flow Shaper: Phosphor Bronze UNS-C51000

Lever Bar Ring: Brass UNS-C31400 or Brass UNS-C84400

Compression Screw: 18-8 Stainless Steel

Fusible Link Assembly: Nickel Alloy and Eutectic Solder

Fusible Link Levers: Stainless Steel UNS-S31600

Guide Pin: Stainless Steel UNS-S43000

Shipping Cap: Polyethylene

#### Cover Assembly Materials:

Cover Plate Assembly: Brass UNS-C26000 or UNS-C26800

Spring: Nickel Alloy

Solder: Eutectic

**Ordering Information:** (Also refer to the current Viking price list.)

Viking Quick Response Concealed Horizontal Sidewall Sprinklers and Cover Plate Assemblies must be ordered separately:

**Sprinkler:** Base Part No. 17555A (includes sprinkler with a protective plastic cap covering the unit).

Specify sprinkler temperature rating by adding the appropriate suffix for the temperature rating to the base part number:

Temperature Suffix: 165 °F (74 °C) = C, 220 °F (104 °C) = F

For example, sprinkler VK481 with a 165 °F (74 °C) temperature rating = 17555AC.

Viking Technical Data may be found on  
The Viking Corporation's Web site at  
<http://www.vikinggroupinc.com>.  
The Web site may include a more recent  
edition of this Technical Data Page.

**CSI #: 21 13 00**

Sprinkler 63i

February 3, 2012

	<b>TECHNICAL DATA</b>	<b>QUICK RESPONSE CONCEALED HORIZONTAL SIDEWALL SPRINKLER VK481</b>
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The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: [techsvcs@vikingcorp.com](mailto:techsvcs@vikingcorp.com)

**Cover Plate Assembly:** Base Part No. 16207

Specify finish and temperature rating of the cover plate assembly by adding the appropriate suffixes for the finish and the cover temperature rating to the base part number:

Finish Suffix: Polished Chrome = F, Brushed Chrome = F-/B, Bright Brass = B, Antique Brass = B-/A, Brushed Brass = B-/B, Brushed Copper = E-/B, Painted White = M-/W, Painted Ivory = M-/I, Painted Black = M-/B

Temperature Suffix: 135 °F (57 °C) = A, 165 °F (74 °C) = C

For example, cover 16207 with a Polished Chrome finish and a 165 °F (74 °C) temperature rating = 16207FC.

**Available Finishes And Temperature Ratings:** Refer to Table 1.

**Accessories:** (Also refer to the "Sprinkler Accessories" section of the Viking data book.)

**Sprinkler Wrenches\*:**

A. Heavy Duty Wrench Part No. 16208W/R\* (available since 2010)

B. Head Cabinet Wrench Part Number 16267\*\* (available since 2010)

C. Optional Large Concealed Cover Plate Installer Tool Part No. 14867 (available since 2007)

\*Requires a ½" ratchet (not available from Viking).

\*\*Ideal for sprinkler cabinets.

**Sprinkler Cabinet:** Part No. 01731A (available since 1971)

#### 4. INSTALLATION

Refer to appropriate NFPA Installation Standards.

#### 5. OPERATION

During fire conditions, when the temperature around the sprinkler approaches its operating temperature, the cover plate detaches. Continued heating of the exposed sprinkler causes the fusible element to disengage, releasing the sealing assembly. Water flowing through the sprinkler orifice strikes the flow shaper, forming a uniform spray pattern to extinguish or control the fire.

#### 6. INSPECTIONS, TESTS AND MAINTENANCE

Refer to NFPA 25 for Inspection, Testing and Maintenance requirements.

#### 7. AVAILABILITY

Viking concealed sprinklers are available through a network of domestic and international distributors. See The Viking Corporation web site for the closest distributor or contact The Viking Corporation.

#### 8. GUARANTEE

For details of warranty, refer to Viking's current list price schedule or contact Viking directly.

**TABLE 1: AVAILABLE SPRINKLER TEMPERATURE RATINGS AND FINISHES**

Sprinkler Temperature Classification	Sprinkler Nominal Temperature Rating <sup>1</sup>	Maximum Ambient Ceiling Temperature <sup>2</sup>	Temperature Rating of Cover Assembly (Required)		Cover Plate Base Part Number <sup>3</sup>
Ordinary	165 °F (74 °C)	100 °F (38 °C)	135 °F (57 °C)	165 °F (74 °C)	16207
Intermediate	220 °F (104 °C)	150 °F (65 °C)	135 °F (57 °C)	165 °F (74 °C)	16207

**Cover Plate Finishes:** Polished Chrome, Brushed Chrome, Bright Brass, Antique Brass, Brushed Brass, Brushed Copper, Painted White, Painted Ivory, and Painted Black.

**Footnotes**

<sup>1</sup> The sprinkler temperature rating is stamped on the sprinkler body.

<sup>2</sup> Based on NFPA-13. Other limits may apply, depending on fire loading, sprinkler location, and other requirements of the Authority Having Jurisdiction. Refer to specific installation standards.

<sup>3</sup> Base part number is shown. For complete part number, refer to Viking's current price list schedule.

**CSI #: 21 13 00**

Sprinkler 63k

February 3, 2012



**TECHNICAL DATA**

**QUICK RESPONSE  
CONCEALED HORIZONTAL  
SIDEWALL SPRINKLER VK481**

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

**DESIGN CRITERIA**

(Also refer to the Approval Chart on page 63j.)

**cULus Listing Requirements:**

Quick Response Concealed Horizontal Sidewall Sprinkler VK481 is cULus Listed for installation in accordance with the latest edition of NFPA 13 for standard coverage sidewall spray sprinklers as indicated below:

- Designed for use in Light or Ordinary Hazard Occupancies for use below smooth, flat, horizontal ceilings only.
- **Position with the centerline of the sprinkler located between 4-3/8" and 12-3/8" (112 mm and 314 mm) below the ceiling. THE TOP OF THE SPRINKLER BODY AND THE TOP OF THE INSTALLATION WRENCH ARE MARKED "TOP".** Orient the top of the sprinkler element parallel with the ceiling as shown in Figure 3.
- This sprinkler must be installed flush with the wall.
- Protection areas and maximum spacing shall be in accordance with the tables provided in NFPA 13 for standard sidewall sprinklers. Minimum spacing allowed is 7 ft. (2.1 m).
- Maximum distance from end walls shall be no more than one-half of the allowable distance between sprinklers. The distance shall be measured perpendicular to the wall. Minimum distance from end walls is 4 in. (102 mm).
- The sprinkler installation and obstruction rules contained in NFPA 13 for standard coverage sidewall spray sprinklers must be followed.

**NOTE: Concealed sprinklers must be installed in neutral or negative pressure plenums only.**

**IMPORTANT: Always refer to Bulletin Form No. F\_091699 - Care and Handling of Sprinklers. Also refer to page QR1-3 for general care, installation, and maintenance information. Viking sprinklers are to be installed in accordance with the latest edition of Viking technical data, the appropriate standards of NFPA, FM Global, LPCB, APSAD, VdS or other similar organizations, and also with the provisions of governmental codes, ordinances, and standards, whenever applicable.**



Identification of Custom Paint Color:  
All custom color painted cover plates will have an identifying label affixed to the inside of the cover that indicates custom color and will have a representative sample (a paint dot) of the paint on the label.

**Figure 2: Identification of Custom Paint Color for Concealed Covers**

**CSI #: 21 13 00**

November 15, 2012

Sprinkler 41a



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

### 1. DESCRIPTION

Viking Microfast® and MicrofastHP® Quick Response Pendent Sprinklers are small, thermosensitive, glass-bulb spray sprinklers available in several different finishes and temperature ratings and K-Factors to meet design requirements. The special Polyester, Polytetrafluoroethylene (PTFE), and Electroless Nickel PTFE (ENT) coatings can be used in decorative applications where colors are desired. In addition, these coatings have been investigated for installation in corrosive atmospheres and are cULus listed as corrosion resistant as indicated in the Approval Chart. (Note: FM Global has no approval classification for PTFE and Polyester coatings as corrosion resistant.)



### 2. LISTINGS AND APPROVALS



**cULus Listed:** Category VNIV

**FM Approved:** Classes 2001, 2002, 2015, and 2017

**NYC Approved:** Calendar Number 219-76-SA and MEA 89-92-E, Volume 16

**ABS Certified:** Certificate 04-HS407984C-PDA



**VdS Approved:** Certificates G4040095, G4040097, G4060056, G4060057, G4880045, G4930038, and G4980021



**LPC Approved:** Ref. Nos. 096e/03 and 096e/04



**CE Certified:** Standard EN 12259-1, EC-certificates of conformity 0786-CPD-40130, 0786-CPD-40170 and 0786-CPD-40279, 0832-CPD-2001, and 0832-CPD-2003

**MED Certified:** Standard EN 12259-1, EC-certificate of conformity 0832-MED-1003 and 0832-MED-1008

**NOTE:** Other International approval certificates are available upon request.

Refer to Approval Chart 1 and Design Criteria on page 41d for cULus Listing requirements and refer to Approval Chart 2 and Design Criteria on page 41f for FM Approval requirements that must be followed.

### 3. TECHNICAL DATA

**Specifications:**

Available since 1987.

Minimum Operating Pressure: 7 psi (0.5 bar)\*

**Maximum Working Pressure: Sprinklers 12282 and 12290 are rated for use with water working pressures ranging from the minimum 7 psi (0.5 bar) up to 250 psi (17 bar) for high-pressure systems. High-pressure (HP) sprinklers can be identified by locating "250" stamped on the deflector. All other Part Nos. not mentioned above are rated to a maximum 175 psi (12 bar) wwp.**

Factory tested hydrostatically to 500 psi (34.5 bar)

Thread size: Refer to the Approval Charts

Nominal K-Factor: Refer to the Approval Charts

Glass-bulb fluid temperature rated to -65 °F (-55 °C)

Overall Length: Refer to the Approval Charts

\*cULus Listing, FM Approval, and NFPA 13 installs require a minimum of 7 psi (0.5 bar). The minimum operating pressure for LPCB and CE Approvals ONLY is 5 psi (0.35 bar).

**Material Standards:**

Frame Casting: Brass UNS-C84400 or QM Brass for Sprinklers 06662B and 12282. Brass UNS-C84400 for all other sprinklers.

Deflector: Phosphor Bronze UNS-C51000 or Copper UNS-C19500 for Sprinklers 06662B, 06666B, and 06765B. Copper UNS-C19500 for Sprinkler 12282. Phosphor Bronze UNS-C51000, Copper UNS-C19500 or Brass UNS-C26000 for Sprinkler 06720B.

Brass UNS-C26000 for all other Sprinklers.

Bushing (for Sprinklers 06718B, 06720B, and 12290): Brass UNS-C36000

Bulb: Glass, nominal 3 mm diameter

Belleville Spring Sealing Assembly: Nickel Alloy, coated on both sides with PTFE Tape

Screw: Brass UNS-C36000

Pip Cap and Insert Assembly: Copper UNS-C11000 and Stainless Steel UNS-S30400

For PTFE Coated Sprinklers: Belleville Spring-Exposed, Screw-Nickel Plated, Pip Cap-PTFE Coated

For Polyester Coated Sprinklers: Belleville Spring-Exposed

For ENT Coated Sprinklers: Belleville Spring-Exposed, Screw and Pipcap - ENT coated.

Viking Technical Data may be found on  
The Viking Corporation's Web site at  
<http://www.vikinggroupinc.com>.  
The Web site may include a more recent  
edition of this Technical Data Page.

Replaces page 41a-f dated September 19 2012

CSI #: 21 20 00

## Residential Series

### Living Area Fire Extinguisher (Primary Protection)

Part number 21005770

Living area use

Single use

UL Rated 2-A:10-B:C



Meets NFPA recommendations for primary home protection



#### Description

Fights fires common to the home living areas such as wood, fabrics, furnishings, and drapes.

Meets NFPA recommendations for primary home protection and has a 10 year warranty.

Features bilingual nameplate and carton.

White finish.

#### Features

- Pressure gauge allows for immediate pressure status check
- Easy-to-pull safety pin
- Rust and impact resistant nylon handle
- 4 lb. of fire extinguishing agent (Average)
- 10 year limited warranty
- UL approved wall hanger
- Powder coated cylinder for corrosion protection



UPC: 0-47871-05770-2

For use on the following types of fire:



#### At a Glance

- Model FX210R
- Multipurpose Dry Chemical
- UL listed
- UL rated 2-A:10-B:C
- Supplied with wall hanger
- Monoammonium Phosphate
- 10 year limited warranty

#### Product Specification

Net agent weight (Average)	4.0 lb.
Unit weight (Average)	7.13 lb.
Diameter	4.5 inches
Height	16.07 inches
Discharge time	13-15 seconds
Discharge range	12-18 feet
Operating pressure	195 psi

#### Packaging Options

Master Pack (2)	21005770
Master Pack (4)	21005771
Cut Case (8)	21005772





CSI #: 21 20 00



## AC Wire-in Combination Carbon Monoxide & Smoke Alarm

- 120VAC Direct Wire with Battery Backup
- Alarm/Voice message warning system
- Permanent independent carbon monoxide and smoke alarm sensors

Part Number 21006377 (Previously 900-0114)

Model KN-COSM-IB

### Voice Warning

Warns of hazard by announcing "Fire, Fire" or "Warning, Carbon Monoxide".

### Peak Level Memory

Alerts user when the unit has detected CO concentrations of 100ppm or higher.

### Smart Hush™

Silences the unit during nuisance alarm situations. (Smoke must be present before hush is activated)

### Two LED's

- Red – Alarm mode.
- Green – Indicates that AC power is present.

### Test/Reset Button Functions

- Tests the unit's electronics and resets the unit during CO alarm.
- Activates Hush Feature and Peak Level Memory.

### Adjustable Mounting Bracket

Allows for easy installation and alignment.

**Alerts user to replace CO alarm after 7 years of operation**



## Description

The Kidde 2106377 Combination Carbon Monoxide & Smoke Alarm provides two important safety devices in a single unit. This alarm includes a voice warning system that announces "Fire, Carbon Monoxide, Low Battery or Smart Hush™ Activation". The voice alarm eliminates any confusion and clearly warns you and your family of a smoke or carbon monoxide danger, or if your battery is in need of replacement. This technically advanced combination alarm includes 9V battery backup providing protection even during a power outage when many incidences occur. The 2106377 is an easy to install alarm that is suitable for all living areas. It has a 7-year life and a 5-year limited warranty.

## Alarm Warnings

**Fire:** The red LED will flash and be accompanied by three long alarm beeps followed by a verbal warning message "FIRE! FIRE!". The alarm will repeat pattern until smoke is eliminated.

**Carbon Monoxide:** Four short alarm beeps followed by a verbal warning "WARNING! CARBON MONOXIDE!". This continues until

## Features and Benefits

- **Smart Interconnect™** – Interconnects up to 24 Kidde devices (of which 18 can be initiating).
- **Battery Backup (9V battery included)** – Provides protection during power outages.
- **Battery Lockout System** – Minimized risk of mounting unit without installation of battery.
- **Alarm Tamper Resist** – Helps deter from tampering and theft.
- **Adjustable Mounting Bracket** – Makes installation fast and easy.
- **Peak Level Memory** – Announces "CO previously detected" if alarm had detected a CO level of 100ppm or higher since it was last reset.
- **Smart Hush™ Feature** – Silences nuisance alarms for approximately 10 minutes. (Smoke must be present before Smart Hush™ is activated)
- **Ionization Sensor Technology** – Ideal for detecting fast flaming and other types of fires.
- **Test Button Functions**

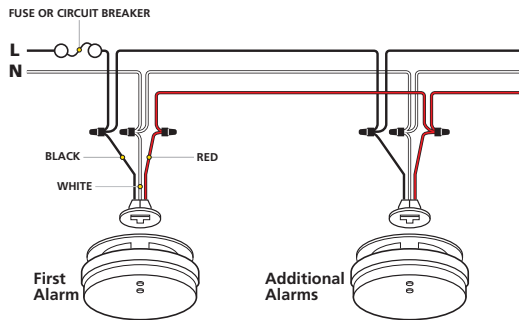
CSI #: 21 20 00

**AC Wire-in Combination  
Carbon Monoxide & Smoke Alarm**

**Part Number 21006377  
Model KN-COSM-IB**

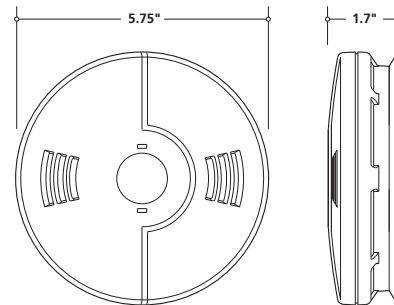
## Installation of Smoke Alarm

The combination alarm should be installed to comply with all local codes having jurisdiction in your area, Article 760 of the National Electric Code, and NFPA 72. Make certain all alarms are wired to a single, continuous (non-switched) power line, which is not protected by a ground fault interrupter. A maximum of 1000 ft. of wire can be used in the interconnect system. Use standard UL listed household wire (18 gauge or larger as required by local codes).



## Technical Specifications

Part Number:	21006377
Model:	KN-COSM-IB
Power Source:	120VAC, 60Hz 25mA max per alarm 9V battery backup
Smoke Sensor:	Ionization
CO Sensor:	Electrochemical
Audio Alarm:	85dB at 10ft
Temperature Range:	40°F (4.4°C) to 100°F (37.8°C)
Humidity Range:	5%-95% relative humidity
Size:	5.75" in diameter x 1.7" depth
Weight:	1lb
Wiring:	Quick connect plug with 8" pigtails
Interconnects:	Up to 24 Kidde devices (of which 18 can be initiating)
Warranty:	5 year limited



## Ordering Information

UPC: 0-47871-00114-9

Part Number	I 2 of 5	Pack Quantity	Dimensions (w x d x h inches)	Weight	Case/Skid	Layers/Skid	Skid Weight
900-0114**	N/A	Individual	5.8 x 2 x 6.2	1lb	N/A	N/A	N/A
900-0114-02	200 47871 00114 3	Master Pack (6 units)	7 x 13 x 7	7.65lbs	100	5	765lbs

\*\*Not for sale by individual unit



1016 Corporate Park Drive  
Mebane NC 27302  
1-800-880-6788 www.Kidde.com

Distributed by:

# Division 22

## Plumbing



**CSI #: 22 05 23**

ES-WP-LFWPBV

**For PEX Piping Systems**

Job Name _____	Contractor _____
Job Location _____	Approval _____
Engineer _____	Contractor's P.O. No. _____
Approval _____	Representative _____

**LEAD FREE\***

**Series LFWPBV**  
**2-Piece, Full Port, Brass Ball Valves**  
**with PEX Ends**

**Sizes: 1/2" - 1" (15 - 25mm)**

Series LFWPBV 2-Piece, Full Port, Brass Ball Valve with PEX Ends are designed for use in PEX piping systems. They feature brass PEX end tailpieces designed for easy crimping into a PEX piping system. The Series LFWPBV features Lead Free\* construction to comply with Lead Free\* installation requirements.

**Features**

- 2-piece, full port design
- Forged Lead Free\* brass body
- PEX end designed to ASTM F-1807
- Valve rated to 400 WOG
- Crimp connection rated to 160psi at 73°F (23°C)
- Designed specifically for use in PEX piping systems



**Specification**

Approved valve to be 2-piece, full port, forged brass body, chrome plated brass ball, virgin PTFE seats and stem packing, and Viton® stem O-ring. Ball valve rated to 400 WOG and PEX end must comply with ASTM F-1807 standard. Crimp joint rated at 160psi at 73°F (23°C). The valve shall be constructed using Lead Free\* brass. Lead Free\* brass ball valves shall comply with state codes and standards, where applicable, requiring reduced lead content. Valve shall be Watts Series LFWPBV.

**Pressure-Temperature**

Ball Valve Rating: 400 WOG

Crimp Connection Rating: 160psi at 73°F (23°C) (refer to PEX piping manufacturers guidelines)

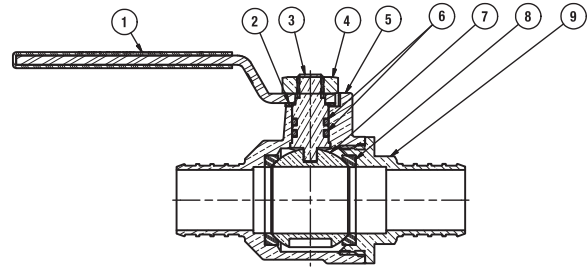
\*The wetted surface of this product contacted by consumable water contains less than one quarter of one percent (0.25%) of lead by weight.

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements...

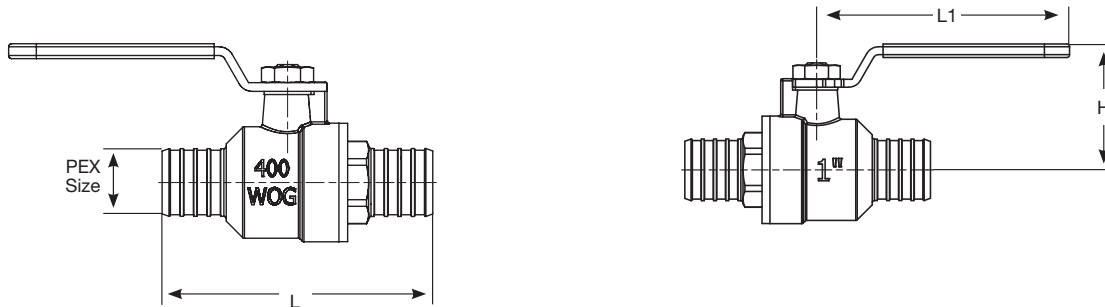
**CSI #: 22 05 23**

**Materials**

ITEM	QTY	DESCRIPTION	MATERIAL
1	1	Handle	Zinc-plated Steel w/Vinyl Handle Insulator
2	1	Stem Packing	Virgin (PTFE)
3	1	Stem	Forging Brass
4	1	Handle Nut	Brass
5	1	Body	Lead Free* brass
6	2	Stem O-ring	FKM
7	1	Ball	Lead Free* brass
8	2	Seat	Virgin PTFE
9	1	Adapter	Lead Free* brass



**Dimensions – Weights**



SIZE (DN)		DIMENSIONS				WEIGHT			
in.	mm	in.	H mm	in.	L mm	in.	L <sub>1</sub> mm	lbs.	kgs.
1/2	15	1 3/8	35	2 5/16	65	3	76	0.3	0.12
3/4	20	1 1/2	38	2 3/4	70	3	76	0.4	0.18
1	25	1 3/4	45	3 7/16	87	3 3/8	91	0.6	0.29



A Watts Water Technologies Company



USA: 815 Chestnut St., No. Andover, MA 01845-6098; [www.watts.com](http://www.watts.com)  
Canada: 5405 North Service Rd., Burlington, ONT L7L 5L7; [www.wattscanada.com](http://www.wattscanada.com)

CSI #: 22 05 23

ES-LF600

**For Residential, Commercial, Industrial and Solar Applications**

Job Name _____	Contractor _____
Job Location _____	Approval _____
Engineer _____	Contractor's P.O. No. _____
Approval _____	Representative _____

**LEAD FREE\***

**Series LF600**

**Lead Free\* Brass Silent Check Valves**

Sizes: 1/4" – 2" (8-50mm)

Series LF600 Lead Free\* brass silent check valves efficiently perform all of the functions of a swing check or vertical lift check valves and at the same time operate silently to prevent the effects of water hammer. The Series LF600 check valves feature Lead Free\* construction to comply with Lead Free\* installation requirements.

**Features:**

- Conical Lead Free\* brass disc for full fluid flow
- PTFE seat
- Install in horizontal or vertical position (consult factory for proper use in vertical installations)
- Low pressure drop equivalent to a swing check
- Stainless steel guide rod and spring (1 1/4" to 2")
- Silent operation
- Threaded ends

**Specifications**

A Lead Free\* brass silent check valve shall be installed as indicated on the plans. The valve shall have a conical Lead Free\* brass disc, PTFE seat and silent operation. Pressure rating no less than 400psi (27.6 bar) WOG non-shock and 15psi (1 bar) WSP. The silent check valve shall be constructed using Lead Free\* brass. Lead Free\* silent check valves shall comply with state codes and standards, where applicable, requiring reduced lead content. Valve shall be a Watts Series LF600.

**Application Notes**

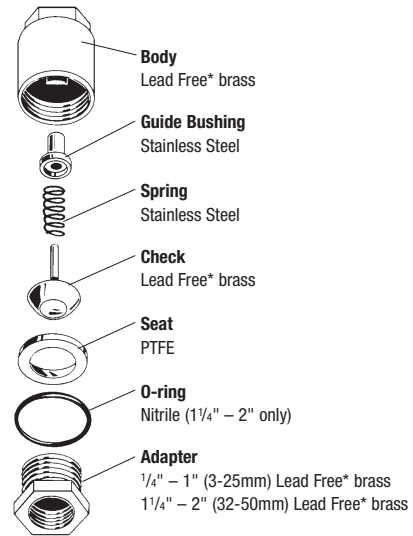
These valves are not suggested for installation in sewage ejector piping.

**WARNING: Do not use for reciprocating air compressor service.**

\*The wetted surface of this product contacted by consumable water contains less than one quarter of one percent (0.25%) of lead by weight.



**Materials**

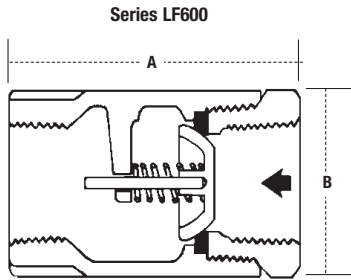


Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.



CSI #: 22 05 23

Dimensions - Weights



SIZE (DN)		DIMENSIONS				WEIGHT	
		A		B			
in.	mm	in.	mm	in.	mm	lbs.	kg.
1/4	8	2 1/8	54	1 1/4	32	.22	.1
3/8	10	2 1/8	54	1 1/4	32	.5	.2
1/2	15	2 1/8	54	1 1/4	32	.5	.2
3/4	20	2 1/2	64	1 1/2	38	.75	.3
1	25	3 1/8	79	2	50	1.38	.6
1 1/4	32	3 3/4	95	2 1/2	64	2.13	1.0
1 1/2	40	4	102	2 3/4	70	3.0	1.4
2	50	4 1/2	114	3 1/2	89	4.38	2.0

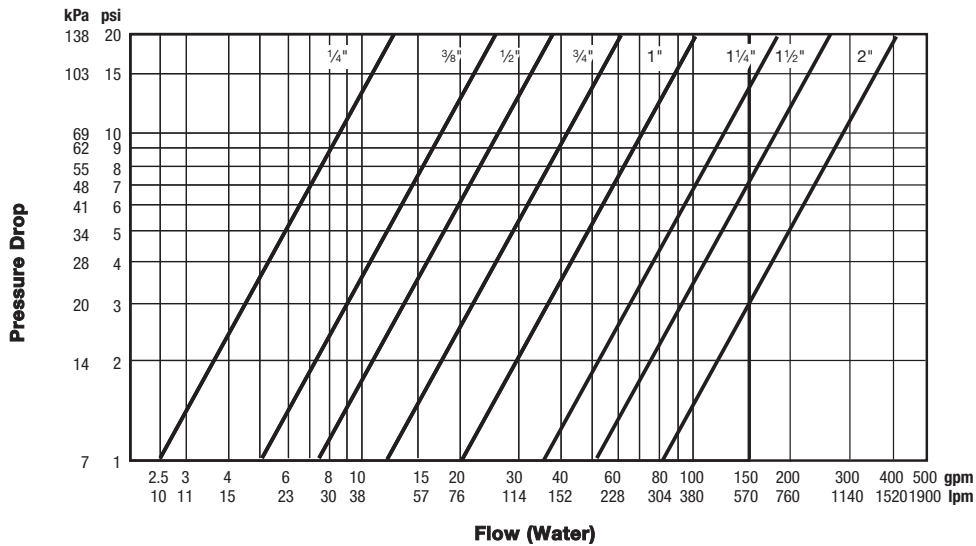
Pressure - Temperature

Maximum Working Pressure:

400psi (27.6 bars) WOG non-shock @ -20°F to 100°F  
(-29°C to 38°C); 15psi (1 bar) WSP @ 250°F (121°C)

TEMPERATURE		PRESSURE	
Fahrenheit	Celsius	psi	bar
-20° to 100°	-29° to 38°	400	27.6
200°	93°	200	13.8
250°	121°	160	11.0

Pressure Drop vs. Flow



USA: 815 Chestnut St., No. Andover, MA 01845-6098; [www.watts.com](http://www.watts.com)  
Canada: 5435 North Service Rd., Burlington, ONT. L7L 5H7; [www.wattscanada.ca](http://www.wattscanada.ca)

ES LF600 0040

© 2000 Watts

CSI #: 22 10 00



## WaterPEX® Tubing

Watts WaterPEX® is manufactured in accordance with ASTM International F876 and F877 to SDR-9 dimensional standards. It is listed by the National Sanitation Foundation to NSF Standards 14 and 61 for use in potable water systems. WaterPEX® is listed by NSF to be in compliance to the Uniform Plumbing Code. All WaterPEX® is labeled B137.5 which indicates that it is compliant to the CSA Standards B137.5.



### Red, Blue and White Coils

Watts Model	Description/Size	Ordering Code	UPC	Net Content	Consumer Unit Weight (lbs)	List Price
<b>Red Coils</b>						
WPTC06-100R	3/8" x 100' coil	0650375	098268310955	100'	4	\$47.10
WPTC06-500R	3/8" x 500' coil	0650376	098268310962	500'	20	235.40
WPTC08-100R	1/2" x 100' coil	0650377	098268310979	100'	6	53.50
WPTC08-250R	1/2" x 250' coil	0651057	098268358858	250'	14	133.75
WPTC08-300R	1/2" x 300' coil	0650996	098268336160	300'	17	160.50
WPTC08-500R	1/2" x 500' coil	0650378	098268311167	500'	28	267.50
WPTC08-1000R	1/2" x 1000' coil	0650379	098268311174	1000'	55	535.00
WPTC12-100R	3/4" x 100' coil	0650380	098268311181	100'	11	93.10
WPTC12-250R	3/4" x 250' coil	0651058	098268358865	250'	26	232.75
WPTC12-300R	3/4" x 300' coil	0651000	098268337532	300'	32	280.35
WPTC12-500R	3/4" x 500' coil	0650381	098268311198	500'	53	465.45
WPTC12-1000R	3/4" x 1000' coil	0650382	098268311204	1000'	105	930.90
WPTC16-100R	1" x 100' coil	0650372	098268527810	100'	17.2	164.80
WPTC16-500R	1" x 500' coil	0650320	098268539134	500'	86	823.90



<b>Blue Coils</b>						
WPTC06-100B	3/8" x 100' coil	0650383	098268311228	100'	4	47.10
WPTC06-500B	3/8" x 500' coil	0650384	098268311235	500'	20	235.40
WPTC08-100B	1/2" x 100' coil	0650385	098268311242	100'	6	53.50
WPTC08-250B	1/2" x 250' coil	0651055	098268358834	250'	14	133.75
WPTC08-300B	1/2" x 300' coil	0650997	098268336177	300'	17	160.50
WPTC08-500B	1/2" x 500' coil	0650386	098268311259	500'	28	267.50
WPTC08-1000B	1/2" x 1000' coil	0650387	098268311266	1000'	55	535.00
WPTC12-100B	3/4" x 100' coil	0650388	098268311273	100'	11	93.10
WPTC12-250B	3/4" x 250' coil	0651056	098268358841	250'	26	232.75
WPTC12-300B	3/4" x 300' coil	0651001	098268337655	300'	32	280.35
WPTC12-500B	3/4" x 500' coil	0650389	098268311280	500'	53	465.45
WPTC12-1000B	3/4" x 1000' coil	0650390	098268311310	1000'	105	930.90
WPTC16-100B	1" x 100' coil	0650371	098268527803	100'	17.2	164.80
WPTC16-500B	1" x 500' coil	0650321	098268539141	500'	86	823.90



<b>White Coils</b>						
WPTC02-25W	1/8" x 25' coil	0651100	098268544466	25'	0.45	11.50
WPTC02-100W	1/8" x 100' coil	0650374	098268337280	100'	3	34.25
WPTC04-100W	1/4" x 100' coil	0650391	098268311327	100'	3	46.00
WPTC06-100W	3/8" x 100' coil	0650392	098268311334	100'	4	47.10
WPTC06-500W	3/8" x 500' coil	0650393	098268311341	500'	20	235.40
WPTC08-100W	1/2" x 100' coil	0650394	098268311358	100'	6	53.50
WPTC08-250W	1/2" x 250' coil	0651035	098268351989	250'	14	133.75
WPTC08-300W	1/2" x 300' coil	0650998	098268336184	300'	17	160.50
WPTC08-500W	1/2" x 500' coil	0650395	098268311365	500'	28	267.50
WPTC08-1000W	1/2" x 1000' coil	0650396	098268311372	1000'	55	535.00
WPTC12-100W	3/4" x 100' coil	0650397	098268311389	100'	11	93.10
WPTC12-250W	3/4" x 250' coil	0651036	098268351729	250'	26	232.75
WPTC12-300W	3/4" x 300' coil	0651002	098268337549	300'	32	280.35
WPTC12-500W	3/4" x 500' coil	0650398	098268311396	500'	53	465.45
WPTC12-1000W	3/4" x 1000' coil	0650399	098268311402	1000'	105	930.90
WPTC16-100W	1" x 100' coil	0650400	098268311419	100'	17	164.80
WPTC16-300W	1" x 300' coil	0651024	098268351934	300'	50.4	411.95
WPTC16-500W	1" x 500' coil	0650401	098268311426	500'	84	823.90
WPTC20-100W	1 1/4" x 100' coil	0650402	098268311440	100'	25	271.80
WPTC20-300W	1 1/4" x 300' coil	0650403	098268311457	300'	76	815.35
WPTC24-100W	1 1/2" x 100' coil	0651090	098268479744	100'	35.4	591.85
WPTC24-300W	1 1/2" x 300' coil	0651091	098268479751	300'	106.2	1,775.55
WPTC28-100W	2" x 100' coil	0651092	098268479768	100'	60	832.60

\*The wetted surface of this product contacted by consumable water contains less than one quarter of one percent (0.25%) of lead by weight.

4

Net Content = Quantity of individual pieces or feet contained in the consumer unit.



CSI #: 22 10 00



## WaterPEX® Tubing

### Red, Blue and White 20' Sticks

Watts Model	Description/Size	Ordering Code	UPC	Net Content	Consumer Unit Weight (lbs)	List Price
<b>Red Sticks</b>						
WPTS08-50R	1/2" x 20' Sticks	0650404	098268311464	50 Sticks	43	\$535.00
WPTS08-25R	1/2Wpx20'-25Sticks-Red	0651026	098268351958	25 Sticks	21	267.50
WPTS12-25R	3/4" x 20' Sticks	0650405	098268311471	25 Sticks	33	465.45
WPTS12-10R	3/4" x 20' Sticks	0651029	098268351927	10 Sticks	21	187.25
WPTS16-5R	1Wpx20'-5 Sticks-Red	0651081	098268456066	5 Sticks	18	164.80

### Blue Sticks

WPTS08-50B	1/2" x 20' Sticks	0650406	098268311501	50 Sticks	43	535.00
WPTS12-25B	3/4" x 20' Sticks	0650407	098268311518	25 Sticks	33	465.45
WPTS08-25B	1/2" x 20' Sticks	0651025	098268351941	25 Sticks	28	267.50
WPTS12-10B	3/4" x 20' Sticks	0651028	098268351972	10 Sticks	21	187.25
WPTS16-5B	1Wpx20'-5 Sticks-Blue	0651082	098268456073	5 Sticks	18	164.80

### White Sticks

WPTS08-50W	1/2" x 20' Sticks	0650408	098268311525	50 Sticks	43	535.00
WPTS12-25W	3/4" x 20' Sticks	0650409	098268311532	25 Sticks	33	465.45
WPTS12-10W	3/4" x 20' Sticks	0651027	098268351965	10 Sticks	21	187.25
WPTS16-5W	1" x 20' Sticks	0650410	098268311549	5 Sticks	18	164.80
WPTS20-5W	1 1/4" x 20' Sticks	0650411	098268311556	5 Sticks	28	271.80
WPTS24-5W	1 1/2" x 20' Sticks	0651093	098268479775	5 Sticks	35.4	591.85
WPTS28-5W	2" x 20' Sticks	0651094	098268479836	5 Sticks	60	832.60



### 10' Sticks - Fast Packs

#### Red Sticks

WPPF08-50R	1/2" x 10' Sticks	0651010	098268340518	50 Sticks	28	275.55
WPPF12-25R	3/4" x 10' Sticks	0651011	098268340525	25 Sticks	26	239.75

#### Blue Sticks

WPPF08-50B	1/2" x 10' Sticks	0651012	098268340532	50 Sticks	28	275.20
WPPF12-25B	3/4" x 10' Sticks	0651013	098268340549	25 Sticks	26	239.75

#### White Sticks

WPPF08-50W	1/2" x 10' Sticks	0651014	098268340556	50 Sticks	28	275.20
WPPF12-25W	3/4" x 10' Sticks	0651015	098268340624	25 Sticks	26	239.75



### Stud Reel with Tubing

#### Red

WPSR06-500R	3/8" x 500' Stud Reel	0651018	098268344073	500'	30	263.65
WPSR08-300R	1/2" x 300' Stud Reel	0651020	098268344103	300'	24	179.75

#### Blue

WPSR06-500B	3/8" x 500' Stud Reel	0651017	098268344066	500'	30	263.65
WPSR08-300B	1/2" x 300' Stud Reel	0651019	098268344080	300'	24	179.75

#### White

WPSR08-300W	1/2" x 300' Stud Reel	0651042	098268358780	300'	24	179.75
WPSR06-500W	3/8" x 500' Stud Reel	0651043	098268358797	500'	30	263.65

\*The wetted surface of this product contacted by consumable water contains less than one quarter of one percent (0.25%) of lead by weight.

Net Content = Quantity of individual pieces or feet contained in the consumer unit.

5

CSI #: 22 11 23



**“Triplex Diaphragm”  
3426 / 3526 / 3626 Series  
Automatic Water System Pump**

Model 3426 / 3526 / 3626 Series

**RES**

- Timing
- Priming
- Shock Absorbing Mounts
- 1/2 Port Fittings
- Bypass : Less Pulsation
- No need for accumulator tank
- Construction Resistant Materials
- UL SO 8846 (Ignition protection)

**FEATURES**

- Permanent Magnet, Ball Bearing
- Completely Enclosed. CE Models are
- Electrically suppressed.
- Three chamber diaphragm design
- Self-priming up to 9 feet suction lift;
- Pump able to run dry without damage



**Dimensions English (SI)**

Pump Series	Height inches (mm)	Length inches (mm)	Width inches (mm)	Weight Lb (Kg)
3X26XXX	4.75 (121)	9.00 (229)	6.00 (152)	3.50 (1.59)



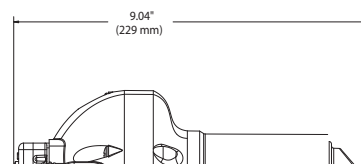
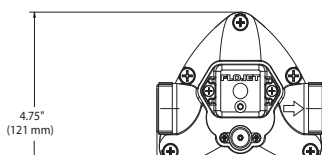
MODEL*	VOLTS	AMP DRAW @10 psi (0.7 bar)	FLOW GPM (LPM)	PRESSURE SWITCH Max psi (bar)	BYPASS
6144	12V dc	4.4	2.9 (11)	50 (3.4)	Yes
6344	24V dc	2.2	2.9 (11)	40 (2.8)	Yes
6144	12V dc	4.4	2.9 (11)	25 (1.7)	Yes
6344	24V dc	2.2	2.9 (11)	25 (1.7)	Yes
6148	12V dc	3.5	2.0 (8)	25 (1.7)	Yes
6348	24V dc	1.7	2.0 (8)	25 (1.7)	Yes

Electrically suppressed models are identified by a prefix “R” and a CE mark on the label.(i.e. R3626144).  
Statement Of Conformance (SDOC) is available upon request.

**OPERATION**

Turn pump switch off and battery fully charged, fill water tank, open all faucets, then turn pump switch on. Water will flow. When the water is free of air, turn faucets off. Remember, you are filling the water heater and the toilet vent lines. When all valves are shut-off, pump will stop. Should pump fail to stop, turn switch off and see the troubleshooting guide. **CAUTION** - Pump surface will get hot to the touch if operated for extended periods of time in pressurized conditions.

**DIMENSIONAL DRAWING**



CSI #: 22 11 23



**MODERN  
COMFORT  
BY GRUNDFOS**

GRUNDFOS HOT WATER RECIRCULATION

## Hot water without the wait

Before Grundfos, hot water recirculation solutions were difficult, if not impossible. Now, installations in both new construction and existing homes are quick, easy and profitable.

### Features & Benefits:

- Installations take an hour or less
- In retrofits, the Comfort System bypass valve makes it all possible with no return line and no need for electricity under the sink
- Uses less energy than a 25-watt light bulb (Comfort System Only)
- Can save up to 16,000 gallons of water per year
- Backed by a 30-month warranty
- All products comply with NSF-61 and AB 1953 standards



### Comfort System

UP 15-10 SU7P TLC  
(Part# 595916)

Pump, valve, line-cord,  
and (2) S.S. flex hoses.



### UP 10-16

UP 10-16BN5 ATLC  
(Part# 97525921)

Built-in timer, line-cord,  
and aquastat

For more information, go to: [moderncomfort.grundfos.us](http://moderncomfort.grundfos.us)

be  
think  
innovate

**GRUNDFOS** 

CSI #: 22 11 23

be think innovate

## – Comfort System UP 15-10 SU7P TLC (Part# 595916)

### Pump Technical Data:

**Flow Range:** 0 to 6.5 U.S. GPM  
**Head Range:** 0 to 6.0 U.S. Feet  
**Motor:** Single Phase, 115V  
**Min. Fluid Temperature:** 36°F (2°C)  
**Max. Fluid Temperature:** 150°F (66°C)  
**Max. Working Pressure:** 145 PSI

### Electrical Data:

**Volts:** 1X115V  
**Watts:** 25W  
**Amps:** 0.23A

### Approvals:

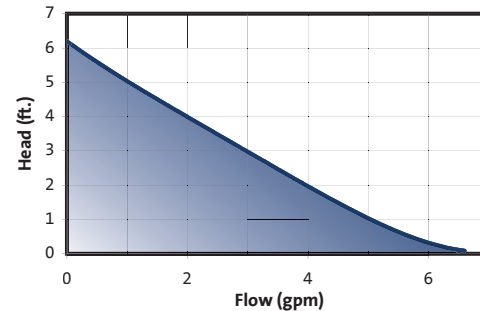


**Electrical Connection:** The pump is fitted with a 10 foot cord and 115V plug.

**Timer:** 3 control options available:

- Continuous
- 15-minute intervals
- OFF

### Performance Curve:

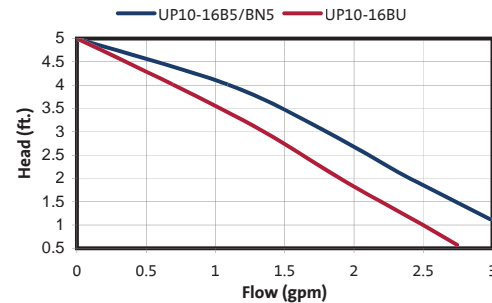


## – UP 10-16

### Pump Technical Data:

**Flow Range:** 0 to 3.5 U.S. GPM  
**Head Range:** 1 to 5 U.S. Feet  
**Motor:** 25W, Single Phase, 115V  
**Min. Fluid Temperature:** 36°F (2°C)  
**Max. Fluid Temperature:** 203°F (95°C)  
**Max. Working Pressure:** 145 PSI  
**Standard Features:** 5ft. line-cord w/plug  
**Optional Features:** Timer, Aquastat

### Performance Curve:



Models	Part Number	1/2" Sweat	1/2" F NPT	1 1/4" Union	Line Cord	Timer	Aquastat	Check Valve	Isolation Valve
UP10-16B5 LC	97525905	•			•				
UP10-16B5 TLC	97525907	•			•	•			
UP10-16B5 ATLC	97525908	•			•	•	•		
UP10-16BN5 LC	97525909		•		•				
UP10-16BN5 TLC	97525910		•		•	•			
UP10-16BN5 ATLC	97525921		•		•	•	•		
UP10-16BU ATLC	97525922			•	•	•	•	•	•

L-UP-SL-024 Rev. 08-12

GRUNDFOS Kansas City  
17100 West 118th Terrace  
Olathe, Kansas 66061  
Phone: (913) 227-3400  
Fax: (913) 227-3500

[www.grundfos.us](http://www.grundfos.us)

GRUNDFOS Canada  
2941 Brighton Road  
Oakville, Ontario  
L6H 6C9  
Phone: (905) 829-9533  
Fax: (905) 829-9512

GRUNDFOS Mexico  
Boulevard TLC No. 15  
Parque Industrial Sierra Aeropuerto  
C.P. 86600 Apodaca, N.L. Mexico  
Phone: 011-52-81-8144 4000  
Fax: 011-52-81-8144 4010



CSI #: 22 12 00



# ATL "Flex-Tank"™

## SPECIFICATIONS

### COLLAPSIBLE FABRIC STORAGE BLADDERS

**SERVING:**

- Defense
- Industry
- Environment
- Exploration
- Energy
- Agriculture
- Utilities
- Homeland Security
- Relief Organizations



PILLOW STYLE  
FLEX-TANKS

Toll Free In North America:  
**1-800-526-5330**



**PETRO-FLEX®**



**AQUA-FLEX®**



**CHEM-FLEX®**



**CARGO-FLEX™**

# www.pillowtanks.com

Aero Tec Laboratories Inc. USA • Aero Tec Laboratories Ltd. UK



DS-483  
5/05

**CSI #: 22 12 00**

**LEVEL 1**

**EXPENDABLE LOW COST AQUA-FLEX® WATER TANKS see DS-460**

Nominal Capacity		Full Dimensions, Nominal Max.		AQUA-FLEX® TYPE-G	Potable Water, Waste Water, Pool Water, Emergency Water			SHIPPING			
U.S. Gal.	1000L/M <sup>3</sup>	FT	M		Fill/Discharge FNPT	Vent FNPT	"Full" Signal	Wt. Lbs. Approx.	Wt. Kg Approx.	Cube Ft <sup>3</sup> Approx.	Cube M <sup>3</sup> Approx.
200	0.8	7' x 5' x 1'	2.1m x 1.5m x .3m	#109716	(1) 1" (25mm)	1" (25mm)	N	11	5	6	.2
250	1.0	7' x 6' x 1'	2.1m x 1.8m x .3m	109717	(1) 1" (25mm)	1" (25mm)	N	13	6	6	.2
500	2.0	11' x 6' x 1'	3.3m x 1.8m x .3m	109722	(1) 1" (25mm)	1" (25mm)	N	24	11	10	.3
1,000	4.0	11' x 9' x 1.5'	3.3m x 2.7m x .4m	109730	(1) 1" (25mm)	1" (25mm)	N	36	16	10	.3
2,000	8.0	11' x 11' x 1.8'	3.3m x 3.3m x .6m	109732	(1) 2" (50mm)	1" (25mm)	Y	54	25	10	.3
4,000	16	22' x 11' x 1.8'	6.7m x 3.3m x .6m	109737	(1) 2" (50mm)	1" (25mm)	Y	80	36	10	.3
8,000	32	22' x 22' x 1.8'	6.7m x 6.7m x .6m	109744	(1) 2" (50mm)	1" (25mm)	Y	124	56	10	.3
12,000	48	33' x 22' x 1.8'	10m x 6.7m x .6m	109750	(2) 2" (50mm)	1" (25mm)	Y	210	95	10	.3

**LEVEL 3**

**PETRO-FLEX® RANGE EXTENSION BLADDER TANKS (GASOLINE OR DIESEL) see DS-539**

Nominal Capacity		Full Dimensions, Nominal Max.		PETRO-FLEX® RANGE EXT.	Fuel Bladders for Gasoline and Diesel Fuels			SHIPPING			
U.S. Gal.	1000L/M <sup>3</sup>	FT	M		Fill FNPT	Vented Safety Cap	Outlet Discharge	Wt. Lbs. Approx.	Wt. Kg Approx.	Cube Ft <sup>3</sup> Approx.	Cube M <sup>3</sup> Approx.
25	.1	2.5' x 3.0' x 0.50'	0.8 m x 0.9m x .15m	#105405	2" (50mm)	Y	1/2" (13mm)	25	11	4	.1
50	.2	4.6' x 3.0' x 0.75'	1.4 m x 0.9m x 0.2m	105410	2" (50mm)	Y	1/2" (13mm)	30	14	6	.2
75	.3	4.6' x 3.8' x 1.00'	1.4 m x 1.2m x 0.3m	105413	2" (50mm)	Y	1/2" (13mm)	34	15	6	.2
100	.4	4.6' x 4.5' x 1.00'	1.4 m x 1.3m x 0.3m	105415	2" (50mm)	Y	1/2" (13mm)	35	16	6	.2
150	.6	4.6' x 6.0' x 1.25'	1.4 m x 1.8m x 0.4m	105420	2" (50mm)	Y	1/2" (13mm)	40	18	10	.3
200	.8	5.0' x 6.8' x 1.25'	1.5 m x 2.0m x 0.4m	105425	2" (50mm)	Y	1/2" (13mm)	45	20	10	.3
300	1.2	7.5' x 7.0' x 1.5'	2.3 m x 1.8m x 0.5m	105430	2" (50mm)	Y	1/2" (13mm)	55	25	10	.3

**LEVEL 3**



**HEAVY DUTY CARGO-FLEX™ TRANSPORT TANKS see DS-544**

\*FOR USE WITH D.O.T. WAIVER ONLY - Consult an ATL Sales Engineer

Stakebeds & Flatbeds	Nominal Capacity		Fill Pressure (psi)	EMPTY DIMENSIONS NOMINAL MAX.		Underliner	Number of Ratchet Tie-Downs Included	Fill/Discharge 1" = 25mm	CARGO-FLEX™	CARGO-FLEX™	CARGO-FLEX™	SHIPPING			
	U.S. GAL	1000L/M <sup>3</sup>		FT	M				TYPE-P2	TYPE-W2	TYPE-C2	Wt. Lbs. Approx.	Wt. Kg Approx.	Cube Ft <sup>3</sup> Approx.	Cube M <sup>3</sup> Approx.
									*Gasoline, Diesel Jet Fuel, Oil	Drinking Water FDA, NSF 61	*Chemicals Brines, Effluents				
	1,000	3.8	3	10' x 7.4'	3.0m x 2.25m	Y	2	2"	#105830	#156830	#160830	100	45	14	.4
	1,200	4.6	3	12' x 7.4'	3.7m x 2.25m	Y	2	2"	105833	156833	160833	125	57	14	.4
	1,500	5.8	3	15' x 7.4'	4.6m x 2.25m	Y	4	2"	105837	156837	160837	150	68	14	.4
	2,000	7.7	3	20' x 7.4'	6.1m x 2.25m	Y	4	2"	105841	156841	160841	175	80	20	.6
	3,000	11.5	3	30' x 7.4'	9.2m x 2.25m	Y	4	4"	105850	156850	160850	200	91	20	.6
	4,000	15.4	3	40' x 7.4'	12.3m x 2.25m	Y	4	4"	105856	156856	160856	220	100	20	.6
	4,600	17.7	3	45' x 7.4'	13.7m x 2.25m	Y	4	4"	105862	156862	160862	240	109	20	.6
	5,000	19.3	3	48' x 7.4'	14.6m x 2.25m	Y	6	4"	105870	156870	160870	260	118	20	.6
	6,000	24.2	3	55' x 7.4'	15.6m x 2.25m	Y	6	4"	105884	156884	160884	300	136	20	.6

**CSI #: 22 12 00**

10/9/12

Bladder Tanks and Collapsible Pillow Tanks



ATL Aqua-Flex® water bladders are your best water storage choice for short or long-term, on-site water storage:

- Clean, Sanitary POTABLE Water Storage
- Fast, Economical NON-POTABLE Water Storage

Aqua-Flex® bladders offer the most desirable characteristics:

- Light, Strong & Flexible
- Instant set-up, Just Unfold & Fill
- Collapsible to Only 4% of Full Volume
- Meets Mil-T-53029, U.S. DOD Specs ATPD-2265 and NSF-Std61

Available in two grades to suit your application:

**HEAVY DUTY: LEVEL 3 Aqua-Flex®**

Heavy-Duty, Military-Industrial Style Rubberized Nylon Water Tanks. U.S. DOD Specs ATPD-2265, Mil-T-53029 and NSF-Std 61 for Potable (drinking) water, deionized water, "ROPU" water and cistern water.

**MEDIUM DUTY: LEVEL 2 Aqua-Flex®**

Light-Duty, Commercial-Style Polyester Reinforced Water Tanks. "FDA" type for drinking water and aqueous solutions. (Not suitable for transport use)



**Technical Specifications**

RATED CAPACITY		APPROXIMATE DIMENSIONS		HEAVY-DUTY	MEDIUM-DUTY	NOM. WT.		NOM. CUBE	
GAL.	M3	FEET	METERS	LEVEL 3	LEVEL 2	LBS.	KG.	FT3	M3
25	0.1	3.5 x 2.5 x 0.50	1.1 x 0.8 x 0.15	156707	125707	25	11	4	0.1
50	0.2	4.2 x 3.3 x 0.75	1.3 x 1.0 x 0.2	156712	125712	30	14	6	0.2
100	0.4	5.3 x 4.2 x 1.00	1.6 x 1.3 x 0.3	156714	125714	35	16	6	0.2
150	0.6	6.6 x 4.2 x 1.25	2.0 x 1.3 x 0.4	156715	125715	40	18	10	0.3
200	0.8	7.9 x 4.9 x 1.25	2.4 x 1.5 x 0.4	156716	125716	45	20	10	0.3
250	1	8.7 x 4.9 x 1.5	2.7 x 1.5 x 0.5	156717	125717	50	23	10	0.3
300	1.2	8.7 x 5.8 x 1.5	3.0 x 1.5 x 0.5	156718	125718	55	25	10	0.3
500	2	9.3 x 7.5 x 1.75	2.8 x 2.3 x 0.5	156722	125722	60	27	10	0.3
750	3	11.5 x 7.5 x 1.75	3.4 x 2.4 x 0.5	156725	125725	75	34	10	0.3
1,000	4	11.6 x 9.8 x 2.0	3.5 x 3.0 x 0.6	156730	125730	90	41	10	0.3
1,500	6	12.8 x 11.0 x 2.5	3.9 x 3.4 x 0.7	156731	125731	115	52	10	0.3
2,000	8	14.2 x 12.3 x 2.75	4.3 x 3.7 x 0.8	156732	125732	145	66	20	0.6
2,500	10	14.8 x 13.25 x 3.0	4.5 x 4.0 x 0.9	156733	125733	150	68	20	0.6
3,000	12	15.3 x 14.8 x 3.25	4.7 x 4.5 x 1.0	156735	125735	165	75	20	0.6
4,000	16	17.4 x 15.5 x 3.5	5.3 x 4.7 x 1.1	156737	125737	185	84	20	0.6
5,000	20	18.7 x 17.2 x 3.75	5.7 x 5.2 x 1.1	156739	125739	205	93	20	0.6
6,000	24	18.8 x 17.7 x 4.0	5.7 x 5.4 x 1.2	156740	125740	245	111	20	0.6
7,500	30	19.8 x 19.3 x 4.25	6.0 x 5.9 x 1.3	156743	125743	295	134	20	0.6
10,000	40	22.1 x 21.0 x 4.5	6.7 x 6.4 x 1.4	156745	125745	375	170	44	1.3
15,000	60	24.7 x 24.6 x 4.75	7.5 x 7.5 x 1.4	156755	125755	490	223	44	1.3
20,000	80	30.8 x 24.6 x 5.0	9.4 x 7.5 x 1.5	156770	125770	530	241	44	1.3
25,000	100	37.0 x 24.6 x 5.25	11.3 x 7.5 x 1.6	156775	125775	745	339	44	1.3
40,000	160	56.6 x 24.6 x 5.5	17.3 x 7.5 x 1.7	156781	125781	1200	545	90	3
50,000	200	66.9 x 24.6 x 5.5	20.4 x 7.5 x 1.7	156785	125785	1500	682	90	3
100,000	400	86.4 x 35.3 x 6.0	26.3 x 10.8 x 1.8	156789	N.A.	2250	1023	120	3.5



For Mild Liquid Chemicals - Technical Specifications



[www.atlinc.com/pillow.html#C2](http://www.atlinc.com/pillow.html#C2)

CSI #: 22 12 00

IS-PLT

# Models: PLT-5, PLT-12, PLT-20

## Potable Hot Water Expansion Tank

### Installation Instructions

#### **WARNING!**

Improper installation, adjustment, alteration, service or maintenance can cause property damage, serious bodily injury or death. Read instructions completely before proceeding with installation. Only qualified personnel may install or service this equipment in accordance with local codes and ordinances.

Do not exceed 80psi (5.5 bar) air charge. Air charge pressure exceeding 80psi (5.5 bar) could become hazardous and will void any and all warranties, either written or implied. Failure to follow these instructions will result in the possibility of property damage, serious bodily injury or death.

This Expansion Tank is designed and intended for water storage at a maximum pressure of 150psi (10.3 bar) and a maximum temperature of 200°F (93°C). Any use other than for potable water or a sustained or instantaneous pressure in excess of 150psi (10.3 bar) or 200°F (93°C) is **UNSAFE** and can cause property damage, serious bodily injury or result in death.



Certified to ANSI/NSF 61  
(73°F/23°C)



Listed by IAPMO

**Disclaimer:** The manufacturer of this tank does not accept any liability or other responsibility for personal injury or property damage resulting from improper use, installation or operation of this tank or the system of which it is a part.

**Notice:** The expansion tank, piping and your connections may in time leak. Select a location to install the expansion tank where a water leak will not damage the surrounding area. The manufacturer is not responsible for any water damage in connection with this expansion tank.

### Acceptance Volume

Air Side Pre-pressure (psi) (bar)	Water Side Volume at 150psi (10.3 bar) (gallons)		
	PLT-5	PLT-12	PLT-20
20 (1.4)	1.48	3.42	7.102
40 (2.8)	1.26	2.88	5.882
60 (4.1)	1.0	2.49	4.705
80 (5.5)	.80	1.85	4.009

	PLT-5	PLT-12	PLT-20
	Order No. 0067370	Order No. 0067371	Order No. 0067372
Description			
Max. Pressure - psi	150	150	150
Max. Temp. - °F	200	200	200
Tank Volume - gal.	2.1	4.5	8.5
Tank Acceptance - gal.	1.26	2.8	3.4
Air Pre-charge - psi	20	20	20
Connections Size - in.	¾ male	¾ male	¾ male
Diameter - in.	8	10.5	12½
Length - in.	11	13.5	19¾
Weight - lbs.	5.5	10	15

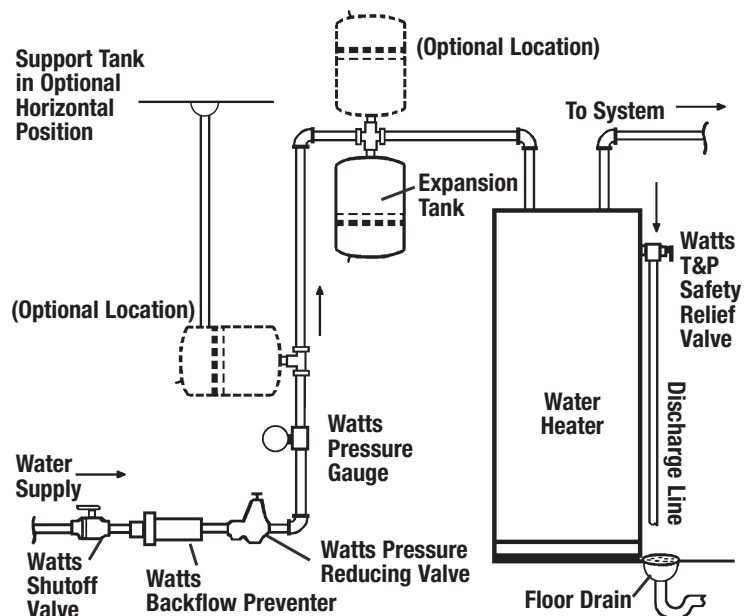


Figure 1



## CSI #: 22 12 00

### Installation

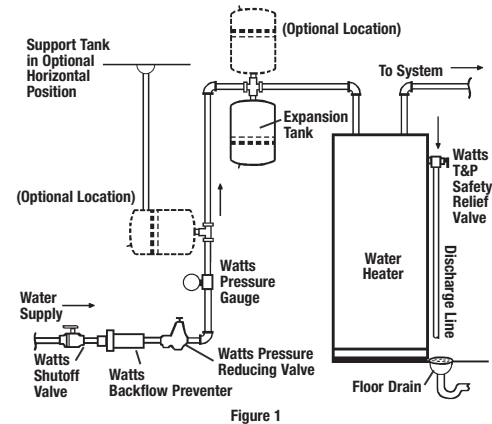
- Before beginning installation determine the system pressure.
  - Open a faucet to allow the system pressure to equalize.
  - Close faucet.
  - Read the system pressure at the pressure gauge (Figure 1).
- The expansion tank pre-charge must be set to the system pressure as determined in Step 1. Pre-charge prior to installation in the system.

**Caution:** Pre-charge prior to installation in the system. Do not adjust the air pre-charge of the expansion tank with the system under pressure. The air pre-charge should only be adjusted under zero system pressure.

**Note:** The normal pre-charge is 20psi (138 kPa).  
**Do not exceed 80psi.** If system pressure exceeds 80psi (5.5 bar) it will be necessary to either: **A.** Add a pressure reducing valve to the system or, **B.** Locate the expansion tank in a riser where the static pressure is below 80psi (5.5 bar).



- Unscrew the protective cap from the air inlet valve.
  - Using a tire pressure gauge, check the tank pre-charge pressure.
  - If necessary, pressurize the tank to the proper setting using a manual bicycle tire pump. **Caution do not exceed 80psi.**
  - Replace the protective air cap.
- Shut off the water supply valve.
  - Shut off power source to the water heater, (electricity, gas, oil burner switch) and drain system following water heater manufacturer recommendations.
  - Install the expansion tank in the system (refer to Figure 1).
    - The weight of the expansion tank filled with water is supported by the system piping. Therefore, it is important that, where appropriate, the piping has suitable bracing (strapping, hanger, brackets).
    - The expansion tank may be installed vertically (preferred method) or horizontally. **Caution: The tank must be properly supported in horizontal applications.**
    - This expansion tank, as all expansion tanks, may eventually leak. **Do not install without adequate drainage provisions.**
  - Turn on the water supply valve.
  - Open a hot water fixture and allow water flow until all air is removed from the system.
  - Reapply power to the water heater.
  - Open a hot water fixture to allow a slight flow until the hot water has reached operating temperature.
  - Recheck system pressure following Step 1.a through c.



**Caution:** Pre-charge prior to installation in the system. Do not adjust the air pre-charge of the expansion tank with the system under pressure. The air pre-charge should only be adjusted under zero system pressure.

If necessary, adjust the pressure reducing valve to the expansion tank pre-charge as determined in Step 2.

### Important!

- A pressure relief valve sized and installed in accordance with local codes must be incorporated in the systems requiring a combined temperature and pressure safety relief valve. The temperature and pressure safety relief valve should be sized and installed in accordance with local codes.
- Never plug a safety Relief Valve.

#### CALIFORNIA PROPOSITION 65 WARNING

**WARNING:** This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. (California law requires this warning to be given to customers in the State of California.)

For more information: [www.watts.com/prop65](http://www.watts.com/prop65)

**Limited Warranty:** Watts Regulator Co. (the "Company") warrants each product to be free from defects in material and workmanship under normal usage for a period of one year from the date of original shipment. In the event of such defects within the warranty period, the Company will, at its option, replace or recondition the product without charge.

**THE WARRANTY SET FORTH HEREIN IS GIVEN EXPRESSLY AND IS THE ONLY WARRANTY GIVEN BY THE COMPANY WITH RESPECT TO THE PRODUCT. THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED. THE COMPANY HEREBY SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

The remedy described in the first paragraph of this warranty shall constitute the sole and exclusive remedy for breach of warranty, and the Company shall not be responsible for any incidental, special or consequential damages, including without limitation, lost profits or the cost of repairing or replacing other property which is damaged if this product does not work properly, other costs resulting from labor charges, delays, vandalism, negligence, fouling caused by foreign material, damage from adverse water conditions, chemical, or any other circumstances over which the Company has no control. This warranty shall be invalidated by any abuse, misuse, misapplication, improper installation or improper maintenance or alteration of the product.

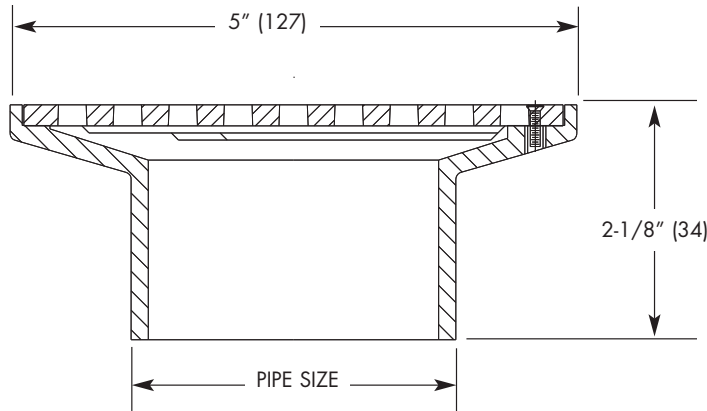
Some States do not allow limitations on how long an implied warranty lasts, and some States do not allow the exclusion or limitation of incidental or consequential damages. Therefore the above limitations may not apply to you. This Limited Warranty gives you specific legal rights, and you may have other rights that vary from State to State. You should consult applicable state laws to determine your rights. **SO FAR AS IS CONSISTENT WITH APPLICABLE STATE LAW, ANY IMPLIED WARRANTIES THAT MAY NOT BE DISCLAIMED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO ONE YEAR FROM THE DATE OF ORIGINAL SHIPMENT.**



CSI #: 22 14 26

 <b>WATTS<sup>®</sup> DRAINAGE</b>	<b>FD5</b> Tag: _____	<b>General Purpose Floor Drain</b>
<b>PROLINE</b>		

**SPECIFICATION:** Watts ProLine FD5 PVC, ABS, or cast iron general purpose floor drain with secured ductile iron or nickel bronze grate.



Pipe Sizing (Select One)		
Suffix	Description	
-2PVC	2" PVC	<input type="checkbox"/>
-2ABS	2" ABS	<input type="checkbox"/>
-2NH	2" No Hub	<input type="checkbox"/>
-3PVC	3" PVC	<input type="checkbox"/>
-3ABS	3" ABS	<input type="checkbox"/>
-3NH	3" No Hub	<input type="checkbox"/>
-4PVC	4" PVC	<input type="checkbox"/>
-4ABS	4" ABS	<input type="checkbox"/>
-4NH	4" No Hub	<input type="checkbox"/>

Options (Select One or More)		
Suffix	Description	
-NB	Nickel Bronze Grate	<input type="checkbox"/>
-VP	Vandal Proof Screws	<input type="checkbox"/>

Job Name _____	Contractor _____
Job Location _____	Contractor's P.O. No. _____
Engineer _____	Representative _____


CSI #: 22 14 29



**Series KP Stainless Steel Submersible Sump & Utility Pump**

**KP**  
**150, 250, 350**

**Submittal Data**

	JOB or CUSTOMER:	
	ENGINEER:	
	CONTRACTOR:	
	SUBMITTED BY:	DATE:
	APPROVED BY:	DATE:
	ORDER NO:	DATE:
	SPECIFICATION REF:	

QTY.	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENTS
					115	1	
					115	1	

Repair Kit P/N:

**Technical Data**

**PERFORMANCE RANGE:**

- Flow: .5 - 62 U.S. GPM
- Head: 0 - 31 feet of water
- Horsepower: 1/4, 1/3, 1/2 HP

**SOLIDS HANDLING:**

- 3/8 Inch Spherical

**PUMPING LEVEL:**

- **Manual Operation**
  - Minimum 1 3/16" or 1/2" with suction strainer removed.
- **Automatic Operation**
  - Minimum 4" for KP 150 & KP 250
  - Minimum 4 3/8" for KP 350

**MOTOR TYPE:**

- AC Induction
- Non-toxic motor liquid
- Class F insulation
- Manufactured by Grundfos

**THERMAL PROTECTION:**

- Automatic reset

**FLUID TEMPERATURE RANGE:**

- 32° - 122°F Continuous Operation
  - 123° - 158°F Intermittent Operation
- Intermittent run time, 2 minutes every 30 minutes totally submerged

**DISCHARGE SIZE:**

- 1 1/4" NPT

**APPROVALS:**



**Applications**

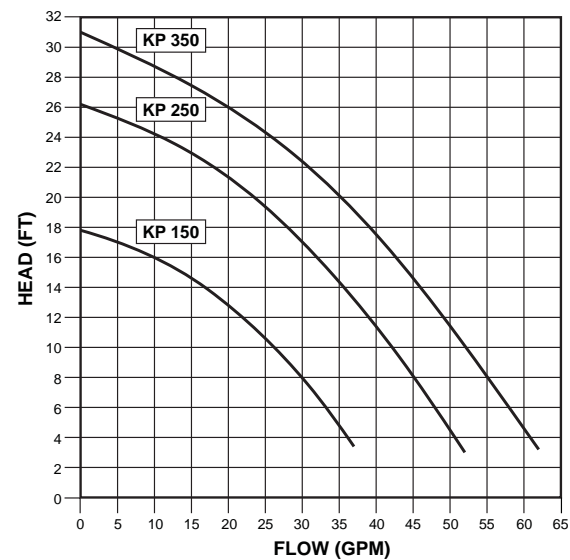
**Use for:**

- Effluent
- Clear or dirty sump water
- Grey water
- Draining ponds, pits and tanks
- De-Watering, Draining and filling tanks, Draining pools & spas
- Light Chemical Mixing\*
- Fountains

**Do not use for:**

- Raw sewage
  - Flammables
  - Highly corrosive liquids
- \* Flush after use

**Performance Curve 3350 RPM 60 Hertz**

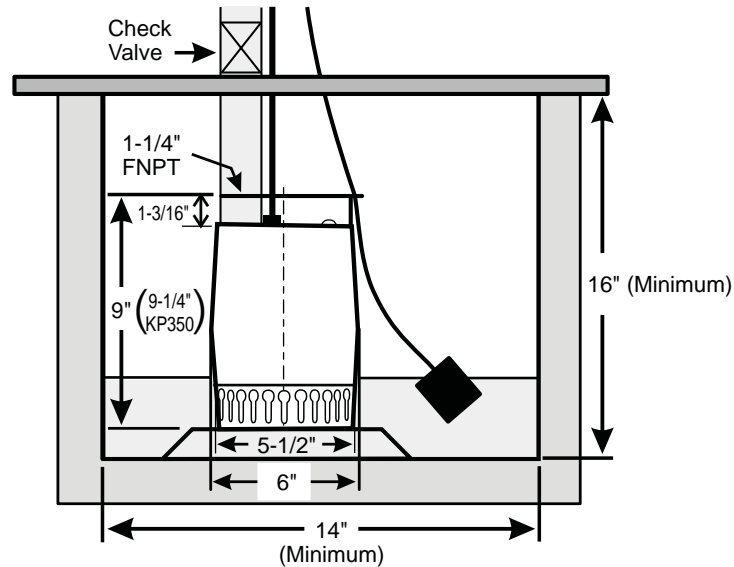


**Electrical Data, Weights, and Volume**

Model	HP	PH	Volts	Maximum Power Consumption (Watts)	Maximum Current (Amps)	Locked Rotor Current (Amps)	Size (NPT)	Ship* (Weight (Lbs.))	Volume (Cu. Ft.)
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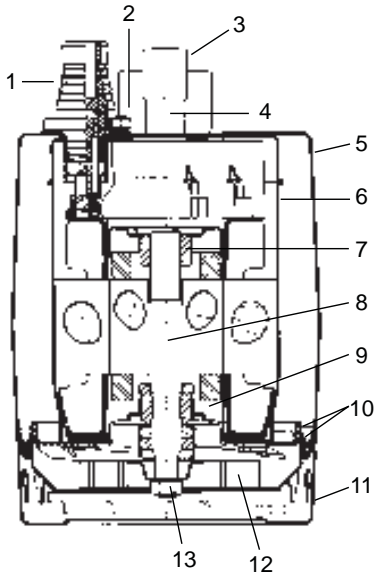
**CSI #: 22 14 29**

**Dimensions/Installation**



Power cord length: 10 ft. and 25 ft. standard, float switch length: 10 ft. and 25 ft. available.

**Sectional Drawing**



**Materials of Construction**

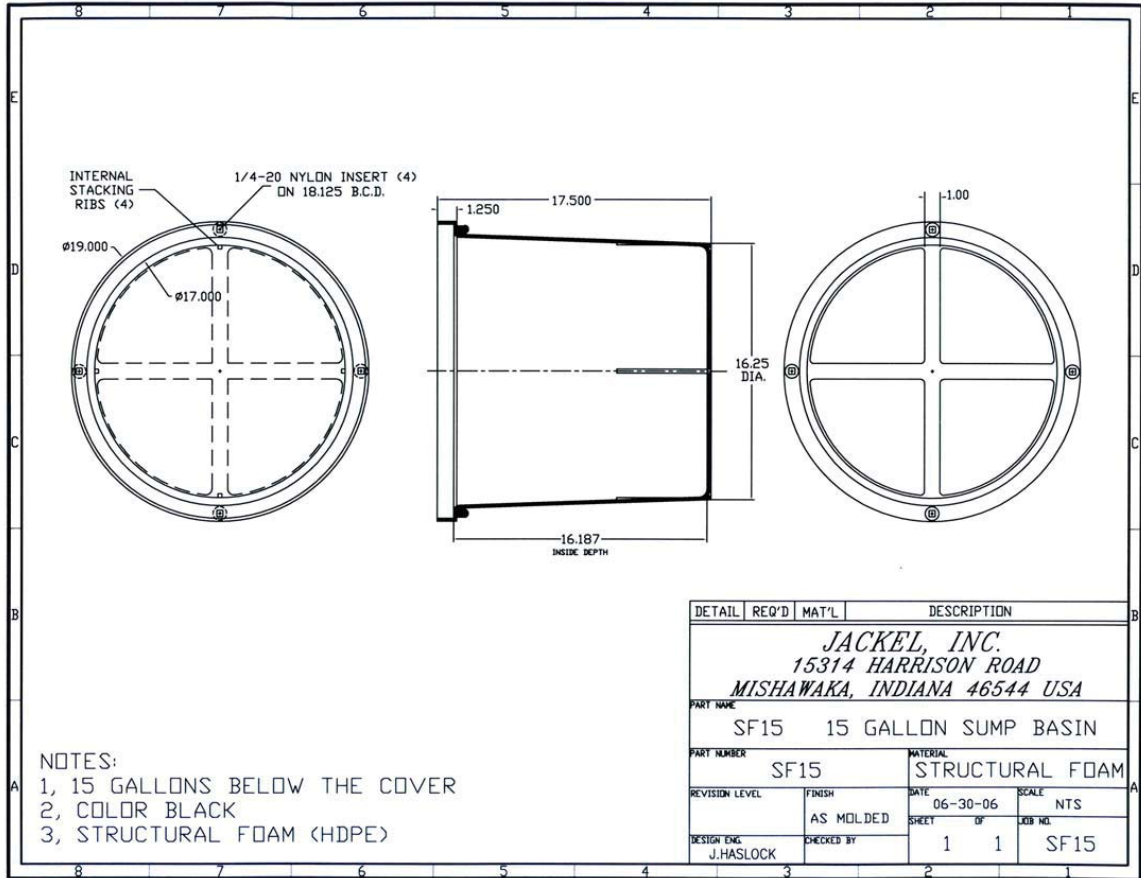
Position	Description	Material	ASTM
1	Power cord	Neoprene	
2	Fasteners (nut and washer)	Stainless steel	304
3	Handle cover / Cord position lock	Luranyl	
4	Handle structure	Stainless steel	304
5	Pump housing	Stainless steel	304
6	Stator housing	Stainless steel	304
7	Bearings	Carbon	
8	Shaft with rotor	Stainless steel / Silumin	304
9	Motor liquid	SML2	
10	O'ring / Seal ring	NBR	
11	Strainer	Stainless steel	304
12	Impeller	Stainless steel	304
13	Nut	Stainless steel	304



Grundfos Pumps Corporation • 17100 W. 118th Terrace • Olathe, KS 66061

CSI #: 22 14 36

### SF-15 Sump Basin



**CSI #: 22 30 00**

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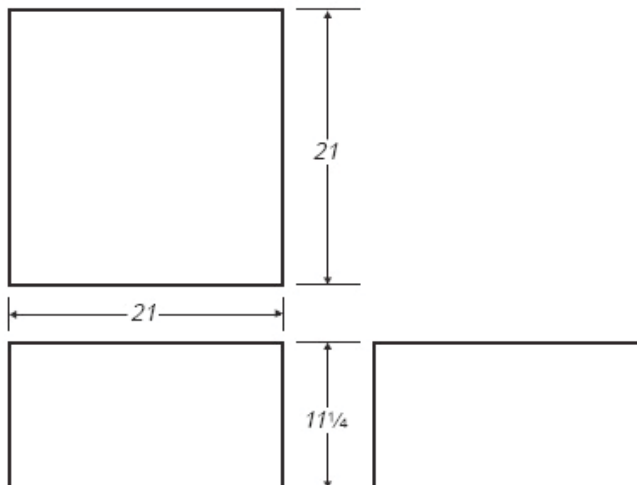


### Product -B233:

Gallons: 20

Price: \$ 248.58

Dimensions: 21L x 21W x 11 1/4H



Available: Call to Order

**This tank includes:**

(1) Inlet, (1) Outlet and (1) Vent (Additional charge if you need more than 3 fittings)

**If you need fittings installed on the tank:**

a. Download our [Fax Form \(PDF\)](#) (You will need to have Adobe Reader to view our

PDF's. It only takes about 3 min. to download and install.  [Adobe](#)

[Reader](#) If you dont want to install the Adobe Reader you can download our [IPG fax](#)

Gallons Search:

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[Marine Water Tanks](#)

[RV Water Tanks](#)

[W-Series Tanks](#)

**CSI #: 22 30 00**

istics of the Water Tanks, RV Water Tank, Auto Detail Tanks, Water Tanks

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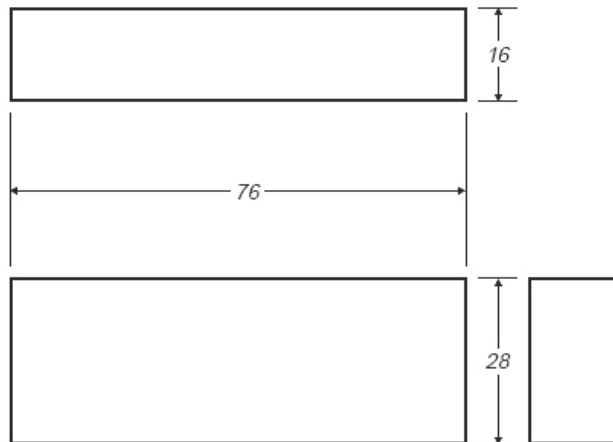


### Product -B300:

Gallons: 135

Price: \$ 799.05

Dimensions: 76L x 28W x 16H



Gallons Search:

Ronco Products:

- [Auto Detail Tanks](#)
- [Holding Water Tanks](#)
- [Inspection Plates](#)
- [Marine Water Tanks](#)
- [RV Water Tanks](#)
- [W-Series Tanks](#)


Available: Call to Order

**This tank includes:**

(1) Inlet, (1) Outlet and (1) Vent (Additional charge if you need more than 3 fittings)

**If you need fittings installed on the tank:**

a. Download our [Fax Form \(PDF\)](#) (You will need to have Adobe Reader to view our

PDF's. It only takes about 3 min. to download and install.  [Adobe Reader](#). If you dont want to install the Adobe Reader you can download our [JPG fax](#)

**CSI #: 22 31 00**

ES-OFRES

***For Residential Applications***

Job Name _____	Contractor _____
Job Location _____	Approval _____
Engineer _____	Contractor's P.O. No. _____
Approval _____	Representative _____

# Series OFRES

## Whole House OneFlow® Residential Anti-Scale Systems

**Connection Sizes: 1" (25mm) MNPT**

**Flow Rates: Up to 16 gpm (60 lpm)**

OneFlow® Residential Anti-Scale Systems provide a home with protection from internal hardness related scale formation on plumbing surfaces. Water using appliances and plumbing fixtures also enjoy a longer lifespan because hardness scale build up on internal parts no longer occurs. These systems are specifically designed for residential applications. OneFlow® Residential systems should be installed at the point-of-entry to a home to treat both the hot and the cold water.

OneFlow® Residential systems prevent scale by transforming dissolved hardness minerals into harmless, inactive microscopic crystal particles. These crystals stay suspended in the water and are passed to drain, thereby having a greatly reduced ability to react negatively like dissolved hardness does. These systems require very little maintenance, no backwashing, no salt, and no electricity. Typical hardness problems, especially build-up of scale in pipes, water heaters, boilers, fixtures, and appliances are no longer a concern.

OneFlow® Residential systems are not water softeners or chemical additives (like anti-scalants or sequestrants). They are scale prevention devices with proven third party laboratory test data and years of successful applications. OneFlow® Residential systems are the one water treatment device that effectively provides scale protection in the home and are a great alternative to water softening (ion exchange) or scale sequestering chemicals.

### Features

- Chemical free scale prevention and protection – converts hardness minerals to harmless, inactive microscopic crystals making OneFlow® an effective alternative technology to a water softener for the prevention of scale due to water hardness
- Virtually maintenance free – No salt bags or other chemicals to constantly add
- No control valve, no electricity and no wastewater
- Uses environmentally friendly "green" technology
- Improves efficiency of all water using appliances – both hot\* and cold

**\*Always install OneFlow® Residential systems before the water heating device.**

**Note: Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.**



OFRES

- Simple sizing & installation
- Perfect system for towns or communities where water softeners are banned or restricted
- OneFlow® - Residential systems do not remove minerals or add sodium to the water supply
- OneFlow® - Residential systems can be installed as a pre-treatment to reverse osmosis (OneFlow® should be the last stage in treatment unless a point-of-use system is being used downstream.)
- Systems include a bypass valve for a simplified installation



## CSI #: 22 31 00

### Feed Water Chemistry Requirements

pH	6.5 to 8.5
Hardness (maximum)	75 grains (1282 ppm CaCO <sub>3</sub> )*
Water Pressure	15psi to 100psi (103 kPa to 6.9 bar)
Temperature	40°F to 110°F (5°C to 43°C)
Chlorine	< 2ppm
Iron (maximum)	0.3 mg/l
Manganese (maximum)	0.05 mg/l
Copper	< 0.1 mg/l
Oil & H <sub>2</sub> S	None allowed
Polyphosphate	None allowed
Silica (maximum)	10 ppm

\*Note: These systems prevent hardness related scale formation inside the plumbing system of the home at influent hardness levels of 75 grains per gallon of calcium carbonate and less. Due to variances in water chemistry certain aesthetic conditions external of the plumbing system may not be attained. Water known to have heavy loads of dirt and debris should be prefiltered. Recommended PWFIL-SED-BB-10-20M-PMT PWHSG-AST-BB-10-1-PR. Copper lines need to be passivized for a minimum of 4 weeks before placing unit into service. Not for use on closed loop systems.

MODEL	CONNECTION SIZE	MINERAL TANK SIZE	MEDIA LITERS	MAXIMUM SERVICE FLOW (GPM)*	PRESSURE DROP (PSI)**	FLOOR SPACE (L X W X H)
OFRES-0835	1" MNPT	8" X 35"	2	8	<15	13" X 9" X 40"
OFRES-0935	1" MNPT	9" X 35"	3	12	<15	13.5" X 10" X 40"
OFRES-1035	1" MNPT	10" X 35"	4	16	<15	14" X 11" X 40"

\*Exceeding maximum flow can reduce effectiveness and void warranty.

\*\*Pressure drop at maximum service flow rate.

### Replacement Media

OFRES-0835RM Media should be replaced every 3 years

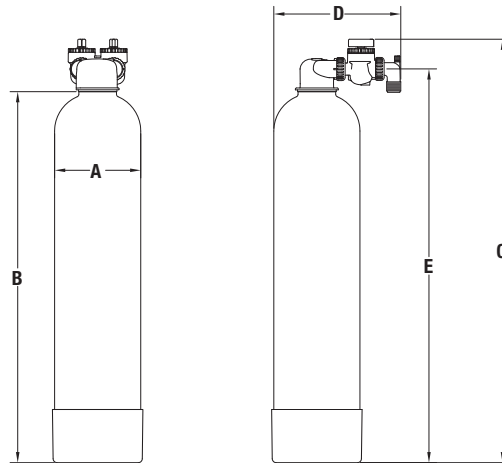
OFRES-0935RM Media should be replaced every 3 years

OFRES-1035RM Media should be replaced every 3 years

**Note: Maximum service flow rate is for intermittent use only and is not to be interpreted as continuous service flow rate capability. These systems are designed to treat the domestic water used in a single family dwelling. For higher volume applications please contact your Watts representative.**

### Standards

Independent scientific testing has confirmed Template Assisted Crystallization (TAC) technology provides scale reduction of over 95+%. Testing was conducted under protocol based on DVGW W512 test to access control of scale formation.



### Dimensions - Weights

PART NO.	TANK (A&B)	IN (E)	OUT (E)	OVERALL HEIGHT (C)	OVERALL DEPTH (D)	SHIPPING WEIGHT	
						lbs.	kgs.
OFRES-0835	8" x 35"	37"	37"	40"	12"	19	9
OFRES-0935	9" x 35"	37"	37"	40"	12.5"	23	10
OFRES-1035	10" x 35"	37"	37"	40"	13"	25	11

The overall height and the height of the fitting varies due to material variations and assembly tolerances. Please allow additional clearances above the tank for making connections.

CSI #: 22 33 00

# AirTap™ Hybrid

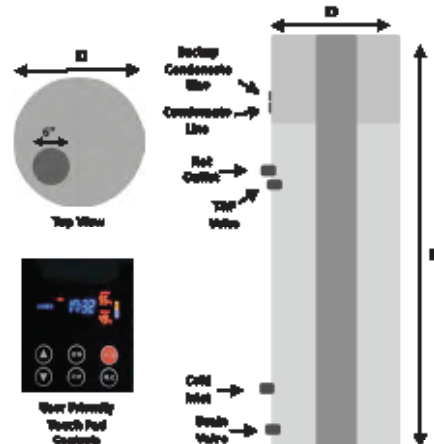
The Next Generation Water heater



Available in 50 and 66 Gallon Models

- Best efficiency in the industry
- High recovery rate
- Made entirely from stainless steel 304
- 3/4" water inlet, outlet, and condensate line
- Backup heating element
- Top exhaust duct
- Releases cool dehumidified air at 400 cfm when heat pump is in operation
- User friendly touch pad controls
- Built in anode rod
- Easy access side connections
- Water temperature can be set anywhere between 90° F to 135° F
- 3 operation modes
  - Energy saver (heat pump only)
  - Hybrid (heat pump & electric element)
  - High demand (electric element only)
- 4 way reversing valve for auto defrost
- Auto overheating detection
- Environmental friendly refrigerant R410a
- Can operate efficiently in ambient temperature ranging between 20° F to 120° F
- Built in T&P valve
- Low noise unit
- Brass drain valve
- Limited Lifetime Warranty

Specifications	ATI50	ATI66
Tank size	50 gallons	66 gallons
Energy Factor (hybrid mode)	2.40	2.40
First Hour Rating (hybrid mode)	60 gallons	75 gallons
Heat Pump BTU Rating	10,000 (3kW)	10,000 (3kW)
Electric Element	4 kW	4 kW
Backup Electric Element	4 kW	4 kW
Compressor	Panasonic	Panasonic
Refrigerant	R410A	R410A
Tank Capsule	Stainless Steel 304	Stainless Steel 304
Diameter (D)	25.6 inches	25.6 inches
Height (H)	58.3 inches	69.3 inches
Weight	190 lbs	227 lbs
Duct Diameter (top of unit)	6 inches	6 inches
Decibel Rating	48	48
Voltage	220V	220V



\*AirGenerate reserves the right to make changes without notice.



For more information about using AirTap™ integrated in your home or business, contact:  
Sales  
1000 Commerce Park Drive, Houston, TX 77066 - U.S.A.  
713.574.6729 or [sales@airgenerate.com](mailto:sales@airgenerate.com) or visit [www.airgenerate.com](http://www.airgenerate.com)



CSI #: 22 41 16

8/14/13

"P" Trap with round box escutcheon - Jaclo

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SEARCH



**NEW PRODUCTS**

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SHOWERHEADS & SHOWER  
COLLECTIONS

THE RAIN MACHINE®

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ACCESSORIES

FAUCETS, POT FILLERS &  
TUB SPOUTS

**DECORATIVE SPECIALTIES**

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**"P" Trap with round box escutcheon**

253-

- 1½" 17 gauge
- Contains round box high with escutcheon
- All solid brass nuts with washers
- Fits 1½" and 1¼" drains



**Available Finishes:**

Select finishes may not be available on all products. Consult your dealer or the Jaclo factory.

(mouse over to view finish)

[Chrome](#), [Polished Brass](#), [Polished Nickel](#),  
[Satin Chrome](#), [Satin Nickel](#), [Antique Brass](#),  
[Antique Copper](#), [Black Nickel](#), [Oil-Rubbed](#)  
[Bronze](#), [Pewter](#), [Polished Copper](#), [Polished](#)  
[Gold](#), [Satin Brass](#), [Satin Gold](#), [Bronze](#)  
[Umber](#), [Matte Black](#), [Unlaquered Brass](#)

[PREVIOUS ITEM](#)   [NEXT ITEM](#)



[Specifications](#)

No product manual available at this time

Chrome

[Add to My Jaclo Project](#)

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CSI #: 22 41 16

**KOHLER**  
FAUCETS

**DUOSTRAINER®**

**Features**

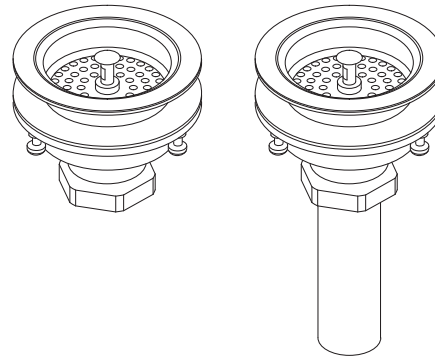
- Brass construction
- For sink installations with 3-1/2" (8.9 cm) or 4" (10.2 cm) outlet
- Removable basket strainer with open/close stopper
- 1-1/2" connection

**Codes/Standards Applicable**

Specified model meets or exceeds the following:

- ASME A112.18.1
- CSA B125
- IAPMO/UPC

**SINK STRAINER**  
**K-8801**  
**ALSO K-8799**



**Colors/Finishes**

- CP: Polished Chrome
- PB: Polished Brass
- Other: Refer to Price Book for additional colors/finishes

**Specified Model:**

Model	Description	Colors/Finishes		
		CP	PB	Other ____
K-8799	Sink strainer less tailpiece	CP	PB	
K-8801	Sink strainer with tailpiece	CP	PB	Other ____

**PRODUCT SPECIFICATION**

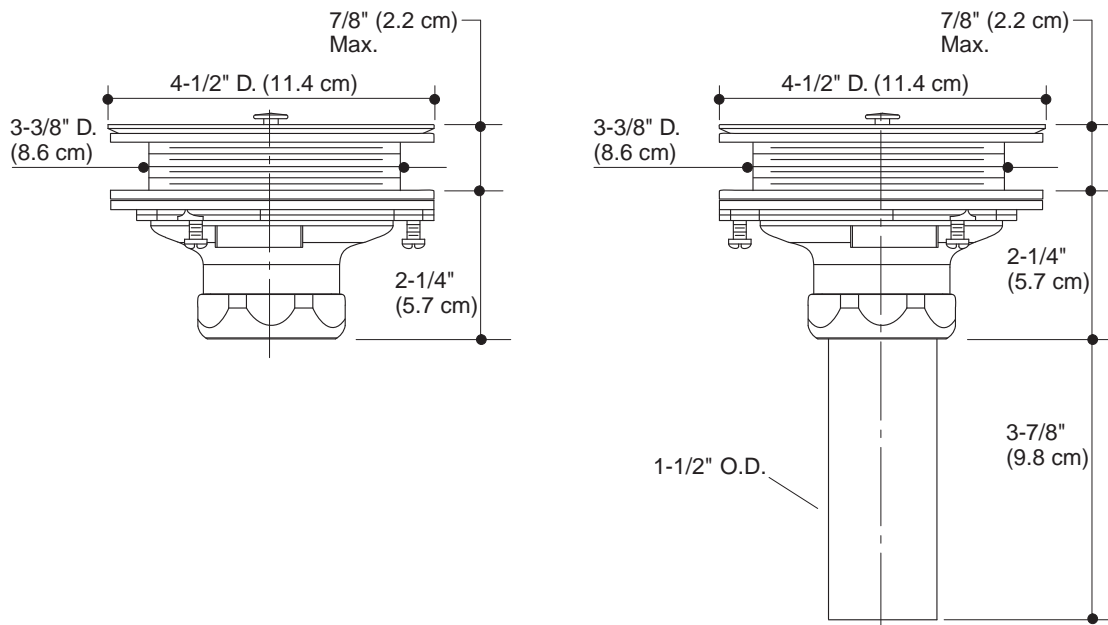
Duostrainer sink strainer shall be of brass construction. Product shall feature removable basket strainer with an open/close stopper, and 1-1/2" connection. Product is intended for sink installations with 3-1/2" (8.9 cm) or 4" (10.2 cm) outlet. Optional feature shall be a brass tailpiece. Strainer shall be Kohler Model K-\_\_\_\_\_-\_\_\_\_\_.

CSI #: 22 41 16

## DUOSTRAINER®

### Installation Notes

Install this product in accordance with the installation instructions.



### Product Diagram

DUOSTRAINER® SINK STRAINER  
Page 2 of 2  
105248-4-BB

THE BOLD LOOK  
OF **KOHLER.**

CSI #: 22 41 16

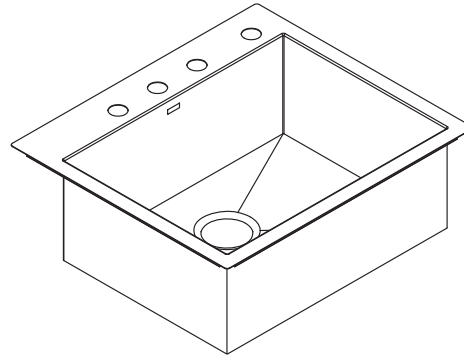
**KOHLER®**

**VAULT™**

**Features**

- 18-gauge stainless steel
- Top-mount or under-mount
- Small single bowl
- Includes bottom bowl rack
- Includes installation hardware
- Includes SilentShield® sound-absorption technology
- Use for standard 27" cabinet
- 25" (635 mm) x 22" (559 mm)

**TOP-MOUNT/UNDER-MOUNT  
KITCHEN SINK  
K-3822**



**Codes/Standards Applicable**

Specified model meets or exceeds the following:

- ASME A112.19.3/CSA B45.4

**Colors/Finishes**

- NA: None applicable

**Accessories**

- CP: Polished Chrome
- ST: Stainless Steel
- NA: None applicable
- Other: Refer to Price Book for additional colors/finishes

**Specified Model**

Model	Description	Colors/Finishes
K-3822-1	Top-mount/Under-mount kitchen sink – single-hole	<input type="checkbox"/> NA
K-3822-3	Top-mount/Under-mount kitchen sink – 3-hole	<input type="checkbox"/> NA
K-3822-4	Top-mount/Under-mount kitchen sink – 4-hole (shown)	<input type="checkbox"/> NA

Included Accessories		
K-6645	Bottom bowl rack	<input type="checkbox"/> ST

Optional Accessories					
K-6429	Sink bridge utility shelf with dish cloth bar				
K-6667	Wood cutting board (fits K-3822-1 only)			<input type="checkbox"/> NA	
K-8801	Duostrainer® sink strainer (cont.)	<input type="checkbox"/> CP	<input type="checkbox"/> ST		<input type="checkbox"/> Other_____

**Product Specification**

The top-mount or under-mount kitchen sink shall be made of 18-gauge stainless steel. Sink shall include bottom bowl rack and installation hardware. Sink shall have a small single bowl. Sink shall include SilentShield sound-absorption technology. Sink shall be 25" (635 mm) in length and 22" (559 mm) in width. Sink shall be for use with standard 27" cabinet. Sink shall be Kohler Model K-3822-\_\_\_\_-NA.

CSI #: 22 41 16

## VAULT™

(cont.) Optional Accessories			
1131881	Hardware kit for countertops with a 2-1/2" (64 mm) thickness or less		<input type="checkbox"/> NA

### Technical Information

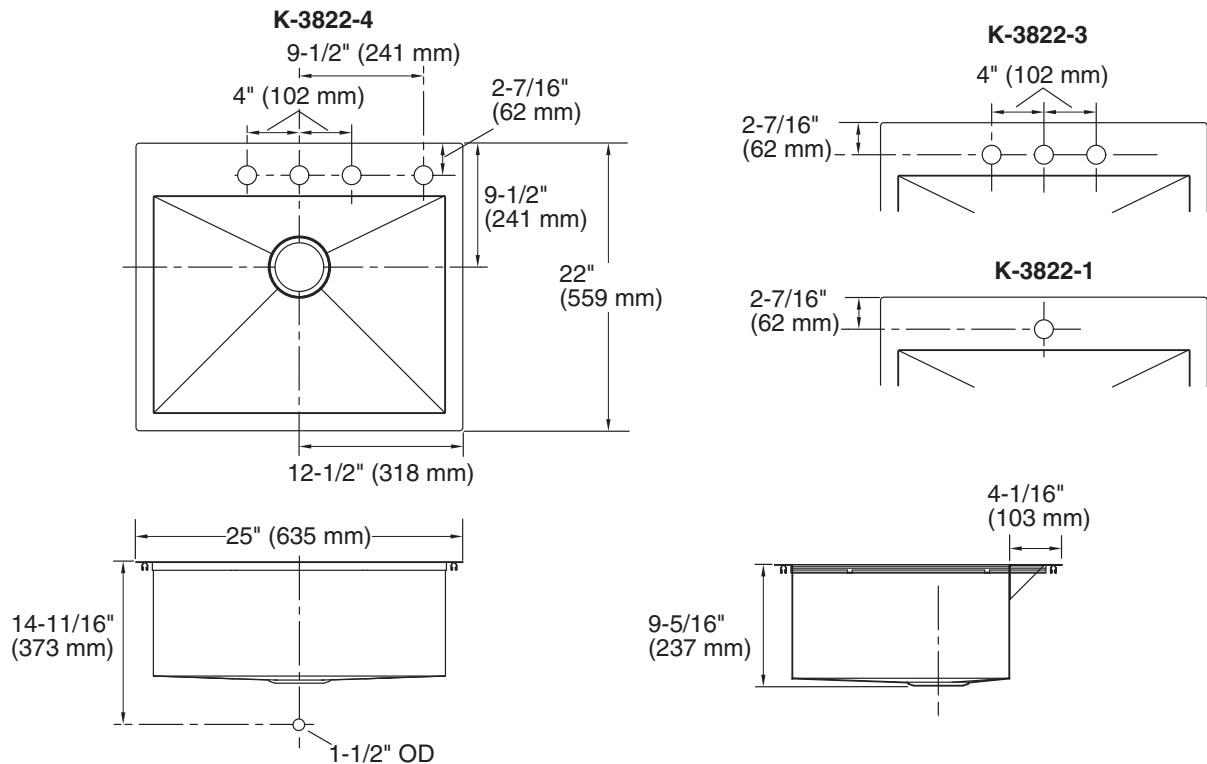
Fixture*:	
Bowl area	22-1/4" (565 mm) x 16-9/16" (421 mm)
Water depth	9" (229 mm)
Drain hole	Ø 3-5/8" (92 mm)
* Approximate measurements for comparison only.	

Included components:	
Hardware kit – top-mount	1130570
Cut-out template	1130822-7

### Installation Notes

Install this product according to the installation guide.

Allow 3/4" (19 mm) clearance beyond the back of the bowl for the wood cutting board (optional accessory).



### Product Diagram

VAULT™ TOP-MOUNT/UNDER-MOUNT KITCHEN SINK  
Page 2 of 2  
1130287-4-D

THE BOLD LOOK  
OF **KOHLER**®

CSI #: 22 41 19

**KOHLER®**

**VILLAGER™**

**Features**

- Cast iron with Safeguard® finish
- Integral apron
- Left or right drain
- 60" (1524 mm) x 30-1/4" (768 mm) x 14" (356 mm)

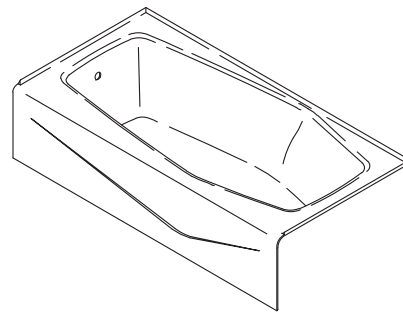
**BATH**  
**K-715**  
**ALSO K-716**

**ADA** **CSA B651** **OBC**

**Codes/Standards Applicable**

Specified model meets or exceeds the following:

- ADA
- ICC/ANSI A117.1
- CSA B651
- OBC
- ASME A112.19.1/CSA B45.2



**Colors/Finishes**

- 0: White
- Other: Refer to Price Book for additional colors/finishes

**Accessories**

- 0: White
- CP: Polished Chrome
- PB: Vibrant® Polished Brass
- Other: Refer to Price Book for additional colors/finishes

**Specified Model**

Model	Description	Colors/Finishes	
K-715	Bath – left drain	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-716	Bath – right drain	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____

Recommended Accessories			
K-7213	Clearflo bath cable drain with PVC tubing	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-7214	Clearflo bath cable drain without PVC tubing	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
K-7160-TF	Clearflo pop-up bath drain	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____

**Product Specification**

The bath shall be made of cast iron with Safeguard finish. Product shall be 60" (1524 mm) in length, 30-1/4" (768 mm) in width, and 14" (356 mm) in height. Product shall feature an integral apron. Product shall be available with left or right drain. Bath shall be Kohler Model K-\_\_\_\_-\_\_\_\_.



CSI #: 22 41 19

## VILLAGER™

Optional Accessories			
K-1491	Pillow	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-1601	Footstop	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____

### Technical Information

Fixture*:	
Bathing well:	
Basin area, bottom	45" (1143 mm) x 22" (559 mm)
Basin area, top	55" (1397 mm) x 24" (610 mm)
Weight	316 lbs (143.3 kg)
To overflow:	
Water depth	8-5/8" (219 mm)
Capacity	33 gal (124.9 L)
* Approximate measurements for comparison only.	

### Installation Notes

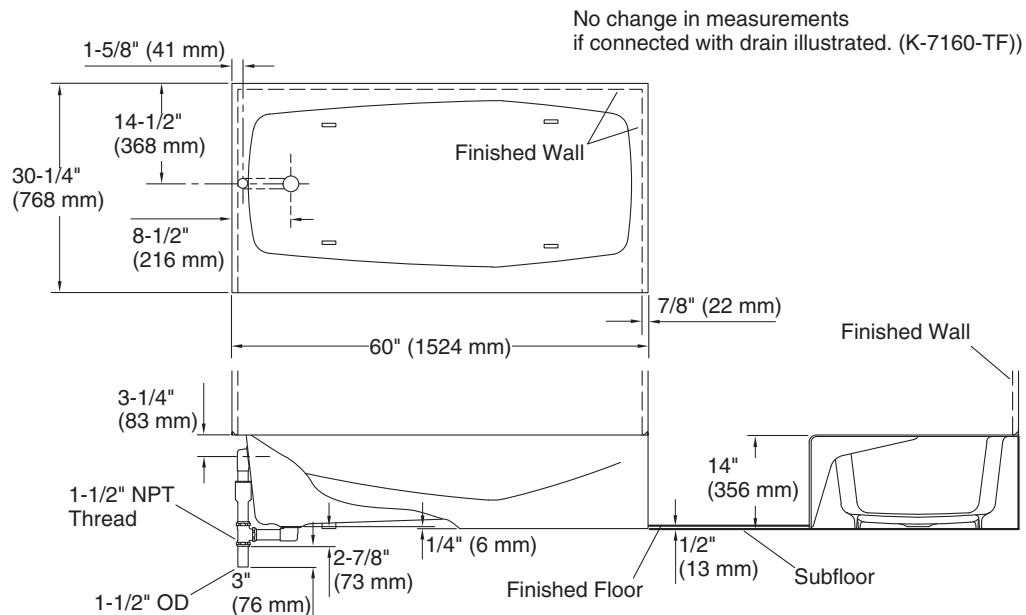
Refer to install installation instructions included with fixture before beginning installation.

Floor support under the bath must provide for a minimum of 49 lbs/square foot (239 kg/square meter) loading.

Will comply with **ADA** when installed per Section 607 Bathtubs of the Act.

Will comply with **CSA B651** when installed per Clause 4.4.7 of the standard.

will comply with **OBC** when installed per Clause 3.8.3.13.

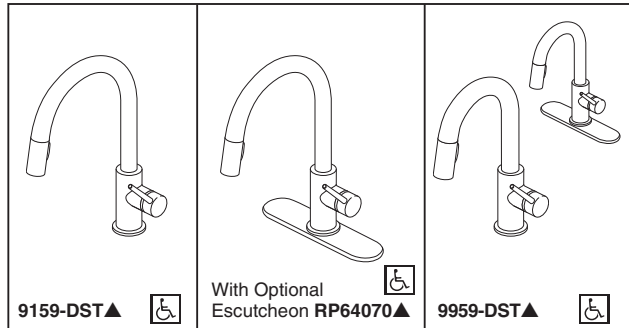


### Product Diagram

VILLAGER™ BATH  
Page 2 of 2  
105009-4-D

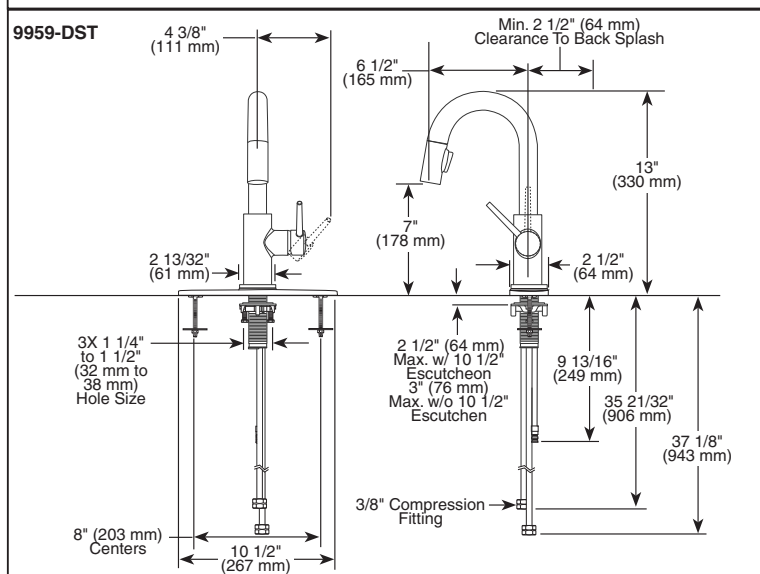
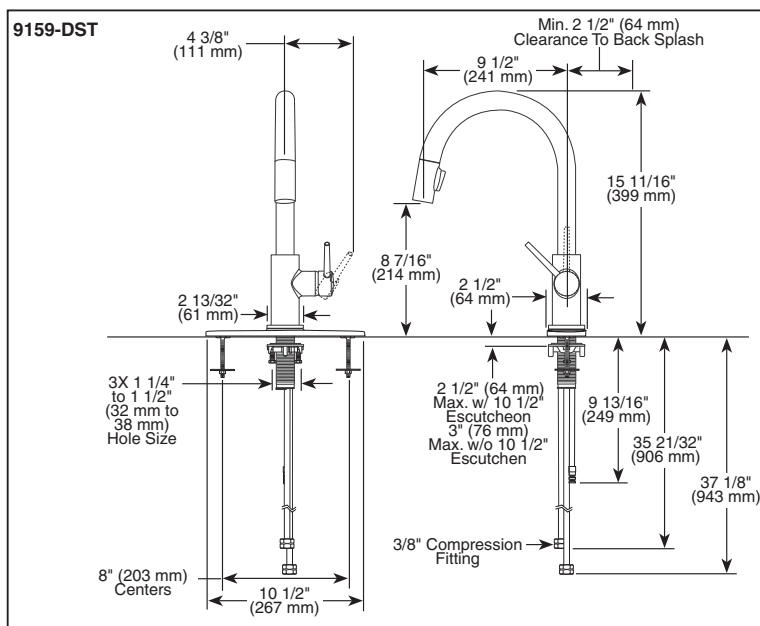
THE BOLD LOOK  
OF **KOHLER**®

CSI #: 22 41 39



Submitted Model No.: \_\_\_\_\_

Specific Features: \_\_\_\_\_



▲ Designate proper finish suffix



## KITCHEN FAUCETS

- Trinsic® Collection
- Single Handle Deck Mount
- 2-Function Pull-Down Sprayer
- Single or 3 Hole Sink Applications
- Centermount or 8" (203 mm) Centers w/ Optional 10 1/2" (267 mm) Escutcheon
- MagnaTite® Magnetic Docking

### STANDARD SPECIFICATIONS:

- Single handle, 2-function pull-down kitchen faucets for exposed mounting on single or three hole sinks.
- Solid brass fabricated body.
- 15 11/16" (399 mm) high, 9 1/2" (241 mm) long, spout swings 360°.
- Lever handle. Control mechanism shall be full-motion valve cartridge.
- Touch-Clean® sprayhead.
- Quick connect hoses.
- Pull-down wand operates in an aerated or spray mode via ergonomic buttons.
- Red/blue indicator on handle button to indicate hot/cold temperature.
- MagnaTite® magnetic docking.
- Dual integral check valves in sprayer.
- Mounting wrench to assist in tightening mounting nut securely.
- Hose travels inside mounting shank so it will not interfere with deck edges.
- Keyed 10 1/2" (267 mm) escutcheon to help alignment and aid installation.
- Flow rate 1.8 gpm max.

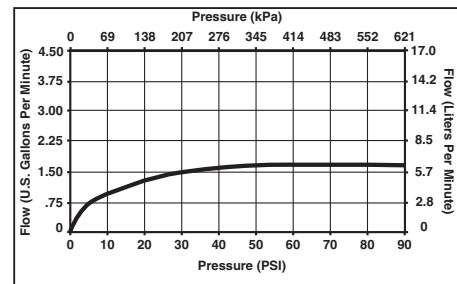
### WARRANTY

- Lifetime Faucet and Finish Limited Warranty to the original consumer purchaser to be free from defects in material and workmanship.
- 5 Year Limited Warranty for usage in all industrial, commercial and business applications.



### COMPLIES WITH:

- ASME A112.18.1 / CSA B125.1
- ASME A112.18.6
- Indicates compliance to ICC/ANSI A117.1
- Verified compliant with .25% weighted average Pb content regulations.



CSI #: 22 41 39

**KOHLER®**  
FAUCETS

**MISTOS™**

**CENTERSET BATHROOM SINK  
FAUCET  
K-R37024**

**Features**

- Metal construction
- Quarter-turn washerless ceramic disc valves
- Pop-up drain with tailpiece
- For 4" (102 mm) centers
- 5" (127 mm) spout reach
- 1.5 gpm (5.7 lpm) maximum flow rate
- Integrated supply hoses with 3/8" compression connection

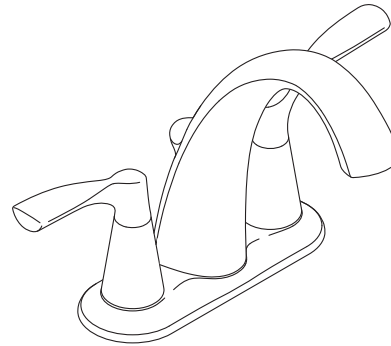
ADA



**Codes/Standards Applicable**

Specified model meets or exceeds the following at date of manufacture:

- ADA
- ICC/ANSI A117.1
- ASME A112.18.1/CSA B125.1
- NSF 61
- EPA WaterSense®
- All applicable US Federal and State material regulations



**Colors/Finishes**

- CP: Polished Chrome
- Other: Refer to Price Book for additional colors/finishes

**Specified Model:**

Model	Description	Color/Finish	
K-R37024-4D	Centerset bathroom sink faucet with plastic drain	<input type="checkbox"/> CP	<input type="checkbox"/> Other ____

**PRODUCT SPECIFICATION**

The centerset bathroom sink faucet shall be made of metal construction. Product shall feature quarter-turn washerless ceramic disc valves. Product shall feature a 5" (127 mm) spout reach and a pop-up drain with tailpiece. Product shall be for 4" (102 mm) centers. Product have a 1.5 gallons (5.7 L) per minute maximum flow rate. Product shall have integrated supply hoses with 3/8" compression connection. Faucet shall be Kohler Model K-R37024-4D-\_\_\_\_\_.

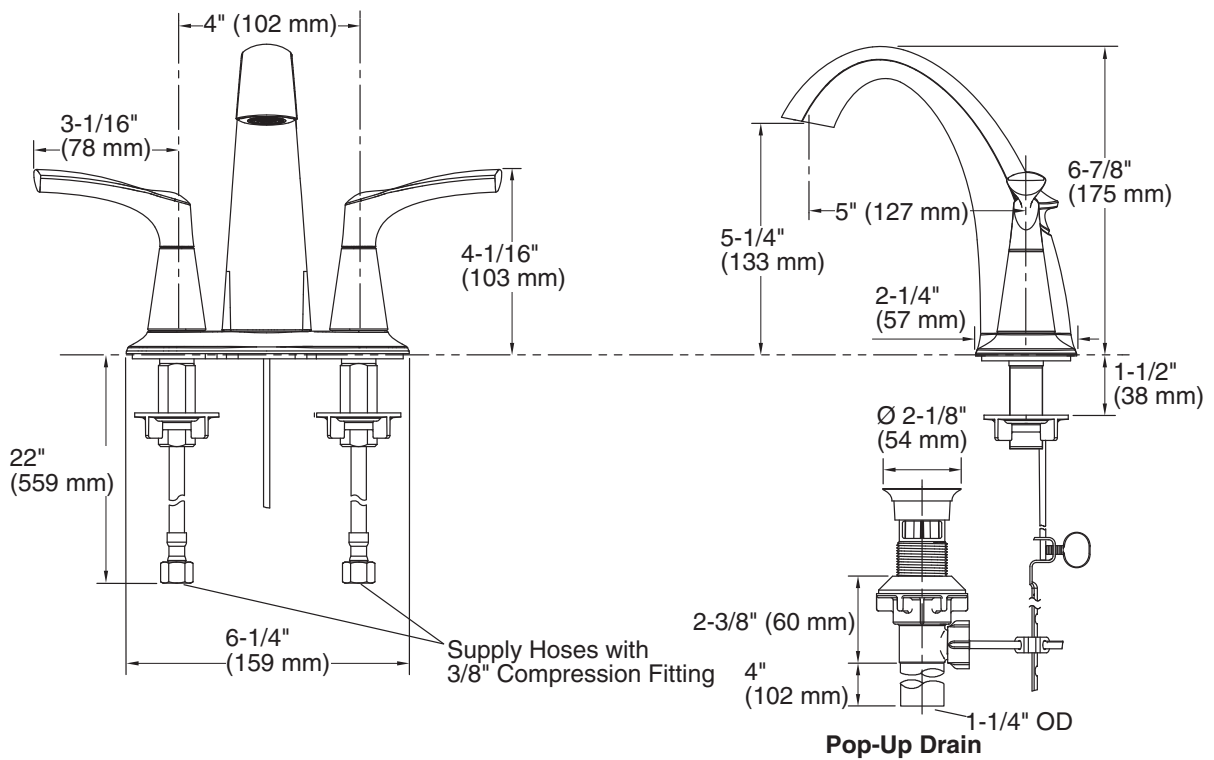
CSI #: 22 41 39

## MISTOS™

### Installation Notes

Install this product according to the installation guide.

ADA compliant when installed to the specific requirements of the regulation.



### Product Diagram

MISTOS™ CENTERSET BATHROOM SINK FAUCET

THE BOLD LOOK

CSI #: 22 41 39

**KOHLER®**  
FAUCETS

**FORTE®**

**BATH & SHOWER TRIM SET**  
**K-T10274**  
ALSO K-T10275

**Features**

- Metal construction
- Intended for use with Rite-Temp® or HiFlow Rite-Temp® valves
- Variety of handle style options
- Includes faceplate and handle
- Available with 5-1/4" (133 mm) diverter bath spout with NPT or slip-fit connection



**Codes/Standards Applicable**

Specified model meets or exceeds the following:



- ASME A112.18.1/CSA B125.1



**Colors/Finishes**

- CP: Polished Chrome
- NA: None applicable
- Other: Refer to Price Book for additional colors/finishes

**Specified Model**

Model	Description		
K-T10274-4	Bath & shower trim, sculpted lever handle, NPT spout	<input type="checkbox"/> CP <input type="checkbox"/> Other _____	
K-T10274-4A	Bath & shower trim, traditional lever handle, NPT spout		<input type="checkbox"/> CP <input type="checkbox"/> Other _____
K-T10275-4	Bath & shower trim, sculpted lever handle, slip-fit spout	<input type="checkbox"/> CP <input type="checkbox"/> Other _____	
K-T10275-4A	Bat h& shower trim, traditional lever handle, slip-fit spout		<input type="checkbox"/> CP <input type="checkbox"/> Other _____

Rite-Temp® valve must be ordered to complete trim.

**Product Specification**

The single-handle bath & shower trim set shall be made of metal construction. Bath & shower trim set shall include showerhead with arm and flange, 5-1/4" (133 mm) diverter spout with NPT or slip-fit connection, and faceplate with handle. Faucet trim shall be K-T\_\_\_\_\_-\_\_\_\_\_-\_\_\_\_\_ and Rite-Temp® valve shall be K-304-\_\_\_\_\_-NA OR K-2791-KS-NA HiFlow Rite-Temp® valve.

CSI #: 22 41 39

## FORTE®

Required Accessories			
K-304-*	Rite-Temp valve <b>OR</b>	<input type="checkbox"/> NA	
K-2971-KS	HiFlow Rite-Temp valve with stops	<input type="checkbox"/> NA	
* For a complete listing of all the Rite-Temp valves, refer to the K-304-* Specification Sheet or Roughing-In sheet.			
Optional Accessories			
88526	HiFlow Rite-Temp® thin wall installation kit	<input type="checkbox"/> CP	<input type="checkbox"/> Other _____
1025388	Forte® deep roughing-in kit for Rite-Temp® valve (lever handles)		<input type="checkbox"/> NA

### Installation Notes

Install this product according to the installation guide.

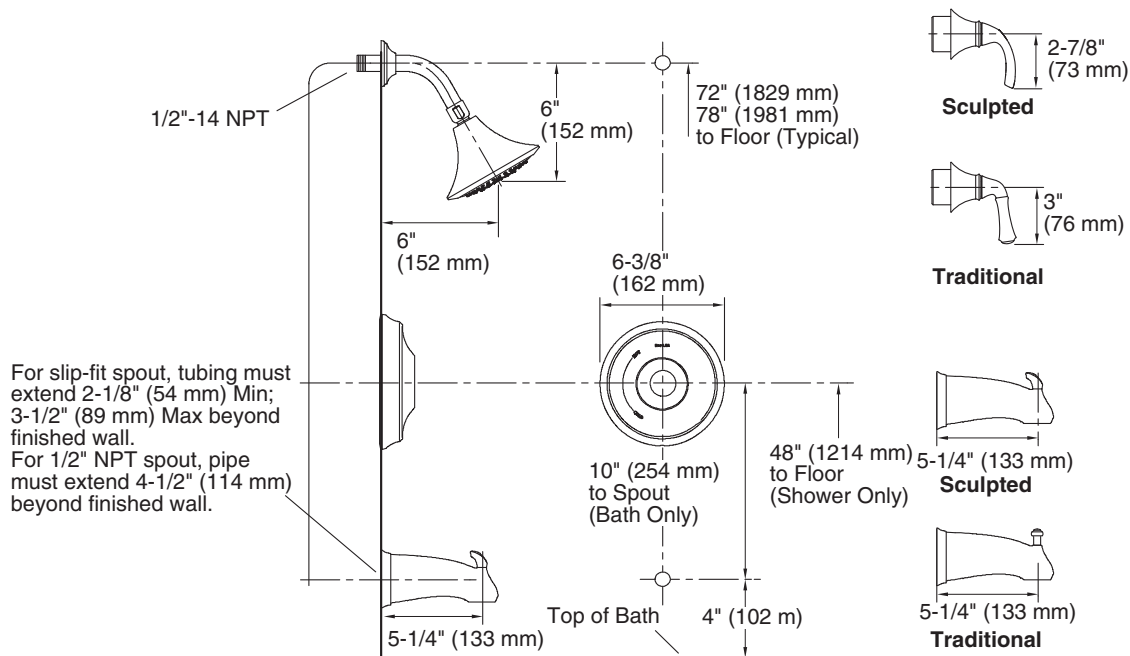
Install the Rite-Temp® valve according to the valve installation guide.

**NOTICE: Risk of product damage.** Long screws, for installing trim, can damage the K-2971-KS valve. Consult the trim installation guide to verify if the thin wall installation kit (88526) is needed.

Avoid cross-flow conditions. Do not install shut-off device on either valve outlet.

Cap shower outlet if deck-mounted spout, diverter, or handshower is connected to the spout outlet.

Install straight pipe or tube drop of 7" (178 mm) to 18" (457 mm) with single elbow between valve and wall-mount spout.



### Product Diagram

FORTE® BATH & SHOWER TRIM SET  
Page 2 of 2  
1041824-4-E

THE BOLD LOOK  
OF **KOHLER**®

CSI #: 22 41 39

**KOHLER®**  
FAUCETS

**RITE-TEMP®**

**Features**

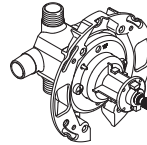
- Brass valve bodies
- High-temperature limit setting for added safety
- Mixing valve cycles from "cold" to "hot"
- Rite-Temp pressure-balancing diaphragm design valve
- One-piece diaphragm cartridge design for ease of maintenance
- Available with or without screwdriver stops

**Codes/Standards Applicable**

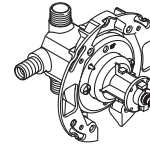
Specified model meets or exceeds the following:

- ASME A112.18.1/CSA B125.1
- ASSE 1016

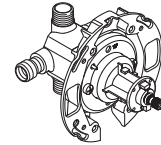
**PRESSURE-BALANCING VALVE  
K-304**



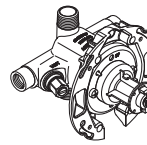
K-304-K



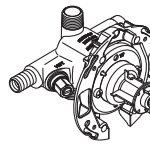
K-304-PX



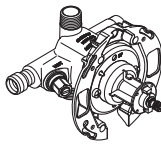
K-304-UX



K-304-KS



K-304-PS



K-304-US

**Colors/Finishes**

- NA: None applicable

**Specified Model**

Model	Description	Colors/Finishes
K-304-K	Pressure-balancing valve without screwdriver stops – universal inlets	<input type="checkbox"/> NA
K-304-KS	Pressure-balancing valve with screwdriver stops – universal inlets	<input type="checkbox"/> NA
K-304-PX	Pressure-balancing valve without screwdriver stops – PEX inlets (crimp)	<input type="checkbox"/> NA
K-304-PS	Pressure-balancing valve with screwdriver stops – PEX inlets (crimp)	<input type="checkbox"/> NA
K-304-UX	Pressure-balancing valve without screwdriver stops – PEX inlets (cold expansion)	<input type="checkbox"/> NA
K-304-US	Pressure-balancing valve with screwdriver stops – PEX inlets (cold expansion)	<input type="checkbox"/> NA
K-304-CX	Pressure-balancing valve without screwdriver stops – 1/2" CPVC inlets	<input type="checkbox"/> NA
K-304-CS	Pressure-balancing valve with screwdriver stops – 1/2" CPVC inlets	<input type="checkbox"/> NA

The K-304-CX and K-304-CS are K-304-K and K-304-KS with CPVC adapters installed on the inlets.

**Optional Accessories**

Deep rough-in kits are available (refer to the trim set Specification Sheet).

**Product Specification**

Rite-Temp pressure-balancing single-control valve shall have a brass valve body. Valve shall include a Rite-Temp pressure-balancing diaphragm design valve with a one-piece diaphragm cartridge design for ease of maintenance. Valve shall have mixing valve cycles from "cold" to "hot" and a high-temperature limit stop for added safety. Valve shall be available without or with screwdriver stops. Rite-Temp pressure-balancing valve shall be Kohler Model K-304-\_\_\_\_-NA.

CSI #: 22 41 39

## RITE-TEMP®

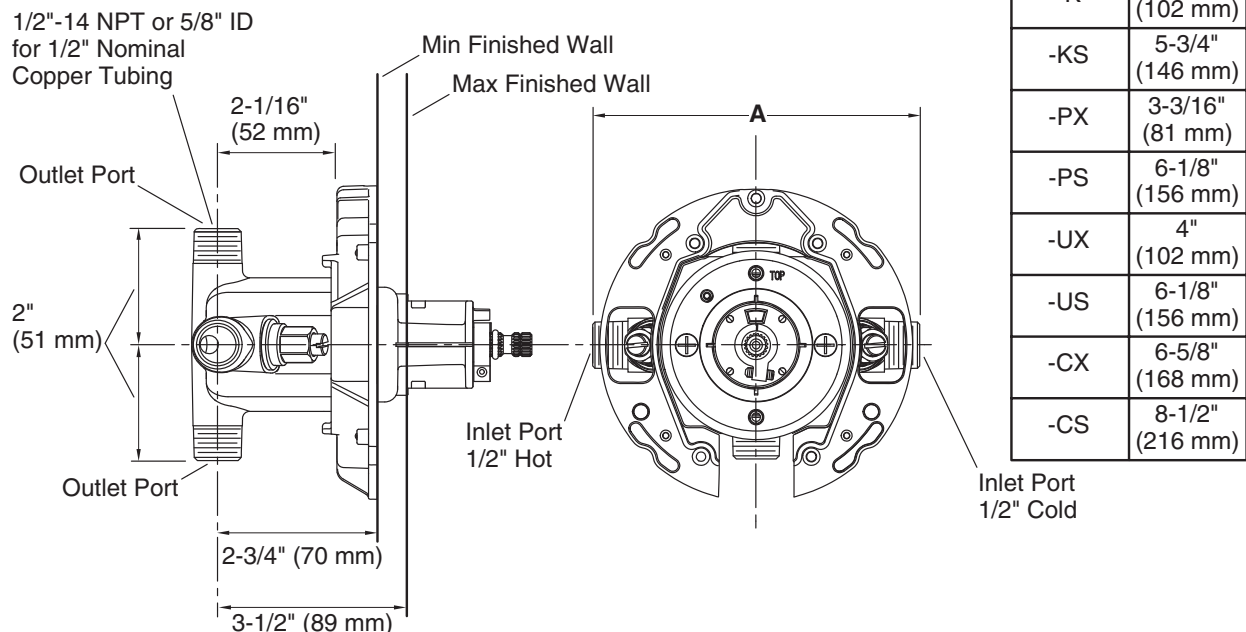
### Installation Notes

Install this product according to the installation guide.

Avoid cross-flow conditions. Do not install a shut-off device on either valve outlet.

Cap the shower outlet if a deck-mount spout, diverter, or handshower is connected to a spout outlet.

Install straight pipe or tube drop of 7" (178 mm) to 18" (457 mm) with single elbow between valve and wall-mount spout. Refer to the installation instructions for proper configuration of the connection between the valve and bath spout.



### Product Diagram

RITE-TEMP® PRESSURE-BALANCING VALVE  
Page 2 of 2  
1110626-4-F

THE BOLD LOOK  
OF **KOHLER**®



CSI #: 22 42 13

**KOHLER®**

**CIMARRON®**

**COMFORT HEIGHT® TOILET  
K-3609**

**Features**

- Vitreous china
- Elongated bowl
- 12" (305 mm) rough-in
- 1.28 gpf (4.8 lpf)
- Less seat and supply
- 2-1/8" (54 mm) glazed trapway
- AquaPiston® flushing system
- With Insuliner® insulated tank lining (-U)
- 10-1/2" (267 mm) x 7-1/8" (181 mm) water area
- 28-3/4" (730 mm) x 17-5/8" (447 mm) x 30-3/4" (781 mm)

ADA CSA B651 OBC



**Codes/Standards Applicable**

Specified model meets or exceeds the following:

- ADA
- ICC/ANSI A117.1
- CSA B651
- OBC
- ASME A112.19.2/CSA B45.1
- EPA WaterSense®

**Colors/Finishes**

- 0: White
- Other: Refer to Price Book for additional colors/finishes

**Specified Model**

Model	Description	Trip Lever	Colors/Finishes
K-3609	Comfort Height toilet (shown)	left-hand	<input type="checkbox"/> 0 <input type="checkbox"/> Other _____
K-3609-RA	Comfort Height toilet	right-hand	<input type="checkbox"/> 0 <input type="checkbox"/> Other _____
K-3609-T	Comfort Height toilet - tank cover locks	left-hand	<input type="checkbox"/> 0 <input type="checkbox"/> Other _____
K-3609-TR	Comfort Height toilet - tank cover locks	right-hand	<input type="checkbox"/> 0 <input type="checkbox"/> Other _____
K-3609-U	Comfort Height toilet - Insuliner® tank	left-hand	<input type="checkbox"/> 0 <input type="checkbox"/> Other _____
K-3609-UR	Comfort Height toilet - Insuliner tank	right-hand	<input type="checkbox"/> 0 <input type="checkbox"/> Other _____
<b>Recommended Accessories</b>			
K-4664	Brevia™ seat with cover	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-4650	Lustra™ elongated, open-front toilet seat – for Accessibility compliant installation	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-7637	Angle supply with stop - 3/8" NPT		<input type="checkbox"/> Other _____

**Product Specification**

The elongated bowl toilet shall be made of vitreous china. Toilet shall be 28-3/4" (730 mm) in length, 17-5/8" (447 mm) in width, and 30-3/4" (781 mm) in height with a 10-1/2" (267 mm) by 7-1/8" (181 mm) water area. Toilet shall be 12" (305 mm) rough-in and 2-1/8" (54 mm) glazed trapway. Toilet shall be 1.28 gpf (4.8 lpf) with AquaPiston flushing system. Toilet shall be less seat and supply. Toilet shall have optional Insuliner insulated tank lining (-U). Elongated bowl toilet shall be Kohler Model K-3609-\_\_\_\_ or K-3609-\_\_\_\_-\_\_\_\_.

CSI #: 22 42 13

## CIMARRON®

### Technical Information

Fixture:	
Configuration	two-piece, elongated
Water per flush	1.28 gpf (4.8 lpf)
Passageway	2-1/8" (54 mm)
Water area	10-1/2" (267 mm) x 7-7/8" (200 mm)
Water depth from rim	6-3/8" (162 mm)
Seat post hole centers	5-1/2" (140 mm)

Included components:	
Bowl	K-4309
Tank cover	1086929
Tank cover with locks	1086929-T
Trip lever, left-hand	1059436
Trip lever, right-hand	1116014 (cont.)

(cont.) Bolt cap accessory pack	1013092
Tank accessory pack	1016548
Tank, left-hand trip lever	K-4421
Insuliner® tank, left-hand trip lever	K-4421-U

### Installation Notes

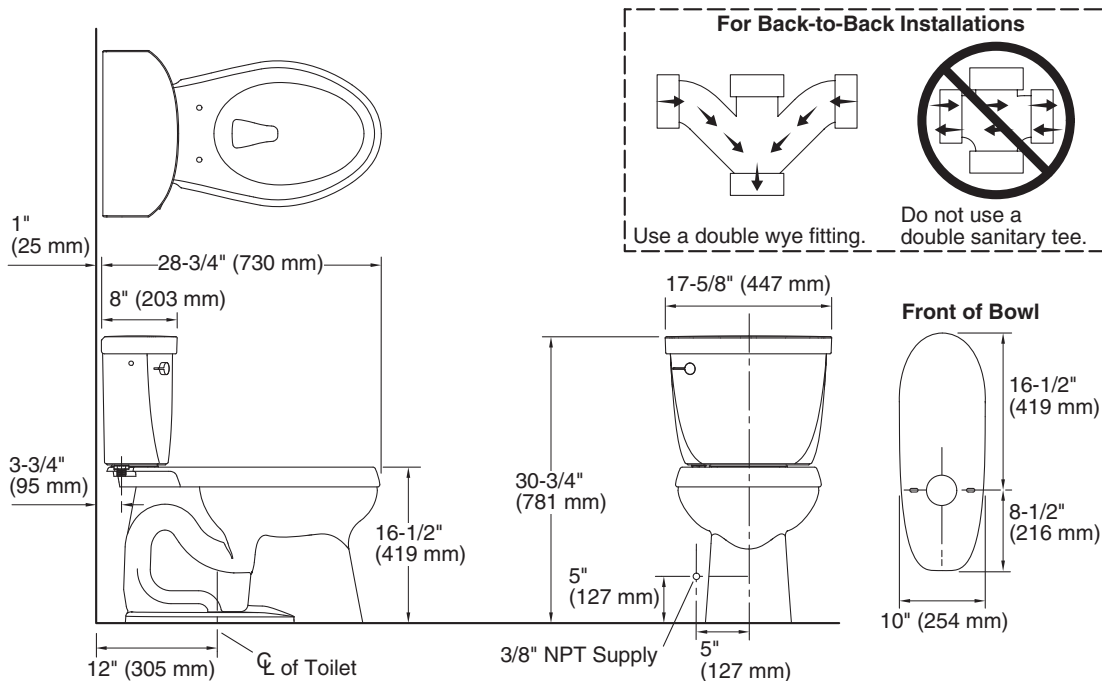
Install this product according to the installation guide.

**For back-to-back toilet installations:** Use only a 45° double wye fitting.

Will comply with the Americans with Disabilities Act (ADA) when installed per the requirements of the 2010 ADA Standards of Accessible Design, Section 604 Water Closets, of the Act. The Model Plumbing Codes require the installation of elongated open-front toilet seats in public bathrooms.

Will comply with **CSA B651** when installed per Clause 4.3.6 of the standard.

Will comply with **OBC Barrier Free** requirements when installed per Clause 3.8.3.8 and 3.8.3.9.



### Product Diagram

CIMARRON® COMFORT HEIGHT® TOILET  
Page 2 of 2  
1095477-4-J

THE BOLD LOOK  
OF **KOHLER**®

CSI #: 22 42 19

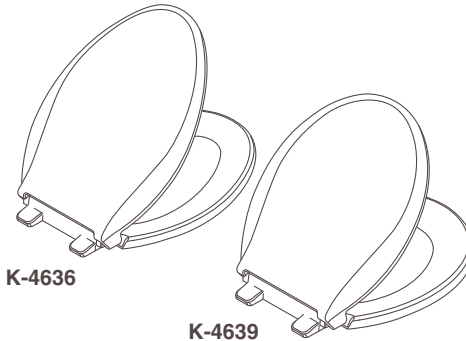
**KOHLER®**

**CACHET® WITH Q3 ADVANTAGE™**

**Features**

- Solid polypropylene plastic
- Closed-front
- Contoured seat for user comfort
- Quiet-Close™ lid and ring prevents slamming
- Quick-Release™ hinge caps snap open and seat pulls forward for removal
- Quick-Attach™ stainless steel fastener allows for top-mount screwdriver only install
- Slip resistant bumpers hold seat firmly in place

**TOILET SEAT**  
**K-4636**  
**ALSO K-4639**



**Codes/Standards Applicable**

Specified model meets or exceeds the following:

- ANSI Z124.5

**Colors/Finishes**

- 0: White
- Other: Refer to Price Book for additional colors/finishes

**Specified Model**

Model	Description	Colors/Finishes	
K-4636	Toilet seat – elongated closed-front	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____
K-4639	Toilet seat – round closed-front	<input type="checkbox"/> 0	<input type="checkbox"/> Other _____

**Product Specification**

The toilet seat shall be made of solid polypropylene plastic. Product shall be available with closed-front. Product shall have Quiet-Close™ lid and ring that prevent slamming, Quick-Release™ hinge caps snap open and seat pulls forward for removal. Product shall have Quick-Attach™ stainless steel fastener, which allows for top-mount screwdriver only install. Product shall have contoured seat for user comfort. Product shall have slip resistant bumpers that hold seat firmly in place. The toilet seat shall be Kohler Model K-\_\_\_\_-\_\_\_\_.

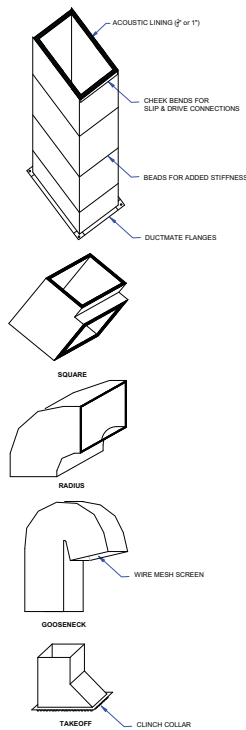
# Division 23

## Heating, Ventilating, and Air-Conditioning (HVAC)



**CSI #: 23 31 00**

- ▶ **MATERIAL** – GALVANIZED, ALUMINUM, STAINLESS STEEL, MILD STEEL. OTHER MATERIALS AVAILABLE AS SPECIAL ORDER
- ▶ **SEAMS** – PITTSBURG, SPOT WELD, ARC / MIG WELD
- ▶ **LINER** - ½" & 1" ACOUSTIC LINER IS ADHERED WITH GLUE AND WELD PINS. LAGGING USED FOR LINER ENDS



- ▶ STRAIGHT DUCTS AVAILABLE IN ANY SIZE (STANDARD SIZE IS 48" LONG)
- ▶ SLIP & DRIVE CONNECTION READY
- ▶ DUCTMATE FRAMES INSTALLED
- ▶ LARGER SIZE DUCTS HAVE BEADS FOR ADDITIONAL RIGIDITY

- ▶ ELBOWS AVAILABLE IN RADIUS & SQUARE
- ▶ ANY ANGLE & SIZE OF ELBOW
- ▶ GOOSENECKS OR ANY OTHER FITTING CAN HAVE WIRE MESH SCREEN INSTALLED

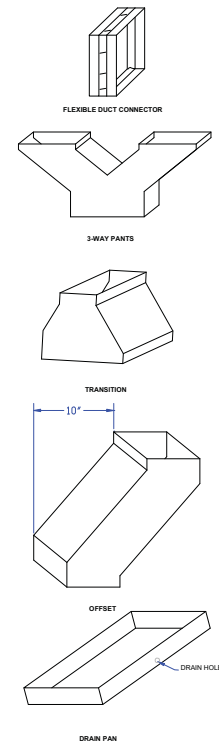
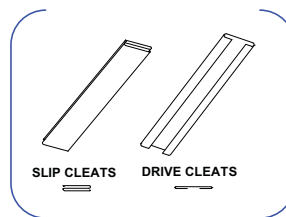
- ▶ TRANSITIONS & OFFSETS CAN BE MADE IN ANY SIZE
- ▶ COMPLEX FITTING & ANGLES? – NO PROBLEM – OUR COMPUTERS CAN CALCULATE EVERYTHING AND MAKE SURE THAT THE FITTING IS NOT CHOKED

- ▶ TAKEOFFS OR BOOTS CAN BE MADE IN ANY SIZE OR ANGLE
- ▶ TAPS CAN BE MADE WITH A CLINCH COLLAR OR A SIMPLE FLANGE

- ▶ FLEXIBLE DUCT CONNECTORS OR CANVAS IS AVAILABLE IN 3"x3"x3" WIDTHS AND CAN BE MADE INTO ANY RECTANGULAR OR ROUND SIZE

- ▶ DRAIN PANS ARE WATER TIGHT PANS MADE IN ANY SIZE AND IN ANY GAUGE
- ▶ DRAIN OPENINGS CAN BE MADE IN ANY SIZE AND ANY LOCATION ON THE PAN (BOTTOM or SIDES)
- ▶ A DRAIN COPPER PIPE CAN BE SOLDERED INTO DRAIN OPENING

- ▶ SLIP CLEATS & DRIVE CONNECTOR CLEATS CAN BE CUT TO SIZE WITH A FITTING ORDER
- ▶ 48" LONG CLEATS ARE SOLD SEPARATELY IN A BUNDLE OF 10
- ▶ S-CLEATS ARE 26 GAUGE; CAN BE MADE IN OTHER GAUGE
- ▶ D-CLEATS ARE 24 GAUGE; CAN BE MADE IN OTHER GAUGE



**SHEET METAL FABRICATION FOR THE HVAC INDUSTRY**

866-749-6331 x703 (t)

973-844-1951 (f)

CSI #: 23 33 00

## ROOF CAPS & WALL HOODS

ALDES provides the highest quality roof caps and wall hoods available today.

### Roof Caps

ALDES High Performance Roof Caps are engineered to minimize noise and pressure resistance for maximum airflow, while effectively removing moisture and condensation from the duct system. All roof caps are of a low-profile, low pressure design.

All incorporate backdraft dampers and removable screens.


Roof Cap	Galvanized Part #	Stainless Part#	Copper Part#
	4"	22 043	22 043SS 22 043COP
	5"	22 044	22 044SS 22 044COP
	6"	22 046	22 046SS 22 046COP
	8"	22 048	22 048SS 22 048COP
	10"	22 051	22 051SS 22 051COP
	12"	22 052	22 052SS 22 052COP
	22 434	4" Aluminum roof cap	} <b>For Flat Roof Applications</b>
	22 436	6" Aluminum roof cap	
	22 438	8" Aluminum roof cap	
	22 440	10" Aluminum roof cap	
	22 442	12" Aluminum roof cap	
	22 041	*12" extensions available for high snow load areas Dryer Roof Cap w/Damper for 4" diameter duct.	

### Wall Hoods

ALDES Wall Hoods are available in screened or dampered versions. Dampered versions feature magnetic closures to avoid flapping in the wind.

Wall Hood w/screen	Galvanized Part #	Stainless Part#	Copper Part#
	4"	22 304	22 304SS 22 304COP
	5"	22 305	22 305SS 22 305COP
	6"	22 306	22 306SS 22 306COP
	8"	22 308	22 308SS 22 308COP
	10"	22 310	22 310SS 22 310COP
	12"	22 312	22 312SS 22 312COP
Wall Hood w/damper	Galvanized Part #	Stainless Part#	Copper Part#
	4"	22 404	22 404SS 22 404COP
	5"	22 405	22 405SS 22 405COP
	6"	22 406	22 406SS 22 406COP
	8"	22 408	22 408SS 22 408COP
	10"	22 410	22 410SS 22 410COP
	12"	22 412	22 412SS 22 412COP
	22 206	6" Insulated Vent Hood with filter option	
	22 025	5" exhaust vent, white plastic cap	
	22 026	6" exhaust vent, white plastic cap	

### Soffit Vent

	22 035	6" Universal wall/soffit exhaust vent *Wall or soffit position obtained by twisting sleeve elements.
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### FLEXIBLE NON-INSULATED DUCT

High quality duct for low to high pressure systems with supporting helix of spring steel wire permanently bonded to a coated woven fiberglass cover. UL Listed Class 1 Air Duct. Suitable for use in warm, insulated spaces for exhaust air or tempered supply air.

Part #	Diameter	Standard Length
91 183	3"	25'
91 184	4"	25'
91 185	5"	25'
91 186	6"	25'

### FLEXIBLE INSULATED DUCT

Inner core made with a double lamination of tough polyester encapsulating a helix of spring steel wire. This double-layer core is wrapped in a 1" blanket of fiberglass insulation. Exterior jacket is a reinforced polyester. Designed for low to medium pressure systems. UL Listed Class 1 Air Duct. Suitable for exhaust or supply air in either heated or unheated spaces.

Part #	Diameter	Standard Length
91 143	3"	25'
91 144	4"	25'
91 145	5"	25'
91 146	6"	25'

### SOUND ABSORBERS

Duct designed for noise attenuating characteristics. A 40" length may achieve more than 30 dB(A) noise reduction on a typical exhaust system. Inner core made of netting bonded to a helix of spring steel wire. A 1" blanket of fiberglass insulation wraps the inner core. Exterior jacket is a reinforced polyester or vinyl. Designed for low to medium pressure systems. Suitable for use in warm, insulated spaces for exhaust air. Not to be used for supply air. Non-listed.

Part #	Diameter	Standard Length
91 151	3" ID	10'
91 166	5" ID	10'
91 167	6" ID	10'
26 002	5" male ends	3'
22 012	6" male ends	3'
94 631	for 4" diameter duct, metal canister	
94 632	for 4" diameter duct, metal canister	
94 633	for 4" diameter duct, metal canister	
94 634	for 4" diameter duct, metal canister	
94 635	for 4" diameter duct, metal canister	
94 636	for 4" diameter duct, metal canister	
94 637	for 4" diameter duct, metal canister	

CSI #: 23 33 00



## HIGH PERFORMANCE OUTLET TERMINATION ROOF CAPS

PRODUCT  
SPECIFICATIONS  
and TECHNICAL  
DATA  
0710



**GALVANIZED STEEL**



**STAINLESS STEEL**



**COPPER**

**HIGH PERFORMANCE  
ROOF CAPS**  
are carefully designed and constructed  
as an important functional and integral  
component to any exhaust  
ventilation system.

### Typical Specification

**General:** American ALDES Ventilation's HIGH PERFORMANCE ROOF CAPS are engineered to minimize noise and pressure resistance for maximum airflow, while effectively removing moisture and condensation from the duct system. All roof caps are designed for durability and high aesthetic value.

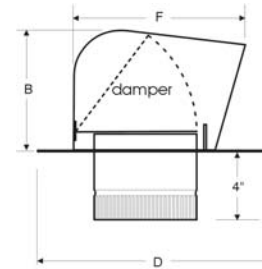
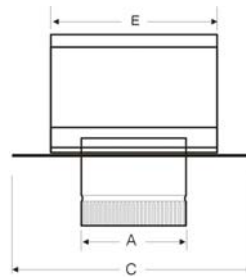
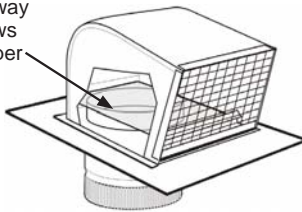
**Construction:** American ALDES Ventilation's low profile, low pressure

drop roof caps include integral back draft/weather dampers, bird screening, no-leak roof flashing, and extended duct collars for simple installation. Available in heavy gauge G90 galvanized steel, 304 2B finish stainless steel or solid copper type CA 110.

**Installing the Roof Caps:** All caps are designed for installation on any roof pitch or shingling.

### DIMENSIONAL DATA:

Cut away  
Shows  
Damper



Size	Description	Galvanized Part No.	Stainless Steel Part No.	Copper Part No.	A	B	C	D	E	F
4"	with Backdraft Damper	22 043	22 043 SS	22 043 COP	4	5.5	11.75	11.75	6	7.50
5"	with Backdraft Damper	22 044	22 044 SS	22 044 COP	5	5.5	11.75	11.75	6	7.50
6"	with Backdraft Damper	22 046	22 046 SS	22 046 COP	6	7.0	13.75	13.75	8	10.00
8"	with Backdraft Damper	22 048	22 048 SS	22 048 COP	8	8.0	15.75	15.75	10	11.75
10"	with Backdraft Damper	22 051	22 051 SS	22 051 COP	10	10.0	19.75	19.75	14	14.50
12"	with Backdraft Damper	22 052	22 052 SS	22 052 COP	12	12.0	21.75	21.75	16	17.50

ALL SIZES ARE IN INCHES. \*Above Galvanized Steel Items (4" to 8" are 26 gauge; 10" and 12" are 24 gauge).

Materials: Galvanized Steel G-90, Copper Type Ca110, Stainless Type 304-2B Finish SMACNA GAUGE ACCORDING TO SIZE. Damper: Aluminum sheet, 0.020"

### WARRANTY

The entire unit is guaranteed for 3 years, from date of shipment, against all manufacturing defects provided the material has been installed and operated per manufacturer's instructions and under normal conditions. Warranty is limited to the repair or replacement of the material upon its return freight paid to our factory.

*This warranty is not transferable and is limited to the original end user.*



4521 19th Street Court E., Suite 104, Bradenton, FL 34203 USA  
Phone: 941-351-3441 | Fax: 941-351-3442



CSI #: 23 33 13

**HVAC & REFRIGERATION**  
**Registers & Grilles**

**Sidewall/Ceiling Registers**



White finish. Stamped-steel registers provide economical air control. Welded steel registers provide max. durability. Adjustable-blade registers are made of aluminum.



Type	Bar Spacing	Maximum Duct Size (in.)		Overall Size (in.)		Item No.	\$ Each
		H	W	H	W		
<b>Stamped Steel</b>							
3-Way	1/2"	4	8	5.75	9.75	4JRP4	6.54
3-Way	3/4"	6	10	7.25	11.25	4JRP5	9.25
3-Way	1"	6	12	7.25	13.25	4JRP6	10.11
3-Way	3/4"	6	14	7.25	15.25	4JRP7	12.41
3-Way	1/2"	8	14	9.75	15.75	4MJG9	14.68
4-Way	1/2"	4	8	5.75	9.75	4MJH2	6.60
1-Way Multilouver	1/2"	4	10	5.88	11.84	4MJJ9	16.84
1-Way Multilouver	1/2"	4	12	5.88	13.84	4MJK2	18.61
1-Way Multilouver	1/2"	6	10	7.88	11.84	4MJK1	18.78
1-Way Multilouver	1/2"	6	12	7.88	13.84	4MJK3	19.84
1-Way Multilouver	1/2"	6	14	7.88	15.84	4MJK4	22.42
1-Way Multilouver	3/4"	8	8	9.88	9.84	4MJJ8	20.01
1-Way Curved Blade	—	8	12	9.75	13.75	4MJF5	13.05
3-Way Curved Blade	—	4	8	5.75	9.75	4MJF6	6.30
<b>Welded Steel</b>							
2-Way	1/2"	4	8	5.75	9.75	4MJG2	5.83
2-Way	3/4"	4	10	5.75	11.75	4JRN9	7.49
2-Way	1"	4	12	5.75	13.75	4JRP2	8.29
2-Way	1/2"	4	14	5.75	15.75	4MJG4	8.54
2-Way	3/4"	6	8	7.75	9.75	4MJG3	7.26
2-Way	1/2"	6	10	7.75	11.75	4JRP1	8.93
2-Way	3/4"	6	12	7.75	13.75	4JRP3	9.97
2-Way	1/2"	6	14	7.75	15.75	4MJG5	11.06
2-Way	3/4"	4	8	5.25	9.25	4MJH5	5.83
2-Way	1/2"	4	12	5.25	13.25	4JRN7	8.15
2-Way	3/4"	4	14	5.25	15.25	4MJH8	8.54
2-Way	1/2"	6	8	7.25	9.25	4MJH6	7.26
2-Way	3/4"	6	10	7.25	11.25	4JRN6	8.85
2-Way	1/2"	6	12	7.25	13.25	4JRN8	9.92
2-Way	3/4"	6	14	7.25	15.25	4MJH9	11.06
2-Way	1/2"	8	8	9.25	9.25	4MJH7	9.66
3-Way	1/2"	4	8	5.75	9.75	4JRP8	6.69
3-Way	3/4"	4	10	5.75	11.75	4MJG6	6.66
3-Way	1/2"	4	12	5.75	13.75	4MJG8	7.38
3-Way	3/4"	6	10	7.75	11.75	4JRP9	9.45
3-Way	1/2"	6	12	7.75	13.75	4JRR1	10.55
3-Way	3/4"	6	14	7.75	15.75	4JRR2	12.79
3-Way	1/2"	8	10	9.75	11.75	4MJG7	11.18
4-Way	1/2"	6	6	7.75	7.75	4MJH1	6.29
4-Way	3/4"	8	8	9.75	9.75	4MJH3	9.66
4-Way	1/2"	10	10	11.75	11.75	4MJH4	15.45
1-Way Curved Blade	—	4	8	5.75	9.75	4MJF2	6.42
1-Way Curved Blade	—	6	10	7.75	11.75	4MJF3	8.94
1-Way Curved Blade	—	6	12	7.75	13.75	4MJF4	10.10
3-Way Curved Blade	—	6	12	7.75	13.75	4MJF8	10.10
3-Way Curved Blade	—	8	8	9.75	9.75	4MJF7	11.41
4-Way Curved Blade	—	8	8	9.75	9.75	4MJF9	11.41
4-Way Curved Blade	—	10	10	11.75	11.75	4MJG1	17.28
<b>Plastic</b>							
2-Way	1 1/16"	4	8	5.79	9.79	4JRU2	6.26
3-Way	1 1/16"	6	10	7.75	11.75	4JRU3	8.07
3-Way	1/2"	6	12	7.75	13.75	4MJC8	8.94
3-Way	3/4"	8	10	9.75	11.75	4MJC7	10.52
<b>Aluminum</b>							
Adjustable Curved Blade	1/2"	4	8	5.75	9.75	4MJK5	10.46
Adjustable Curved Blade	1/2"	6	10	7.75	11.75	4MJK6	16.84
Adjustable Curved Blade	1/2"	6	12	7.88	13.75	4MJK7	19.30
Adjustable Curved Blade	1/2"	8	12	8.75	13.75	4MJK8	22.96
Adjustable Curved Blade	1/2"	10	10	11.75	11.75	4MJK9	26.80
Adjustable Curved Blade	1/2"	12	12	13.75	13.75	4MJL1	31.25
Adjustable Straight Blade	1/16"	4	8	5.75	9.75	4MJL2	16.78
Adjustable Straight Blade	1/16"	4	10	5.75	11.75	4MJL3	17.92
Adjustable Straight Blade	1/16"	4	12	5.75	13.75	4MJL6	21.25
Adjustable Straight Blade	1/16"	6	10	7.75	11.75	4MJL4	20.89
Adjustable Straight Blade	1/16"	6	12	7.75	13.75	4MJL7	25.40
Adjustable Straight Blade	1/16"	6	14	7.75	15.75	4MJL9	27.85

**Perimeter Baseboard Diffusers**



Diffusers are multipattern, with 1-pc. dampers.



Maximum Duct Size (in.)	Overall Size (in.)		WHITE		BROWN	
	H	W	H	W	Item No.	\$ Each
2.25	12	4.50	15.00	15.00	4MJV8	13.51
2.25	12	4.50	18.00	18.00	4JRT4	15.97
2.25	16	4.50	24.00	24.00	4MJW1	26.60

**Floor Registers and Grilles**



Extra-wide border compensates for oversized floor openings. Surface treatments are dual electrocoated/powder-coated for excellent corrosion resistance. Stamped-steel items provide economical air control. Welded steel registers provide max. durability. Toe-space grilles are good for return air in narrow locations such as stair risers and between kitchen cabinets and floor.



Floor Register

Floor Grille



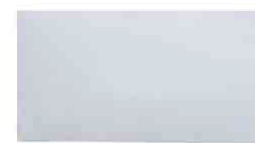
Toe-Space Grille

Maximum Duct Size (in.)	Overall Size (in.)		WHITE		BROWN	
	H	W	H	W	Item No.	\$ Each
<b>Floor Registers</b>						
<b>Stamped Steel</b>						
2	10	3.75	11.50	11.50	4MJD8	4.47
2	12	3.75	13.50	13.50	4MJD9	5.61
2	14	3.75	15.50	15.50	—	—
4	8	5.50	9.50	9.50	—	—
4	10	5.50	11.50	11.50	4MJE3	5.89
4	12	5.50	13.50	13.50	4MJE4	7.38
4	14	5.50	15.50	15.50	—	—
6	10	7.50	11.50	11.50	—	—
6	12	7.50	13.50	13.50	—	—
6	14	7.50	15.50	15.50	—	—
<b>Welded Steel</b>						
4	10	5.13	11.13	11.13	—	—
4	12	5.13	13.13	13.13	—	—
<b>Floor Grilles</b>						
6	12	7.75	13.75	13.75	—	—
6	14	7.75	15.75	15.75	—	—
<b>Toe Space Grilles</b>						
2	10	3.36	11.3	11.3	—	—
2	10	3.36	11.31	11.31	4MJD3	3.91
2	12	3.36	13.13	13.13	4MJD5	4.18
2	14	3.36	15.13	15.13	—	—

**Air Deflectors and Vent Cover**



No. 6TUC3



No. 6TUC6

Description	For Use With	L (in.)	W (in.)	Item No.	\$ Each
Air Deflector, Clear with Magnets, Adjustable 10° to 14°	Floor Register	9 1/2	4	6TUC3	8.07
Air Deflector, Clear with Magnets, Adjustable 10° to 16°	Wall Register	10 1/2	6	6TUC4	9.80



CSI #: 23 37 13

ENGINEERING DATA



202 - SIDEWALL/CEILING 2-WAY									
Face Velocity		300	400	500	600	700	800	900	1000
Pressure Loss		0.008	0.012	0.016	0.024	0.032	0.044	0.052	0.064
6 x 4 Ak .081	cfm	23	30	38	46	53	61	68	76
	Throw	3	4	5	6	7	8	9	10
6 x 6 Ak .113	cfm	32	42	53	63	74	84	95	105
	Throw	4	5	6	7	8	10	11	12
8 x 4 Ak .110	cfm	28	37	47	56	65	74	84	93
	Throw	3	5	6	7	8	9	10	11
8 x 6 Ak .153	cfm	44	59	74	89	103	118	133	148
	Throw	5	6	7	9	10	11	12	14
8 x 8 Ak .22	cfm	60	80	100	120	140	160	180	200
	Throw	5	6	8	9	10	12	13	15
10 x 4 Ak .125	cfm	36	48	60	72	84	96	108	120
	Throw	4	5	6	7	9	10	12	13
10 x 6 Ak .192	cfm	56	75	94	112	131	150	168	187
	Throw	6	7	9	10	11	13	14	15
10 x 8 Ak .27	cfm	72	96	120	144	168	192	216	240
	Throw	5	6	8	10	12	14	17	19
10 x 10 Ak .318	cfm	94	126	157	188	220	251	283	314
	Throw	6	8	11	12	14	15	18	19
12 x 4 Ak .152	cfm	44	58	73	87	102	116	131	145
	Throw	4	6	7	9	10	12	13	14
12 x 6 Ak .236	cfm	71	94	118	142	165	189	212	236
	Throw	6	8	9	11	13	14	16	17
12 x 8 Ak .327	cfm	97	130	162	194	227	259	292	324
	Throw	7	9	11	12	14	16	18	20
14 x 4 Ak .178	cfm	51	68	86	103	120	137	154	171
	Throw	5	6	8	9	10	12	13	14
14 x 6 Ak .304	cfm	89	118	148	177	207	236	266	295
	Throw	7	8	10	12	13	15	17	19
14 x 8 Ak .405	cfm	119	158	198	237	277	316	356	395
	Throw	7	10	11	13	15	17	19	21
14 x 10 Ak .480	cfm	135	180	225	270	315	360	405	450
	Throw	8	11	13	14	16	19	21	22
16 x 6 Ak .34	cfm	102	136	170	204	238	272	306	340
	Throw	7	9	11	13	15	16	18	20
20 x 6 Ak .430	cfm	126	168	210	252	294	336	378	420
	Throw	7	11	12	14	15	18	20	21
10 x 5 Ak .169	cfm	51	68	85	101	118	135	152	169
	Throw	5	6	7	9	10	11	12	14
12 x 5 Ak .190	cfm	57	76	95	114	133	152	171	190
	Throw	6	7	9	10	11	13	14	15

16 x 8 Ak .443	cfm	133	177	222	266	310	354	399	443
	Throw	7	10	11	13	16	17	20	21
18 x 6 Ak .379	cfm	114	152	190	227	265	303	341	379
	Throw	6	9	11	13	14	16	17	20
Terminal Velocity of 75 fpm									

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ENGINEERING DATA



500 - RETURN AIR GRILLE						
FACE VELOCITY		300	400	500	600	700
6 x 6 Ak .18	cfm	54	72	90	108	126
	Ps	0.020	0.036	0.052	0.080	0.108
8 x 6 Ak .23	cfm	69	92	115	138	161
	Ps	0.020	0.036	0.052	0.080	0.108
8 x 8 Ak .33	cfm	90	120	150	180	210
	Ps	0.020	0.036	0.052	0.080	0.108
8 x 14 Ak .54	cfm	156	208	260	312	364
	Ps	0.020	0.032	0.052	0.076	0.104
10 x 4 Ak .21	cfm	58	77	96	115	134
	Ps	0.020	0.032	0.052	0.076	0.108
10 x 6 Ak .30	cfm	85	113	142	170	198
	Ps	0.020	0.036	0.052	0.080	0.108
10 x 8 Ak .38	cfm	112	149	187	224	261
	Ps	0.020	0.032	0.052	0.076	0.104
10 x 10 Ak .49	cfm	140	187	234	281	328
	Ps	0.020	0.032	0.052	0.076	0.104
10 x 14 Ak .65	cfm	193	257	322	386	450
	Ps	0.020	0.032	0.052	0.076	0.104
10 x 20 Ak .93	cfm	274	365	456	547	638
	Ps	0.020	0.032	0.052	0.072	0.104
10 x 24 Ak 1.12	cfm	328	437	547	656	765
	Ps	0.020	0.032	0.052	0.072	0.100
12 x 4 Ak .24	cfm	72	96	120	144	168
	Ps	0.020	0.032	0.052	0.076	0.108
12 x 6 Ak .36	cfm	101	134	168	202	235
	Ps	0.020	0.036	0.052	0.076	0.108
12 x 8 Ak .44	cfm	133	177	222	266	310
	Ps	0.020	0.032	0.052	0.076	0.104
12 x 10 Ak .56	cfm	168	224	280	336	392
	Ps	0.020	0.032	0.052	0.076	0.104
12 x 12 Ak .69	cfm	200	267	334	400	467
	Ps	0.020	0.032	0.052	0.076	0.104
12 x 18 Ak 1.01	cfm	302	403	504	605	706
	Ps	0.020	0.032	0.052	0.072	0.100
12 x 20 Ak 1.10	cfm	328	437	547	656	765
	Ps	0.020	0.032	0.052	0.072	0.100
12 x 24 Ak 1.32	cfm	391	522	652	782	913
	Ps	0.020	0.032	0.052	0.072	0.100
12 x 30 Ak 1.64	cfm	489	652	815	978	1141
	Ps	0.016	0.032	0.052	0.072	0.100
14 x 4 Ak .32	cfm	96	128	160	192	224
	Ps	0.020	0.032	0.052	0.072	0.108
14 x 6 Ak .42	cfm	117	156	195	234	273
	Ps	0.020	0.032	0.052	0.076	0.108

14 x 8 Ak .54	cfm	156	208	260	312	364
	Ps	0.020	0.032	0.052	0.076	0.104
14 x 10 Ak .65	cfm	193	257	322	386	450
	Ps	0.020	0.032	0.052	0.076	0.104
14 x 12 Ak .79	cfm	237	316	395	474	553
	Ps	0.020	0.032	0.052	0.076	0.104
14 x 14 Ak .91	cfm	270	360	450	540	630
	Ps	0.020	0.032	0.052	0.076	0.100
14 x 16 Ak 1.04	cfm	312	416	520	624	728
	Ps	0.020	0.032	0.052	0.072	0.100
14 x 20 Ak 1.29	cfm	383	510	638	765	893
	Ps	0.020	0.032	0.052	0.072	0.100
14 x 24 Ak 1.55	cfm	457	610	762	914	1067
	Ps	0.020	0.032	0.052	0.072	0.100
14 x 25 Ak 1.59	cfm	475	634	792	950	1109
	Ps	0.016	0.032	0.052	0.072	0.100
14 x 30 Ak 1.91	cfm	569	758	948	1137	1327
	Ps	0.016	0.032	0.048	0.072	0.096
16 x 6 Ak .45	cfm	133	177	222	266	310
	Ps	0.020	0.032	0.052	0.076	0.104
16 x 8 Ak .62	cfm	179	238	298	358	417
	Ps	0.020	0.032	0.052	0.076	0.104
16 x 10 Ak .75	cfm	225	300	375	450	525
	Ps	0.020	0.032	0.052	0.076	0.104
16 x 12 Ak .89	cfm	267	356	445	534	623
	Ps	0.020	0.032	0.052	0.076	0.100
16 x 14 Ak 1.05	cfm	309	412	515	618	721
	Ps	0.020	0.032	0.052	0.072	0.100
16 x 16 Ak 1.17	cfm	351	468	585	702	819
	Ps	0.020	0.032	0.052	0.072	0.100
16 x 20 1.46	cfm	434	578	723	867	1012
	Ps	0.020	0.032	0.052	0.072	0.100
16 x 24 Ak 1.75	cfm	520	694	867	1040	1214
	Ps	0.016	0.032	0.052	0.068	0.096
16 x 25 Ak 1.81	cfm	541	722	902	1082	1263
	Ps	0.016	0.032	0.052	0.072	0.096
18 x 8 Ak .69	cfm	207	276	345	414	483
	Ps	0.020	0.032	0.052	0.072	0.100
18 x 12 Ak .99	cfm	297	396	495	594	693
	Ps	0.020	0.036	0.052	0.076	0.104
18 x 18 Ak 1.48	cfm	440	587	734	880	1027
	Ps	0.020	0.032	0.052	0.072	0.100
20 x 8 Ak .75	cfm	225	300	375	450	525
	Ps	0.020	0.036	0.052	0.076	0.104
20 x 10 Ak .93	cfm	275	366	458	549	641
	Ps	0.020	0.032	0.052	0.072	0.104

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ENGINEERING DATA



20 x 12 Ak 1.11	cfm	328	438	547	656	766
	Ps	0.020	0.032	0.052	0.072	0.100
20 x 14 Ak 1.28	cfm	382	510	637	764	892
	Ps	0.020	0.032	0.052	0.072	0.100
20 x 16 Ak 1.46	cfm	433	578	722	866	1011
	Ps	0.020	0.032	0.052	0.072	0.100
20 x 20 Ak 1.83	cfm	543	724	905	1086	1267
	Ps	0.016	0.032	0.052	0.072	0.096
20 x 24 Ak 2.17	cfm	649	865	1081	1297	1513
	Ps	0.016	0.032	0.048	0.068	0.096
20 x 25 Ak 2.26	cfm	678	904	1130	1356	1582
	Ps	0.016	0.032	0.052	0.068	0.096
20 x 30 Ak 2.71	cfm	813	1084	1355	1626	1897
	Ps	0.016	0.032	0.048	0.068	0.092
24 x 6 Ak .67	cfm	199	265	332	398	464
	Ps	0.020	0.032	0.052	0.076	0.100
24 x 8 Ak .89	cfm	264	352	440	528	616
	Ps	0.020	0.032	0.052	0.076	0.100
24 x 10 Ak 1.12	cfm	328	437	547	656	765
	Ps	0.020	0.032	0.052	0.072	0.100
24 x 12 Ak 1.32	cfm	392	522	653	783	914
	Ps	0.020	0.032	0.052	0.072	0.100
24 x 14 Ak 1.53	cfm	457	609	762	914	1066
	Ps	0.020	0.032	0.052	0.072	0.100
24 x 16 Ak 1.75	cfm	520	694	867	1040	1214
	Ps	0.016	0.032	0.052	0.068	0.096
24 x 18 Ak 1.96	cfm	588	784	980	1176	1372
	Ps	0.020	0.032	0.052	0.072	0.096
24 x 20 Ak 2.17	cfm	649	865	1081	1297	1513
	Ps	0.016	0.032	0.048	0.068	0.096
24 x 24 Ak 2.59	cfm	775	1033	1292	1550	1808
	Ps	0.016	0.032	0.048	0.068	0.092
24 x 30 Ak 3.22	cfm	966	1288	1610	1932	2254
	Ps	0.016	0.032	0.048	0.064	0.088
25 x 14 Ak 1.59	cfm	475	634	792	950	1109
	Ps	0.016	0.032	0.052	0.072	0.100
25 x 20 Ak 2.26	cfm	678	904	1130	1356	1582
	Ps	0.016	0.032	0.052	0.068	0.096
30 x 6 Ak .83	cfm	249	332	415	498	581
	Ps	0.020	0.032	0.052	0.076	0.100
30 x 8 Ak 1.12	cfm	328	437	547	656	765
	Ps	0.020	0.032	0.052	0.072	0.100
30 x 10 Ak 1.37	cfm	409	546	682	818	955
	Ps	0.020	0.032	0.052	0.072	0.100

30 x 12 Ak 1.64	cfm	489	652	815	978	1141
	Ps	0.016	0.032	0.052	0.072	0.100
30 x 14 Ak 1.91	cfm	569	758	948	1137	1327
	Ps	0.016	0.032	0.048	0.072	0.096
30 x 16 Ak 2.16	cfm	648	864	1080	1296	1512
	Ps	0.020	0.032	0.052	0.068	0.092
30 x 20 Ak 2.71	cfm	807	1076	1345	1614	1883
	Ps	0.016	0.028	0.048	0.064	0.088
30 x 16 Ak 2.18	cfm	654	872	1090	1308	1526
	Ps	0.016	0.032	0.048	0.072	0.096

Velocity measured 1" from face

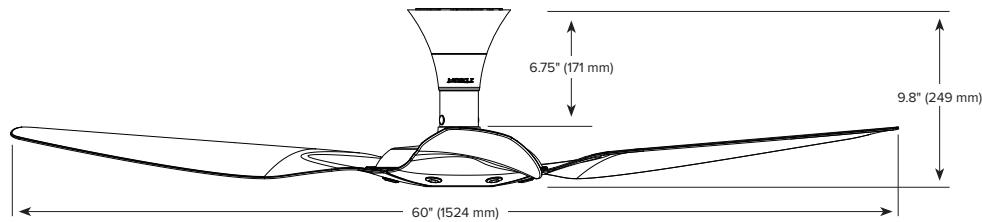
510 - ALUMINUM RETURN AIR GRILLE

FACE VELOCITY		300	400	500	600	700
8 x 8 AK .34	cfm	90	120	150	180	210
	Ps	0.020	0.032	0.052	0.072	0.108
10 x 10 Ak .51	cfm	144	192	240	288	336
	Ps	0.020	0.032	0.052	0.072	0.104
12 x 12 Ak .69	cfm	201	268	335	402	469
	Ps	0.020	0.032	0.052	0.072	0.100
14 x 6 Ak .42	cfm	117	156	195	234	273
	Ps	0.020	0.032	0.052	0.072	0.104
14 x 8 Ak .54	cfm	153	204	255	306	357
	Ps	0.020	0.032	0.052	0.072	0.100
14 x 10 Ak .67	cfm	198	264	330	396	462
	Ps	0.020	0.032	0.052	0.072	0.100
16 x 8 Ak .62	cfm	186	248	310	372	434
	Ps	0.020	0.032	0.052	0.076	0.104

Velocity measured 1" from face

**CSI #: 23 60 00**

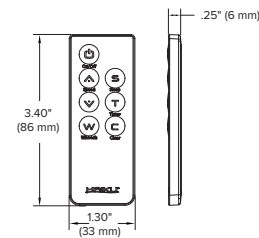
Technical Specifications



Technical Specifications	
Model	Haiku® Bamboo
Model number	S3150-S1
Fan diameter	60 in. (1524 mm)
Motor and assembly finishes	Black or white
Airfoil material	Bamboo
Airfoil finishes	Caramel or Cocoa
Number of airfoils	3
Motor type	EC motor with a digital inverter drive
Controller included	Yes, remote
Controller features	On/off
	Sleep mode
	Off timer
	Whoosh mode
	Reverse
Mount and drop tube	Short length, included (6.3 in. / 160 mm)
Hanging weight	13.2 lb (6 kg)
Number of fan speeds	6
Operating voltage	100–240 VAC, 1Φ
Operating frequency	50–60 Hz
RPM (min/max)	33/173 RPM
Amps (min/max)	0.05 - 0.363 A
Watts (min/max)	2/30 W
Ambient operational temperature range	32°–120° F (0–49° C)
Environment	UL listed for dry locations
Fan mode indicator	LED display
Warranty*	Limited lifetime

\* See Haiku warranty in installation guide for complete details

Controller



Color Options



855-MY HAIKU (855-694-2458) | [WWW.HAIKUFAN.COM](http://WWW.HAIKUFAN.COM)

**BIG ASS FANS**  
No Equal.



Ask how Haiku Fans contribute to LEED®-NC 2009 credits in: Optimized Energy Performance; Enhanced Refrigerant Management; Minimum Indoor Air Quality Performance; Increased Ventilation; Thermal Comfort - Design; Innovation in Design and LEED-H 2008 credits in: Advanced Lighting Package; High Efficiency Appliances



May be protected by one or more of the following patents: U.S. Pat. Nos. D612476 and D614757 | ANSI/UL STD 507 | Can/CSA C22.2 NO 113 | An ISO 9001:2008 certified company. HF400-0-K3150-A0-02/12-03-00

CSI #: 23 70 00

## ADVANCED FEATURES THAT MAKE A DIFFERENCE

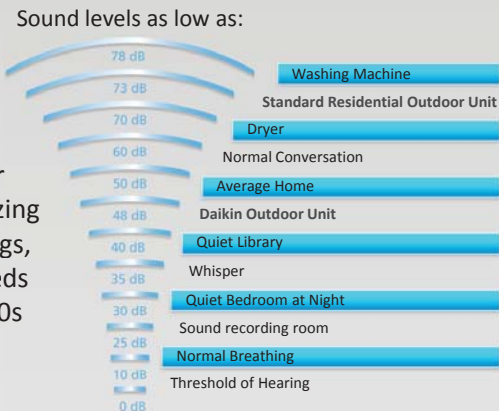
### Feel the Difference



Designed for superior heating capacity in low-ambient conditions and absolute comfort, Daikin Inverter Ducted units provide comfortable heating down to 0°F, with up to 100% capacity available at temperatures as low as 14°F. With the ability to operate in cooling mode from 23°F to 115°F, this makes installation easier in most climates since additional supplemental electric heater is not required.

### Hear the Difference

Daikin Inverter Ducted systems have sound reducing features such as compressor sound attenuators, but they're also quieter than conventional systems because they have fewer moving parts and rarely run at full speed. Utilizing inverter technology to maintain comfort settings, Daikin systems most often operate at low speeds with outdoor sound levels in the mid to high 50s dB(A).



### Easy Installation

A Daikin Inverter Ducted outdoor unit is not as large and bulky as the outdoor unit on a conventional system. More than one of the compact and lightweight units can be fitted in the bed of a standard pickup truck.



- Reduced installation time with integrated electronic expansion valve and printed circuit boards
- Volt-free float switch integration option
- Corrosion-resistant coating on outdoor unit heat exchanger
- Indoor fan coil unit with up flow or horizontal right configurations
- Heating and Cooling Fan Auto mode can be configured separately
- Dual-voltage 208-230V/1/60 Hz power supply
- Optional electric resistance heat
- Gravity-fed drain connection



CSI #: 23 70 00

## LEADING TECHNICAL PERFORMANCE

System Performance						
Model Name	Indoor	FTQ18PBVJU	FTQ24PBVJU	FTQ30PBVJU	FTQ36PBVJU	FTQ42PBVJU
	Outdoor	RZQ18PVJU9	RZQ24PVJU9	RZQ30PVJU9	RZQ36PVJU9	RZQ42PVJU9
Cooling Capacity (Rated)	Btu/h	18,000	24,000	30,000	36,000	40,000
Cooling Capacity (Min - Max)	Btu/h	9,000 - 18,000	9,000 - 24,000	2,000 - 30,000	12,000 - 36,000	12,000 - 42,000
Heating Capacity (Rated)	Btu/h	20,000	27,000	34,000	40,000	47,000
Heating Capacity (Min - Max)	Btu/h	9,000 - 20,000	9,000 - 27,000	2,000 - 34,000	12,000 - 40,000	12,000 - 47,000
SEER		20.0	19.0	19.5	18.0	17.0
EER		14.5	13.5	13.5	12.5	12.0
HSPF		12.0	11.5	10.0	9.5	9.0
Power Supply	V/ph/Hz	208-230/1/60				
Minimum Circuit Amps	A	6.5		27.0		
Maximum Overcurrent Protection	A	20.0		30.0		
Power Consumption - Cooling	kW	1.19	1.68	2.06	2.65	3.05
Power Consumption - Heating	kW	1.41	1.98	2.53	3.03	4.02
Operating Current - Cooling	A	1.2	1.3	1.8	2.2	2.8
Operating Current - Heating	A	1.2	1.3	1.8	2.2	2.8
Indoor Units - FTQ Unitary						
Model Name		FTQ18PBVJU	FTQ24PBVJU	FTQ30PBVJU	FTQ36PBVJU	FTQ42PBVJU
External Static Pressure	*W.G.	Up to 0.50				
Airflow (H/M/L)	CFM	600/510/420	800/680/560	1,000/850/700	1,200/1,020/840	1,400/1,190/980
Piping Connections	Liquid (O.D.)	in. Ø 3/8	Ø 3/8	Ø 3/8	Ø 3/8	Ø 3/8
	Gas (O.D.)	in. Ø 5/8	Ø 5/8	Ø 5/8	Ø 5/8	Ø 5/8
	Condensate Drain	in. Ø 1	Ø 1	Ø 1	Ø 1	Ø 1
Dimensions (H x W x D)	in.	48-1/8 x 22 x 26		58-1/4 x 22 x 26		
Net Weight	lbs.	150.0		192.0		203.0
Outdoor Units - RZQ_PVJU9 Heat Pump						
Model Name		RZQ18PVJU9	RZQ24PVJU9	RZQ30PVJU9	RZQ36PVJU9	RZQ42PVJU9
Sound Pressure Level - Cooling/Heating	dB(A)	49/49	49/49	49/49	58/58	58/58
Operating Range - Cooling	°F DB	23 - 115	23 - 115	23 - 115	23 - 115	23 - 115
Operating Range - Heating	°F DB	0 - 77	0 - 77	0 - 77	0 - 77	0 - 77
Operating Range - Heating	°F WB	0 - 60	0 - 60	0 - 60	0 - 60	0 - 60
Max. Piping Length	ft.	8.0		230.0		
Max. Piping Height	ft.	8.0		164.0		
Dimensions (H x W x D)	in.	30-5/16 x 35-7/16 x 12-5/8		52-15/16 x 35-7/16 x 12-5/8		
Net Weight	lbs.	150.0		283.0		

Options	Part Number
Wired Controller	BRC1E71
Simplified remote controller	BRC2A71
Remote sensor	KRCS01-4B
Electric Heater Connection Kit	KER26A60
Electric Heater Kits	HKR-03, HKR-05C, HKR-06, HKR-08C, HKR-10C, HKR-15C
Remodeling wiring adaptor	KRP1C75 *1
Group control adaptor	KRP4A74 *2
Fixing box for options	KRP1B101 *3
External control adaptor for outdoor unit	DTA104A53 *2

\*1 Need 24V AC power supply

\*2 Need 16V DC power supply

\*3 Fixing box is installed beside the unit

CSI #: 23 70 00

## TIME-SAVING INSTALLATION

To ensure continuous heating in the harshest climates, Daikin provides electric heater options with the capacities as follow. This represents Daikin's free of mind guarantee to ensure full compatibility within the total system offered and top performance.

Model name	Electrical heater capacity					
	3kW	5kW	6kW	8kW	10kW	15kW
FTQ18PBVJU	⊙	○	○	×	×	×
FTQ24PBVJU	⊙	○	○	○	○	×
FTQ30PBVJU	⊙	⊙	○	○	○	×
FTQ36PBVJU	⊙	⊙	○	○	○	×
FTQ42PBVJU	⊙	⊙	⊙	⊙	○	○ ※

⊙ Operation with Heat Pump Allowed      ○ Electric Heater Option Only      × Not Allowed

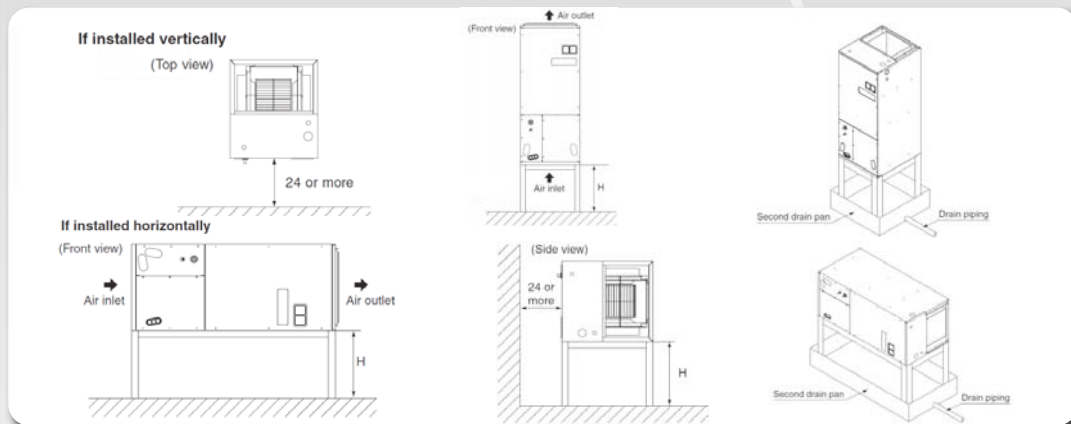
## EASE OF INSTALLATION

Connected by a pair of refrigerant lines, few electrical connections, and little to no ductwork, indoor and outdoor units can be easily installed in existing spaces with minor disruption and often in a single day's work. The compact and lightweight designs combined with flexible piping and minimal wiring allow installation with minimal time and costs.

For FTQ18/24/30/36/42PBVJU

Space required for installation (in.)  
H = 19" 1/8

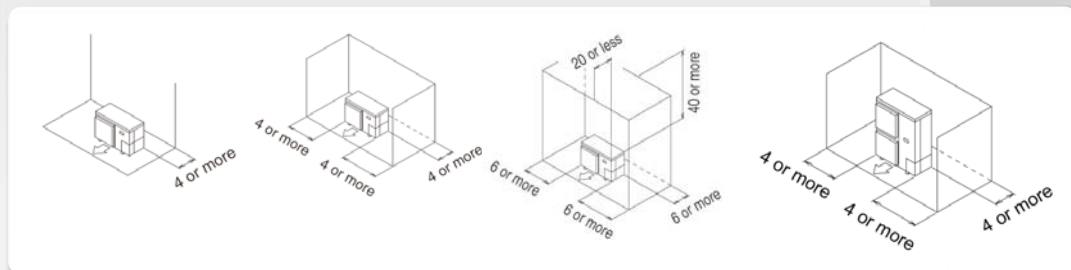
The installation of a secondary drain pan is necessary as shown below.  
Always refer to installation manuals for details.



For RZQ18/24/30/36/42PVJU(9)

Space required for installation (in.)

For double-fan outdoor modules, the requirements are similar in some cases.  
Always refer to installation manuals for details.



CSI #: 23 70 00

# Ultra-Aire™ 70H Ventilating Dehumidifier

The **Ultra-Aire 70H** is the first compact, high-efficiency, whole-house ventilating dehumidifier designed to fit in tight, low-clearance applications. The unit removes up to 70 pints per day, is ENERGY-STAR® rated and provides effective air filtration (MERV 11). The UA 70H is designed to handle up to 1800 sq. ft, which makes it ideal for a small home, condo or apartment application. The unit can be tied into a forced air duct system, ducted with separate ducting or used in a freestanding application and can be installed in mechanical rooms, closets, attics, basements and crawlspaces.

The UA70H has an innovative cabinet design that easily converts to either vertical or horizontal airflow discharge which allows for easier installation in tight spaces. Flexible airflow configurations allow the UA70H to be installed in locations where other dehumidifiers don't fit due to duct issues and size constraints. (See picture below.)



## ULTRA-AIRE 70H SPECIFICATIONS

<b>Part Number:</b>	4029870
<b>Blower:</b>	160 CFM @ 0.0" WG
<b>Power:</b>	600 Watts @ 80°F and 60% RH
<b>Supply Voltage:</b>	110-120 VAC – 1phase – 60 Hz
<b>Current Draw:</b>	5.3 Amps
<b>Energy Factor:</b>	2.32 L/kWh
<b>Operating Range:</b>	Between 45°F and 95°F Max (inlet Air Temperature)
<b>Sized for:</b>	Up to 1800 Sq. Ft. - Typical
<b>Minimum Performance at 80°F and 60% RH</b>	
Water Removal:	70 pints/day
Efficiency:	4.9 Pints/kWh
<b>Air Filter:</b>	MERV-11
Efficiency:	Standard 65% Efficient ASHRAE Dust Spot Test
Size:	9" x 11" x 1"
<b>Power Cord:</b>	9', 110-120 VAC, Ground
<b>Drain Connection:</b>	3/4" Threaded NPT
<b>UA 70H Dimensions:</b>	28"W x 12"H x 12"L – 55lbs.



One of the best Limited Warranties in the industry today –

1 YEAR 100% – All Parts and Labor  
5 YEARS 100% – Condenser, Evaporator, and Compressor only (with certain limitations)

## OPTIONAL ACCESSORIES

4030671	MERV 11 Filter
4030734	MERV 11 4-Pack
4030733	MERV 11 12-Pack
4023647	8" Gravity Damper
4020646	8" Butterfly Damper
4027415	8" Flex Duct
4020177	8" Flex Duct (Insulated)

## ULTRA-AIRE 70H INSTALLATION OPTIONS

Control Options	Part Number
DEH 3000 - Digital Control	4028539
DEH 3000R - Digital Control	4028407

Ducting Options	Part Number
6", 2 wire 24 volt Electric Air Damper	4023672
Insulated 6" Air Duct (Flex) - 25 ft.	4020128
Hang Kit	4029908
Pump Kit	4030113

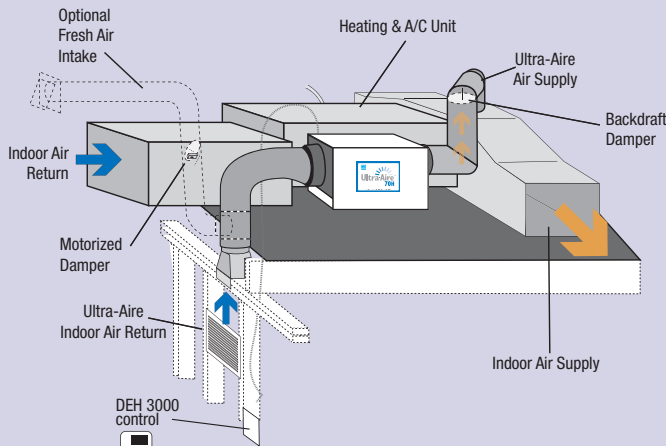
It's not a dream home without  
**Ultra-Aire™**  
WHOLE HOUSE VENTILATING DEHUMIDIFIERS

1-800-533-7533 | [www.Ultra-Aire.com](http://www.Ultra-Aire.com)



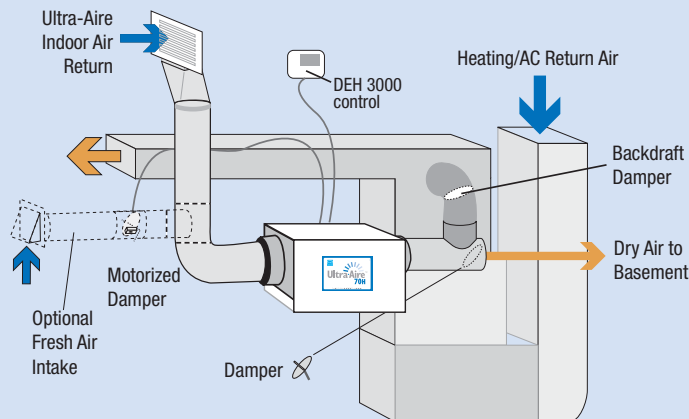
CSI #: 23 70 00

# Ultra-Aire™ 70H Installation Options



## ULTRA-AIRE 70H ATTIC INSTALLATION

1. The indoor air return should come from an open area on the first floor or main level of the home / building.
2. The Ultra-Aire supply can be ducted into the forced air system past the air conditioning coil. The duct connection should be perpendicular to the air flow. You may also run an independent supply directly from the dehumidifier into a large open room. Depending on the application, multiple returns and or supplies may be needed.
3. The optional six inch fresh air intake should be located at least six feet away from any exhaust ports, such as, dryer, range hood, or combustion device exhaust. Intake location should be consistent with local codes.
4. A section of flex duct or vibration absorbing duct should be located between the connections of the Ultra-Aire ductwork and the forced air system ductwork. (When ducting into the forced air systems)
5. A back draft damper should be installed when ducting into the forced air system. This prevents counter-flow of the A/C supply air through the UA 70H. A back draft damper is not needed when ducted independently.
6. If placed over a finished area, a secondary drip pan is recommended



## ULTRA-AIRE 70H BASEMENT OR CRAWLSPACE INSTALLATION

1. Indoor air return should come from an open area of the first or second floor.
2. The Ultra-Aire supply should be ducted into the forced air system supply beyond the air conditioning coil. The duct connection should be perpendicular to the air flow.
3. An optional eight inch tee fitting with an adjustable blade damper on the straight run may be attached at the Ultra-Aire supply. This allows for increased air flow to the basement/crawlspace during the summer months.
4. The optional six inch fresh air intake should be located at least six feet away from any exhaust ports, such as, dryer, range hood, or combustion device exhaust. Intake location must be consistent with local codes.
5. A section of flex duct or vibration absorbing duct should be located between the connections of the Ultra-Aire ductwork and the forced air system ductwork.
6. The backdraft damper prevents counter-flow of the A/C supply air through the Ultra-Aire 70H.

**Please Note:** Therma-Stor does not recommend drawing air from the return ducting system and discharging into the supply, because it could reduce the capacity and may cause potential counterflow through the unit. Preferred installation is to draw air from a separate intake duct located in the central part of the home. Duct the outlet air into the supply duct for distribution throughout the home. A backdraft damper prevents air from the supply duct from being pushed backward through the Ultra-Aire 70H when central (A/C) fan is on and the Ultra-Aire fan is off.

1-800-533-7533 | [www.Ultra-Aire.com](http://www.Ultra-Aire.com)

CSI #: 23 72 00



# Fantech

## Energy Recovery Ventilator



Compact ERV with easy mount wall bracket. Brings a continuous supply of fresh air into a home while exhausting an equal amount of contaminated air. The enthalpic core at the center of the unit transfers heat and moisture from the incoming air to the outgoing air. The air brought into the living area is cooled and the humidity is reduced for maximum comfort. Reduces the load on a home's air conditioner to save on cooling costs.

### FEATURES

- Super Compact Size
- Includes Easy-Mount Wall Bracket
- Enthalpy Core
- 4" (100mm) Duct Connection
- No Balancing Required
- Unit Can Be Installed In Any Position
- No Defrost or Drain Pan Needed
- Easy Access Service Door
- 3' (914mm) Plug-in Power Cord
- Only 25 lbs (11 kg)
- Electrostatic Filters (washable)
- Easy Core Guide Channels For Removing Core
- Single Speed Ventilation

### ACCESSORIES

- FTD 7 – 7 Day Digital Programmable Timer
- COM 4P – 4" Weather Hoods (1 supply & 1 exhaust)
- FEL 4 – 4" 90° Elbow
- CG 4 – 4" Adjustable Grille

Distributed by:

Fantech, reserves the right to modify, at any time and without notice, any or all of its products' features, designs, components and specifications to maintain their technological leadership position.

## SE704N

**S** = Side discharge  
**E** = Energy recovery  
**704** = 70cfm, 4 port design  
**N** = No defrost & drain pan

### SPECIFICATIONS

**CASE** 24 gauge galvanized steel. Baked powder coated paint, antique white. Cabinet fully insulated with 1" (25 mm) aluminum foil-face high density polystyrene foam to prevent condensation and meet the requirements of the UL 94HF.

**MOTORS** Two (2) German-manufactured, factory-balanced ebm™ motors with backward curved blades. Motors come with permanently lubricated sealed ball bearings to guarantee long life and maintenance-free operation. Seven (7) year warranty. Steep fan curve requires no balancing.

**CORE** Enthalpy core configured for efficient cross-flow ventilation. Core is 8.5" x 8.5" (216 x 216 mm) with a 8" (205 mm) depth. Cores are manufactured to withstand large temperature variations.

**FILTERS** Two (2) Washable Electrostatic Panel Type Air Filters, 8.5" (216mm) x 8" (203mm) x 0.125" (3mm).

**CONTROLS** Unit is designed to operate continuously on a single speed. See FDT 7 under accessories or contact Tech Support for possible intermittent, line-voltage options.

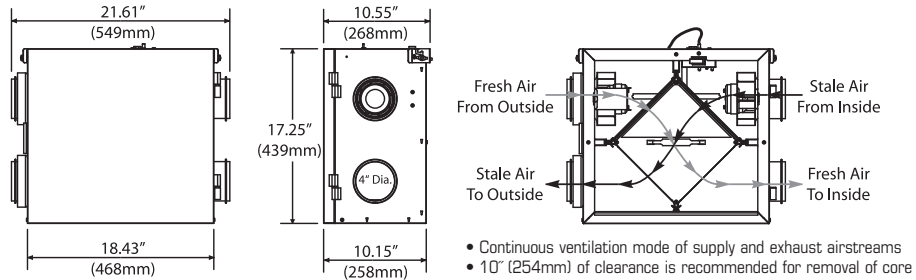
**SERVICEABILITY** Core, filters, and motors can be easily accessed through latched door. Core conveniently slides out on our new easy glide core guides. 10" (250mm) of clearance is recommended for removal of core.

**DUCT CONNECTION** 4" (100mm) steel duct connections with rubber gasket for easy sealing.

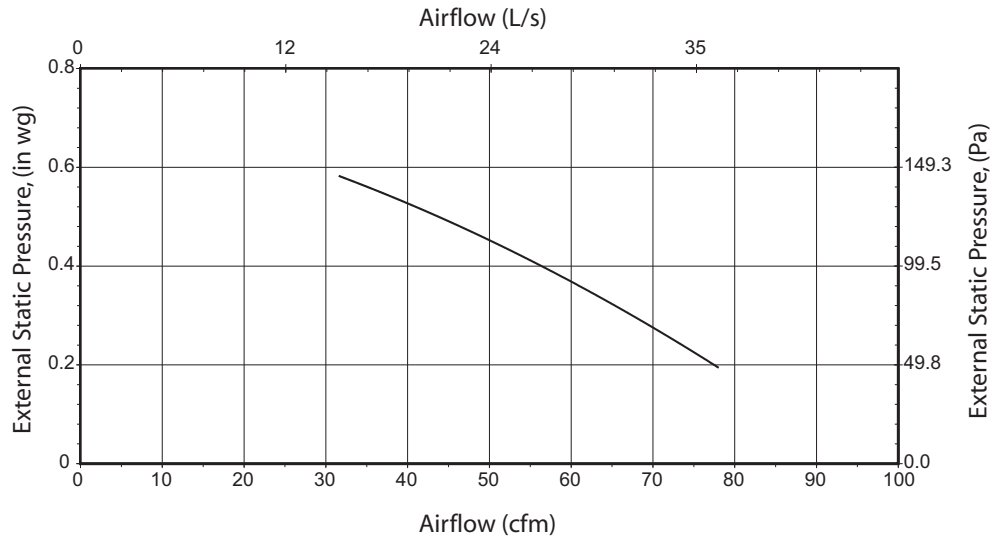
**WARRANTY** Limited 5 year on Enthalpy core, 7 year on motors, and 5 year on parts.

CSI #: 23 72 00

**Dimensions & Airflow** - All units feature three foot plug-in power cord with 3-prong plug.



**Ventilation Performance**



**Specifications and Ratings**

- Model: SE704N
- Total assembled weight: 25 lbs (11kg)
- Cabinet: 24 ga. steel w/powder coat finish
- Motors: ebm motors w/backward curved blades
- Filters: 2 washable electrostatic filters 8.5" (216mm) x 8" (205mm) x 0.125" (3mm)
- Insulated with 1" (25 mm) aluminum foil-face high density polystyrene foam to prevent condensation and meet the requirements of the UL 94HF.
- Core: Enthalpy 8.5" (216mm) x 8.5" (216mm) x 8" (205mm)
- Supply & exhaust ducts: 4" (100mm)
- Mounting: Wall bracket included
- Electrical requirements:
 

Volts	Frequency	Amps	Watts
115V	60Hz	0.36A	40W
- 3' plug-in power cord w/ 3-prong plug

**Contacts**

Submitted by:	Date:
City:	Model #:
Comments:	
Project #:	
Location:	
Architect:	
Engineer:	
Contractor:	



United States  
 10048 Industrial Blvd.,  
 Lenexa, KS. 66215  
 (T) 1.800.747.1762  
 (F) 1.800.487.9915  
 (T) 1.913.752.6000  
 (F) 1.913.752.6466  
[www.fantech.net](http://www.fantech.net)  
[info@fantech.net](mailto:info@fantech.net)

Canada  
 50 Kanelfakt Way,  
 Bouctouche, NB E4S 3M5  
 (T) 1.800.565.3548  
 (F) 1.877.747.8116  
 (T) 1.506.743.9500  
 (F) 1.506.743.9600



Article #: 412122  
 Rev Date: 012011

# Division 25

## Integrated Automation



**CSI #: 25 00 00**

## Specifications

<b>General</b>	
Brand	INSTEON
Manufacturer Product No.	2412N
UPC	718122398315
Patent No.	Protected under U.S. and foreign patents (see <a href="http://www.insteon.com">www.insteon.com</a> )
Color	White
Internal Clock	Real-time clock, 10-year lifespan
Network Interface	RJ45 Ethernet (10Mbps)
User Upgradeable Server Applications	JavaScript, HTML-only
DHCP	Supported
User-Assigned IP	Supported
Dynamic DNS	Supported
Ethernet Port Range	Any standard 65k ports
Warranty	Two years
<b>Operation</b>	
Status LED	Blinks on setup and on local traffic
Ethernet Jack LED	Two traffic LEDs, green and amber
Setup Memory	Non-volatile EEPROM
Webpage Memory	128KB
User-Updated Pages	Yes, via HTTP
<b>INSTEON Features</b>	
INSTEON Address	1 hard-coded out of 16,777,216 possible
INSTEON Links	2,016
INSTEON Powerline Frequency	131.65 KHz
INSTEON Minimum Transmit Level	10mV
INSTEON Messages Repeated	Yes
INSTEON Device Category	0x03
INSTEON Device Subcategory	0x10
INSTEON Product Key (IPK)	0x000044
<b>X10 Features</b>	
X10 Addresses Supported	256
X10 Powerline Frequency	120KHz
X10 Minimum Transmit Level	3.2 Vpp into 5 Ohms
X10 Minimum Receive Level	20mV into 5 Ohms
X10 Messages Repeated	No
<b>Mechanical</b>	
Operating Conditions	Indoors, 32° F to 104° F, up to 85% relative humidity
Dimensions	4" H x 2.5" W x 1.5" D
Weight	10 oz.

**CSI #: 25 00 00**

<b>Electrical</b>		
Supply Voltage	120V +/- 10%, 60Hz, single phase	
Surge Protection	MOV rated for 150V	
Power Plug	3-pin grounded	
Pass-Through Outlet	Uncontrolled 3-pin (grounded), 120V, 15A	
Power Consumption	2.11W	
Certification	Safety-tested for use in USA and Canada (ETL #3017581)	
<b>Default Application</b>		
Maximum Number of Scenes/Devices	240	
Number of Rooms	15	
Scene/Device Commands Supported	On	Off
	Dim	Brighten
Timer Events Supported	1 On and 1 Off timer per day per scene/device	
Maximum Number of Timer Events	480 per day (240 On, 240 Off)	
Timer Day of the Week Condition	Supported	
Browsers Supported	All browsers supported for HTML-only interface; JavaScript/AJAX enabled browsers for ideal interface use Linux browsers not currently supported	

## Certifications and Warranty

### Certification

This product has been thoroughly tested by ITS ETL SEMKO, a nationally recognized independent third-party testing laboratory. The North American ETL Listed mark signifies that the device has been tested to and has met the requirements of a widely recognized consensus of U.S. and Canadian device safety standards, that the manufacturing site has been audited, and that the manufacturer has agreed to a program of quarterly factory follow-up inspections to verify continued conformance.

### FCC and Industry Canada Compliance Statement

This device complies with FCC Rules Part 15 and Industry Canada RSS-210 (Rev. 7 or 8). Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le present appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisee aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioelectrique subi, mme si le brouillage est susceptible d'en compromettre le fonctionnement.

The digital circuitry of this device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio and television reception. However, there is no guarantee that interference will not occur in a particular installation. If this device does cause such interference, which can be verified by turning the device off and on, the user is encouraged to eliminate the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna of the device experiencing the interference
- Increase the distance between this device and the receiver
- Connect the device to an AC outlet on a circuit different from the one that supplies power to the receiver
- Consult the dealer or an experienced radio/TV technician

**WARNING:** Changes or modifications to this device not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### ETL/UL Warning (Safety Warning)

**CAUTION:** To reduce the risk of overheating and possible damage to other equipment, do not install this device to control a receptacle, a motor-operated appliance, a fluorescent lighting fixture, or a transformer-supplied appliance.  
Gradateurs commandant une lampe a filament de tungstene – afin de reduire le risque de surchauffe et la possibilite d'endommagement a d'autres materiels, ne pas installer pour commander une prise, un appareil a moteur, une lampe fluorescente ou un appareil alimente par un transformateur.

CSI #: 25 00 00

2/7/13

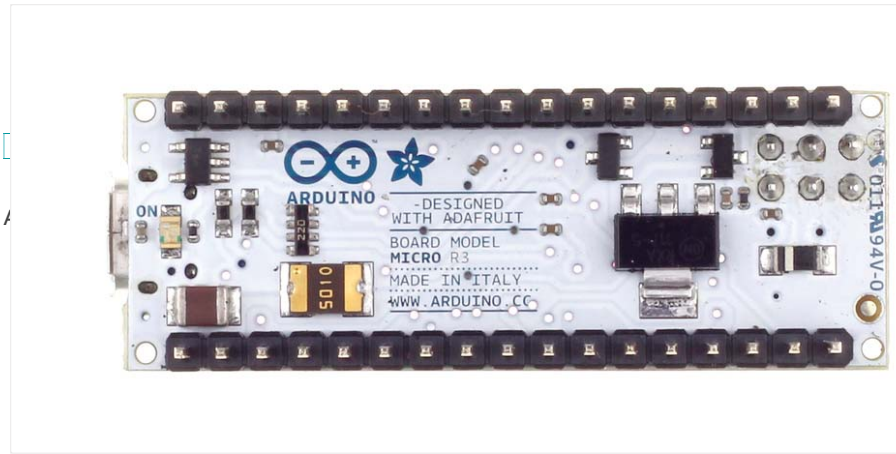
Arduino - ArduinoBoardMicro

[Main Site](#) [Blog](#) [Playground](#) [Forum](#) [Labs](#) [Store](#)

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|

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Arduino Micro Front

Arduino Micro Rear



### Overview

The Arduino Micro is a microcontroller board based on the ATmega32u4 ([datasheet](#)), developed in conjunction with [Adafruit](#). It has 20 digital input/output pins (of which 7 can be used as PWM outputs and 12 as analog inputs), a 16 MHz crystal oscillator, a micro USB connection, an ICSP header, and a reset button. It contains everything needed to support the microcontroller: simply connect it to a computer with a micro USB cable to get started. It has a form factor that enables it to be easily placed on a breadboard.

The Micro is similar to the Arduino Leonardo in that the ATmega32u4 has built-in USB communication, eliminating the need for a secondary processor. This allows the Micro to appear to a connected computer as a mouse and keyboard, in addition to a virtual (CDC) serial / COM port. It also has other implications for the behavior of the board; these are detailed on the [getting started page](#).

### Summary

Microcontroller	ATmega32u4
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	20
PWM Channels	7
Analog Input Channels	12
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega32u4) of which 4 KB used by bootloader
SRAM	2.5 KB (ATmega32u4)
EEPROM	1 KB (ATmega32u4)
Clock Speed	16 MHz

### Schematic & Reference Design

EAGLE files: [arduino-micro-reference-design.zip](#)

[arduino.cc/en/Main/ArduinoBoardMicro](http://arduino.cc/en/Main/ArduinoBoardMicro)

1/4

CSI #: 25 00 00

**Honeywell**

## DT7450/DT7450C/DT7450-MIC

DUAL TEC® MOTION SENSORS



Designed for tough, commercial environments, the DT7450 Motion Sensor achieves reliable protection with improved false alarm immunity through DualCore™ signal processing. Optimum performance is achieved using K-Band microwave technology and Uniform Sensitivity Optics. The DT7450-MIC is a fully featured DualTec with integrated microphone, for listen in capabilities.

### FEATURES

- **Advanced DualCore Signal Processing**

DualCore signal processing analyzes PIR and microwave signals through the DT7450's microcontroller. DualCore processing supports a multitude of advanced functions, including concurrent diagnostics, digital fluorescent light interference filter, digital adaptive microwave threshold, adaptive baselines, and bidirectional temperature compensation.

- **Superb Detection Through K-Band Technology**

K-Band microwave technology delivers sharp detection without holes or weak spots. The custom made source offers pattern shaping to fill the protected area with a broad, balloon-shaped pattern which matches the PIR pattern. It also offers pattern containment to reduce the penetration of microwave energy through walls.

- **Enhanced False Alarm Prevention Features**

The DT7450 offers more than the standard features that protect against false alarms due to RF signals, electrostatic discharge, and electrical overstress. The patented black bug guard improves white light immunity and digital adaptive microwave thresholds automatically adjust for room disturbances.

- **Self-Testing for Consistently Reliable Operation**

Concurrent diagnostics assure optimum performance and reliability. Self-testing is performed upon power-up and at least once every hour on the PIR, microwave, PCB circuitry and temperature compensation circuitry.

- **Sturdy, Attractive Housing**

The sleek, sturdy housing fits into a variety of building styles and blends with any room decor. ABS plastic is used for shock and impact protection. The housing offers a convenient wiring channel, knockouts for mounting and wiring, and easy access to wiring terminals.

- **DualCore Signal Processing**

PIR and microwave signals are analyzed in the microcontroller in multiple domains, including amplitude, time, frequency and duration to provide superior false alarm immunity without compromising detection. DualCore processing not only supports alarm functions, but also advanced temperature compensation, diagnostics, and false alarm features.

- **Uniform Sensitivity Optics**

The custom-designed Fresnel lens provides the same sensitivity for human targets at the edge of the pattern as exists directly in front of the sensor, giving the DT7450 consistent coverage throughout the protected area.

- **Digital Adaptive Microwave Thresholds**

The DT7450 digitally adjusts its thresholds to account for room disturbances such as ceiling fans and other repetitive moving objects which are not an intrusion event. The result – excellent false alarm immunity even in “active” rooms.



CSI #: 25 00 00

## DT7450/DT7450C/DT7450-MIC

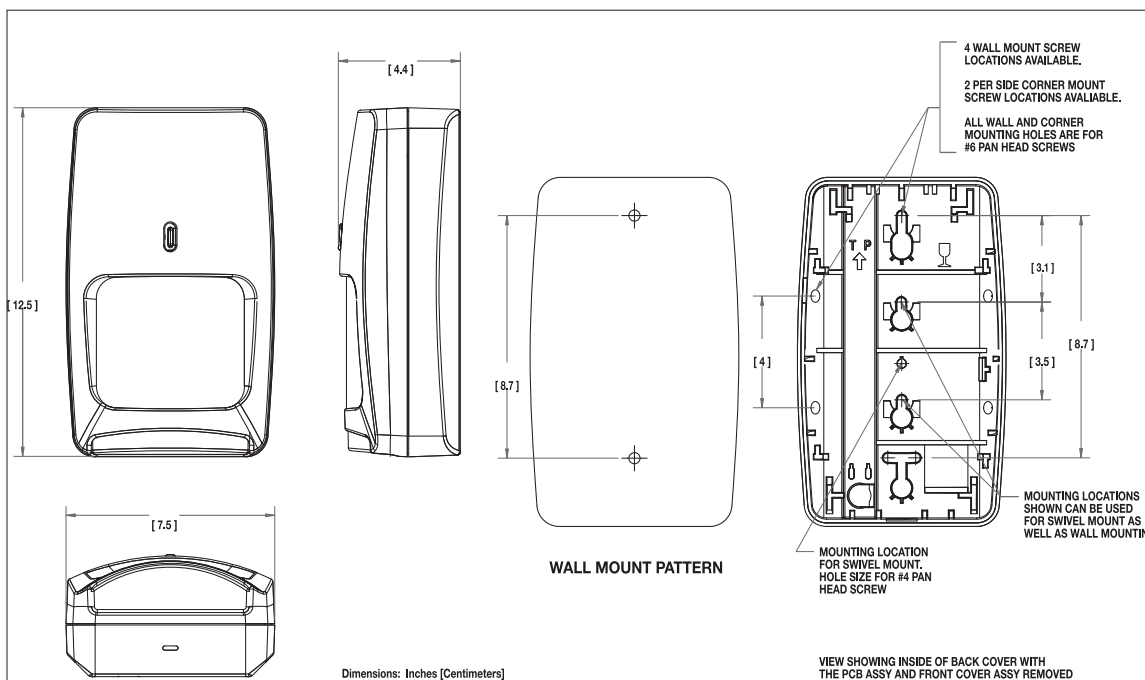
DUAL TEC® MOTION SENSORS

# Honeywell

### SPECIFICATIONS

- **Range**
  - 50' x 60' (15 m x 18 m), 90 wide° angle
- **Alarm Relay**
  - DT7450/DT7450-MIC: Energized Form A
  - DT7450C: Energized Form C 125mA, 25VDC, 20 Ohm series resistor
- **Mounting Height**
  - 7'6" (2.3 m) optimal
- **Tamper**
  - (NC) 50 mA, 24VDC
- **Power Requirements**
  - 7.5–16VDC (8.0–16VDC for UL installations)
  - DT7450: 25mA typical, 30mA max. at 12VDC
  - DT7450C: 30mA typical, 35mA max. at 12VDC
  - DT7450-MIC: 25mA typical, 33 mA Max at 12 VDC
  - AC Ripple: 3V peak-to-peak at 12VDC nominal
- **Frequencies**
  - 24.125 GHz (K-Band)
- **PIR White Light Immunity:**
  - 6,500 lux typical
- **Fluorescent Light Filter**
  - 50 Hz or 60 Hz, selectable
- **RFI Immunity**
  - 30 V/m, 10 MHz – 1000 MHz
- **Operating Temperature**
  - 14° to 131° F (-10° to 55° C)
  - 5% – 95% relative humidity (non-condensing)
- **Self-test Intervals**
  - Microwave supervision: Continuous
  - PIR self-test: Once every hour
  - Temp. comp.: Every 30 seconds
- **Microphone Output**
  - 15V peak-to-peak max, 10 mA max
- **PIR Fields of View**
  - 22 long range
  - 12 intermediate
  - 6 lower
  - 4 look-down
- **Dimensions**
  - 4.92" x 2.94" x 1.72" (12.5 cm x 7.5 cm x 4.4 cm)
- **Sensitivity**
  - Low (Pulse count 2): 3-4 steps
  - High (Pulse count 1): 2-3 steps
- **Temperature Compensation**
  - Advanced Dual Slope Temperature Compensation
- **Agency Listings**
  - EN50131-1 Grade 2, Class II
  - cULus – FCC – FG
  - IC – IMQ – INCERT
  - MABISZ – NCP – NFA2P
  - SBSC – SKAFOR

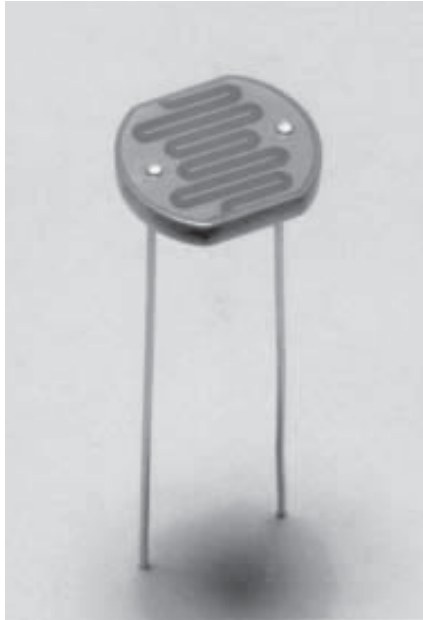
### MECHANICAL MOUNTING SPECIFICATIONS



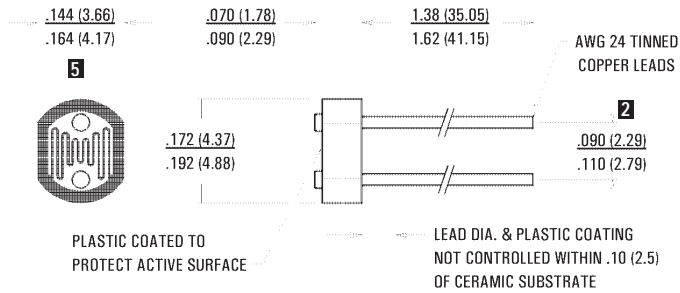
CSI #: 25 00 00

# Photoconductive Cell

# VT900 Series



### PACKAGE DIMENSIONS inch (mm)



### ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Units
Continuous Power Dissipation Derate Above 25 C	$P_D$ $\square P_D / \square T$	80 1.6	mW mW/ C
Temperature Range Operating and Storage	$T_A$	-40 to +75	C

### ELECTRO-OPTICAL CHARACTERISTICS @ 25°C (16 hrs. light adapt, min.) 4

Part Number	Resistance (Ohms) 3 6						Material Type	Sensitivity ( $\square$ typ.)  $\frac{\text{LOG}(R_{10}/R_{100})}{\text{LOG}(100/10)}$	Maximum Voltage (V, pk)	Response Time @ 1 fc (ms, typ.)	
	10 lux 2850 K			2 fc 2850 K	Dark					Rise (1-1/e)	Fall (1/e)
	Min.	Typ.	Max.	Typ.	Min.	sec.					
VT90N1	6 k	12 k	18 k	6 k	200 k	5	$\emptyset$	0.80	100	78	8
VT90N2	12 k	24 k	36 k	12 k	500 k	5	$\emptyset$	0.80	100	78	8
VT90N3	25 k	50 k	75 k	25 k	1 M	5	$\emptyset$	0.85	100	78	8
VT90N4	50 k	100 k	150 k	50 k	2 M	5	$\emptyset$	0.90	100	78	8
VT93N1	12 k	24 k	36 k	12 k	300 k	5	3	0.90	100	35	5
VT93N2	24 k	48 k	72 k	24 k	500 k	5	3	0.90	100	35	5
VT93N3	50 k	100 k	150 k	50 k	500 k	5	3	0.90	100	35	5
VT93N4	100 k	200 k	300 k	100 k	500 k	5	3	0.90	100	35	5
VT935G											
1 Group A	10 k	18.5 k	27 k	9.3 k	1 M	5	3	0.90	100	35	5
Group B	20 k	29 k	38 k	15 k	1 M	5	3	0.90	100	35	5
Group C	31 k	40.5 k	50 k	20 k	1 M	5	3	0.90	100	35	5

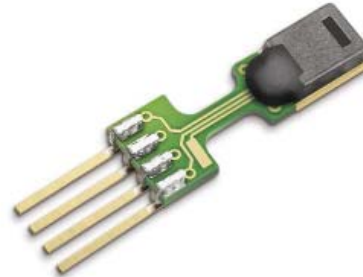
See page 13 for notes.

CSI #: 25 00 00

**SENSIRION**  
THE SENSOR COMPANY

## Datasheet SHT7x (SHT71, SHT75) Humidity and Temperature Sensor IC

- Fully calibrated
- Digital output
- Low power consumption
- Excellent long term stability
- Pin type package – easy integration



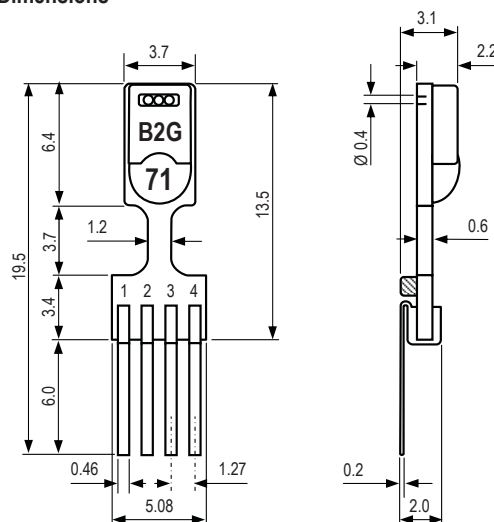
### Product Summary

SHT7x (including SHT71 and SHT75) is Sensirion's family of relative humidity and temperature sensors with pins. The sensors integrate sensor elements plus signal processing in compact format and provide a fully calibrated digital output. A unique capacitive sensor element is used for measuring relative humidity while temperature is measured by a band-gap sensor. The applied CMOSens® technology guarantees excellent reliability and long term stability. Both sensors are seamlessly coupled to a 14bit analog to digital converter and a serial interface circuit. This results in superior signal quality, a fast response time and insensitivity to external disturbances (EMC).

Each SHT7x is individually calibrated in a precision humidity chamber. The calibration coefficients are programmed into an OTP memory on the chip. These coefficients are used to internally calibrate the signals from the sensors. The 2-wire serial interface and internal voltage regulation allows for easy and fast system integration. The small size and low power consumption makes SHT7x the ultimate choice for even the most demanding applications.

SHT7x is supplied on FR4 with pins which allows for easy integration or replacement. The same sensor is also available as surface mountable packaging (SHT1x) or on flex print (SHTA1).

### Dimensions



**Figure 1:** Drawing of SHT7x (applies to SHT71 and SHT75) sensor packaging, dimensions in mm (1mm = 0.039inch). Contact assignment: 1: SCK, 2: VDD, 3: GND, 4: DATA. Hatched item on backside of PCB is a 100nF capacitor – see Section 2.1 for more information.

### Sensor Chip

SHT7x V4 – for which this datasheet applies – features a version 4 Silicon sensor chip. Besides a humidity and a temperature sensor the chip contains an amplifier, A/D converter, OTP memory and a digital interface. V4 sensors can be identified by the alpha-numeric traceability code on the sensor cap – see example “B2G” code on Figure 1.

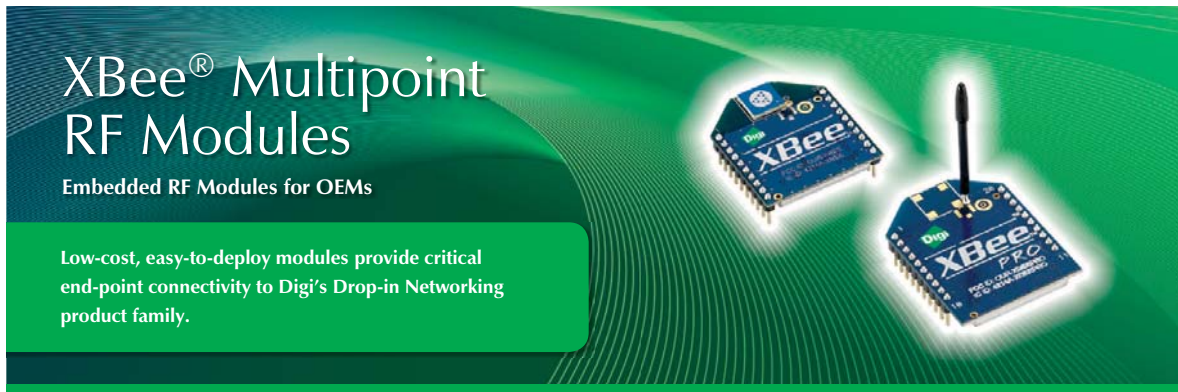
### Material Contents

While the sensor is made of a CMOS chip the sensor housing consists of an LCP cap with epoxy glob top on an FR4 substrate. Pins are made of a Cu/Be alloy coated with Ni and Au. The device is fully RoHS and WEEE compliant, thus it is free of Pb, Cd, Hg, Cr(6+), PBB and PBDE.

### Evaluation Kits

For sensor trial measurements, for qualification of the sensor or even experimental application (data logging) of the sensor there is an evaluation kit *EK-H4* available including SHT71 (same sensor chip as SHT1x) and 4 sensor channels, hard and software to interface with a computer. For other evaluation kits please check [www.sensirion.com/humidity](http://www.sensirion.com/humidity).

CSI #: 25 00 00



## Overview

### XBee Product Family

The XBee family of embedded RF modules provides OEMs with a common footprint shared by multiple platforms, including multipoint and ZigBee/Mesh topologies, and both 2.4 GHz and 900 MHz solutions. OEMs deploying the XBee can substitute one XBee for another, depending upon dynamic application needs, with minimal development, reduced risk and shorter time-to-market.

### Why XBee Multipoint RF Modules?

XBee multipoint RF modules are ideal for applications requiring low latency and predictable communication timing. Providing quick, robust communication in point-to-point, peer-to-peer, and multipoint/star configurations, XBee multipoint products enable robust end-point connectivity with ease. Whether deployed as a pure cable replacement for simple serial communication, or as part of a more complex hub-and-spoke network of sensors, XBee multipoint RF modules maximize wireless performance and ease of development.

### Drop-in Networking End-Point Connectivity

XBee OEM RF modules are part of Digi's Drop-in Networking family of end-to-end connectivity solutions. By seamlessly interfacing with compatible gateways, device adapters and extenders, XBee embedded RF modules provide developers with true beyond-the-horizon connectivity.

### Application Highlight



### Features/Benefits

- 802.15.4/Multipoint network topologies
- 2.4 GHz for worldwide deployment
- 900 MHz for long-range deployment
- Fully interoperable with other Digi Drop-in Networking products, including gateways, device adapters and extenders
- Common XBee footprint for a variety of RF modules
- Low-power sleep modes
- Multiple antenna options
- Industrial temperature rating (-40° C to 85° C)
- Low-power and long-range variants available



[www.digi.com](http://www.digi.com)

# Division 26

## Electrical

CSI #: 26 05 23

AC-DC

## 5-60 Watts DNR Series

xppower.com 



- Rugged Design for Industrial Applications
- Up to 89% Efficiency
- Full Power to +60 °C
- Wide Adjustment Range
- DC OK 24 V Models
- DC Standby Versions
- 3 Year Warranty

### Specification

#### Input

Input Voltage	• 90-264 VAC, 120-375 VDC (DNR05/10/18) 85-264 VAC, 90-375 VDC (DNR30/60)
Input Frequency	• 47-63 Hz
Input Current	• See tables
Inrush Current	• 5-18 W: 10/18 A at 115/230 VAC 30 W: 20/40 A at 115/230 VAC 60 W: 30/60 A at 115/230 VAC
Power Factor	• EN61000-3-2, class A
Earth Leakage Current	• 0.8 mA max
Input Protection	• Internal fuse T2A, 250 VAC fitted in line

#### Output

Output Voltage	• See tables
Output Voltage Trim	• See tables
Initial Set Accuracy	• ±1%
Minimum Load	• No minimum load required
Start Up Delay	• <1 s (may increase at low temperature extremes)
Start Up Rise Time	• <150 ms
Hold Up Time	• 30/130 ms at 115/230 VAC (DNR05) 25/100 ms at 115/230 VAC (DNR10) 20/75 ms at 115/230 VAC (DNR18) 20/30 ms at 115/230 VAC (DNR30) 20/30 ms at 115/230 VAC (DNR60)
Line Regulation	• 5-18 W: ±1.0% max 30-60 W: ±0.5% max
Load Regulation	• 5-18 W: ±2.0% max 30-60 W: ±0.5% max
Parallel Operation	• Redundancy module DPM10 available for load currents up to 10 A (not with standby system), contact sales
Transient Response	• 4% max deviation recovery to within 1% in 2 ms for a 50% load change
Ripple & Noise	• 50 mV pk-pk, 20 MHz bandwidth (may increase at low temperature extremes)
Oversvoltage Protection	• Output clamps at 120-145% Vnom, auto recovery
Overload Protection	• 110-145% constant current (DNR05-18) 105-150% power limited (DNR30/60)
Short Circuit Protection	• Power limited, auto recovery
Temperature Coefficient	• ±0.03%/°C

#### General

Efficiency	• See tables
Isolation	• 3000 VAC Input to Output, 1500 VAC Input to Ground, 500 VAC Output to Ground
Switching Frequency	• 132 KHz typical, 55-90 kHz (DNR60)
Signals	• DC ON indicator LED Green: All models DC LOW indicator LED Red: 5-18 W models DC OK: 24 V 30-60 W models DC OK: All standby models
MTBF	• 800 kHrs typical Bellcore, Issue 6 at +40 °C, GB (DNR05/10/18), 530 kHrs typical Bellcore, Issue 6 at +40 °C, GB (DNR30/60)
DIN Rail	• Compatible with TS35/7.5 or TS35/15

#### Environmental

Operating Temperature	• -20 °C to +70 °C (DNR05/10/18) -40 °C to +70 °C, start up at -35 °C (DNR30/60), all units derate linearly from 60 °C (see derating curves)
Cooling	• Convection-cooled with 25mm free space all sides
Operating Humidity	• 20-95% RH, non-condensing
Storage Temperature	• -25 °C to +85 °C (DNR05/10/18) -40 °C to +85 °C (DNR30/60)
Shock	• 15 g, 11 ms, X, Y & Z axis, 3 shocks/axis in both directions
Vibration	• 2 g, 10 Hz to 500 Hz, along X, Y & Z axis, 60 mins/axis, mounted on rail

#### EMC & Safety

Emissions	• EN55022, level B conducted & radiated
Harmonic Currents	• EN61000-3-2, class A
Voltage Flicker	• EN61000-3-3
ESD Immunity	• EN61000-4-2, level 4, Perf Criteria A
Radiated Immunity	• EN61000-4-3, level 3, Perf Criteria A
EFT/Burst	• EN61000-4-4, level 4, Perf Criteria A
Surge	• EN61000-4-5, installation class 3, Perf Criteria A
Conducted Immunity	• EN61000-4-6, level 3, Perf Criteria A
Magnetic Field	• EN61000-4-8, level 4 Perf Criteria A
Dips & Interruptions	• EN61000-4-11, 30% 10 ms, 60% 100 ms, 100% 5000 ms Perf Criteria A, B, B
Safety Approvals	• EN60950-1, UL508 Pollution Degree 2, UL1310 class 2 power recognised, See note 3 & ratings table, UL60950-1 Overvoltage Category II, UL508 Overvoltage Category III, DNR30 & DNR60: SEMI F47 ANSI/ISA 12.12.01. Class 1, Division 2 Groups A,B,C and D



T H E X P E R T S I N P O W E R

CSI #: 26 05 23

AC-DC

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- Full Power to +60 °C
- Wide Adjustment Range
- DC OK 24 V Models
- DC Standby Versions
- 3 Year Warranty

### Specification

#### Input

Input Voltage	• 90-264 VAC, 120-375 VDC (DNR05/10/18) 85-264 VAC, 90-375 VDC (DNR30/60)
Input Frequency	• 47-63 Hz
Input Current	• See tables
Inrush Current	• 5-18 W: 10/18 A at 115/230 VAC 30 W: 20/40 A at 115/230 VAC 60 W: 30/60 A at 115/230 VAC
Power Factor	• EN61000-3-2, class A
Earth Leakage Current	• 0.8 mA max
Input Protection	• Internal fuse T2A, 250 VAC fitted in line

#### Output

Output Voltage	• See tables
Output Voltage Trim	• See tables
Initial Set Accuracy	• ±1%
Minimum Load	• No minimum load required
Start Up Delay	• <1 s (may increase at low temperature extremes)
Start Up Rise Time	• <150 ms
Hold Up Time	• 30/130 ms at 115/230 VAC (DNR05) 25/100 ms at 115/230 VAC (DNR10) 20/75 ms at 115/230 VAC (DNR18) 20/30 ms at 115/230 VAC (DNR30) 20/30 ms at 115/230 VAC (DNR60)
Line Regulation	• 5-18 W: ±1.0% max 30-60 W: ±0.5% max
Load Regulation	• 5-18 W: ±2.0% max 30-60 W: ±0.5% max
Parallel Operation	• Redundancy module DPM10 available for load currents up to 10 A (not with standby system), contact sales
Transient Response	• 4% max deviation recovery to within 1% in 2 ms for a 50% load change
Ripple & Noise	• 50 mV pk-pk, 20 MHz bandwidth (may increase at low temperature extremes)
Oversvoltage Protection	• Output clamps at 120-145% Vnom, auto recovery
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Short Circuit Protection	• Power limited, auto recovery
Temperature Coefficient	• ±0.03%/°C

#### General

Efficiency	• See tables
Isolation	• 3000 VAC Input to Output, 1500 VAC Input to Ground, 500 VAC Output to Ground
Switching Frequency	• 132 KHz typical, 55-90 kHz (DNR60)
Signals	• DC ON indicator LED Green: All models DC LOW indicator LED Red: 5-18 W models DC OK: 24 V 30-60 W models DC OK: All standby models
MTBF	• 800 kHrs typical Bellcore, Issue 6 at +40 °C, GB (DNR05/10/18), 530 kHrs typical Bellcore, Issue 6 at +40 °C, GB (DNR30/60)
DIN Rail	• Compatible with TS35/7.5 or TS35/15

#### Environmental

Operating Temperature	• -20 °C to +70 °C (DNR05/10/18) -40 °C to +70 °C, start up at -35 °C (DNR30/60), all units derate linearly from 60 °C (see derating curves)
Cooling	• Convection-cooled with 25mm free space all sides
Operating Humidity	• 20-95% RH, non-condensing
Storage Temperature	• -25 °C to +85 °C (DNR05/10/18) -40 °C to +85 °C (DNR30/60)
Shock	• 15 g, 11 ms, X, Y & Z axis, 3 shocks/axis in both directions
Vibration	• 2 g, 10 Hz to 500 Hz, along X, Y & Z axis, 60 mins/axis, mounted on rail

#### EMC & Safety

Emissions	• EN55022, level B conducted & radiated
Harmonic Currents	• EN61000-3-2, class A
Voltage Flicker	• EN61000-3-3
ESD Immunity	• EN61000-4-2, level 4, Perf Criteria A
Radiated Immunity	• EN61000-4-3, level 3, Perf Criteria A
EFT/Burst	• EN61000-4-4, level 4, Perf Criteria A
Surge	• EN61000-4-5, installation class 3, Perf Criteria A
Conducted Immunity	• EN61000-4-6, level 3, Perf Criteria A
Magnetic Field	• EN61000-4-8, level 4 Perf Criteria A
Dips & Interruptions	• EN61000-4-11, 30% 10 ms, 60% 100 ms, 100% 5000 ms Perf Criteria A, B, B
Safety Approvals	• EN60950-1, UL508 Pollution Degree 2, UL1310 class 2 power recognised, See note 3 & ratings table, UL60950-1 Overvoltage Category II, UL508 Overvoltage Category III, DNR30 & DNR60: SEMI F47 ANSI/ISA 12.12.01. Class 1, Division 2 Groups A,B,C and D



T H E X P E R T S I N P O W E R

**CSI #: 26 05 23**



## Square D by Schneider Electric Homeline 15 Amp Single-Pole GFCI Circuit Breaker

Model # HOM115GFICP

### PRODUCT DESCRIPTION

The Homeline 15 Amp 1 in. Single-Pole GFCI Circuit Breaker offers protection of entire branch circuits where clamp-location shock hazards may exist, as well as overload and short-circuit protection. This unit has a thermal-magnetic tripping mechanism and is rated 10,000 AIR and 120/240 VAC.

- Homeline 15 Amp one-pole GFCI circuit breaker
- The Homeline 15 Amp one-pole GFCI circuit breaker is designed for the protection of entire branch circuits in damp locations as the breaker has a load maximum of 240 volts, a 10,000 maximum AIR
- This unit has a thermal-magnetic tripping mechanism
- Trip thermally (in an overload situation) or magnetically (under a short circuit situation)
- Thermal-magnetic tripping mechanism
- Compatible with Homeline load centers and CSED devices
- 120/240 Vac
- 10,000 AIR
- ANSI certified and UL listed
- MFG Brand Name : Square D by Schneider Electric
- MFG Model # : HOM115GFICP
- MFG Part # : HOM115GFICP

### SPECIFICATIONS

ANSI Certified	Yes	Assembled Depth (in.)	7.9 in
Assembled Height (in.)	1.2 in	Assembled Width (in.)	4.5 in



**CSI #: 26 27 00**



## Square D by Schneider Electric Homeline 20-Amp Single-Pole GFCI Circuit Breaker

Model # HOM120GFICP

### PRODUCT DESCRIPTION

The Homeline 20 Amp 1 in. Single-Pole Ground Fault Circuit Breaker is for overload and short-circuit protection of wiring. The circuit breaker has a maximum Amp interrupt rating (AIR) of 10,000 amps and a maximum load of 240 volts. It is compatible with Homeline load centers and combination service entrance devices and features a thermal/magnetic tripping mechanism.

- Homeline 20 Amp one-pole GFCI circuit breaker
- The Homeline 20 Amp one-pole GFCI circuit breaker is designed for the protection of entire branch circuits in damp locations as the breaker has a load maximum of 240 volts, a 10,000 maximum AIR
- This unit has a thermal-magnetic tripping mechanism
- Trip thermally (in an overload situation) or magnetically (under a short circuit situation)
- Thermal-magnetic tripping mechanism
- Compatible with Homeline load centers and CSED devices
- 120/240 Vac
- 10,000 AIR
- ANSI certified and UL listed
- MFG Brand Name : Square D by Schneider Electric
- MFG Model # : HOM120GFICP
- MFG Part # : HOM120GFICP

### SPECIFICATIONS

ANSI Certified	Yes	Assembled Depth (in.)	7.9 in
Assembled Height (in.)	1.2 in	Assembled Width (in.)	4.5 in

**CSI #: 26 27 00**



### Eaton 20 Amp Single Pole BR Type Breaker Fireguard AFCI

Model # BR120AFCS

#### PRODUCT DESCRIPTION

The Eaton Cutler-Hammer 20 Amp 1 in. Single-Pole Type BR Arc Fault Circuit Breaker is designed to provide protection from fires caused by arcing faults. The AFCI breaker meets 2002 National Electric Code (NEC) requirements for bedrooms and has a maximum load of 240 volts.

- Protects against fires caused by arcing faults
- 120/240 VAC
- ANSI certified and CSA- and UL listed
- Meets 2002 NEC requirements for bedrooms
- MFG Brand Name : Eaton
- MFG Model # : BR120AFCS
- MFG Part # : BR120AFCS

#### SPECIFICATIONS

ANSI Certified	Yes	Assembled Depth (in.)	2.75 in
Assembled Height (in.)	3.25 in	Assembled Width (in.)	1 in
CSA Listed	Yes	Electrical Product Type	Breaker
Manufacturer Warranty	10 Years	Maximum Amperage (amps)	20 A

**CSI #: 26 27 00**



## Eaton 20 Amp Single Pole BR Type Breaker Fireguard AFCI

Model # BR120AFCS

### PRODUCT DESCRIPTION

The Eaton Cutler-Hammer 20 Amp 1 in. Single-Pole Type BR Arc Fault Circuit Breaker is designed to provide protection from fires caused by arcing faults. The AFCI breaker meets 2002 National Electric Code (NEC) requirements for bedrooms and has a maximum load of 240 volts.

- Protects against fires caused by arcing faults
- 120/240 VAC
- ANSI certified and CSA- and UL listed
- Meets 2002 NEC requirements for bedrooms
- MFG Brand Name : Eaton
- MFG Model # : BR120AFCS
- MFG Part # : BR120AFCS

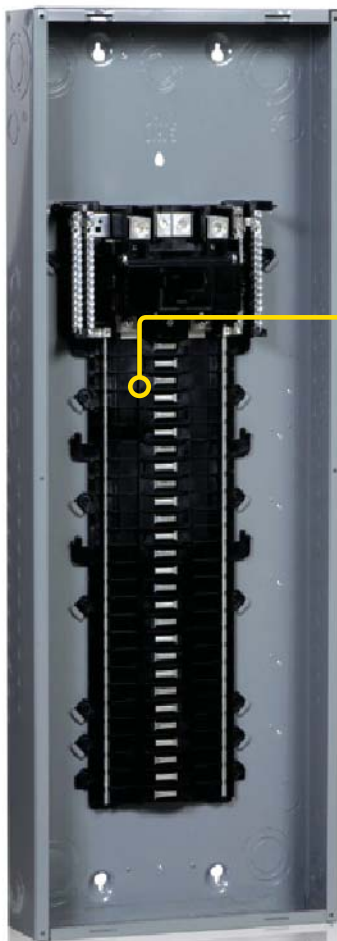
### SPECIFICATIONS

ANSI Certified	Yes	Assembled Depth (in.)	2.75 in
Assembled Height (in.)	3.25 in	Assembled Width (in.)	1 in
CSA Listed	Yes	Electrical Product Type	Breaker
Manufacturer	Eaton	Maximum	240 V

CSI #: 26 27 00

# Innovative Design!

## Square D QO Plug-on Neutral Load Centers and CFI Circuit Breakers



Designed for reliability, the QO™ Plug-on Neutral CFI Circuit Breakers connect directly to the neutral bar, providing a time- and labor-saving installation.



Square D™ CFI Circuit Breakers now feature TIME SAVER diagnostics to help you find circuit issues faster

### The QO Plug-on Neutral Advantage:

- > Fewer connections — **Faster installation**
- > No pigtails — **Frees gutter space**
- > TIME SAVER diagnostics — **Advanced trip indication technology saves time**
- > QO Plug-on Neutral CFI Circuit Breaker neutral connector — **Designed for reliability and ease of installation**
- > QO Load Center interior — **Engineered for a quick Plug-on Neutral connection on every circuit**



Want to learn more?

Scan this QR Code for more information about QO Plug-on Neutral Load Centers



**SQUARE D**™

**CSI #: 26 27 00**

## QO Plug-on Neutral Load Center and CAFI Circuit Breaker offer

Mains Rating	Spaces	Max. 1P Circuits	Max. Tandem Breakers	Load Center Box and Interior	Indoor Cover with Door (Order Separately)		Main Wire Size AWG/kcmil	Equipment Ground Bar Kit (Order Separately If Priced)
				Catalog Number	Flush Catalog Number	Surface Catalog Number	Al/CU	Catalog Number
Convertible Mains — Factory-Installed Main Lugs — 65 kA Short Circuit Current Rating — Copper Bus								
QOM1 Main Frame Size, Convertible to Main Circuit Breaker								
125 A	24	24	0	QO124L125PG	QOC24UF	QOC24US	6-2/0	PK15GTA
Convertible Mains — Factory-Installed Main Lugs — 65 kA Short Circuit Current Rating — Copper Bus								
QOM2 Main Frame Size, Convertible to Main Circuit Breaker								
200 A	30	30	0	QO130L200PG	QOC30UF	QOC30US	6-250	PK23GTA, LK100AN
225 A	42	42	0	QO142L225PG	QOC42UF	QOC42US	6-300	(2) PK15GTA
	54	54	0	QO154L225PG	QOC54UF	—		PK23GTA, LK100AN
Convertible Mains — Factory-Installed Main Circuit Breaker — 22 kA Short Circuit Rating — Copper Bus								
QOM1 Main Circuit Breaker Frame Size, Convertible to Main Lugs or Lower Amperage Main Circuit Breaker								
100 A	24	24	0	QO124M100P	QOC24UF	QOC24US	6-2/0	PK15GTA
Convertible Mains — Factory-Installed Main Circuit Breaker — 22 kA Short Circuit Rating — Copper Bus								
QOM2 Main Circuit Breaker Frame Size, Convertible to Main Lugs or Lower Amperage Main Circuit Breaker								
200 A	30	30	0	QO130M200P	QOC30UF	QWOC30US	4-250	PK18GTA
	42	42	0	QO142M200P	QOC42UF	QOC42US		PK23GTA
	54	54	0	QO154M200P	QOC54UF	—		PK23GTA
	60	60	0	QO160M200PC*	Included	—		PK23GTA

\* Door kit available separately, order QOCDK60

Circuit Breaker Type	Ampere Rating	1P 120 Vac 10k AIR 1 Space Required	1P 120 Vac 22k AIR 1 Space Required
		Catalog Number	Catalog Number
Combination Arc Fault Interrupter	15	QO115PCAFI	QO115VHPCAFI
	20	QO120PCAFI	QO120VHPCAFI

### See the difference!



▲ Pigtail Neutral connection

- > Less wiring
- > Clean gutter
- > Fast installation



▲ Plug-on Neutral connection



Take the next step to quality with QO Plug-on Neutral Load Centers and CAFI Circuit Breakers. Whatever your requirements for products are, Schneider Electric has a solution to meet your needs.

For more information, call us at **888-SQUARED**.

Schneider Electric USA, Inc.

1415 S. Roselle Road  
Palatine, IL 60067  
Tel: 847-397-2600

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CSI #: 26 27 00



8.5 in.

11-0206



## DOW POWERHOUSE™ inverter series

**SPECIAL FEATURES**

- Grid Tie certified
- High efficiency
- Independent DC inputs
- Independent MPPT tracking circuits
- Small and lightweight for ease of installation
- Convection cooled (no unreliable fans)
- 10-year warranty
- Outdoor rated
- Front panel LCD display monitoring
- Inverter easily removable from Wiring Box



**INVERTER STATS**

Total Power: 3500 to 5000 Watts  
MPPT Input Voltage: 150 to 420 Vdc  
Number of Inputs: two, three and four with independent MPPT trackers

**POWERHOUSE SAFETY**



ETL: UL1741



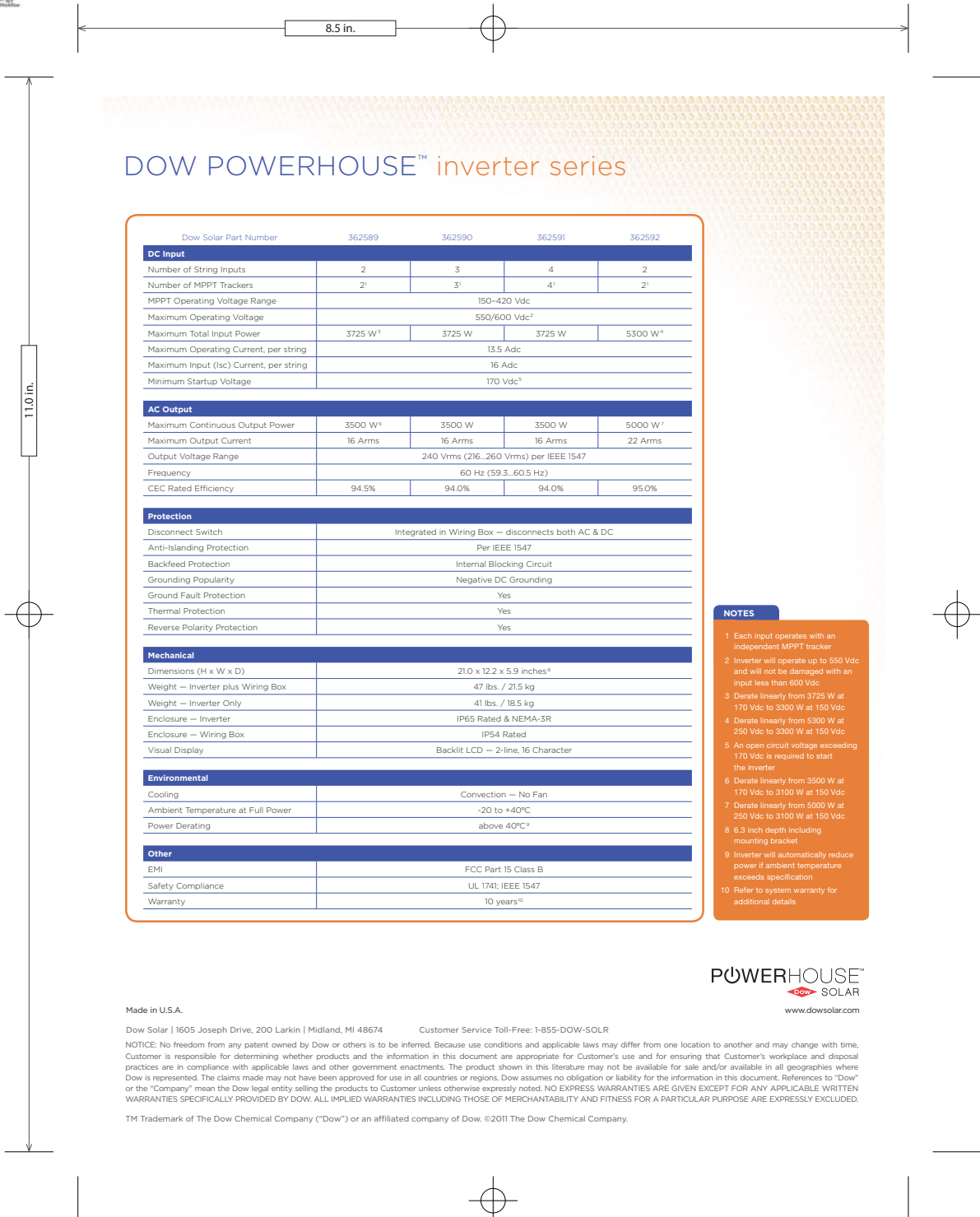
**POWERHOUSE™**  
SOLAR  
[www.dowsolar.com](http://www.dowsolar.com)  
Form No. 836-00008-0311BBI

APPROVALS		As is	W/C	As is	W/C	As is	W/C
Executive CD				Sr. Fulfillment Artist		KMG (Knowledge Mgt.)	
Creative Director				Fulfillment Artist		USPS Operations	
Design Director				Print Production		CE Legal	
Associate CD - Art				Art Buyer		Account Supervisor	
Associate CD - Copy				Product Info (Art/Copy)		Account Executive	
Art Director				Program HQ		Mgt. Supervisor	
Writer				Postal Supervisor		Legal	
Project Manager				Coordinator		<b>OKAY TO SHIP</b>	
QA Edit:	Cold Read	Fact Check	Full Read	Second Read			

110XZ0039_Spec_Sheet	
<b>E Content Studio</b>	<b>Required proof:</b> <input type="checkbox"/> Contract <input type="checkbox"/> Laser <input type="checkbox"/> Quick Print <input type="checkbox"/> Mock-up
File Name: 0039_Inv_Spec	Bill to: 110XQ0020 Executive CD:
Market:	<b>REQ 115665</b> Creative Director:
Run/Disk Date: 10/03/2011	10/05/11 13:28 Art Director: K. Roberts
Color/Space: 4C	CE: 2/0 Writer: N. Piggins
Live: " (w) x " (h)	Production Artist: DJ Account Executive: A. Stevens
Trim: 8.5" (w) x 11" (h)	Task: Fix & print Production Supervisor: K. Warmack
Bleed: " (w) x " (h)	<b>Spell checked</b> Coordinator: S. Beaudette Ext. 6493

This pdf file is for viewing purposes only

CSI #: 26 27 00



## DOW POWERHOUSE™ inverter series

Dow Solar Part Number	362589	362590	362591	362592
<b>DC Input</b>				
Number of String Inputs	2	3	4	2
Number of MPPT Trackers	2 <sup>1</sup>	3 <sup>1</sup>	4 <sup>1</sup>	2 <sup>1</sup>
MPPT Operating Voltage Range	150-420 Vdc			
Maximum Operating Voltage	550/600 Vdc <sup>2</sup>			
Maximum Total Input Power	3725 W <sup>3</sup>	3725 W	3725 W	5300 W <sup>4</sup>
Maximum Operating Current, per string	13.5 Adc			
Maximum Input (Isc) Current, per string	16 Adc			
Minimum Startup Voltage	170 Vdc <sup>5</sup>			
<b>AC Output</b>				
Maximum Continuous Output Power	3500 W <sup>6</sup>	3500 W	3500 W	5000 W <sup>7</sup>
Maximum Output Current	16 Arms	16 Arms	16 Arms	22 Arms
Output Voltage Range	240 Vrms (216..260 Vrms) per IEEE 1547			
Frequency	60 Hz (59.3..60.5 Hz)			
CEC Rated Efficiency	94.5%	94.0%	94.0%	95.0%
<b>Protection</b>				
Disconnect Switch	Integrated in Wiring Box — disconnects both AC & DC			
Anti-Islanding Protection	Per IEEE 1547			
Backfeed Protection	Internal Blocking Circuit			
Grounding Popularity	Negative DC Grounding			
Ground Fault Protection	Yes			
Thermal Protection	Yes			
Reverse Polarity Protection	Yes			
<b>Mechanical</b>				
Dimensions (H x W x D)	21.0 x 12.2 x 5.9 inches <sup>8</sup>			
Weight — Inverter plus Wiring Box	47 lbs. / 21.5 kg			
Weight — Inverter Only	41 lbs. / 18.5 kg			
Enclosure — Inverter	IP65 Rated & NEMA-3R			
Enclosure — Wiring Box	IP54 Rated			
Visual Display	Backlit LCD — 2-line, 16 Character			
<b>Environmental</b>				
Cooling	Convection — No Fan			
Ambient Temperature at Full Power	-20 to +40°C			
Power Derating	above 40°C <sup>9</sup>			
<b>Other</b>				
EMI	FCC Part 15 Class B			
Safety Compliance	UL 1741; IEEE 1547			
Warranty	10 years <sup>10</sup>			

**NOTES**

- Each input operates with an independent MPPT tracker.
- Inverter will operate up to 550 Vdc and will not be damaged with an input less than 600 Vdc.
- Derate linearly from 3725 W at 170 Vdc to 3300 W at 150 Vdc.
- Derate linearly from 5300 W at 250 Vdc to 3300 W at 150 Vdc.
- An open circuit voltage exceeding 170 Vdc is required to start the inverter.
- Derate linearly from 3500 W at 170 Vdc to 3100 W at 150 Vdc.
- Derate linearly from 5000 W at 250 Vdc to 3100 W at 150 Vdc.
- 6.3 inch depth including mounting bracket.
- Inverter will automatically reduce power if ambient temperature exceeds specification.
- Refer to system warranty for additional details.

**POWERHOUSE™**  
DOW SOLAR  
[www.dowsolar.com](http://www.dowsolar.com)

Made in U.S.A.

Dow Solar | 1605 Joseph Drive, 200 Larkin | Midland, MI 48674 Customer Service Toll-Free: 1-855-DOW-SOLR

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APPROVALS		As Is	W/C	As Is	W/C	As Is	W/C
Executive CD				Sr. Fulfillment Artist		KMG (Knowledge Mgt.)	
Creative Director				Fulfillment Artist		USPS Operations	
Production Director				Print Production		CEI Final	

**110XZ0039\_Spec\_Sheet**

	<b>Required proof:</b>	<input type="checkbox"/> Contract	<input type="checkbox"/> Laser
		<input type="checkbox"/> Quick Print	<input type="checkbox"/> Mock-up
File Name: 0039_Inv_Spec	Bill to: 120XQ011	Executive CD:	

CSI #: 26 27 00



8.5 in.

+

11.0 in.

11-0206



## technical specifications

Works like any other shingle but harder. The DOW POWERHOUSE™ Solar Shingle System is designed to install like any other asphalt shingled roof but provides the additional benefit of generating clean, renewable energy for homes.

### DOW POWERHOUSE™ Solar Shingle System delivers:

DUAL FUNCTIONALITY

INTEGRATED AESTHETICS

EASE OF INSTALLATION

EXCELLENCE GUARANTEED

Protects as a roofing material and provides renewable energy.

A building-integrated photovoltaic solution for asphalt-composition shingle roofs that installs flush with asphalt shingles.

Nails directly to the roof deck, just like traditional asphalt shingles.

Withstands sun exposure, extreme temperatures, wind, hail and other inclement weather.

#### safety and performance certifications

UNDERWRITERS LABORATORY

- UL 1703 Flat-Plate Photovoltaic Modules & Panels
- UL 790 Standard Test Methods for Fire Tests of Roof Coverings
- UL 1897 Uplift Tests for Roof Covering Systems

CALIFORNIA ENERGY COMMISSION

- CEC-300-2011-005-CMF, Fourth Edition

INTERNATIONAL CODE COUNCIL EVALUATION SERVICE

- 2006 and 2009 International Building Code (IBC)
- 2006 and 2009 International Residential Code

AMERICAN SOCIETY FOR TESTING AND MATERIALS

- ASTM D3161-09
- Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

- IEC 61646 (Thin-film terrestrial photovoltaic (PV) modules — Design qualification and type approval)

THE DOW CHEMICAL COMPANY

- Backed by the strength of Dow and a 20-year performance warranty.

**POWERHOUSE™**  
DOW SOLAR  
[www.dowsolar.com](http://www.dowsolar.com)  
Form No. 636-00008-0112 CE

+

APPROVALS		As Is	W/C	As Is	W/C	As Is	W/C
Executive CD				Sr. Fulfillment Artist		KMG (Knowledge Mgt.)	

<b>110X20058_Spec_Sheet</b>	<input type="checkbox"/> Contract	<input type="checkbox"/> Laser
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CSI #: 26 31 00

## DOW POWERHOUSE™ Solar Shingles:

### MECHANICAL SPECIFICATIONS

Weight	5.3 lbs
Roof Load (installed)	3.4 lbs/ft <sup>2</sup>
Color	Black
Front Glass	High transmission tempered glass
<b>Dimensions</b>	
Reveal Height	10 inches (overall dimensions: approx. 23 inches)
Reveal Width	22.8 inches
Thickness	0.5 inches
Installation Offset	6 inches
Connectors	Touch-safe, wireless, UL listed
Photovoltaic Technology	CIGS (Copper Indium Gallium diSelenide), 5 cells

### SAFETY & DURABILITY

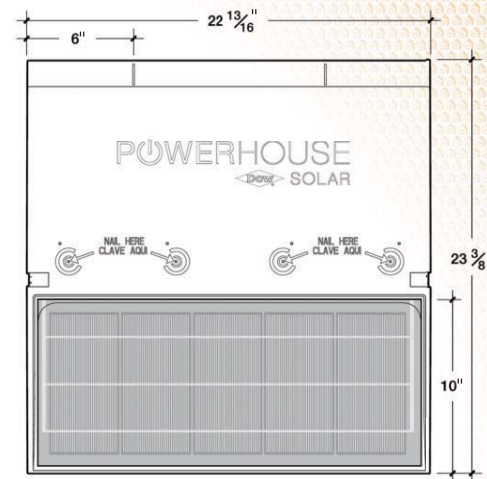
<b>Certifications</b>	
	UL 746, 1703, 1897, 790, 486 and 514; CEC; Class A Fire 2006, 2009 IBC, IRC
Impact Resistance	Hail, 1-inch diameter at 52 mph
Wind Resistance	110 mph @ 4:12 pitch, 135 psf uplift (UL 1897)
<b>Product Warranty/Power Warranty</b>	
	20-year material weatherization warranty 10-year wind retention warranty 10-year and 20-year power output warranties 10-year manufacturer's inverter warranty

### ELECTRICAL SPECIFICATIONS

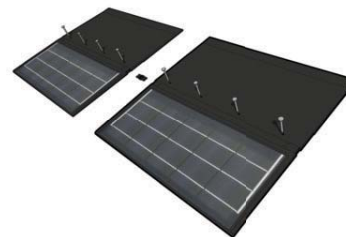
Maximum Power Rating (Pmax)	12 W
Open Circuit Voltage (Voc)	3.1 V
Short Circuit Current (Isc)	6.3 A
Maximum Power Voltage (Vmpp)	2.1 V
Maximum Power Current (Impp)	5.4 A
Normal Operating Cell Temperature (NOCT)	53°C
Maximum System Voltage (UL)	600 V
Fuse Rating	10 A
Voc Temperature Coefficient	-0.31%/C
Vmp Temperature Coefficient	-0.40%/C

Measured at Standard Test Conditions (STC): irradiance of 1000 W/m<sup>2</sup>, AM 1.5, and cell temperature 25°C.

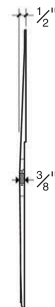
### TOP VIEW



### ISOMETRIC VIEW



### PROFILE



Made in U.S.A.

Dow Solar | 1605 Joseph Drive, 200 Larkin | Midland, MI 48674

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CSI #: 26 31 00

**Product Bulletin for  
Weather-Resistant GFCI Receptacles**



When it comes to outdoor GFCI protection, it's smart to go with a pro, SmartlockPro Weather-Resistant (WR) GFCI Receptacles. The new GFCIs offer all the advantages of Leviton's popular brand, plus they are UL Listed weather resistant to comply with Section 406.8 of the 2008 NEC Code. Built with UV stabilized engineering thermoplastic for high cold impact resistance, the WR GFCI devices feature stainless steel straps and mounting screws, as well as conformally coated PC board to protect critical components from moisture. For an even higher level of safety, the GFCIs are available in tamper-resistant (TR) versions that help protect children from the danger of inserting foreign objects into receptacles. Rain or shine, Leviton offers products to meet all your outdoor needs, including a selection of raintight-while-in-use covers.

Important: Covers must be used with WR GFCI receptacles in damp or wet locations per Section 406.8 of the NEC Code.

**Applications:**

- Ideal in damp locations that are protected from the weather and wet locations that are subject to water saturation
- Code-compliant solution for patio, deck and pool areas
- Designed for residential and commercial applications

Section 406.8 of the 2008 NEC® Code mandates all non-locking 15A and 20A receptacles in damp or wet locations should be listed weather resistant.



**CSI #: 26 31 00**



**Features and Benefits:**

**Weather-Resistant GFCIs**

Professional grade lockout action, dead-face design and  
10-year-of-life indication offer superior ground fault protection  
Stainless steel strap and mounting screws  
Stainless steel terminal screws with nickel plated steel  
Mounting plates  
UV stabilized engineering thermoplastic with high cold  
impact resistance  
Electrochemically coated PC board to protect critical components  
from moisture  
Meets UL 498 requirements for weather-resistant receptacles

**UL Standards:**

UL Listed (File #E-48380)  
UL 5A Certified (File #LR-57811)  
Meets UL 498 requirements for weather-resistant receptacles

**Tamper-Resistant Versions:**

- TR symbol on residential receptacles assures they meet Section 406.11 of the NEC Code mandating that all 15A and 20A receptacles installed in dwelling units be listed as tamper resistant
- Shutter mechanism inside the receptacle blocks access to the contacts unless a two-prong plug is inserted, helping ensure foreign objects will be locked out

**ORDERING INFORMATION:**

**120V SmartlockPro® Weather-Resistant (WR) and Tamper-Resistant (TR) GFCI Receptacles**  
**Options Match Face Color - Wallplate Not Included**  
**125V @ Receptacle, 20A-125V Feed-Through**

**NEMA 5-15R** 

Part No.	Description	Tamper Resistant	Color	Standard Pack
12-W7599-TKW	WR GFCI with LED Indicator Light	✓	White	1/Box, 8/Carton
15-W7599-TKE	WR GFCI with LED Indicator Light	✓	Black	1/Box, 8/Carton
20-W7599-TRW	WR GFCI with LED Indicator Light	✓	White	1/Box, 10/Carton
20-W7599-TRE	WR GFCI with LED Indicator Light	✓	Black	1/Box, 10/Carton
12-W7599-00W	WR GFCI with LED Indicator Light	—	White	1/Box, 10/Carton
12-W7599-00E	WR GFCI with LED Indicator Light	—	Black	1/Box, 10/Carton

**125V @ Receptacle, 20A-125V Feed-Through**

**NEMA 5-20R** 

14-W7899-TKE	WR GFCI with LED Indicator Light	✓	Black	1/Box, 8/Carton
20-W7899-TRW	WR GFCI with LED Indicator Light	✓	White	1/Box, 10/Carton
20-W7899-TRE	WR GFCI with LED Indicator Light	✓	Black	1/Box, 10/Carton
12-W7899-00W	WR GFCI with LED Indicator Light	—	White	1/Box, 10/Carton
14-W7899-00E	WR GFCI with LED Indicator Light	—	Black	1/Box, 10/Carton

Product is covered by U.S. Patents Nos. 6,040,967; 6,246,558; 6,282,070; 6,381,112; 6,437,953; 6,864,766, as well as other U.S. and foreign patents pending.

is a registered trademark of the National Fire Protection Association, Inc.

**Leviton Manufacturing Co., Inc.**

CSI #: 26 24 16



## TBR20-W



UPC Code: 07847738181

Country of Origin: Mexico - \*Eligible for  
ARRA funded projects > \$7,443,000

NEMA: 5-20R



## Tamper-Resistant Receptacles

### Brand Features

Plug Into Safety with Leviton's Line of Tamper-Resistant (TR) Receptacles. As a long-time manufacturer of tamper-resistant devices, we are pleased to be at the forefront of this safety measure with an expanded product line that encompasses a wide range of TR devices in Residential, Commercial, Industrial and Hospital Grades.

### Item Description

20 Amp, 125 Volt, NEMA 5-20R, 2P, 3W, Tamper-Resistant, Duplex Receptacle, Straight Blade, Commercial Grade, Self Grounding, Back & Side Wired, Steel Strap - WHITE

### Technical Information

#### AC Horsepower Ratings

**At Rated Voltage:** 1 HP

#### 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 cycles OL at 150 percent rated current

#### Environmental Specifications

**Flammability:** Rated V-2 per UL94

**Operating Temperature:** -40C to 60C

#### Material Specifications

**Face Material:** Nylon

**Body Material:** Nylon

**Line Contacts:** Brass Triple-Wipe .040 Thick

**Terminal Screws:** Steel 10-32

**Grounding Screw:** Steel 8-32

**Strap Material:** Zinc-Plated Steel

**Ground Clips:** Brass

**Shutter Mechanism:** Delrin® Acetal

**Color:** White

#### Mechanical Specifications

**Terminal ID:** Brass-Hot, Green-Ground, Silver-Neutral

**Terminal Accom.:** 14-10 AWG

**Product ID:** Ratings permanently marked on device

**Termination:** Back & Side

#### Product Features

**NEMA:** 5-20R

**Color:** White

#### Standards and Certifications

**NEMA:** WD-1 WD-6

**ANSI:** C-73

**UL 498:** File E13399

**CSA C22.2 No. 42:** File 152105

**NOM:** 057

**Warranty:** 2-Year Limited

**CSI #:**

*Product Data Sheet*

**QO200TR**

AC Disconnect Switch Non Fusible - Molded Case Switch, 60A, NEMA 3R, 2-Pole



by Schneider Electric

List Price \$161.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

**Technical Characteristics**

Ampere Rating	60A
Application	Residential and light commercial applications
Approvals	UL Listed
Disconnect Type	Non Fusible - Molded Case Switch
Enclosure Type	Metallic - Rain proof and Ice proof (Indoor/Outdoor)
Enclosure Rating	NEMA 3R
For Use With	Air Conditioner
Receptacles	None
Mounting Type	Panel/Surface
Number of Poles	2-Pole
Terminal Type	Screw
Voltage Rating	240VAC
Wiring Configuration	2-Wire
Depth	3.88 Inches
Height	6.50 Inches
Width	4.63 Inches

**Notes:**

Does not contain overcurrent protection. Suitable for use on systems with up to 10kA available fault current at 240VAC (max) when protected by a fuse or circuit breaker rated 60A or less.

**Shipping and Ordering**

Category	00044 - Disconnects, Air Conditioner
Discount Schedule	DE2A
GTIN	00785901535966
Package Quantity	1
Weight	3.03 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

CSI #: 26 27 00

## Product Bulletin for USB Charger/Tamper-Resistant Receptacle



# Leviton's New USB Charger/Tamper-Resistant Receptacle Delivers More Charging Power in Less Time!

Leviton's USB Charger/Tamper-Resistant Receptacle offers a ground-breaking 2.1A of charging power and a 15A/125V Tamper-Resistant Receptacle. This state-of-the-art device has the ability to charge up to two electronic devices simultaneously utilizing the USB Ports, leaving the receptacle free for additional power needs. The USB Ports are Type A, 2.0/3.0 and are controlled by a smart chip which recognizes and optimizes the charging power of your device. This means you can spend less time charging your device and more time enjoying it! Leviton's USB Charger/Tamper-Resistant Receptacle is ideal for charging tablets\*, smart and mobile phones, e-readers and much more.

Strategically designed with two vertical USB Ports, the Leviton USB Charger/Tamper-Resistant Receptacle allows additional space for maneuvering of charging cords, reduces stress on the cables while charging and provides an aesthetically pleasing design. Our device is engineered to fit in a standard wallbox, use a standard wallplate and can be multi-ganged with another Leviton USB Charger/Tamper-Resistant Receptacle or any standard Leviton wiring device. The value-added features of Leviton's Tamper-Resistant Receptacle provides the safe and superior device you have come to expect from an industry leader like Leviton!

### Compatibility

The Leviton USB Charger/Tamper-Resistant Receptacle is compatible with a wide range of electronic devices including, but not limited to, the following:

- iPad®
- iPhone®
- iPod®
- Tablets
- Mobile Phones
- BlackBerry®, Android Phones
- Galaxy Tab™
- Nintendo 3DS™
- PlayStation® Vita
- Bluetooth™ Headsets
- Digital Cameras
- Kindle™, Nook e-readers
- GPS
- Much More

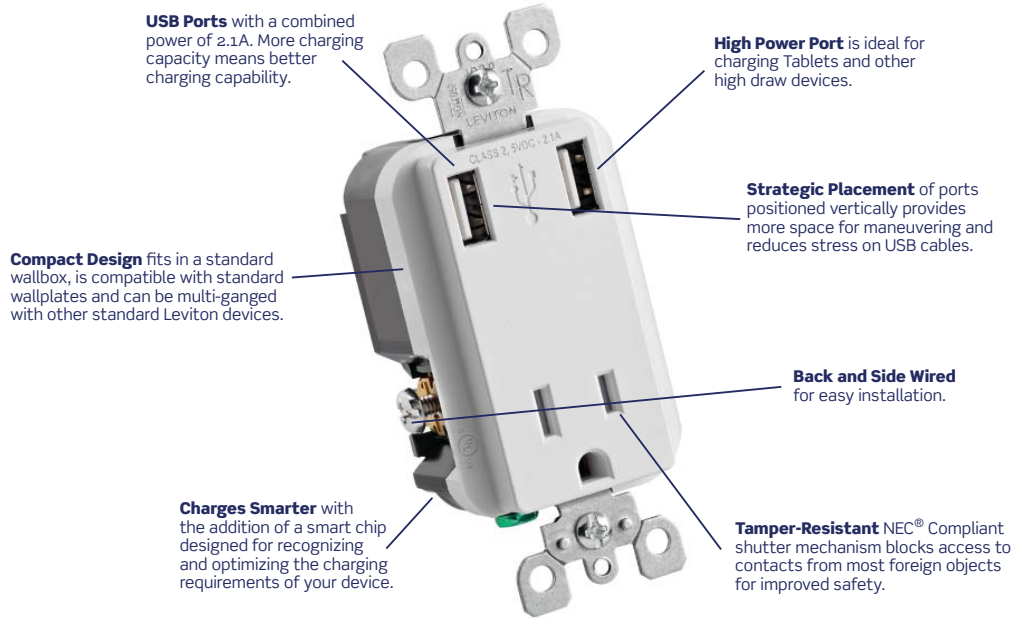
*\*USB Ports are not intended to charge two tablets simultaneously. If the devices combined power requirements exceed the power capacity of the USB Ports, the charger will automatically shut down to protect your devices. To charge two tablets use the high power USB Port and the Tamper-Resistant Receptacle.*



Cat. No. T5630  
Shown with screwless wallplate  
80301 sold separately

CSI #: 26 27 00

## USB Charger/Tamper-Resistant Receptacle



### Ordering Information:

Description	Rating	Cat. No.	Color
USB Charger/Tamper-Resistant Receptacle	2.1 A USB 15 AMP, 125V	T5630-W	White
USB Charger/Tamper-Resistant Receptacle	2.1 A USB 15 AMP, 125V	T5630-T	Light Almond



### Perfect for Residential and Light Commercial Applications:

- Kitchens
- Bedrooms
- Home Offices
- Hotels
- Airports
- Office Cubicles
- College Dorm Rooms

The Leviton USB Charger/Tamper-Resistant Receptacle is Underwriters Laboratories (UL) listed 498 and 1310 and meets all NEC® Tamper-Resistant Requirements. It is backed by a 5 year limited warranty.

Shown with Leviton's Mobile Device Station Cat. No. 47112

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Visit our Website at: [www.leviton.com/USB](http://www.leviton.com/USB)

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CSI #: 26 51 13

8/17/13

Commercial Electric 6 in. Recessed White LED Trim-CER6730WH at The Home Depot

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### Commercial Electric 6 in. Recessed White LED Trim

Model # CER6730WH Internet # 203489880 Store SKU # 126878

**\$29.87 / each**



**LED**

This item cannot be shipped to the following state(s):  
AK, GU, HI, PR, VI

**Ships FREE with \$45.00 Order**

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## PRODUCT OVERVIEW

The Commercial Electric 5 in. and 6 in. Recessed LED Trim with clean and elegant design is ideal for glare free lighting in any room of the house. This ETL classified high efficiency dimmable Trim has received Energy Star Certification for year-round energy savings. Compatible with dimmer switch for different illumination needs and increased energy saving. This LED Trim is for use with 5 in. and 6 in. IC and Non-IC recessed housings and will retrofit 5 in. and 6 in. incandescent housings to energy saving LED down lights. Reduce energy consumption to 11 watt LED - comparable to BR30/65 watt incandescent bulb. Rated for wet location make it applicable for shower and exterior application.

- White recessed LED trim
- For use with 5 in. and 6 in. IC or Non-IC recessed housings (housings not included)
- Dimming range between 10% to 100% and compatible with most household dimmers
- Rated for wet location and certified airtight per ASTM E283-04
- Can be used for CA title 24/high efficacy compliance
- 65 watt bulb equivalent light output - 11 watt energy used
- IC rated for direct contact with insulation
- Save on bulb replacement up to 35,000 hours lamp life
- Medium base socket adapter included
- Retrofits 5 in. and 6 in. incandescent housings to energy saving LED down lights
- Designed to install in other incandescent housing by other major brands, please refer to instruction sheet for list of additional compatible housing
- MFG Model # : CER6730WH
- MFG Part # : CER6730WH

## SPECIFICATIONS

Adjustable Lamp Head	No	Aperture width (in.)	6.0
Assembled Depth (in.)	7.5 in	Assembled Height (in.)	3.89 in
Assembled Width (in.)	7.5 in	Certifications and Listings	1-UL Listed,ETL Listed
Fixture Finish	White	Fixture finish family	White
Fixture/track material	Aluminum	Light Source	LED



CSI #: 26 51 13

8/18/13

Hampton Bay Sadie Collection 1-Light Hanging Metal Satin Nickel Ceiling Pendant-21394-010 at The Home Depot

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### Hampton Bay Sadie Collection 1-Light Hanging Metal Satin Nickel Ceiling Pendant

Model # 21394-010 Internet # 202814828 Store SKU # 530049

**\$54.97 / box**

This item cannot be shipped to the following state(s): GU, PR, VI

Free Shipping

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## PRODUCT OVERVIEW

The Sadie Collection 1-Light 79 in. Hanging Metal Satin Nickel Ceiling Pendant includes a Classic Opal white glass shade that diffuses light output and a satin nickel base finish that can help create a casual look in your room.

- Includes a Classic Opal white glass shade that diffuses light output
- Metal construction
- Uses 1 candelabra base bulb, 60 watts maximum (sold separately)
- Ceiling-mounted, adjustable hanging length design
- UL listed
- Includes hardware for easy installation
- MFG Model # : 21394-010
- MFG Part # : 21394-010

### Info & Guides

#### Installation Guide

You will need Adobe® Acrobat® Reader to view PDF documents. [Download](#) a free copy from the Adobe Web site.

## SPECIFICATIONS

Adjustable Lamp Head	No	Adjustable hanging length	Yes
Assembled Depth (in.)	5 in	Assembled Height (in.)	7 in
Assembled Width (in.)	5 in	Certifications and Listings	1-UL Listed, ETL Listed
ENERGY STAR Certified	No	Fixture Color/Finish Family	Nickel
Fixture Material	Metal	Fixture depth (in.)	5.0
Fixture height (in.)	7.0	Fixture width (in.)	5.0
Hardwired or Plug-In	Hardwired	Lamp Style	Mini-pendant
Manufacturer Warranty	One Year Limited Warranty	Maximum Bulb Wattage	100 W
Maximum Hanging Length (in.)	79.0	Number of Bulbs Required	1
Pendant Type	Mini Pendant	Product Weight (lb.)	2.9 lb

CSI #: 26 51 13

8/17/13

Home Decorators Collection Sydney 3-Light Polished Nickel Bowl Pendant-27184 at The Home Depot

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### Home Decorators Collection Sydney 3-Light Polished Nickel Bowl Pendant

Model # 27184 Internet # 202816448 Store SKU # 527542

**\$119.00 / each**

This item cannot be shipped to the following state(s): GU,PR,VI

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## PRODUCT OVERVIEW

The Home Decorators Collection Sydney 3-Light Bowl Pendant is finished in gleaming polished nickel. The unique bowl is etched white glass, which completes the transitional look. Use this beautiful pendant to transform your space.

- Elegant glass and durable steel construction for lasting beauty
- Uses three 100-watt medium base bulbs, sold separately
- Additional chain and wire included for adjustable hanging length up to 92-1/2 in. max
- ETL listed for indoor locations
- Instructions included for assembly and installation
- MFG Model # : 27184
- MFG Part # : 27184

## SPECIFICATIONS

Adjustable Lamp Head	No	Adjustable hanging length	Yes
Assembled Depth (in.)	21.25 in	Assembled Height (in.)	20.5 in
Assembled Width (in.)	21.25 in	Certifications and Listings	ETL Listed
ENERGY STAR Certified	No	Fixture Color/Finish Family	Nickel
Fixture Material	Steel and Glass	Fixture depth (in.)	21.25
Fixture height (in.)	20.5	Fixture width (in.)	21.25
Hardwired or Plug-In	Hardwired	Lamp Style	Pendant
Manufacturer Warranty	Five (5) year limited warranty	Maximum Bulb Wattage	100 W
Maximum Hanging Length (in.)	92.5	Number of Bulbs Required	3
Pendant Type	Bowl Pendant	Product Weight (lb.)	14.62
Recommended bulb type	A19	Returnable	90-Day
Wattage (watts)	100 W		

CSI #: 26 51 13

8/18/13

Lithonia Lighting 3 in. Recessed Matte White LED Baffle Kit-LK3BPMW LED M4 at The Home Depot

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### Lithonia Lighting 3 in. Recessed Matte White LED Baffle Kit

Model # LK3BPMW LED M4 Store SKU # 762362

**\$44.97 / each**

This item cannot be shipped to the following state(s):  
AK, GU, HI, PR, VI

**Store Only**

**Buy Online, Pick Up In Store Today**  
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## PRODUCT OVERVIEW

The LED 3 in. Recessed Matte White Baffle Kit from Lithonia Lighting makes shopping for and installing recessed downlighting easy by conveniently including a 3 in. remodel housing, decorative trim with integrated LEDs, wire nuts and a cutting stencil all in one box. The energy efficient integrated LEDs operate for 28,000 hours without maintenance, which means you never have to buy or change a bulb. The kit can be converted to new construction using hanger bars and construction pan accessories.

- Energy Star qualified LED technology offers maximum energy efficiency and maintenance-free operation
- Attached j-box has 3 knockouts for branch wiring and a captive door for ease of wiring
- 3 in. matte white baffle trim evenly distributes light while reducing glare
- Housing is constructed of durable aluminum and is powder coat painted to prevent rust
- 3000K LEDs produce light output of 400 lumens (45-Watt PAR20 equivalent) and are fully dimmable down to 10%
- IC/Non-IC remodel airtight housing includes 3 remodel clips for easy installation in existing plaster, sheet rock or mechanical ceilings
- CSA certified to US and Canadian wet location safety standards and California T24 compliant
- Easily converts to new construction installation using hanger bars and new construction pan accessories
- MFG Model # : LK3BPMW LED M4
- MFG Part # : 213EEL

## SPECIFICATIONS

Adjustable Lamp Head	No	Aperture width (in.)	3.0
Assembled Depth (in.)	10 in	Assembled Height (in.)	4.5 in
Assembled Width (in.)	7.75 in	Certifications and Listings	1-UL Listed, CSA Listed, IC Rated
ENERGY STAR Certified	No	Fixture Finish	Matte White
Fixture finish family	White	Fixture\track material	Aluminum
Housing depth (in.)	5.25	Light Bulb Base Type	Bi-Pin
Light Source	LED	Manufacturer Warranty	3 year
New Construction or Remodel	New Construction and Remodel	Number of Housings Included	1.0
Product Weight (lb.)	3	Recommended bulb type	LED

CSI #: 26 51 13

8/18/13

Lithonia Lighting 4 in. Recessed Matte White LED Baffle Kit-LK4BPMW LED M4 at The Home Depot

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### Lithonia Lighting 4 in. Recessed Matte White LED Baffle Kit

Model # LK4BPMW LED M4 Store SKU # 762428

**\$47.97 / each**

This item cannot be shipped to the following state(s):  
AK, GU, HI, PR, VI

**Store Only**

**Buy Online, Pick Up In Store Today**

**Check Store Inventory**

## PRODUCT OVERVIEW

The LED 4 in. Recessed Matte White Baffle Kit from Lithonia Lighting makes shopping for and installing recessed downlighting easy by conveniently including a 4 in. remodel housing, decorative trim with integrated LEDs, wire nuts and a cutting stencil all in one box. The energy efficient integrated LEDs operate for 28,000 hours without maintenance, which means you never have to buy or change a bulb. The kit can be converted to new construction using hanger bars and construction pan accessories.

- Energy Star qualified LED technology offers maximum energy efficiency and maintenance-free operation
- Attached j-box has 3 knockouts for branch wiring and a captive door for ease of wiring
- 4 in. matte white baffle trim evenly distributes light while reducing glare
- Housing is constructed of durable aluminum and is powder coat painted to prevent rust
- 3000K LEDs produce light output of 400 lumens (50-watt incandescent flood equivalent) and are fully dimmable down to 10%
- IC/Non-IC remodel airtight housing includes 3 remodel clips for easy installation in existing plaster, sheet rock or mechanical ceilings
- CSA certified to US and Canadian wet location safety standards and California T24 compliant
- Easily converts to new construction installation using hanger bars and new construction pan accessories
- MFG Model #: LK4BPMW LED M4
- MFG Part #: 213EEN

## SPECIFICATIONS

Adjustable Lamp Head	No	Aperture width (in.)	4.0
Assembled Depth (in.)	12 in	Assembled Height (in.)	5.25 in
Assembled Width (in.)	9.75 in	Certifications and Listings	1-UL Listed, CSA Listed, IC Rated
ENERGY STAR Certified	Yes	Fixture Finish	Matte White
Fixture finish family	White	Fixture/track material	Aluminum
Housing depth (in.)	5.75	Light Bulb Base Type	Other
Light Source	LED	Manufacturer Warranty	3 year
New Construction or Remodel	New Construction and Remodel	Number of Housings Included	1.0

CSI #: 26 51 13



## FEATURES & SPECIFICATIONS

**INTENDED USE** — Our recessed LED module is the most economical means to create a well lit environment with exceptional energy efficiency and near zero maintenance. Great for retrofit into existing downlight cans or new construction and remodel applications. Unique torsion spring and friction clip retention allows fitment into nearly 100% of installed cans. The LED module maintains at least 70% light output for 50,000 hours.

**CONSTRUCTION** — Aluminum die cast reflector with deep baffle configuration for reduced glare. Combined LED and driver printed circuit board attached. Inner reflector cone funnels light through the pressed-in diffused lens.

**OPTICS** — Diffused lens at end of mixing chamber to provide even light distribution for general illumination, equivalent to 65W BR30 lamp.

Wide flood beam angle at >45°. Utilizes 3000 K color temperature LEDs. CRI - 86

**ELECTRICAL SYSTEM** — Center 2 Edge™ (patent pending) technology created for a single point source. Primary power disconnect provided for simple connection to a dedicated LED connector in the housing.

Dimming down to 15%. For compatible dimmers, refer to [Compatible Dimmers Chart](#).

Standard input wattage is 8.9 watts, 70 lumens per watt; equivalent to 65-watt incandescent.

\*Actual wattage may differ by +/-5% when operating at 120V +/-10%.

**INSTALLATION** — Suitable for installation in standard and shallow-height rough-in sections.

E26 socket adaptor and splice kit ships standard. This enables easy installation or permanent conversion to an LED source for Title 24 compliance.

Twin torsion springs ensure easy installation.

Friction clips included to allow fitment into cans without torsion brackets from an inside diameter of 6.0" to 7.0".

**LISTINGS** — CSA certified to US and Canadian safety standards. ENERGY STAR® qualified; California T24 compliant. Wet location listed for indoor use only. WSEC ASTM E283 for Air-Tight (with IC housings).

**WARRANTY** — Five-year limited warranty. Full warranty terms located at:

[www.acuitybrands.com/CustomerResources/Terms\\_and\\_conditions.aspx](http://www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx).

Note: Specifications subject to change without notice.

**PATENTS PENDING.**

### Specifications

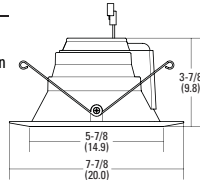
Aperture: 5 7/8 (14.91)

Ceiling Opening: as rough-in

Overlap Trim: 7-5/8 (19.4)

Height: 3-7/8 (9.8)

All dimensions are inches (centimeters) unless otherwise noted.



Catalog Number
Notes
Type

LED Recessed Downlighting

# 6BP 6" LED Module

IC/Non-IC  
Retrofit



Torsion mount shown



Friction clip shown (included)



E26 adaptor



Splice kit

## ORDERING INFORMATION

For shortest lead times, configure products using **bolded options**.

Example: 6BPMW LED

6BPMW		LED				
Series/Finish		Lamps/Lumens <sup>1</sup>	Color temperature	Voltage	Options	
<b>6BP</b>	6" Baffle LED Module	<b>MW</b> Matte white	<b>LED</b> 8.9W, 620 lumens	(blank) 3000 K	(blank) 120V	<b>L7XLED T24</b> New Construction Rough-In LED Base <b>L7XRLED T24</b> Remodel Rough-In LED Base <b>LC6LED T24</b> New Construction Rough-In LED Base <b>L7X<sup>2</sup></b> New construction rough-in <b>L7XR<sup>2</sup></b> Remodel rough-in <b>L7XP<sup>2</sup></b> New construction shallow rough-in <b>L7XPR<sup>2</sup></b> Remodel shallow rough-in <b>LC6<sup>2</sup></b> New construction rough-in <b>LCP<sup>2</sup></b> New construction shallow rough-in

<b>Accessories:</b> Order as separate catalog number.	
FL2LED	Makes L7XF housings compatible with the LED module

### Notes

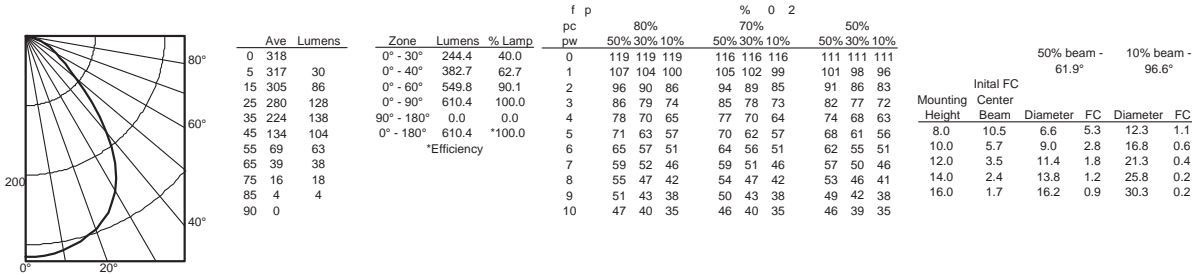
- Total system delivered lumens.
- Must be ordered on separate line.

**CSI #: 26 51 13**  
**6" LED Module**

**PHOTOMETRICS**

Distribution Curve	Distribution Data	Output Data	Coefficient of Utilization	Illuminance Data at 30" Above Floor for a Single Luminaire
--------------------	-------------------	-------------	----------------------------	--

6BPWM LED, 3000 K LEDs, input watts: 8.9, delivered lumens: 620, LM/W=70, test no. LTL21369, tested in accordance with IESNA LM 79-08



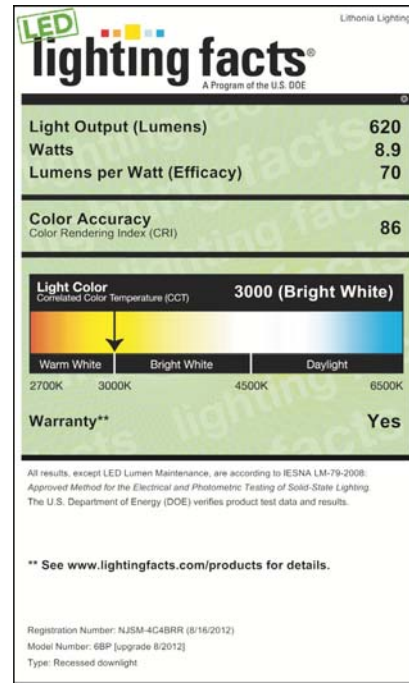
**ADDITIONAL DATA**

ENERGY DATA*	
Lumens	620
Min. starting temp	-18°C (0°F)
EMI/RFI	FCC Title 47 CFR, Part 15, Class B
Sound rating	Class A standards
Input voltage	120V
Min. power factor	0.80
Input frequency	50/60 Hz
Rated wattage	8.9W
Input power	8.9W
Input current	.08A

\*Values at non-dimming line voltage.

COMPATIBLE DIMMER SWITCHES		
Manufacturer	Model/Series	Part Numbers
Pass & Seymour	Harmony	D703PTCCCV6
	TradeMaster	T600WV
	Wide Slide Series	WS700TCCCV6
Lutron	Diva	DV-600PR
	Toggler	TGLV-600PR
	Toggler	TGLV-600PR
Leviton	Decora	6674-P
	Decora	6633P
	Illumatech	IPI06++
	Illumatech	IPL06++
	TRIMATRON	6681++
	TRIMATRON	6684++

++ Must have at least 60W on dimmer circuit or 4 P Series LED downlighting modules.



**LED lighting facts**  
A Program of the U.S. DOE

**Light Output (Lumens) 620**  
**Watts 8.9**  
**Lumens per Watt (Efficacy) 70**

**Color Accuracy 86**  
Color Rendering Index (CRI)

**Light Color 3000 (Bright White)**  
Correlated Color Temperature (CCT)

Warm White 3000K Bright White 4500K Daylight 6500K

**Warranty\*\* Yes**

All results, except LED Lumen Maintenance, are according to IESNA LM-79-2008: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting. The U.S. Department of Energy (DOE) verifies product test data and results.

**\*\* See [www.lightingfacts.com/products](http://www.lightingfacts.com/products) for details.**

Registration Number: NJSM-4C4BRR (8/16/2012)  
Model Number: 6BP (upgrade 8/2012)  
Type: Recessed downlight

CSI #: 26 51 13



## FEATURES & SPECIFICATIONS

### INTENDED USE

Provides task or accent illumination in residential and light commercial applications. Ideal for use under cabinets offering shadow-free lighting in kitchens and work areas, in bookcases, display cabinets or above cabinets setting a warm, inviting atmosphere in the kitchen.

### ATTRIBUTES

Rugged post painted low profile housing with snap on/off hinged service tray for quick installation and wiring. Shatter-resistant, acrylic white diffuser provides soft widespread illumination with zip-lock design for easy lamp access, cleaning and superior retention. Separate snap on/off service tray for easy maintenance. Available in four lengths, comes standard with on/off rocker switch.

Utilizes linear T8 lamp for energy efficiency, superior color rendering and long life (not included).

Standard with electronic ballast (120 volt, 60Hz) ensures no flickering and quiet operation without interfering with other home electronics. Use with non-dimmable switches only.

All mounting hardware included.

### LISTING

CUL listed to US and Canadian safety standards and suitable for damp locations. ENERGY STAR® qualified.

### WARRANTY

Guaranteed for two years against mechanical defects in manufacture.

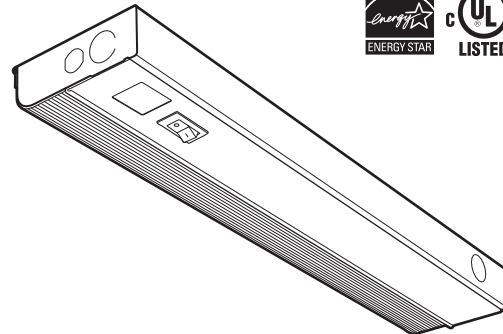
Catalog Number	
Notes	Type

Indoor General Purpose





# Cabinet Light

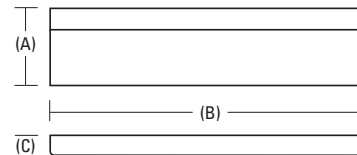
## Direct Wire - T8

Linear T8 Fluorescent



## DIMENSIONS

Nominal Size	Lamp Configuration	Model Number	Number of Lamps	(A) Width inches (cm)	(B) Length inches (cm)	(C) Extension* inches (cm)
18"		UC8 15	(1) 15W linear T8	4" (10.2)	18" (45.7)	1-3/8" (3.5)
24"		UC8 17	(1) 17W linear T8	4" (10.2)	24-3/8" (61.0)	1-3/8" (3.5)
36"		UC8 25	(1) 25W linear T8	4" (10.2)	36-3/8" (91.4)	1-3/8" (3.5)
48"		UC8 32	(1) 32W linear T8	4" (10.2)	48-3/8" (121.9)	1-3/8" (3.5)



\* Extension from ceiling

All dimensions are in inches (centimeters)

## ORDERING INFORMATION

Choose the boldface catalog nomenclature that best suits your needs and write it on the appropriate line. Order accessories and replacement parts as separate catalog numbers.

Example: **UC8 15 120 SWR**

Model Number <sup>1,2,3</sup>		120 Voltage	SWR Rocker Switch
<b>UC8 15</b>	18" - (1) 15W linear T8 fluorescent lamp <b>required</b>	<b>120</b>	<b>SWR</b>
<b>UC8 17</b>	24" - (1) 17W linear T8 fluorescent lamp <b>required</b>	120 volt electronic ballast (standard)	Rocker switch standard
<b>UC8 25</b>	36" - (1) 25W linear T8 fluorescent lamp <b>required</b>		
<b>UC8 32</b>	48" - (1) 32W linear T8 fluorescent lamp <b>required</b>		

### Accessories/Replacement parts

<b>DUC818</b>	18" white acrylic diffuser
<b>DUC824</b>	24" white acrylic diffuser
<b>DUC836</b>	36" white acrylic diffuser
<b>DUC848</b>	48" white acrylic diffuser

### Notes:

1. **Lamps not included**
2. Use with non-dimmable switches only.
3. Maximum quantity of cabinet fixtures that can be connected from a single power source can not exceed 540 watts from the lamp wattage.

Light Concepts General Purpose Indoor - Cabinet Lighting

Sheet #: 08GU

DEC-627

# Division 27

## Communications





# Division 28

## Electronic Safety and Security



# Division 31

## Earthwork



# Division 32

## Exterior Improvements



**CSI #: 32 84 00**

11/20/12

Green Roof Drip Irrigation Kit

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**Bonus Points** help your bottom line!  
Get 5% Store Credit on Most Purchases.

- Irrigation Kits
  - Drip Irrigation Kits
  - Drip & Micro Sprinkler Kits
  - Gravity Feed Kits
  - **Green Roof Kits**
  - Misting Cooling Kits
  - Micro Sprinkler Kits
  - Retrofit Drip Kits
  - Vegetable Drip Tape Kits
  - Greenhouse Kits
- Controllers & Sensors
- Valves & Drip Zones
- Backflow Prevention
- Screen and Disc Filters
- Pressure Regulators
- Applicators & Fertilizer
- Drip Tubing & Micro Tubing
- Dripline & Drip Tape
- Drip Emitters
- Micro Sprinklers
- Drip Fittings
- Drip Accessories
- Retrofit Drip
- Landscape Drip Pro
- PVC Fittings and Glue
- Threaded Fittings
- System Accessories
- Misting System for Cooling
- Greenhouse Irrigation
- Nursery Irrigation
- Orchard Irrigation
- Garden Tools
- Monthly Specials**
- Clearance Items**

**Green Roof Drip Irrigation Kit**

Complete line of drip irrigation system for green roof planters, boxes, containers, pots and vegetables plants for green roofs

This drip irrigation kit includes all the components needed to water a green roof with small to large plants, and it can accommodate a flow rate of up to 220 GPH, using .5 GPH drip emitters.



In Stock

Part #: K100     \$98.24 ea.         

See [Added Parts](#) to expand your system by purchasing additional pieces separately.

The K100, Green Roof Drip Irrigation Kit is a custom designed kit that contains all the parts needed included a battery operated timer to cover a roof garden of up to 250 square feet. This drip irrigation kit includes 100' of 1/4" drip line with .52 GPH drip emitters spaced every 9" and 25 pressure-compensating drip emitters with flow rates of .5 GPH (gallons per hour). The K100 Drip Irrigation Kit also includes 100' of high quality 1/2" drip irrigation tubing and 50' of 1/4" micro tubing to water up to 100 plants including a few rows of vegetable garden.

Drip irrigation is the slow application of water directly to the plants' root zone in a predetermined pattern, resulting in reduced water loss to sun and wind and no water wasted on non-growth areas. The root zone is maintained at its ideal moisture level, combining the proper balance of water and air for a very efficient irrigation system.

One of the most important features of a drip irrigation system is the creation of a totally new and more favorable root zone environment within the planting. Drip irrigation sustains this environment by using low flow rates to maintain constant soil moisture levels. This encourages better growth and disease resistance by reducing plant stress.

Note: The pressure regulator (included) is used to lower the incoming pressure to the suggested operating pressure of 25 PSI, which is within the range of recommended pressures for a drip system.

Suggestion in connecting the 1/2" compression drip fittings. To install the 1/2" compression fittings, cut the drip tubing with a hand pruner, being careful to keep dirt from entering the line. Hold the compression fitting in one hand and the drip tubing in the other and force the drip tubing into the fitting by wiggling it from side to side. Make sure that the drip tubing is pushed into the compression fitting for about 1/2 to 5/8 of an inch for a very tight fit. No glue or clamps are required.

- Maximum incoming operating pressure: 100 PSI
- Operating pressure: 25 PSI

Product Reviews

Look and see what others have said about our products

Product Tutorials

- [First time users](#)
- [Drip irrigation tutorial](#)
- [Greenhouses & Nurseries](#)

Resources

- [Articles](#)
- [Help index](#)

**Installation for K100**

This drip irrigation kit has all the parts needed to start the system connecting to a faucet. The Drip Store also includes instructions on how to start the system from a PVC pipe or a pipe thread.

Starting the irrigation system from a faucet:

- To automate the system, first connect the battery-operated timer (model C001) to the faucet.
1. Connect the 3/4" FHT x MHT backflow device (model A015) to the controller or to the faucet if not using a controller.
  2. Connect the 3/4" FHT x MHT filter (model F300) to the backflow device if used, or directly to the controller male outlet or faucet.
  3. Connect the 3/4" FHT x MHT pressure regulator (model A013) to the filter.

Optional: Starting the irrigation system from a PVC pipe:

1. Glue to a 3/4" PVC pipe a PVC male adapter (model P357) (not included).
2. Use the 3/4" MHT x MPT nipple (model A010) to connect to the pipe thread making sure to use 3-5 rounds of Teflon tape.

**Green Roof Drip Irrigation Kit**

3. Connect the 3/4" FHT X MHT battery-operated controller (model C001) (not included) to the nipple.
4. Connect the 3/4" FHT x MHT backflow device (model A015) to the controller, or to the faucet.
5. Connect the 3/4" FHT x MHT filter (model F300) to the backflow device, if used, or directly to the controller male outlet or faucet.
6. Connect the 3/4" FHT x MHT 25 PSI pressure regulator (model A013) to the filter.

**Steps to connect all other components:**

1. To the 3/4" FHT x MHT pressure regulator connect the 3/4" FHT swivel adapter (model LF503). To the adapter connect the poly tubing by wiggling and forcing the drip tubing into the compression side of the adapter and lay out the drip tubing in the green roof area, make sure to have the 1/2" main line along the wall. The 1/2" drip tubing(model T003) is used as the main line to deliver the water to the plants.
2. Use the 1/2" elbow (model LF007) as needed.
3. Use 1/2" coupling .700 O.D. (model LF001) to connect additional 1/2" drip tubing or for repair.
4. Use the 1/2" tee (model LF005) to split the 1/2" drip tubing if needed.
5. Make sure that the end of the drip tubing is near the drainage. Turn the water on and flush the line, and then close the end of the 1/2" drip tubing using the hose end (model A006).
6. Use the 1/4" micro tubing (model T009) to extend the drippers to the plant boxes or to the pots that are far from the 1/2" drip irrigation tubing. Insert the drip emitter at the end of the 1/4" micro tubing and secure with a stake or use the 1/4" drip line to loop along the planter. If you use the 1/4" drip line (T051) it should be installed every 6"-8" between the line
7. Use the 1/4" barb (model SF001) to connect the 1/4" micro tubing or the 1/4" drip line to the 1/2" drip tubing. To connect the 1/4" micro tubing or the 1/4" drip line to the 1/2" drip tubing punch a hole in the 1/2" drip hose using the punch (model A019) and insert the 1/4" barb, then connect the 1/4" micro tubing to the barb.

To water a diverse selection of plant sizes such as shrubs, bulbs and vegetable plants, the option below can be utilized:





**Layout Option:**For maximum system expansion using a single water source, and to better control the system's total flow rate, use .5 GPH drip emitters (gallons per hour). We recommend using drip emitters of the same flow rate to resolve the difficulty of irrigating a green roof with a diversity of plant types and planter boxes and pots of different sizes, for example a green roof with planters, boxes, pots, vegetable boxes with trees, shrubs, bulbs and vegetable plants installed on the same system. To compensate for the sizes and types adjust the amount of water applied to larger or thirstier plants by simply adding more drip emitters, at intervals of 6-10" around or along the plants. This drip irrigation method provides a larger wetted area to cover a larger section of the plant root zone. By adjusting watering time, the right amount of water can then be applied evenly to all the plants.

8. Suggested number of drippers per plant:
  - A. Pots and boxes up to 1 gallon: use one .5-GPH drip emitter.
  - B. Pots and boxes up to 5 gallons: use two .5-GPH drip emitters, one on each side of the plant.
  - C. Long planters and boxes up to 8" wide: use the 1/4" drip line down the center of the planter or box
  - D. Long planters and boxes up to 12" wide: use two 1/4" drip lines spaced 6" apart.
  - E. Large boxes up to 25 gallons: loop the 1/4" drip line around the perimeter of the box.
9. Use the 1/4" stake (if needed) (model S005) to hold and secure the micro tubing with the dripper near the plant area.
10. Use the 1/4" heavy duty stake (model S040) to secure the 1/4" drip line to the planter.
11. Use the punch (model A019) to punch holes in the 1/2" drip tubing for the insertion of the drippers and 1/4" fittings if needed.
12. Use goof plugs (if needed) (model SF007) to repair small holes in the 1/2" drip tubing. The goof plug may also be used to close the end of the 1/4" micro tubing.

**How much time to water:** Turn the water on for 5 to 10 minutes, and check the system. If you need less or more water adjust the time on the irrigation controller. The goal is that all the containers, boxes and potted plants regardless of size will drain at the same time. Program the irrigation controller for about 2 to 4 minutes less than the time it took you to test the system. Run the system every one or two days, depending on your location and the soil type. After a week or two check the pots, soil, the health of the plants, and adjust the irrigation time, as needed.

- [Winterizing Your Irrigation System](#)
- [Drip irrigation tubing head loss](#)
- [Maximum recommended drip tubing length \(in feet\) on flat terrain with PC dripper](#)

For K025

Kit Qty	Part #	Image	Description
6	<a href="#">A006</a>		Figure "8" Hose End for 1/2" Drip Tubing
1	<a href="#">A010</a>		3/4" MPT x 3/4" MHT Nipple
1	<a href="#">A013</a>		3/4" FHT Basic Pressure Regulator, 25 PSI
1	<a href="#">A015</a>		Backflow Preventer 3/4" FHT x 3/4" MHT
















**CSI #: 32 84 00**

11/20/12





Green Roof Drip Irrigation Kit

1	<a href="#">A019</a>		Palm Hole Punch
1	<a href="#">C001</a>		DIG Corporation 3/4" Hose End Battery Timer
25	<a href="#">D005</a>		Supertif .5 GPH Pressure Compensating Button Drip Emitter, Color Brown
1	<a href="#">F300</a>		3/4" "Y" Style Filter with Hose Threads, 155 mesh, polyester screen, green
3	<a href="#">LF001</a>		1/2" .700 OD Compression Coupling
5	<a href="#">LF005</a>		1/2" .700 OD Compression Tee
2	<a href="#">LF007</a>		1/2" .700 OD Compression Elbow
1	<a href="#">LF503</a>		3/4" FHT x .700 O.D. Swivel Adapter with Washer
25	<a href="#">S005</a>		4" Supporting Stake for 1/8" or 1/4" Micro Tubing
25	<a href="#">S040</a>		5" Heavy Duty Hold Down Plastic Stake for 1/4" Drip Line
25	<a href="#">SF001</a>		1/4" Barbed Connector, Long
1	<a href="#">SF007</a>		Goof Plugs, Strip of 10
1	<a href="#">T003</a>		DIG Corporation Drip Tubing, 100', 1/2" with .700 OD
1	<a href="#">T009</a>		50', 1/4" Vinyl Black Micro Tubing
1	<a href="#">T051</a>		100', 9" Spacing, 1/4" .52 GPH Drip Line, color black

KIT K100 contains a total of 127 pcs. for \$98.24

Image	Description	Part #	Price	Qty.
	Figure "8" Hose End for 1/2" Drip Tubing	<a href="#">A006</a>	\$0.13 ea.	1 <input type="text"/>
	3/4" MPT x 3/4" MHT Nipple	<a href="#">A010</a>	\$0.55 ea.	1 <input type="text"/>
	3/4" FHT Basic Pressure Regulator, 25 PSI	<a href="#">A013</a>	\$5.59 ea.	1 <input type="text"/>
	Backflow Preventer 3/4" FHT x 3/4" MHT	<a href="#">A015</a>	\$3.11 ea.	1 <input type="text"/>
	Palm Hole Punch	<a href="#">A019</a>	\$1.74 ea.	1 <input type="text"/>
	DIG Corporation 3/4" Hose End Battery Timer	<a href="#">C001</a>	\$42.95 ea.	1 <input type="text"/>
	Supertif .5 GPH Pressure Compensating Button Drip Emitter, Color Brown, Color Brown	<a href="#">D005</a>	<del>\$0.25</del> - <del>\$0.30</del> ea.	1 <input type="text"/>
	3/4" "Y" Style Filter with Hose Threads, 155 mesh, polyester screen, green, 155 mesh, polyester screen, green	<a href="#">F300</a>	\$10.08 ea.	1 <input type="text"/>
	1/2" .700 OD Compression Coupling	<a href="#">LF001</a>	\$0.48 ea.	1 <input type="text"/>
	1/2" .700 OD Compression Tee	<a href="#">LF005</a>	\$0.72 ea.	1 <input type="text"/>
	1/2" .700 OD Compression Elbow	<a href="#">LF007</a>	\$0.69 ea.	1 <input type="text"/>
	3/4" FHT x .700 O.D. Swivel Adapter with Washer	<a href="#">LF503</a>	\$0.81 ea.	1 <input type="text"/>
	4" Supporting Stake for 1/8" or 1/4" Micro Tubing	<a href="#">S005</a>	\$0.13 ea.	1 <input type="text"/>
	5" Heavy Duty Hold Down Plastic Stake for 1/4" Drip Line	<a href="#">S040</a>	\$0.16 ea.	1 <input type="text"/>
	1/4" Barbed Connector, Long	<a href="#">SF001</a>	\$0.12 ea.	1 <input type="text"/>

Green Roof Drip Irrigation Kit

	Goof Plugs, Strip of 10	<a href="#">SF007</a>	\$0.49 ea.	1	<input type="text"/>
	DIG Corporation Drip Tubing, 100', 1/2" with .700 OD, 100', 1/2" with .700 OD	<a href="#">T003</a>	\$10.48 ea.	1	<input type="text"/>
	50', 1/4" Vinyl Black Micro Tubing	<a href="#">T009</a>	\$4.08 ea.	1	<input type="text"/>
	100', 9" Spacing, 1/4" .52 GPH Drip Line, color black	<a href="#">T051</a>	\$11.21 ea.	1	<input type="text"/>

Related Items

			
<a href="#">3/4" 9-VDC In-line Valve with Flow Control</a>	<a href="#">3/4" Female Hose Thread (FHT) Adapter with</a>	<a href="#">3/4" Female Pipe Thread (FNPT) Adapter with</a>	<a href="#">Barbed Ball Valve 1/4"</a>

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The Drip Store  
980 Park Center, Ste. E  
Vista, CA 92081  
Tel: 760-597-1669 : Toll Free: 877-597-1669 Fax: 760-597-1673  
Business Hours: M-F, 7 AM - 4 PM (PST)  
*We are not a retail store, we do offer will call during checkout for local customers.*

## Green Living Technologies

<http://agreenroof.com/walls/wall-mounted-systems/>

### WALL MOUNTED SYSTEMS

- Standard panels are manufactured with 3, 4 or 6 inch depths
- Accommodates deeper rooted plants like vegetables and grasses
- Stainless steel or aluminum—for zero expansion or contraction—unlike plastic
- 15-year minimum product warranty with potential lifetime warranty
- Patented design allows free water flow/drainage and unlimited root migration
- No root rot or wasted irrigation
- Simple mounting system for any application
- Custom manufacturing and details allow for 100% design flexibility





CSI #: 32 93 00

## PLANTS



*Kalimeris pinnatifida*



*Cuphea hyssopifolia*



*Mimulus* 'Jack'



*Mimulus* 'Trish'



*Polygala fruticosa*



*Agapanthus africanus*



*Erysimum insular*



*Penstemon*  
'Apple Blossom'



*Gaillardia x grandiflora*



*Ceanothus*  
'Joyce Coulter'



*Alternanthera*  
*ficoidea* 'Rosea  
Nana'



*Drosanthemum*  
*floribundum*



*Pachysandra terminalis*



*Sedum sieboldii*

# Division 33

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PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
  - 1. Work covered by the Documents.
  - 2. Specification formats and conventions.
  
- A. This set of documents, including the Drawings, Specifications, and other data provided, is an incomplete representation of the project. Pricing the project using these documents will result in an estimate that may be more or less than the price for the project when the documents are complete. Commencing or pursuing construction activities using these documents, including ordering of materials or systems, is not permitted.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: ECOHABITAT, a project of the Stephens Institute of Technology.
- B. Owner: Board of Trustees, Stevens Institute of Technology.
- C. The Work consists of the following:
  - 1. The Work includes a single-family home, newly-constructed on a portable frame, designed for highway transport in 2 main sections, and for reassembly on another site. Work includes structure, interior and exterior finishes, fixtures, appliances, and electrical, mechanical, and plumbing systems. Work also includes some exterior work that is also transportable, and which serves to complete the utility systems and provide access to the home.
  - 2. The Owner desires to have a minimal impact on the environment resulting from this Work, and therefore has established a goal of recycling 50-percent of the demolition and construction waste that is removed from the site.

1.03 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI's "MasterFormat 2010 Update" numbering system.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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END OF SECTION 01 12 00

PIPE AND TUBE RAILINGS

---

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

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

## 1.02 SUMMARY

- A. This Section includes steel pipe and tube railings, including galvanized steel pipe railings.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.

## 1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 3. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Infill load and other loads need not be assumed to act concurrently.

## 1.04 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel".



## 1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

## 1.07 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Steel Pipe and Tube Railings:
    - a. Pisor Industries, Inc.
    - b. Sharpe Products.
    - c. Wagner, R & B, Inc.; a division of the Wagner Companies.

### 2.02 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

### 2.03 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Castings: Either gray or malleable iron, unless otherwise indicated.
  - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
  - 2. Malleable Iron: ASTM A 47/A 47M.

## 2.04 FASTENERS

- A. Provide plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
  - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
  - 3. Provide tamper-resistant flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide torque-controlled expansion 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, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

## 2.05 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.06 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately  $\frac{1}{32}$  inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

- G. Connections: Fabricate railings with welded connections, unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove flux immediately.
  4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form changes in direction as follows:
  1. By inserting prefabricated flush-elbow fittings.
- J. Close exposed ends of railing members with prefabricated end fittings.
- K. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is  $\frac{1}{4}$  inch (6 mm) or less.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
  1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

## 2.07 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.08 STEEL AND IRON FINISHES

- A. Galvanized Railings:
  1. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
  2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
  3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For non-galvanized steel railings, provide non-galvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

### 3.02 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of  $1/16$  inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed  $1/4$  inch in 12 feet (5 mm in 3 m).
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.03 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (51 mm) beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches (152 mm) of post.

### 3.04 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

### 3.05 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and 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.

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END OF SECTION 05 52 13

SECTION 06 05 23  
WOOD FASTENERS

---

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheathing nails: 8d common nails
- B. Frame screws: 4"
- C. Simpson Strong-Tie Company Inc.
  - 1. Column Caps: Simpson CCCQ-SDS2.5, Simpson CCTQ-SDS2.5
  - 2. Source: Simpson Strong-Tie Company Inc.
- D. Simpson Strong-Tie Company Inc.
  - 1. Face Mount Hangers: Simpson LUC210Z
  - 2. Source: Simpson Strong-Tie Company Inc.
- E. Simpson Strong-Tie Company Inc.
  - 1. Hurricane Ties: Simpson H1
  - 2. Source: Simpson Strong-Tie Company Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide 2"x6" blocking at all free edges.
- B. All sill plates shall be p.t. and anchored to foundation walls with 1/2" diameter headed anchor bolts (ASTM F1554) at 4'-0" o.c. and within 12" of all sill plate slices (min. 7" embed.).
- C. Joist Hangers shall be a minimum of 18 gauge steel.
- D. Built-up beams less than 8" deep shall be spiked together with two (2) 16d nails at 16" o.c.
- E. Built-up beams greater than 8" deep shall be spiked together with three (3) 16d nails at 16" o.c.

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END OF SECTION 06 05 23

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data. Shop Drawings.
- B. Provide dressed lumber marked with grade stamp of inspection agency.
- C. All wood framing including details for bridging, blocking, fire stopping, etc., shall conform to the latest edition of the "National Design Specification for Wood Construction" and its supplements and shall be installed in accordance with the NFPA "Manual for House Framing".
- D. Fastening shall be in accordance with the most restrictive of: The International Building Code 2012 or the manufacturer's recommended fastening schedules.

## PART 2 - PRODUCTS

## 2.01 LUMBER

- A. Dimensional Lumber:
  - 1. Maximum Moisture Content: 19 percent
  - 2. Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3
  - 3. Framing Other Than Non-Load-Bearing Interior Partitions: Douglas fir-larch: WCLIB or WWPA
  - 4. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics on exposed surfaces and edges that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
    - a. Species:
      - 1) Rafters and Joists: Douglas Fir
      - 2) Beams, Girders, and Headers: Douglas Fir
      - 3) Studs and Plates: Douglas Fir
- B. Miscellaneous Lumber:
  - 1. Standard, Stud, or No. 3 grade with 19 percent maximum moisture content of any species
  - 2. Provide for nailers, blocking, and similar members

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. All flush-framed connections shall be made with approved galvanized steel joist or beam hangers, minimum 18 gauge, installed according to manufacturer's recommendations.

- B. Where framing lumber is flush framed to microlam, steel or flitch-plate girder, set these girders 1/4" clear (min.) below top of framing lumber, to allow for shrinkage.
- C. Stud walls are to be constructed of 2"x4" at 16" o.c. at the interior unless noted otherwise on plan.
- D. Use double studs at ends of wall and ends of wall openings.
- E. Use double trimmers and headers at all floor openings where beams are not designated.
- F. Built-up beams less than 8" deep shall be spiked together with two (2) 16d nails at 16" o.c.
- G. Built-up beams greater than 8" deep shall be spiked together with three (3) 16d nails at 16" o.c.
- H. No joists shall be cut or notched without approval.

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END OF SECTION 06 11 00



ENGINEERED WOOD PRODUCTS

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data
- B. Manufacturer's published values of allowable design stresses shall be demonstrated by comprehensive testing.

## PART 2 - PRODUCTS

## 2.01 NORDIC LAM COLUMN

- A. Dimension: 5-1/2" x 5-1/12" nominal.
- B. Loads are based on simply axially loaded columns subjected to a maximum eccentricity of either 1/6 column width or 1/6 column depth, whichever is worse
- C. For side loads, other eccentric end loads, or other combined axial and flexural loads, see NDS 2005.
- D. Values are based on a load duration factor  $C_D$  of 1.00 and dry service conditions. The allowable bearing loads shall not be increased by any load duration factor.
- E. The column is assumed to be unbraced, except at the column ends, and the effective column length is equal to the actual column length.

## 2.02 NORDIC LAM HEADERS

- A. Dimension: 3-1/2" x 9-1/2" nominal, 5-1/2" x 9-1/2" nominal, 5-1/2" x 11-7/8" nominal.
- B. Span is measured center to center of supports. The maximum uniform loads are based on a load duration factor  $C_D$  of 1.00.
- C. Assume lateral support is provided at each support and continuously along the compression edge of the beam.
- D. Sufficient bearing length shall be provided at supports. The bearing length requirements are based on the maximum total uniform loads and have been adjusted per NDS 2005, 3.10

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Nordic Lam Column:
  - 1. Install to full compliance with specifications and details of manufacturer.

B. Nordic Lam Headers:

1. Install to full compliance with specifications and details of manufacturer.

---

END OF SECTION 06 11 13

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data. Shop Drawings.

## PART 2 - PRODUCTS

## 2.01 DECKS AND FRAMING STRUCTURE

- A. Provide heat treated materials (“cooked wood”) treated as follows: heated wood up to 250°C, using a water vapor as shielding gas.
- B. Heat treated materials do not need to be stamped by WWPA as qualifying lumber, with the KD-HT mark.
- C. Exterior Decks
  - 1. 5/4” x 4” Western Red Cedar
- D. Deck Framing Structure
  - 1. 2” x 10” nom. Douglas Fir

## 2.02 DECK SKIRTS

- A. Provide heat treated materials (“cooked wood”) treated as follows: heated wood up to 250c, using a water vapor as shielding gas.
- B. Heat treated materials do not need to be stamped by WWPA as qualifying lumber, with the KD - HT mark.
- C. 5/4” x 4” Western Red Cedar
  - 1. Provide product matching same specifications as all exterior decking

## 2.03 WOOD PLANTER BOXES AND BENCHES

- A. Provide heat treated materials (“cooked wood”) treated as follows: heated wood up to 250c, using a water vapor as shielding gas.
- B. Heat treated materials do not need to be stamped by WWPA as qualifying lumber, with the KD - HT mark.
- C. 5/4” x 4” Western Red Cedar
  - 1. Provide product matching same specifications as all exterior decking

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Fastening shall be in accordance with the most restrictive of: The International Building Code 2012 or the manufacturer's recommended fastening schedules.
- B. Decking shall run perpendicular to substructure and end on a girder. Deck boards will be fastened together at butt joints with Hurricane Simpson Ties.
- C. All light-gauge hangers supporting preservative treated wood shall meet or exceed G185 (1.85 oz. of zinc per square foot). Alternatively, stainless steel connectors may be used. Fasteners shall match the selected hanger finish and material.
- D. Set work to required levels in accordance with the most restrictive of: The International Building Code 2012 or the manufacturer's recommended fastening schedules.

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END OF SECTION 06 15 33

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: DOC PS 1

2.02 ROOF SHEATHING

- A. Plywood Roof Sheathing: 5/8" thick, 48/24 span rating

2.03 MISCELLANEOUS PRODUCTS

- A. Fasteners: 8d common nails at 4" o.c. at each sheet perimeter and 12" o.c.
- B. Adhesives for Field Gluing Panels to Framing: BF Goodrich PL400 or equal

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Securely attach to substrates, complying with the following:
  - 1. "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- B. Fastening Methods:
  - 1. Roof Sheathing:
    - a. Nail to wood framing.
    - b. Screw to cold-formed metal framing.

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END OF SECTION 06 16 00

EXTERIOR FINISH CARPENTRY

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## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Exterior wood trim.
2. Lumber and Hardboard siding.

## B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.

## 1.02 SUBMITTALS

## A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

## B. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.
3. For fire-retardant-treated wood that is not marked with classification marking of testing and inspecting agency.

## C. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Cellular PVC trim.
4. Foam plastic moldings.

## D. Sample Warranties: For manufacturer's warranties.

## 1.03 QUALITY ASSURANCE

## A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

## 1.04 DELIVERY, STORAGE, AND HANDLING

## A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## 1.05 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
  - 1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## 1.06 WARRANTY

- A. Manufacturer's Warranty for Hardboard Siding: Manufacturer agrees to repair or replace siding that fails in materials or workmanship within specified warranty period. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.
  - 1. Warranty Period for Siding (Excluding Finish): 25 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MATERIALS, GENERAL

- A. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
  - 1. Exterior trim.
  - 2. Exterior lumber and high-density fiber-cement siding.
- B. Lumber: DOC PS 20 and the following grading rules:
  - 1. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
  - 2. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."
- C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
  - 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

### 2.02 EXTERIOR TRIM

- A. Lumber Trim for Unfinished Applications:

1. Species and Grade: Western red cedar, Clear Heart; NLGA, WCLIB, or WWPA.
  2. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
  3. Finger Jointing: Not allowed.
  4. Face Surface: Surfaced (smooth).
- B. Primed Hardboard Trim: High-temperature-cured, high-resin, wood-fiber composite; factory primed on faces and edges. Recommended by manufacturer for exterior use.
- 2.03 LUMBER SIDING
- A. Species and Grade: Clear VG (Vertical Grain) Heart western red cedar; NLGA, WCLIB, or WWPA.
- 2.04 HARDBOARD SIDING
- A. Minerit HD Concrete exterior panels (fibre C), 1/4-inch thickness.
- 2.05 MISCELLANEOUS MATERIALS
- A. Fasteners for Exterior Finish Carpentry: Provide screws, in sufficient length to penetrate not less than **1-1/2 inches (38 mm)** into wood substrate.
1. Provide stainless-steel fasteners.
- B. Flashing: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
1. Horizontal Joint Flashing for Panel Siding: Preformed, stainless-steel, Z-shaped flashing.
- 2.06 FABRICATION
- A. Back out or kerf backs of standing and running trim wider than **5 inches (125 mm)**, except members with ends exposed in finished work.
- B. Ease edges of lumber less than **1 inch (25 mm)** in nominal thickness to **1/16-inch (1.5-mm)** radius and edges of lumber **1 inch (25 mm)** or more in nominal thickness to **1/8-inch (3-mm)** radius.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.



- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 09 91 13 "Exterior Painting."

### 3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
  - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Install to tolerance of **1/8 inch in 96 inches (3 mm in 2438 mm)** for level and plumb. Install adjoining exterior finish carpentry with **1/32-inch (0.8-mm)** maximum offset for flush installation and **1/16-inch (1.5-mm)** maximum offset for reveal installation.
  - 3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

### 3.04 STANDING AND RUNNING TRIM INSTALLATION

- A. Install flat-grain lumber with bark side exposed to weather.
- B. Install trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **24 inches (610 mm)** long except where necessary.
  - 1. Use scarf joints for end-to-end joints.
  - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

### 3.05 SIDING INSTALLATION

- A. Install siding to comply with manufacturer's written instructions and warranty requirements.
- B. Horizontal Lumber Siding: Apply starter strip along bottom edge of sheathing or sill. Install subsequent courses spaced as detailed over course below. Screw at each stud. Do not allow screws to penetrate more than one thickness of siding.
  - 1. Leave **1/8-inch (3-mm)** gap at trim and corners unless otherwise recommended by manufacturer.
  - 2. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.

- C. Hardboard Siding: Install hardboard siding to comply with manufacturer's recommendations. Install panels with edges over framing or blocking. Leave **3/16-inch (5-mm)** gap at perimeter, openings, and horizontal panel joints unless otherwise recommended by panel manufacturer.
  - 1. Seal butt joints at inside and outside corners and at trim locations.
  - 2. Install continuous metal flashing at horizontal panel joints.
  - 3. Conceal fasteners to greatest practical extent by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.
- D. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

### 3.06 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### 3.07 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

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END OF SECTION 06 20 13

INTERIOR FINISH CARPENTRY

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## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Interior trim, including non-fire-rated interior door frames.
2. Shelving and clothes rods.

## B. Related Requirements:

1. Section 09 91 23 "Interior Painting" for priming and backpriming of interior finish carpentry.

## 1.02 SUBMITTALS

## A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
2. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

## 1.03 DELIVERY, STORAGE, AND HANDLING

## A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

## 1.04 FIELD CONDITIONS

## A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

## B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.01 MATERIALS, GENERAL

- A. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
  1. Interior trim.
  2. Shelving and clothes rods.
- B. Lumber: DOC PS 20 and the following grading rules:
  1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
  2. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."
  3. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
  4. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."
  5. WCLIB: West Coast Lumber Inspection Bureau, Standard No. 17, "Grading Rules for West Coast Lumber."
  6. WWPA: Western Wood Products Association, "Western Lumber Grading Rules."
- C. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
  1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- D. Softwood Plywood: DOC PS 1.
- E. Hardboard: AHA A135.4.
- F. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.
- G. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea-formaldehyde resin.
- H. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
  1. Color: Match Architect's samples.

### 2.02 INTERIOR TRIM

- A. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade: Eastern white pine, Premium or 2 Common; NeLMA or NLGA.
2. Maximum Moisture Content: 10 percent.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).
5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

## 2.03 SHELVING AND CLOTHES RODS

- A. Utility Shelving: Made from one of the following materials, **3/4 inch (19 mm)** thick.
  1. MDF with radiused or solid-wood front edge.
  2. MDO softwood plywood with solid-wood edge.
- B. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.
- C. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.
- D. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.
- E. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; powder-coat-finished steel.
- F. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; powder-coat-finished steel.
- G. Clothes Rods: **1-5/16-inch- (33-mm-)** diameter, color-coated steel tubes.

## 2.04 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
  1. Wood glue shall have a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.
  1. Adhesive shall have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.05 FABRICATION

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
  1. Interior standing and running trim except shoe and crown molds.
  2. Wood-board paneling.

- B. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius and edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

### 3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
  - 3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
  - 4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### 3.04 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
  - 1. Install trim after gypsum-board joint finishing operations are completed.

2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

### 3.05 SHELVING AND CLOTHES ROD INSTALLATION

- A. Cut shelf cleats at ends of shelves about **1/2 inch (13 mm)** less than width of shelves and sand exposed ends smooth.
- B. Install shelf brackets according to manufacturer's written instructions, spaced not more than **32 inches (800 mm)** o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than **12 inches (300 mm)** o.c.
- D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than **36 inches (900 mm)** o.c. and within **6 inches (150 mm)** of end of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.
  1. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
- F. Install rod flanges for rods as indicated. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

### 3.06 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

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END OF SECTION 06 20 23

## SELF-ADHERING SHEET WATERPROOFING

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### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes the following:
  - 1. Concealed rubberized-asphalt strip flashing at exterior openings.
  - 2. Concealed rubberized-asphalt strip flashing under roofing.
- B. Related Sections include the following:
  - 1. Division 07 Section "Joint Sealing" for joint-sealant materials and installation.

#### 1.02 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

#### 1.03 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

#### 1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

#### 1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
  - 1. Do not apply waterproofing in snow, rain, fog, or mist.



- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

## 1.07 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
  - 1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.
  - 2. Warranty Period: Three years after date of Substantial Completion.
- B. Special Installer's Warranty for Roofing Underlayment: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years.

## PART 2 - PRODUCTS

### 2.01 MATERIALS, GENERAL

### 2.02 RUBBERIZED-ASPHALT STRIP FLASHING

- A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; Window & Door Flashing.
  - 2. W. R. Grace & Co.; Vycor V40.
  - 3. W. R. Meadows, Inc.; AirShield.
- B. Rubberized-Asphalt Strips: 40-mil- (1.02-mm-) thick, self-adhering sheet consisting of 37-mil (0.95-mm) of rubberized asphalt laminated to a 3-mil- (0.07-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction. Provide minimum 9-inch wide strips.
  - 1. Physical Properties: As follows, measured per standard test methods referenced:
    - a. Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
    - b. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
    - c. Low-Temperature Flexibility: Unaffected at minus 45 deg F (minus 43 deg C); ASTM D 1970.
    - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
    - e. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

### 2.03 RUBBERIZED-ASPHALT STRIP ROOFING UNDERLAYMENT

- A. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; Water & Ice Protection 200.
  - 2. W. R. Grace & Co.; Ice & Water Shield.
  - 3. W. R. Meadows, Inc.; AirShield.

- B. Rubberized-Asphalt Strips: 40-mil- (1.02-mm-) thick, self-adhering sheet consisting of 37-mil (0.95-mm) of rubberized asphalt laminated to a 3-mil- (0.07-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction. Provide minimum 9-inch wide strips.
  - 1. Physical Properties: As follows, measured per standard test methods referenced:
    - a. Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
    - b. Ultimate Elongation: 250 percent minimum; ASTM D 412, Die C, modified.
    - c. Low-Temperature Flexibility: Unaffected at minus 29 deg F (minus 20 deg C); ASTM D 1970.
    - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
    - e. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

#### 2.04 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Tape: Self-adhering strips of same material and thickness as sheet waterproofing or compatible material as recommended by the membrane manufacturer.
- F. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- G. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- H. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
  - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  - 2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

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

### 3.02 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
  1. Install sheet strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).
- F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
  1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
  1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
    - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
    - b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

### 3.03 RUBBERIZED-ASPHALT SHEET AND STRIP APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
  1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

- D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
- E. Application at Openings: Apply strips at sill first, then jambs, and lastly at head of openings. Install over fins and flanges, and install weatherproofing membranes for general wall areas over the strips.
- F. Application at Roofs: Apply strips from low point to high point of roofs to ensure that side laps shed water and in accordance with roofing manufacturer's recommendations.
  - 1. At roof eaves: Install from roof edge to a height 24-inches away from the roof edge.
  - 2. At valleys: Install from center of valley to 24 inches from the valley in both directions.
- G. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- H. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches (150 mm) beyond repaired areas in all directions.
- J. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

#### 3.04 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

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END OF SECTION 07 13 26

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**HOT FLUID-APPLIED WATERPROOFING**

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**PART 1 - GENERAL****1.01 SUMMARY**

- A. This Section includes reinforced hot fluid-applied waterproofing membrane, including special permits that may be required for hot-applied systems.

**1.02 SUBMITTALS**

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties.

**1.03 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer, approved by manufacturer to install manufacturer's products; and who is eligible to receive waterproofing warranty specified.

**1.04 PROJECT CONDITIONS**

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F (minus 18 deg C).

**1.05 WARRANTY**

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, in which manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that do not remain watertight for a period of five years after date of Substantial Completion.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. American Hydrotech, Inc.; Monolithic Membrane 6125.
  - 2. Tremco; Tremproof 150.

**2.02 MATERIALS**

- A. Membrane: Single-component; 100 percent solids; hot fluid-applied, rubberized asphalt complying with CAN/CGSB-37.50.
- B. Primer: ASTM D 41, asphaltic primer.
- C. Elastomeric Flashing Sheet: 50-mil- (1.3-mm-) minimum, nonstaining, uncured sheet neoprene

- D. Reinforcing Fabric: Manufacturer's recommended spun-bonded polyester fabric.
- E. Protection Course: Semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between 2 asphalt-saturated fibrous liners and nominal thickness 1/8 inch (3 mm).

### 2.03 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, 1/2-inch Type III (perlite) or Type IV (cellulosic fiber) insulation board on one major surface and felt or glass-fiber mat facer on other major surface.
  - 1. Manufacturers:
    - a. Atlas Roofing Corporation.
    - b. Carlisle SynTec Incorporated.
    - c. Celotex Corporation.
    - d. Firestone Building Products Company.
    - e. GAF Materials Corporation.
    - f. Johns Manville International, Inc.
    - g. Koppers Industries.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

### 2.04 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side and a polymeric film bonded to the other side of a 3-dimensional, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Secure special permits and variances from authorities having jurisdiction for using hot systems.
- B. Clean and prepare substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- C. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- D. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

- E. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- F. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

### 3.02 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate according to CAN/CGSB-37.51, "Application of Rubberized Asphalt, Hot-Applied, for Roofing and Waterproofing," and waterproofing manufacturer's written instructions.
- B. Install elastomeric sheet reinforcement and bond to deck and wall substrates where indicated or required. Extend elastomeric sheet reinforcement a minimum of 6 inches (150 mm) onto perpendicular surfaces and other work penetrating substrate.
- C. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and sleeves.
  - 1. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joint with sheet flashing extended along each side of joint and securely bond to substrate.
  - 2. Install elastomeric flashing sheet at terminations and adhere to deck and wall substrates in a layer of hot, rubberized asphalt.

### 3.03 MEMBRANE APPLICATION

- A. Apply rubberized asphalt according to CAN/CGSB-37.51 and manufacturer's written instructions.
- B. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized-asphalt waterproofing.
- C. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
- D. Reinforced Membrane: Apply waterproofing to substrates and adjoining surfaces indicated. Spread hot fluid-applied, rubberized asphalt to a thickness of 90 mils (2.3 mm); embed reinforcing fabric, overlapping sheets 2 inches (50 mm); and spread another 125-mil- (3.2-mm-) thick layer to provide a uniform, reinforced, seamless membrane 215 mils (5.5 mm) thick.
- E. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.
- F. Install protection course with overlapped joints while rubberized asphalt is still hot.

### 3.04 INSULATION INSTALLATION

- A. Install insulation panels over fluid-applied membrane according to manufacturer's written instructions. Use adhesives that do not penetrate or degrade waterproofing. Slope insulation to drain.

### 3.05 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels to substrate according to manufacturer's written instructions. Use adhesives that do not penetrate waterproofing. Lap edges and

ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.06 PROTECTING AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected horizontal membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction

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END OF SECTION 07 14 13



## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - 1. Foam-plastic board insulation.
  - 2. Spray polyurethane foam insulation.
  - 3. Vapor retarders.
- B. Related Work specified elsewhere includes:
  - 1. Division 07 roofing Sections for insulation installed as part of the roofing system.

## 1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Schedule: Indicate where each type of product is to be applied. Provide drawings if necessary to show where insulation is to be installed.

## PART 2 - PRODUCTS

## 2.01 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Chemical Company (The).
    - b. Owens Corning.
  - 2. Type VI, 40 psi (276 kPa) at wall systems where insulation will be completely enclosed.

## 2.02 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation.
    - b. Dow Chemical Company (The).
    - c. Gaco Western Inc.
    - d. Henry Company.
    - e. Volatile Free, Inc.
  - 2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

## 2.03 VAPOR RETARDERS

- A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Raven Industries Inc.; DURA-SKRIM 6WW.
    - b. Reef Industries, Inc.; Griffolyn T-65.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

## 2.04 AUXILIARY INSULATING MATERIALS

- A. Insulation for Small Voids: Foamed in-place plastic; C.R. Laurence Company "Handi-Foam II".
- B. Sheet Caulking: Lowry's "Electrical Box Pads" resilient, self-adhesive sheet sealer.

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.02 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.
  - 1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

### 3.03 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
  - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- E. Electrical Boxes: Install sheet caulking at each electrical switch and outlet box and at cavity spaces where required to prevent air infiltration through boxes in framed and cavity walls.

### 3.04 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
  - 1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

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END OF SECTION 07 21 00

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## FLUID-APPLIED MEMBRANE AIR BARRIERS

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### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. This Section includes the following:
  - 1. Fluid-applied membrane air barrier, vapor retarding.

#### 1.02 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

#### 1.03 SUBMITTALS

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

#### 1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

### PART 2 - PRODUCTS

#### 2.01 FLUID-APPLIED MEMBRANE AIR BARRIER

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Elastomeric Modified Bituminous Membrane:
      - 1) Carlisle Coatings & Waterproofing; Barriseal.
      - 2) Henry Company; Air-Bloc 06.
      - 3) Meadows, W. R., Inc.; Air-Shield LM.
      - 4) NEI; AC AVS1.
      - 5) Tremco Incorporated; ExoAir.
    - b. Synthetic Polymer Membrane:
      - 1) Grace, W. R. & Co.; Perm-A-Barrier Liquid.
      - 2) Henry Company; Air-Bloc 21 or 21S.
      - 3) Rubber Polymer Corporation; Rub-R-Wall Airtight.
  - 2. Physical and Performance Properties:
    - a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.

- b. Membrane Vapor Permeance: Not to exceed 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96.

## 2.02 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by manufacturer of air barrier material.
- C. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.
- D. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- E. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- F. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- (1.3- to 1.6-mm-) thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with aluminum termination bars and stainless-steel fasteners.
- G. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

## PART 3 - EXECUTION

### 3.01 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air barrier membrane over joint reinforcing strip.

### 3.02 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials as indicated.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply elastomeric flashing sheet so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

### 3.03 AIR BARRIER MEMBRANE INSTALLATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- B. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- C. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
  1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
  1. Vapor-Retarding Membrane Air Barrier: 40-mil (1.0-mm).

- F. Apply strip and transition strip a minimum of 1 inch (25 mm) onto cured air membrane or strip and transition strip over cured air membrane overlapping 3 inches (75 mm) onto each surface according to air barrier manufacturer's written instructions.
- G. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

#### 3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements.
- C. Tests: Testing to be performed will be determined by Owner's testing agency as follows:
  - 1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization.
- D. Remove and replace deficient air barrier components and retest as specified above.

#### 3.05 PROTECTION

- A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
  - 1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 60 days.

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END OF SECTION 07 27 26

SECTION 07 31 13  
ASPHALT SHINGLES

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PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes asphalt shingles and installation of roof shingles specified elsewhere.
- B. Related Work specified elsewhere includes:
  - 1. Self-adhering sheet membrane underlayment, specified in Division 07 Section "Self-Adhering Sheet Waterproofing."
  - 2. Roof shingles with integral photovoltaic collectors, specified in Division 26 Section "Photovoltaic Collectors."

1.02 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For asphalt shingles.
- C. Product test reports.
- D. Research/evaluation reports.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain ridge and hip cap shingles felt underlayment through one source from a single asphalt shingle manufacturer.
- B. Fire-Test-Response Characteristics: Provide asphalt shingle and related roofing materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.

1.04 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials within specified warranty period.
  - 1. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first 5 years nonprorated.

PART 2 - PRODUCTS

2.01 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Multitab-Strip Asphalt Shingles: ASTM D 3462, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.



1. Products:
  - a. Owens Corning; "Duration" Premium Cool.

## 2.02 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Membrane Waterproofing: As specified in Division 07 Section, "Self-Adhering Sheet Waterproofing" for roof underlayment.

## 2.03 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, smooth shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
  1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

## 2.04 METAL FLASHING AND TRIM

- A. Sheet Metal Flashing and Trim: Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim."
  1. Sheet Metal: Aluminum, mill finished.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

## PART 3 - EXECUTION

### 3.01 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Membrane Underlayment: Install self-adhering sheet membrane underlayment on roof deck in locations and as specified in Division 07 Section "Self-Adhering Sheet Waterproofing."

### 3.02 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
  1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

### 3.03 ASPHALT SHINGLE INSTALLATION

- A. Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

- C. Fasten asphalt shingle strips with a minimum of five roofing nails located according to manufacturer's written instructions.

3.04 PHOTOVOLTAIC COLLECTOR SHINGLE INSTALLATION

- A. Install shingles with integral photovoltaic collectors according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

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END OF SECTION 07 31 13

EXTERIOR WALL CLADDING SYSTEM

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## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes: Wood panels, cementitious panels, wood louvers, and secondary support system for wall cladding system application.
  - 1. Aluminum clip and sub-girt secondary support system.
- B. Related Sections: Section(s) related to this section include:
  - 1. Rough Carpentry: Division 06 Rough Carpentry Section.
  - 2. Air and moisture barriers: Division 07.

## 1.02 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide panels that have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

## 1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for specified products.
- B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.
- C. Samples: Submit selection and verification samples for finishes, colors and textures.

## 1.04 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer Qualifications: Manufacturer producing product in ISO 9001 certified facility, capable of providing field service representation during fabrication and approving application method.
    - a. Obtain from a single manufacturer.
  - 2. Fabricator/Installer Qualifications: Installer shall be approved by the manufacturer and experienced in performing work of similar type and scope.
- B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

## 1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

## 1.06 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

## PART 2 - PRODUCTS

### 2.01 CEMENTITIOUS WALL PANELS

- A. Fiber-Reinforced Cementitious Siding: Siding made from fiber-cement board that complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
    - a. American Fiber Cement Corporation "Minerit HD (Heavy Duty)".
    - b. CertainTeed Corp.
    - c. James Hardie Inc.
  - 2. Panels 48 inches wide and 120 inches long with smooth texture.
- B. Colors: Natural cement color.
- C. Finish: Unfinished.
- D. Panel Core: Fiber-reinforced cementitious panels.
  - 1. Panel Thickness: 1/4 inch (6 mm).
  - 2. Surface Impact Resistance: 9 lbf (40 N) index minimum.
  - 3. Scratch Resistance: 0.79 lbf (3.5 N) index minimum.
  - 4. Fire Performance: Maximum flamespread index of 5 per ASTM E84 (Type I, Class A).
  - 5. Smoke Development Index: 5.
  - 6. Water Absorption: Less than 1.0%.
  - 7. Porosity: Nonporous surface and edges.
  - 8. Microbial Characteristics: Will not support microorganic growth.
  - 9. Cleanability: Resists dirt pickup. Easily cleaned.

### 2.02 WOOD WALL PANELS

- A. Wood Siding: Siding milled from Western Red Cedar as specified in Division 06 Section, "Exterior Finish Carpentry".
  - 1. Panel Profile: Flat with smooth texture.
- B. Wood Louvers: Louvers constructed from milled Western Red Cedar boards as specified in Division 06 Section, "Exterior Finish Carpentry" with smooth texture.
  - 1. Louver Profiles:
    - a. Nearly horizontal louvers, evenly spaced, with slight slope to shed water.
    - b. Sloped fixed louvers, evenly spaced.
- C. Finish: Clear Sealer and finish.

### 2.03 ACCESSORIES

- A. Supporting system; Fastening method: A complete, pre-engineered aluminum clip and sub-girt system, complying with the following requirements:

1. The panels are through-fastened to aluminum clips.
2. To ensure proper structural performance, the clips should be located at appoint equal to 20% of the length of the tile from the edge of the panel.
3. The aluminum clips must be fastened to horizontal aluminum sub-frame in order to maintain an accurate horizontal gap.
4. Panels must be capable of easy and fast assembly
5. The replacement of damaged panels, particularly in the middle sections, must be possible using simple methods and should not require special tools.
6. Under no circumstances shall it be possible to remove individual panels unless they are first destroyed.

#### 2.04 FABRICATION

- A. Fabricate wall panels and accessory items in accordance with manufacturer's recommendations and approved submittals.
- B. Fabricate panels to profiles indicated.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

#### 3.02 PREPARATION

- A. Surface Preparation: Provide air and moisture barriers, insulation, and primary support structure with sheathing.

#### 3.03 INSTALLATION

- A. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.
- B. Install wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals.
- C. Fasten wall panels to supporting substrate with fasteners and adhesive approved for use with adjoining construction.
- D. Accessory Items: Install corner profiles, gaskets and trim with fasteners and adhesive appropriate for use with adjoining construction as indicated on drawings and as recommended by manufacturer.

#### 3.04 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.05 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

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END OF SECTION 07 42 33

Not for Construction

EPDM MEMBRANE ROOFING

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## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

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

## 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Adhered ethylene-propylene-diene-monomer (EPDM) roofing system.
  - 2. Vapor retarder.
  - 3. Roof insulation.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
  - 2. Division 07 Section "Thermal Insulation" for insulation beneath the roof deck.
  - 3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
  - 4. Division 07 Section "Joint Sealing."

## 1.03 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

## 1.04 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

## 1.05 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Warranties: Special warranties specified in this Section.

## 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Source Limitations: Obtain components for membrane roofing system from same manufacturer as roofing membrane.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

## 1.08 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
  - 1. Special warranty includes roofing membrane, base flashings, roofing accessories, roof insulation, fasteners, substrate board, vapor retarder, walkway products, and other components of membrane roofing system.
  - 2. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 EPDM ROOFING MEMBRANE

- A. EPDM Roofing Membrane: ASTM D 4637, Type I, non-reinforced uniform, flexible sheet made from EPDM, and as follows:
  - 1. Manufacturers:
    - a. Carlisle SynTec Incorporated.
    - b. Firestone Building Products Company.
    - c. Johns Manville International, Inc.



- d. Knight-Celotex Corporation.
2. Thickness: 60 mils (1.5-mm), nominal.
3. Exposed Face Color: White.

## 2.02 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
  1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: 60-mil- (1.5-mm-) thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive.
- D. Seaming Material: Single-component butyl splicing adhesive and splice cleaner.
- E. Lap Sealant: Manufacturer's standard single-component sealant, color to match roofing membrane.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- H. 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.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
- J. Liquid coating, specifically formulated for coating EPDM roofing membrane, as follows:
  1. Type: Acrylic emulsion Hypalon.
  2. Color: White.

## 2.03 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 728, perlite board, 3/4 inch (19 mm) thick, seal coated.

## 2.04 VAPOR RETARDER

- A. Laminated-Sheet Vapor Retarder: Kraft paper, 2 layers, laminated with asphalt and edge reinforced with woven fiberglass yarn with maximum permeance rating of 0.50 perm (29 ng/Pa x s x sq. m) and manufacturer's standard adhesive.

## 2.05 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

- B. Polyisocyanurate Board Insulation: ASTM C 1289, 1/2-inch Type III (perlite) or Type IV (cellulosic fiber) insulation board on one major surface and felt or glass-fiber mat facer on other major surface.
    - 1. Manufacturers:
      - a. Atlas Roofing Corporation.
      - b. Carlisle SynTec Incorporated.
      - c. Celotex Corporation.
      - d. Firestone Building Products Company.
      - e. GAF Materials Corporation.
      - f. Johns Manville International, Inc.
      - g. Koppers Industries.
  - C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.
  - D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- 2.06 INSULATION ACCESSORIES
- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
  - B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
  - C. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
  - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Deck."
  - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
  - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
  - 7. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Deck," according to acoustical roof deck manufacturer's written instructions.

### 3.03 VAPOR-RETARDER INSTALLATION

- A. Install laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches (50 mm) and 6 inches (150 mm), respectively. Bond vapor retarder to deck as follows:
  - 1. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

### 3.04 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
  - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
2. Install subsequent layers of insulation in a cold fluid-applied adhesive.

### 3.05 ADHERED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- G. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
  1. Apply a continuous bead of in-seam sealant before closing splice if required by membrane roofing system manufacturer.
- H. Repair tears, voids, and lapped seams in roofing that does not meet requirements.
- I. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.
- J. Install roofing membrane and auxiliary materials to tie in to existing roofing.

### 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
  1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.07 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

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END OF SECTION 07 53 23

SHEET METAL FLASHING AND TRIM

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PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
  - 1. Formed roof drainage system.
  - 2. Formed wall flashing and trim.
  
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
  - 2. Division 07 Section "Hot Fluid-Applied Waterproofing" for installing sheet metal flashing and trim integral with roofing membrane.
  - 3. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
  - 4. Division 07 Section "Joint Sealing" for field-applied sheet metal flashing and trim sealants.

1.02 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
  
- B. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1.04 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual". Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.05 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and non-corrosive installation.

PART 2 - PRODUCTS

2.01 SHEET METALS

- A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: One-side bright.
  - B. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality, mill phosphatized for field painting.
- 2.02 UNDERLAYMENT MATERIALS
- A. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- 2.03 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.
  - B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
    1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
    2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
    3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
    4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
    5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
  - D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
  - E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.
  - F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- 2.04 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, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
  - B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

- C. Fabricate 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.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25.4 mm) deep, filled with elastomeric butyl sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.
  - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

## 2.05 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2438-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
  - 1. Gutter Style: A.
  - 2. Expansion Joints: Lap type.
  - 3. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
  - 4. Gutters with Girth up to 15 Inches (381 mm): Fabricate from the following material:
    - a. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.
- B. Downspouts: Fabricate round downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Manufactured Hanger Style: Concealed straps.
  - 2. Fabricate downspouts from the following material:
    - a. Copper: 16 oz./sq. ft. (0.55 mm thick).
    - b. Galvanized Steel: 0.0217 inch (0.55 mm) thick.

## 2.06 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Valley Flashing: Fabricate from the following material:
  - 1. Prepainted, Metallic-Coated Steel: 0.0276 inch (0.7 mm) thick.
- B. Drip Edges: Fabricate from the following material:
  - 1. Aluminum: 0.0320 inch (0.8 mm) thick.



- C. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following material:
  - 1. Aluminum: 0.0320 inch (0.8 mm) thick.
- D. Roof-Penetration Flashing: Fabricate from the following material:
  - 1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

## 2.07 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2438-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (152 mm) beyond each side of wall openings. Form with 2-inch- (51-mm-) high end dams. Fabricate from the following material:
  - 1. Stainless Steel: 0.0156 inch (0.4 mm) thick.
- B. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (102 mm) beyond wall openings. Form head and sill flashing with 2-inch- (51-mm-) high end dams. Fabricate from the following material:
  - 1. Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch (0.55 mm) thick.

## 2.08 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 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. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. 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 fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum, stainless-steel, and lead 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 underlayment.
  3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric butyl sealant.
- E. 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.
1. Space cleats not more than 12 inches (305 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25.4 mm) deep, filled with elastomeric butyl sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
  2. Aluminum: Use aluminum or stainless-steel fasteners.
  3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
  4. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric butyl sealant as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25.4 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
  2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealing".
- I. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

### 3.03 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. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric butyl sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches (914 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
  - 1. Fasten gutter spacers to front and back of gutter.
  - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
  - 3. Anchor and loosely lock back edge of gutter to continuous cleat eave or apron flashing.
  - 4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (610 mm) apart.
  - 5. Anchor gutter with spikes and ferrules spaced not more than 24 inches (610 mm) apart.
  - 6. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.25 m) apart. Install expansion joint caps.
  - 7. Install continuous gutter screens on gutters with non-corrosive fasteners, removable for cleaning gutters.
  
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25.4 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
  - 1. Provide elbows at base of downspout to direct water away from building.
  - 2. Connect downspouts to underground drainage system indicated.

#### 3.04 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof 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.
  
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
  - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch (406-mm) centers.
  
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
  - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
  - 2. Seal with elastomeric butyl sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

#### 3.05 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
  
- B. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Division 04 Section "Unit Masonry".

- C. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (102 mm) beyond wall openings.

3.06 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. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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END OF SECTION 07 62 00

SECTION 07 71 00  
ROOF SPECIALTIES

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data and Product Samples.
- B. Warranties: Provide manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace roof specialties that show evidence of deterioration of factory-applied finishes within 5 years from date of Substantial Completion.
- C. SPRI Wind Design Standard: Provide roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:
  - 1. Design Pressure: ANSI/SPRI ES-1 Test Method RE-1 Test for Roof Edge Termination of Single-Ply Roofing Membranes: The fascia system shall be tested to secure the membrane to minimum 100 lbs./ft.

PART 2 - PRODUCTS

2.01 ROOF SPECIALTIES

- A. Siding Vents: heat resistant polypropylene
  - 1. Cor-A-Vent SV-5 Siding Vent
    - a. 3/4" x 3" x 4' heat resistant polypropylene siding vent, 8.5 sq. in. NFVA per lineal foot
    - b. <http://www.cor-a-vent.com/siding-vent-sv-3.cfm>
- B. Gutters and Downspouts
  - 1. Guttersupply Aluminum Downspouts
    - a. 2" x 3" Aluminum downspout, .019" gauge, Almond color
    - b. <http://www.guttersupply.com/m-aluminum-downspout-rectangular.gstml>
  - 2. Guttersupply Aluminum Elbows
    - a. 2" x 3" A style Aluminum elbow, .019" gauge, Almond color
    - b. <http://www.guttersupply.com/m-aluminum-elbows-rectangular-A.gstml>
  - 3. Guttersupply Aluminum Outlets
    - a. Wide flange rectangular Aluminum outlet
    - b. Manufactured to fit 2" x 3" downspout
    - c. <http://www.guttersupply.com/p-2x3-Outlet-Wide-Flange.gstml>
  - 4. Guttersupply PVC Adapter
    - a. 2" x 3" x 3" Flush Downspout Tile Adapter
    - b. Manufactured to connect a 2" x 3" downspout to a 3" PVC pipe
    - c. <http://www.guttersupply.com/p-tile-adapter-2x3x3-Flush-Downspout-Ad.gstml>

2.02 ACCESSORIES

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper as recommended by manufacturer for use and finish indicated.

- B. Aluminum Finish: Mill finish
  - C. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements.
    - 1. Exposed Penetrating Fasteners: Gasketed screws with heads matching color of metal.
    - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
    - 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel.
  - D. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.
  - E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- 2.03 FINISHES
- A. Finish to be selected by Architect from manufacturer's full range of standard colors.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement.
- B. Coat back side of aluminum and stainless-steel roof specialties with bituminous coating where they will contact wood, ferrous metal, or cementitious construction.
- C. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- D. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 24 inches (609.6 mm) of corners or intersections unless indicated.
- E. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

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END OF SECTION 07 71 00

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes but is not limited to interior and exterior horizontal and vertical joint sealing.
- B. Related Sections
  - 1. Division 08 Section "Hollow Metal Doors and Frames."
  - 2. Division 08 Section "Glazing."
  - 3. Division 09 Section "Gypsum Board."
  - 4. Division 10 Section "Toilet and Bath Accessories."

1.02 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide joint sealants that have been produced and installed to establish and maintain continuous seals that cause no staining or deterioration of joint substrates.

1.03 SUBMITTALS

- A. Product data from manufacturers for each joint sealant product required.
  - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- B. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4.4 deg C).
  - 2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

#### 1.07 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
  - 1. Architectural Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- C. Colors: Provide color of exposed joint sealants to comply with the following:
  - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

#### 2.02 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.
- B. One-Part Neutral Cure Silicone Sealant: Type S; Grade NS; Class 25; where specifically approved by the Architect.
  - 1. Additional Capability: When tested per ASTM C 719, to withstand 50 percent increase and decrease of joint width as measured at time of application.
  - 2. Products
    - a. "Dow Corning 795"; Dow Corning Corp.
    - b. "Dow Corning 790"; Dow Corning Corp.



- c. "Silpruf"; General Electric Co.
  - d. "GE Construction 1200"; General Electric Co.
  - e. "895 Silicone"; Pecora Corp.
  - f. "Spectrum 2"; Tremco, Inc.
- C. Two-Part Gunnable Polyurethane Sealant: Type M; Grade NS; Class 25.
- 1. Products
    - a. "Dymeric"; Tremco, Inc.
    - b. "Dynatrol II"; Pecora Corp.
    - c. "Chem-Calk 900"; Bostik Cons.
- D. Acrylic Sealant: Manufacturer's standard one-part, nonsag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhered to joint substrates indicated for Project without failing cohesively:
- 1. 7-1/2 percent movement in both extension and compression for a total of 15 percent.
  - 2. Products:
    - a. "60+Unicrylic," Pecora Corp.
    - b. "PTI 738," Protective Treatments, Inc.
    - c. "PTI 767," Protective Treatments, Inc.
    - d. "Mono," Tremco, Inc.
- E. Butyl Sealant: Manufacturer's standard one-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.
- 1. Products:
    - a. "BC-158," Pecora Corp.
    - b. "PTI 757," Protective Treatments, Inc.
    - c. "Sonneborn Multi-Purpose Sealant," Sonneborn Building Products Div., ChemRex, Inc.
    - d. "Tremco Butyl Sealant," Tremco, Inc.

### 2.03 LATEX JOINT SEALANTS

- A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.
- B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.
- C. Silicone Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.
- D. Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:
- 1. Acrylic-Emulsion Sealant:
    - a. "AC-20," Pecora Corp.
    - b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
    - c. "Tremco Acrylic Latex 834," Tremco, Inc.

2. Silicone-Emulsion Sealant:
  - a. "Trade Mate Paintable Glazing Sealant," Dow Corning Corp.

#### 2.04 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
  1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- C. Products: Subject to compliance with requirements, acoustical joint sealants that may be incorporated in the Work include, but are not limited to, the following:
  1. Acoustical Sealant:
    - a. "Sheetrock Acoustical Sealant," United States Gypsum Corp.
    - b. "AC-20 FTR Acoustical and Insulation Sealant," Pecora Corp.
  2. Acoustical Sealant for Concealed Joints:
    - a. "BA-98," Pecora Corp.
    - b. "Tremco Acoustical Sealant," Tremco, Inc.

#### 2.05 MISCELLANEOUS MATERIALS

- A. Joint Cleaners: Provide joint cleaning compounds as recommended by sealant manufacturer(s).
- B. Joint Prime Sealer: Provide type(s) of joint primers as recommended by sealant manufacturer(s).

### PART 3 - EXECUTION

#### 3.01 PRE-INSTALLATION MEETING

- A. Prior to all work of this Section, schedule a job site pre-installation meeting to review the procedures and time schedule proposed for installation of all sealant work.
- B. Present at meeting shall be Contractor, Architect, Installer, sealant manufacturer's technical representative and other trades involved in coordination with sealant work.

#### 3.02 SURFACE CONDITIONS

- A. Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is complete to point where this installation may properly commence. In the event of discrepancy do not proceed with installation until all such discrepancies have been fully resolved.

#### 3.03 JOINT SURFACE PREPARATION

- A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant.

- B. For polyurethane sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-227 has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- C. Etch concrete surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.
- D. Roughen joint surfaces on non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

### 3.04 INSTALLATION

- A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- B. Prime or seal the joint surfaces wherever recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- C. Install sealant backer rod for liquid elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.
- D. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- F. Install sealants to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center section of bead.
  1. For normal moving joints sealed with one component silicone sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
  2. For joints sealed with acrylic-latex sealant, fill joints to a depth in the range of 75% to 125% of joint width.
- G. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant compound.
- H. Remove excess and spillage of compounds promptly as work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

- I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and complying with sealant manufacturer's directions for installation methods, materials and tools which produce seal continuity at ends, turns, and intersections of joints. For application at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.05 CURE AND PROTECTION

- A. Cure sealant compounds in compliance with manufacturer's instructions and recommendations, in order to obtain high early bond strength, cohesive strength and surface durability.
- B. Adopt procedures as required for the curing and protection of sealants and caulking compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

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END OF SECTION 07 92 00

DOOR HARDWARE SCHEDULE

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## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

## 1.02 SUMMARY

- A. This Section references specification sections relating to commercial door hardware for the following:

- 1. Swinging doors.
- 2. Sliding Doors.
- 3. Other doors to the extent indicated.

- B. Commercial door hardware includes, but is not necessarily limited to, the following:

- 1. Mechanical door hardware.
- 2. Electromechanical and access control door hardware.
- 3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
- 4. Automatic operators.
- 5. Cylinders specified for doors in other sections.

- C. Related Sections:

- 1. Division 08 Section "Hollow Metal Doors and Frames".
- 2. Division 08 Sections "Flush and Clad Wood Doors".
- 3. Division 08 Section "Stile and Rail Wood Doors".
- 4. Division 08 Section "Integrated Door Opening Assemblies".
- 5. Division 08 Section "Door Hardware".
- 6. Division 08 Section "Automatic Door Operators".

- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

- 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- 2. ICC/IBC - International Building Code.
- 3. NFPA 70 - National Electrical Code.
- 4. NFPA 80 - Fire Doors and Windows.
- 5. NFPA 101 - Life Safety Code.
- 6. NFPA 105 - Installation of Smoke Door Assemblies.
- 7. State Building Codes, Local Amendments.

- E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

### 1.03 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

#### 1.04 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.
- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.
- F. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.06 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified

hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

- B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.07 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

#### 1.08 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

### PART 2 - PRODUCTS

#### 2.01 SCHEDULED DOOR HARDWARE

- A. Refer to "PART 3 – EXECUTION" for required specification sections.

### PART 3 - EXECUTION

#### 3.01 DOOR HARDWARE SETS

- A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- B. The supplier is responsible for handing and sizing all products as listed in the door hardware sets. Quantities listed are for each pair of doors, or for each single door.

- C. Products listed in the Door Hardware Sets must meet the requirements described in the specification sections noted.

1. Section 08 71 00 – Door Hardware.

- D. Manufacturer's Abbreviations:

1. MK - McKinney
2. YA - Yale
3. RO - Rockwood
4. PE - Pemko



5. EZ – EZY Jamb

**Hardware Schedule**

**Set: 1.0**

Doors: D102 3' x 7'0" x 1 3/4" HMD X HMF Trio E Door with Kerf Frame (LHR)

3 Hinge	TA314 NRP 4-1/2" x 4-1/2"	US32D	MK	087100
1 Mortise Lock	8807RL TBR	626	YA	087100
1 Surface Closer	3521T	689	YA	087100
1 Threshold	253x3AFG- 36"		PE	087100
1 Gasketing	S773W 18"		PE	087100
1 Gasketing	315CN 26"		PE	087100

**Set: 2.0**

Doors: D103 3' x 6'8" x 1 3/4" WDD X EZ Frame ( 1 LH, 1 RH, 1 LHR)

Description: Bedroom/Bathroom

9 Surface Mounted Invisible Hinge	RocYORK RY-30	US26D	EZ	087100
3 Tubular Lock	TBR3 RL202	626	YA	087100
3 Door Stop	441CU	US26D	RO	087100
9 Silencer	608		RO	087100

**Set: 3.0**

Doors: D104

Description: 4 Dr Bifold Door Track & HW – 5'0" x 6'8"

1 Sliding Door Hdwe	HF4/100A/5		PE	087100
4 Flush Pull	872 US26D			RO
087100				

**Set: 4.0**

Doors: D105

Description: 2-Dr Bifold Door Track 2'6" x 6'8"

1 Sliding Door Hdwe	HF2/100A/2'6"		PE	087100
2 Flush Pull	872 US26D			RO
087100				

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END OF SECTION 08 06 71

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HOLLOW METAL DOORS AND FRAMES

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## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

## B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Flush Wood Doors".
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

## C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.15 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

## 1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
  1. Elevations of each door design.
  2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  4. Locations of reinforcement and preparations for hardware.
  5. Details of anchorages, joints, field splices, and connections.
  6. Details of accessories.
  7. Details of moldings, removable stops, and glazing.
  8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
  1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

## 1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL 10C.
  1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
  2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

3. Smoke Control Door Assemblies: Comply with NFPA 105.
  - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
  1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

#### 1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

#### 1.06 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

#### 1.07 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. CECO Door Products.
  - 2. Curries Company.

### 2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

### 2.03 ENERGY-EFFICIENT HOLLOW METAL DOORS

- a. General: Provide 1-3/4 inch doors of design specified, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- A. Energy Efficient Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
  - 1. Design: Flush panel.
  - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
    - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
    - b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, thermal-break frame and threshold.
      - 1) Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type frame, and threshold.
  - 3. Level/Model: Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch - 1.1-mm) thick steel, Model 2.
  - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

B. Manufacturers Basis of Design:

1. CECO Door Products Trio-E/Trio Series.
2. Curries Company 777 Trio-E/Trio Series.

2.04 ENERGY-EFFICIENT HOLLOW METAL FRAMES

- A. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate from minimum 16 gauge galvanized steel, with positive 3/8" vinyl thermal break and integral vinyl weatherstripping.

1. Manufacturers Basis of Design:

- a. CECO Door Products - Thermal Break SQT and SRT Series.
- b. Curries Company - Thermal Break M and C Series.

2.05 INTERIOR HOLLOW METAL FRAMES

- A. Trimless door frame shall be 20 gage galvanized steel. The installation shall be concealed jointing system with reinforced rolled edge perforated side strips that can be screwed onto wood or steel wall stud.

1. Manufacturer Basis of Design
  - a. EZY Jamb

2.06 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
4. Windstorm Opening Anchors: Types as tested and required for indicated wall types to meet specified wind load design criteria.
5. FEMA 361 Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors.

- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.07 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

## 2.08 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
  - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
  - 2. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
  - 3. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
- D. Hollow Metal Frames:
  - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
  - 3. Knocked Down Frames: Provide frames with locking corner tabs which permit field assembly. Factory install compression type anchors and countersunk screw holes to secure the bottom of the jambs.
  - 4. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 5. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.

6. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
  7. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
  8. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
  9. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  10. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
  11. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.



## 2.09 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

### 3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
  3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
  4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

#### 3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

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END OF SECTION 08 11 13

SECTION 08 14 16  
FLUSH WOOD DOORS

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PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Solid core doors with wood veneer, hardboard or MDF faces.

B. Related Sections:

1. Section 08 11 13 Section "Hollow Metal Doors and Frames".
2. Section 08 71 00 Section "Door Hardware" for door hardware for flush wood doors and hollow metal frames.
3. Section 08 06 71 "Door Hardware Schedule".
4. Division 09 "Painting"

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A208.1 – Wood Particleboard.
2. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.02 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A or AWS classifications. Include factory finishing specifications.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the wood door supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate finish requirements.
4. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
  - a. Provide samples for each species of veneer and solid lumber required.

D. Informational Submittals:

1. Submit manufacturer's environmental documentation and applicable sustainability program credits that are available to contribute towards a LEED rated project certification.
- E. Warranty: Sample of special warranties.
- 1.03 QUALITY ASSURANCE
- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
  - B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
  - C. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.
- 1.04 DELIVERY, STORAGE, AND HANDLING
- A. Comply with requirements of referenced standard and manufacturer's written instructions.
  - B. Package pre-finished doors individually in plastic bags or cardboard cartons and wrap bundles of doors in plastic sheeting.
  - C. Mark each door on top rail with opening number used on Shop Drawings.
- 1.05 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- 1.06 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
    1. Failures include, but are not limited to, the following:
      - a. Warping (bow, cup, or twist) more than **1/4 inch** in a **42-by-84-inch** section.
      - b. Telegraphing of core construction in wood face veneers exceeding **0.01 inch in a 3-inch** span.
      - c. Telegraphing of core construction and delaminating of face in decorative laminate-faced doors.
    2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
    3. Warranty Period for Solid Core Interior Doors: Life of installation according to manufacturer's written warranty.

## PART 2 - PRODUCTS

### 2.01 DOOR CONSTRUCTION – GENERAL

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Environmentally Responsible Doors: Provide where specified doors manufactured with the following environmentally responsible components:
  - 1. Agrifiber Core:
    - a. Rapidly Renewable Materials: Interior wood flush doors to include materials made from agricultural products that are typically harvested within a 10-year or shorter cycle.
    - b. Recycled Content: Interior wood flush doors to contain a minimum of 20% recycled content.
    - c. Regional Materials: Door and agrifiber core manufacturer products or materials have been manufactured and/or extracted, harvested, or recovered within 500 miles of the project site.
    - d. Low Emitting Materials: Interior wood flush doors must contain no added urea-formaldehyde resins.
  - 2. Veneer Face: Forest Stewardship Council (FSC) certified, as available.

### 2.02 CORE CONSTRUCTION

- A. Particleboard Core Doors:
  - 1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
  - 2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
  - 3. Blocking: When through-bolted hardware is not used, provide wood blocking in particleboard core doors as follows:
  - 4. Basis of Design:
    - a. Graham: PC, PC5

### 2.03 DOORS FOR OPAQUE FINISH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eggers Industries.
  - 2. Graham.
  - 3. Marshfield.
  - 4. VT Industries.
- B. Interior Solid Core Doors:
  - 1. Grade: Custom.
  - 2. Faces: Sound closed grain hardwood of mill option, Hardboard or MDF. Face veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
    - a. Hardboard Faces: AHA A135.4, Class 1 (tempered) or Class 2 (standard).
    - b. MDF Faces: ANSI A208.2, Grade 150 minimum.

3. Vertical Edges: Any closed grain hardwood. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
4. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
5. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.

#### 2.04 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  1. Comply with requirements in NFPA 80 for fire rated doors.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

#### 3.03 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

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END OF SECTION 08 14 16

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Out-swing entry doors.

1.02 PERFORMANCE REQUIREMENTS

- A. Doors shall have a certified rating in accordance with WDMA CS2 Hallmark Program Guide for Side-hinged Exterior Door Systems.
- B. Door Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.30 cfm per square foot of frame or less.
- C. Door Unit Water Penetration: No water penetration through door unit when tested in accordance with ASTM E 331 with water applied at rate of 5 gallons per hour per square foot. Doors with standard sill shall have water resistance performance level up to 7.5 psf and low profile sill (ADA) shall have water resistance performance level of 0 psf.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including installation instructions.
- B. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- C. Samples: Submit full-size or partial full-size sample of door illustrating glazing system, quality of construction, and color of finish.
- D. Warranty: Submit manufacturer's standard warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.



## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website [www.pella.com](http://www.pella.com).

### 2.02 OUT-SWING ENTRY DOORS

- A. Out-Swing Entry Doors: Factory-assembled doors with outward-swing door panels installed in frames.
- B. Frames:
  - 1. Select softwood, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the head and jambs.
  - 2. Interior Exposed Surfaces: Aluminum Clad Wood.
  - 3. Exterior Surfaces: Aluminum Clad Wood
  - 4. Sills: Extruded aluminum.
    - a. Aluminum Sills with the following finishes: Nickel Anodized, Bronze Anodized, Brass Anodized, Mill Finish
    - b. Standard sill and ADA Approved sills are available.
  - 5. Frame Dimensions:
    - a. Overall Frame Depth: 5-15/16 inches (150 mm).
    - b. Nail-fin or Brickmould Frame Depth: 4-9/16 inches (116 mm).
    - c. Other Frame Conditions available by Jamb Extending on 1/8" increments up to 9-3/16" inches (233 mm).
- C. Door Panels:
  - 1. Fiberglass Door Panels:
    - a. 0.072-inch minimum fiberglass skin on exterior and interior surfaces with CFC-free injected foam insulating core.
    - b. Rails and Stiles: Wood top rails and stiles and wood plastic composite bottom rails secured with structural adhesive between skins at perimeter.
    - c. Fiberglass Grain: [Mahogany] [Oak] [Smooth].
    - d. Lock Block: 12-inches or greater, solid wood.
    - e. Panel Thickness: 1-11/16 inches (43 mm).
    - f. 20-minute fire panels are Warnock-Hersey labeled.
  - 2. Hardware Preparation
    - a. Factory prepared Multi-point with lock installed
    - b. 2-3/8-inch backset
    - c. 6 inches on center
  - 3. Door Closer and Panic Hardware Reinforcement: Solid reinforcement positioned to support surface-mounted closer and panic hardware.
- D. Weather Strip:
  - 1. Head: Dual-seal weatherstrip shall contact interior face and side of door panel and extruded leaf rain screen shall cover the exterior face of door panel.
  - 2. Jambs: Dual-seal weatherstrip shall contact interior face and side of door panel.
  - 3. Sill: Bristle rain screen at exterior face of door panel with bulb weatherstrip on threshold shall contact interior face of door panel.

## 2.03 GLAZING

- A. Glazing:
  - 1. Float Glass: ASTM C 1036, Quality 1.
    - a. Tempered Glass: ASTM C 1048.
    - b. ASTM E1300 compliant.
  - 2. Type:
    - a. Tempered Insulating Glass: Clear

## 2.04 HARDWARE

- A. Hinges: Three (3) per door panel on 6' 8" and 7' 0" panel heights; four (4) per door panel on 8' 0" heights for operable units].
  - 1. Type:
    - a. 4-inch by 4-inch by 0.100-inch thick cold-rolled steel with non-removal pin.
    - b. 4-inch by 4-inch by 0.130-inch thick aluminum with non-removal pin.
    - c. 4-inch by 4-inch by 0.100-inch thick cold-rolled steel with Ball bearings and non-removal pin.
    - d. 4-inch by 4-inch by 0.100-inch thick cold-rolled steel with spring and non-removal pin.
  - 2. Finish: US26, polished chrome-plated
- B. Frames are prepared for hardware to match door panel boring
- C. Locking Hardware:
  - 1. Multi-point lock mechanism includes stainless steel face plate.
  - 2. Multi-point lock handle set hardware, with Schlage 5-pin configured keyway, is Satin Nickel.

## 2.05 TOLERANCES

- A. Doors shall accommodate the following opening tolerances:
  - 1. Vertical Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
  - 2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
  - 3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

## 2.06 FINISH

- A. Door Frame Exterior Finish System: Pella EnduraClad.
  - 1. Exterior aluminum door frame surfaces shall be finished with the following multi-stage system:
    - a. Clean and etch aluminum surface of oxides.
    - b. Pre-treat with chrome phosphate conversion coating.
    - c. Pre-treat with chromic acid sealer/rinse.
    - d. Prime with baked-on modified polyester primer.
    - e. Top coat with baked-on polyester enamel.
  - 2. Color: Black.
- B. Exterior Finish System Performance Requirements:
  - 1. Exterior aluminum finishes shall meet or exceed the following performance requirements:
    - a. Copper-Accelerated Acetic Acid Salt Spray (Fog) Testing (CASS Test), ASTM B 368.

- b. Ozone Deterioration, ASTM D 1149, Modified: 5 ppm ozone, 160 degrees F, 60 percent relative humidity, 100 hours exposure, little or no loss of cure.
  - c. Filiform Corrosion Resistance of Organic Coatings on Metal, ASTM D 2803: No corrosion.
  - d. Taber Abrasion Resistance, ASTM D 4060: 500 g weight, CS-10 wheel, 500 cycles, less than 25 g weight loss.
  - e. Cyclic Acidified Salt Fog Test, ASTM G 85, Appendix A-2.
- C. Door Panel Exterior Finish:
    - 1. Fiberglass Door Panels: Factory pre-finished, paint; color Black.
  - D. Door Frame Interior Finish: Factory pre-finished, paint; White.
  - E. Door Panel Interior Finish:
    - 1. Fiberglass Door Panels: Factory pre-finished paint; color: Black.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

#### 3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and approved shop drawings.
- B. Install doors to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate door system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with door manufacturer's instructions.
- F. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.
- G. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave doors closed.

#### 3.03 CLEANING

- A. Clean door frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove manufacturer's proprietary labels and visible markings.

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END OF SECTION 08 14 23

ALUMINUM-CLAD WOOD DOORS

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## PART 1 - GENERAL

## 1.01 SECTION INCLUDES

- A. Aluminum-clad wood French hinged doors.

## 1.02 RELATED SECTIONS

- A. Section 07 27 00 - Air Barriers: Water-resistant barrier.
- B. Section 07 92 00 - Joint Sealants: Sealants and caulking.
- C. Section 08 71 00 - Door Hardware.

## 1.03 PERFORMANCE REQUIREMENTS

- A. Doors shall be Hallmark certified to a rating in accordance with ANSI/AAMA/NWWDA 101/I.S.2/A440-08.
- B. Door Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.15 cfm per square foot of frame or less.
- C. Door Unit Water Penetration: No water penetration through door unit when tested in accordance with ASTM E 547, under static pressure of [3.75 psf (40 mph)] [4.5 psf (42 mph)] [6.0 psf (48 mph)] [8.36 psf (57 mph)] [10.66 psf (64 mph)] [0 psf (0 mph)] after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

## 1.04 SUBMITTALS

- A. Comply with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Warranty: Submit manufacturer's standard warranty.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website [www.pella.com](http://www.pella.com).

### 2.02 ALUMINUM-CLAD WOOD DOORS

- A. Aluminum-Clad Wood In-swing French Doors: Architect Series factory-assembled aluminum-clad wood French doors with inward swing door panels installed in frame.

- B. Frame:

- 1. Select woods, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
- 2. Interior Exposed Surfaces: Clear pine, veneered and edge-banded.
- 3. Exterior Surfaces: Clad with aluminum at head and jambs.
- 4. Sill: 1/2-inch low-profile extruded aluminum with bronze anodized finish.
- 5. Overall Frame Depth: 5-7/8 inches (149 mm) to 8-5/16 inches (211 mm).

- C. Frame:

- 1. Select softwood, water-repellent, preservative-treated with EnduraGuard in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
- 2. Interior Exposed Surfaces: Clear pine, veneered and edge-banded with no visible fastener holes.
- 3. Exterior Surfaces: Clad with aluminum at head and jambs. Solid extruded aluminum with built-in elastomeric weep valve system to drain water to exterior. Brown EnduraClad finish at sill with oak insert at threshold.
- 4. Overall Frame Depth: 5-7/8 inches (149 mm).

- D. Door Panel:

- 1. Select woods, water-repellent, preservative-treated with EnduraGuard™ in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the panel.
- 2. Panel Rails and Stiles: Three-ply construction. Randomly finger-jointed blocks laminated with water-resistant glue and veneered both sides.
- 3. Interior Exposed Surfaces: Veneered Douglas Fir.
- 4. Exterior Surfaces: Clad with aluminum.
- 5. Corners: Urethane-sealed and secured with metal fasteners and structural adhesive.
- 6. Panel Thickness: 2-1/16 inches (52 mm).

- E. Weather Strip: Dual-durometer extruded polymer along perimeter of door frames and along the bottom of door panels..

### 2.03 GLAZING

- A. Glazing:

- 1. Float Glass: ASTM C 1036, Quality 1.
  - a. Tempered Glass: ASTM C 1048.
- 2. Type: Urethane-glazed 13/16-inch, dual-seal, fully tempered, insulating glass, clear.

## 2.04 HARDWARE

- A. Handles:
  - 1. Solid brass on interior and exterior.
  - 2. Interior thumb-turn.
  - 3. Schlage configured "C-K" keyway pinlock cylinder on exterior.
  - 4. Finish: Endura Hardware Collection satin nickel
- B. Locking System:
  - 1. Mortised and keyed multi-point locking system.
  - 2. 1-inch center dead bolt and shoot-bolts at head and sill shall engage simultaneously.
- C. Hinges:
  - 1. Corrosion-resistant leaves with wear-resistant hinge bushings and stainless steel pin and decorative cap.
  - 2. Doors with Frame Heights 6' 10" and Under: 3 hinges.
  - 3. Doors with Frame Heights Greater than 6' 10": 4 hinges.

## 2.05 TOLERANCES

- A. Doors shall accommodate the following opening tolerances:
  - 1. Vertical Dimensions Between High and Low Points: Plus 1/8 inch, minus 0 inch.
  - 2. Width Dimensions: Plus 1/8 inch, minus 0 inch.
  - 3. Building Columns or Masonry Openings: Plus or minus 1/8 inch from plumb.

## 2.06 FINISH

- A. Exterior Finish System: Pella EnduraClad.
  - 1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
    - a. Clean and etch aluminum surface of oxides.
    - b. Pre-treat with chrome phosphate conversion coating.
    - c. Pre-treat with chromic acid sealer/rinse.
    - d. Top coat with baked-on polyester enamel.
  - 2. Color: Black.
  - 3. Performance Requirements: Exterior aluminum finishes shall meet or exceed the following performance requirements of AAMA 2605:
    - a. Dry Film Hardness: Eagle Turquoise Pencil, F minimum.
    - b. Film Adhesion: 1/16-inch crosshatch, dry, wet, boiling water.
    - c. Impact Resistance: 1/10-inch distortion, no film removal.
    - d. Abrasion Resistance: Falling sand coefficient value of 20 minimum.
    - e. Chemical Resistance: 10 percent Muriatic acid, 15 minutes. Mortar pat test, 24 hours.
    - f. Detergent Resistance: 3 percent at 100 degrees F, 72 hours.
    - g. Corrosion Resistance: Humidity, 3,000 hours. Salt spray exceeds 3,000 hours.
- B. Interior Finish: Factory finished with 1 prime coat and 1 top coat of White.

## 2.07 INSTALLATION ACCESSORIES

- A. Flashing/Sealant Tape: Pella SmartFlash.
  - 1. Aluminum-foil-backed butyl window and door flashing tape.
  - 2. Maximum Total Thickness: 0.013 inch.

3. UV resistant.
  4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: “Pella Window and Door Installation Sealant” or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

#### 3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and approved shop drawings.
- B. Install doors to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate door system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with door manufacturer's instructions.
- F. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.
- G. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave doors closed and locked with shoot bolts extended.

#### 3.03 CLEANING

- A. Clean door frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove labels and visible markings.

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END OF SECTION 08 14 33



ACCESS DOORS AND FRAMES

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## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

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

## 1.02 SUMMARY

- A. This Section includes wall and ceiling access doors and frames.
- B. Related Sections include Division 23 for heating and air-conditioning duct access doors.

## 1.03 LEED BUILDING GENERAL REQUIREMENTS:

- A. Implement practices and procedures to meet the project's environmental goals, which include achieving a LEED™ 2009 New Construction Silver rating. Specific project goals which may impact this and the other sections of this specification include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; use of certified wood products; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section and other Sections of the contract documents, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes substantially compromise the stated LEED Building criteria.
- B. Comply with LEED (Leadership in Energy and Environmental Design) Green Building Rating System BD+C, Version 3, Silver.

## 1.04 SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.
- C. LEED Building Submittal Requirements: The contractor or subcontractor shall submit the following LEED Building certification items:
  - 1. A completed LEED Building Materials Certification Form, per Section 013300 – Submittal Requirements under the LEED BUILDING Submittal Requirements article of these specifications. Information to be supplied includes:
    - a. The percentage by weight of recycled content in the product(s). Identify post-consumer and/or pre-consumer recycled content.
    - b. The manufacturing location for the product(s); and the location (source) of the raw materials used to manufacture the product(s).

- c. Provide material costs for the materials included in the contractor's or subcontractor's work. Material cost does not include costs associated with labor and equipment.
2. Letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the amount of recycled content.
3. Product Cut Sheets for all materials that meet the LEED Building Performance Requirements this Section.
4. Material Safety Data Sheets (MSDS), for all applicable products. Applicable products include, but are not limited to adhesives, sealants, carpets, paints and coatings applied on the interior of the building. MSDS shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC content, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC content).

#### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.
- C. LEED Building Performance Requirements
  1. Adhesives or sealants used for work in this section for interior applications shall meet the requirements of Division 1, Section 018115: "Volatile Organic Compound (VOC) Limits for Adhesives, Sealants, Paints and Coatings", where applicable.
  2. Materials manufactured within a radius of 500 miles from the project site where all or a portion of the raw resources also originate within a radius of 500 miles shall be documented in accordance with the LEED Building Submittal Requirements of this Section.
  3. Steel materials used for work in this section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the LEED Building Submittal Requirements of this Section.
  4. Materials that contain recycled content shall be documented in accordance with the LEED Building Submittal Requirements of this Section.

#### 1.06 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Access Doors Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Access Panel Solutions, Inc. (APS).
  2. Acudor Products, Inc.

3. Bar-Co, Inc. Div.; Alfab, Inc.
  4. Cendrex, Inc.
  5. Cesco Products.
  6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
  7. Jensen Industries.
  8. J. L. Industries, Inc.
  9. Karp Associates, Inc.
  10. Larsen's Manufacturing Company.
  11. MIFAB Manufacturing, Inc.
  12. Milcor Limited Partnership.
  13. Nystrom Building Products Co.
  14. Precision Plumbing Products, Inc.
  15. Williams Bros. Corporation of America (The).
- B. Fire Rated Access Doors and Frames: Provide fire rated access doors and frames for installation into fire rated walls and ceilings as indicated on Drawings.

## 2.02 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304; with minimum sheet thickness indicated representing specified thickness according to ASTM A 480/A 480M.
- D. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board and gypsum base for veneer plaster.

## 2.03 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

## 2.04 ACCESS DOORS AND FRAMES

- A. Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.
  1. Locations: Ceramic-tile wall surfaces.
  2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with exposed face flange of frame.
  3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
  4. Hinges: Spring-loaded concealed pin type.
  5. Lock: Key-operated cylinder lock.

- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
  1. Locations: Gypsum board and veneer-plaster wall and ceiling surfaces.
  2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
  3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead.
  4. Hinges: Spring-loaded concealed pin type.
  5. Lock: Key-operated cylinder lock.
  
- C. Gasketed Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
  1. Locations: Gypsum board wall and ceiling surfaces where acoustics, air pressure difference, or infection control measures are required.
  2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
  3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead.
  4. Hinges: Spring-loaded concealed pin type.
  5. Gasket: Neoprene or other non-hardening material to provide full air-tight enclosure.
  6. Lock: Key-operated cylinder lock.

## 2.05 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
  
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
  
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
  2. For trimless frames with drywall bead for installation in gypsum board assembly and resin veneer plaster, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
  3. Provide mounting holes in frames to attach frames to metal or wood framing in plaster and drywall construction.
  
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  1. For cylinder lock, furnish two keys per lock and key all locks alike.

## 2.06 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  
- B. Finish metal fabrications after assembly.

## 2.07 STEEL FINISHES

- A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
  1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

- B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

#### 2.08 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Polish: No. 4 finish. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

#### 3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

#### 3.03 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

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END OF SECTION 08 31 13

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**ALUMINUM-CLAD WOOD FRAMED FOLDING WALL SYSTEM**

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**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes engineered sliding and folding wood and glass exterior wall system.
  - 1. Provide engineering design of wall system.

**1.03 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 611.98, Voluntary Specification for Anodized Architectural Aluminum.
  - 2. AAMA 2603.02, Voluntary Specifications, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 3. AAMA 1303.5, Voluntary Specifications for Forced Entry Resistant Aluminum Sliding Glass Doors.
- B. American National Standards Institute (ANSI):
  - 1. ANSI Z97.1, Safety Performance Specifications and Methods of Test for Safety Glazing Material Used In Buildings.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM E 283, Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 2. ASTM E 330, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
  - 3. ASTM E 547, Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
- D. Consumer Product Safety Commission (CPSC):
  - 1. CPSC 16CFR-1201, Safety Standard for Architectural Glazing Materials.
- E. National Fenestration Rating Council (NFRC):
  - 1. NFRC 100, Procedure for Determining Fenestration Product Thermal Materials.
  - 2. NFRC 200, Procedure for Determining Solar Heat Gain Coefficient.

**1.04 SUBMITTALS**

- A. Detail Drawings: Indicate dimensioning, direction of swing, configuration, swing panels, typical head jamb, side jambs and sill details, type of glazing material and handle height.

- B. Product Data: Manufacturer's literature including independently tested data listing performance criteria and Owner's Manual with installation instructions.
- C. Contract Closeout Submittal: Submit Owner's Manual from manufacturer. Identify with project name, location and completion date, type and size of unit installed.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer: Provide complete, precision built, engineered, pre-fitted unit by a single source manufacturer with at least 15 years experience in providing folding/sliding door systems for large openings in the North American market.
- B. Performance Requirements: Unit to comply with applicable manufacturer's independently certified testing results. Testing results include air infiltration in accordance with ASTM E 283, water penetration in accordance with ASTM E 547, structural loading in accordance with ASTM E 330, and forced entry in accordance with AAMA 1303.5 and CAWM 300-96.
- C. Thermal Performance: Unit to comply with the U value, rated, certified and labeled or simulated in accordance with NFRC 100, shown in manufacturer's latest published data for the glazing, sill and direction of opening specified.
- D. Solar Heat Gain Coefficient: Unit to comply with the solar heat gain coefficient, simulated in accordance with NFRC 200, shown in manufacturer's latest published data for the glazing and sill specified.
- E. Installer Qualifications: Installer experienced in the installation of manufacturer's products or other similar products for large openings. Installer to provide reference list of at least 3 projects of similar scale and complexity successfully completed in the last 3 years. Provide project names, locations, completion dates, names and telephone numbers of General Contractor and Owner's contact person.

#### 1.06 WARRANTY

- A. Provide manufacturer's standard warranty against defects in materials and workmanship.
- B. Warranty Period: Ten years for rollers and for seal failure of insulated glass supplied. For all other components, one year (two years if unit is installed by manufacturer's certified trained installer) from date of delivery by manufacturer.

#### 1.07 SITE CONDITIONS, DELIVERY, STORAGE AND HANDLING

- A. In addition to general delivery, storage and handling requirements specified in Division 01, comply with the following:
  - 1. Deliver materials to job site in sealed, unopened cartons or crates. Protect units from damage. Store material under cover, protected from weather and construction activities.
- B. Condition wood components to average prevailing relative humidity before installation.
- C. Do not subject wood components to extreme nor rapid changes in heat or humidity.
- D. Do not use forced heat to dry out building.
- E. Store flat in dry, well ventilated area out of direct sunlight.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Dynamic Architectural Windows & Doors, Inc.
  2. Modernfold, Inc.
  3. Nana Wall Systems, Inc.
  4. Solar Innovations, Inc.

### 2.02 WALL SYSTEM

- A. Nana Wall Systems, Inc., NanaWall WA67 aluminum-clad wood wall system including aluminum clad wood frame; threshold; aluminum clad wood panels; sliding, folding, and locking hardware; splines; weather stripping; glass and glazing; designed to provide an opening glass wall with sizes and configurations as shown on drawings and as specified.
- B. Frame and Panels: From manufacturer's standard profiles, provide head jamb, side jambs, and panels with dimensions shown on drawings.
1. Provide panels with standard one lite.
  2. Provide standard bottom rail.
  3. Type of Wood: Solid, three layer, cross-grained, kiln-dried Douglas fir with matching solid wood glazing stops.
  4. Construction of wood panels to include close tolerance mortise and tenon, glued and pinned corners.
  5. Wood Finish: Clear sand sealed and additional one coat of factory applied clear finish [OR choose from pre-selected two coats of factory applied finishes available from manufacturer]. Finishes to be water based, opened pored.
  6. Aluminum Extrusion: Extrusions with nominal thickness of .098" (2.5 mm). Alloy specified as AlMgSi0.5 with strength rated as 6063-T5 or F-22 (European standard). Anodized conforming to AAMA 611.98 or powder coated conforming to AAMA 2603.02.
  7. Aluminum Finish: Dark bronze anodized E6 C34.
- C. Glass: Provide manufacturer's standard glass and dry glazing with EPDM gaskets and glass stops fixed with hidden nails, 1" (26 mm) insulating clear tempered 1-inch (26 mm) insulating argon filled Low-E tempered] [custom glass specified in Division 08 Section, "Glazing" complying with safety glazing requirements of ANSI Z97.1 and CPSC 16CFR 1201.
1. Provide manufacturer's standard dark bronze anodized, E6 C34 glass spacers.
- D. Locking Hardware and Handles: Provide manufacturer's standard flat handle and concealed two point locking hardware operated by 180 degree turn of handle between each pair of folding panels and on any secondary swing panel. Face applied flush bolt locking will not be allowed.
1. For locking operation from inside only, on main entry swing panel or pair of bi-fold panels, provide manufacturer's standard flat handle and concealed two point locking hardware operated by 180 degree turn of handle.
  2. On the main entry panel for models with a swing panel, provide manufacturer's standard solid brass lever handles in brush chrome finish on the inside and outside, a Schlage compatible lock set with lockable latch, dead bolt and rods at the top and bottom. Rods to be concealed and not edge mounted. Depression of



- handles withdraws latch. Lifting of handles engages rods and turn of key or thumb turn engages deadbolt and operates lock.
3. On the main entry panel for models with a swing panel, provide HEWI 550.33 ADA nylon pull handles with separate lock set and dead bolt. Nylon handle color: closest match to flat handle color from available colors.
  4. Aluminum locking rods with standard fiber glass reinforced polyamide end caps at top and bottom. Rods to have a stroke of 15/16" (24 mm).
  5. Provide handle height centered as shown on Drawings from bottom of panel.
- E. Sliding/Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top, bottom tracks and threshold. All running carriages to be with sealed, self-lubrication, ball bearing multi-rollers. Surface mounted hinges and running carriages will not be allowed. Weight of panels to be borne by the bottom of the track will not be allowed.
1. For each pair of folding panels, for top hung system WA67/o, provide cardanic, independently suspended, four wheeled coated with fiber glass reinforced polyamide upper running carriage and lower guide carriage. Provide sill thermally broken with 3/4" polyamide.
  2. At floor mounted system WA67/u, provide upper guide carriage and lower running carriage with four vertical stainless steel wheels and two horizontal wheels. The vertical wheels to ride on Type 304 stainless steel guide track covers over the full length of sill track and lie above the water run-off level. Carrying capacity of lower running carriage to be 440 lbs.
  3. Provide manufacturer's standard aluminum hinges and spline on edge of panel. For structural strength, hinges to be connected to spline and not directly into wood. Provide stainless steel security hinge pins with set screws.
  4. Adjustment: Provide sliding/folding hardware capable of specified amount of compensation and adjustments without needing to remove panels from tracks, in width, 1/8" (3 mm) per hinge and in height, 1/4" up and down.
  5. Finish for Exposed Hardware: dark bronze anodized, E6 C34.
- F. Weather stripping: Provide manufacturer's standard double layer EPDM or brush seals with a two layer polyamide fin at both the inner and outer edge of door panels or on frame for sealing between panels and between panel and frame.

## 2.03 FABRICATION

- A. Use solid, three layer, cross grained frame and panel profiles connected to exterior aluminum extrusion, hinges and splines, sliding and folding hardware, locking hardware and handles, threshold and track, glass and glazing and weather stripping as specified herein to make a folding glass wall. Factory pre-assemble as is standard for manufacturer and ship with all components and installation instructions.
- B. Sizes and Configurations: Custom dimensions, number of panels, and configurations are indicated on Drawings. Swinging and stacking directions: Indicated on Drawings.

## 2.04 ACCESSORIES

- A. Provide the Opening Screen Wall, a motorized, overhead, retractable, rolling solar/insect screen. Provide weather sealed tubular motor concealed in a roll tube, a three-position switch, a protective box, a load bar and vinyl coated screen. Looking from inside for screens for inward opening units and outside for screens for outward opening units, switches on right [OR left].

## PART 3 - EXECUTION

### 3.01 ERECTION

- A. Because of the large dimensions involved and the weight and movement of the panels, verify the structural integrity of the header such that the maximum deflection with the live load is limited to be the lesser of  $L/720$  of the span and  $\frac{1}{4}$ ".
- B. Examine surfaces of openings and verify dimensions; verify rough openings are level, plumb, and square, with no unevenness, bowing, or bumps on floor.
- C. Installation of units constitutes acceptance of existing conditions.

### 3.02 INSTALLATION

- A. Install frame in accordance with manufacturer's recommendations and installation instructions. Properly flash and waterproof around the perimeter of the opening.
- B. Installer to provide appropriate anchorage devices and to securely and rigidly fit frame in place, absolutely level, straight, plumb and square. Install frame in proper elevation, plane and location, and in proper alignment with other work.
- C. If necessary, provide drain connections from lower track.
- D. Install panels, handles and lock set in accordance with manufacturer's recommendations and installation instructions.
- E. If necessary, adjust hardware for proper operation.
- F. Finishing: Field finish as specified in Division 9 section "Painting"; seal and finish promptly after installation and prior to exposure to weather in accordance with manufacturer recommendations.
- G. Accessories: Screens; install in accordance with screen manufacturer's recommendations and installation instructions.

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END OF SECTION 08 43 33

ALUMINUM-CLAD WOOD CASEMENT AND AWNING WINDOWS

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PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-clad wood casement and awning windows.

1.02 PERFORMANCE REQUIREMENTS

- A. Windows shall be Hallmark certified to a rating of in accordance with ANSI/AAMA/NWDA 101/I.S.2/A440-08.
- B. Window Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.05 cfm per square foot of frame or less.
- C. Window Unit Water Penetration: No water penetration through window unit when tested in accordance with ASTM E 547, under static pressure of 7.5 psf (52 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.03 SUBMITTALS

- A. Comply with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.
- E. Warranty: Submit manufacturer's standard warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website www.pella.com.

### 2.02 ALUMINUM-CLAD WOOD CASEMENT AND AWNING WINDOWS

- A. Aluminum-Clad Wood Casement and Awning Windows: Architect Series factory-assembled aluminum-clad wood windows with outward-opening sash installed in frame and/or fixed unit.

- B. Frame:

- 1. Select woods, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
- 2. Interior Exposed Surfaces: Pine.
- 3. Exterior Surfaces: Clad with aluminum.
- 4. Overall Frame Depth: 5 inches (127 mm).

- C. Sash:

- 1. Select woods, water water-repellent, preservative-treated with EnduraGuard in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the sash.
- 2. Interior Exposed Surfaces: Pine.
- 3. Exterior Surfaces: Clad with aluminum, lap-jointed at corners.
- 4. Corners: Mortised and tenoned, glued and secured with metal fasteners.
- 5. Sash Thickness: 1-3/4 inches (45 mm).

- D. Weather Stripping:

- 1. Dual weather stripping.
- 2. Continuous, flexible, Santoprene material in dual-durometer design.
- 3. Units shall have welded corners, compressed between frame and sash for positive seal on all 4 sides.
- 4. Secondary PVC leaf-type weather strip between sash and frame for positive seals on all 4 sides.

### 2.03 GLAZING

- A. Glazing:

- 1. Float Glass: ASTM C 1036, Quality 1.
  - a. Tempered Glass: ASTM C 1048.
- 2. Type: Silicone-glazed 11/16-inch dual-seal, insulating glass, multi-layer Low-E coated with argon

### 2.04 SCREENS

- A. Insect Screens: Standard.

- 1. Compliance: ASTM D 3656 and SMA 1201.
- 2. Screen Cloth: Vinyl-coated fiberglass, 18/16 mesh.
- 3. Set in aluminum frame fitted to inside of window.
- 4. Complete with necessary hardware.
- 5. Screen Frame Finish: Baked enamel.
  - a. Color: White.

## 2.05 HARDWARE

- A. A. Operator:
  - 1. Steel worm-gear operator with hardened gears.
  - 2. Operator Base: Zinc die cast with painted finish.
  - 3. Operator Linkage, Hinge Slide, and Hinge Arms: 300 series stainless steel.
  - 4. Exposed Fasteners: Stainless steel.
  - 5. External Hardware Salt Spray Exposure, ASTM B 117: Exceed 1,000 hours.
- B. Crank Handle Finish
  - 1. Integrated Folding Crank: Baked enamel, white.
- C. Locking System: SureLock System.
  - 1. Single-handle locking system.
  - 2. Operate positive-acting arms that reach out and pull sash into locked position.
  - 3. Casement Windows: One installed on sash 29 inches and smaller in frame height, 2 unison operating locks installed on sash over 29 inches in frame height.
  - 4. Awning Windows: One installed on sash 29 inches and smaller in frame width, 2 unison operating locks installed on sash over 29 inches in frame width.
  - 5. Lock Handle Finish: Baked enamel, white.

## 2.06 TOLERANCES

- A. Windows shall accommodate the following opening tolerances:
  - 1. Vertical Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
  - 2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
  - 3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

## 2.07 FINISH

- A. Exterior Finish System: Pella EnduraClad.
  - 1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
    - a. Clean and etch aluminum surface of oxides.
    - b. Pre-treat with chrome phosphate conversion coating.
    - c. Pre-treat with chromic acid sealer/rinse.
    - d. Top coat with baked-on polyester enamel.
  - 2. Color: Black.
  - 3. Performance Requirements: Exterior aluminum finishes shall meet or exceed the following performance requirements of AAMA 2605:
    - a. Dry Film Hardness: Eagle Turquoise Pencil, F minimum.
    - b. Film Adhesion: 1/16-inch crosshatch, dry, wet, boiling water.
    - c. Impact Resistance: 1/10-inch distortion, no film removal.
    - d. Abrasion Resistance: Falling sand coefficient value of 20 minimum.
    - e. Chemical Resistance: 10 percent Muriatic acid, 15 minutes. Mortar pat test, 24 hours.
    - f. Detergent Resistance: 3 percent at 100 degrees F, 72 hours.
    - g. Corrosion Resistance: Humidity, 3,000 hours. Salt spray exceeds 3,000 hours.
- B. Interior Finish: Factory finished with 1 prime coat and 1 top coat of White.

## 2.08 INSTALLATION ACCESSORIES

- A. Flashing/Sealant Tape: Pella SmartFlash.
  - 1. Aluminum-foil-backed butyl window and door flashing tape.

2. Maximum Total Thickness: 0.013 inch.
  3. UV resistant.
  4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

#### 3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions and approved shop drawings.
- B. Install windows to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's instructions.
- F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using insulating-foam sealant.
- G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave windows closed and locked.

#### 3.03 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove labels and visible markings.

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END OF SECTION 08 52 13

SECTION 08 71 00  
DOOR HARDWARE

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PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Sliding doors.
  - 3. Other doors to the extent indicated.
  
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Cylinders specified for doors in other sections.
  
- C. Related Sections:
  - 1. Division 08 Section "Door Hardware Schedule".
  - 2. Division 08 Section "Hollow Metal Doors and Frames".
  - 3. Division 08 Section "Flush Wood Doors".
  
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 101 - Life Safety Code.
  - 4. State Building Codes, Local Amendments.
  
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series

1.02 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
  
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. **Organization:** Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. **Content:** Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
  4. **Submittal Sequence:** Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. **Shop Drawings:** Details of electrified access control hardware indicating the following:
1. **Wiring Diagrams:** Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
  2. **Electrical Coordination:** Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. **Keying Schedule:** Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.
- E. **Operating and Maintenance Manuals:** Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of



the installation test to include "as built" modifications made during installation, checkout, and acceptance.

- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

### 1.03 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

- B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

- D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.

- 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

- E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

- 1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

- a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
    - b. Door Closers: Comply with the following maximum opening-force requirements indicated:

- 1) Interior Hinged Doors: 5 lbf applied perpendicular to door.

- 2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
- 2. NFPA 101: Comply with the following for means of egress doors:
  - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
  - b. Thresholds: Not more than 1/2 inch high.
- 3. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 (neutral pressure at 40" above sill) or UL-10C.
  - a. Test Pressure: Positive pressure labeling.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  - 3. Review sequence of operation narratives for each unique access controlled opening.
  - 4. Review and finalize construction schedule and verify availability of materials.
  - 5. Review the required inspecting, testing, commissioning, and demonstration procedures

- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.05 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.06 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  1. Structural failures including excessive deflection, cracking, or breakage.
  2. Faulty operation of the hardware.
  3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  4. Electrical component defects and failures within the systems operation.

- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Twenty five years for manual surface door closers.

#### 1.07 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

### PART 2 - PRODUCTS

#### 2.01 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
  - 1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
    - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
  - B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

#### 2.02 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
      - 1) Out-swinging exterior doors.
  5. Acceptable Manufacturers:
    - a. Hager Companies (HA).
    - b. McKinney Products (MK).
- B. Interior Hinges: Surface mounted invisible hinges
1. Acceptable Manufacturers:
    - a. EZY Jamb (EZ).
    - b. Soss Hinges (SO).
- C. Sliding Door Hardware: Sliding door hardware is to be of type and design as specified and should comply with ANSI/BHMA A156.14.
1. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
  2. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
  3. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
    - a. Acceptable Manufacturers:
      - 1) Pemko Manufacturing (PE).
      - 2) Richards-Wilcox, Inc. (RW).

## 2.03 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
  - 1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU).
    - b. Sargent Manufacturing (SA).
    - c. Yale Locks and Hardware (YA).
- C. Cylinders: Original manufacturer cylinders complying with the following:
  - 1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
  - 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 3. Keyway: Manufacturer's Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:
- E. Key Quantity: Provide the following minimum number of keys:
  - 1. Top Master Key: One (1)
  - 2. Change Keys per Cylinder: Two (2)
- F. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

#### 2.04 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- B. Standards: Comply with the following:
  - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
- C. All door closers specified herein shall meet or exceed the following criteria:
  - 1) General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 10 million cycles in a test witnessed and verified by UL.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
    - a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    - b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    - c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    - d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
  6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.
- D. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC6000 Series.
    - b. Norton Door Controls (NO) - 8500 Series.
    - c. Sargent Manufacturing (SA) - 1431 Series.
    - d. Yale Locks and Hardware (YA) - 3500 Series.

## 2.05 DOOR STOPS AND HOLDERS

- a. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do

not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:
  - a. Rockwood Manufacturing (RO).

## 2.06 ARCHITECTURAL SEALS

- a. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
  - b. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
    - 1) Provide smoke labeled perimeter gasketing at all smoke labeled openings.
  - c. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
2. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
    - A. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
    - B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
    - C. Acceptable Manufacturers:
      1. Pemko Manufacturing (PE).
      2. Zero International (ZE).
    3. ELECTRONIC ACCESSORIES
    - D. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
      1. Acceptable Manufacturers:



- a. Securitron (SU) - BPS Series.

## 2.07 FABRICATION

- a. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.08 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
  - a. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
  - b. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

#### 1. PREPARATION

- C. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- D. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.02 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.03 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.04 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.05 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.06 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.07 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- a. Refer to Section 080671, Door Hardware Schedule, for hardware sets.
  - b. Manufacturer's Abbreviations:

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END OF SECTION 08 71 00

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY

- A. This Section includes the following:
  - 1. Insulating glass units.
- B. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
  - 2. Division 10 Section "Toilet and Bath Accessories" for mirrors.

1.03 QUALITY ASSURANCE

- A. Standards: Comply with applicable provisions and recommendations of:
  - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
  - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
  - 3. CPSC "Safety Standard for Architectural Glazing Materials" (16 CFR 1201).
  - 4. FS DD-G-451, prime glass standard.
- B. Manufacturer's Qualifications: Provide glazing systems produced by a single manufacturer with not less than 5 years successful experience in the fabrication of assemblies of the type and quality required.
- C. Installer's Qualifications: Interior glazed systems shall be installed by a firm that has not less than 5-years successful experience in the installation of systems similar to those required.

1.04 ACTION SUBMITTALS

- A. Samples: Submit 12 inch square samples of each glass product. Submit 6 inch long samples of glazing sealant and glazing tape, for color review.
- B. Manufacturer's Data: Submit manufacturers' technical data and instructions for installing and maintaining each glazing material.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

## 1.05 DELIVERY, STORAGE AND HANDLING

- A. Protect glazing materials and according to manufacturer's written instructions and as needed to prevent damage to glass, glazing and plastic wall panels materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.06 EXTENDED WARRANTIES

- A. General: Submit warranties signed by the respective manufacturers agreeing to repair or replace defective materials or workmanship within the specified warranty periods, starting from the date of substantial completion.
  - 1. Insulating Glass Units: Submit a ten (10) year warranty against defects of each of the insulating glass unit types specified, from manufacturer.
    - a. Defects include but are not limited to loss of seal, interior clouding, discoloration, and other imperfections.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Glazing Manufacturers and Fabricators: Subject to compliance with requirements, firms producing glass products which may be incorporated into the work include the following:
  - 1. Advanced Glazing, Ltd.
  - 2. AFG Industries, Inc.
  - 3. Bendheim Glass.
  - 4. Corning Incorporated.
  - 5. General Glass International (GGI).
  - 6. Guardian Industries Corp.
  - 7. J.E. Berkowitz, LP.
  - 8. LOF Glass, Inc.
  - 9. Pilkington North America.
  - 10. PPG Industries, Inc.
  - 11. Viracon, Inc.

### 2.02 GLASS, GENERAL

- A. Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements for type, class and quality.
- B. Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements. Surface compression of heat strengthened glass shall be in the range of 3500 to 6500 psi.
  - 1. Provide heat treated glass where glass would be vulnerable to thermal breakage and where required for safety of persons.
  - 2. Provide fully tempered or heat strengthened glass where indicated or required by authorities having jurisdiction.
  - 3. Tempered glass shall comply with ANSI Z97.1.
- C. Sizes: Fabricate glass to sizes required, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses to comply with Building Code, and as recommended by glass manufacturer, unless greater thickness is indicated.

## 2.03 PRIMARY GLASS

- A. Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), 1/4 inches (6.4 mm) thick.
- B. Mirror Glass: Clear float glass conforming to specified standard, Quality q1, silvering, 1/4-inches (6.4 mm) thick.

## 2.04 HEAT-TREATED GLASS

- A. Clear, Heat-Treated Float Glass: ASTM C 1048, Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.
  - 1. Kind HS (heat strengthened) where indicated.
  - 2. Kind FT (fully tempered) where indicated.
- B. Tempered Glass: Provide fully tempered glass only where safety glass is mandatory or where design pressures are beyond the capacity of heat strengthened glass. Tempered glass shall be free from inclusions.
  - 1. Provide 1/4-inch (6.4 mm) thick tempered glass where indicated on drawings.
  - 2. Provide 1/2-inch (12.7 mm) thick tempered glass at frameless and sliding glass panel locations.

## 2.05 COATED GLASS

- A. Low-Emittance Coated Vision Glass: ASTM C 1376, coated by vacuum deposition (sputter-coating) process, and complying with other requirements specified.
  - 1. Kind: Kind CV (coated vision glass), except that Kind CO (coated overhead glass) may be used where the lower edge of the glass is more than **6 feet (1.8 m)** above the adjacent floor level or cannot be approached closer than **10 feet (3.0 m)**.
  - 2. Glass: Clear float.

## 2.06 INSULATING GLASS UNITS

- A. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units.
  - 1. Provide Low-E vacuum deposition-coated glass with coating on surface 2.
  - 2. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  - 3. Provide Kind FT (fully tempered) or laminated glass lites where safety glass is indicated.
  - 4. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
  - 5. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 6. Sealing System: Dual seal, with custom color primary and secondary sealants.
  - 7. Spacer: Manufacturer's standard spacer material and construction.
  - 8. Desiccant: Molecular sieve or silica gel, or blend of both.
- B. U-Factor: As indicated.
- C. Solar Heat-Gain Coefficient (SHGC): Provide aluminum windows with a whole-window SHGC maximum of 0.35, determined according to NFRC 200 procedures.

## 2.07 GLAZING MATERIALS

- A. General: Provide standard color of glazing materials as selected by Architect. Comply with manufacturer's recommendations for applications and conditions at time of installation.
- B. Polyurethane Glazing Gasket: Polyurethane gasket or stick tape, color to be selected by Architect, thickness and size as shown on drawings.
- C. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- D. Setting Blocks: Neoprene, silicone or EPDM, 70-90 durometer hardness, with proven compatibility with glazing materials used.
- E. Spacers: Neoprene, silicone or EPDM, 40-50 durometer hardness with proven compatibility with glazing materials used.
- F. Compressible Fillers: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.
- G. Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  - 1. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.

## 2.08 INSULATING-GLASS TYPES

- A. Glass Type: Low-e-coated, clear insulating safety glass.
  - 1. Overall Unit Thickness: 1 inch (25 mm).
  - 2. Thickness of Each Glass Lite: 6.0 mm.
  - 3. Outdoor Lite: Heat-strengthened float glass or Fully tempered float glass.
  - 4. Interspace Content: Air.
  - 5. Indoor Lite: Fully tempered float glass.
  - 6. Low-E Coating: Sputtered on second surface.
  - 7. Visible Light Transmittance: 53 percent minimum.
  - 8. Winter Nighttime U-Factor: 0.26 maximum.
  - 9. Summer Daytime U-Factor: 0.22 maximum.
  - 10. Solar Heat Gain Coefficient: 0.33 maximum.
  - 11. Provide safety glazing labeling.
  - 12. Basis of Design: Viracon VRE 1-59.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Each glazing installation must withstand normal temperature changes, and impact loading without failure of glass, failure of sealants or gaskets, deterioration of glazing materials and other defects in the work.
- B. Protect glass from damage during handling and installation, and subsequent operation of glazed components of the work. Discard units with edge damage or other imperfections.
- C. Glazing channel dimensions are intended to provide for necessary bite on glass, minimum edge clearance, and adequate tape or sealant thicknesses, with reasonable tolerances.

- D. Comply with recommendations by manufacturers of glass and glazing products, except where more stringent requirements are indicated, including those of referenced glazing standards.

### 3.02 PREPARATION

- A. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate.
- B. Where sealants are used, apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

### 3.03 GLAZING

- A. Where indicated, provide spacers for size and spacing required for glass sizes larger than 50 united inches, except where gaskets or pre-shimmed tapes are used for glazing. Provide 1/4 inch minimum bite of spacer on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.
- B. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
- C. Where sealants are used at butt joints, apply sealant in thin continuous clear bead. Tool sealant to a uniform, continuous, even profile.
- D. Unless otherwise indicated mirrors in exercise and athletic rooms shall extend from top of base to ceiling and from wall to wall, with no horizontal joints and a minimum number of vertical joints. Penetrations of mirrors shall be accomplished solely with drilled holes or with cuts in the edge of the mirror. Splicing of mirror pieces is not permitted.

### 3.04 PROTECTION AND CLEANING

- A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- B. Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish Date of Substantial Completion in each area of project. Comply with glass manufacturer's recommendations for final cleaning.

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END OF SECTION 08 80 00



LOUVERS AND VENTS

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes fixed, extruded-aluminum storm-resistant louvers, fixed formed-metal acoustic louvers.
- B. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
  - 2. Division 23 Sections for louvers that are a part of mechanical equipment.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.[ For louvers specified to bear AMCA seal, include printed catalog pages showing AMCA Certified Ratings Seals.]
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
  - 1. Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Louvers, Storm Resistant:
    - a. Airolite Company (The).
    - b. Construction Specialties, Inc., (C/S Group).
    - c. Greenheck.
    - d. Nystrom Building Products.
    - e. Ruskin Company; Tomkins PLC.

2.02 MATERIALS

- A. Aluminum Extrusions: ASTM B 221(ASTM B 221M), alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209(ASTM B 209M), alloy 3003 or 5005.
- C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.03 FABRICATION, GENERAL

- A. Fabricate frames to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to louver blades with fillet welds concealed from view.
- C. Join frame members to each other and to louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view.

## 2.04 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Storm-Resistant Louver.
  - 1. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.5 mm) for blades and 0.080 inch (2.0 mm) for frames.
  - 2. Performance Requirements:
    - a. Free Area: Not less than 8.0 sq. ft. for 48-inch-wide by 48-inch- (1.2-m-) high louver.
    - b. Air Performance: Not more than 0.10-inch wg static pressure drop at 500-fpm free-area velocity.
    - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rain fall rate of 3 inches per hour and a wind speed of 29 mph at a core area intake velocity of 350 fpm.
  - 3. Basis-of-Design Product: C/S Group RS-7315, or a comparable product of one of the specified manufacturers.

## 2.05 LOUVER SCREENS

- A. General: Provide screen at interior face of each exterior louver.
- B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening:
  - 1. Bird Screening: Aluminum or stainless steel, 1/2-inch- (12.7-mm-) square mesh, 0.063-inch (1.6-mm)-wire.

## 2.06 FINISHES

- A. Aluminum, High-Performance Organic Finish: Two-coat thermocured system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
  - 1. Color and Gloss: As selected from manufacturer's full range.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

- C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- E. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

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END OF SECTION 08 90 00

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.02 PANEL PRODUCTS

- A. Provide in maximum lengths available to minimize end-to-end butt joints.
- B. Interior Gypsum Board: ASTM C 1396/C 1396M, in thickness indicated, with manufacturer's standard edges. Regular type unless otherwise indicated Sag-resistant type for ceiling surfaces.
  - 1. Core: Regular
  - 2. Surface Paper: 100% recycled content paper on front, back and long edges
  - 3. Long Edges: Square
  - 4. Overall thickness: 5/8 inch
  - 5. Manufacturers:
    - a. American Gypsum.
    - b. CertainTeed Corp.
    - c. Georgia-Pacific Gypsum LLC.
- C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, in thickness indicated. Regular type unless otherwise indicated.
  - 1. Core: mold and moisture resistant gypsum core
  - 2. Surface Paper: 100% recycled content moisture/mold/mildew resistant paper on front, back and long edges
  - 3. Long Edges: Square
  - 4. Overall thickness: 5/8 inch
  - 5. Manufacturers:
    - a. American Gypsum.
    - b. CertainTeed Corp.
    - c. Georgia-Pacific Gypsum LLC.
- D. Cementitious Backer Units: ANSI A118.9, ASTM C 1288, or ASTM C 1325 compliant

1. Overall Thickness: ½ inch
  2. Install in all locations receiving tile finish material or as indicated in drawings.
  3. Retain option in "Products" Subparagraph below to limit products to those listed.
  4. Products:
    - a. C-Cure; C-Cure Board 990.
    - b. CertainTeed Corp.; Fiber Cement
    - c. USG Corporation; DUROCK Cement Board.
- E. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
1. Provide corner bead at outside corners unless otherwise indicated.
  2. Provide LC-bead (J-bead) at exposed panel edges.
  3. Provide control joints where indicated.
- F. Joint-Treatment Materials: ASTM C 475/C 475M.
1. Joint Tape: Paper unless otherwise recommended by panel manufacturer.
  2. Joint Compounds: Drying-type, ready-mixed, all-purpose compounds or Setting-type taping compound and drying-type, ready-mixed, compounds for topping.
  3. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
  4. Cementitious Backer Unit Joint-Treatment Materials: Products recommended by cementitious backer unit manufacturer.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install gypsum board to comply with ASTM C 840.
1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
  2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.
- B. Install cementitious backer units to comply with ANSI A108.11.
- C. Finishing Gypsum Board: ASTM C 840.
1. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.
  2. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
  3. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.
  4. Where indicated, provide Level 5 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges. Apply skim coat to entire surface.
- D. Cementitious Backer Units: Finish according to manufacturer's written instructions.

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END OF SECTION 09 29 00

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Obtain tile of each type and color or finish from same production run for each contiguous area
- C. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

## PART 2 - PRODUCTS

## 2.01 CERAMIC TILE

- A. Ceramic tile that complies with Standard grade requirements in ANSI A137.1, "Specifications for Ceramic Tile."
- B. Tile Type CT-1: Factory-mounted, impervious natural clay or porcelain cushion-edged ceramic mosaic tile.
  - 1. Manufacturers: Fireclay Tile
    - a. Fireclaytile.com
  - 2. Basis-of-Design Product: Recycled Ceramic Tiles, Debris Series
  - 3. Module Size: 2 by 8 inch
  - 4. Surface: Smooth.
  - 5. Finish: White Gloss glaze.
  - 6. Grout Color: As selected.
  - 7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile.
- C. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.
  - 1. One soap holder for each shower and tub indicated.
  - 2. Color and Finish: Match adjoining glazed wall tile .

## 2.02 GLASS TILE

- A. Glass Tile Type GT-1:
  - 1. Manufacturers: Eco Friendly Flooring, Inc.
    - a. Ecofriendlyflooring.com
    - b.
  - 2. Basis-of-Design Product: Recycled Glass Tiles
  - 3. Module Size: 1 by 1 inch
  - 4. Surface: Smooth.
  - 5. Finish: Sky Glossy 132.

## 2.03 STONE THRESHOLDS

- A. Stone Threshold Type TH-1:
  - 1. Stone Type: carrera marble, complying with ASTM C 1527, Classification II, Interior.
  - 2. Color: White.
  - 3. Finish: Honed.
  - 4. Fabricate thresholds to be not more than 1/2 inch above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

## 2.04 INSTALLATION MATERIALS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, 1/2 inch thick.
  - 1. Products:
    - a. USG Corporation; DUROCK Cement Board.
- B. Low-Emitting Materials: Adhesives and fluid-applied waterproofing membranes shall have a VOC content of 65 g/L or less.
- C. Low-Emitting Materials: Adhesives and fluid-applied waterproofing membranes shall comply with Green Seal's GS-36 and with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Setting and Grouting Materials: Comply with material standards in ANSI's "Specifications for the Installation of Ceramic Tile" that apply to materials and methods indicated.
  - 1. Thin-Set Mortar Type: latex-portland cement.
  - 2. Thin-Set Mortar Type for Wood Subfloors: EGP latex-portland cement.
  - 3. Grout Type: Standard cement, unless otherwise indicated.
  - 4. Grout Type: Polymer modified, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For installations indicated below, follow procedures in ANSI's "Specifications for the Installation of Ceramic Tile" for providing 95 percent mortar coverage.
    - a. Tile floors in wet areas.
- B. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- C. Lay tile in grid pattern unless otherwise indicated. Align joints where adjoining tiles on floor, base, walls, and trim are the same size.
- D. Install cementitious backer units and treat joints according to ANSI A108.11.

- E. Install waterproofing to comply with ANSI A108.13.
- F. Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
- G. Interior Floor Tile Installation Method(s):
  - 1. Over Wood Subfloors: TCA F144 (thin-set mortar bonded on cementitious backer units or fiber cement underlayment) TCA F150/160 (thin-set mortar on exterior-glue plywood).
  - 2. Over Waterproof Membranes on Wood Subfloors: TCA F121 (cement mortar bed).
- H. Interior Wall Tile Installation Method(s):
  - 1. Over Wood Studs or Furring: TCA W244 (thin-set mortar on either cementitious backer units or fiber cement underlayment).
  - 2. Bathtub/Shower Wall Installations, Wood Studs or Furring: TCA B412 (thin-set mortar on either cementitious backer units or fiber cement underlayment).

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END OF SECTION 09 30 00



ACOUSTICAL PANEL CEILINGS

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PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 09 Section "Gypsum Board" for gypsum board ceilings and soffits.

1.02 SUBMITTALS

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

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.05 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS

- A. Acoustical Panel Standard: Provide manufacturer's standard size panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring Noise Reduction Coefficient: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Manufacturers:
1. Armstrong World Industries, Inc.
  2. Certainteed Corporation.
  3. USG Interiors, Inc.
- C. **ACT-01:** Water-Felted, Mineral Base Acoustical Panels with smooth, monolithic fine texture for general use in offices, community room, and computer room. Provide acoustical panels complying with the following:
1. Product "Ultima"; Item 1912, non-sag type as manufactured by Armstrong World Industries.
  2. Classification: Panels fitting ASTM E1264 for Type IV, Form 2, Pattern- E.
  3. Color: White
  4. Surface Finish: Manufacturer's standard factory applied finish.
  5. Light Reflectance Coefficient: 0.90.
  6. Noise Reduction Coefficient: 0.70.
  7. Ceiling Attenuation Coefficient: 35.
  8. Edge Detail: Beveled tegular to fit Interlude 9/16-inch grid.
  9. Thickness: 3/4-inch.
  10. Size: 24 x 24-inches.

## 2.02 SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard indirect-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
1. International Building Code requirements for Seismic Design Category C.
- C. Manufacturers:
1. Armstrong World Industries, Inc.
  2. Chicago Metallic Corporation.
  3. USG Interiors, Inc.
- D. Systems: Subject to compliance with requirements and as scheduled, provide:
1. "Prelude XL" 15/16-inch exposed tee system as manufactured by Armstrong World Industries, or equal products of one of the specified manufacturers.
- E. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
  2. End Condition of Cross Runners: Override (stepped) type.
  3. Face Design: Flat, flush.
  4. Cap Material: Steel cold-rolled sheet.
  5. Cap Finish: Painted white.
- F. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Indirect Hung, unless otherwise indicated.

- G. Direct Clip: BSA #548-58 SM.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Coordination: Furnish layouts for clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.03 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
  - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
  - 2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
  - 3. Direct clip to metal suspension members.
  - 4. Space clips not more than 48 inches (1200 mm) o.c. along each member supported directly from metal suspension members, unless otherwise indicated; and provide direct clips not more than 8 inches (200 mm) from ends of each member.
- B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- C. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- D. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.

2. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
3. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.

3.04 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

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END OF SECTION 09 51 13

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
  - 1. Field-finished wood flooring.

- B. Related Sections:

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor assembly and accessory. Include plans, elevations, sections, details, and attachments to other work. Include expansion provisions and trim details.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.
  - 1. Certification: Provide flooring that carries NOFMA grade stamp on each bundle or piece.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.05 PROJECT CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
  - 1. Environmental Conditioning: Maintain an ambient temperature between **65 and 75 deg F (18 and 24 deg C)** and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
  - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.

- a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
  - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.01 FIELD-FINISHED WOOD FLOORING

- A. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.
- 1. Species and Grade: Select red oak.
  - 2. Cut: Plain sawn.
  - 3. Thickness: 3/4 inch (19 mm).
  - 4. Face Width: 5-1/8 inches (130 mm).
  - 5. Lengths: Random-length strips complying with applicable grading rules.
- B. Urethane Finish System: Complete water-based system of compatible components that is recommended by finish manufacturer for application indicated.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Basic Coatings, Inc.
    - b. BonaKemi USA Inc.
    - c. Dura Seal, Sherwin-Williams Company (The).
    - d. Hillyard, Inc.
  - 2. VOC Content: When calculated according to 40 CFR 59, Subpart D (EPA Method 24), as follows:
    - a. Finish Coats and Floor Sealers: Not more than 350 g/L.
    - b. Stains: Not more than 250 g/L.
  - 3. Floor Sealer: Pliable, penetrating type.
  - 4. Finish Coats: Formulated for multicoat application on wood flooring.
- C. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

### 2.02 ACCESSORY MATERIALS

- A. Wood Underlayment: As specified in Section 06 16 00 "Sheathing."
- B. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 8.0 mils (0.2 mm) thick.

- C. Asphalt-Saturated Felt: ASTM D 4869, Type II.
- D. Fasteners: As recommended by manufacturer, but not less than that recommended in NWFA's "Installation Guidelines: Wood Flooring."
- E. Thresholds and Saddles: To match wood flooring. Tapered on each side.
- F. Reducer Strips: To match wood flooring. 2 inches (51 mm) wide, tapered, and in thickness required to match height of flooring.
- G. Cork Expansion Strip: Composition cork strip.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.03 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
- B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch (19 mm).
- C. Vapor Retarder: Comply with NOFMA's "Installing Hardwood Flooring" for vapor retarder installation and the following:
  - 1. Wood Flooring Nailed to Wood Subfloor: Install flooring over a layer of asphalt-saturated felt.
- D. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
  - 1. For flooring of face width more than 3 inches (75 mm):
    - a. Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.

### 3.04 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

1. Comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring."
- B. Fill open-grained hardwood.
- C. Fill and repair wood flooring seams and defects.
- D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
  1. Apply stains to achieve an even color distribution matching approved Samples.
  2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.
- E. Cover wood flooring before finishing.
- F. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

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END OF SECTION 09 64 00



SECTION 09 65 10  
RESILIENT FLOORING

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PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring and accessories.

1.02 SUBMITTALS

- A. Product Data: Provide detailed data on each product to be used including but not limited to the following information as applicable:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance recommendations.
- B. Selection Samples: For each finish product specified, two sets of each type, colors and finish of resilient flooring and accessory required, indicating full range of color and pattern variation.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Flooring material and adhesive shall be acclimated to the installation area for a minimum of 48 hours prior to installation.
- C. Store cartons of tile products flat and squarely on top of one another, not on edge

1.04 PROJECT CONDITIONS

- A. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations. Areas to receive flooring shall be clean, fully enclosed, weather tight with the permanent HVAC set at a uniform temperature of at least 65 degrees F (18 degrees C) and less than 85 degrees (30 degrees C) 48 hours prior to and during and for not less than 48 hours after installation. The flooring material shall be conditioned in the same manner prior to installation.
- B. Close spaces to traffic during resilient flooring installation and for a period of time after installation as recommended in writing by the manufacturer.
- C. Install resilient flooring materials and accessories after other finishing operations, including painting, have been completed.
- D. Where demountable partitions and other items are indicated for installation on top of sheet resilient flooring material, install flooring material before these items are to be installed.

- E. WARRANTY

- F. Warranty Period: Manufacturer's standard warranty against manufacturing defects and wearing for flooring and as follows:
  - 1. Van Gogh Range:
    - a. 10 year commercial warranty.
    - b. 15 year residential warranty.

#### 1.05 EXTRA MATERIALS

- A. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 closeout submittals requirements.
  - 1. Quantity: Furnish quantity of flooring units equal to 2 percent of amount installed. Karndean Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Karndean Design Flooring, which is located at: 1100 Pontiac Court ; Export, PA 15632; Toll Free Tel: 888-266-4343; Fax: 800-887-7043; Email: [request info \(michael.lang@karndean.com\)](mailto:michael.lang@karndean.com); Web: [www.karndean.com](http://www.karndean.com)
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

#### 2.02 RESILIENT TILE FLOORING

- A. Resilient Tile Flooring: Knight Tile Range Planks by Karndean Design Flooring.
  - 1. Dimensions: 36 inches by 4 inches (915 mm by 102 mm).
  - 2. Material Compliance: ASTM F 1700, BS EN 649, BSEN 654.
    - a. Reaction to Fire: ASTM E 662, ASTM E 648.
    - b. Slip Resistance: ASTM C 1028, R9 classification.
  - 3. Antimicrobial Properties: AATCC Method 174, Part 174.
  - 4. Wear Layer Thickness: 12 mil (0.3 mm).
  - 5. Tile Thickness: 2 mm.
  - 6. Edge: Non-beveled edge.
  - 7. Item Number and Name:
    - a. KP32 Sycamore.
- B. Resilient Tile Flooring: Van Gogh Range Planks by Karndean Design Flooring.
  - 1. Dimensions: 48 inches by 7 inches (1219 mm by 178 mm).
  - 2. Material Compliance: ASTM F 1700, BS EN 649, BSEN 654.
    - a. Reaction to Fire: ASTM E 662, ASTM E 648.
    - b. Slip Resistance: ASTM C 1028, R9 classification.
  - 3. Antimicrobial Properties: AATCC Method 174, Part 174.
  - 4. Wear Layer Thickness: 20 mil (0.5 mm).
  - 5. Tile Thickness: 3 mm.
  - 6. Edge: Non-beveled edge.
  - 7. Item Number and Name:
    - a. VGW33 Copper Gum.

## 2.03 ACCESSORIES

- A. Karndean Floor Care Kit with cleaning and maintenance products in quantities appropriate to size and scope of resilient flooring application are available but not required.
- B. Adhesive: Manufacturer's recommended adhesive as follows.
  - 1. Karndean Epoxy adhesive.
    - a. Provide manufacturer's recommended concrete floor sealer for high moisture applications.
  - 2. Karndean KNA 332 acrylic "wet set" adhesive.
    - a. Provide manufacturer's recommended concrete floor sealer for high moisture applications.
  - 3. Karndean K-91A pressure sensitive adhesive.
    - a. Provide manufacturer's recommended concrete floor sealer for high moisture applications.
- C. Portland based cementitious base leveler. Gypsum based not acceptable.
- D. Manufacturer approved substrate board.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Inspect floor to be installed immediately upon arriving at job site; perform a moisture test.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. The installation of the resilient flooring shall not begin until the work of all other trades has been completed, particularly wet and overhead trades.
- E. Areas to receive flooring shall be adequately lighted during all phases of the installation process.

### 3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Using Portland based cementitious base leveler fill and cover all seams, nail heads, voids, cracks, and expansion joints. Achieve smooth, even, firmly attached substrate for best finish results. Gypsum based underlayment not acceptable with Karndean Luxury Vinyl Flooring unless it is first properly prepared.
  - 1. Encapsulate the gypsum with a premium latex primer/sealer.
  - 2. Float with a Portland cement compound using a latex additive (as recommended by the manufacturer) instead of water.
  - 3. Once substrate levelness is achieved continue with the next step.
- C. Apply concrete floor sealer to substrate in accordance with manufacturer's recommendations.

D. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

E. INSTALLING RESILIENT TILES AND PLANKS

F. General:

1. Karndean does not mandate any one brand of resilient flooring underlayment. Permanent HVAC system shall be turned on and set to a minimum of 65 degrees F (20 degrees C) for a minimum of 48 hours prior to, during and 48 hours after installation. After the installations, the maximum temperature should not exceed 125 degrees F (37 degrees C).
2. All products must be allowed to acclimate at least 24 to 48 hours before installation. This means product must be placed in the same room as the install that is taking place and removed from its factory packaging.
3. Material shall be visually inspected prior to installation.
4. Install in accordance with manufacturer's installation instructions for each product type and application specified.

G. Layout and Installation:

1. In order to achieve a random natural wood look, take planks and cut nominal lengths to be used on the first course; example: 10 inches (254 mm), 40 inches (1016 mm), 15 inches (381 mm), 25 inches (635 mm), 8 inches (203 mm). At the end of the first course, all cut planks remaining should be used on the next course. Position planks so the end seams are no closer than the width of the plank being installed. Maintain this approach to staggering the planks throughout the entire installation.
2. Center tiles or planks in rooms and hallways so borders are not less than half a tile or plank when possible.
3. Cut edges shall always be installed against a wall.
4. Install using tile and plank installation techniques recommended by manufacturer.
5. Install tiles, planks, borders and feature strips in locations and configurations indicated on the Drawings.

H. Adhesive Application:

1. Any spread glue has to be covered with material and rolled within the recommended time frame described on the adhesive container.
2. If troweled adhesive skims over, scrape up and reapply.
3. Install in accordance with adhesive manufacturer's recommendations.

3.03 CLEANING

- A. Wipe off any adhesive on floor as installation proceeds. Wait 48 hours before applying the cleaning and maintenance products.
- B. Prior to installation of permanent fixtures or furniture, remove all dirt, debris, or residual adhesive and clean the floor. If desired, a protective coating may be applied at this time. Specific products and instructions are available from the manufacturer.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 MAINTENANCE

- A. Comply with manufacturer's instructions for proper cleaning and maintenance of the products.

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END OF SECTION 09 65 10

SECTION 09 91 23  
INTERIOR PAINTING

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data. Include printout of MPI's "MPI Approved Products List" with product highlighted.
  - 2. Samples.
- B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.
- C. Extra Materials: Deliver to Owner 1 gal. of each color and type of finish coat paint used on Project, in containers, properly labeled and sealed.
- D. Compliance:
  - 1. Interior paints and coatings shall comply with the following limits for VOC content:
    - a. Flat Paints and Coatings: 50 g/L.
    - b. Nonflat Paints, Coatings: 50 g/L.
    - c. Primers, Sealers, and Undercoaters: 100 g/L
    - d. Pretreatment Wash Primers: 300 g/L.

PART 2 - PRODUCTS

2.01 PAINT

- A. Primer
  - 1. Benjamin Moore & Co. Classic Colors Eco-Spec® WB
  - 2. Paint Line: Primer N372
- B. Wall and Ceiling Paint
  - 1. Benjamin Moore & Co. Classic Colors Eco-Spec® WB
  - 2. Paint Line: Flat Finish N373
  - 3. Color: "Cream Froth" No. 2158-70
  - 4. Description: off-white, premium-quality, odorless, zero-VOC paint.
- C. Interior Wood Door Paint
  - 1. Benjamin Moore & Co. Classic Colors Eco-Spec® WB
  - 2. Paint Line: Flat Finish N373
  - 3. Color: "Delightful Golden" No. 2158-30
  - 4. Description: off-white, premium-quality, odorless, zero-VOC paint.
- D. Accent Wall Paint
  - 1. Benjamin Moore & Co. Classic Colors Eco-Spec® WB
  - 2. Paint Line: Flat Finish N373
  - 3. Color: "Blue Heather" No. 1620 or "Amsterdam" AF-550
  - 4. Description: off-white, premium-quality, odorless, zero-VOC paint.

- E. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."
- F. Material Compatibility: Provide materials that are compatible with one another and with substrates.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.
- C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

#### 3.02 APPLICATION

- A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Paint exposed surfaces unless otherwise indicated.
  - 1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
  - 2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint the back side of access panels.
  - 4. Color-code mechanical piping in accessible ceiling spaces.
  - 5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.
- C. Apply paints according to manufacturer's written instructions.
  - 1. Use brushes only for exterior painting and where the use of other applicators is not practical.
  - 2. Use rollers for finish coat on interior walls and ceilings.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
  - 1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

---

END OF SECTION 099123

EXTERIOR STAINING AND FINISHING

---

## PART 1 - GENERAL

## 1.01 SECTION INCLUDES

- A. Submittal: Product Data, Selection Samples, Verification Samples.
- B. Quality Assurance
  - 1. Installer qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
  - 2. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship. Provide samples that designate primer and finish coats.
- C. Project Conditions
  - 1. 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.
- D. Extra Materials
  - 1. Furnish one percent of each material and color to the Owner, but not less than 1 gal or 1 case, as appropriate.

## PART 2 - PRODUCTS

## 2.01 STAINS

- A. Siding & Decking Stain
  - 1. Materials: wood siding (western red cedar), railings (western red cedar), and decking and deck skirts (western red cedar)
  - 2. Manufacturer: Sikkins
  - 3. Stain: Cetol Water based SRD translucent wood finish
    - a. Finish: Clear, No. SIK77000
    - b. Color: Cedar, No.77
    - c. Coats: 1
    - d. Description: contains an optimal amount of translucent iron oxide pigments and UV light stabilizers

## PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.



- B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

### 3.02 SURFACE PREPARATION

- A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

### 3.03 INSTALLATION

- A. Apply all coatings and materials with manufacture specifications in mind. Mix and thin coatings according to manufacturer's recommendations.
- B. Do not apply to wet or damp surfaces.
- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. The coated surface must be inspected and approved by the Architect immediately prior to each coat.

### 3.04 PROTECTION

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

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END OF SECTION 09 93 13

RESIDENTIAL BATH ACCESSORIES

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

## PART 2 - PRODUCTS

## 2.01 TOILET TISSUE DISPENSER

- A. Toto Soiree Toilet Paper Holder
  1. Model No: YP960#CP
  2. Type: Single-roll dispenser
  3. Mounting: Surface mounted with concealed anchorage
  4. Material/Finish: Polished Chrome

## 2.02 MIRROR UNIT

- A. Pegasus Jameson 20 in. x 26 in. Rectangular Mirror
  1. Frame: Brushed nickel, adjustable tilt
  2. Manufacturer Model #: 130-26-121-25
  3. Manufacturer Part #: 130-26-121-25

## 2.03 ROBE HOOK

- A. Toto Soiree Robe Hook
  1. Model No: YH960#CP
  2. Material/Finish: Polished Chrome

## 2.04 TOWEL BAR

- A. Toto Soiree Towel Bar
  1. Model No: YB960#CP
  2. Material/Finish: Polished Chrome
  3. Mounting: Flanges with concealed fasteners.
  4. Install Length: 25.4 inches

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated in drawings.
  1. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

- B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.
- C. Repair, refinish, or replace finishes damaged during installation or transit, as directed by Architect.

---

END OF SECTION 10 28 16

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Provide wire type shelving systems complete.
- B. Related requirements specified elsewhere include structural backing in walls – Division 06 Section, Rough Carpentry, or Division 09 Section, Gypsum Board Assemblies.

1.03 QUALITY ASSURANCE

- A. Reference Standards: Manufacturer's specifications and recommendations.
- B. Manufacturer
  1. Clairson International.
  2. Lee/Rowan Company.
  3. Schulte Corporation.
  4. Approved equal.

1.04 SUBMITTALS

- A. Catalogue data.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Storage Units: Clairson "Closet Maid" vinyl-coated, or Lee/Rowan epoxy-coated, or Schulte epoxy-coated, steel rod assemblies, colors as selected.
- B. Ancillary Materials: Manufacturer's standard interconnecting hardware, anchor clips, and brackets as required. Provide self-tapping screws, lengths as required to anchor into wood backing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install with screws into wall framing and blocking (drywall anchors are not acceptable).
- B. Components shall be level, in alignment and securely anchored.

---

END OF SECTION 10 57 00

RESIDENTIAL EQUIPMENT

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Comply with NFPA 70, "National Electrical Code."

PART 2 - PRODUCTS

2.01 CEILING FAN

- A. Modern Fan Company
  1. Product Name: Lapa
  2. Finish: Bright Nickel
  3. Blade length: 42"
  4. Blade color: Nickel
  5. No light

2.02 ACCESSORIES

- A. Downrod
  1. Use appropriate length downrod to have blade height at 8'-0" above finished floor.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install as per manufacturer's instructions.

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END OF SECTION 11 30 00

RESIDENTIAL APPLIANCES

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

## PART 2 - PRODUCTS

## 2.01 RESIDENTIAL APPLIANCES

- A. Regulatory Requirements: Comply with the following:
  - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC A117.1.
- C. Electric Cooktop: 30-inch, built-in cooktop with four burner elements.
  - 1. Manufacturers: LG
  - 2. Product Number: LCE30845
  - 3. Dimensions: 21 1/2" x 23 3/16" x 30 3/16"
  - 4. Finish: Stainless Steel
- D. Electric Wall Oven: Built-in, single, electric, self-cleaning wall oven with broiler unit.
  - 1. Manufacturers: LG
  - 2. Product Number: LWS3030ST
  - 3. Dimensions: 24 3/8" x 29 5/16" x 29 3/4"
  - 4. Finish: Stainless Steel
- E. Microwave Oven: Built-in microwave oven, 1.6-cu. ft capacity, 1000 W.
  - 1. Manufacturers: LG
  - 2. Product Number: LMV1683
  - 3. Dimensions: 15 11/16" x 16 7/16" x 29 15/16"
  - 4. Finish: Stainless Steel
- F. Exhaust Hood: 36-inch, suspended-island-canopy exhaust hood with three-speed automatic fan.
  - 1. Manufacturers: Kitchen Aid
  - 2. Product Number: KXI2536YSS
  - 3. Dimensions: 27" x 36" x 51"
  - 4. Finish: Stainless Steel
- G. Refrigerator/Freezer: Freestanding,, two-door refrigerator with top-mounted freezer, interior cabinet liners.
  - 1. Manufacturers: LG
  - 2. Product Number: LTC19340

3. Color: Stainless Steel
  4. Fresh Food Compartment Volume: 13.4 cu. Ft.
  5. Freezer Compartment Volume: 5.4 cu. Ft.
  6. Shelf Area: 2 adjustable glass shelves,.
  7. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- H. Dishwasher: Built-in, under counter, automatic dishwasher, sized to replace 24-inch base cabinet, 7 wash cycles with hot-air and heat-off drying cycles.
1. Manufacturers: LG
  2. Product Number: LDF8072ST
  3. Color: Stainless Steel
  4. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- I. Clothes Washer: Freestanding, Front-loading, automatic clothes washer with 3.6-cu. ft. capacity stainless-steel tub and 9 wash cycles including regular.
1. Manufacturers: LG
  2. Product Number: WM2655HVA
  3. Color: Stainless Steel
  4. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- J. Electric Clothes Dryer: Freestanding, front-loading clothes dryer,7.3-cu. ft. capacity with stainless-steel interior.
1. Manufacturers: LG
  2. Product Number: DLEX2655V
  3. Color: Stainless Steel

## PART 3 - EXECUTION

### 3.01 INSTALLATION

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

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END OF SECTION 11 31 00

POLYETHYLENE CASEWORK

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## PART 1 - GENERAL

## 1.01 DESCRIPTION OF WORK

- A. All polyethylene casework shall be furnished, installed and shall be demonstrated to properly perform in accordance with the specifications stated herein.

## 1.02 PRODUCTS

- A. Polyethylene Casework of a Stock or Custom Design.

## 1.03 RELATED SECTIONS

- A. Section "Rough Carpentry" for wood blocking to anchor manufactured polyethylene casework.
- B. Section "Solid Surface Fabrications" for countertops, including backsplash.

## 1.04 PRODUCT HANDLING

- A. Schedule delivery of polyethylene casework after installation area is sufficiently complete to allow for immediate installation.
- B. Protect finished surfaces from soiling or damage during handling and installation with a protective covering.

## 1.05 SUBMITTALS

- A. Product Data: Manufacturer's data and installation instructions on each item of casework to be used. Include component dimensions and configurations, construction details, description of joinery, preparation and installation instructions and maintenance recommendations.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show fabrication details, including types and locations of hardware. Show installation details, including filler panels. If available, indicate manufacturer's catalog numbers for casework.
- C. Samples: Submit samples of polyethylene panel material and the full range of colors available.

## 1.06 REFERENCES

- A. Comply with all applicable trade standards, ordinances, building codes and regulations and those standards and references listed (where applicable).
- B. Approval for Food-Safe Contact from the Food and Drug Administration (FDA).



- C. Meet or exceed standards established by American Nat'l Stand. Institute/Business & Institutional Furniture Mfr. Assoc. (ANSI/BIFMA) for casework, X5.9-2004 – Storage Units.
  - D. Adjustable to ADA Height Requirements of 33-1/2".
- 1.07 WARRANTY
- A. Polyethylene casework and hardware shall be warrantied for a period three (3) years, from the date of delivery by Manufacturer, and shall cover only defects in material and/or workmanship.
  - B. Defects reported to Manufacturer in writing prior to the expiration of the warranty period shall be repaired or replaced at Manufacturer's option.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Acceptable Manufacturer. Wer/Ever Products, Inc., 3900 South 50<sup>th</sup> Street, Tampa, Florida 33619, (888) 324-3837, [www.werever.com](http://www.werever.com). All polyethylene casework shall be the product of one manufacturer and shall be fabricated at one geographic location to ensure product consistency, shipping continuity, and single-source responsibility.
- B. Products of other polyethylene casework manufacturers may be used as an approved equal provided they meet the product characteristics specified herein. No known equal exists.

### 2.02 MATERIALS, GENERAL

- A. Materials:
  - 1. Casework.
    - a. Casework bodies, drawer heads, drawer bodies, drawer guides, shelves, and door assemblies shall be fabricated from marine grade high density polyethylene (HDPE) that contains a UV inhibitor, and is FDA approved for food-safe contact.
    - b. Colors shall be chosen by the Architect from the full range of standard colors available from the manufacturer.
    - c. Door and drawer styles shall be chosen by the Architect from the full range of standard door and drawer styles available from the manufacturer.
  - 2. Casework Hardware
    - a. Doors shall be equipped with 304 stainless steel 110 degree self-closing hinges securely fastened to doors and casework with stainless steel screws.
    - b. Door and drawer pulls shall be made of stainless steel, securely fastened to doors and drawers with screws (if applicable).
    - c. Casework and extendible elements may contain stainless steel screws and or nails for non-support purposes.
    - d. Casework shall be equipped with plastic cabinet legs adjustable from 3 3/4" to 5 3/4" with a load capacity of not less than 250 pounds per leg.
    - e. Shelving height shall be adjustable, but shelf pins shall secure the shelf in place using corrosive resistant pins.

## 2.03 CASEWORK FABRICATION.

- A. Polyethylene Material: All polyethylene casework shall be constructed using polyethylene sheets with the following thicknesses:
1. Side panels shall be cut from  $\frac{3}{4}$ " solid HDPE.
  2. Floor panel shall be cut from  $\frac{3}{4}$ " solid HDPE.
  3. Back panel shall be cut from  $\frac{1}{2}$ " solid HDPE.
  4. Drawer face shall be cut from  $\frac{3}{4}$ " solid HDPE.
  5. Drawer box front, sides, back and bottom shall be cut from  $\frac{1}{2}$ " solid HDPE.
  6. Door panels shall be cut from  $\frac{3}{4}$ " solid HDPE.
  7. Shelves shall be cut from  $\frac{3}{4}$ " solid HDPE.
  8. Top spreaders shall be constructed of  $\frac{3}{4}$ " solid HDPE.
  9. Drawer guides shall be constructed of  $\frac{1}{2}$ " solid HDPE.
- B. Casework Assembly: Polyethylene casework shall be cut and assembled without any supporting metal or hardware. All casework cuts shall be made using a computer numerical control (CNC) machine, to ensure precision cutting for consistent quality and rigidity of completed casework, and shall be assembled as follows:
1. Each polyethylene panel shall be cut with channels that will allow all polyethylene panels to slide snugly together and lock in place.
  2. Interior side panels of base and wall casework shall be pre-drilled using a CNC machine, except where otherwise indicated, for uniform attachment of adjacent casework.
  3. Adjustable shelves shall have a mechanism for securing the shelves from moving, using non-metal corrosive-resistant pins.
  4. Drawer faces shall be attached to the face of a drawer box to provide for additional strength to the drawer.
  5. Drawer slides shall be made from a non-metal corrosive resistant material.
  6. Door panels shall be attached to side panels using not less than three (3) 304 stainless steel 110 degree self-closing hinges.
  7. Top spreaders shall be designed to enable use of a countertop adhesive to adhere the countertop to the casework.
  8. Casework adjustable leg bases shall be attached from the underside of the bottom panels using four (4) stainless steel screws.
- C. Performance Requirements: All polyethylene casework shall meet the following MINIMUM standards:
1. Casework body shall be waterproof;
  2. Casework shall be UV stabilized for direct sun exposure;
  3. Casework shall be manufactured from solid color material;
  4. Casework shall be FDA approved for food-safe contact;
  5. Casework material shall be rated as not less than a Class C under ASTM E-84;

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 COORDINATION

- A. Coordination with appropriate contractors, who shall furnish plumbing and electrical services which shall be passing through the casework.

3.03 INSTALLATION OF CASEWORK.

- A. All exterior surface protective covering shall be left in place and removed only when the casework is ready for installation and only on surfaces that will be concealed during installation.
- B. Set casework components plumb, square, and straight with no distortion. Adjust leveling legs as needed. Where casework abuts other finished work, apply filler panels and scribe for accurate fit with fasteners concealed where practical.
- C. Set all base casework straight, level, and plumb. Adjust subtops within 1/4 inch of a single plane. Fasten casework to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners. Bolt adjacent casework together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
- D. Install hardware uniformly and precisely. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- E. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.04 CLEANING AND PROTECTING.

- A. Repair, or remove and replace, defective work as directed upon completion of installation.
- B. Clean finished surfaces to match original factory finish, as approved by Architect.

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END OF SECTION 12 34 00

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## SIMULATED STONE COUNTERTOPS

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### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Quartz agglomerate countertops.

#### 1.02 SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

#### 1.03 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace simulated stone countertops that fail in materials or workmanship within specified warranty period.
  - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective simulated stone countertops.
  - 2. Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 QUARTZ AGGLOMERATE COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
  - 1. Front: Straight, slightly eased at top.
  - 2. Backsplash: Straight, slightly eased at corner.
- B. Countertops: ~~1/2-inch-~~ (12.7-mm-) thick, quartz agglomerate with front edge built up with same material.
- C. Backsplashes: ~~1/2-inch-~~ (12.7-mm-) thick, quartz agglomerate.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- E. Fabricate countertops without joints.

#### 2.02 COUNTERTOP MATERIALS

- A. Certified Wood Materials: Fabricate countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification

body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

- B. Adhesives: Adhesives shall contain no added urea formaldehyde.
  - 1. Stone Adhesive: Manufacturer's recommended adhesive, formulated specifically for bonding simulated stone to simulated stone with a VOC content of 65 g/L or less.
- C. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
    - a. Caesarstone.
    - b. Cambria.
    - c. Cosentino USA.
    - d. E. I. du Pont de Nemours and Company.
    - e. LG Chemical, Ltd.
    - f. Samsung Chemical USA, Inc.
    - g. Technistone USA, Inc.
    - h. Transolid, Inc.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. Clean surfaces to receive countertops; remove loose and foreign matter that could interfere with adhesion.

#### 3.02 INSTALLATION

- A. Install countertops in accordance with manufacturer's written instructions and approved Shop Drawings.
- B. Install countertops level to a tolerance of **1/8 inch in 8 feet (3 mm in 2.4 m)** , and with a **maximum variation in plane between adjacent pieces at joint of plus or minus 1/16 inch.**
- C. For quartz agglomerate countertops, fasten by applying continuous bead of adhesive along all base cabinet surfaces, or if underlayment is used, apply continuous bead of adhesive along perimeter and around openings. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's recommended written instructions. Carefully dress joints smooth; remove excess adhesive and sealant, and clean entire surface.
  - 1. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
    - a. Fill joints with stone adhesive level with quartz surfacing.
    - b. Clamp or brace quartz-agglomerate surfacing in position until adhesive sets.

2. Install backsplashes to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

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END OF SECTION 12 36 61

WET PIPE SPRINKLER SYSTEM

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data for valves, sprinklers, specialties, and alarms.
  - 1. Submit sprinkler system drawings identified as "working plans" and calculations according to NFPA 13. Submit required number of sets to authorities having jurisdiction for review, comment, and approval. Include system hydraulic calculations.
  - 2. Submit test reports and certificates as described in NFPA 13.
- B. Design and Installation Approval: Acceptable to authorities having jurisdiction.
- C. Hydraulically design sprinkler systems according to NFPA 13.
- D. Comply with NFPA 13D and NFPA 70, and IRC 2009 Section P2904. E. UL listed and labeled and FM-approved pipe and fittings.
- E. Verify dimensions in field measurements before fabrication & indicate on shop drawings.

## PART 2 - PRODUCTS

## 2.01 PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 442/F 442M, UL 1821, 175-psig rating, made in NPS for sprinkler service. Include "Listed" and "CPVC Sprinkler Pipe" marks on pipe.
- B. CPVC Plastic Pipe Fittings: ASTM F 438 for NPS 3/4 to NPS 1-1/2 and ASTM F 439 for NPS 2, UL listed, 175-psig rating, for sprinkler service. Include "Listed" and "CPVC Sprinkler Fitting" marks on fittings.
- C. Black steel piping shall be provided in all exposed areas.
- D. Provide hangers, supports, and seismic restraints with UL listing and FM approval for fire-protection systems.

## 2.02 VALVES

- A. Fire-Protection Service Valves: UL listed and FM approved, with 175-psig non-shock minimum working-pressure rating. Indicating valves shall be butterfly or ball type, bronze body, and integral indicating device with 115-V ac, electric, single-circuit supervisory switch indicator.

## 2.03 SPRINKLERS

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

- B. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- C. Sprinkler types include the following:
  - 1. Pendent Sprinkler: Viking MI49058 Quick Response Pendent Sprinkler Head
  - 2. Pendent Sprinkler: Viking VK481 Concealed Sidewall Sprinkler Head
  - 3. Pendent Sprinkler: Viking VK480 Ceiling-Recessed Sprinkler Head
- D. Sprinkler Escutcheons: steel, one piece, with finish to match sprinklers.
- E. Sprinklers shall be low flow residential hidden pendent sprinklers engineered to provide a minimum design density of 0.05 gpm/ft<sup>2</sup> over the listed coverage area.
- F. Sprinkler frame and deflector shall be of bronze frame construction having a 1/2" NPT thread.
- G. Water seal assembly shall consist of a Teflon-coated Belleville spring washer with top-loaded extruded or cold head cup with 3 mm glass bulb containing no plastic parts, and having a temperature rating of 155°F, 165°F or 175°F.
- H. Sprinklers shall have a nominal K-factor of as designed in the hydraulic sprinkler design.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.
- B. Correct deficiencies in or remove and reinstall sprinkler that does not comply with requirements.
- C. Repair, refinish, or replace sprinklers damaged during installation, as directed by Architect.
- D. Adjust operating parts and hardware for smooth, quiet operation and weather tight closure. Lubricate hardware and moving parts.

#### 3.02 PIPE AND FITTING APPLICATION

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

#### 3.03 PIPING INSTALLATION

- A. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve.

#### 3.04 TESTING

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

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END OF SECTION 21 13 13



DOMESTIC WATER PIPING

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

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

## PART 2 - PRODUCTS

## 2.01 PIPE AND FITTINGS

- A. Hard Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Types B and C), water tube, drawn temper with wrought-copper, solder-joint fittings and pro-press fittings.
  - 1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint ends.
  - 2. Joining Materials: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder.
- B. Watts
  - 1. PEX tubing: ½" type A: Part #: WPTC08 (red) and WPTC08 (blue)
  - 2. PEX tubing: ¾" type A: Part #: WPTC12
  - 3. PEX tubing: ¾" type A: Part #: WPTC12
- C. Uponor
  - 1. PEX tubing: 1" type A: Part #: F3061000
- D. PVC Pipe: ASTM D 1785, Schedule 40.
  - 1. PVC Fittings: 1 1 / 2 ", ASTM D 2466, Schedule 40, socket type
  - 2. PVC Fittings: 1 1 / 4 ", ASTM D 2466, Schedule 40, socket type
  - 3. PVC Fittings: 2 ", ASTM D 2466, Schedule 40, socket type
  - 4. PVC Fittings: 3 ", ASTM D 2466, Schedule 40, socket type
- E. Transition Fittings: Manufactured piping coupling or specified piping system fitting. Same size as pipes to be joined and pressure rating at least equal to pipes to be joined.

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping installation requirements.
- B. Install floor penetration system at each service pipe penetration through foundation floor. Make installation watertight. Comply with requirements in Division 22 Section

- C. "Common Work Results for Plumbing" for wall penetration systems.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install domestic water piping without pitch for horizontal piping and plumb for vertical piping.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- G. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
  - 1. Soldered Joints: Comply with procedures in ASTM B 828 unless otherwise indicated.
- H. Comply with requirements in Division 22 Section "Common Work Results for Plumbing" for pipe hanger and support devices.

### 3.02 INSPECTING AND CLEANING

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

### 3.03 PIPING SCHEDULE

- A. Aboveground Distribution Piping: PEX piping
- B. Mechanical Room Piping: Copper pipe and PEX piping

### 3.04 VALVE SCHEDULE

- A. Drawings indicate valve types to be used.
- B. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use bronze ball valve
  - 2. Throttling Duty: Use bronze ball valve
  - 3. Drain Duty: Hose-end drain valves
- C. Install ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.
- D. PVC ball, butterfly, and check valves may be used in matching piping materials.

- E. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.
- F. Install spring check valve on discharge side of each pump and elsewhere as indicated.
- G. Install ball valves in each hot-water circulating loop and discharge side of each pump.

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END OF SECTION 22 11 16

DOMESTIC WATER PIPING SPECIALTIES

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.01 BACKFLOW PREVENTER

- A. Watts
  1. Brass construction. Temperature Range: -20 degrees F – 100 degrees F. Max pressure: 400 psi.
  2. Part #: LF600

2.02 BALL VALVES

- A. Watts
  1. 3/4" and 1" Ball Valve with full-port, Barbed end connectors, Rated to 400WOG, crimped joint rated at 160 psi at 70 degrees F
  2. Part #: LFWPBV

2.03 WATER CONDITIONER

- A. Watts
  1. 1" Connections, rated operating pressure 15-100 psi
  2. Part #: OFRES-0935

PART 3 - EXECUTION

3.01 INSTALLATION

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

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END OF SECTION 22 11 19

DOMESTIC WATER PUMPS

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data. Include certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Comply with NFPA 70, "National Electrical Code."
- C. Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.01 MAIN PRESSURIZING DOMESTIC WATER PUMP

- A. Grundfos
  - 1. 3/4 Horsepower, 115 Volt
  - 2. Part #: MQ3-35

2.02 MOTORS

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

2.03 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
  - 1. Type: Water-immersion temperature sensor, for installation in piping.
  - 2. Settings: Pump turned on and off by remotely

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.
- C. Support pumps and piping so weight of piping is not supported by pump volute.

- D. Install electrical connections for power, controls, and devices.
- E. Connect piping with valves that are at least the same size as piping connecting to pumps.
- F. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- G. Install shutoff valve on suction and discharge side of pumps.
- H. Install strainer on suction side of pumps.
- I. Install non-slam check valve and throttling valve on discharge side of pumps if pump comes with integral check valve, installation of non-slam check valve is not required.
- J. Install thermostats in hot-water return piping.
- K. Install test plugs on suction and discharge of each pump. Install at integral pressure gauge tapings where provided.

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END OF SECTION 22 11 23

FACILITY POTABLE-WATER STORAGE TANKS

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data. Shop Drawings.

PART 2 - PRODUCTS

2.01 EXPANSION TANK

- A. Watts
  1. 2.1 gal. capacity, factory pre-charge 20 psi, max P 150 psi, max temp 200 degrees F
  2. Part #: PLT-5

2.02 WATER SUPPLY TANKS

- A. Aero Tec Labs Inc
  1. 1300 gallon structurally supported flexible membrane tank, Potable water fabric NSF/ANSI 61 standard, 4' NPT stainless steel opening
  2. Custom fabricated part
  3. Will provide the necessary 250 gallons of water to the fire suppression system
- B. Ronco Plastics
  1. 135 gallon polyethylene tank, potable water NSF/ANSI 61 standard, 4' NPT stainless steel opening
  2. Part#: B-300
  3. Will provide supply to green wall
- C. Ronco Plastics
  1. 20 gallon polyethylene tank, potable water NSF/ANSI 61 standard, 4' NPT stainless steel opening
  2. Part#: B-233
  3. Will provide supply to condensate misting system

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.
- B. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.

- C. Separate dissimilar metals and metal products from contact with wood or cementitious materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.
- D. Correct deficiencies in or remove and reinstall products that do not comply with requirements.
- E. Repair, refinish, or replace products damaged during installation, as directed by Architect.
- F. Adjust operating parts and hardware for smooth, quiet operation.

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END OF SECTION 22 12 19



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**SANITARY WASTE AND VENT PIPING**

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**PART 1 - GENERAL****1.01 SECTION REQUIREMENTS**

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

**PART 2 - PRODUCTS****2.01 PIPES AND FITTINGS**

- A. PVC Pipe
  1. 2" pipe, ASTM D 1785, Schedule 40.
  2. 1-1/2" pipe, ASTM D 1785, Schedule 40.
  3. 3" pipe, ASTM D 1785, Schedule 40.
- B. ASTM D 2466, Schedule 40, socket type and npt.

**PART 3 - EXECUTION****3.01 PIPING INSTALLATION**

- A. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight.
- B. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- C. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

- D. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- E. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.02 PIPE SCHEDULE

- A. Aboveground Applications: PVC plastic, DWV pipe and fittings with solvent-cemented joints

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END OF SECTION 22 13 16

RESIDENTIAL ELECTRIC DOMESTIC WATER HEATER

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data
- B. Comply with NFPA 70, "National Electrical Code."
- C. Warranty: 6-year limited tank and parts warranty.

PART 2 - PRODUCTS

2.01 66 GALLON HEAT PUMP HOT WATER HEATER

- A. Airgenerate
  - 1. 10,000 BTU heating capacity, 220-240 V, 4kW primary election heater, 2.35 energy factor
  - 2. 2.75 kW heat pump output
  - 3. Part #: ATI 66

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.
- B. Fasten securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.
- C. Separate dissimilar metals and metal products from contact with wood or cementations materials, by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.
- D. Correct deficiencies in or remove and reinstall products that do not comply with requirements.
- E. Repair, refinish, or replace products damaged during installation, as directed by Architect.
- F. Adjust operating parts and hardware for smooth, quiet operation.

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END OF SECTION 22 33 30

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

- A. Refrigerant Insulation
  - 1. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 2. K-Flex USA INSUL-TUBE Coil
  - 3. <http://www.kflexusa.com/HomePages/Downloads.aspx>
- B. SHURTAPE HVAC Tape
  - 1. Polypropylene Film
  - 2. <http://www.grainger.com/Grainger/SHURTAPE-HVAC-Tape-10A374?Pid=search>
- C. Duct Insulation
  - 1. Fiberglass, wrapped duct insulation
  - 2. Suitable for indoor and outdoor use on below ambient services
  - 3. <http://www.grainger.com/Grainger/JOHNS-MANVILLE-Duct-Insulation-6ZKK3?Pid=search>
- D. FSK Facing Tape
  - 1. Scrim on polyethylene coated kraft paper
  - 2. <http://www.grainger.com/Grainger/3M-FSK-Facing-Tape-5GKE1?Pid=search>

PART 3 - EXECUTION

3.01 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. 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.
- E. Piping Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawlspaces.
  - 2. Chrome-plated pipes and fittings unless there is a potential for injury.

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END OF SECTION 23 07 00

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product data. Shop Drawings.
- B. Comply with NFPA 70, "National Electrical Code."

## PART 2 - PRODUCTS

## 2.01 PIPING

- A. PEX Tube and Fittings
  1. Comply with: ASTM F 877, SDR 9 PEX tubing and ASTM F 1807, metal insert-type fittings with copper or stainless-steel crimp rings.
  2. Uponor F2060750 PEX-a
  3. <http://www.pexsupply.com/Wirsbo-Uponor-F2060750-3-4-AQUAPEX-Red-300-ft-coil-2188000-p>
- B. PEX Tubing
  1. 3/4" type A
  2. Uponor F1060750
  3. <http://www.pexsupply.com/Wirsbo-Uponor-F2060750-3-4-AQUAPEX-Red-300-ft-coil-2188000-p>

## 2.02 PUMP FOR HEAT EXCHANGER

- A. Grundfos
  1. Model MQ 3-35
  2. [http://www.us.grundfos.com/web/download.nsf/Pages/6A0893C7B967963088256EDF00546536/\\$File/L-MQ-PG-001.pdf](http://www.us.grundfos.com/web/download.nsf/Pages/6A0893C7B967963088256EDF00546536/$File/L-MQ-PG-001.pdf)

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Comply with requirements for basic piping installation.
- B. Install wall penetration system at each service pipe penetration through exterior wall. Make installation watertight.
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- D. Install domestic water piping with 0.25 percent slope downward toward drain for horizontal piping and plumb for vertical piping.

- E. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

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END OF SECTION 23 20 00

REFRIGERANT PIPING

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

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

## PART 2 - PRODUCTS

## 2.01 TUBES AND FITTINGS

- A. Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B) and ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- D. Brazing Filler Metals: AWS A5.8.

## 2.02 VALVES

- A. Thermostatic Expansion Valve: Comply with ARI 750; forged brass or steel body, stainless-steel internal parts, copper tubing filled with refrigerant charge for 46 deg F heating and 71 deg F cooling suction temperature; 102-411 psig working pressure, and 240 deg F operating temperature.
- B. Solenoid Valves: Comply with ARI 760; 240 deg F temperature rating, 400-psig (2760-kPa) working pressure, 240 deg F operating temperature; and 24-V normally closed holding coil.
- C. Reversing Valve: Max operating temp. 250 deg F, 2500 minimum burst pressure

## 2.03 REFRIGERANT PIPING SPECIALTIES

- A. Filter Drier: Comply with ratings in accordance to ARI standard 710-86, 500 psi maximum working pressure
- B. Moisture/Liquid Indicators: 500-psig operating pressure, 240 deg F operating temperature; with replaceable, polished, optical viewing window and color-coded moisture indicator
- C. Refrigerant: ASHRAE 34; R-410A.



## PART 3 - PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight.
- B. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.
- C. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.
- D. Insulate suction lines to comply with Division 23 Section "HVAC Insulation."
- E. 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.
- F. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.
- H. 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.
- I. 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:
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

### 3.02 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type L (B), annealed- or drawn-temper tubing and wrought-copper fittings with soldered joints.

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END OF SECTION 23 23 00

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data

PART 2 - PRODUCTS

2.01 REFRIGERANT

- A. R-410A, ASHRAE 34.
  - 1. Non-ozone depleting refrigerant

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.

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END OF SECTION 23 23 23

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 DUCTS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip galvanized coating.
- B. Joint and Seam Tape, and Sealant: Comply with UL 181A.

2.02 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. 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.

PART 3 - EXECUTION

3.01 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. Outdoor, Supply-Air Ducts: Seal Class A.
  - 2. Outdoor, Exhaust Ducts: Seal Class C.
  - 3. Outdoor, Return-Air Ducts: Seal Class C.

4. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
  5. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
  6. Conditioned Space, Exhaust Ducts: Seal Class B.
  7. 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. Clean new duct system(s) before testing, adjusting, and balancing.
- 3.02 TESTING, ADJUSTING, AND BALANCING
- A. Balance airflow within distribution systems, including sub-mains, branches, and terminals to indicated quantities.

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END OF SECTION 23 31 13

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, manufacturer's color charts showing the full range of colors available for factory-applied finishes.
- B. Comply with NFPA 70, "National Electrical Code."
- C. Verify dimensions by field measurements before fabrication and indicate on Shop Drawings.
- D. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of 1 year.

PART 2 - PRODUCTS

2.01 THROUGH-THE-WALL VENTILATION FAN

- A. Panasonic
  - 1. Energy recovery ventilator, servicing the bathroom, 40CFM
  - 2. <http://shop.panasonic.com/shop/model/FV-04VE1>

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install per manufacturer's instructions.

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END OF SECTION 23 34 13

DIFFUSERS, REGISTERS AND GRILLES

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 REGISTERS

- A. Granger
  1. Material: Steel; Finish: Appliance White; Mounting: Flush.
  2. Sidewall/Ceiling Register Part #: 4MJN1
  3. <http://www.grainger.com/Grainger/SidewallCeiling-Register-4MJN1?Pid=search>

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install registers.
- 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 registers to air patterns indicated, or as directed, before starting air balancing.

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END OF SECTION 23 37 13

AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings.
- B. Comply with NFPA 70, "National Electrical Code."
- C. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of 5 years.

PART 2 - PRODUCTS

2.01 ENERGY RECOVERY VENTILATOR

- A. Panasonic
  - 1. Variable speed energy recovery ventilator providing filtration and ventilation, removing particles from both incoming and outgoing air.
  - 2. Panasonic 40 CFM Whisper Comfort Spot
  - 3. <http://www.panasonic.com/business/building-products/ventilation-systems/products/whisper-comfort.asp>

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install unit per Manufacturer's instructions under supervision of HVAC contractor.
- B. Connect and install ducts as described in Section 23 31 13.

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END OF SECTION 23 72 00

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SPLIT-SYSTEM AIR-CONDITIONERS

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings.
- B. Comply with NFPA 70, "National Electrical Code."
- C. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of 7 years for compressor, 5 years for parts.

## PART 2 - PRODUCTS

## 2.01 OUTDOOR UNIT

- A. Trane 4TWZ0024A OUTDOOR SPLIT SYSTEM HEAT PUMP
  1. 24,000 BTUH, 19 SEER, Dual-stage heating and cooling
  2. <http://www.trane.com/residential/products/heat-pumps/xl20i-heat-pumps>

## 2.02 INDOOR VARIABLE SPEED MODULAR COMMUNICATING AIR HANDLER

- A. Trane TAM8A0A24V21CB Air Handler
  1. Multi-position, variable airflow, independently controlled units
  2. [http://www.mitsubishicomfort.com/media/336793/m\\_p\\_catalog.pdf](http://www.mitsubishicomfort.com/media/336793/m_p_catalog.pdf)

## 2.03 INSTALLATION MATERIALS

- A. TAM8A0A24V21CB unit comes with wall-mount installation plates, remote control holder, hardware, and Anti-Allergen and deodorizing filters.
- B. DiversiTech Ultralite Equipment Pad
  1. 32"x37"x2" equipment pad to be placed under outdoor compressor unit. Withstands environmental stresses such as freezing/thawing, UV light, and fire.
  2. DiversiTech UC3237-2
  3. <http://www.diversitech.com/Product?id=01t80000002s8TpAAI>

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Installation shall be executed as per installation manuals provided by the Manufacturer.
- B. Set units level, plumb, and true to line, without warp or rack of products and anchor securely in place as described in manufacturer's specifications.



- C. Correct deficiencies in or remove and reinstall units that do not comply with requirements.
- D. Repair, refinish, or replace products or finishes damaged during installation or transit, as directed by Architect.

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END OF SECTION 23 81 26

INTEGRATED AUTOMATION NETWORK EQUIPMENT

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data.
- B. Compliance:
  - 1. NFPA 70, "National Electrical Code"
- C. Referring Sections
  - 1. 262726: Wiring Devices
    - a. Smart Switches

PART 2 - PRODUCTS

2.01 POWER SUPPLY

- A. 12 Volt Power Supply
  - 1. DNR30US12
- B. 24 Volt Power Supply
  - 1. DNR60US24
- C. [www.xppower.com](http://www.xppower.com)

2.02 DATABASE COMPUTER

- A. Apple Mac Mini
  - 1. [www.apple.com](http://www.apple.com)
- B. Samsung 830 Series MZ-7PC256B/WW
  - 1. [www.samsung.com](http://www.samsung.com)
- C. ASUS VK VK228H-CSM 21.5 inch Monitor
  - 1. [www.asus.com](http://www.asus.com)
- D. BUFFALO Ministation Plus
  - 1. HD-PNT500U3R
  - 2. <http://www.buffalo-technology.com/en/>

2.03 ROUTER

- A. Linksys
  - 1. EA2700
  - 2. <http://home.cisco.com>
- B. Material Compatibility: Provide materials that are compatible with one another and with substrates.

## 2.04 SENSOR MODULE

- A. Microcontroller
  1. Arduino Micro 5V Operating
  2. <http://www.arduino.cc>
- B. Wireless Communication
  1. XBee 802.154.4 Series 1 RF Module
  2. <http://www.digi.com/xbee/>
- C. Sensors
  1. Temperature/Humidity Sensor
    - a. Sensiron SHT75
    - b. <http://www.sensiron.com>
  2. Light Sensor
    - a. PerkinElmer VT900 Series Photoresistor
    - b. <http://www.alldatasheet.com/datasheet-pdf/pdf/84374/PERKINELMER/VT900.html>
  3. Occupancy Sensor
    - a. Honeywell DT7450 Dual Tec Motion Sensor
    - b. <http://www.honeywell.com>
  - 4.

## 2.05 CURRENT MONITORING

- A. Brultech Greeneye Monitoring Package
  1. Brultech Greeneye Hub
  2. Brultech Micro- 40/80/100
  3. [http://www.brultech.com/home/store/product.php?id\\_product=108](http://www.brultech.com/home/store/product.php?id_product=108)

## 2.06 LIGHTING CONTROL

- A. INSTEON
  1. 2412N SmartLinc Hub
  2. INSTEON Smart Switches
    - a. Refer to 262726: Wiring Devices
  3. <http://www.insteon.net>

## PART 3 - EXECUTION

### 3.01 INSTALLATIONS

- A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in manufacturer's written instructions.
- B. Network equipment to be installed according to manufacturer's specifications.
- C. Set units level, plumb, and true to line and anchor securely in place.
- D. Correct deficiencies in or remove and reinstall materials that do not comply with requirements.
- E. Repair, refinish, or replace substrate damaged during installation or transit, as directed by Architect.

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END OF SECTION 25 10 00

LOW-VOLTAGE ELECTRICAL POWER  
CONDUCTORS AND CABLES

---

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data
- B. B. Comply with NFPA 70, "National Electrical Code."

PART 2 - PRODUCTS

2.01 THHN/THWN COPPER WIRE

- A. Southwire
  1. Used for Line Voltage power transfer to electrical device located throughout the house.
  2. Solid and Stranded Copper
  3. AWG: 14/12/10/6/4/ 2/0
  4. <http://www.southwire.com/Residential.htm>

2.02 CAT5E SHIELDED CABLE

- A. CableWholesale
  1. Required to support both network and sensor communications (analog) runs parallel with power lines, up to 1000 ft.
  2. MFG Model # : 56917949
  3. <http://www.southwire.com/products/Category5eCable.htm>

2.03 18/5

- A. Southwire
  1. Required to facilitate analog signal carrying over short distances, up to 500ft of cable MFG Model #: 64169642
  2. <http://www.southwire.com/products/ThermostatWire.htm>

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install according to manufacturer's specification inside flexible ENT. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

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END OF SECTION 26 05 19

## GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

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### PART 1 - GENERAL

#### 1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data
- B. Comply with NFPA 70, "National Electrical Code"

### PART 2 - PRODUCTS

#### 2.01 GROUND ROD

- A. Ground Electric System
- B. McMaster-Carr
- C. <http://www.mcmaster.com/#grounding-rods/=lg6ul>

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Prepare grounding location set by the DOE by clearing debris and other obstructions.
- B. Drive grounding rod(s) into pre-selected location(s) at depths set forth by competition organizers
- C. Bond Main Service Panel and V circuit bare ground copper wires to grounding rod.
- D. Correct deficiencies in or remove and reinstall wires and connectors that do not comply with requirements.

---

END OF SECTION 26 05 26

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

---

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data
- B. Comply with NFPA 70, "National Electrical Code."

PART 2 - PRODUCTS

2.01 RACEWAY AND CONDUIT

- A. Carlon
  - 1. Electrical Nonmetallic Tubing used as raceway or conduit walls of house
  - 2. Flex-Plus Blue ENT
  - 3. [www.tnb.com/pub/node/187](http://www.tnb.com/pub/node/187)

2.02 BOXES

- A. Carlon
  - 1. Single, Double, and Four Gang Non Metallic junction box for residential and light commercial use
  - 2. [www.tnb.com/pub/node/187](http://www.tnb.com/pub/node/187)

2.03 METER HOUSING

- A. Schneider Square D
  - 1. QOM2 Meter Socket
  - 2. <http://www.schneider-electric.com>

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.
- B. Fasten raceway and boxes securely in place, with provisions for thermal and structural movement. Install with concealed fasteners, unless otherwise indicated.
- C. Repair, refinish, or replace raceway or boxes damaged during installation, as directed by Electrician.

---

END OF SECTION 26 05 33

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

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

## PART 2 - PRODUCTS

## 2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush and Surface-mounted cabinets; Type 1.
  - 1. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- B. Incoming Mains Location: Bottom
- C. Phase, Neutral, and Ground Buses: Plated Copper
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Tin-plated copper.
  - 2. Main and Neutral Lugs: Mechanical Type.
- E. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral overcurrent protective devices and labeled by UL.
- F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.02 DISTRIBUTION PANELBOARDS

- A. Mains: Circuit Breaker
- B. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers
- C. Main Service Panel Outside
  - 1. Service Panel to house main circuit breaker
  - 2. Schneider Electric QOM2
  - 3. <http://www.schneider-electric.com>
- D. Sub Service Panels
  - 1. Service panels for house electrical wiring in each module



2. Schneider Electric QO142L225PG
3. MLO, 42 space, Three-Wire
4. <http://www.schneider-electric.com>

#### 2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Mains: Circuit Breaker (Located outside)
- B. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

#### 2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Overcurrent Breaker
  1. Protect house electric system from voltage spikes
  2. Schneider Electric QO115, QO120, QO220, QO230, QO240
  3. <http://www.schneider-electric.com>
- B. Arc Fault Breaker
  1. Schneider Electric QO115PCAFI, QO120PCAFI
  2. <http://www.schneider-electric.com>

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Mount bottom of trim 55 inches above finished floor unless otherwise indicated. C. Arrange conductors into groups; bundle and wrap with wire ties.
- C. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory.

---

END OF SECTION 26 24 16

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Referring Sections: 2510000 Integrated Automation: Insteon Hub

## PART 2 - PRODUCTS

## 2.01 RECEPTACLES

- A. Tamper Resistant Receptacles
  - 1. Leviton
  - 2. TBR20-W
  - 3. <http://www.leviton.com>
- B. Duplex GFCI Convenience Receptacles: 125 V, 20 A, straight blade, feed-through type. NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
  - 1. Leviton
  - 2. W7899-TRW
  - 3. <http://www.leviton.com>
- C. USB Charger/ Tamper Resistant Receptacle: UL 498 and all NEC Tamper Resistent Requirements. 2.1 A USB and one 125V, 15 A outlet.
  - 1. Leviton
  - 2. TS630-W
  - 3. <http://www.leviton.com>

## 2.02 SWITCHES

- A. Standard Switches: NEMA WD 1 and UL 20. Single-pole, double-throw, momentary contact, center-off switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
  - 1. Leviton 15-amp Decora style rocker switch
  - 2. 5601-2W
  - 3. <http://www.leviton.com>
- B. Smart Switches
  - 1. INSTEON

2. 2466SW ToggleLine Relay (Non-Dimming)
3. 2477S SwitchLine On/Off
4. <http://www.insteon.net>

## 2.03 WALL PLATES

- A. Wall Plates, Finished Areas: Smooth, high-impact thermoplastic fastened with metal screws having heads matching plate color.
  1. Leviton
    - a. Snap-on single, double, triple gang faceplate
    - b. 80301-SW, 80309-SW, 80311-SW
    - c. <http://www.leviton.com>
- B. Wall Plates, Unfinished Areas: Smooth, high-impact thermoplastic with metal screws.
- C. Wall Plates, Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet locations.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Install devices and assemblies plumb, level, and square with building lines.
- C. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- D. Install unshared neutral conductors on line and load side of dimmers.
- E. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top unless otherwise indicated. Group adjacent devices under single, multigang wall plates.

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END OF SECTION 26 27 26

PHOTOVOLTAIC COLLECTORS

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data
- B. Comply with NFPA 70, "National Electrical Code."
- C. Related Sections: 481916 Electrical Power Generation Inverters

## PART 2 - PRODUCTS

## 2.01 SOLAR SHINGLES

- A. Dow Solar
  - 1. Powerhouse Solar Shingle
  - 2. Copper Indium Gallium diSelenide with high tempered glass
  - 3. <http://www.dowpowerhouse.com>

## 2.02 INVERTER

- A. Dow Powerhouse
  - 1. Part #: 362590
  - 2. DC to AC Transformer for up to 3 strings.
  - 3. Warranty: 10 years
  - 4. <http://www.dowpowerhouse.com>

## 2.03 ACCESSORIES

- A. Solar Shingle Mounting-Mounting Screws
  - 1. McMaster Carr
    - a. Required to mount PV modules on roof
    - b. Roofing Screws
    - c. Product Number: 90694A814
    - d. <http://www.mcmaster.com/#roofing-screws/=lg7tr6>

## PART 3 - EXECUTION

## 3.01 INSTALLATION

- A. Prepare substrate by cleaning, removing projections, filling voids, sealing joints, and as otherwise recommended in photovoltaic cell manufacturer's written instructions. Adjust operating parts and hardware for smooth, quiet operation. Lubricate hardware and moving parts.
- B. Set units level, plumb, and true to line, without warp of shingles and anchor securely in place to torque pressures required in manufacturer's specifications.

- C. Make connections between the individual shingles as per manufacturer instructions.
- D. Correct deficiencies in or remove and reinstall mountings and modules that do not comply with requirements.
- E. Repair, refinish, or replace mountings and modules damaged during installation or transit, as directed by Architect.
- F. Wire PV system to the Inverter as per manufacturers instructions.

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END OF SECTION 26 32 00

PACKAGED GENERATOR ASSEMBLIES

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals:
  - 1. Product Data
- B. Comply with NFPA 54, "National Fuel Gas Code."
- C. Comply with NFPA 70, "National Electrical Code."

PART 2 - PRODUCTS

2.01 GENERATOR ASSEMBLY

- A. Honda EB10000AH
  - 1. 120/240 Single-Phase, 60 Hertz Gasoline-powered generator
  - 2. Maximum AC Output 10000 Watts (41.66A @ 240 V / 833.33A @ 120 V)
  - 3. Operating Noise 76 db @ rated load.
  - 4. <http://powerequipment.honda.com/generators/>

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Set unit level on a stable surface during use. Store in a weather-protected location when not in use.
- B. Adjust operating parts and hardware for smooth, quiet operation. Lubricate hardware and moving parts.

---

END OF SECTION 26 32 00

## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

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

## PART 2 - PRODUCTS

## 2.01 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA Le 5 and NEMA LE 5A as applicable.
- C. Exterior Luminaires: Comply with UL 1598 and listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- D. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- E. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

## 2.02 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Fixture 1: Exterior Surface Mounted Lighting
  - 1. Basic-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. Lux Space BCS490
  - 2. Voltage: 120V AC, 35 W
  - 3. Mounting: Exterior Covering
  - 4. Lamps: Non-replaceable LED module
  - 5. External Finish: Sheet metal
- B. Fixture 2: Main Room Cove Lighting
  - 1. Basic-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. Elliptipar F307

2. Voltage: 120V AC, 56W
  3. Mounting: Fixture attached to ceiling
  4. Nominal Dimensions: 40 9/16"-52 3/8"L x 8 3/4" W x 4" H
  5. Lamps: 2 T5 4ft. 112W
  6. External Finish: Painted material
- C. Fixture 3: Bedroom Ceiling Float
1. Basis-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. Artemide Float L ceiling
  2. Voltage: 120V AC, 56W
  3. Mounting: Fixture attached to ceiling
  4. Nominal Dimensions: 40 9/16"-52 3/8"L x 8 3/4" W x 4" H
  5. Lamps: 2 T5 4ft., 56W
  6. External Finish: Painted material
- D. Fixture 4: Dining Room Pendant
1. Basis-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. YLighting AMC-AT-SPINNING-BH2
  2. Voltage: 120V AC, 18W
  3. Mounting: Hanging pendant
  4. Lamps: CFL, 18W
  5. External Finish: Painted Aluminum, white
- E. Fixture 5: Kitchen Pendant
1. Basis-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. YLighting AMC-AT-SPINNING-BH1
  2. Voltage: 120V AC, 13W
  3. Mounting: Hanging pendant
  4. Lamps: 2 CFL, 13W
  5. External Finish: Painted Aluminum, white
- F. Fixture 6: Bathroom Vanity Lighting
1. Basis-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. YLighting TEC-700BCMET
  2. Voltage: 120V AC
  3. Mounting: Wall mounted
  4. Lamps: LED, 20W
  5. External Finish: Chrome
- G. Fixture 7: Bathroom / Hallway Recessed Lighting
1. Basis-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. Focal Point 3.5" FL3 L3D
  2. Voltage: 120V AC
  3. Mounting: Recessed ceiling
  4. Lamps: 6 LED, 9.5W
  5. Trim: CSI EDL-1200; Glass, Round Frost Shower
- H. Fixture 8: Mechanical / Laundry Room Lighting
1. Basis-of-Design Product: product indicated in Lighting Schedule or comparable product subject to approval by architect.
    - a. Philips VRF 4026



2. Voltage: 120V AC
3. Mounting: Fixture attached to ceiling
4. Lamps: 2 T5 4ft, 56W
5. Trim: CSI EDL-1200; Glass, Round Frost Shower

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Set units level, plumb, and square with ceiling and walls, and secure.
- B. Terminate appropriate fixtures with corresponding transformer and secure transformer.
- C. Wire fixtures to scheduled switch legs.
- D. Correct deficiencies in or remove and reinstall mountings and modules that do not comply with requirements.
- E. Repair, refinish, or replace mountings and modules damaged during installation or transit, as directed by Architect.

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END OF SECTION 26 50 00

SMOKE DETECTION SENSORS

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PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data and system operating description.
- B. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals, make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations.
- C. Comply with NFPA 72.
- D. D.UL listed and labeled.
- E. E.Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.01 SMOKE DETECTORS

- A. Kidde KN-COSM-IB AC Wire-in Combination Carbon Monoxide & Smoke Alarm
- B. Sensors: Ionization and Electrochemical
- C. High-Level Chimes: 85 dBA at 10ft

2.02 WIRE AND CABLE

- A. UL listed and labeled as complying with NFPA 70, Article 760.
- B. Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation. No. 12 AWG or larger as required by local codes.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install and test systems according to NFPA 72. Comply with NECA 1.
- B. Install wiring “finished” in concealed spaces and exposed on ceilings and walls where indicated.
- C. Wire system per manufacturer specifications.

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END OF SECTION 28 31 46

VEGETATED ROOF SYSTEM

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## PART 1 - GENERAL

## 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, plants
- B. Warranties: Provide standard manufacturer's written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace products that fail in materials or workmanship for the period of 1 year.

## PART 2 - PRODUCTS

## 2.01 VEGETATED ROOFING

- A. Roof Membrane: Hot Fluid-Applied Waterproofing as specified in Division 07.
- B. Modular Vegetated Roofing, manufactured in 18" x 22" trays. Saturated weight of system to be approximately 22 lbs./sf.
  - 1. Trays will be made of recycled polyethylene and colored black, gray or clear. Tray dimensions 18 inches wide by 22 inches long and 4 inches deep. Total soil height to be 4 inches.
  - 2. Growing medium – Sedum carpet laid over extensive growing media.
  - 3. Recommended plant mixes consisting of highly drought resistant ground covers. Local horticulturalists should be consulted for specific recommendations.
  - 4. Components are shipped separately and assembled on site.

## 2.02 ACCESSORIES

- A. Growing Medium
  - 1. Lightweight growing medium specifically designed for use with modular systems. Composed of organic and mineral materials.

## PART 3 - EXECUTION

## 3.01 PREPARATION OF ROOF SURFACE

- A. Slip sheet/roof barrier, specified by architect and approved by manufacturer, of 40 mil thickness with overlapped and effectively bonded seams to ward against roof penetration and to keep waterproofing layer safe and clean from soil during installation. Slip sheet/roof barrier typified as follows:
  - 1. Glued seam types (40 mil thickness)
    - a. EPDM, with seams overlapped a minimum of 3 inches and glued with roll out adhesive or double sided tape adhesive of the type that is impervious to and not affected by moisture, and recommended by the manufacturer.

### 3.02 INSTALLATION

- A. Installation season: Module installation to be conducted when plants are:
  - 1. Properly adapted and acclimatized to local weather conditions.
  - 2. When weather is above 35 degrees F, there is no ice on the roof and vegetated roof soil is unfrozen.
  - 3. When plants cover 95 percent or more of soil surface.
- B. Install vegetated trays moving from low roof elevation to high roof elevation until desired roof area is covered

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END OF SECTION 32 95 13

VEGETATED WALL SYSTEM

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## PART 1 - GENERAL

## 1.01 INSTALLATION CONTRACTOR

- A. Vegetated Wall Panels must be installed by the manufacturer's authorized installer or local labor under manufacturer's supervision.

## 1.02 SUBMITTALS

- A. Provide scale drawings showing all material terminations, transitions and penetrations.

## 1.03 WARRANTIES

- A. Provide one (1) year standard warranty on workmanship on the wall system, except for plants.
- B. Provide 3-year warranty on all panels, spacers, catch basin, drip pan and brackets (not for 3 years provided it was installed by a manufacturer-certified installer. Components will not degrade due to physical, chemical or biological processes that naturally occur in a green wall system.
- C. Provide one (1) year warranty and maintenance contract for vegetation covering all aspects of the vegetation, irrigation and system performance.

## PART 2 - PRODUCTS

## 2.01 DESCRIPTION

- A. Provide standard and custom modular panels of vegetation preassembled and ready for installation.
- B. System Components for a vertical surface (Exterior or Interior)
  - 1. Mounting surface suitable for retaining hardware with a minimum 1500 lbs minimum shear force of 1500 pounds (680 kilograms) as specified by the hardware manufacturer.
  - 2. Green Wall bracket Spacers 1/2" (minimum) (1.27 cm) to 3/4" (maximum) (1.905cm)
  - 3. Green wall brackets drilled at a minimum 16" (40.64 cm) on center for hardware.
  - 4. Green Living Wall Panels: Aluminum.
  - 5. Soil Provide manufacturer's standard growing medium.
  - 6. Plant Material: Provide plants as selected by the Architect from the manufacturer's full range, and within the weight limits specified.
- C. Irrigation Components
  - 1. Provide edging and flashings, and irrigation accessories.
  - 2. Provide Irrigation catch basins and drainage

## 2.02 SUBSTRATE

- A. Mounting surfaces shall be acceptable to the wall system manufacturer. Substrates shall meet the structural support requirements as specified by the system manufacturer.

## 2.03 ACCESSORIES

- A. Provide waterproofing membrane in place under the green wall system prior to installation.

## 2.04 VEGETATION

- A. Provide vegetation with root establishment into the green wall cells and substrate, mature enough to provide 90 percent cover upon installation.

## 2.05 IRRIGATION

- A. Provide irrigation designs approved by the manufacturer.
- B. Provide an irrigation water source in the vicinity of the green wall with a shut-off valve and backflow prevention. Provide for grey water or rainwater irrigation water where possible.

## 2.06 EDGING DETAILS

- A. Provide manufacturer's approved edging anchored under and over the green wall panel. Provide edge details with manufacturer's powder coating in color to be selected by the Architect.

## PART 3 - EXECUTION

### 3.01 DELIVERY

- A. Deliver pre-grown panels on manufacturer's approved panel carrier. Pre-grown sedum may be palletized. All other varieties will not be stacked or transported in such a way as to crush the plants while in transit.

### 3.02 STORAGE

- A. If the outside temperature is above 77°F (25°C) the modules must be installed within one (1) day after being palletized to prevent damage to the vegetation. If the outside temperature is between 59°F (15°C) and 77°F (25°C) the modules must be installed three (3) days after being palletized to prevent damage to the vegetation. If the outside temperature is between 41°F (5°C) and 59°F (15°C) the modules must be installed five (5) days after being palletized to prevent damage to vegetation.
- B. Palletized vegetated material must be stored in a secure, cool shady environment out of direct sunlight prior to installation. Vegetated panels must be protected from rapid temperature changes of more than 30°F (7°C)/hour. All vegetation is to be installed within three (3) days of being delivered.
- C. All other materials (non-living) should be stored in a dry location out of direct sunlight with original packaging and documentation left intact prior to installation.

- D. All interior plants must be stored in a temperature equal to that of the installation area or as specified by manufacturer.
- E. Ideally as the panels are delivered they are hung on the wall or assembled in a manner allowing for staging.

### 3.03 SITE PROTECTION

- A. The work area is to be protected from damage by first sweeping off all debris and then laying protective covering in work and traffic areas.
- B. All areas below the installation area must be sectioned off with caution tape, protective cones or other means to prevent persons from walking under the installation work area.

### 3.04 INSTALLATION

- A. Install spacers and green wall brackets to support the green wall panels as per manufacturer's details.
- B. Panels must interlock from the upper and lower sections of the panel with minimum spacing of 1/4" (.635 cm) (6.35 mm) and maximum of 1/2" (1.27 cm) (12.7 mm).

### 3.05 MAINTENANCE

- A. Maintenance must be provided by manufacturer's approved agent.
- B. Provide a one-year maintenance contract beginning from the completion of system installation included in the Contract Amount.

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END OF SECTION 32 95 16



# Quantity Takeoff

## Appendix B

8/22/2013

Stevens Institute of Technology

Ecohabit Net-Zero H

Specification	Category	Brief Description	Detailed Description	Manufacturer	Qty	Unit
<b>Division 01 General Requirements</b>						
01 54 00		Forklift	5000 lb 2 wheel drive, gasoline		1	Week
		Typical House Crane	80-ton truck mounted crane, plus crew		2	Day
		Generator	Inverter Generator w/CMD Triple-Fuel System: Honda EU6500IS	Honda	1	week
		Night time site lighting	Bull Dog work light. twin 500 watt bulbs		2	each
<b>Division 02 Existing Conditions</b>						
<b>Division 03 Concrete</b>						
<b>Division 04 Masonry</b>						
<b>Division 05 Metals</b>						
05 05 23	exterior deck framing	Double Shear Joist Hangers	2x10 Joist Hangers	Simpson	164	EA
05 05 23	exterior deck framing	Hurricane/Seismic Straps		Simpson	26	EA
05 XX XX	exterior deck framing	Joist Hangers- Custom	Right-45 degree hanger	Simpson	6	EA
05 XX XX	exterior deck framing	Joist Hangers- Custom	Left- 45 degree hanger	Simpson	6	EA
05 XX XX	exterior deck framing	Joist Hangers- Custom	Double Right-45 degree hanger	Simpson	1	EA
05 XX XX	exterior deck framing	Joist Hangers- Custom	Double Left-45 degree hanger	Simpson	1	EA
05 XX XX	exterior deck framing	Joist Hangers- Custom	Double inside hanger	Simpson	1	EA
05 XX XX	exterior deck framing	Flange Hanger	Strong-Tie 2x6 concealed flange hanger	Simpson	8	EA
05 XX XX		Metal Studs			9	EA
	House roof	2x8 Hangers	Top Flange?	Simpson	30	EA
	house deck	9.25" TJI joist hangars		Simpson	120	EA
5 XX XX	house deck	Footing Connections	6x6 Base Caps BC-60	Simpson	72	each
	house deck	Footing/Joist Connections	4x4 Base Caps BC-460	Simpson	36	EA
05 XX XX		Railings	Aluminum 1.5" rails	custom	126	LF
		Roofing Soffits				
	rain screen metal components/joinery	Design and Facilitation				1
	rain screen metal components/joinery	Waterjet cutting	130 pcs		130	ea
	rain screen metal components/joinery	custom binding posts	1545 count		1545	ea
	rain screen metal components/joinery	Misc Fasteners				
	rain screen metal components/joinery	non-directional finish	130 pcs		130	ea
	rain screen metal components/joinery	clear anodize	130 pcs		130	ea
	rain screen metal components/joinery	clear anodize	binding posts			
	rain screen metal components/joinery	Drill & Tap and Countersink	312 locations			
	rain screen metal components/joinery	aluminum angle sections	1 pc - 4.875" x 4.875" .188"thk x 120" long			
	rain screen metal components/joinery	aluminum angle sections	1 pc - 4.875" x 4.875" .188"thk x 35.75" long			
	rain screen metal components/joinery	aluminum angle sections	1 pc - 1.5" x 4.875" .188"thk x 120" long			
	rain screen metal components/joinery	aluminum angle sections	1 pc - 1.5" x 4.875" .188"thk x 47.75" long			
	rain screen metal components/joinery		TOTAL FOR ALUMINUM ANGLES:			
	rain screen metal components/joinery	Fabrication 16 hrs @ 125 per				
	rain screen metal components/joinery	Misc Materials				

06 12 00	module roofing	wood studs	2" x 6" wood studs length: 12'	33	EA	
06 XX XX	module roofing	Plywood	3/4" plywood	30	EA	
06 XX XX	module roofing	2" x 8"	length: 14'	30	EA	
06 XX XX	module roofing	2" x 8"	Length: 16' Wet/Dry Roof Rim	30	EA	
06 XX XX	module roofing	2" x 6"	2" x 6" length: 10'	12	EA	
06 XX XX	module roofing	2" x 6"	Length: 12'	33	EA	
06 18 13	module roofing	6 x 6 Columns	6 x 6 length: 12'	6	EA	
06 18 13	module roofing	6 x 6 Columns	6 x 6 length: 16'	2	EA	
06 18 13	module roofing	5.5 x 9.5 Beams	length: 12' east porch roof	2	EA	
6 18 13	module roofing	5.5 x 9.5 Beams	length: 14' east porch roof	1	EA	
6 18 13	module roofing	5.5 x 9.5 Beams	length: 24' south porch roof	1	EA	
06 XX XX	module roofing	LVL Module Connection		2	EA	
06 XX XX	solar roofing	1.75 x 11.5 LVL	1.75 x 11.5 LVL length: 28'	37	EA	
06 XX XX	solar roofing	2x8	2x8 length: 16' solar roof rafters	10	EA	
06 XX XX	solar roofing	Plywood Sheathing		36	EA	
06 XX XX	solar roofing	Felt Paper		4	RL	
06 XX XX	solar roofing	Roofing Staples		5	BX	
06 XX XX	walls	2" x 6"	2" x 6" length: 10'	190	EA	
06 XX XX	walls	2" x 6"	2" x 6" length: 12'	55	EA	
06 XX XX	walls	2" x 4"	2" x 4" length: 10'	70	EA	
06 XX XX	walls	2" x 4"	2" x 4" length: 12'	16	EA	
06 XX XX	walls	2" x 4"	2" x 4" length: 14'	16	EA	
06 XX XX	headers	2" x 10"	2" x 10" length: 12'	8	EA	
06 XX XX	headers	5.5 x 9.5 glu-lam	5.5 x 9.5 glu-lam length: 8'	1	EA	
06 XX XX	headers	5.5 x 9.5 glu-lam	5.5 x 9.5 glu-lam length: 12'	1	EA	
06 XX XX	interior drywall	4'x10' 5/8" Drywall		80	SHT	
06 XX XX	interior drywall	4'x10' Green Board		3	SHT	
06 XX XX	interior drywall	Drywall adhesive		2	CS	
06 XX XX	interior drywall	25lb Box of Drywall screws		1	BX	
06 XX XX	interior drywall	5lb Bag of Green Spackle		8	BU	
06 XX XX	interior drywall	5lb Bag of Blue Spackle		6	BU	
06 XX XX	interior drywall	Rapid Mix Spackle		1	BG	
06 XX XX	interior drywall	Drywall Tape		8	RL	
06 XX XX	interior drywall	Flex Tape		1	RL	
06 XX XX	interior drywall	Corner Bead - Outside corner 10'		33	EA	
06 XX XX	interior drywall	J-Bead 8'		50	LF	
06 XX XX	interior drywall	Hardi board 1/2"		4	SHT	
06 XX XX	interior drywall	Hardi board 1/4"		3	SHT	
06 XX XX	house deck	1.75 x 9.25 LVL	1.75 x 9.25 LVL length: 14'	8	EA	
06 XX XX	house deck	1.75 x 9.25 LVL	1.75 x 9.25 LVL length: 36'	10	EA	
06 XX XX	house deck	230 Series 9.25" TJI	Length: 14'	60	EA	
06 XX XX	house deck	4x8 x .75 T&G plywood		30	SHT	
06 XX XX	house deck	4x8 x 3/8" plywood		30	SHT	
06 XX XX	house deck	Cases of Sub-Floor Adhesive	case of 24	2	Cases	
06 XX XX	house deck	2x4 green plate		240	BF	
06 XX XX	exterior deck framing	Electrical Cover Plate		50	EA	
06 XX XX	exterior deck framing	Pressure Treated 2x10s	2x10x8	33	EA	
06 XX XX	exterior deck framing	Pressure Treated 2x10s	2x10x10	66	EA	
06 XX XX	exterior deck framing	Pressure Treated 2x10s	2x10x14	11	EA	
06 XX XX	exterior deck framing	Pressure Treated 2x10s	2x10x16	48	EA	
06 XX XX	exterior deck	Deck Boards	Red Cedar - knotty - 1-1/4" x 6 x 12'	2772	BF	
	deck skirt	deck skirt	Western Red Cedar - Clear 1" x 4"	335 sf	20	SHT
	planter + mill	planters clad	Western Red Cedar - Clear 1" x 4"	525	577.5	
	planter + mill	East_Mill_Work (in + out)	Western Red Cedar - Clear 1" x 4"	165	181.5	
09 XX XX	Exterior Rainscreen	Wood Rain Screen (Dry Module)	1" x 4" Western Red Cedar slats	720	1,061.5	S.F.



07 71 23		Outlet	K-style Aluminum Outlets, GAKOX23GXXX	GutterSupply	3.	EA
07 71 23		Outlet/PVC Adapter	2"x3"x3" Flush Downspout tile adapter: TA233DSAWH	GutterSupply	3	EA
07 71 23		Elbow	Rectangular A Elbows: ALAEX23A019	GutterSupply	6	EA
		Gutter Grate		GutterSupply		
		roof scuppers		b&b sheet	3	ea
		Batten Floor Insulation	Assumed R-38 6" for the floor framing		100	SF
07 21 00		Phase Change Material	M51 bioPCmat	515	360	SF
07 21 00		Phase Change Material	M91 bioPCmat	380	360	SF
06 XX XX	roofing	Asphalt Roof Shingles			14	BD
	roofing	VersaShield	VersaShield underlayment fire resistant		978	SF
	Waterproofing	Liquid Applied Air Barrier	Air Shield LMP - Black	WR Meadows	1	DR
	Waterproofing	Seam Tape	Air Shield Transition Membrane	WR Meadows	22	ea
	Waterproofing	window seam tape	vycor plus	WR Grace		
07 46 00	cement rain screen	Minerit HD 2440 x 1218 x 8	4' x 8' x 5/16"		26	ea
7 46 00	cement rain screen	EPDM Rubber	90mm x 50m (164')		3	ea
7 46 00	cement rain screen	Stainless steel screw	TW-S-D12-A10-4.8 x 38 painted screw w/ bond seal washer		800	ea
Needs to be added to PM	Green roof	Waterproofing	MM6125 Fully-adhered, monolithic rubberized asphalt waterproofing	Hydrotech	468	SF
Needs to be added to PM		Root Stop	Universal Root Barrier	Hydrotech	468	SF
		Moisture Mat		Hydrotech	432	SF
		Sedum Tile		Hydrotech	315	SF
Needs to be added to PM	Green roof	Roof Garden Insulation	Dow Styrofoam HIGHLOAD 40	Dow	468	SF
	spray foam	Exterior walls	3" thick	Envirofoam		1920
	spray foam	Ceiling 1 (L = 15ft)	6" thick	Envirofoam		920
	spray foam	Ceiling 2 (L = 12ft)	6" thick	Envirofoam		920
	spray foam	Underside of building	2" thick	Envirofoam		920

Division 08	Openings					
08 32 00	Operable Glass Wall (Kitchen)	Door Size: 6'-10" W x 6'-10" H , Model: SL60 , Frame Type: ALUM.	NanaWall	1	EA	
08 32 00	Operable Glass Wall (Living Room)	Door Size: 9'-2" W x 6'-10" H , Model: SL60 , Frame Type: ALUM.	NanaWall	1	EA	
Window	Master Bedroom - West wall	5317: Proline, Awning Right, 53 x 17, Black, 3-11/16"	PELLA		1 EA	
Window	Bathroom - East wall	4117: Proline, Awning Right, 41 x 17, Black, 3-11/16"	PELLA		1 EA	
Window	Flex Room (2) / Hallway / Master Bedroom	3559: Proline, Casement Left, 35 x 59, Black, 3-11/16"	PELLA		4 EA	
Window	Kitchen - East wall	5325: Proline, Awning Right, 53 x 25, Black, 3-11/16"	PELLA		1 EA	
Window	Dinning Room - East wall	2935: Proline, Casement Fixed, 29 x 35, Black, 3-11/16"	PELLA		1 EA	
Window	North Wall (7)	4125: Proline, Awning Fixed, 41 x 25, Black, 3-11/16"	PELLA		7 EA	
Window	Entry - North wall	4153: Proline, Casement Fixed, 41 x 53, Black, 3-11/16"	PELLA		1 EA	
Door	Front entrance	3680, 2 wide outswing entry door, 50.5 x 80.937, Black, 4 9/16"	PELLA		1 EA	
Door	Bedroom Door	3680, 2 wide inswing door, 72 x 79.5, Black, 4-9/16"	PELLA		1 EA	

PELLA TOTAL:

	door	interior doors	Graham Wood Doors		3	EA
	door	bifold door	Pemko Assa Abloy assembly kit		1	EA
	door	bifold door	bifold		1	EA
08 71 00	door hardware	Door D101	Handle Set	Pella	1	EA
08 71 00	door hardware	Door D101	Butt Hinge	Pella	3	EA
08 71 00	door hardware	Door D101	Lockset	Pella	1	EA
08 71 00	door hardware	Door D102	Butt Hinge + Self Closing	Assa Abloy	3	EA
08 71 00	door hardware	Door D102	Lever	Assa Abloy	2	EA
08 71 00	door hardware	Door D102	Lockset	Assa Abloy	1	EA
08 71 00	door hardware	Door D102	Deadbolt Lock	Assa Abloy	1	EA
08 XX XX	door hardware	Door D102	Metal Door Framing	CECO	1	EA
08 XX XX	door hardware	Door D102	Hollow Metal Door	CECO	1	EA
08 XX XX	door hardware	Door D103, D107	EZY-JAMB Standard Hinge	Ezy-Jamb	3	EA
08 XX XX	door hardware	Door D103, D107	Lever	Yale	2	EA
8 71 00	door hardware	Door D103, D107	Deadbolt Lock	Assa Abloy	1	EA
8 71 00	door hardware	Door D103, D107	Door Stop	Rockwood	1	EA
8 71 00	door hardware	Door D103, D107	Concealed Door Jamb	Studco B.S.	1	EA
8 71 00	door hardware	Door D103, D107	Interior Slab Door	Graham Earth	1	EA
8 71 00	door hardware	Door D104	EZY-JAMB Standard Hinge	Ezy-Jamb	3	EA
8 71 00	door hardware	Door D104	Lever	Yale	2	EA
8 71 00	door hardware	Door D104	Ada Turn and release set	Assa Abloy	1	EA
8 XX XX	door hardware	Door D104	Door Stop	Rockwood	1	EA
8 XX XX	door hardware	Door D104	Concealed Door Jamb	Studco B.S.	1	EA
8 XX XX	door hardware	Door D104	Interior Slab Door	Graham Earth	1	EA
8 XX XX	door hardware	Door D105	Folding Door Hardware	Pemko	1	EA
8 71 00	door hardware	Door D105	Flush Pull	Rockwood	1	EA
8 71 00	door hardware	Door D105	Interior Slab Door	Graham Earth	1	EA
8 71 00	door hardware	Door D106	Folding Door Hardware	Pemko	2	EA
8 71 00	door hardware	Door D106	Flush Pull	Rockwood	2	EA
8 71 00	door hardware	Door D106	Interior Slab Door	Graham Earth	2	EA

Division 09	Finishes					
	flooring	Flooring	Interior flooring - white oak		750	SF
	flooring	Flooring	Mechanical Room - VCT		30	SF
09 65 00	tile	Bathroom Floor Tiling	Arctic White - high gloss 3"x6"	DALTILE	40	SF
	tile	Bathroom Wall Tiling	Arctic White - Matte 3"x6"	DALTILE	70	SF
09 91 23	paint	Interior Paint - Walls	Benjamin Moore- Novajo White	Benjamin Moore	2000	SF
	paint	Interior Paint - Ceilings	Behr - W-D-700 powdered snow / flat	Behr	750	SF
	paint	Interior Paint - base and trim	Behr - White High Gloss	Behr	200	SF
	paint	wood stain	Behr - 401 5 Gal	Behr	2	EA
09 XX XX		Kitchen Countertops	Quartz Blizzard 2141, Polished 3/4" Slab	Ceasarstone	31	SF
09 XX XX		Int. moldings	Molding, casings		600	LF
09 30 23	backsplash	Kitchen Backsplash	1" x 1" Recycled Glass Tile		10	SF
	roof	soffit	PAINTED ALUMINUM SOFFIT SHEETS		225	SF
		Aluminum Channel	4" x 3/4"	Stylmark	81	LF
		Aluminum Channel	3/4" x 1 3/16" x 3/64"	Stylmark	10	LF
		Swiveling Caster	Grey / Black	Hafele	24	EA
		Closet Rod & Tube Support	chrome plated	Hafele	11	LF
		Blumotion European Hinge	standard	Blum	62	EA
		Tandem Drawer Runner	standard	Blum	22	EA
		Rubber Bumper	black	MCMMASTER Carr	20	EA
		Shelf Support Peg 1/4"	plated nickel	Prime-Line	100	EA
		Screw Mounted Magnetic Pressure Catch	black	Hafele	1	EA
		Base Cabinet Leveler	black	Hafele	44	EA
		Twin Ball Catch	polished brass	Hafele	20	EA
		Murphy Bed Hardware Kit	standard	Murphy Wall b.h.	1	EA
		Mortise Flush Pull	matt nickel; back aluminum	Hafele	3	EA
		Tab Pull	matt silver anodized	Hafele	14	EA

Division 10		Specialties				
10 28 13	bathroom	Towel Bar	K-37050-CP 18" Alteo Towel Bar	Kohler	1	EA
10 28 13	bathroom	Robe Hook	K-37055-CP Alteo Robe Hook	Kohler	1	EA
10 28 13	bathroom	Bathroom Vanity	Godmorgon / Odensvik sink cabinet w/ 4 drawers	IKEA	1	EA
10 28 13	bathroom	Mirror Cabinet	Godmorgon mirror cabinet w/ 2 doors	IKEA	1	EA
10 28 13	bathroom	Toilet Tissue Dispenser	K-37054-CP Pivoting Toilet Tissue Holder	Kohler	1	EA
10 28 13	bathroom	curtain rod	satin chrome w/ mounting hardware	generic	1	EA

Division 11		Equipment				
11 31 00		Range Top	LG LCE30845	LG	1	EA
11 31 00		Oven	LG LWS3010ST	LG	1	EA
11 31 00		Refrigerator	LG LTC19340	LG	1	EA
11 31 00		dishwasher	LG LDF8072ST	LG	1	EA
11 31 00		Microwave	GE JE740DRWW	GE	1	EA
11 31 00		Washing Machine	LG WM2655HVA	LG	1	EA
11 31 00		Dryer	LG DLEX2655V Front Load Dryer	LG	1	EA

Division 12		Furnishings				
	Living Room	Custom Millwork	MW 100 Wood veneer wall panel unit per MW-100.1		23.5	If
	Living Room	Custom Millwork	MW 101 Mobile Bench #1 per MW-101.0		4	pc
	Living Room	Custom Millwork	MW 102 Mobile Bench #2 per MW-102.0		2	pc
	Living Room	Custom Millwork	MW 103 WD-1 Coat closet cabinet per MW-103		1	pc
	Living Room	Custom Millwork	MW 104 WD-1 hanging cubby per MW-104		4	pc
	Living Room	Custom Millwork	MW 105 WD-1 hanging cubby per MW-105		1	pc
	Living Room	Custom Millwork	MW 106 WD-1 hanging shelf per MW-106		3	pc
	Flex Room	Custom Millwork	MW 200 WD-1 murphy bed		1	unit
	Flex Room	Custom Millwork	MW 201 WD-1 shelving unit		1	unit
	Flex Room	Custom Millwork	MW 202 WD-1 wardrobe unit		1	unit
	Kitchen	Custom Millwork	MW 300 WD-1 pantry		6.5	If
	Bathroom	Custom Millwork	MW 400 WD-1 wardrobe unit		1	unit
	Master Bedroom	Custom Millwork	MW 500.1 WD-1 wardrobe unit		2	unit
	Master Bedroom	Custom Millwork	MW 501 WD-1 bed unit		2	unit
		Custom Millwork	MW 701 shop primed architrave		1	unit
	exterior	Custom Millwork	MW 600 trespa storage units		20	If
			TOTAL CUSTOM MILWORK			

Division 13 Special Construction

Division 14 Conveying Equipment

Division 21		Fire Suppression				
21 13 00		Sidewall Sprinkler	Viking VK481 ("1/2" Residential Standard) Coverage Concealed Sidewall Sprinkler"	Viking	3	EA
21 13 00		Ceiling Sprinkler	Viking VK480 (1/2" Residential Concealed Ceiling Recessed Sprinkler)	Viking	1	EA
21 13 00		Sprinkler Head	Viking Microfast Quick Response Pendant Sprinkler	Viking	1	EA
21 13 00		Sprinkler Cover Plate	Viking 16207MA/W (Standard Sprinkler Cover Plate @ 135°F)	Viking	4	EA
Needs to be added to PM		Smoke/CO Detector	Kiddie KN-COSM-IB Sensors	Kiddie	5	EA
21 20 00		Fire Extinguisher	Kiddie FX210R (Residential Series Living Area UL rated 2-A: 10-B:C Fire Extinguisher) Height: 16.07, Diameter: 4.50	Kiddie	1	EA
21 00 00		Fire Suppression Piping	Blazemaster	Blazemaster	100	LF
21 XX XX		Manual Globe Valves			3	EA
21 XX XX		Pressure Gauges	General piping gauges		2	EA

Division 22		Plumbing				
22 41 19	Bathroom	bathroom sink	St paul Del Mar sink	IKEA	1	EA

	Bathroom	Lavatory faucet	Kohler Mistos faucet	IKEA	1	EA
	Bathroom	P Trap	253-PC	Jalco	1	EA
	Bathroom	toilet	K-3609-White Cimarron 2pc elongated toilet	Kohler	1	EA
	Bathroom	toilet seat	K-4636 - White Elongated Toilet Seat	Kohler	1	EA
22 41 19	Bathroom	Bath tub	Kohler K-715 Villager 60" x 30-1/4"	Kohler	1	EA
	Bathroom	Tub drain	K-7160-TF-PC	Kohler	1	EA
	Bathroom	Pressure Balance T&S trim	K-T10274-4-PC	Kohler	1	EA
	Bathroom	Pressure Balance Rough W/ Stops	K304-KS	Kohler	1	EA
22 41 39	Bathroom	Shower head	KOHLER K-10591-CP Bancroft Multifunction Showerhead, 2.5 GPM	Kohler	1	EA
22 41 39	Bathroom	Bath spout	KOHLER K-10280-4-CP	Kohler	1	EA
22 41 16	Kitchen	Kitchen sink	Kohler K-3822-1	Kohler	1	EA
	Kitchen	Kitchen sink drain	K-8801-CP	Kohler	1	EA
22 41 39	Kitchen	Kitchen faucet	9159-DST-PC	Delta	1	EA
22 10 00		Piping	Watts Pex Piping WPTC for 3/4" lines (hot & cold) and smaller	Watts	111	LF
		Piping	Watts Pex Piping WPTC for 1/2" lines connections recirc	Watts		
22 XX XX		Piping	Uponor F3061000 for 1 inch cold line	Uponor	50	LF
22 11 23		Rain Water Garden Pump	FloJet Triplex Diaphragm R3526144	FloJet	1	EA
Cut Sheets?		Plastic Tank	135 Gallon Rectangular Polyethylene Plastic Tank, R-RB494	Ronco Plastics	1	EA
22 12 00		Supply water tank	ATL Custom 1300 Gallon "AquaFlex Tank"	Aero Tec Labs	0	EA
22 12 00		Waste Water Tank	ATL Custom 1000 Gallon "AquaFlex Tank"	Aero Tec Labs	0	EA
22 11 23		Condensate Misting Pump	FloJet Triplex Diaphragm R3526144	FloJet	1	EA
22 14 29		Sump Pump	Grundfos KP 150	Grundfos	0	EA
23 21 23		Supply Pump	Grundfos MQ 3-35	Grundfos	0	EA
22 11 23	on demand water	Hot Water Re-circulation Pump	Grundfos UP10-16BN5/LC	Grundfos	1	EA
	on demand water	Sterilite 35 Gallon Latch Tote			1	EA
	on demand water	LED Switch			1	EA
	on demand water	Piping	1/2" pex piping - white - 25 ft	Sharkbite	1	coil
	on demand water	Pex Connectors				
	on demand water	plastic adapter	1/2 CF x 1/2 MPT adapter - plastic	Sharkbite	2	EA
	on demand water	hose clamp	1/2" hose clamp	Grundfos	1	EA
	consensate mist	Outdoor Misting Kit	Orbit Basic 12 ft. kit	Orbit	1	EA
22 30 00		Rain Water Tank	Ronco Plastics B300	Ronco Plastics	1	EA
22 30 00		Condensate Misting Tank	Ronco Plastics B233	Ronco Plastics	1	EA
23 81 00		80 Gallon Heat Pump Water Heater	Airgenerate Airtap Hybrid AT180	Airgenerate	1	EA
22 12 00		Hot Water Tank	Watts 2.1 Gallon Expansion Tank PLT-5	Watts	1	EA
22 05 23		Check Valve	Watts LF600	Watts	2	EA
22 14 26		Floor Drain	Watts FD5-2PVC	Watts	1	EA
22 05 23		Ball Valve	Watts LFWPBV	Watts	5	EA
		Water Conditioner	Watts OFRES0935	Watts	1	EA
22 12 36		Sump Basin	Jackel SF-15	Jackel	1	EA
Division 23	Heating, Ventilating, and Air-Conditioning					
	mech. Equipment	AC	Daikin Inverter Ducted unit	Daikin	1	EA
	mech. Equipment	thermostat	Daikin Thermostat EDUS72_975	Daikin	1	EA
23 70 00	mech. Equipment	Dehumidifying Ventilator, 160 CFM, 70pint/day	Ultra-Aire 70H-4029870	Ultra-Aire	1	EA
23 60 00	mech. Equipment	Haiku Ceiling Fan	Big Ass Fan S3150-S1	Big Ass Fan	1	EA
23 38 13	mech. Equipment	Range Hood	XO vent hood	XO	1	EA
	mech. Equipment	ERV	Fantech Se704N	Fantech	1	EA
23 33 00	duct accessories	4" Wall Cap (ERV)	American Aldes: 22 306SS, Diameter: 4	American Aldes	2	EA
	duct accessories	Return Grill	ABRGWH88	Accord	1	EA
	duct accessories	Return Grill	ABRGWH2016	Accord	1	EA
	duct accessories	Register	ABSWWH284	Accord	1	EA
	duct accessories	Register	ABSWWH2108	Accord	1	EA

23 31 00	Ducting		ICS	95	L.F.
Liquid Dessicant	Salt for solution	CaCl2	C-Force	2	BG
Liquid Dessicant		DM312 Pump	Dynamax	1	EA
Liquid Dessicant		DC 15/5 Pump	Totten	1	EA
Liquid Dessicant		Fan			EA
Liquid Dessicant		Sensor Salinity	Vernier	2	EA
Liquid Dessicant		Sensor Temp	Vernier	2	EA
Liquid Dessicant		Packing Mtrl.		1	LS
Liquid Dessicant		Plexiglass		5	
Liquid Dessicant		Storage Tank	Plastic Mart	1	
Liquid Dessicant		Heater	Tempco	4	EA
Liquid Dessicant	Outside Unit	Plywood Box	Custom		
Liquid Dessicant	Rubber Sealant				
Liquid Dessicant		Solenoid Valve	Asco Redhat	2	EA
Liquid Dessicant		Pex Piping	Watts	1	LS
Liquid Dessicant	Plexiglass Adhesive	Plastic Adhes	Weld-On	2	EA

**Division 25 Integrated Automation**

Sensor Module	Microcontroller	Arduino Micro	Arduino	1	EA
Sensor Module	Temp/Hum Sensor	SENSIRION SHT75	Sensirioin	1	EA
Sensor Module	Motion Sensor	Honeywell DT7450	Honeywell	1	EA
Sensor Module	Photoresistor	20PCS Photoresistor GL5537		1	EA
Sensor Module	Wireless	Digi Xbee (XBEE 802.154.4 Series 1)	Xbee	1	EA
Sensor Module	Wireless	Digi Xbee Explorer Regulated	Xbee	1	EA
Hot Water module	Control Board	Arduino Pro Miini 328 - 5V/16MHz	Arduino	1	EA
Hot Water module	Wireless	Digi Xbee (XBEE 802.154.4 Series 1)	Xbee	1	EA
Hot Water module	Wireless	Digi Xbee Explorer Regulated	Xbee	1	EA
Hot Water module	Clip on Temp			1	EA
Hot Water module	Button			1	EA
Desiccant Module	Control Board	Arduino Pro Miini 328 - 5V/16MHz	Arduino	1	EA
Desiccant Module	Wireless	Digi Xbee (XBEE 802.154.4 Series 1)	Xbee	1	EA
Desiccant Module	Wireless	Digi Xbee Explorer Regulated	Xbee	1	EA
Desiccant Module	Relay			3	EA
Central Module	Microcontroller	Arduino Micro		1	EA
Central Module	Wireless	Digi Xbee 1.5		1	EA
Central Module	Router	Linksys EA 2700	Linksys	1	EA
Interconnection	Switching Power Supply 12V	DNR30US12		1	EA
Interconnection	Switching Power Supply 24V	DNR60US24		1	EA
Interconnection	16/2 Data Wire			500	L.F.
IR Module	Control Board	Arduino Pro Miini 328 - 5V/16MHz	Arduino	1	EA
IR Module	Wireless	Digi Xbee (XBEE 802.154.4 Series 1)	Xbee	1	EA
IR Module	Wireless	Digi Xbee Explorer Regulated	Xbee	1	EA
Lighting Control	Lighting Controller	Smartlink Hub 2412N	Insteon	1	EA
Lighting Control	Instean Light Switches	2466SW ToggleLinc, non-dimming	Insteon	8	EA
Lighting Control	Instean Light Switches	2477SSwitchLinc	Insteon	7	EA
CT Sensors	Monitoring Package	Greeney Monitoring Package	Brultech	1	EA
CT Sensors	Package G			1	EA
CT Sensors	Package K			1	EA
CT Sensors	CT Line Sensor	Brultech Micro 40	Brultech	8	EA
HVAC	Control Board	Arduino Pro Miini 328 - 5V/16MHz	Arduino	1	EA
HVAC	Wireless	Digi Xbee (XBEE 802.154.4 Series 1)	Xbee	1	EA
HVAC	Wireless	Digi Xbee Explorer Regulated	Xbee	1	EA
HVAC	Relay			3	EA

**Division 26 Electrical**



26 31 00	Solar Array	12W Solar Shingles	Dow (estimate with 3.725kW inverters included)	Dow	512	EA
26 31 00	Solar Array	3.725kW Inverter AC Disconnect Switch	Dow UFP222R	Dow SquareD	2 1	EA EA
	Distribution	42 Space Distribution Panel	LoadCenter, MLO, 42 Space, Three Wire, 120/240, QO142L225PG	SquareD	1	EA
	Distribution	Cover Flush	LoadCenter Cover Flush QOC42UF	SquareD	1	EA
26 27 00	Distribution	Circuit Breaker - 15 A - 1 Pole	QO115	SquareD	3	EA
	Distribution	Circuit Breaker - 15 A - 1 Pole - AFCI	QO115PCAFI	SquareD	7	EA
26 27 00	Distribution	Circuit Breaker - 15 A - 2 Pole	QO215	SquareD	1	EA
	Distribution	Circuit Breaker - 20 A - 1 Pole - AFCI	QO120PCAFI	SquareD	2	EA
	Distribution	Circuit Breaker - 20 A - 2 Pole	QO220	SquareD	4	EA
	Distribution	Circuit Breaker - 30 A - 2 Pole	QO230	SquareD	2	EA
	Distribution	Circuit Breaker - 40 A - 2 Pole	QO240	SquareD	1	EA
	Distribution	Circuit Breaker - 20A - 1 Pole	QO120	SquareD	7	EA
	Distribution	Circuit Breaker - 20A - 2 Pole - GFCI	QO220GFCI	SquareD	2	EA
	Distribution	Main Circuit Breaker - 150A	Main Circuit Breaker 150 A, 35 Kaic,QOM2150VH	SquareD	1	EA
	Distribution	Main Circuit Breaker Enclosure	QOM2225NRB	SquareD	1	EA
	Distribution	Utility Meter Housing	UTRS213A	SquareD	1	EA
	Distribution	Air Conditioning Disconnect	QO200TR	SquareD	1	EA
	Distribution	General Duty Safety Switch	DU		2	EA
	Wiring	Need to add Swift Order		Various	1	LS
	Wiring	FIT1PB	BRDGPOR 323 1-IN 105D PLSTC B BRI323 TPZ833		5	EA
	Wiring	MUL 90101	MULB 90101 1G WHT DPLX RCPT PL		25	EA
	Wiring	MUL 90401	MULB 90401 1G WHT DPLX RCPT PL		10	EA
	Wiring	MUL 90402	MULB 90402 1G WHT DPLX RCPT PL		3	EA
	Wiring	MUL 90403	MULB 90403 1G WHT DPLX RCPT PL		3	EA
	Wiring	LEVCR20W	LEV CR20-W DPLX RCPT NEMA5		10	EA
	Wiring	PVC3LB	PVC 3-IN TYPE-LB COND FTG		2	EA
	Wiring	FIT3PB	BRDGPOR 328 3-IN 105D PLSTC B BRI328 TPZ838		3	EA
	Wiring	EMT34	CONDUIT 3/4 EMT TUBING		50	EA
	Wiring	EMT1	CONDUIT 1 IN EMT TUBING		50	EA
	Wiring	RAC564	RACO 564 2-3 / 4D SW BOX W/FLAT		16	EA
	Wiring	RAC567	RACO 567 2-3 / 4D NMC SW BOX W/E		4	EA
	Wiring	MUL11201	MULB 11201 4-IN SQ BLANK CRV		10	EA
	Wiring	PASS122R	P&S S1-22-R 1G PLSTC OUTLET BO		20	EA
	Wiring	PASS235RAC	P&S S2-35-RAC 2G PLSTC OUTLET B		5	EA
	Wiring	PASS354RAC	P&S S3-54-RAC 3G PLSTC OUTLET		2	EA
	Wiring	PASS120RAC	P&S S1-20-RAC 4-IN RND CEIL BO		10	EA
	Wiring	BRI650DC2	BRDGPOR 650-DC2 3/8 2SCR SEC TPZ140		100	EA
	Wiring	FIT34PB	BRDGPOR 322 3/4 105D PLASTC BU BRI322 TPZ822		5	EA
	Wiring	LEVTS320W	LEV T5320-W WHT NEMA5-15R DPLX		15	EA
	Wiring	LEVX7899W	WHT 20A TR GFCI RC		5	EA
	Wiring	LEVWT899W	20A 125V GFCI RCP		5	EA
	Wiring	EAGTR7740WBOX	CWD TR7740W-BOX CMBO USB CHGR&		5	EA
	Wiring	LEV56012W	SP WHT 15A SWITCH		5	EA
	Wiring	PVC150	PVC 1-1/2 SCH 40 CONDUIT		50	EA
	Wiring	PVC112CPL	PVC 1-1/2 CONDUIT CPLG		8	EA
	Wiring	PVC11290	PVC 1-1/2 90D ELBOW SCH 40		3	EA
	Wiring	PVC11245	PVC 1-1/2 45D ELBOW SCH 40		3	EA
	Wiring	FIT112PB	BRDGPOR 325 1-1/2 105D PLSTC BRI325 TPZ835		3	EA
	Wiring	PVC300	PVC 3-IN SCH 40 CONDUIT		50	EA
	Wiring	PVC3CPL	PVC 3-IN CONDUIT CPLG		8	EA
	Wiring	PVC345	PVC 3-IN 45D ELBOW SCH 40		3	EA
	Wiring	PVC390	PVC 3-IN 90D ELBOW SCH 50		3	EA
	Lights		Hampton Bay Sadie Collection 1-Light Hanging Metal Satin Nickel Ceiling Pendant	Lithonia Lighting	1	EA
	Lights		Home Decorators Collection Sydney 3-Light Polished Nickel Bowl Pendant	Lithonia Lighting	2	EA
	Lights		Lithonia Lighting 3 in. Recessed Matte White LED Baffle Kit	Lithonia Lighting	2	EA

Lights		Lithonia Lighting 4 in. Recessed Matte White LED Baffle Kit	Lithonia Lighting	20	EA
Lights	exterior recessed	6" LED Module	Lithonia Lighting	6	EA
Lights	laundry	Cabintet Light Direct Wire T8	Light Concepts	1	EA

**Division 27 Communications / Compsci**

Apple Mac Mini	2.5GHz Dual-Core Intel Core i5, Wifi Enabled, Bluetooth Enabled	1	EA
SAMSUNG 830 Series MZ-7PC256B/WW	256 GB SSD, 6GB/Sec, SATA III, 2.5"	1	EA
BUFFALO MiniStation Plus HD-PNT500U3R	500 GB External HDD, USB 3.0 Compatible, UP 410 MBPS	1	EA

**Division 32 Exterior Improvements**

32 84 00		Drip Irrigation Kit	Green Roof Irrigation Kit, #k100	The Drip Store	1	EA
32 90 00		Green Wall Panels	2"x2"x4" Green Wall Module, Wall-mounted, aluminum	Green Living Technologies	40	EA
	Green Wall Panels	Unpainted cover	2x2 green wall panel covers	Green Living Technologies	2	EA
32 90 00		Green Wall Brackets	Brackets 24'X2".25	Green Living Technologies	3	EA
32 90 00		Green Wall Spacers	Spacers 1/2" spacers (bags of 20 only)	Green Living Technologies	6	BG
			9" tall Aluminum Edger		86	Lf
32 90 00		L Shaped Trim (8'-4")	Side Trim "L" (75" each) 2 sections		2	EA
	planters/benches	Ramp-Planters (2x4)	Red Cedar		50.6	LF
	planters/benches	Ramp-Planters (2x4)	Ply wood		176	LF
	planters/benches	Ramp-Planters (2x4)	nailer		88	LF
	planters/benches	Ramp-Planters (2x4)	2x4 pines		22	LF
	planters/benches	Planters (4x4)	Red Cedar		468	LF
	planters/benches	Planters (4x4)	Ply wood		264	LF
	planters/benches	Planters (4x4)	nailer		157.3	LF
	planters/benches	Planters (4x4)	border		102.3	LF
	planters/benches	Planters (4x4)	2x4 pines		22	LF
	planters/benches	Benches	1X4 Red Cedar		224	LF
	planters/benches	Benches	Ply wood		8	LF
	planters/benches	Benches	nailer		52.8	LF
	planters/benches	Benches	border		102.3	LF
	planters/benches	Benches	2x4 pines		36	LF
32 93 00	P1	Wild Lilac	Ceanothus 'Joyce Coulter'		2	Each
32 93 00	P2	False Aster	Kalimeris pinnatifida, Pot Size: 14in (5 in)		5	Each
32 93 00	P3	False Heather	Cuphea hyssopifolia, Pot Size: 8in (5 in)		1	Each
32 93 00	P4	Red Monkeyflower	Mimulus 'Jack', Pot Size: 8in (5 in)		4	Each
32 93 00	P5	Pink Monkeyflower	Mimulus 'Trish', Pot Size: 10in (5 in)		4	Each
32 93 00	P6	Dwarf Sweet Pea Bush	Polygala fruticosa, Pot Size: 14in (1 gallon)		2	Each
32 93 00	P7	Grass (Blonde Ambition Blue Grama)	Bouteloua gracilis 'Blonde, pot size: 8in.		2	Each
32 93 00	P8	Island Wallflower	Erysimum insular, Pot Size: 10in		5	Each
32 93 00	P9	Apple Blossom Penstemon	Penstemon 'Apple Blossom', Pot Size: 8in (5.5)		3	Each
32 93 00	P10	Autumn Joy Stonecrop	Sedum telephium, pot size: 10in		1	Each
32 93 00	P11	Blanket flower	Gaillardia X grandiflora, Pot Size: 6in (4 in)		4	Each
32 93 00	P12	Blue oat grass	Helictrotrichon sempervirens, pot size: 10in		2	Each
32 93 00	G1	Dwarf Rose Joseph's Coat	Alternanthera ficoidea 'Rosea Nana' pot size: 4 in		5	Each
32 93 00	G2	Ice Plant	Drosanthemum floribundum, Pot Size: 4in (4.5 in)		6	Each
32 93 00	G3	Japanese Pachysandra	Pachysandra terminalis, Pot Size: 12in		42	Each
32 93 00	G4	October Daphne, Stonecrop	Sedum sieboldii, Pot Size: 8in (6x15 in)		7	Each
32 93 00	V2	Oregano	Origanum vulgare (3.5 in)		8	Each
32 93 00	V3	Cilantro	Coriandrum sativum (3 in)		8	Each



32 93 00	V4	Parsley	Petroselinum crispum	8	Each
32 93 00	V5	Carrots	Daucus carota	8	Each
32 93 00	V6	Common Bean	Phaseolus vulgaris	8	Each
32 93 00	V7	Bell Pepper	Capsicum annuum (4 in)	8	Each
32 93 00	V8	Zucchini	Cucurbita pepo (4 in)	8	Each
32 93 00	V9	Radish	Raphanus sativus	8	Each