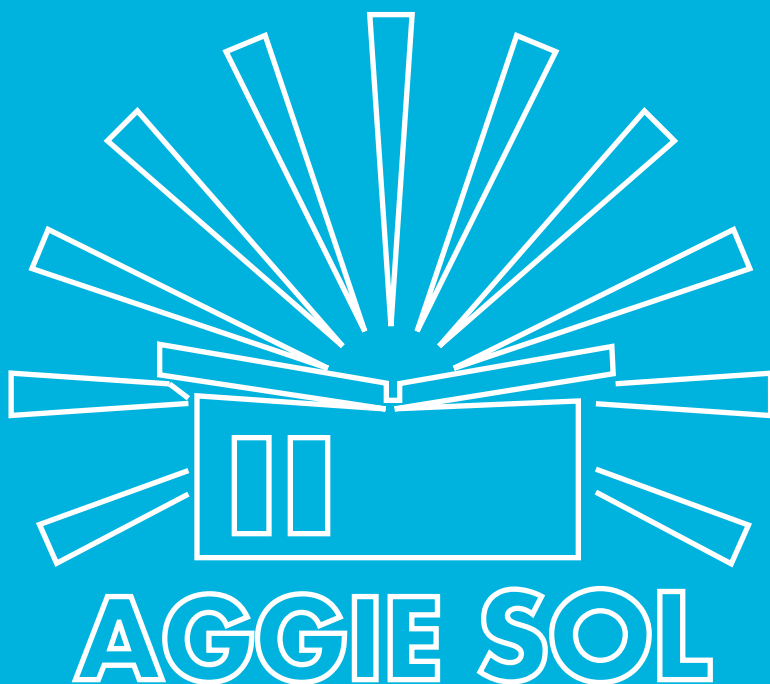


U.S. DEPARTMENT OF ENERGY
Solar Decathlon 2015

PROJECT MANUAL

AS-BUILT DOCUMENTATION
AUGUST 17, 2015



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TABLE OF CONTENTS

Project Manual Cover Page
Table of Contents
Rules Compliance Checklist
Structural Calculations
Detailed Water Budget
NEC 220 Calculations
Interconnection Application Form
Energy Analysis Results + Discussion
Summary of Unlisted Electrical Components
Summary of Reconfigurable Features
Quantity Takeoff
Construction Specifications

DIVISION 00 PROCUREMENT & CONTRACTING REQUIREMENTS

00 01 01	Project Title Page
00 01 07	Seals Page
00 01 15	List of Drawing Sheets

DIVISION 01 GENERAL REQUIREMENTS

01 42 00	References
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 74 19	Construction Waste Management and Disposal
01 81 13.26	Sustainable Design Requirements

DIVISION 03 CONCRETE

03 54 13	Gypsum Concrete_SP
----------	--------------------

DIVISION 06 WOOD, PLASTICS, & COMPOSITES

06 16 00	Sheathing
06 16 00	Sheathing_SP
06 25 13	Hardie Board Panels
06 48 13	Exterior Wood Door Frames
06 48 13	Exterior Wood Door Frames_2

DIVISION 07 THERMAL AND MOISTURE PROTECTION

07 21 00	Thermal Insulation_SP
07 21 16	Blanket Insulation (Eco-Batt)
07 25 00	Weather Barriers_SP
07 27 00	Air Barrier (Tyvek HomeWrap)
07 46 46	Fiber Cement Siding (Hardie Panels)_SP
07 54 23	Thermoplastic Polyolefin Roofing (TPO) _SP
07 62 00	Sheet Metal Flashing and Trim
07 65 00	Flexible Flashing (DuPont FlexWrap)
07 71 00	Roof Specialties_SP
07 92 00	Joint Sealants_SP
07 92 16	Rigid Joint Sealants (Alex Plus)
07 92 16	Rigid Joint Sealants (Dynaflex)
07 92 16	Rigid Joint Sealants (GE Silicone II)

DIVISION 08 OPENINGS

08 01 14	Door Hardware Lever 1, 2, 3
08 01 71	Front Door Hardware
08 14 00	Wood Doors
08 36 16	Interior Doors
08 51 13	Aluminum Windows (Awning Windows)
08 62 50	Tubular Daylighting Device

DIVISION 09 FINISHES

09 29 00	Gypsum Board
09 64 53	Resilient Wood Flooring Assemblies
09 65 13.13	Baseboard
09 91 23	Interior Paint

DIVISION 10 SPECIALITIES

10 21 13	Kohler Toilet
10 21 16.13	Shower and Dressing Compartments
10 28 16	Bath Accessories (Countertops, Bath Surround, and Shower)
10 28 16	Cleansing Room Shower Head
10 84 16.13	Bath Controls
10 84 13	Exterior Lighting
10 84 16	Recessed Lighting

DIVISION 11 EQUIPMENT

11 30 13.13	Residential Kitchen Appliances (Oven-Stove)
11 20 13.13	Residential Kitchen Appliances (Dishwasher)
11 20 13.13	Residential Kitchen Appliances (Microwave)
11 20 13.13	Residential Kitchen Appliances (Refrigerator)
11 20 13.13	Residential Kitchen Appliances (Dryer)
11 20 13.13	Residential Kitchen Appliances (Washer)
11 30 34	Residential Ceiling Fan
11 31 00	Residential Appliances_SP
11 32 13	Kitchen Sink

DIVISION 12 FURNISHINGS

12 36 61	Kitchen Countertops
----------	---------------------

DIVISION 21 FIRE SUPPRESSION

21 05 29	Hangers and Supports for Fire-Suppression Piping and Equipment
21 10 00	Water-Based Fire Suppression Systems (Sprinklers)
21 10 00	Water-Based Fire Suppression Systems_SP
21 10 00	Water-Based Fire Suppression Systems-Bronze Ball Valves
21 13 13	Electric Drive Centrifugal Fire Pump
21 24 16	Dry Chemical Fire Extinguishing Equipment

DIVISION 22 PLUMBING

22 07 00	Plumbing Insulation_SP
22 07 19	Plumbing Piping Insulation
22 07 19	Plumbing Piping Insulation (Aluminum Foil Tape)
22 07 19	Plumbing Piping Insulation (Vinyl Pipe Insulation Tape)
22 11 16	Domestic Water Piping_SP

22 11 16	Domestic Water Piping (Fire and Domestic Return)
22 11 23	Domestic Water Pumps_SP
22 11 23	Domestic Water Pumps (Jet Pump and Pressure Tank Combo)
22 12 19	Facility Ground-Mounted, Potable-Water Storage Tanks (Greywater Tank)
22 12 19	Facility Ground-Mounted, Potable-Water Storage Tanks (Primary Supply Tank)
22 13 16	Sanitary Waste and Vent Piping
22 13 16	Sanitary Waste and Vent Piping_SP
22 13 23	Domestic Water Pump
22 30 00	Plumbing Manifold
22 33 00	Electric Domestic Water Heaters_SP
22 33 30.16	Storage Electric Domestic Water Heater (Nexus Water Heater)
22 33 30.26	Residential, Collector to Tank, Heat Exchanger Coil, Electric Domestic Water Heater (Nexus Collection Tank)
22 40 00	Plumbing Fixtures_SP
22 41 00	Bathroom Shower Head
22 41 16	Residential Lavatories and Sinks-Kitchen
22 41 19	Residential Bathtub (Kohler)
22 41 23	Cleansing Room. Pfister Adjustable Shower. Polished Chrome
22 41 23	Kohler Bathroom
22 41 39	Pfister Bathroom Sink Faucet

DIVISION 23 HVAC

23 05 23	General Duty Valves for HVAC Piping_SP
23 05 29	Hangers and Supports for HVAC Piping and Equipment_SP
23 05 48	Vibration and Seismic Controls for HVAC Piping and Equipment_SP
23 05 93	Testing, Adjusting, and Balancing for HVAC_SP
23 07 00	HVAC Insulation_SP
23 09 13.23	Sensors and Transmitters (Chilled Water Storage Tank Sensor)
23 09 13.33	HVAC Control Valves
23 21 13.13	Hydronic Piping (Radiant Heating + Cooling Underfloor)
23 21 13.23	Aboveground Hydronic Piping
23 21 16	Hydronic Piping Specialities (Radiant Pump Flanges)
23 21 23.13	In-Line Centrifugal Hydronic Pump (Radiant Pump)
23 23 00	Refrigerant Piping
23 23 00	Refrigerant Piping_SP
23 33 46	Flexible Ducts
23 34 23	HVAC Power Ventilators
23 38 13	Kitchen Hood
23 62 00	Packaged Compressor and Condensor Units_SP
23 81 46	Water Source Unitary Heat Pump (Rheem EcoSense)
23 83 16	Radiant Heating Hydronic Piping_SP
23 83 16	Radiant Heating Hydronic Piping (Sioux Chief Manifold)

DIVISION 25 INTEGRATED AUTOMATION

25 55 00	Integrated Automation Control of HVAC (Touch-Screen Thermostat)
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DIVISION 26 ELECTRICAL

26 01 10	Operation and Maintenance of Medium Voltage Distribution
26 05 13.16-14	AWG THHN
26 05 26	Grounding and Bonding for Electrical Systems_SP
26 05 29	Hangers and Supports for Electrical Systems_SP
26 05 33	Raceways and Boxes for Electrical Systems_SP
26 05 33.16	1 Inch Conduit for Electrical Systems
26 05 33.16	Junction Box NEMA 3R
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling_SP
26 24 16	Switchboards and Panelboards (Siemens Load Center)
26 27 13	Electricity Metering_SP
26 27 16	Weatherproof Outlet Cover
26 27 26	GFCI Outlet
26 27 26	Wiring Devices_SP
26 27 26	Wiring Devices Tamper Resistant GFCI Wall Outlets
26 27 26	WP Outlet WR899-W
26 28 16	Enclosed Switches and Circuit Breakers_SP
26 28 16.13	Low Voltage Circuit Protective Devices (AFCI Breakers)
26 28 16.13	Low Voltage Circuit Protective Devices (GFCI Breakers)
26 28 16.16	Enclosed Switch AC Disconnect
26 31 00	Photovoltaic Collectors
26 31 00	Photovoltaic Collectors_SP
26 33 43	Battery Charger (Electric Vehicle)
26 43 13	Transient Voltage Suppression for Low Voltage Electrical Power Circuits_SP
26 50 00	Lighting_SP
26 50 00	Interior Lighting (Recessed Lighting Including Bathroom)
26 51 13	Interior Lighting Fixtures Lamps & Ballasts (Bathroom Sconce)
26 51 13	Interior Lighting Fixture, Lamps, & Ballasts (Kitchen, Under Cabinet)
26 56 00	Exterior Lighting (Wall Mounted)

DIVISION 28 ELECTRONIC SAFETY AND COMMUNICATION

28 31 46	Smoke Detector
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DIVISION 32 EXTERIOR IMPROVEMENTS

32 82 00	Irrigation Pump (Night Sky Pump)
32 84 00	Planting Irrigation (Globe Values)
32 84 00	Planting Irrigation (Night Sky Sprinklers)

DIVISION 46 INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

46 61 53	Cartridge Filters
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DIVISION 48 ELECTRICAL POWER GENERATION

48 19 16	Electric Power Generation Inverters
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Rules Compliance Checklist

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 4-2	Construction Equipment	Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site	O-101 O-102 O-103 O-104 O-201 O-202 O-203
Rule 4-2	Construction Equipment	Specifications for heavy machinery	None
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	None
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	S-103 S-104 S-105 P-101 P-102 O-101 O-102 O-103 O-104 O-201 O-202 O-203
Rule 4-5	Generators	Specifications for generators (including sound rating)	None
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	F-101 P-101 P-102 P-901 P-902 M-101 M-201 M-901
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	21 10 00 21 13 13 22 05 16 22 05 23 22 11 16 22 13 16 22 13 23 22 12 19 22 13 16 22 30 00 22 33 00

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
			22 33 30.16 22 33 30.26 22 40 00 22 41 00 22 41 19 23 05 23 23 05 29 23 05 48 23 05 93 23 09 13.33 23 21 13 23 21 13.13 23 21 13.23 23 23 00 23 62 00 23 83 16 23 81 46 32 82 00 32 84 00 33 16 00
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	Structural Calculations
Rule 4-7	Lot Conditions	Drawing(s) showing shimming methods and materials to be used if 18 in. (45.7 cm) of vertical elevation change exists on the lot	S-101 S-102
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	G-201
Rule 5-2	Solar Envelope Dimensions	List of solar envelope exemption requests accompanied by justifications and drawing references	Not Applicable
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-002 S-003 S-101 S-102 S-103 S-104 S-105 S-106 S-107 S-108 S-109 S-110 S-201 S-202 S-203 S-204 S-301

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
			S-302 S-401 S-402 S-403 S-901 S-902 Structural Calculations
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	Not Applicable
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-201 L-202 L-601 L-602 L-603
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of gray water irrigation systems	Not Applicable
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	26 31 00
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	Not Applicable
Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	Not Applicable
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	Not Applicable
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	Not Applicable
Rule 8-5	Village Grid	Completed interconnection application form	Interconnection Application Form
Rule 8-5	Village Grid	Drawing(s) showing the locations of the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	A-101 A-112 E-102
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	26 05 26 26 05 33 26 24 16 26 27 26 26 31 00 48 19 16
Rule 8-5	Village Grid	One-line electrical diagram	E-601

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	NEC 220 Calculations
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	A-101 L-101
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	Not Yet Done
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	G-104
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	P-503
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	Detailed Water Budget M-001 23 23 00
Rule 9-3	Gray Water Reuse	Drawing(s) showing the layout and operation of gray water reuse systems	Not Applicable
Rule 9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	Not Applicable
Rule 9-6	Thermal Mass	Drawing(s) showing the locations of liquid-based thermal mass systems	M-101 M-102 M-201 M-203
Rule 9-6	Thermal Mass	Specifications for components of liquid-based thermal mass systems	23 09 13.23 23 09 13.33 23 21 13 23 21 13.13 23 21 13.23 23 23 00 23 83 16 32 84 00 33 16 00
Rule 9-7	Gray Water Heat Recovery	Drawing(s) showing the layout and operation of gray water heat recovery systems	M-101 M-102
Rule 9-8	Water Delivery	Drawing(s) showing the complete sequence of water delivery and distribution events	O-103 O-104
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	22 12 19 22 33 00 22 33 30.16 23 71 16
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	O-201 O-202

RULE	RULE DESCRIPTION	LOCATION DESCRIPTION	LOCATION
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	22 12 19 22 13 16
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	G-103

Structural Calculation Package

Project Information:
2015 Solar Decathlon
Aggie Sol Team
UC Davis

Contents

Loadings	2
Wind Loading MWFRS (Envelope Procedure)	2
Seismic Loading	3
Diaphragm Calculations	10
Shear Wall Calculations	10
Overturn, Sliding, Uplift.....	12
Foundation	15
Building Calculations.....	16

All Calculations confirm to the 2013 CBC, 2012 IBC, 2012 NDS, ASCE 7-10, and Solar Decathlon Building Code

Issue Date: **August 17, 2015**

Loadings

Roof	psf
TPO Single Ply	0.25
Misc.	5.9
5/8 PLY	1.77
Joists	3.1
9" Insulation	2.0
PV Panels	2.0
Total	15

Floor	psf
Gyp Concrete	17
3/4 Sheathing	3
2x10	1.9
Insulation	1.4
3/8 Plywood	1.5
Total	24.8

Interior Walls	psf
2x4 @ 24 OC	1.3
5/8 GYP	2.75
Insulation (3.5 thick)	2.45
5/8 GYP	2.75
Total	9.25

Exterior Walls	psf
Hardie Plank	2.3
2x6 @24 OC	2.1
5/8 GYP	2.75
3/8 Ply	1.5
Insulation (3.5 thick)	2.45
Total	11.1

Area	sf
Roof	1421
Floor	1032
Interior Wall	1004
Exterior Wall	1302

Loads	lbs
Roof Load	21315
Floor Load	25594
Interior Wall Load	9287
Exterior Wall Load	14452.2
Total	70648

Wind Loading MWFRS (Envelope Procedure)

Basic Wind Speed	110 mph
Exposure Category	C
Risk Category	II
Kzt	1
Lambda	1.21
qh	22.38
q	18.65

ASCE Figure 28.4-1

Zone	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
GCpf	0.4	-0.69	-0.37	-0.29	0.4	-0.29	0.61	-1.07	-0.53	-0.43	0.61	-0.43
GCPi	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
p (psf)	4.10	-16.23	-10.26	-8.77	4.10	-8.77	8.02	-23.31	-13.24	-11.38	8.02	-11.38

Load Zones from Wind Parallel to the Ridge

Wall:					Roof			
Zone	5	6	5E	6E	2	3	2E	3E
GCpf	0.4	-0.29	0.61	-0.43	-0.69	-0.37	-1.07	-0.53
Gcpi	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
P	4.10	-8.77	8.02	-11.38	-16.23	-10.26	-23.31	-13.24
Total	12.87		19.40		-5.97		-10.07	
AVG P	13.61		psf		-6.43		psf	
Wroof	57.38		plf					
Wfloor	149.68		plf					

Seismic Loading

Equivalent Lateral Force Procedure (Section 12.8 ASCE 7-10)

Site Classification	D
Risk Category	II
Seismic Design Category	D
Ie	1
R	6.5
Cs	0.157
Base V	7.846 kips
CvRpf	0.4
FxRoof	1.57 kips
CvFloor	0.6
FxFloor	2.35 kips

USGS Design Maps

S _{Ds}	1.02	g
S _{D1}	0.489	g
S _{M5}	1.529	g
S _{M1}	0.734	g
S _s	1.529	g
S ₁	0.564	g


Design Maps Detailed Report

ASCE 7-10 Standard (33.68621°N, 117.82643°W)

Site Class D – “Stiff Soil”, Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From [Figure 22-1](#) ^[1]

$S_S = 1.529 \text{ g}$

From [Figure 22-2](#) ^[2]

$S_1 = 0.564 \text{ g}$

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	\bar{v}_s	\bar{N} or \bar{N}_{ch}	\bar{s}_u
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf

Any profile with more than 10 ft of soil having the characteristics:

- Plasticity index $PI > 20$,
- Moisture content $w \geq 40\%$, and
- Undrained shear strength $\bar{s}_u < 500 \text{ psf}$

F. Soils requiring site response analysis
in accordance with Section 21.1

See Section 20.3.1

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_s

For Site Class = D and $S_s = 1.529$ g, $F_a = 1.000$

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and $S_1 = 0.564$ g, $F_v = 1.500$

Equation (11.4-1): $S_{MS} = F_a S_s = 1.000 \times 1.529 = 1.529 \text{ g}$

Equation (11.4-2): $S_{M1} = F_v S_1 = 1.500 \times 0.564 = 0.847 \text{ g}$

Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4-3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.529 = 1.020 \text{ g}$

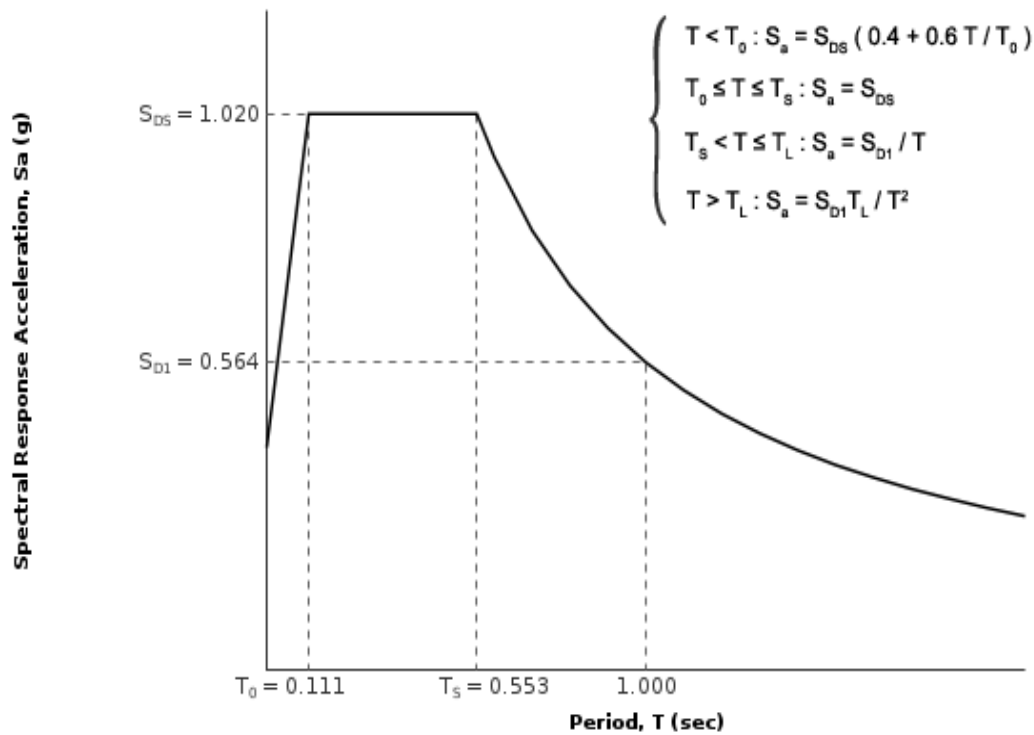
Equation (11.4-4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.847 = 0.564 \text{ g}$

Section 11.4.5 — Design Response Spectrum

From [Figure 22-12](#) ^[3]

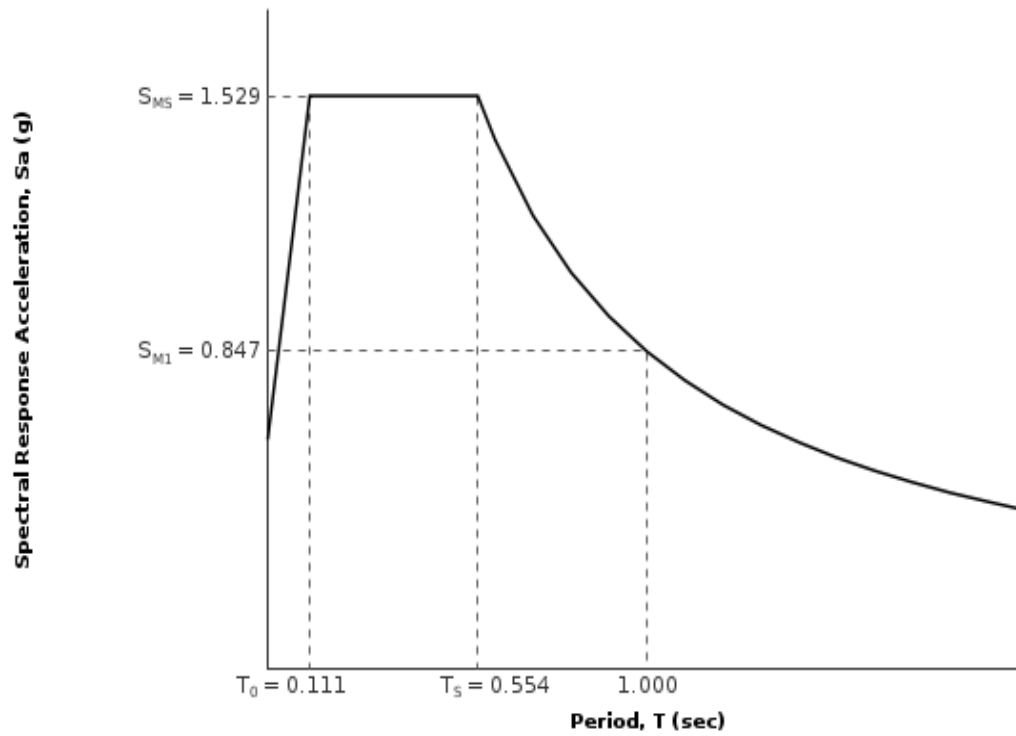
$T_L = 8 \text{ seconds}$

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From [Figure 22-7](#) ^[4]

$$PGA = 0.582$$

Equation (11.8-1):

$$PGA_M = F_{PGA}PGA = 1.000 \times 0.582 = 0.582 \text{ g}$$

Table 11.8-1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.582 g, $F_{PGA} = 1.000$

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From [Figure 22-17](#) ^[5]

$$C_{RS} = 0.987$$

From [Figure 22-18](#) ^[6]

$$C_{R1} = 1.021$$

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

For Risk Category = I and $S_{DS} = 1.020 g$, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

For Risk Category = I and $S_{D1} = 0.564 g$, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category \equiv "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. Figure 22-1: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. Figure 22-2: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. Figure 22-12: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. Figure 22-7: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. Figure 22-17: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. Figure 22-18: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Diaphragm Calculations

Diaphragm Level 1 "Y" Axis

Sub-Diaphragm X axis

Diaphragm	Width	Depth	Left	Grid Lines		Wind Load		Seismic Load		Diaphragm Shear (plf)	
				Right	Bottom	Top	Left	Right	Left		Right
Dy1	10	44	1	5	A	B	694	666	727.97	727.97	17
Dy2	18	44	1	5	B	D	1200	1248	2088.97	2088.97	47

Diaphragm Level 1 "X" Axis

Sub Diaphragms X Axis

Diaphragm	Width	Depth	Left	Grid Lines		Wind Load		Seismic Load		Diaphragm Shear (plf)	
				Right	Bottom	Top	Left	Right	Left		Right
Dx1	13	28	1	2	A	B	972	796	960.08	960.08	35
Dx2	9	18	2	3	D	B	612	612	427.29	427.29	34
Dx3	22	28	3	5	A	B	1346	1646	1624.76	1624.76	59

Note: Seismic loads are higher in shorter side and Wind loads are higher in longer side

Shear Wall Calculations

Grid Line	1	Wind Load	972.00
Diaphragm	Roof	Seismic Load	960.09

Wall #	Length	Height	H/W Ratio	BS Wind	BS Seismic	S.W. Type
1	12.00	9.33	2.00	77.76	76.81	A

Shear Wall Data and Uplift Calculations Wind

Wall#	Dead Load plf	Wind Suction plf	Uplift Left	Uplift Right
1	320	-180.11	77.28	77.28

Grid Line	2	Wind Load	1408.00
Diaphragm	Roof	Seismic Load	1387.38

Wall #	Length	Height	H/W Ratio	BS Wind	BS Seismic	S.W. Type
1	6.50	9.33	2.00	148.21	146.04	A

Shear Wall Data and Uplift Calculations Wind

Wall#	Dead Load plf	Wind Suction plf	Uplift Left	Uplift Right
1	282.5	147.948	237.0683	237.07

Grid Line	3	Wind Load	1958.00
Diaphragm	Roof	Seismic Load	2052.05

Wall #	Length	Height	H/W Ratio	BS Wind	BS Seismic	S.W. Type
1	9.50	9.33	2.00	206.11	216.01	A

Shear Wall Data and Uplift Calculations Wind

Wall#	Dead Load plf	Wind Suction plf	Uplift Left	Uplift Right
1	282.5	-141.516	433.755	433.76

Grid Line	5	Wind Load	1646.00
Diaphragm	Roof	Seismic Load	1624.76

Wall #	Length	Height	H/W Ratio	BS Wind	BS Seismic	S.W. Type
1	6.0	9.33	2	92.73	91.54	A
2	8.00	9.33	2	92.73	91.54	A

Shear Wall Data and Uplift Calculations Wind

Wall#	Dead Load plf	Wind Suction plf	Uplift Left	Uplift Right
1	215	-90.0555	229.2788	229.2788
2	215	-90.0555	199.1106	199.1106

Grid Line	A	Wind Load	1893.57
Diaphragm	Roof	Seismic Load	2538.88

Wall #	Length	Height	H/W Ratio	BS Wind	BS Seismic	S.W. Type
1	8.00	9.33	2.00	76.51	102.58	A
2	7.50	9.33	2.00	76.51	102.58	A
3	8.00	9.33	2.00	76.51	102.58	A

Shear Wall Data and Uplift Calculations Seismic

Wall#	Dead Load plf	Uplift Left	Uplift Right
1	305	156.46	156.46
2	275	338.33	338.33
3	275	255.83	255.83

Grid Line	D	Wind Load	1914.43
Diaphragm	Roof	Seismic Load	3095.04

Wall #	Length	Height	H/W Ratio	BS Wind	BS Seismic	S.W. Type
1	8.00	9.33	2.00	117.81	190.46	A
2	7.75	9.33	2.00	117.81	190.46	A

Shear Wall Data and Uplift Calculations Seismic

Wall#	Dead Load plf	Uplift Left	Uplift Right
1	440	622.03	622.03
2	440	787.03	787.03

Overturn, Sliding, Uplift

Lateral force:

Seismic: 6024 lbs
Wind 5984 lbs

Check for moment around modular line:

$35000 \times 4 - 6024 \times 10 / 2 = 109880$ lbs-ft

There will not be an overturn due to the weight of the house

Seismic piers are being used to resist sliding. Quantities have been calculated in the foundation table. Anchorage points are shown in the structural sheets.

Overhang Uplift:

Maximum uplift per rafter = $2\text{ft} \times 4\text{ft} \times 23.31\text{psf} = 186.48$ lbs

Each rafter is connected to the top plate with Simpson VPA connector. These connectors can withstand 295 lbs of uplift.

Additionally, wall sheathing is to be continued to the roof and notched for the rafters, for better stability and shear transfer.

House Sliding

		North Module	South Module	
Transverse	BS Seismic	3012.139	3012.139	controls
Transverse	BS Wind	2992	2992	
Longitudinal	BS Seismic	2816.957	2816.957	controls
Longitudinal	BS Wind	1904	1904	

μ asphalt 0.5
 Fn of Modules 35000 lbs

	ffriction	Transverse Shear	Longitudinal Shear	Sliding Ratio Transverse	Sliding Ratio Longitudinal	Sliding Ratio > 2.0	Tie Down Req.
North Module	17500	3012.139	2816.957	5.81	6.21	Yes Check	No
South Module	17500	3012.139	2816.957	5.81	6.21	Yes Check	No

Tie Down

Tension To Resist (Ft) = $(\text{Uplift}^2 + \text{Shear}^2)^{0.5}$

North Module								
	Ft	Allowed Resistance Per Pier	Number of Pier Required	Provided Piers	# of Anchor Rod Per Pier	Tension On Ea. Anchor Rod	Max Tension <Ult. Strength?	
Transverse	14	5722.99	2852	2.006659	4	4	357.6875	Yes
Longitudinal	44	5546.03	2852	1.944611	4	4	346.6268	Yes

South Module								
	Ft	Allowed Resistance Per Pier	Number of Pier Required	Provided Piers	# of Anchor Rod Per Pier	Tension On Ea. Anchor Rod	Max Tension <Ult. Strength?	
Transverse	14	5684.144	2852	1.993038	4	4	355.2590	Yes
Longitudinal	44	5546.03	2852	1.944611	4	4	346.6268	Yes

Deck Uplift and Sliding

Uplift

North Deck					
Uplift force:	-18.7 psf	DL	20 psf		
Area:	369 sf	Total DL	7380	Total Uplift	6900.3 lbs

South Deck					
Uplift force:	-18.7 psf	DL	20 psf		
Area:	247 sf	Total DL	4940	Total Uplift	4618.9 lbs

Sliding			North Deck lbs	South Deck lbs
μ_{asphalt}	0.5	ffriction	3690	2470

		North Deck	South Deck	
Transverse	BS Seismic	173.799	116.337	
Transverse	BS Wind	350.3959	323.898	controls
Lateral	BS Seismic	173.799	116.337	
Lateral	BS Wind	154.9006	103.6869	
Sliding Ratio				
N. Deck	Sliding Ratio	10.53095	>>	2 Check
S. Deck	Sliding Ratio	7.625858	>>	2 Check

Gravity Load			
Worse Case:			
DL=	20 psf		
LL=	100 psf		
Trib. Area	19 sf		
Foundation Area	1 Sf		
Gravity Load	2280 Psf	<3000 psf	Check

Foundation

Foundation design is a mix system of both standard and anchor piers by central pier, Inc. See S-103 Foundation Plan for pier locations.

Foundation Load Table 1 (lbs)				Standard Pier	Vertical	Capacity	Adequate
B1	1960	6000	Yes	D1	1960	6000	Yes
B2	3920	6000	Yes	D2	3920	6000	Yes
B3	3430	6000	Yes	D3	3430	6000	Yes
B4	3920	6000	Yes	D4	3920	6000	Yes
B5	1960	6000	Yes	D5	1960	6000	Yes
BC1	1960	6000	Yes	E1	1960	6000	Yes
BC2	3920	6000	Yes	E2	3920	6000	Yes
BC3	3430	6000	Yes	E3	3430	6000	Yes
BC4	3920	6000	Yes	E4	3920	6000	Yes
BC5	1960	6000	Yes	E5	1960	6000	Yes
C1	5460	6000	Yes				
C2	5330	6000	Yes				
C3	5330	6000	Yes				
C4	5395	6000	Yes				
C5	4810	6000	Yes				

Foundation Load Table 2 (lbs)							
Anchor Pier	Vertical	Horizontal	Uplift	Allowable Vertical	Allowable Horizontal	Allowable Uplift	Adequate
B1	2450	712.19	399.34	8251	1893	2133	Yes
B5	2800	794.33	418.36	8251	1893	2133	Yes
BC1	2450	712.19	399.34	8251	1893	2133	Yes
BC4	2800	794.33	418.36	8251	1893	2133	Yes
D1	2450	712.19	399.34	8251	1893	2133	Yes
D4	2800	794.33	418.36	8251	1893	2133	Yes
E1	2450	712.19	399.34	8251	1893	2133	Yes
E2	2800	794.33	418.36	8251	1893	2133	Yes
E3	2450	712.19	399.34	8251	1893	2133	Yes
E4	2800	794.33	418.36	8251	1893	2133	Yes

Building Calculations

1. Roof Structural Calculations

Roof Joist	
W	60 plf
L	14 ft
EI	315 Weyerhaeuser catalog pg. 3
d	14 in
Wself	2.8 lbs/ft
Delta	0.19 in
L/360	0.47 Check

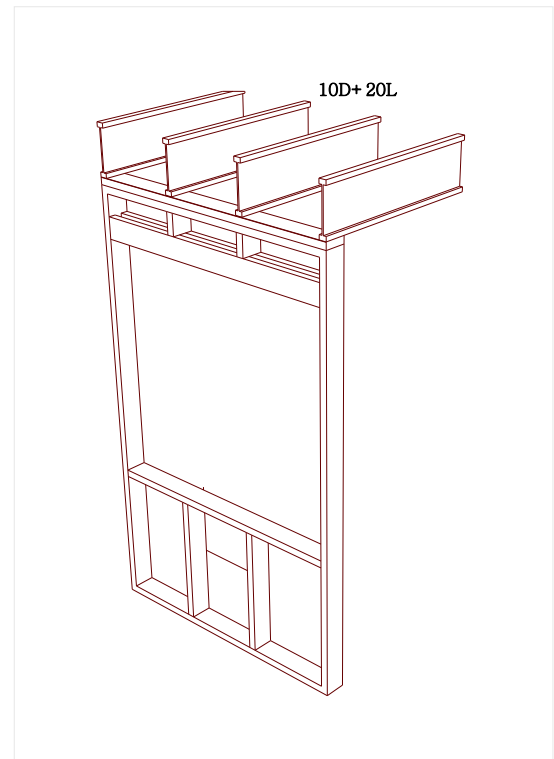
Roof 2x14 LVL	
Span	22 ft
W	210 Plf
w	154 lbs/ft
Max M	12705 lbs.ft
Delta	0.0512 in
L/360	0.061111111 Check

2. Wall Structural Calculations

Header For Bending (Critical)	
Largest Header	35 ft
Factored Wind Load	17.908 psf
Tributary Area	36 ft ²
P	11025 lbs
fb	1575 psi

Use 2, 2x6 LVL for header

Structural Stud Wall (critical)	
P wind	17.91 psf
Height	10 ft
Stud Spacing	2 ft
Wind Load	50.1424 plf
Roof Load	3060 lbs
Max Allowable Load for L/399	TJ-9003
Deflection	4485 lbs Weyerhaeuser



C3 column

Tributary Area	140 sf	FcE for y	FcE for x					
Dead Load, D	15 lb	kf	0.6 kf					
Live Load, L	20 lb	Cp	0.23 Cp					
Total Load	35 lb	le/d	1.521 le/d					
Weight, W	4.9 kips	FcE for y	671.0783 FcE for x					
			405.7831					
cf	cm	cd	Fc	F*c	xd	Yd	Emin	Capacity
1.15	1	1	1350	1552.5	3.5	4.5	580000	5623.931

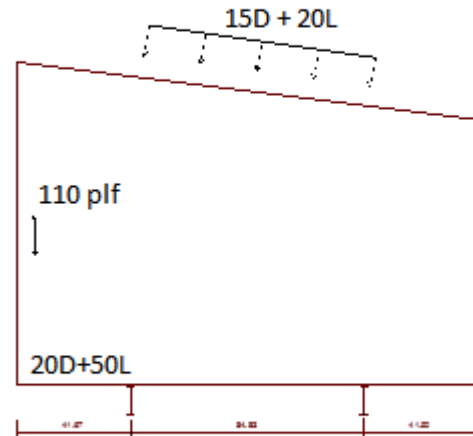
Use 3, 2x4's for this post.

3. Floor Structural Calculations

Floor Joist	
L	14 ft
M	2200 Ft.lbs
fb	1234 Psi
Cf	1.1
Cd	1.25

Fb 1650 Psi
 Use 2x10 No.1 & Btr Douglas Fir Floor Joists

Note: Load Combination used is
 D + 0.75L ASCE 7-10, 2.4.1



Bottom Plate to Trailer Connections (Anchor Bolts) Resisting Shear From Seismic

1/2" diameter anchor bolt lateral ASD design value

Z' = 1,088 lbs

ASD unit shear capacity of the shear wall 239 plf

Bolts req.	8.555607	Spacing	5.084385	L=	43.5
Bolts req.	2.075368	Spacing	4.818423	L=	14

Ridge connection loads from wind

	WR	LR	Mw=0		
GCpf	-1.07	-0.53	M _L =0	-111.14	
GCpi	0.18	0.18	FRx	706.47	
P	-16.78	-9.53	Tx	706.47	plf
Vertical	-234.99	-133.47	Tx	1412.95	lbs
Horizontal	-19.58	-11.12	Ty	168.68	plf
Dead load	126	126	Ty	337.36	lbs

Detailed Water Budget

Part 1) Appliance Water Usage

Unit Conversions

Parameter	Value	Units	Source
Water Density	62.20	lbf/ft ³	White, Fluid Mechanics
	0.13	ft ³ /gal	http://www.metric-conversions.org/volume
	8.31	lbf/gal	Calculated
Volume	1.00	ft ³	
	7.4850	gal/ft ³	http://www.metric-conversions.org/volume
	1728	in ³ /ft ³	Calculated

A) Cooking Contest Water Usage

(1) The cooking contest requires the boiling of 5,000 lbs of water during a 2 hour period.

$$(2) \text{ Volume (gallons)} = (\text{Weight (lbs)}) * \frac{1}{\text{Density}} \left(\frac{\text{gal}}{\text{lbf}} \right)$$

(3) According to the SD Rules, the cooking contest will occur 6 times.

Weight (lb)	Water/Cycle (gallons)
6	0.72

(B) Dishwasher Water Usage/Event

(1) According to a Bosch representative, a full load on a normal cycle requires 1.5-4.5 gallons, so we assumed the worst-case scenario.

Parameter	Value	Unit
Model	Bosch SGE63E06UC	
Water Use/Cycle	4.5	Gallons

(C) Clothes Washer Water Usage/Event

(1) The Frigidaire representative stated that 18 gallons would be a safe assumption, although he stated that 14 gallons was average for a normal load, full cycle.

Parameter	Value	Unit
Model	Frigidaire FFFW5000QW	
Water Use	18	Gallons

(D) Fire Protection Calculations

Parameter	Value	Unit
# Design Fire Sprinklers	2	Count
Single Head Flow Rate	13	Gallons/Minute
Total Head Flow Rate	26	Gallons/Minute
Time Running	7	Minutes
Total Fire Protection Demand	182	Gallons

(E) Kitchen Sink Calculations

- (1) Assume that 3 people will help with the cooking and food preparation.
- (2) Assume that the cooks will wash their hands once before, during, and after food preparation.
- (3) Assume that the cooks will use safe hand-washing procedure, which according to the CDC (<http://www.cdc.gov/features/handwashing/>), requires a duration of at least 20 seconds.
- (4) Assume that every participant of the dinner party will wash their hands twice (before and after eating). Assume 12 participants at the dinner party, per the SD Rules.
- (5) Assume that every participant at the movie night will wash their hands twice (before and after eating). Assume 12 participants at the movie night, per the SD Rules.
- (6) The maximum kitchen faucet flow-rate according to the cut sheet is 2.2 GPM.
- (7)
$$\text{Kitchen Sink Demand} = \text{Kitchen Flowrate} * \text{Duration} * \left(\frac{\text{Washes}}{\text{Cook}} * \text{Cooks} * 2 \text{ parties} \right) + \left(\frac{\text{Washes}}{\text{Guest}} * (\text{Dinner Guests} * 2 \text{ parties} + \text{movie guests} * 1 \text{ movie night}) \right)$$

F) Showerhead Calculations

The hot water draw contest requires that the shower supply 15 gallons of hot water within 10 minutes.

Parameter	Value	Unit
Kitchen Faucet Flow Rate	2.2	Gallons/Minute
Hand-Washing Duration	20	Seconds
Washes/Cook	10	Wash/Person
Washes/Guest	2	Wash/Person
Movie Night Guests	12	Persons
Dinner Party Guests	12	Persons
Hand-Washes/Guest	2	Wash/Person
Dinner Party Cooks	3	Persons
Dinner Parties	2	Count
Kitchen Sink Demand	58.3	Gallons

2) Water Budget Summary

Water Use	Total Use (Gallons)	Gallons/Use	Use
Hot Water Draws	240	15	16
Evaporation/Cooking	4.33	0.72	6
Dishwasher	58.50	4.5	13
Clothes Washer	144.00	18	8
Kitchen Sink	58.30	NA	NA
Fire Protection	182.00	NA	NA
Total	688.00		

Varying the Safety Factor

Type	Safety Factor	Total Volume
Minimum	0.10	757
Medium	0.20	826
Maximum	0.30	894

(3) Primary Tank Size Calculations

Calculating Unusable Water at the Bottom of the Tank

(1) Assume that water below the pump level will not be pumped--assume a pump height of 9 inches per domestic pump cut sheet.

$$(2) V (ft^3) = \frac{\pi D^2}{4} h \text{ where "h" is the pump height, D is the tank diameter and V is the unusable volume}$$

$$(3) V_{\text{tank}} = V_{\text{water}} + V \text{ where } V_{\text{tank}} \text{ is the minimum required tank volume and } V_{\text{water}} \text{ is the water demand}$$

(4) A greater diameter means more wasted water!

B) Primary Supply Tank Selection Pass/Fail Test

- (1) The tank is less than a user-defined maximum height.
 (2) The tank diameter is less than the maximum diameter permitted at a given volume--for example at a volume of 850 gallons, the maximum permitted diameter is 58 inches.

Will your PST fail?	Tank Size (gallons)	Tank Diameter (in)	Tank Height (in)	Outlet Height (in)	Unusable Volume (gallons)
	500.00	49.00	67.00	4	32.65
2-Tank Total	1000.00	NA	NA	NA	97.96
PASS					

Part 4) Graywater Budget and Secondary Graywater Tank Sizing

Water Use	Total Use (Gallons)
Hot Water Draws	240.00
Dishwasher	58.50
Clothes Washer	144.00
Kitchen Sink	58.30
Total Graywater	500.80
Graywater not in Nexus	425.80

Varying the Safety Factor

Type	Safety Factor	Total Volume
Minimum	0.10	551
Medium	0.20	601
Maximum	0.30	651

Safety Factors

Graywater Tanks	10%	20%	30%
Nexus Collection Tank	75	75	75
Secondary Graywater Tank	476	526	576

We will be using two graywater tanks. The Nexus Collector has a 75 gallon capacity and it will recover heat from incoming graywater. R-410a refrigerant will deliver this heat to the Nexus Water Heater in the mechanical room. When the Nexus Collector becomes full, it will overflow into a secondary graywater tank.

We have not included the fire suppression water volume into the graywater storage calculation because the water will be spread on the fire and in the house in case of an actual fire. In case of an emergency overflow, we will keep the vented lid on the top of the graywater tank open to the atmosphere and water flow out of the top of the tank in case of an emergency.

Dwelling Units - NEC Standard Method Calculation

This file is exclusive for www.Electrical-Knowhow.com

Note: If a dwelling has more than one feeder, a separate load calculation is needed for each feeder.

Step-1: Calculating general lighting and general receptacles loads (except for small-appliance and Laundry Receptacles)					
Procedure	Note	Calculation			
From NEC Table 220.12, for dwelling units, minimum general lighting load is 3 VA/ft ² .	Under any conditions, for dwelling units, don't use value less than 3 VA/ft ² , there are no exceptions. While the designer can choose a higher value based on the existing design conditions.	The general lighting load is calculated by multiplying the floor area (in ft ²) of a dwelling unit by 3 VA/ft ² .			
Calculate the floor area for each floor of Dwelling Unit in ft ² .	The floor area for each floor shall be calculated from the outside dimensions of the dwelling unit. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use (like some attics, cellars, and crawl spaces).	Floor area in ft ² =	1000	ft ²	
		General lighting and general receptacles loads =	3000	VA	

Step-2: Calculating Small-appliance branch circuits' load					
Procedure	Note	Calculation			
Calculate the required number of small-appliance branch circuits in the dwelling unit.	As per NEC 210.11(C)(1), in each dwelling unit, two or more 20-ampere small-appliance branch circuits must be provided. the designer assign the number of small-appliance branch circuits based on the existing condition (space dimension , number of required small appliances, etc.).	The Small-appliance branch circuits' load, for dwelling units, is calculated by multiplying number of Small-appliance branch circuits by 1,500 VA.			
	Don't exceed the permissible loading of a 120 V, 20-ampere branch circuit which is 2400 VA	As per 210.52(B)(1)Exception.2, An individual branch circuit is permitted for Refrigeration equipment at 1,500 VA. If you will apply this rule, choose Number of Refrigerator Circuits from F13			
As per NEC section 220.52(A), each 2-wire small-appliance branch circuit load is calculated at no less than 1,500 volt-amperes.		Number of Small-appliance branch circuits in the dwelling unit =	2	Circuit	1
		Small-appliance branch circuits' load =	3000	VA	N

Step-3: Calculating Laundry branch circuit load					
Procedure	Note	Calculation			
Calculate the required number of laundry branch circuits in the dwelling unit.	As per NEC 210.11(C)(2), In each dwelling unit, At least one 20-ampere branch circuit shall be provided	The Laundry branch circuits' load, for dwelling units, is calculated by multiplying number of Laundry branch circuits by 1,500 VA.			
As per NEC 220.52(B), each 2-wire laundry branch circuit is calculated at no less than 1,500 volt-amperes.		In multifamily dwelling building, if Laundry facilities are provided on the premises and available to all building tenants (as a common usage), Laundry branch circuits load will not be added to each individual dwelling unit and will be added to a separate "house load" panelboard. Is Laundry Facility available to all building tenants? Select answer from F21			
		A combination of clothes washer and clothes dryer will be handled in calculations as it is a clothes dryer, is there a combination? Select answer from F22			
		Number of Laundry branch circuits in the dwelling unit =	1	Circuit	Y
		Laundry branch circuits' load =	1500	VA	Y

Step-4: Applying Demand Factors from Table 220.42					
Sum Loads of Step-1, Step-2 and Step-3	Total Sum =	7500	VA		
Calculate the demand of The First 3,000 VA or Less at 100%	demand of The First 3,000 VA or Less =	3,000	VA		
Calculate the demand of (120,000 VA - 3,000 VA), if any, at 35%	demand of (120,000 VA - 3,000 VA), if any =	1575	VA		
Calculate the demand of the remainder over 120,000 VA, if any, at 25%	demand of the remainder over 120,000 VA, if any =	0	VA		
General Load for Lighting, General Receptacles, Small Appliances and Laundry =		4,575	VA		

Step-5: Fastened in Place Appliances Load					
As per NEC section 220.53, electric ranges, clothes dryers, space-heating equipment or air conditioning equipment must not be included with the number of appliances that are fastened in place. Also, All portable small Appliances for kitchen and others are not Fastened-in-Place Appliances. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW)					
As per NEC section, 220.53, It shall be permissible to apply a demand factor of 75 % to the nameplate rating load of four or more appliances fastened-in-place, that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling.					
In a multifamily dwelling, the four or more fastened-in-place appliances do not have to be on the same feeder for each dwelling unit. In this case, the 75% demand factor will not apply to the feeder for each dwelling unit but it must be applied to the multifamily dwelling service.					
As per NEC section 430.6(A)(1), Do not use the actual current rating marked on the nameplate. When calculating motor loads, use the values given in Tables 430.247 through 430.250.					
	Number of appliances	Current (A)	Voltage (V)	Rating of appliances	
Refrigerator	1	15	120	1800	VA
dishwasher	1	15	120	1800	VA
EV	1			6000	VA
total number of appliances =				3	Circuits
Total ratings of appliances				9600	VA
Total load =				9600	VA

Step-6: Clothes Dryers Load					
A clothes dryer is not a requirement for a load calculation. Skip this step if there is no clothes dryer. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW)					
Procedure	Note	Calculation			
Write the Nameplate Rating of Clothes dryer	As per NEC section 220.54, the load for household electric clothes dryers in a dwelling unit(s) shall be either 5000 watts (volt-amperes) or the nameplate rating, whichever is larger, for each dryer served.	Write the Nameplate Rating of Clothes dryer			
	A combination of clothes washer and clothes dryer (see below image) will be handled in calculations as it is a clothes dryer.	5000 VA or the nameplate rating, whichever is larger			
		7200	VA		
		7200	VA		

	For single, two-family or multi-family dwelling when each tenant has separate clothes dryer, Table 220.54 Demand Factors for Household Electric Clothes Dryers will be used in a multi-family dwelling where there is a common Laundry area, use the full load of all dryers without applying demand factor.	Number of Clothes Dryers =	1	
		Total Connected load of clothes dryers =	7200	VA
		Demand Factor =	1	
Total Demand load of clothes dryers =			7200	VA

Step-7: Household cooking appliances load
 We can skip the calculation of Household Cooking Appliances Load if there are no cooking appliances rated over 1.75 KW. Kilovolt-amperes (kVA) shall be considered equivalent to kilowatts (kW).
 When the kilowatt rating fraction is 0.5 or more, it must be rounded up to the next whole kilowatt rating i.e. 14.5 KW up to a 15 KW and When the fraction is less than 0.5, it can be dropped i.e. 14.4 KW dropped to 14 KW.
 The table 220.55 is not applicable for ranges rated more than 27 kW because ranges rated more than 27 kW would not be considered household ranges.

Case#1: Individual Appliance

Household cooking appliances Rating in KW=		Less that 3.5 KW Rating	3.5-8.5 KW	less than 12 KW	12KW<rating<=27KW
		0	0	9600	0
Household cooking appliances Demand load in KW=					9600

Case#2: group of Appliances with equal (same) ratings not over 12 KW

Number of Household cooking appliances =	0	Put Demand/max. Demand Factor from table 220.55	Calculated demand load	
Household cooking appliances Rating in KW=	0		0	0
			0	0
		Less that 3.5 KW Rating		
		3.5-8.5 KW	11	0
		less than 12 KW	11	0
Household cooking appliances Demand load in KW=				0

Case#3: group of Appliances with unequal ratings not over 12 KW

	group Rating #1	group Rating #2	group Rating #3	
Number of Household cooking appliances =	0			
Household cooking appliances Rating in KW=	0			
IF Less that 3.5 KW Rating, D.F =				
IF from 3.5 to 8.5 KW, D.F=				
IF less than 12 KW, Max. Demand =	0			
Calculated demand load	0	0	0	
	0	0	0	
Household cooking appliances Demand load in KW=				0

Case#4: group of Ranges with equal (same) ratings Over 12 kW through 27 KW

Number of Household cooking appliances =	0	Put Demand/max. Demand Factor from table 220.55	Calculated demand load	
Household cooking appliances Rating in KW=	0		0	0
Household cooking appliances Demand load in KW=				0

Case#5: group of Ranges with unequal ratings Over 8 3/4 kW through 27 kW

total Number of Household cooking appliances =	1	Ranges Rating Below 12 KW	
Max. Demand from Column C, Table 220.55=			2
Number of Household cooking appliances =			
Sum of Household cooking appliances Rating in KW=			
the Average Rating =	0		
Household cooking appliances Demand load in KW=			0

Step-8: Heating and air conditioning loads
 the blower motor works with both the heating and air conditioning system, it must be included in both calculations.
 With a heat pump, the compressor (and accompanying motors) and some or all of the electric heat can be on at the same time. The load contribution of a heat pump is the air conditioning system load plus the maximum amount of heat that can be on while the air conditioner compressor is on.
 As per NEC section 430.6(A)(1), Do not use the actual current rating marked on the nameplate. When calculating motor loads, use the values given in Tables 430.247 through 430.250.

	Noncoincident Loads	coincident Loads
Room air conditioners Load in VA at 100%	0	FALSE
Fixed electric space-heating Load in VA at 100%	0	FALSE
Central air conditioning Load in VA at 100%	373	4500
Central heating system Load in VA at 100%	4500	FALSE
Heating and air conditioning load in VA =	4500	0

Step-9: The Largest Motor
 As per NEC section 430.6(A)(1), Do not use the actual current rating marked on the nameplate. When calculating motor loads, use the values given in Tables 430.247 through 430.250.
 Exceptions to 430.6(A)(1):
 1- Motors built for low speeds (less than 1,200 rpm) or high torques for multispeed motors.
 2- For equipment that employs a shaded-pole or permanent-split capacitor-type fan or blower motor that is marked with the motor type, use the full load current for such motor marked on the nameplate of the equipment in which the fan or blower motor is employed.
 3- For a listed motor-operated appliance that is marked with both motor horsepower and full-load current, use the motor full-load current marked on the nameplate of the appliance.
 When calculating a feeder or service As per NEC Standard calculation method, the largest motor must be multiplied by 25 percent and add it to the service load calculation.
 If the motor is air conditioning compressor, usually the air conditioning compressor is the largest motor in dwelling units. in this case, multiply the load of one compressor by 25 percent and add it to the service load calculation. But if the heating load is larger than the air conditioning load, and because of 220.60 which states that "it is permissible to use only the larger of the noncoincident loads" the air conditioning load will be omitted and the air conditioning compressor will not be the largest motor in this case.

VA of Largest Motor =	4500		
Largest Motor Additional Load =		1125	VA

TOTAL DEMAND LOAD =	36,600	VA
----------------------------	--------	----

Calculated	152.5	A
Panel Size	183	A

Interconnection Application Form

Team Aggie Sol, Lot 201

PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
SUNPOWER	21 PANELS – STRINGS OF 10 AND 11, Model E20-327	6000 V DC

Total DC power of all arrays is 6.0 kW (in tenths)

INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
SUNPOWER	SPR-6000p-TL-1	240 V AC	6.0 KW	1

Total AC power of all inverters is 6 kVA or kW (in whole numbers)

REQUIRED INFORMATION

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

	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	A-101

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

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Energy Analysis Results and Discussion

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Abstract

The 2015 UC Davis Solar Decathlon Team has designed an affordable, sustainable prototype home for California farmworkers. The prototype will rest on the UC Davis campus after the competition, so the house was modeled with BEopt and Excel for year-round operation under the Davis climate. Each major energy-efficient feature of the home was separately analyzed in order to gauge its energy savings impact. The construction strategy of balloon framing, low window to wall ratio, and thermal mass in the floor saved X kWh in space conditioning. We developed an equation to score appliances on water efficiency, energy efficiency, and affordability—this “appliance scoring equation” yielded an overall annual energy savings exceeding 400 kWh. The Nexus eWater graywater heat recovery system saved roughly 3500 kWh of electricity compared to an electric resistance water heater. The combined radiant/night sky system reduced the space conditioning energy of the home by nearly 1,400 kWh. Over a full year, the Aggie Sol home is 1.9% energy positive and consumes 42.5% less energy than a conventional home exposed to the Davis climate and also built with the same floor plan.

Keywords: Solar House; Energy Modeling; Net-Zero Energy; Appliances; Radiant Heating and Cooling; Night Sky Cooling

1. Introduction

The 2015 UC Davis Solar Decathlon Team, “Team Aggie Sol,” designed a roughly 1000 ft² house as a prototype home for farmworkers in California. The final resting location for the competition home will be on the UC Davis campus. As such, our energy model considered year-round operation in Davis under typical climate conditions.

The Aggie Sol home will provide below market-rate sustainable housing through a detailed, multi-faceted approach to energy efficiency. This report will discuss how the following five choices allowed our home to achieve net-zero energy:

1.1. Construction Materials:

By utilizing the balloon framing method, the home requires substantially less lumber, thereby cheapening the cost, but also allowing more room for insulation, thereby reducing heating and cooling loads that the HVAC system must overcome. By reducing the window to wall ratio, the home also eliminated significant heat loss during the winter and heat gain during the winter. The last major construction choice was utilizing gypsum concrete as thermal mass in the floor in order to cover the radiant system.

1.2. Appliance Selection:

Team Aggie Sol carefully selected home appliances by using an appliance scoring equation that evaluated water efficiency, energy efficiency, aesthetics, cost, and availability. Increased energy efficiency means less electricity consumed and smaller internal gains, while improved water efficiency translates into hot water energy savings.

1.3. Combined Radiant/Night Sky HVAC System

By replacing a traditional forced air HVAC system with a combined radiant/night sky system, Team Aggie Sol considerably cut down annual energy consumption. The radiant system completely eliminates duct losses, replaces an air handler with a weak circulating water pump, and expands the range of acceptable indoor air temperature. The night sky system uses a 1500 gallon chilled water storage tank (CWST), another small water circulator, and rooftop sprinklers to take advantage of radiative cooling. The night sky system eliminates the energy intensive reversible air source heat pumps used for air conditioning.

1.4. Graywater Heat Recovery

Instead of using a standard electric resistance water heater (energy factor of 1.0 or less), the Aggie Sol home used the Nexus eWater graywater heat recovery system which features an overall energy factor (EF) of 4.0. The system consists of a collection tank which captures heat from incoming graywater and transfers it to the 80 gallon NEXheater via refrigerant. The NEXheater then heats incoming cold water to generate the home's domestic hot water.

1.5. High Efficiency Photovoltaic Panels

The Aggie Sol home features twenty-one E20-327 photovoltaic panels. With a 20.4% nominal efficiency, these panels are currently the eighth-most efficient panels among hundreds of other alternatives available. In addition to cooling the home, the night sky sprinklers perform an important second function—washing the panels and removing dust that would otherwise accumulate and reduce system efficiency by up to 40% [1].

Nomenclature		Subscripts and superscripts	
A	area, ft ²	a	ambient air
B	equation of time factor	A	availability
EF	energy factor	C	cost
EoT	equation of time, minutes	Compressor	compressor of SPX 50 DHPT water heater
G_b	beam radiation on a horizontal surface, W/m ²	CWST	chilled water storage tank
G_{br}	beam radiation on a tilted surface, W/m ²	dp	dewpoint
G_t	beam radiation received by a photovoltaic panel, W/m ²	E	energy efficiency
$Lloc$	local meridian, °	HPWH	heat pump water heater
L_{st}	standard meridian, °	i	refers to any given item in a collection
n	day of the year	L	aesthetics
OH	operating hours	max	maximum
Q	heat, Btu	min	minimum
S	wind speed, m/s	mp	maximum power point of a photovoltaic panel
$SEER$	Seasonal Energy Efficiency Ratio	NOCT	normal operating cell temperature
T	temperature, °F	O	operative
T_r	mean radiant temperature, °F	Panel	individual photovoltaic panel
W	weighting factor	Pond	water sprayed onto Aggie Sol roof
T_c	temperature of photovoltaic cell, °C	Ref	Panel properties at reference temperature
w	hour angle, °	Roof	Aggie Sol Roof
X	score from 0 to 10 assigned to an appliance category	SHGC	solar heat gain coefficient
<i>Greek symbols</i>		Sky	night sky
β	slope, °	W	water efficiency
γ	surface azimuth angle, °		
γ_s	solar azimuth angle, °		
δ	declination angle, °		
η	efficiency		
θ_z	zenith angle, °		
$\mu_{n,mp}$	maximum power point efficiency temperature coefficient,		
σ	Stefan-Boltzmann constant,		
φ	latitude, °		

2. Methods

2.1. Modeling the Home

The home was modeled in BEopt, a free energy modeling program provided by NREL. A few aspects of the home, such as the radiant system, night sky cooling system, and Nexus system, could not be simulated in BEopt so external Excel calculations were utilized to supplement the BEopt model. BEopt allows accurate modeling of the home's footprint, but its 3D modeling capabilities are limited. Figure 1 illustrates the rendering of the Aggie Sol home in BEopt.

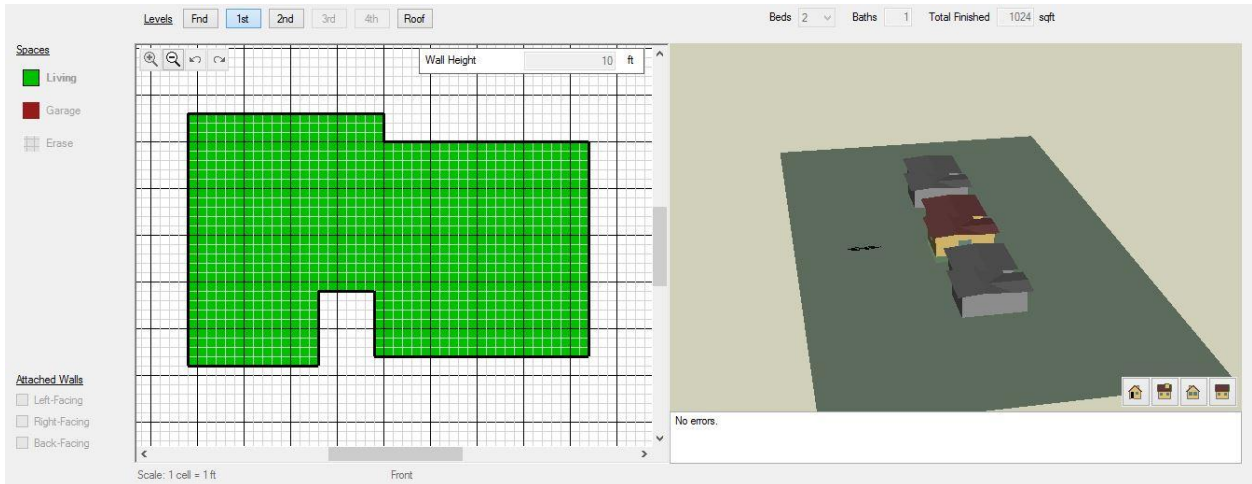


Figure 1. Aggie Sol Home modeled in BeOpt. The image on the left shows the footprint of the home while the image on the right shows the 3D rendering of the home.

Individual rooms cannot be modeled nor can the specific positions of doors and windows be assigned. However, these limitations do not affect the accuracy of the energy simulation because the user can manually input the surface area of each wall occupied by windows. Additionally, our HVAC control system treats the home as a single zone so individual room loads are irrelevant.

Table 1 summarizes how construction materials, equipment and appliances were entered into BEopt to generate the energy model. Irrelevant BEopt entry options such as the number of gas grills, extra freezers, etc., have been omitted from this table for the sake of brevity and clarity.

Table 1. BEopt Entry Summary

Group Name	Category Name	Option
Building	Orientation	South, Azimuth 0.0 degrees
	Neighbors	15' offset
Walls	Wood Stud	R-21 EcoBatt, 0.121 Framing Factor
	Wall Sheathing	OSB
	Exterior Finish	Fiber-Cement, Light
Ceilings/Roofs	Finished Roof	R-38 EcoBatt, 0.0381 Framing Factor
	Roof Material	TPO Single Ply Membrane
Foundation/Floors	Pier & Beam	R-30 EcoBatt
	Carpet	No Carpet
Thermal Mass	Floor Mass	2" Gypsum Concrete
	Exterior Wall Mass	1/2" Light Drywall
	Partition Wall Mass	2 X 1/2" Light Drywall
	Ceiling Mass	1/2" Light Drywall

Windows & Doors	Window Areas	146 ft² total windows: South= 57 ft ² North= 35 ft ² West= 29 ft ² East= 25 ft ²
	Windows	Double-Pane, Low-E, Metal Frame, Argon Fill
	Interior Shading	Summer= 0.6, Winter=0.7
	Eaves	2'
	Overhangs	None
Airflow	Air Leakage	10 ACH50
	Mechanical Ventilation	Exhaust
	Natural Ventilation	Year-Round
	Air Source Heat Pump	SEER 14, 8.2 HSPF
	Ducts	None
	Ceiling Fan	Standard Efficiency, 3 Fans
Space Conditioning Schedules	Cooling Set Point	65 °F
	Heating Set Point	78 °F
	Humidity Set Point	60% Relative Humidity
Water Heating	Water Heater	HPWH, 80 Gallons
	Distribution	R-3.21. HomeRun, PEX
Lighting	Lighting	92.3% Hardwired LED, 7.7% Hardwired CFL
Appliances & Fixtures	Refrigerator	Frigidaire FFHT1831QS
	Cooking Range	Electric, 417 kWh/year
	Dishwasher	Bosch SGE63E15UC
	Clothes Washer	Frigidaire FFFW5000QW
	Clothes Dryer	Frigidaire FFQE5000QW
	Hot Water Fixtures	0.50 (half the usage of a standard BEopt home)
Miscellaneous	Plug Loads	0.15 (15% of the plug loads of a standard BEopt home)
Appliances & Fixtures Schedules	Refrigerator Schedule	Standard BEopt schedule
	Cooking Range Schedule	Standard BEopt schedule
	Dishwasher Schedule	Standard BEopt schedule
	Clothes Washer Schedule	Standard BEopt schedule
	Clothes Dryer Schedule	Standard BEopt schedule
	Hot Water Fixtures Schedule	Standard BEopt schedule

2.2. Construction Techniques

2.2.1. Balloon Framing

The framing factor of a home’s walls, roof, and floor is critical to its energy efficiency—the framing factor is the ratio of wood stud area to total wall area. A lower framing factor means larger cavities for insulation to be installed. To achieve the lowest possible framing factor while not compromising the structural integrity of the house, our team utilized in-line framing, also known as balloon framing. In-line framing reduces the amount of lumber by changing stud spacing from 16 inches on-center to 24 inches on-center and eliminating unnecessary headers [2].

Not only does our home feature more insulation because of in-line framing, but we also chose insulation with high R-values. Insulation is typically installed in building cavities or attached to a building’s structural frame. Insulation reduces heat transfer into and out of a building through two mechanisms: (1) Insulation forces heat to conduct through air—air conducts heat very poorly, compared to wood and metal. Heat moves slowly through insulation because it must cross numerous slow-conducting air pockets. (2) Insulation eliminating radiation and convection within building cavities by filling up the otherwise empty space [3]. The construction industry uses R-values ($\frac{hr*ft^2*°F}{BTU-in}$) to measure the ability of insulation to reduce heat transfer [3]. Our home utilizes Eco-Batt blanket insulation in the floor, wall and roof cavities, with R-values substantially higher than those used in conventional framing [4]—Table 2 compares our insulation to conventional insulation utilized by the BEopt benchmark case [5]:

Table 2. Aggie Sol Home Insulation vs Conventional Insulation

Category	Aggie Sol Home	Conventional Home
Floor Insulation	R-30 EcoBatt	R-19 Fiberglass Batt
Wall Insulation	R-21 EcoBatt	R-13 Fiberglass Batt
Roof Insulation	R-38 EcoBatt	R-30C Fiberglass Batt

To perform the head-to-head comparison in BEopt, we created two cases: “Aggie Sol Home” and “Conventional Framing.” The two cases shared the same footprint, HVAC system, equipment, and appliances and only differed in their framing and insulation, as described above.

2.2.2. Low Window to Wall Ratio

Windows are a substantial source of transmission heat loss in the winter and a substantial source of solar heat gain during the summer—consequently, the larger the ratio of window area to wall area, the more prone a house becomes to the outside climate and hence heating and cooling loads increase. Obviously, completely eliminating windows is not an option—windows provide much needed natural light, ventilation, and a view of the outdoors. As a result, it is necessary to select windows that minimize thermal transmittance and solar heat gain. The window industry rates thermal transmittance by utilizing the U-factor[3], which is measured in $\frac{BTU}{ft^2*hr*F}$, and rates solar heat gain with the solar heat gain coefficient (SHGC), which is the ratio of solar heat passing through the glass to solar heat falling on the glass at a 90 degree angle [3].

The BEopt analysis consisted of a head-to-head comparison of two cases, “Aggie Sol Home” and “Conventional Windows.” “The Conventional Windows” case utilized the same framing, footprint, thermal mass, and appliances as the Aggie Sol home—only the window selection differed. The conventional home featured a 15% window to wall ratio with the windows equally distributed on all four walls. These windows had a mean U-factor and SHGC of 0.37 and 0.3, respectively. The Aggie Sol home has a much smaller window to wall ratio—only 9.2% and the window areas are distributed unequally. The south wall contains 39% of the home’s window area to maximize passive heating during the winter [6]. Finally, the mean U-factor and SHGC are 0.44 and 0.24, respectively [7].

2.2.3. Thermal Mass

Thermal mass is the ability of a material to absorb and store heat—in buildings, thermal mass can be utilized to resist external temperature fluctuations [3]. Thermal mass is a function of specific heat and density—gypsum concrete is a great source of thermal mass because it is high in both of these characteristics [8]. However, thermal mass cannot be substituted for insulation—insulation blocks heat transfer while thermal mass stores and releases heat. Thermal mass must be carefully managed in order to be effective—otherwise it can actually exacerbate the effects of severe

weather [9]. In our home, we are utilizing underfloor gypsum concrete as thermal mass in close conjunction with our radiant heating and cooling system.

When the house is in heating mode, the hot water running through the radiant system is significantly hotter than the gypsum concrete—as a result, the gypsum concrete absorbs a substantial quantity of heat. The floor can keep the home warm even after the thermostat has switched off the radiant pump because the gypsum concrete releases the heat that it has absorbed [10]. In cooling mode, the gypsum concrete acts in reverse, losing heat to the much cooler water running through the radiant system. After the thermostat switches off the radiant pump, the cold slab continues to cool the home by absorbing heat from the warmer room [8].

2.3. Appliance Selection

Choosing energy efficient appliances is critical to maximizing energy savings. However, Team Aggie Sol wanted to choose appliances that were not only energy efficient, but also water efficient, aesthetically pleasing, readily available for purchase (in order to avoid long lead times during construction), and affordable. We consulted EnergyStar [11] to obtain spreadsheets containing data on dishwashers, refrigerators, clothes washers, and televisions. Before utilizing our appliance scoring equations, we considered the following selection criteria:

- (1) Dishwashers—ADA compliant, Energy Star compliant, counter-depth
- (2) Refrigerators—ADA compliant, counter-depth, total capacity exceeding 16 ft³
- (3) Clothes washers—ADA compliant, counter-depth, stackable. We selected a clothes dryer that matched the washer.
- (4) Televisions—50 inch screen size, vertical resolution of 1080p

2.3.1. Exceptions to the Appliance Scoring Equation Range

The appliance scoring equation was not applied to the range because annual electricity consumption data was not available from Energy Star for residential cooking appliances. Our team selected a slide-in, ADA compliant cooking range, Frigidaire LFES3025PF based on aesthetics and cost. This model is a regular electric cooking range—our BEopt indicates that electric induction ovens consume only 27 Kwh per year less than their non-induction counterparts.

2.3.1.1. Computer

Although the Solar Decathlon requires the operation of a 15” or larger computer, the appliance scoring equation was not applied to computers because performing an accurate energy usage comparison among two or more computers is quite difficult as many factors influence the amount of energy computers consume. For example, users have a variety of ways of dealing with a non-active computer---some users turn off the computer entirely, while others place it in sleep mode and still others let it idle—these behaviors have vastly different energy outcomes. An idling desktop computer consumes 45 W, while its sleeping and switched off counterparts consume 2.4 W and 1.0 W, respectively [12].

The easiest way to save energy on a computer without substantially sacrificing performance is to purchase a high-functioning laptop instead of a desktop. Laptops average 53 kWh annually, which is less than a third of the 180 kWh energy usage of a typical desktop [13]. For this reason, our team chose the HP Pavilion 15-p030nr laptop to satisfy the Home Electronics Contest [14].

2.3.1.2. Dryer

Additionally, since the washer and dryer needed to be bought together, their combined cost, availability and aesthetic appeal, as opposed to the cost, availability and aesthetic appeal of just the washer alone, were considered in the analysis. The energy usage of the dryer was not considered in the analysis because at the time of the analysis, annual electricity consumption data was not available from Energy Star.

2.3.1.3. Tablets

The Aggie Sol Team will be using multiple tablets during the public exhibition periods to show off the augmented reality software developed by our Design Team—users can take advantage of virtual walkthroughs and narrations on different aspects of the design by using the tablets as homing devices onto specially designed electronic targets throughout the house. The appliance scoring equation was not used in the tablet selection process because tablets

consume an insignificant fraction of household energy—a typical tablet draws 6.1 kWh of electricity per year [13], which is less than 0.2% of our home’s annual energy usage.

2.3.2. Appliance Scoring Equation in Action

In order to evaluate these five parameters, (1) E= energy efficiency, (2) W= water efficiency, (3) C= cost, (4) A= availability, (5) and L= aesthetic appeal (looks), we developed an appliance scoring equation to rate each appliance from 0 to 10 in each respective parameter, with 0 being the lowest and 10 being the highest score:

- (1) *E* was categorized by annual electricity consumption in kWh.
- (2) *W* was categorized by annual water consumption in gallons. In the case of refrigerators and televisions, which do not utilize water, water efficiency was disregarded.
- (3) *C* was categorized by manufacturer suggested retail price in dollars.
- (4) *A* was categorized by the ease with which the appliance could be procured in the United States. Appliances not available in the United States were assigned a zero, appliances not available at a local retailer but available via shipping were assigned a 5, and Appliances ready for pick-up at local retailers were assigned a 10.
- (5) *L* was determined by our design team, who assigned a score from 0 to 10.

In order to achieve a continuous scoring spectrum from 0 to 10, the energy efficiency, water efficiency, and cost of the appliances had to be normalized. We have shown below the normalization process for assigning a cost score to the dishwasher (in reality 43 dishwashers were scored, but for simplicity the example below shows only five dishwashers).

Table 3. Appliance Scoring Equation in Action

Model #	Appliance ID	Cost (MSRP, \$)	Score
Bosch SHX68E15UC	1	\$1,249.00	0.00
Bosch SGE63E06UC	2	\$809.99	5.17
Whirlpool WDF750SAYB	3	\$400	10.00
Bosch SHV68E13UC	4	\$1,249.00	0.00
Bosch SHX98M09UC	5	\$1,099	1.77

Let X_i and C_i represent the cost (\$) and cost score, respectively, of the dishwasher with appliance ID. X_{min} and X_{max} represent the costs of the least and most expensive dishwashers, respectively. Then:

$$C_i = (X_i - X_{max}) / (X_{min} - X_{max}) * 10 \quad (1)$$

$$C_1 = (1249.00 - 1249) / (400 - 1249) * 10 = 0 \quad (2)$$

$$C_3 = \frac{400 - 1249}{400 - 1249} * 10 = 10 \quad (3)$$

Note that since lower cost, energy consumption, and water consumption are desirable, these parameters result in higher scores. After normalization, we assign weights to each of the scores and then use the appliance scoring equation, excluding aesthetics, to obtain an overall pre-aesthetic score.

In order to evaluate the viability of appliances under different circumstances, three sets of weighting factors were assigned:

- (1) All parameters were treated equally.
- (2) Affordability is weighted double the other parameters.
- (3) Affordability and energy efficiency are weighted double the other parameters.

Table 4. Appliance Scoring Criteria

Appliance	Weighting Scenarios		
	(1) All Parameters Equal	(2) Affordability Double	(3) Affordability and Energy Double
Dishwasher	$W_A = W_C = W_E = W_L = W_W = 1/5$	$W_A = W_E = W_L = W_W = 1/6$ $W_C = 1/3$	$W_A = W_L = W_W = 1/7$ $W_C = W_E = 2/7$
Clothes washer	$W_A = W_C = W_E = W_L = W_W = 1/5$	$W_A = W_E = W_L = W_W = 1/6$ $W_C = 1/3$	$W_A = W_L = W_W = 1/7$ $W_C = W_E = 2/7$
Television	$W_A = W_C = W_E = W_L = 1/4$	$W_A = W_E = W_L = 1/5$ $W_C = 2/5$	$W_A = W_L = 1/6$ $W_C = W_E = 1/3$
Refrigerator	$W_A = W_C = W_E = W_L = 1/4$	$W_A = W_E = W_L = 1/5$ $W_C = 2/5$	$W_A = W_L = 1/6$ $W_C = W_E = 1/3$

We defined the weighting factors as follow:

- W_A = Availability weighting factor
- W_C = Affordability weighting factor
- W_E = Energy Efficiency weighting factor
- W_L = Aesthetics weighting factor
- W_W = Water Efficiency weighting factor

The pre-aesthetic scoring equation is as follows:

$$Pre - Aesthetic Score = X_A W_A + X_C W_C + X_E W_E + X_W W_W \quad (4)$$

Our design team reviewed the appliances under each weighting scenario with the top ten pre-aesthetic scores. The design team then assigned an aesthetic score to these appliances, after which the appliances were re-ranked with the overall scoring equation:

$$Overall Score = X_A W_A + X_C W_C + X_E W_E + X_L W_L + X_W W_W \quad (5)$$

Table 5 and Table 6 indicate the appliances with the highest overall scores under each weighting scenario, along with their key characteristics (price, energy consumption, water consumption):

Table 5. Final Appliance Selections

Appliance	Scenario 1	Scenario 2	Scenario 3
Dishwasher	Bosch SGE6306UC	Bosch SGE6306UC	Bosch SGE6306UC
Clothes Washer	Frigidaire FFW5000QW [15]	Frigidaire FFW5000QW	Frigidaire FFW5000QW
Clothes Dryer	Frigidaire FFQE5000QW [16]	Frigidaire FFQE5000QW	Frigidaire FFQE5000QW
Television	Samsung UN58H5005AF [17]	Samsung UN58H5005AF	Samsung UN58H5005AF
Refrigerator	Frigidaire FFHT1831QS [18]	Frigidaire FFHT1831QS	Frigidaire FFHT1831QS

Table 6. Energy Use, Water Use, and Cost of Aggie Sol Appliances

Appliance	Model #	Energy Use (kWh/year)	Water Use	Cost (\$)
Dishwasher	Bosch SGE6306UC	234	4.5 gallons/cycle	\$ 649.00
Clothes washer	Frigidaire FFW5000QW	96	18 gallons/cycle	\$ 656.00
Clothes Dryer	Frigidaire FFQE5000QW	Not Available	Not Applicable	\$ 829.00
Television	Samsung UN58H5005AF	69.6	Not Applicable	\$ 799.99
Refrigerator	Frigidaire FFHT1831QS	363	Not Applicable	\$ 929.00

Under the weighting scenarios important to the team, thankfully the top scoring appliance did not change, which made selection much easier. However, depending on a team's particular circumstances, the weighting factors could be adjusted with an even greater emphasis on affordability, which could certainly change the top scoring appliance.

2.4. HVAC System

2.4.1. Controls

The Aggie Sol home features a simple but slick controls system. It is cheap, easy to set-up and also uses negligible energy [19], [20], [21], and [22]. It allows two pumps operating on independent series circuits, to circulate hot and chilled water as needed.

When the indoor temperature rises above the cooling set point, the thermostat sends a 24 volt signal to the Taco sentry cooling zone valve. Likewise, when the indoor temperature falls below the heating set point, the thermostat sends a 24 volt signal to the heating zone valve. The zone valve consists of a mechanical valve and an electronic actuator [20]. The electronic actuator closes a series circuit ending with the radiant pump, thereby activating the pump, while the mechanical valve opens the pipe and allows water to flow downstream to the radiant pump. The pump then circulates water throughout the underfloor radiant circuits.

The night sky controls system also uses a series circuit, which consists of a Honeywell RPLS730B timeclock directly connected to the electrical panel, an ETC Ranco 111000 temperature sensor, and the night sky pump. The timeclock allows the resident to set a specific timeframe for the operation of the ETC sensor, for example 11 PM to 7 AM [19]. The ETC sensor uses a thermistor to measure the temperature of the CWST. When the temperature of the tank rises above the user-defined setpoint (for night sky cooling, the setpoint is 55 °F), the ETC's microprocessor closes the switch between itself and the night sky pump, thereby activating the pump. The night sky pump then delivers water to the rooftop sprinklers for as long as necessary to restore the 55 °F setpoint temperature of the CWST.

2.4.2. Radiant System Theory

The nature of heat delivery in radiant systems allows the occupant to feel comfortable over a larger air temperature range than forced air systems allow. Allowing air temperature to fluctuate over a larger range reduces the operation time of the HVAC system, which in turn decreases the energy used to heat and cool the home.

Six factors control human thermal comfort: air temperature, radiant temperature, humidity, air velocity, clothes, and metabolism[23]. Clothing and metabolism are both occupant-dependent so only the first four factors can be regulated by a home's HVAC system. Conventional HVAC systems control air temperature, humidity, and air velocity, but neglect radiant temperature. Radiant systems, however address radiant temperature, which contributes to their superior efficiency. Mean radiant temperature T_r can be thought of as the area-weighted average surface temperature of all surfaces enclosing the occupant [24]:

$$T_r = \frac{T_1A_1 + T_2A_2 + \dots + T_NA_{AN}}{A_1 + A_2 + \dots + A_N} \quad (6)$$

By combining the mean radiant temperature and air temperature, we obtain the operative temperature T_o , which is the temperature that the occupant "feels [24]."

The operative temperature is obtained as follows:

$$\theta_{f,i} = \frac{(h_c * T_a) + (h_r * T_r)}{h_c + h_r} \quad (7)$$

Where:

T_a = air temperature (°F)

h_c = convective heat transfer coefficient for the human body $\left(\frac{Btu}{h * ft^2 * ^\circ F}\right)$

h_r = radiant heat transfer coefficient for the human body $\left(\frac{Btu}{h * ft^2 * ^\circ F}\right)$

In practice, the operative temperature equation can be simplified as the average of the air and mean radiant temperatures [24].

$$\theta_{f,i} = (T_a + T_r)/2 \tag{8}$$

This simplification is valid as long as the difference in the air and mean radiant temperatures remains less than 7 F and the air velocity is below 0.2 m/s [24].

The take-home point is that radiant systems address both temperature variables present in the operative temperature equation while forced air systems do not. As a result, the comfortable indoor air temperature range increases substantially. The heating setpoint can go as low as 65° F [25] while the cooling setpoint is 78 °F[24] . By contrast, the typical forced air heating setpoint is 71 °F [5] while the cooling setpoint is 76 °F [5].

Two other factors contribute more heavily to the energy efficiency of the radiant system than does the expanded air temperature range: replacing ductwork with PEX tubing and substituting water for air. Heat loss in ductwork can add up to 25-40% before the air is even delivered to the room [26]—ducts lose heat via air leaks through small cracks and seams and also by conduction through the duct wall. Additionally, air retains heat very poorly—the specific heat of air is only 1.005 J/g°C at 25°C [27] while water has a specific heat of 4.18 J/g°C at 25 °C [28]. Furthermore, water also is much denser than air (1000 kg/m³ at 25 °C [28] vs 1.165 kg/m³ at 25 °C [27]). Consequently, a given volume of water can hold about 3,450 times as much heat as an equivalent volume of air.

2.4.3. Radiant System Design

In order to simplify and cheapen the control system, we treated the home as a single zone. This zone was divided into eight radiant circuits, each approximately 200 lineal feet in length. Heat transfer occurs continuously along the circuit length. By restricting the circuit length to 200 lineal feet, we can maintain a ten degree temperature drop across the surface and thereby sustain a large temperature gradient between the floor and the tubing throughout the entire length of the circuit.

HDPE tubing with ½” inner diameter was utilized and spaced six inches on-center, although in a few spots in order to not exceed 200 lineal feet in circuit length, the spacing was increased to twelve inches. Each circuit was designed to receive a flowrate of 1 GPM. Thus, the radiant pump was sized to deliver 8 GPM to the radiant system and to overcome 11.51 psi of head loss. For this task, the Taco 0013 circulator, which draws only 1/6 hp [29], was selected.

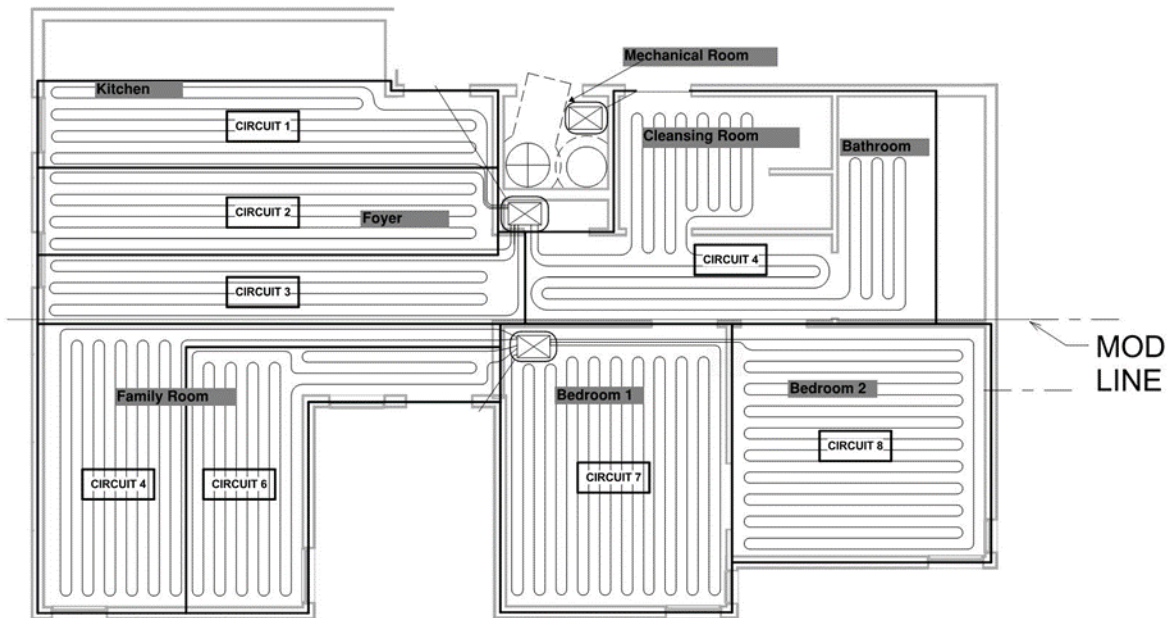


Figure 2. Radiant Circuits of the Aggie Sol Home

2.4.4. Heating Energy Calculation

The heating energy was externally calculated with Excel because BEopt cannot model radiant systems nor can it account for the operation of heat pump water heaters (HPWH) for a use other than domestic hot water production. To minimize electricity consumption, we will operate our 50 gallon State SPX 50 DHPT water heater primarily in heat pump mode. The mean ambient temperature in Davis during the heating season is 52.3 °F.

The GE water heater has a DOE rated energy factor of 3.19 [30] in heat pump only mode which exceeds the 2.78 energy factor of our State model [31]. However, these energy factors are only valid at the temperature difference measured by the DOE test—an air temperature of 67.5 °F (the air functions as the heat source) and a tank temperature of 135 °F (the tank functions as the heat sink) [32]. The temperature gradient of the Aggie Sol radiant system is roughly 52.7 °F as the mean air temperature is 52.3 °F and the radiant supply temperature (which is equivalent to the setpoint temperature of the HPWH's tank) is 105 °F.

To evaluate the energy factor of the State water heater at a temperature gradient of 52.7 °F, the energy factor was modeled as a function of temperature gradient by utilizing data from the NEEA's Northern Climate Energy Factor Test [30]:

$$EF_{compressor} = -0.0271(T_a - T_{HPWH}) + 4.6847 \quad (9)$$

According to State, the compressor of our HPWH is rated at 0.49 kW [33]The power drawn by the heat pump also varies with temperature. The heat transfer capacity of the heat pump depends on the power draw and energy factor of its compressor:

$$Capacity \left(\frac{Btu}{hr} \right) = Power Draw * EF_{compressor} * \frac{3412.12 Btu}{kW} \quad (10)$$

Thus, the State HPWH has an EF of 3.54 during radiant heating when the compressor alone is active while the energy factor for resistance heating is 0.89 [31]. To obtain the effective energy factor for the entire heating season, the weighted average was taken of the operating hours for the compressor alone, $OH_{compressor}$ and the compressor and resistance element working together, $OH_{combined}$:

$$EF_{effective} = \frac{EF_{compressor}OH_{compressor} + EF_{resistance}OH_{combined}}{OH_{compressor} + OH_{combined}} \quad (11)$$

To obtain the annual energy consumption of the State HPWH, $EF_{effective}$ was divided into the annual heating load:

$$Annual HPWH Energy = \frac{Annual Heating Load}{EF_{effective}} \quad (12)$$

The radiant pump's annual energy use is the product of its hourly power draw and the number of operating hours of the HPWH:

$$Radiant Pump Energy = Power Draw * OH_{combined} \quad (13)$$

Then the annual heating energy becomes the sum of the electricity usage of the HPWH and the radiant pump, as the HVAC system controls consume an unsubstantial amount of electricity [21], [22], and [19].

$$Heating Energy = HPWH Energy + Radiant Pump Energy \quad (14)$$

2.4.5. Night Sky System

The Aggie Sol home features a night sky cooling system originally patented and developed as the "Cool Storage Roof" by Richard Bourne, founder of the Davis Energy Group [34].

Our night sky cooling system utilizes conventional lawn sprinklers to spray the water stored in a highly insulated CWST into a thin mist that spreads across the roof surface. Richard Bourne has developed a rule of thumb flowrate of 1 GPM for 100 ft² of roof area [35]. Since our roof is roughly 1000 ft², our design flowrate is 10 GPM. This water loses heat primarily by radiation to the clear night sky although evaporation and convection also contribute to the cooling effect [34].

Radiative cooling to the sky occurs when the "effective sky temperature" is lower than the temperature of the rooftop water. The night sky temperature, T_{sky} , is usually lower than the ambient air temperature T_a because

atmospheric temperature falls with increasing elevation [34]. T_{sky} is a function of the clear sky emissivity, ϵ_{sky} , and T_a [36].

$$T_{sky} = \epsilon_{sky} \sigma T_a \quad (15)$$

The clear sky emissivity is in turn a function of the dewpoint temperature T_{dp} [36]:

$$\epsilon_{sky} = 0.736 + 0.0577 T_{dp} \quad (16)$$

We can represent radiative heat loss in W/m^2 to the night sky as R where ϵ_r is the emissivity of the water, T_{pond} is the temperature of the water, σ is the Stefan-Boltzmann constant [36].

$$R = \epsilon_r (\sigma T_{pond}^4 - \sigma T_{sky}^4) \quad (17)$$

Thus the driving force behind the night sky cooling system is the temperature gradient between the night sky and the roof “pond.” Since Davis enjoys clear skies, low dewpoint and ambient temperatures during summer nights, in practice, this temperature gradient is large enough to eliminate a conventional air conditioning system.

The controls of the night sky system consume negligible electricity [19] and [21] so the energy usage is purely a product of the pump power draw and the number of spray hours:

$$E_{nightsky} = \text{Night Sky Pump Power}(kW) * \text{Spray Hours} \quad (18)$$

We assume that the temperature of the CWST, $T_{CWST,1}$, drops to 55 °F after the night sky system has finished running. Since the CWST is insulated with R-30 fiberglass batts and water has a high specific heat, we assume only 1 °F temperature rise due to solar radiation. The radiant heating system will dump the home’s daily cooling load into the CWST and raise the water temperature to $T_{CWST,2}$.

$$T_{CWST,2} = T_{CWST,1} + 1 + \frac{\text{Cooling Load}}{V_{CWST} C_{water}} \quad (19)$$

The night sky sprinklers spray over the entire roof surface to more quickly dissipate the heat carried by the CWST, Q_{CWST} , and restore the CWST to 55 F:

$$Q_{CWST} = V_{CWST} C_{water} (T_{CWST,2} - T_{CWST,1}) \quad (20)$$

$$\text{Spray Hours} = \frac{Q_{CWST}}{A_{roof}} \quad (21)$$

After cooling, this water collects in the gutter, enters the downspout, where a cartridge filter removes any particulates that it has picked up on the roof. The water then returns to the CWST, where it is recirculated by the night sky pump until the CWST’s temperature falls to 55 °F.

2.5. Nexus Graywater Heat Recovery System

Our house features the Nexus E-Water system, which uses captured heat from graywater to produce domestic hot water. The system consists of two main components, the NEXcollector, and the NEXheater [37]. The home’s graywater collects in the NEXcollector, where a steel plate heat exchanger delivers its heat to R-410 refrigerant [38]. This refrigerant then travels via copper tubing to the NEXheater [39]. The heat delivered by the refrigerant combined with the waste heat from the heater’s compressor, warm up incoming cold water by 65 F, to produce 125 F hot water for domestic use [37]. Figure 3 provides a conceptual schematic of the Nexus system in action.

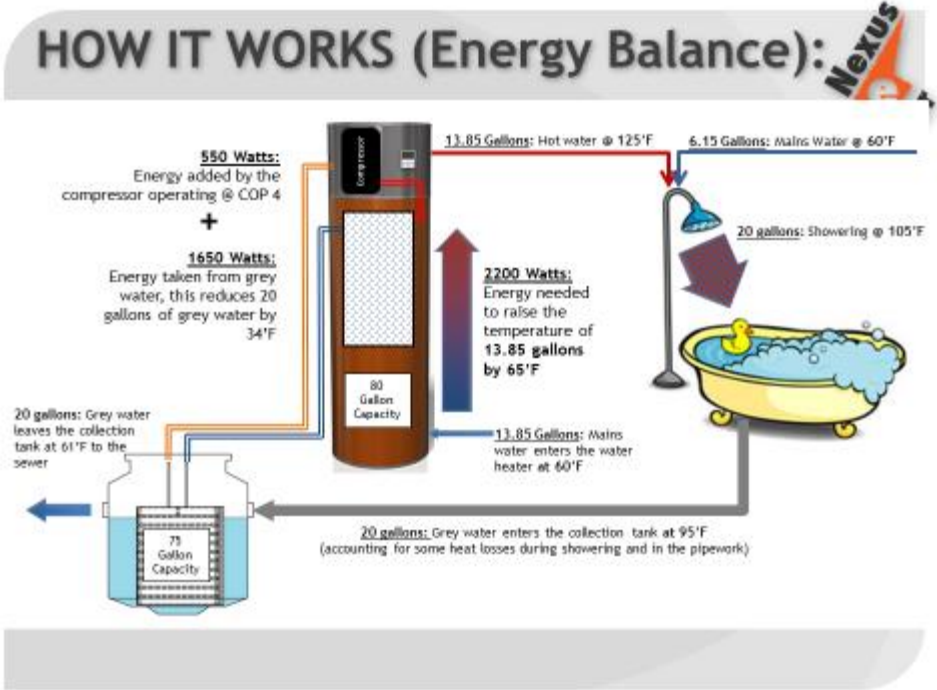


Figure 3. Conceptual Schematic of the Nexus System, provided by Nexus eWater

2.6. PV Array Sizing

We sized our photovoltaic array to ensure that under the worst-case scenario, where our home consumes 175 kWh during the competition week, the maximum allowable amount before the team is penalized [14], we remain zero-net energy. We used the procedure laid out in the classic textbook, Duffie and Beckman (2006) to perform our photovoltaic calculations [40].

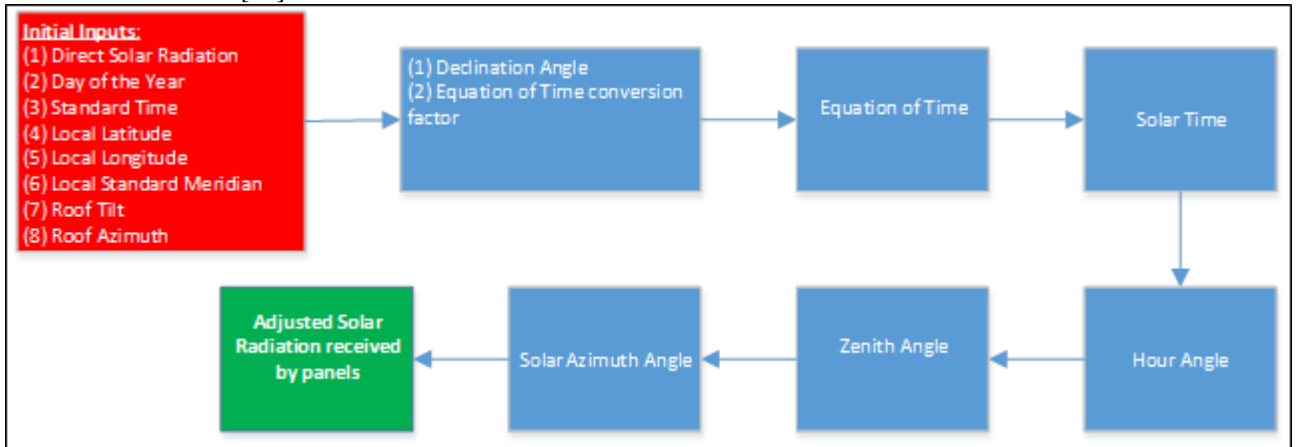


Figure 4. Duffie and Beckman (2006) Solar Radiation Calculation Procedure

We gathered ten years of direct solar radiation data for Davis, CA (from 2005-2014) from CIMIS [41] we determined the solar radiation by calculating the appropriate solar angles with the following equations:

Declination Angle

$$\delta = 23.45 \sin\left(\frac{360(284+n)}{365}\right) \quad (22)$$

Equation of Time

$$B = (n - 1) * \frac{360}{365} \quad (23)$$

$$EoT = 229.2(0.000075 + 0.01868\cos B - 0.032077\sin B - 0.014615\cos 2B - 0.04089 \sin 2B) \quad (24)$$

Solar Time

$$\text{Solar Time} = \text{Standard Time} + 4 (L_{st} - L_{loc}) + EoT \quad (25)$$

Hour Angle

$$w = 15(\text{Solar Time} - 12) \quad (26)$$

Zenith Angle

$$\cos(\theta_z) = \cos \phi \cos \delta \cos w + \sin \phi \sin \delta \quad (27)$$

Solar Azimuth Angle

$$\gamma_s = \text{sign}(w) * \text{abs}\left(\frac{\cos^{-1}(\cos \theta_z \sin \phi - \sin \delta)}{\sin \theta_z \cos \phi}\right) \quad (28)$$

We obtained the adjusted solar radiation, G_{bt} , by accounting for the pitch of the roof, β .

$$G_{bt} = \cos \theta_z \cos \beta + \frac{\sin \theta_z \sin \beta (\gamma_s - \gamma)}{\cos \theta_z} G_b \quad (29)$$

Although the nominal panel efficiency n_{mpref} for our SunPower E20-327 panels is 20.4% [42], the eighth-highest on the market (as of March 2015) out of hundreds of available alternatives. This efficiency is only seen at the reference cell temperature, T_{cref} , of 25 °C. Panel efficiency decreases with increasing cell temperature:

$$n_{mp} = n_{mpref} - \mu_{nmp}(T_c - T_{cref}) \quad (30)$$

The actual cell temperature, T_c , is a function of the wind speed, V , and T_a —we used CIMIS data for Davis averaged from 2005-2014 [41].

$$T_c = \frac{G_T}{800} \left(\frac{9.5}{5.7 + 3.8V} \right) (T_{NOCT} - T_{a,NOCT}) + T_a \quad (31)$$

To obtain the electricity production of a panel, one needs to multiply the panel area by the inverter derate factor and the panel efficiency. The derate factor measures how much electricity that the inverter successfully converts from DC to AC current [43].

$$E_{panel} = n_{mp} * \text{derate} * A_{panel} \quad (32)$$

3. Results and Discussion**3.1. Aggie Sol Construction vs Conventional Construction**

This model analyzes three facets of our construction effort, balloon framing, low window to wall ratio, and thermal mass independently before accounting for the combined heating and cooling energy savings of all three. Figure 5 and Figure 6 show the annual heating and cooling loads associated with the different construction scenarios analyzed with BEopt. Figure 7 and Figure 8 illustrate the annual heating and cooling energy consumption associated with these construction scenarios.

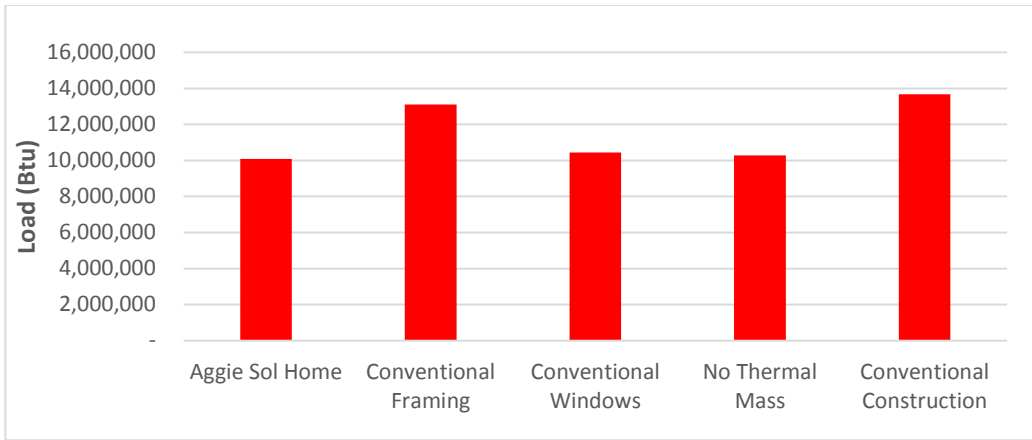


Figure 5. Annual Heating Loads Comparison for Different Construction Techniques

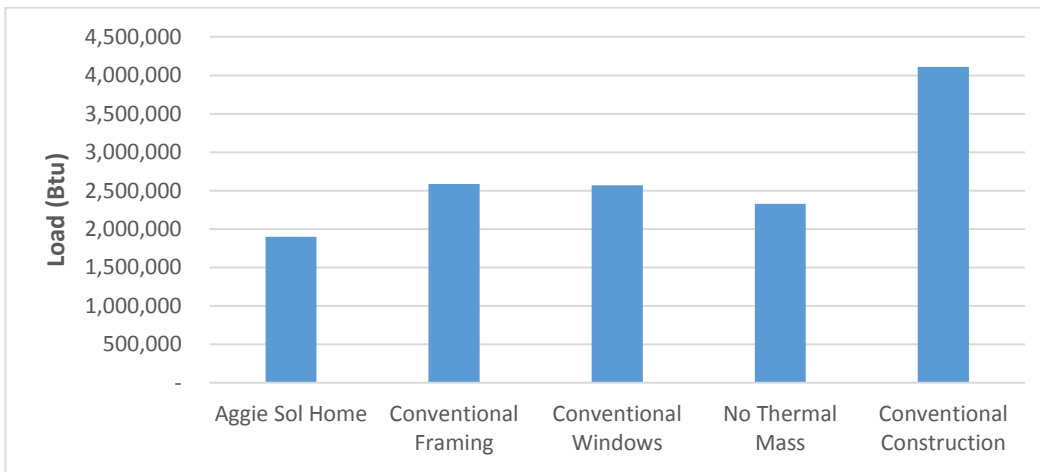


Figure 6. Annual Cooling Loads Comparison for Different Construction Techniques

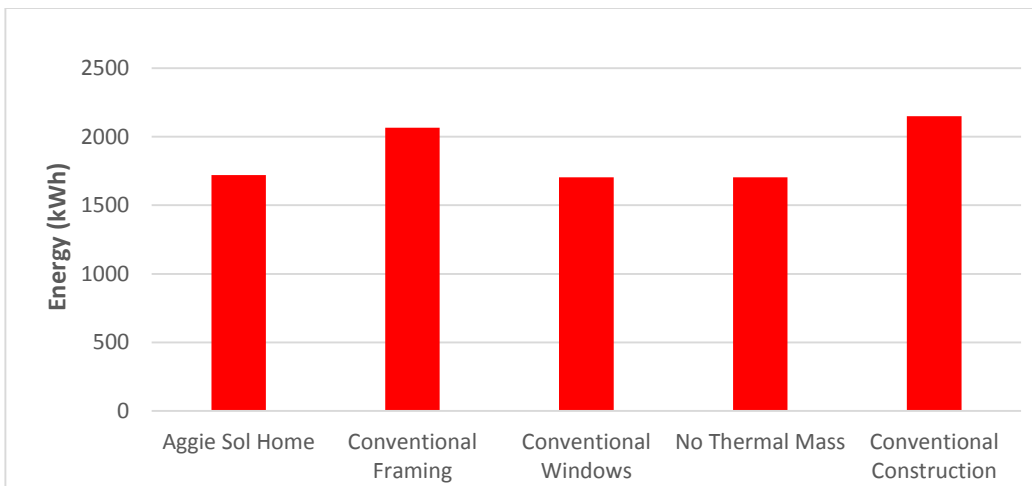


Figure 7. Annual Heating Energy Comparison for Different Construction Techniques

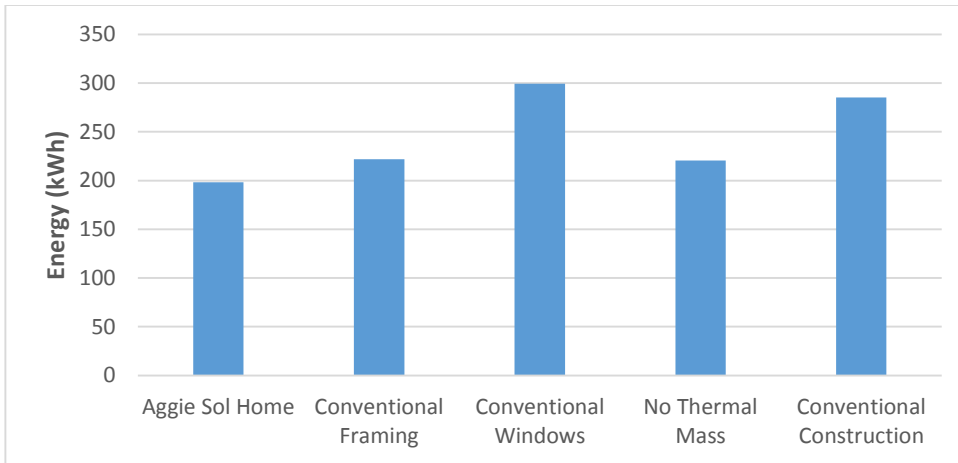


Figure 8. Annual Cooling Energy Comparison for Different Construction Techniques

3.1.1. Balloon Framing vs Conventional Framing

The combined effect of high insulation and balloon framing resulted in a tremendous reduction in heating and cooling loads throughout the calendar year. According to BEopt, conventional framing of the home (while holding the appliances, HVAC system, and home geometry constant) would have resulted in an annual heating load of 14.47 million BTUs. By comparison, our framing method produces an annual heating load of 10.88 million BTUs, a savings of nearly 3.59 million BTUs and a 33.0% reduction. Additionally, the “Aggie Sol framing” method produces an annual cooling load of 1.40 million BTUs while conventional framing would generate an annual cooling load of 1.71 million BTUs—that is a savings rate of 43.3%.

Heating and cooling loads represent the amount of thermal energy that must be added or removed in order for the home to reach the desired setpoint temperatures. Since loads correlate with HVAC electricity consumption, by reducing loads, one also reduces the electricity demand of the HVAC system. Conventional framing would require 2830 kWh for heating and 190 kWh for cooling. Aggie Sol framing, on the other hand would require only 2129 kWh for heating, a reduction of 32.9%, and 175 kWh for cooling, a decrease of 3.8%. Clearly, maximizing the quantity and the quality of insulation in a home is an effective way of reducing HVAC electricity demand.

3.1.2. Aggie Sol Windows vs Conventional Windows

As with the previous comparison, all variables were held constant except for the variables of interest—window area and window type. An interesting phenomenon takes place with regard to our window selection—the Aggie Sol windows immensely decrease the annual cooling load and cooling energy consumption of the house. The cooling load falls from 2.57 million BTUs to 1.90 million BTUs, a 35.5% drop. The cooling energy plummets from 299 kWh to 198 kWh, a 51.1% drop. However, the annual heating load only decreases by 3.4% and in fact the heating energy is virtually identical—1702 kWh for the Aggie Sol windows vs 1719 kWh for conventional windows. This phenomenon occurs because of the opposing effects of our high U-factor and low window to wall area. During the summer, the low window to wall ratio plays a huge role in eliminating solar heat gain into the house. However, during the winter, the high U-factor exacerbates the rate of heat loss across the windows to the colder outside environment—additionally the low solar heat gain coefficient of our windows now works against us.

3.1.3. Thermal Mass vs No Thermal Mass

The head-to-head comparison in BEopt featured compared the Aggie Sol Home baseline case to the “No Thermal Mass” case. The “No Thermal Mass” case utilized the same framing, window selection, footprint, and appliances as the Aggie Sol Home case—in fact the only difference was the modeling of a 2 inch wooden floor instead of a 2 inch gypsum concrete layer. The “No Thermal Mass” case produced an annual heating load of 10.28 million BTUs, an increase of 1.8% over the Aggie Sol Home. The “No Thermal Mass” case demands 1704 kWh of heating energy, which is almost identical to the 1719 kWh required by the baseline case—thus thermal mass in the floor neither reduces the heating load nor does it save heating energy.

But the “No Thermal Mass” case did generate an annual cooling load of 2.33 million BTUs, which exceeds the annual cooling load of the Aggie Sol Home by a staggering 35.5%. The cooling energy demand also rises substantially from the Aggie Sol home baseline—from 198 kWh to 221 kWh, an 11.4% increase.

By far the single most important construction method in improving the energy efficiency of the Aggie Sol home is balloon-framing. The Aggie Sol home demands 1917 kWh year-round for heating and cooling—conventional framing would increase this quantity to 2287 kWh, a 19.3% jump. But using conventional windows or neglecting to add thermal mass would only increase the baseline energy to 2002 kWh and 1925 kWh, respectively. Both of these jumps are less than 5%.

3.1.4. Aggie Sol Construction vs Conventional Construction

In order to evaluate the combined effect of the Aggie Sol Construction method (the use of balloon framing, thermal mass, and low window to wall ratio), the “Conventional Construction” case was modeled with BEopt. “Conventional Construction” utilized the same floor plan, equipment, and appliances as the Aggie Sol home but modeled the house as built entirely according to conventional construction techniques, with conventional framing, a 15% window to wall ratio, a U-factor of 0.37 and an SHGC of 0.3, and no thermal mass in the floor. Conventional construction generated a yearly heating load of 13.68 million BTUs and a yearly cooling load of 4.11 million BTUs. The Aggie Sol home thus reduces heating and cooling loads by 26.3% and 53.8% respectively.

Conventional construction requires 2148 kWh electricity for heating and 285 kWh electricity for cooling, per year. The overall heating and cooling energy demand stands at 2433 kWh—thus Aggie Sol construction reduces annual home energy use by 21.2%.

3.2. Aggie Sol Appliances vs Conventional Appliances

To evaluate the energy efficiency of our appliances, we compared two cases in BEopt, “Aggie Sol Main” versus “Conventional Appliances,” while holding all other variables constant. As illustrated by Table 7, not only did the annual energy consumption of the home appliances decrease substantially, but also the energy required by hot water production and space cooling also fell. The 8.4% drop in hot water energy demand can be attributed to the appliance scoring equation described in the Methodology section above—by utilizing water-efficient appliances, less hot water needs to be generated and therefore less energy is required for its production.

Please note that the hot water production energies provided by Table 7 disagrees with the NEXheater annual electricity usage—this contradiction arises because BEopt cannot accurately model graywater heat recovery. But the Nexus e-Water calculator described in section 3.4 does not model water appliances with BEopt’s level of detail—hence to perform the hot water energy comparison, we relied on BEopt.

Waste heat from inefficient appliances contribute to internal heat gains, which are responsible for 20% of a home’s summer cooling loads [3]. By utilizing energy efficient appliances, the Aggie Sol Home reduced the annual cooling energy use by 13.8%. Since less waste heat was available from the appliances during the winter, the home required 2.5% more heating energy. Altogether however, the appliance scoring equation produces an annual energy savings of almost 400 kWh.

Table 7. Aggie Sol Appliances vs Conventional Appliances: Energy Usage Comparison

Annual Energy Use (kWh/year)	Aggie Sol Appliances	Conventional Appliances	% Savings
Appliances	1617	1961	17.5%
Hot Water	673	732	8.4%
Heating	1719	1677	-2.5%
Cooling	198	230	13.8%

3.3. Aggie Sol HVAC System Energy Savings

3.3.1. Under-Pressure Night Sky System—Energy Savings

Since the night sky pump runs for several hours during summer nights, its power draw has a substantial impact on the overall energy usage of our home. To minimize the power draw, we run the sprinklers at 10 psi, even though

20 psi is the bottom end of the operating range listed by most manufacturers [35]. Although the flowrate is less intense, we determined by experiment that we will still get adequate coverage on the roof and that the sprinklers will still produce the fine mist needed for radiative cooling to occur. By running an under-pressure system, we can use an Armstrong pump that draws 0.576 kW (120 V*4.8 A) [34] instead of a Grundfos pump that draws 0.944 kW [36]. Annually, the Armstrong pump uses 65.87 kWh of electricity, while the Grundfos uses 107.96 kWh, an energy savings of 42 kWh.

3.3.2. Radiant/Night Sky System vs Forced Air System

To evaluate the energy savings of our HVAC system, we created the “Forced Air” case in BEopt. The “Forced Air” case featured several differences from the Aggie Sol baseline model:

- (1) Forced air systems can only alter the operative temperature by changing the air temperature. Consequently, to ensure comfort, the forced air system must maintain a much tighter air temperature range than its radiant counterpart. We utilized the 71 °F heating setpoint and 76 °F cooling setpoint recommended by Building America [5].
- (2) The “Forced Air” case features R-8 insulated ducts with 30% system energy losses.
- (3) A reversible SEER 14.2 air source heat pump served as the heating and cooling source for the home—heating and cooling electricity usage was derived directly from BEopt instead of being externally calculated in Excel.

Table 8 provides the heating and cooling energy used year-round by both HVAC systems. The percentage energy savings for heating is significant but much smaller than for cooling (36.0% vs 65.3%). The tremendous drop-off for cooling occurs because on the cooling side, the Aggie Sol home has entirely replaced air as the heat transfer fluid. As a result, two weak circulating pumps are the only sources of considerable energy usage. As for heating, radiant heating is indeed more effective than forced-air heating. However, the ultimate source of the heat is still an air-source heat pump, which relies on a 4.5 kW electric resistance heating element whenever the hourly heating load exceeds 5924 BTUs.

Table 8. Heating and Cooling Energy for Radiant/Night Sky and Forced Air Systems

Case	Heating Energy (kWh)	%Savings	Cooling Energy (kWh)	% Savings
Radiant/Night Sky	1719	36.0%	198	65.3%
Forced Air	2,679		571	

3.4. Nexus System vs Conventional Domestic Hot Water System

To determine our energy savings, we utilized the Nexus e-Water Calculator. This program calculated the electricity consumed by the NEXheater as well as other water heaters by taking the following inputs: zipcode, household size and fixture efficiency. The Davis zipcode, 95616, corresponded with an average inlet water temperature of 60 °F. The Aggie Sol water fixtures were assumed to be “highly efficient,” since water efficiency was one of the cornerstones of the appliance scoring equation. The program calculated 100 gallons of daily graywater production (20 gallons *5 people) and 2.689 kWh/day of electricity consumption by the NEXheater.

By extrapolating the daily electricity consumption of the NEXheater and alternative water heaters, we obtained the yearly values listed in Table 9. Note that the NEXheater has a coefficient of performance of 4, which exceeds the highest EF of any HPWH certified by Energy Star—the A.O. Smith HPHE10250H045DV 120 water heater has an EF of 3.24, which we also evaluated in this comparison.

Table 9. NEXheater Performance vs Alternative Water Heaters

Water Heater Type	Daily Electricity (kWh/day)	Annual Electricity (kWh/year)	% More than Nexus
NEXheater	2.69	981	
Heat Pump, EF 3.24	4.10	1496	52.4%
Electric Resistance	11.95	4362	344.4%
Gas Tank	18.54	6768	589.6%
Gas Tankless	13.12	4787	387.8%
Condensing Gas Tankless	11.20	4089	316.6%

Natural gas tank energy consumption is typically measured in therms—but to make an equivalent comparison, therms have been converted to kWh—1 therm equals 29.3 kWh. The NEXheater consumes 981 kWh of electricity annually while its closest competitor consumes an additional 52.4%. All of the other alternatives consume over triple the amount that the NEXheater consumes.

3.5. Photovoltaic Electricity Production

Situated in the Central Valley, Davis enjoys mostly sunny days and high insolation throughout the year, which make it a great venue for solar energy production. The daily average insolation in Davis ranges from a low of 1405 W/m²*day in January to a high of 6363 W/m²*day in July. Figure 9 shows that insolation rises linearly from February to June, flattens out in the summer months, before decreasing linearly until November and flattening out again in the winter months.

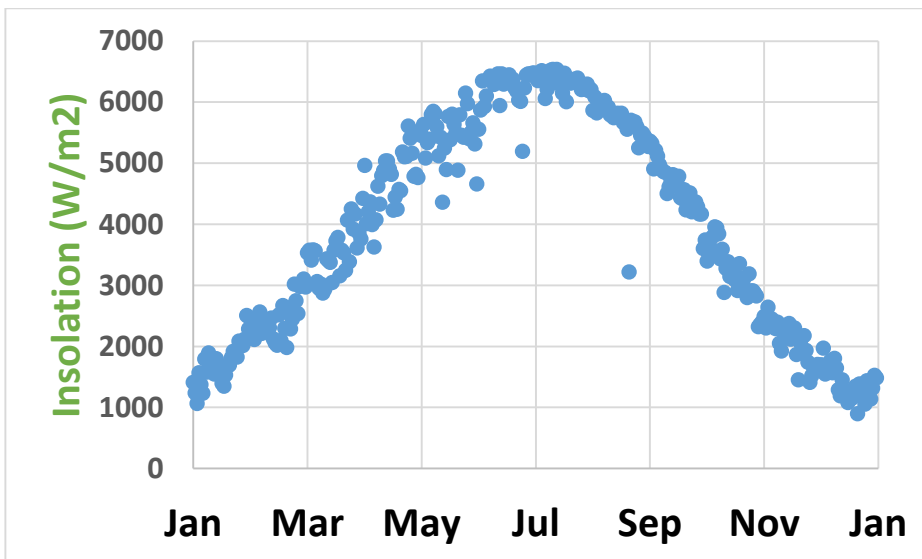


Figure 9. Average Insolation (W/m²) in Davis, CA throughout the year

The night sky sprinklers not only cool the home but also clean off the dust that accumulates on the panels throughout the day—dust accumulation can cause a 40% drop off in panel efficiency, and by extension photovoltaic electricity production, throughout the year [1]. Our house would go from being slightly positive-energy to over-consuming by 40%--it is not enough to simply install solar panels; proper maintenance is also important.

3.6. Annual Energy Consumption and overall Energy Efficiency

Figure 11 provides another metric by which to judge the energy efficiency of the Aggie Sol home—the energy production of the Aggie Sol home and the conventional home are juxtaposed next to the electricity production of the

photovoltaic array for every day of the year. While the Aggie Sol home is almost invariably energy positive from March to October, the conventional home is not—in fact the conventional home is energy negative during the summer months when photovoltaic production peaks. Thus during both the hottest and coldest time of the year, the conventional home possesses a large electricity gap that it must make up—this electricity will be provided by the grid and will cost the occupant substantially. By contrast, the Aggie Sol home provides the occupant with the opportunity to sell electricity back to the grid for much of the year.

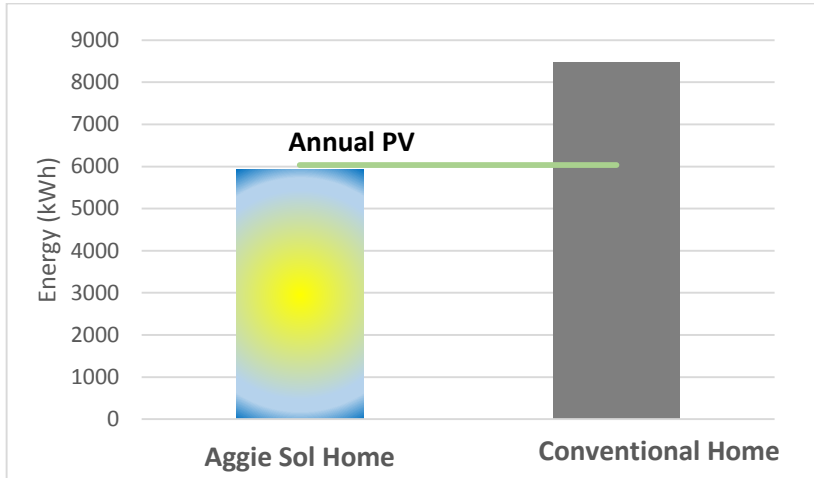


Figure 10. Annual Energy Consumption of Aggie Sol Home vs Conventional Home

The last phase of the energy model involved combining all the factors discussed earlier in this report in order to judge the energy efficiency of the Aggie Sol Home compared to a conventionally built home with the same floor plan also exposed to the Davis climate. While the Aggie Sol home features a combined radiant/night sky system, balloon framing, thermal mass in the floor, energy and water efficient appliances, and a low window to wall ratio, the conventional home would not. Figure 10 compares the annual energy consumption of the Aggie Sol home to the conventional home—the Aggie Sol home uses 5945 kWh of electricity, making it 1.9% energy positive. By contrast, the conventional home uses 8472 kWh and even with 21 high efficiency SunPower solar panels, it consumes 28.7% more electricity than it produces.

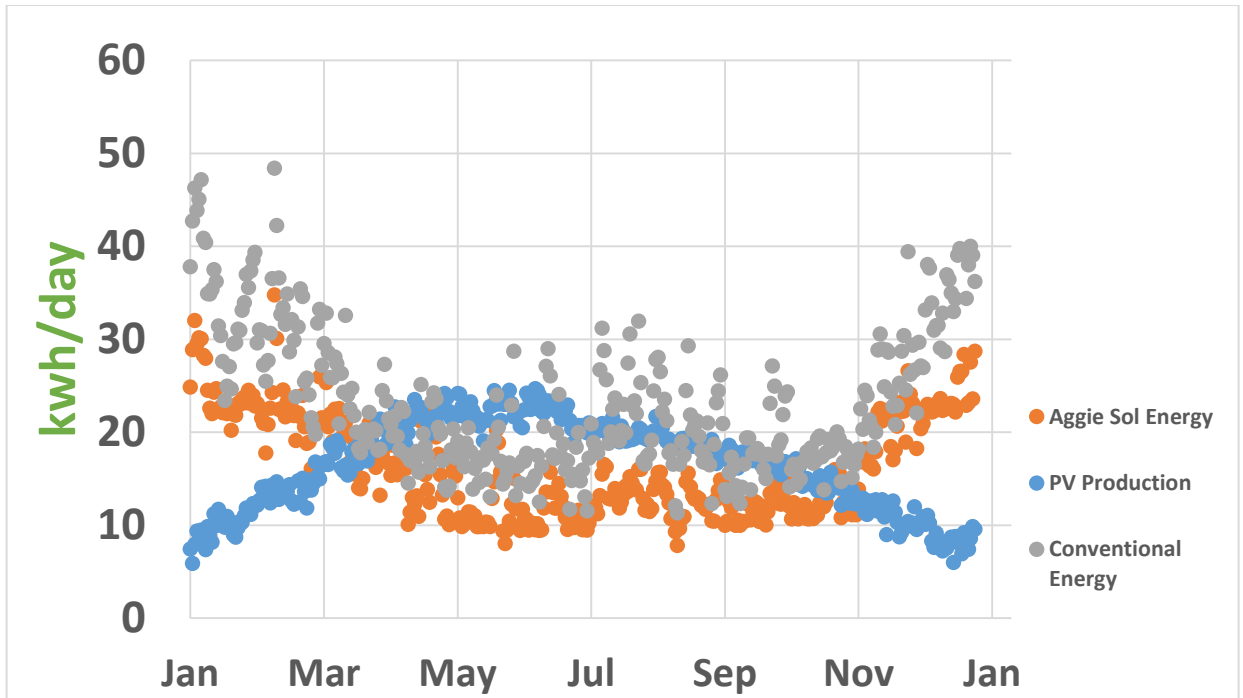


Figure 11. Annual Energy Consumption and Production

Figure 12 breaks down the energy usage of the Aggie Sol home by category—appliances are responsible for 31% of the electricity consumed, heating and cooling combine for 23%, and hot water production takes up another 19%. Altogether, these three categories comprise 73% of the annual electricity bill—it is for this reason that we focused on limiting heating and cooling loads by design, optimizing the HVAC system, choosing efficient appliances, and incorporating the Nexus graywater heat recovery system—doing so presented the best returns on our energy efficiency investment.

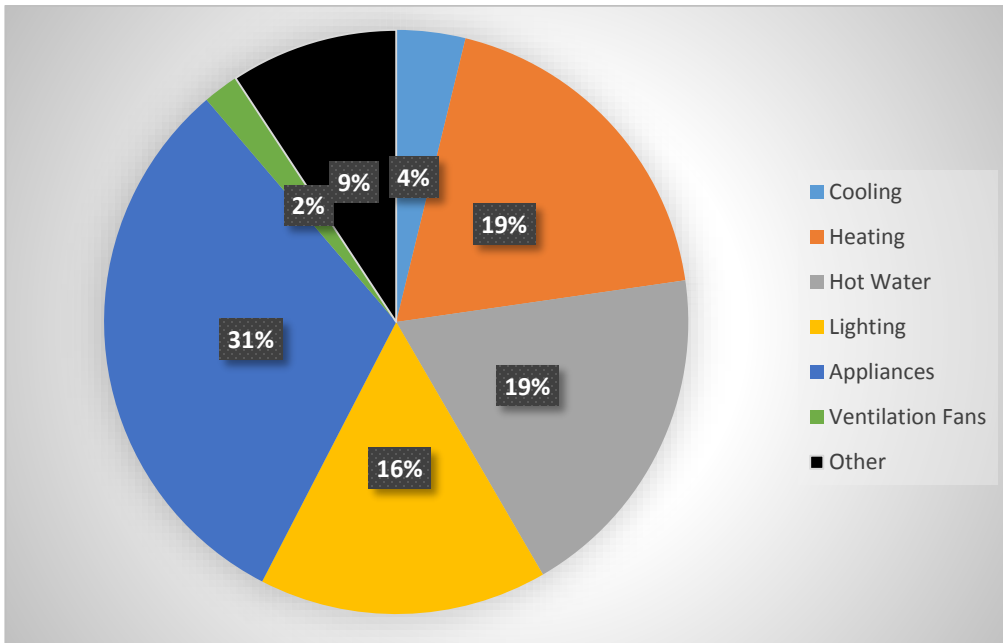


Figure 12. Aggie Sol Home Energy Usage Breakdown By Category

4. Conclusions

The combined BeOpt-Excel energy model yielded comprehensive and intriguing results on the different energy-efficient features of the Aggie Sol home:

- (1) Our construction method substantially reduced annual heating and cooling energy—the single most effective technique was balloon framing, which decreased space conditioning electricity usage by 16.2%. The low window to wall ratio and the use of gypsum concrete as thermal mass only produced 4.2% and 0.4% in annual energy savings. The overall construction method yielded an energy savings rate of 21.2%.
- (2) The appliance scoring equation saved electricity by lessening the quantity of water to be heated, reducing actual appliance energy usage, and eliminating waste heat that would otherwise contribute to internal gains. Our appliance selection saved nearly 400 kWh compared to the benchmark appliances in BeOpt—that is a 9.4% reduction.
- (3) Being a water-source heat pump, the Nexus system achieved an EF of 4.0. As a result, it was far more efficient than even the highest rated HPWH on the market—the Nexus expended about 500 kWh less energy annually than the A.O. Smith 50 gallon HPWH with EF 3.24
- (4) The radiant/night sky HVAC system reduces energy consumption by eliminating ductwork and entirely substituting water for air as the heat transfer fluid on the cooling side. This system requires 35.8% energy yearly for heating and 65.3% less for cooling.
- (5) The Aggie Sol home produces 6037 kWh of electricity per year and consumes 5945 kWh. It is 1.9% energy-positive during a full year of operation. By contrast, the conventional home consumes 8472 kWh of electricity yearly and is 28.7% energy negative.

Acknowledgements

We are extremely grateful to all of the students, faculty, staff, and mentors who spent time and energy designing and constructing the Aggie Sol Home. We would like to thank the University of California, Davis for all of its financial and infrastructural support. We also would like to express gratitude to all of the companies, local and national, that donated their valuable time, money, and resources to supporting our project. We owe a special debt to the Davis Energy Group, especially senior engineer Alea German, for mentoring our energy modeling team for the past year. We would like to give another special thank you to Nexus eWater for not only donating their system but also explaining how to properly model its energy usage. And certainly the brilliance of the combined radiant/night sky cooling system would not have been possible without the tremendous mentorship of long-time energy consultant Richard Bourne who has installed this system many times in the past and headed the installation effort for our house as well.

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SUMMARY OF UNLISTED ELECTRICAL COMPONENTS

Aggie Sol does not propose to use any unlisted electrical components.

SUMMARY OF RECONFIGURABLE FEATURES

Our home has no reconfigurable features.

QUANTITY TAKE-OFF

LineNumber	Description	Unit	Quantity
033513300125	Concrete Floor for Cleansing Room	S.F.	16
035413500600	Poured gypsum underlayment, self-leveling, pumped, 2500 psi, 2" thick	S.F.	857
	Footings for mobile home, seismic	Ea.	16
	Footings for mobile home, standard	Ea.	13
050523	Misc Structural Wood Fasteners	Unit	1
050523	5/8" all thread with washers & nuts (module connection)	Ea.	24
061110183000	Wood framing, Rim, composite wood joists, 10" deep	LF	144
	Wood framing, floor joists, 2x10	LF	644
061110280310	Porch or deck framing, 2 x 8 pressure-treated	S.F.	200
061110281260	Porch or decking, redwood, 2 x 6	SF	691
	4x4x2' Pressure-Treated, deck posts	Ea.	50
	roof framing, 2x14 TJI at 24" OC, no rim	SF	1500
061110302200	Framing, roof trim, rough, Douglas Fir, 2" x 14"	L.F.	164
061110400100	Wall Framing, 2x6 "In Line" or "Balloon" framing style	LF	158
061110400130	Wall Framing, 2x4 "In Line" or "Balloon" framing style	LF	87
061623100207	Subfloors, Plywood, 7/8" Tongue and Groove Subfloor	S.F.	1024
061636100207	T/G Sheathing, plywood on roof, 5/8" thick, pneumatic nailed	S.F.	1421
061636100507	Sheathing, plywood on walls, CDX, 3/8" thick, pneumatic nailed	S.F.	1303
0618	Floor Framing, 2x10 DF	L.F.	734
062213155155	Moldings, base, modern profile, 5/8" x 3-1/2", mdf	L.F.	287
062213352970	Ceiling molding, crown, poplar, 7/8" x 8-3/4"	L.F.	50
	Door/Window Casing	L.F.	200

062213503170	Moldings, window & door, double width, 1 head & 2 sides, 3-1/2" wide	Opng.	6
072116102210	Blanket insulation for floors/ceilings, fiberglass, paper or foil backing, 1 side, 9-1/2" thick, R30, incl. spring type wire fasteners	S.F.	1000
072116102220	Blanket insulation for floors/ceilings, fiberglass, paper or foil backing, 1 side, 12" thick, R38, incl. spring type wire fasteners	S.F.	1320
072116200180	Blanket insulation, for walls or ceilings, kraft faced fiberglass, 6" thick, R19, 23" wide	S.F.	1300
072510100480	Weather barriers, building paper, housewrap, exterior, spun bonded polypropylene, large roll	S.F.	1320
075216102025	SBS modified bituminous membrane, self adhering vapor retarder, 30 to 45 mils thick	S.F.	600
075800000000	Roofing, TPO, single-ply	S.F.	1421
	4x4 L metal	LF	30
	parapet wall cap metal, 6" wide	LF	180
076513108550	shower pan waterproofing	S.F.	16
077123106300	Steel downspouts, galvanized, rectangular, corrugated, epoxy painted, 2" x 3", 24 gauge	L.F.	7
077123302700	Galvanized steel gutters, half round or box, stock, 5" wide, 26 gauge	L.F.	47
077123305190	Gutter end caps, half round galvanized steel, 5"	Ea.	2
081416090180	Door, wood, architectural, flush, interior, hollow core, 7 ply, birch face, 3'-0" x 6'-8" x 1-3/8" thick	Ea.	4
081433205061	Doors, wood, residential, interior, bi-passing closet, hardboard, 4'-0" x 6'-8", incl. hardware and frame, excl. trim	Opng.	1
081613100060	Doors, wood, exterior entry, 4'-0" x 8'-0"	Ea.	1
081613100061	Doors, wood, exterior entry, 3'-0" x 8'-0"	Ea.	4

085113202600	Windows, aluminum, commercial grade, stock units, projected, with screen, enamel finish, 4'-5" x 5'-3", incl. frame and glazing	Ea.	10
086213204010	Skylights, solar tube kit, 1 pipe, 10" diameter, includes dome, flashing, diffuser	Ea.	2
087120400100	Door hardware, lockset, standard duty, cylindrical, with sectional trim, non-keyed, privacy	Ea.	4
087120502520	Door hardware, doorstops, holder, wall type, aluminum	Ea.	5
087120652330	Threshold, aluminum, ADA, 5" wide x 36" long	Ea.	4
087120920200	Door hardware, hinges, average frequency, steel plated, ball bearing, 3-1/2" x 3-1/2"	Pr.	6
087920100600	Door hardware, deadbolt and lock cover plate, brass or stainless steel	Ea.	4
087920102240	Door hardware, mortise lockset, passage, lever handle	Ea.	4
092423000000	Hardie REVEAL Panels, Exterior Pre-Finished	S.F.	1303
092910300350	Gypsum wallboard, on walls, standard, taped & finished (level 4 finish), 1/2" thick	S.F.	3300
093013105830	Ceramic tile, walls, interior, thin set, 16" x 16"	S.F.	64
093013107300	Ceramic tile, for tile set in Portland cement mortar, add	S.F.	64
096519107000	Resilient flooring, vinyl composition tile, 12" x 12" x 1/16"	S.F.	900
099123740240	Paints & coatings, interior walls, drywall or plaster, zero voc latex, primer or sealer coat, smooth finish, roller	S.F.	3300
099123740840	Paints & coatings, interior walls, drywall or plaster, zero voc latex, 2 coats, smooth finish, roller	S.F.	3300
10	Recertified modular home trailer frame (includes deconstruction, welding, paint and transportation to Davis)	Ea.	2
10	Central Piers Standard Pier	Ea.	13
10	Central Piers Anchor Pier	Ea.	16
102116106800	Shower/dressing compartments, tub surround, polypropylene, 3 wall, excludes plumbing	Ea.	1
102813130200	Toilet accessories, curtain rod, stainless steel, 1" diameter x 5' long	Ea.	1

102813130200	Toilet accessories, hand towel holder	Ea.	1
102813130200	Toilet accessories, towel rods	Ea.	2
102819105240	Shower surround, solid surface enclosure (paneled)	S.F.	100
104416132080	Fire extinguishers, dry chemical, pressurized, ABC all purpose type, portable, 9-1/2 lb	Ea.	1
105723191300	Wood shelving, adjustable closet rod and shelf, 12" wide, 8' long	Ea.	1
113113130020	Frigidaire EasyCare Smooth Surface 4.6 cubic feet Self-Cleaning Slide-In Electric Range (Stainless Steel) (Common: 30 in; Actual)--Model LFES3025PF	Ea.	1
113113235750	16.0 cu ft Top Mount Refrigerator, Frigidaire FFHT1621QS	Ea.	1
113113332960	Dishwasher, BOSCH 24" Bar Handle Dishwasher 800 Plus Series - Stainless Steel SGE63E06UC	Ea.	1
113121326770	Front load Stackable Dryer, Frigidaire, 7.0 cu. ft. Electric Dryer in Classic White, FFQE5000QW	Ea.	1
113123136650	Stackable Washing Machine, Frigidaire 3.9 cu. ft. High-Efficiency Front Load Washer in Classic White, Energy Star, FFFW5000QW	Ea.	1
113123237450	Vent kit, residential appliances, for dryers	Ea.	1
122113130020	custom shades for windows	Ea.	5
123223100800	Custom cabinets, kitchen base cabinets, hardwood, prefinished, 4 drawers, 24" deep, 35" high, 14" wide, excl. countertops	Ea.	1
123223100880	Custom cabinets, kitchen base cabinets, hardwood, prefinished, 1 top drawer, 1 door below, 24" deep, 35" high, 24" wide, excl. countertops	Ea.	1
	Custom cabinets, kitchen base cabinets, hardwood, prefinished, 1 top front, 2 doors below, 24" deep, 35" high, 36" wide, removable bottom, excl.	Ea.	1

	Custom cabinets, kitchen pantry cabinets, hardwood, prefinished, 1 top front, 4 doors, 24" deep, 88" high, 24" wide, 7 pullout drawers	Ea.	1
	Custom cabinets, kitchen wall cabinets, hardwood, prefinished, 1 door, 24" deep, 20" high, 24" wide	Ea.	1
123223105040	Custom cabinets, kitchen wall cabinets, hardwood, prefinished, 1 door, 12" deep, 30" high, 14" wide	Ea.	1
	Custom cabinets, kitchen wall cabinets, hardwood, prefinished, 2 doors, 12" deep, 24" high, 30" wide	Ea.	1
	Custom cabinets, kitchen wall cabinets, hardwood, prefinished, 2 doors, 12" deep, 30" high, 24" wide	Ea.	2
	Custom cabinets, kitchen wall cabinets, hardwood, prefinished, 2 doors, 12" deep, 30" high, 36" wide	Ea.	1
	Custom cabinets, bathroom vanity cabinets, hardwood, prefinished, 2 doors, 24" deep, 36" high, 48" wide	Ea.	1
123223352200	Wood casework hardware, door/drawer pulls, handles, projecting, metal, minimum	Ea.	25
123223353020	Wood casework hardware, drawer tracks/glides, average	Pr.	6
123223354020	Wood casework hardware, hinges, average	Pr.	20
123661190160	Engineered stone countertops, color group D, 25" wide, 4" backsplash, minimum	L.F.	15
21	PEX Fire Suppression System	S.F.	910
211313502200	Sprinkler system, sprinkler head, tyco Rapid Response Series LFII Residential Sprinklers 3 K Factor Pendant Wet Pipe Systems TY1234	Ea.	7
22	Misc domestic water distribution valves & fittings (PEX)	Ea.	1
22	Primary Vertical Supply Tank, Plastic-Mart 825 Gallon Plastic Vertical Water Storage Tank	Ea.	1

22	Pressure Tank, Flotec, 35 Gal. Pre-Charged Pressure Tank with 82 Gal. Equivalent Rating	Ea.	1
22	Insulating blanket/shade for primary tank	Ea.	1
220719108130	Insulation, pipe covering (price copper tube one size less than I.P.S.), rubber tubing flexible closed cell foam, 1/2" wall, 1/2" iron pipe size	L.F.	100
2211	Domestic Water Supply Pump	Ea.	1
221100000000	Wastewater/Greywater Tank; Plastic-Mart 300 Gallon Rectangle Poly Tank	Ea.	1
221113744216	Pipe, plastic, ABS, foam core, 2" diameter, DWV, schedule 40, includes couplings 10' OC, and hangers 3 per 10'	L.F.	120
221113747350	Pipe, plastic, PEX, flexible, non-barrier type, white, hot/cold tubing rolls, 3/8" diameter x 100 ', excludes couplings and hangers	L.F.	300
221113747780	Pipe, plastic, PEX, non-barrier type, white, hot/cold tubing, straight lengths, 1-1/2" diameter x 20', excludes couplings and hangers	L.F.	40
221316502800	Drain, shower, with strainer, uniform diameter trap, bronze top, 2" and 3" pipe size	Ea.	1
221316502800	Bathtub and drain, acrylic	Ea.	1
221316800330	Vent cap, PVC, 2" - 2-1/8" pipe	Ea.	4
221316803040	Vent flashing, neoprene, one piece, 2" pipe	Ea.	4
223300000000	Heat Pump and Water Heater	Ea.	1
223330160000	Nexus Water Heater (NEXHeater)	Ea.	1
223330260000	Nexus Collection Tank (Nexus Hub)	Ea.	1
224113400000	Toilet	Ea.	1

224116102601	Bathroom Sink	Ea.	1
224116300000	Kitchen Faucet	Ea.	1
224116304000	Kitchen Sink	Ea.	1
224139104240	Faucets/fittings, shower pressure balancing mixing valve, chrome, with shower head, arm, flange and diverter tub spout	Ea.	2
23	Insulating blanket / shade for water tank	Ea.	1
23	Night Sky Sprinklers, fittings and base to roof	Ea.	20
23	0.5" PEX Radiant Floor	L.F.	1500
23	PVC Piping 1" no connections (Night Sky System)	Ea.	200
232123130640	Radiant Pump, circulating, cast iron, heated or chilled water application, in line, sweat connections, 1/25 H.P., 3/4" size,	Ea.	1
232123130640	Rheem Ecosense HB50ES	Ea.	1
232123130640	Night Sky Pump, 0.5 HP Flotec 5112 Utility Pump	Ea.	1
233346101540	Ductwork, flexible coated fiberglass fabric on corrosion resistant metal helix, non-insulated, 5" diameter, pressure to 12"(WG) UL-181	L.F.	10
26	Solar Panels PV, Sunpower E20-327 w/install	Ea.	1
26	Solar Panel Racking System	Ea.	1
260519550201	Non-metallic sheathed cable, copper with ground wire, 600 V, 2 wire, #14, (Romex)	L.F.	200
260519550251	Non-metallic sheathed cable, copper with ground wire, 600 V, 2 wire, #12, (Romex)	L.F.	800
260519550401	Non-metallic sheathed cable, copper with ground wire, 600 V, 3 wire, #10, (Romex)	L.F.	200

260519550501	Non-metallic sheathed cable, copper with ground wire, 600 V, 3 wire, #6, (Romex)	L.F.	50
260590000000	Thermostat (CT-80)	Ea.	3
260590102110	Switch devices, residential, single pole, ivory, type NM (Romex) cable, 20', 15 amp, incl box & cover plate	Ea.	9
260590102150	Switch devices, residential, 3-way, #14/3, type NM cable, 20', incl box & cover plate	Ea.	6
260590104015	Receptacle devices, residential, duplex outlet, white, type NM cable, 20', 15 amp, incl box & cover plate	Ea.	22
260590104300	Receptacle devices, residential, decorator style, GFI, type NM cable, 15 amp, incl box & cover plate	Ea.	2
260590104670	Dryer outlet, residential, 20' of #10/3, 2 pole circuit breaker, type NM cable, 30 amp, 240 V, incl box & exterior cover plate	Ea.	1
260590104710	Range outlet, residential, 30' of #8/3, type NM cable, 50 amp, 240 V, incl box & exterior cover plate	Ea.	1
260590104910	Low voltage outlets, residential, telephone receptacle, 4/C phone wire, 20'	Ea.	1
260590104920	TV receptacle, residential, 20' of RG59U coax cable, F type connector, incl box & exterior cover plate	Ea.	1
260590106100	Lighting outlets, residential, box 4" & wire (for fixture), type NM cable, 20'	Ea.	3
260590106310	Light fixtures, 6" recessed can lights	Ea.	10
260590106320	Light fixtures, residential, kitchen fixture LED undercabinet	Ea.	1
260590106370	Light fixtures, residential, outdoor, wall mounted, luxury grade	Ea.	5
260590108280	Bathroom vent fan, residential, with light, 70 CFM	Ea.	2

260590108660	Hot water heater, residential, hook-up, #10/2, NM cable, 20', incl 1-2 pole circuit breaker, box, 3' of flexible	Ea.	2
260590109530	Thermostat, residential, hook-up, using low voltage wire, heating/cooling, 25' of #18-4	Ea.	3
262416100800	Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 200 amp, 24 circuits, incl 20 A 1 pole plug-in breakers	Ea.	1
262416202050	Circuit breakers, plug-in, 2 pole, 150 to 200 amp	Ea.	1
263343552100	Electric vehicle charging, wall mounted, light duty, hard wired	Ea.	1
265113500000	Lamps A-19	Ea.	10
283146505200	Detection system, heat detector, smoke detector, ceiling type, excl. wires & conduit	Ea.	5
32	(rental) Exterior sloped walkways, no railings	feet	116
328400000000	Night Sky Cooling Sprinklers, MPR Plus Spray Nozzles, Flat Spray Black	Ea.	14
329000000000	citrus reticulatu	Ea.	5
329000000000	Mentha spicata	Ea.	5
329000000000	Hymux x citriodus	Ea.	5
329000000000	Bouteloua gracilis	Ea.	40
329000000000	Muhlenbergia rigens	Ea.	40
329000000000	Epilobium carnum	Ea.	40
329000000000	Lavandula	Ea.	40
329000000000	Festucia glauca (Elijah Blue)	Ea.	43
329000000000	Planter Boxes	Ea.	45
	Davis breakdown		
	Irvine Set up - forklift		
	Davis to Irvine - 2 mobile homes, 600 miles		

	Irvine to Davis - 2 mobile homes, 600 miles		
	Moving Truck Rental - 1 month		2
	Enclosed Utility Trailer rental - 1 month		1
	water fill/drain		1

DIVISION 00 PROCUREMENT & CONTRACTING REQUIREMENTS

- 00 01 01 Project Title Page
- 00 01 07 Seals Page
- 00 01 15 List of Drawing Sheets

DOCUMENT 00 01 01 - PROJECT TITLE PAGE

1.1 PROJECT MANUAL VOLUME 1: 95% Construction Documents: Not for construction until approved

- A. Project Name: Aggie Sol.
- B. Owner: University of California, Davis
- C. Location: Davis, CA.
- D. UC Davis Project Manager: Robert Good
- E. Phone: 530-312-2385
- F. Website: <http://solardecathlon2015.ucdavis.edu/>
- G. Issued: January 12, 2015

END OF DOCUMENT 00 01 01

DOCUMENT 00 01 07 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Structural Engineer:

1. Norman J Scheel, P.E., S.E., F.SEAOC, FASCE
Owner, Norman Scheel Structural Engineering
2. California Structural Engineer #S2567
3. Responsible for structural drawings and calculations

END OF DOCUMENT 00 01 07

DOCUMENT 00 01 15 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled dated December 12, 2015 as modified by subsequent Addenda and Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

Drawing #	Drawing Title
G-001	TITLE PAGE
G-101	FINISHED SQUARE FOOTAGE COMPLIANCE PLAN
G-102	EGRESS PLAN
G-103	ADA TOUR ROUTE COMPLIANCE PLAN
G-104	LIQUID CONTAINERS PLAN
G-201	SOLAR ENVELOPE COMPLIANCE ELEVATIONS
L-001	LANDSCAPE NOTES, SYMBOLS, AND SCHEDULE
L-101	LANDSCAPE AND PLANTING SITE PLAN
L-201	LANDSCAPE ELEVATIONS
L-202	LANDSCAPE ELEVATIONS
L-601	PLANTING DETAILS
L-602	PLANTER BED DETAILS
L-603	PLANTER BED RAILING
S-001	STRUCTURAL NOTES AND SYMBOLS
S-002	FRAMING SCHEDULES
S-003	TYPICAL NOTES AND DETAILS
S-101	ENGINEERED ANCHOR FOUNDATION PLAN
S-102	ENGINEERED STANDARD FOUNDATION PLAN
S-103	FOUNDATION PLAN
S-104	FOUNDATION TRAILER PLAN
S-105	FIRST FLOOR FRAMING PLAN
S-106	WALL FRAMING PLAN
S-107	ROOF FRAMING PLAN
S-108	SHEAR WALL PLAN
S-109	DECK FRAMING
S-110	DECK DETAILS
S-201	FRAMING ELEVATIONS
S-202	FRAMING ELEVATIONS
S-203	FRAMING ELEVATIONS
S-301	FRAMING SECTIONS
S-302	FRAMING SECTIONS
S-401	FRAMING DETAILS

Drawing #	Drawing Title
S-402	FRAMING DETAILS
S-403	TRAILER AXLE LOACTION
S-404	TRAILER FRAME DETAILS
S-901	FRAMING ISOMETRIC
S-902	EXTERIOR FRAMING VIEWS
A-001	ARCHITECTURAL SYMBOLS AND NOTES
A-101	SITE PLAN
A-102	FURNITURE PLAN
A-111	FIRST FLOOR PLAN
A-112	ROOF PLAN
A-121	FIRST FLOOR REFLECTED CEILING PLAN
A-211	EXTERIOR ELEVATIONS
A-212	EXTERIOR ELEVATIONS
A-213	INTERIOR ELEVATIONS
A-214	BATHROOM ADA COMPLIANCE
A-215	KITCHEN ADA COMPLIANCE AND ENLARGED PLAN
A-216	MECHANICAL ROOM AND CLEANSING ROOM ENLARGED PLAN
A-301	BUILDING SECTIONS
A-302	BUILDING SECTIONS
A-311	WALL SECTIONS
A-401	SCHEDULES
A-501	TYPICAL DETAILS
A-502	SIDING DETAILS
A-503	ROOF DETAILS
A-504	EXTERIOR DETAILS
A-531	WINDOW DETAILS
A-532	WINDOW DETAILS
A-533	DOOR DETAILS
A-601	RENDERINGS
G-002	TABLE OF CONTENTS, GENERAL NOTES AND SYMBOLS
F-001	FIRE PROTECTION NOTES, SYMBOLS, AND SCHEDULE
F-101	FIRE DETECTION AND SUPPRESSION PLAN
F-201	FIRE CONNECTION DETAILS
P-001	PLUMBING NOTES, SYMBOLS, AND SCHEDULE
P-101	DOMESTIC SUPPLY PLAN
P-102	DOMESTIC RETURN PLAN
P-104	ELEVATIONS NORTH
P-105	ELEVATIONS EAST
P-106	ELEVATION WEST
P-501	DOMESTIC SUPPLY CONNECTION DETAILS
P-502	DOMESTIC RETURN CONNECTION DETAILS
P-601	PLUMBING SYSTEM DIAGRAM

DIVISION 01 GENERAL REQUIREMENTS

01 42 00	References
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 74 19	Construction Waste Management and Disposal
01 81 13.26	Sustainable Design Requirements

Drawing #	Drawing Title
P-901	ISOMETRIC PIPING SUPPLY PLAN
P-902	ISOMETRIC PIPING RETURN PLAN
M-001	MECHANICAL SYMBOLS AND SCHEDULE
M-101	RADIANT FLOOR PLAN
M-102	RADIANT FLOORING DETAILS
M-104	GUTTER DETAILS
M-201	NIGHT SKY ROOFTOP
M-202	NIGHT SKY DETAILS
M-301	MECHANICAL ROOM
M-302	MECHANICAL WIRING DETAILS
M-601	HVAC DIAGRAM
E-001	ELECTRICAL SYMBOLS AND NOTES
E-101	ELECTRICAL DISTRIBUTION PLAN
E-102	LIGHTING PLAN
E-103	PV WIRING PLAN
E-201	ELECTRICAL ELEVATION
E-601	ONE-LINE DIAGRAM
E-602	THREE-LINE DIAGRAM
E-603	ELECTRICAL SCHEDULES
O-001	OPERATIONS SYMBOLS AND NOTES
O-101	ARRIVAL SEQUENCE PLAN 1
O-102	ARRIVAL SEQUENCE PLAN 2
O-103	ARRIVAL SEQUENCE PLAN 3
O-104	ARRIVAL SEQUENCE PLAN 4
O-201	DEPARTURE SEQUENCE PLAN 1
O-202	DEPARTURE SEQUENCE PLAN 2
O-203	DEPARTURE SEQUENCE PLAN 3

END OF DOCUMENT 00 01 15

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- B. Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
 - 3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
 - 6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
 - 10. AF&PA - American Forest & Paper Association; www.afandpa.org.
 - 11. AGA - American Gas Association; www.aga.org.
 - 12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
 - 13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
 - 14. AI - Asphalt Institute; www.asphaltinstitute.org.
 - 15. AIA - American Institute of Architects (The); www.aia.org.
 - 16. AISC - American Institute of Steel Construction; www.aisc.org.
 - 17. AISI - American Iron and Steel Institute; www.steel.org.
 - 18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
 - 19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
 - 20. ANSI - American National Standards Institute; www.ansi.org.
 - 21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 22. APA - APA - The Engineered Wood Association; www.apawood.org.
 - 23. APA - Architectural Precast Association; www.archprecast.org.
 - 24. API - American Petroleum Institute; www.api.org.
 - 25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
 - 26. ARI - American Refrigeration Institute; (See AHRI).
 - 27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
 - 28. ASCE - American Society of Civil Engineers; www.asce.org.
 - 29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
 - 30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
 - 31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
 - 32. ASSE - American Society of Safety Engineers (The); www.asse.org.
 - 33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
 - 34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
 - 35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
 - 36. AWEA - American Wind Energy Association; www.awea.org.
 - 37. AWI - Architectural Woodwork Institute; www.awinet.org.

38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWWA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
48. CDA - Copper Development Association; www.copper.org.
49. CEA - Canadian Electricity Association; www.electricity.ca.
50. CEA - Consumer Electronics Association; www.ce.org.
51. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.pbmdf.com.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.
61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - Canadian Standards Association; www.csa.ca.
63. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
64. CSI - Construction Specifications Institute (The); www.csinet.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).
71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA ? Electronic Components Industry Association; www.eciaonline.org
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.
79. FIBA - F?d?ration Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - F?d?ration Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.

82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Accreditation Service; www.iasonline.org.
96. IAS - International Approval Services; (See CSA).
97. ICBO - International Conference of Building Officials; (See ICC).
98. ICC - International Code Council; www.iccsafe.org.
99. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
100. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
101. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
102. IEC - International Electrotechnical Commission; www.iec.ch.
103. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
104. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
105. IESNA - Illuminating Engineering Society of North America; (See IES).
106. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
107. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
108. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
109. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.
122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.

126. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
135. NCMA - National Concrete Masonry Association; www.ncma.org.
136. NEBB - National Environmental Balancing Bureau; www.nebb.org.
137. NECA - National Electrical Contractors Association; www.necanet.org.
138. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
139. NEMA - National Electrical Manufacturers Association; www.nema.org.
140. NETA - InterNational Electrical Testing Association; www.netaworld.org.
141. NFHS - National Federation of State High School Associations; www.nfhs.org.
142. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
143. NFPA - NFPA International; (See NFPA).
144. NFRC - National Fenestration Rating Council; www.nfrc.org.
145. NHLA - National Hardwood Lumber Association; www.nhla.com.
146. NLGA - National Lumber Grades Authority; www.nlga.org.
147. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
148. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
149. NRCA - National Roofing Contractors Association; www.nrca.net.
150. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
151. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
152. NSPE - National Society of Professional Engineers; www.nspe.org.
153. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
154. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
155. NWFA - National Wood Flooring Association; www.nwfa.org.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoor.org.
166. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.
167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.

171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
 172. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
 173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
 174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
 175. SPRI - Single Ply Roofing Industry; www.spri.org.
 176. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
 177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
 178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
 179. STI - Steel Tank Institute; www.steeltank.com.
 180. SWI - Steel Window Institute; www.steelwindows.com.
 181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
 182. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
 183. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
 184. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
 185. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
 186. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
 187. TMS - The Masonry Society; www.masonrysociety.org.
 188. TPI - Truss Plate Institute; www.tpinst.org.
 189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
 190. TRI - Tile Roofing Institute; (Formerly: National Tile Roofing Manufacturing Association); www.tilerroofing.org.
 191. UBC - Uniform Building Code; (See ICC).
 192. UL - Underwriters Laboratories Inc.; www.ul.com.
 193. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
 194. USAV - USA Volleyball; www.usavolleyball.org.
 195. USGBC - U.S. Green Building Council; www.usgbc.org.
 196. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
 197. WASTEC - Waste Equipment Technology Association; www.wastec.org.
 198. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
 199. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
 200. WDMA - Window & Door Manufacturers Association; www.wdma.com.
 201. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
 202. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
 203. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
 204. WWPA - Western Wood Products Association; www.wwpa.org.
- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.
1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 2. ICC - International Code Council; www.iccsafe.org.
 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION (Not Used)
END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Use Charges: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated.
- B. Water and Electric Power: Available from Owner's existing system without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- D. Accessible Temporary Egress: Comply with applicable provisions in ICC A117.1.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: At UC Davis construction site, provide 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts and top and bottom rails.

2.2 TEMPORARY FACILITIES

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

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, UC Davis campus authorities, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
- C. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

3.2 SUPPORT FACILITIES INSTALLATION

- A. Install project identification and other signs in locations approved by campus authorities to inform the public and persons seeking entrance to Project.
- B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
- C. Temporary Elevator Use: Use of elevators is not permitted.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- E. Furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

3.4 MOISTURE AND MOLD CONTROL

- A. Before installation of weather barriers, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
 - 1. Protect stored and installed material from flowing or standing water.
 - 2. Remove standing water from decks.
 - 3. Keep deck openings covered or dammed.
- B. After installation of weather barriers but before full enclosure and conditioning of building, protect as follows:
 - 1. Do not load or install drywall or porous materials into partially enclosed building.
 - 2. Discard water-damaged material.
 - 3. Do not install material that is wet.
 - 4. Discard, replace, or clean stored or installed material that begins to grow mold.
 - 5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion.
- C. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period.

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
- B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced.
 - 1. Show compliance with requirements for comparable product requests.
 - 2. Architect will review the proposed product and notify Contractor of its acceptance or rejection.
- C. Basis-of-Design Product Specification Submittal: Show compliance with requirements.
- D. Compatibility of Options: If Contractor is given option of selecting between two or more products, select product compatible with products previously selected.
- E. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Deliver products to Project site in manufacturer's original sealed container or packaging, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 3. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 - 4. Store materials in a manner that will not endanger Project structure.
 - 5. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- F. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. Provide products that comply with the Contract Documents, are undamaged, and, unless otherwise indicated, are new at the time of installation.
 - 1. Provide products complete with accessories, trim, finish, and other devices and components needed for a complete installation and the intended use and effect.
 - 2. Where products are accompanied by the term "as selected," Architect will make selection.
 - 3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Where the following headings are used to list products or manufacturers, the Contractor's options for product selection are as follows:
 - 1. Products:
 - a. Where requirements include "one of the following," provide one of the products listed that complies with requirements.
 - b. Where requirements do not include "one of the following," provide one of the products listed that complies with requirements or a comparable product.
 - 2. Manufacturers:
 - a. Where requirements include "one of the following," provide a product that complies with requirements by one of the listed manufacturers.

- b. Where requirements do not include "one of the following," provide a product that complies with requirements by one of the listed manufacturers or another manufacturer.
- 3. Basis-of-Design Product: Provide the product named, or indicated on the Drawings, or a comparable product by one of the listed manufacturers.
- C. Where Specifications require "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- D. Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Architect will consider Contractor's request for comparable product when the following conditions are satisfied:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications.
 - 3. List of similar installations for completed projects, if requested.
 - 4. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END

OF

SECTION

01 60 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Action Submittals:
 - 1. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.
- B. Informational Submittals:
 - 1. Waste Reduction Progress Reports: Submit monthly during on-campus construction. Include total quantity of waste, total quantity of waste salvaged and recycled, and percentage of total waste salvaged and recycled.
 - 2. Records of Donations and Sales: Receipts for salvageable waste donated or sold to individuals and organizations. . Indicate whether organization is tax exempt.
 - 3. Recycling and Processing Facility Records: Manifests, weight tickets, receipts, and invoices.
 - 4. Landfill and Incinerator Disposal Records: Manifests, weight tickets, receipts, and invoices.
- C. Waste Management Plan: Develop a waste management plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
 - 1. Salvaged Materials for Reuse: Identify materials that will be salvaged and reused.
 - 2. Salvaged Materials for Sale: Identify materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: Identify materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Clean salvaged items and install salvaged items to comply with installation requirements for new materials and equipment.
- B. Salvaged Items for Sale and Donation: Permitted on Project site.
- C. Salvaged Items for Owner's Use: Clean salvaged items and store in a secure area until delivery to Owner.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.

3.3 RECYCLING WASTE

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- C. Wood Materials:
 - 1. Sort and stack reusable members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
 - 2. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 3. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- D. Metals: Separate metals by type.
- E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- F. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- G. Conduit: Reduce conduit to straight lengths and store by type and size.

3.4 DISPOSAL OF WASTE

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

END OF SECTION 01 74 19

SECTION 01 81 13.26 - SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Definitions:

1. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
2. Recycled Content: The recycled content shall be determined by weight.
 - a. "Postconsumer" material is defined as waste material that is generated by end users of the product and that can no longer be used for its intended purpose.
 - b. "Preconsumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as scrap generated in a process that is reclaimed in the same process that generated it.

B. Submittals:

1. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for furniture plumbing mechanical electrical and wood-based construction materials. Submit within 30 days of date established for commencement of the Work.
2. List of proposed materials with recycled content. Indicate postconsumer recycled content and preconsumer recycled content for each product. Submit within 30 days of date established for commencement of the Work.
3. List of proposed regional materials. Submit within 30 days of date established for commencement of the Work.
4. List of proposed certified wood products. Submit within 30 days of date established for commencement of the Work.
5. Product Data.
6. Certification letter for materials with recycled content. Indicate postconsumer recycled content, preconsumer recycled content, and cost for each product.
7. Certification letter for regional materials. Indicate location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
8. Chain-of-custody certificates for certified wood products. Include statement of cost for each product.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide products and procedures necessary to meet requirements of this Section. Although other Sections may specify similar requirements, the Contractor shall determine additional materials and procedures necessary to comply with this Section.
- B. Recycled Content of Materials: Building materials shall have recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent of cost of materials used for Project.
 1. Do not include mechanical and electrical components in the calculation.
- C. Regional Materials: Not less than 20 percent of building materials (by cost) shall be regional materials.
- D. Certified Wood: Wood-based materials produced from tropical forests shall be certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.2 LOW-EMITTING MATERIALS

- A. Adhesives and sealants shall comply with the following limits for VOC content:

1. Wood Glues: 30 g/L.
 2. Metal-to-Metal Adhesives: 30 g/L.
 3. Adhesives for Porous Materials (Except Wood): 50 g/L.
 4. Subfloor Adhesives: 50 g/L.
 5. Plastic Foam Adhesives: 50 g/L.
 6. Carpet Adhesives: 50 g/L.
 7. Carpet Pad Adhesives: 50 g/L.
 8. VCT and Asphalt Tile Adhesives: 50 g/L.
 9. Cove Base Adhesives: 50 g/L.
 10. Gypsum Board and Panel Adhesives: 50 g/L.
 11. Rubber Floor Adhesives: 60 g/L.
 12. Ceramic Tile Adhesives: 65 g/L.
 13. Multipurpose Construction Adhesives: 70 g/L.
 14. Fiberglass Adhesives: 80 g/L.
 15. Contact Adhesive: 80 g/L.
 16. Structural Glazing Adhesives: 100 g/L.
 17. Wood Flooring Adhesive: 100 g/L.
 18. Structural Wood Member Adhesive: 140 g/L.
 19. Single-Ply Roof Membrane Adhesive: 250 g/L.
 20. Special-Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported vinyl, PTFE, ultra-high molecular weight polyethylene, rubber or wood veneer no more than 1/16 inch thick to any surface): 250 g/L.
 21. Top and Trim Adhesive: 250 g/L.
 22. Plastic Cement Welding Compounds: 250 g/L.
 23. ABS Welding Compounds: 325 g/L.
 24. CPVC Welding Compounds: 490 g/L.
 25. PVC Welding Compounds: 510 g/L.
 26. Adhesive Primer for Plastic: 550 g/L.
 27. Sheet-Applied Rubber Lining Adhesive: 850 g/L.
 28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
 29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
 30. Special-Purpose Aerosol Adhesive (All Types): 70 percent by weight.
 31. Other Adhesives: 250 g/L.
 32. Architectural Sealants: 250 g/L.
 33. Nonmembrane Roof Sealants: 300 g/L.
 34. Single-Ply Roof Membrane Sealants: 450 g/L.
 35. Other Sealants: 420 g/L.
 36. Sealant Primers for Nonporous Substrates: 250 g/L.
 37. Sealant Primers for Porous Substrates: 775 g/L.
 38. Modified Bituminous Sealant Primers: 500 g/L.
 39. Other Sealant Primers: 750 g/L.
- B. Paints and coatings shall comply with the following limits for VOC content:
1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 150 g/L.
 3. Dry-Fog Coatings: 400 g/L.
 4. Primers, Sealers, and Undercoaters: 200 g/L.
 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 7. Pretreatment Wash Primers: 420 g/L.
 8. Clear Wood Finishes, Varnishes: 350 g/L.

DIVISION 03 CONCRETE

03 54 13

Gypsum Concrete_SP

SECTION 03 54 13 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Installer Qualifications: Installer who is approved by manufacturer.
- C. Environmental Limitations: Place gypsum-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 GYPSUM-CEMENT-BASED UNDERLAYMENTS

- A. Underlayment: Gypsum-cement-based, self-leveling product.
 - 1. Compressive Strength: Not less than 2000 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- C. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Concrete Substrates: Remove laitance, glaze, curing compounds, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 3. Wood Substrates: Remove coatings, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond. [**Install underlayment reinforcement.**]

3.2 APPLICATION

- A. General: Mix and apply underlayment components according to manufacturer's written instructions.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply underlayment to produce uniform, level surface.
- D. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

END OF SECTION 03 54 13

DIVISION 06 WOOD, PLASTICS, & COMPOSITES

06 16 00	Sheathing
06 16 00	Sheathing_SP
06 25 13	Hardie Board Panels
06 48 13	Exterior Wood Door Frames
06 48 13	Exterior Wood Door Frames_2



Specifications – Sheathing

Plytanium[®] plywood sheathing is ideal for residential and light commercial construction, and provides outstanding performance for walls and roofs. It adds proven performance and durability to new homes, room additions and renovations.

Available Sizes (Sized for 4' x 8')

Square Edge 3'-11⁷/₈" (1.216 m) x 7'-11⁷/₈" (2.435 m)

Building Code Performance Categories, Panel Thickness

- 3/8 CAT, 0.354" (8.99 mm)
- 15/32 CAT (3-ply), 0.451" (11.45 mm)
- 15/32 CAT (4-ply), 0.451" (11.45 mm)
- 19/32 CAT, 0.578" (14.68 mm)
- 23/32 CAT, 0.703" (17.85 mm)

Specifications

Length/Width Tolerance +0, - 1/16" (+0, -1.6 mm)

Straightness Tolerance ± 1/16" (±1.6 mm)

Squareness Tolerance ± 1/8" (±3.2 mm)

Primary Species Southern Yellow Pine

Testing Agency APA[®] -The Engineered Wood Association

Classifications
 Exposure 1 – Plywood suitable for uses not permanently exposed to the weather. Panels classified as Exposure 1 are intended to resist the effects of moisture on structural performance as may occur due to construction delays, or other conditions of similar severity.
 Exterior – Plywood suitable for repeated wetting and redrying or long-term exposure to weather and other conditions of similar severity.

Code Fire Classification Class III or C

Flame Spread Rating 76-200, smoke-developed index <450

Building Code Compliance PS 1-09 or PS 2-10

Other Information

Forestry Certification Plytanium plywood panels are made from wood sourced through a system that is third-party certified to the Sustainable Forestry Initiative[®] procurement standard.



Green Building Programs See our Plytanium plywood Sustainability Fact Sheet available at www.builditbetter.com for more information on potential point contributions towards specific green building programs.

NGBS Green Certified Plytanium plywood is Home Innovation NGBS Green Certified for Resource Efficiency and Indoor Environmental Quality. Please visit Homeinnovation.com/Green for more information.



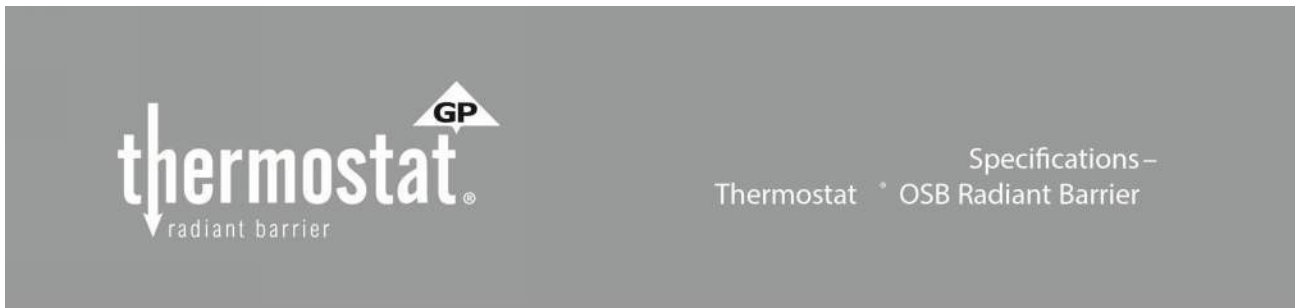


Specifications – Sheathing

- Product Warranty** Plytanium® plywood is covered by a Lifetime Limited Warranty. For terms and conditions, please refer to our Lifetime Limited Warranty available at www.builditbetter.com.
- International Shipping** To prevent the introduction and spread of plant pests, ISPM 15: International Standards for Phytosanitary Measures, requires that internationally shipped solid wood pallets be debarked, treated with heat or fumigated with methyl bromide, and marked with a seal of compliance. Pallets made with engineered wood, including Plytanium plywood, are exempt from ISPM 15 regulations. This is because the process of manufacturing engineered wood destroys any live organisms in the wood. (Source: "Boxes, Crate and Reel Manufacturing," www.PerformancePanels.com)
- Formaldehyde Emissions** Plytanium plywood contains no added urea formaldehyde resins. PS 1 and PS 2 structural panels are exempt from testing by the California Air Resources Board (CARB) in the Composite Wood Air Toxic Control Measure (ATCM) and phenolic bonded structural panels are exempt from testing or monitoring by HUD in the Manufactured Home Construction and Safety Standards.

Manufacturing Locations

Location	APA Mill Number	Zip Code	Harvest Radius
Camden, TX	515	75934	90 miles
Corrigan, TX	516	75939	90 miles
Dudley, NC	348	28333	80 miles
Emporia, VA	230	23847	40 miles
Gurdon, AR	517	71743	60 miles
Madison, GA	404	30650	100 miles
Prosperity, SC	329	29127	80 miles
Taylorville, MS	282	39168	50 miles
Warm Springs, GA	324	31830	450 miles



Thermostat[®] oriented strand board (OSB) radiant barrier sheathing is designed for roof sheathing applications, reflecting up to 97% of the sun's radiant heat and keeping it from being absorbed into the attic of your home. That means you can maintain indoor comfort while potentially lowering cooling energy consumption.

Backed with a specially designed aluminum foil/craft paper laminate, this high-quality Georgia-Pacific OSB sheathing is installed side down facing into the attic space. Since aluminum foil is highly reflective, up to 97% of the radiant heat is reflected from entering the attic space.

Available Sizes

Square Edge	3'-11 7/8" (1.216 m) x 7'-11 7/8" (2.435 m) – sized for 4' x 8'
	3'-11 7/8" (1.216 m) x 8'-11 7/8" (2.740 m) – sized for 4' x 9'
	3'-11 7/8" (1.216 m) x 9'-11 7/8" (3.044 m) – sized for 4' x 10'

Building Code Performance Categories, Panel Thickness

- 7/16 CAT, 0.418" (10.61 mm)
- 15/32 CAT, 0.451" (11.45 mm)
- 19/32 CAT, 0.578" (14.68 mm)

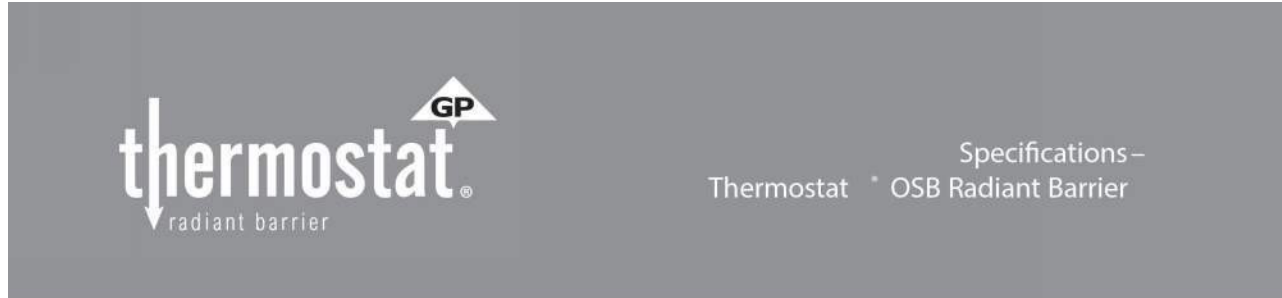
Specifications

Thickness Tolerance	± 1/32" (± 0.79)
Length/Width Tolerance	+0, - 1/8" (+0, -3.2 mm)
Straightness Tolerance	± 1/16" (± 1.6 mm)
Squareness Tolerance	± 1/8" (± 3.2 mm)
Classification	Exposure 1 – OSB suitable for uses not permanently exposed to the weather. Panels classified as Exposure 1 are intended to resist the effects of moisture on structural performance as may occur due to construction delays, or other conditions of similar severity.
Code Fire Classification	Class III or C
Flame Spread Rating	75-200, smoke-developed index <450
Building Code Compliance	PS 2-04
Foil	Foil utilizes a Kraft backer and bright (polished) aluminum foil with emissivity of .03.

Other Information

Forestry Certification	Thermostat OSB panels are made from Sustainable Forestry Initiative [®] (SFI [®]) certified responsible wood sources.
NGBS Green Certified	Thermostat OSB panels are Home Innovation NGBS Green Certified for Resource Efficiency, Energy Efficiency and Indoor Environmental Quality. Please visit Homeinnovation.com/Green for more information.
Formaldehyde Content	Thermostat OSB panels contain no added urea formaldehyde resins. Emission levels for certified PS 1 and PS 2 structural panels are exempt by the California Air Resources Board in the Composite Wood Air Toxic Control Measure (ATCM) and phenolic bonded structural panels are exempt from testing or monitoring by HUD in the Manufactured Home Construction and Safety Standards.





Manufacturing Locations

Location	APA Mill Number	Zip Code	Harvest Radius
Allendale, SC	515	29827	50 miles
Fordyce, AR	311	71742	100 miles
Hosford, FL	310	32334	75 miles



Specifications – Sheathing

DryGuard[®] enhanced oriented strand board (OSB) is an unsanded, multi-layered wall and roof sheathing product that has improved moisture resistance throughout the panel plus a black edge seal to help reduce moisture absorption. This means protection from the elements that helps avoid costly and time-consuming moisture-related issues like edge swell. Each panel is third-party certified for quality and is rated for Exposure 1 bond durability for protected applications and limited exposure during normal construction delays.

Available Sizes (Sized for 4' x 8')

Square Edge	3'-11 ⁷ / ₈ " (1.216 m) x 7'-11 ⁷ / ₈ " (2.435 m)
Tongue & Groove	3'-11 ¹ / ₂ " (1.206 m) x 7'-11 ⁷ / ₈ " (2.435 m)

Building Code Performance Categories, Panel Thickness (Struct 1)

- 1/2 CAT, 0.483" (12.26 mm)
- 19/32 CAT, 0.578" (14.68 mm)
- 23/32 CAT, 0.703" (17.85 mm)

Specifications

Length/Width Tolerance	±1/16" (±1.6 mm)
Straightness Tolerance	±1/16" (±1.6 mm)
Squareness Tolerance	±1/8" (±3.2 mm)
Testing Agency	APA [®] –The Engineered Wood Association
Classification	Exposure 1 – OSB suitable for uses not permanently exposed to the weather. Panels classified as Exposure 1 are intended to resist the effects of moisture on structural performance as may occur due to construction delays, or other conditions of similar severity.
Code Fire Classification	Class III or C
Flame Spread Rating	76-200, smoke-developed index <450
Building Code Compliance	PS 2-10

Other Information

Forestry Certification	DryGuard OSB panels are made from Forest Stewardship Council (FSC [®]) certified wood sources.
NGBS Green Certified	DryGuard OSB is Home Innovation NGBS Green Certified for Resource Efficiency and Indoor Environmental Quality. Please visit Homeinnovation.com/Green for more information.
Product Warranty	DryGuard OSB is covered by a Lifetime Limited Warranty. For terms and conditions, please refer to our Lifetime Limited Warranty available at www.builditbetter.com .





Specifications – Sheathing

International Shipping

To prevent the introduction and spread of plant pests, ISPM 15: International Standards for Phytosanitary Measures, requires that internationally shipped solid wood pallets be debarked, treated with heat or fumigated with methyl bromide, and marked with a seal of compliance. Pallets made with engineered wood, including DryGuard OSB, are exempt from ISPM 15 regulations. This is because the process of manufacturing engineered wood destroys any live organisms in the wood. (Source: "Boxes, Crate and Reel Manufacturing", www.PerformancePanels.com)

Formaldehyde Emissions

DryGuard OSB contains no added urea formaldehyde resins. PS 1 and PS 2 structural panels are exempt from testing by the California Air Resources Board (CARB) in the Composite Wood Air Toxic Control Measure (ATCM) and phenolic bonded structural panels are exempt from testing or monitoring by HUD in the Manufactured Home Construction and Safety Standards.

Manufacturing Locations

Location	APA Mill Number	Zip Code	Harvest Radius
Englehart, ONT, CA	530	P0J 1H0	50 miles

SECTION 06 16 00 – SHEATHING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: ICC-ES evaluation reports for preservative-treated plywood fire-retardant-treated plywood and foam-plastic sheathing.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

- A. Plywood: DOC PS 1.
- B. Oriented Strand Board: DOC PS 2.
- C. Certified Wood: Wood-based materials shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and to FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

2.2 TREATED PLYWOOD

- A. Preservative-Treated Plywood: AWWPA U1; Use Category UC2.
 - 1. Use treatment containing no arsenic or chromium.
 - 2. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- B. Provide preservative-treated plywood for items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.
- C. Fire-Retardant-Treated Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet** beyond the centerline of the burners at any time during the test.
 - 1. Use Exterior type for exterior locations and where indicated.
 - 2. Use Interior Type A unless otherwise indicated.
 - 3. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to **170 deg F** shall be not less than span ratings specified.
 - 4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Provide fire-retardant-treated plywood for items indicated on Drawings.

2.3 WALL SHEATHING

- A. TBD: Use of Plywood and OSB Dependent on structural requirements and locations of shear/non-shear panels.
- B. Plywood Wall Sheathing: Exterior, Structural I sheathing.
 - 1. Georgia Pacific Plytanium Plywood Sheathing, 23/32" thickness.
- C. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.
 - 1. Georgia Pacific Blue Ribbon OSB Sheathing.
- D. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core.
 - 1. Manufacturers: Subject to compliance with requirements and cost estimates, Georgia Pacific preferred:
 - a. Georgia-Pacific Building Products.
 - b. National Gypsum Company.

2.4 ROOF SHEATHING

- A. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.
 - 1. Georgia Pacific Thermostat Radiant Barrier OSB

2.5 SUBFLOORING AND UNDERLAYMENT

- A. Subflooring: To be decided between OSB and Plywood:

1. Plywood Subflooring: Exterior, Structural I single-floor panels or sheathing. Georgia Pacific Plytanium Sturd-I-Floor.
 2. Oriented-Strand-Board Subflooring: Exposure 1, Structural I sheathing or single-floor panels or sheathing depending on structural requirements. Georgia Pacific DrGuard Enhanced OSB.
- B. Underlayment: TBD
- 2.6 MISCELLANEOUS PRODUCTS
- A. Fasteners: Size and type indicated.
 1. Power-Driven Fasteners: CABO NER-272.
 - B. Adhesives for Field Gluing Panels to Framing: APA AFG-01.

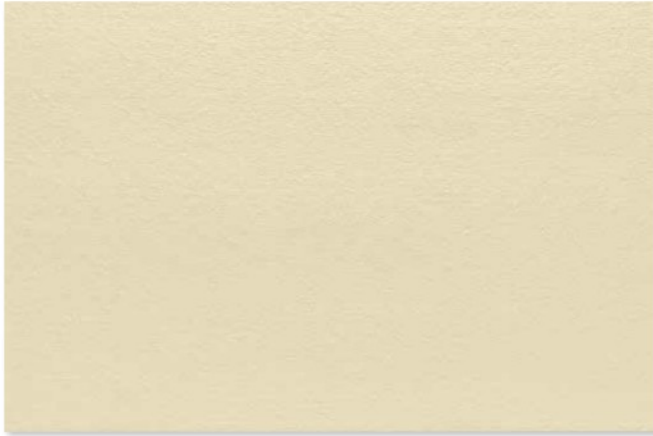
PART 3 - EXECUTION

3.1 INSTALLATION

- A. Securely attach to substrates, complying with the following:
 1. CABO NER-272 for power-driven fasteners.
- B. Fastening Methods:
 1. Subflooring:
 - a. Screw and glue to wood framing. Omit glue at modular seams where specified on drawing.
 2. Wall and Roof Sheathing:
 - a. Screw to wood framing.

06 25 13 Hardie Board Panels

- Siding
- Trim
- Soffit
- HardieWrap®
- Finishing Touches



NON-VENTED SMOOTH

Not available with ColorPlus Technology

Thickness	1/4 in.			
Length	12 ft.	12 ft.	8 ft.	8 ft*
Width	12 in.	16 in.	24 in.	48 in.
Prime Pcs./Pallet	200	150	100	50



[View all HardieSoffit Products](#)

*48 in. x 8 ft. panels only available primed.



[ABOUT JAMES HARDIE](#)

[PRODUCTS](#)

[COLOR](#)

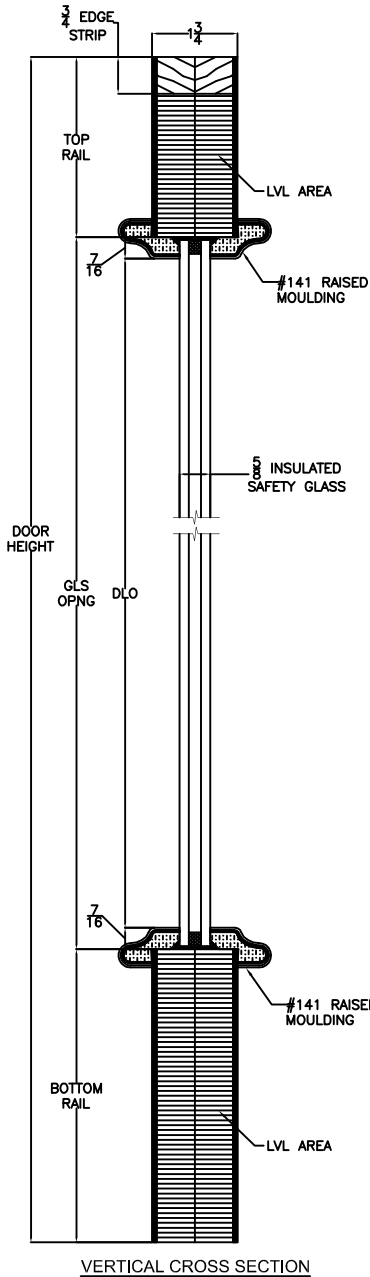
06 48 13 Exterior Wood Door Frames

Door Size = Book Size Before Prefit
Daylight Opening (DLO) = Visible Glass

Values in brackets [] are millimeter conversions.
Sidelight Match = A5701

DOOR CROSS-SECTION

Moulding Profile = 141
Panel Profile = n/a
See A5001 Cross Section sheet for more detail.



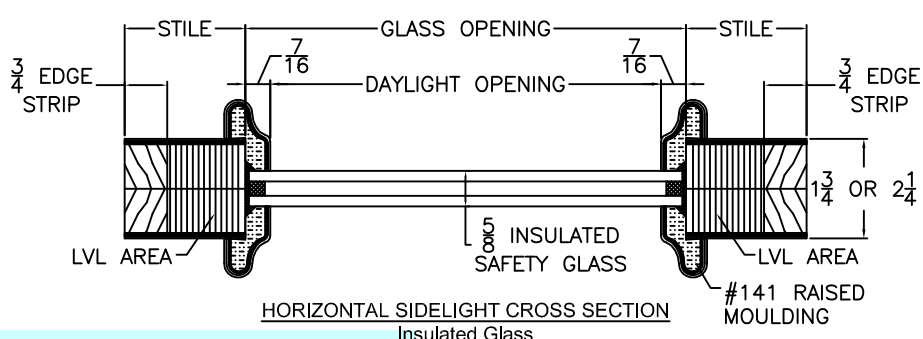
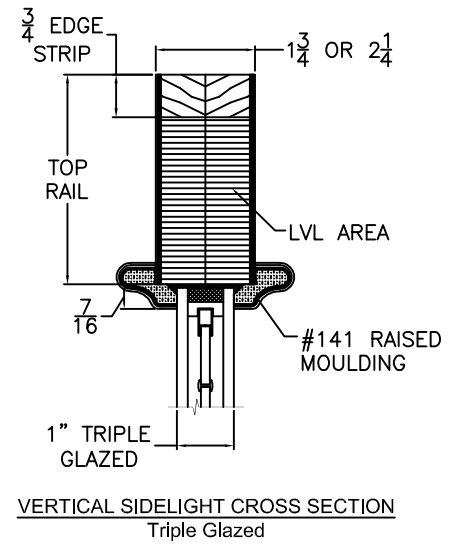
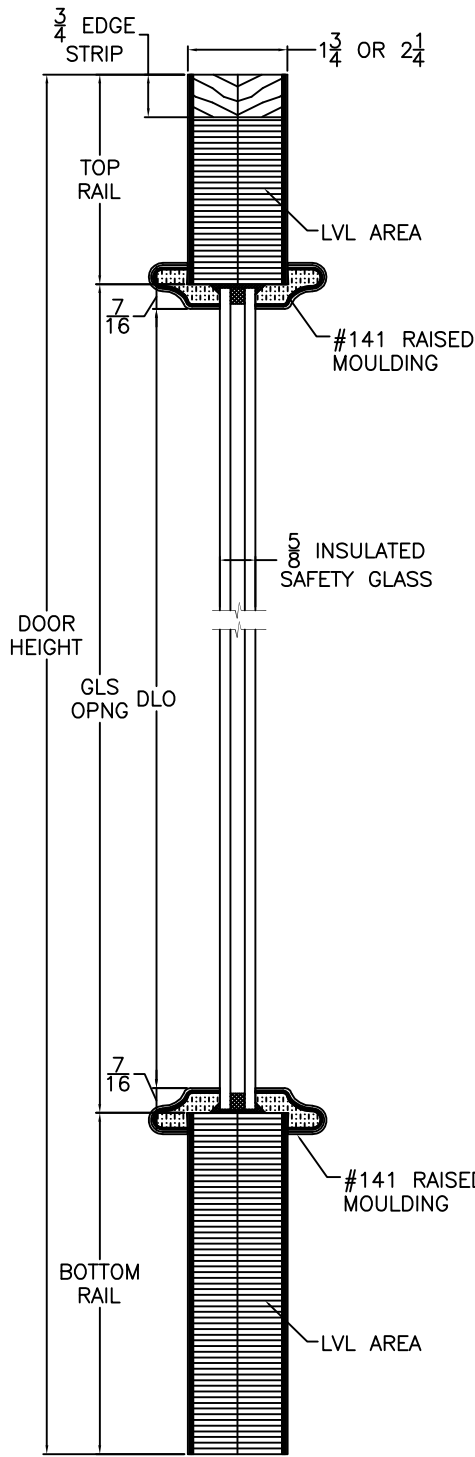
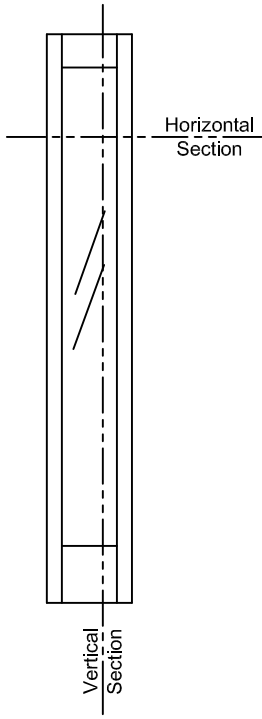
Door Size	30" [762]	32" [813]	36" [914]
Daylight Opening	19 3/4" [502]	21 3/4" [552]	25 3/4" [654]
80" [2032]	66 7/16" [1688]	67 1/8" [1702]	67 5/8" [1715]
84" [2134]	66 7/16" [1688]	67 1/8" [1702]	67 5/8" [1715]
96" [2438]	82 7/16" [2094]	83 5/8" [2121]	83 5/8" [2121]

06 48 13 Exterior Wood Door Frames



CROSS SECTIONS

Scale: 3" = 1'-0"





EXTERIOR FRENCH

1501

SERIES: [Exterior French & Sash Doors](#)

TYPE: Exterior French & Sash

Wood: Maple

Size: 36x84

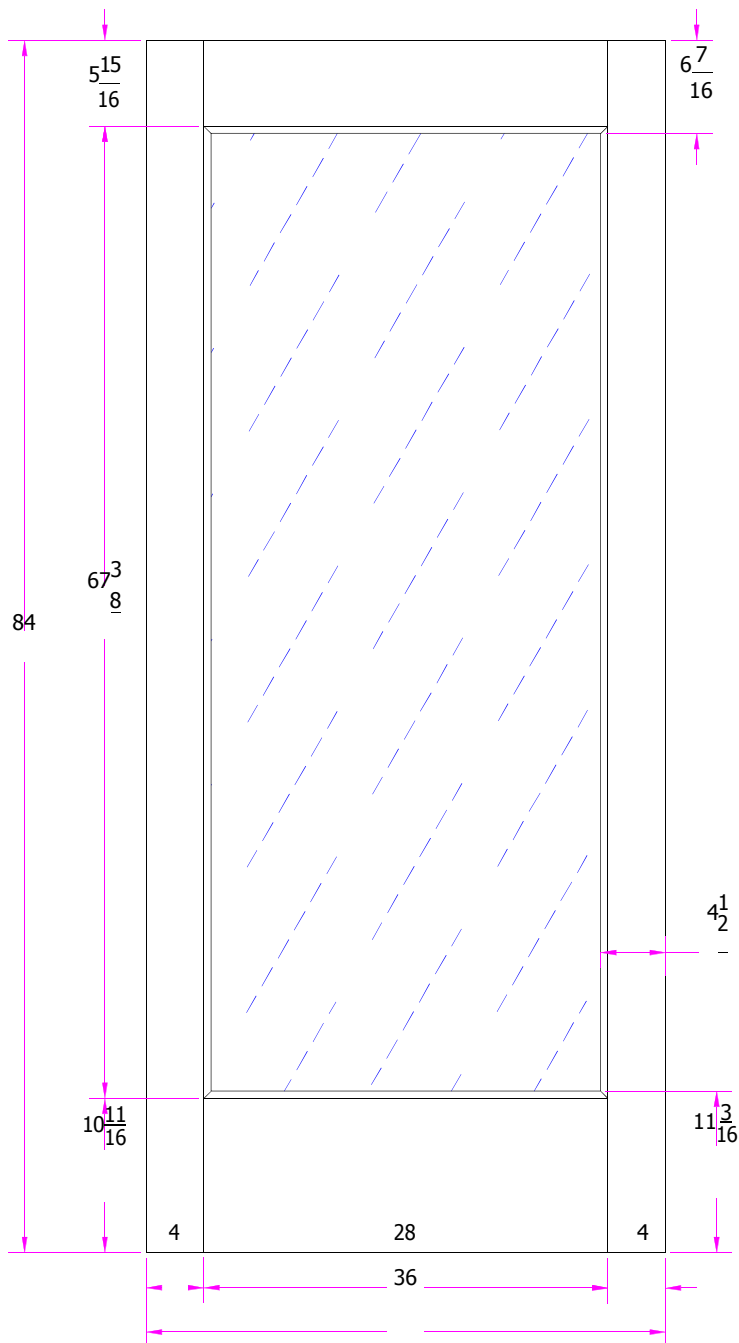
Glass: Screen Dot

Panels: na

Profile: Ovolo Sticking

Glass: 1/8" Single Glazed

Caming: na



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Revisions

Rev. #	Description	Date	by Whom

TITLE **1501 3/0 x 7/0**
Customer Layout

DRAWING NO. **D-1501-300-700-0800**

LAYOUT **SHA** SCALE **NTS** PATTERN # **7002**
DRAWN BY: **C. Kuehl** DATE **12/01/2014**



DIVISION 07 THERMAL AND MOISTURE PROTECTION

07 21 00	Thermal Insulation_SP
07 21 16	Blanket Insulation (Eco-Batt)
07 25 00	Weather Barriers_SP
07 27 00	Air Barrier (Tyvek HomeWrap)
07 46 46	Fiber Cement Siding (Hardie Panels)_SP
07 54 23	Thermoplastic Polyolefin Roofing (TPO) _SP
07 62 00	Sheet Metal Flashing and Trim
07 65 00	Flexible Flashing (DuPont FlexWrap)
07 71 00	Roof Specialties_SP
07 92 00	Joint Sealants_SP
07 92 16	Rigid Joint Sealants (Alex Plus)
07 92 16	Rigid Joint Sealants (Dynaflex)
07 92 16	Rigid Joint Sealants (GE Silicone II))

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data[and ICC-ES evaluation reports for foam-plastic insulation].
- B. Surface-Burning Characteristics: According to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS

- A. Glass-Mineral-Wool-Blanket Insulation: ASTM C 665, Type III, Class A, Kraft faced on one side with flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - 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. Knauf Insulation.
 - b. Owens Corning.

2.2 ACCESSORIES

- A. Vapor Retarder: Reinforced polyethylene, 4 mils thick.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. DuPont.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.
- B. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

- C. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
- D. Except for loose-fill insulation and insulation that is friction fitted in stud cavities, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- E. Place loose-fill insulation to comply with ASTM C 1015.
 - 1. Comply with the CIMA's Special Report #3, "Standard Practice for Installing Cellulose Insulation."
- F. Spray-Applied Insulation: Apply 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 items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs.
- G. Install sheet radiant barriers according to ASTM C 1158.
- H. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape. Seal joints caused by pipes, conduits, electrical boxes, and similar items with tape.

END OF SECTION 07 21 00

07 21 16 Blanket Insulation (Eco-Batt)



Knauf Data Sheet

BI-BT-DS 09-14

ECOBATT[®]
Thermal/Acoustical Insulation

with **ECOSE**[®]
TECHNOLOGY
1 of 8



Think of it as green...only browner.



Knauf Insulation EcoBatt® with ECOSE® Technology

All Knauf Insulation products are sustainable. EcoBatt glasswool insulation with ECOSE Technology takes that standard to a whole new level. It is based on rapidly renewable, bio-based material—up to 70% less energy intensive than traditional binders. ECOSE Technology is a revolutionary more sustainable binder that contains no phenol, formaldehyde, acrylics or artificial colors.

Knauf Insulation's EcoBatt insulation combines ECOSE Technology with sand—one of the world's most abundant resources—and over 50% post-consumer recycled bottle glass. EcoBatt insulation products deliver the same exceptional quality, handling and durability that you have come to expect from Knauf Insulation, with an even higher level of sustainability.



Lab-tested, Mother Nature Approved

EcoBatt insulation products are interior friendly. They are certified to the toughest indoor air quality certification in the industry, GREENGUARD Gold, and are certified to meet CHPS Low-Emitting Materials criteria section 01350. They also meet or exceed all applicable industry performance specifications and standards.

All Knauf Insulation products are inherently sustainable because of high recycled and renewable content. They save hundreds of times more energy in use than is required to manufacture them. EcoBatt insulation is even more sustainable because its ECOSE Technology helps reduce our carbon footprint further by eliminating the traditional non-renewable petroleum-based binder chemistry.



EcoBatt insulation is naturally brown— assures no phenol, formaldehyde, acrylics or artificial colors are used in the manufacturing process.



EcoBatt insulation ensures the professional touch—consistent quality, low dust and easy to cut—handling characteristics that you've come to expect from Knauf Insulation.



Knauf Insulation manufactures a full line of EcoBatt insulation—a variety of widths, R-values, densities and facings.

Knauf Insulation EcoBatt® Insulation with ECOSE® Technology

EcoBatt Insulation Description

Knauf Insulation EcoBatt glasswool insulation made with ECOSE Technology contains a high concentration of one of the world's most abundant renewable resources—sand—and over 50% recycled bottle glass bonded with ECOSE Technology. The products are available unfaced or with kraft, foil or flame-rated FSK-25 (Foil-Scrim-Kraft) foil facings.

ECOSE Technology Description

ECOSE Technology is a revolutionary bio-based binder that contains no phenol, formaldehyde, acrylics or artificial colors. It is made from rapidly renewable bio-based materials instead of petroleum-based chemicals for greater sustainability.

Application

Knauf Insulation EcoBatt batts and blankets are cost-effective thermal and acoustical barriers for energy-efficient construction. Their consistent quality, low dust, and easy-cutting resilient fibers make fabrication simple and installation fast. The products can be used in new and retrofit wood and metal frame applications in residential and commercial structures, as well as in manufactured housing applications. These applications include thermal and acoustical treatments to walls, ceilings and floors.

In addition, High Density (HD)

EcoBatt batts are available where optimal thermal performance is required and space for insulation is limited. High Density EcoBatt Cathedral Ceiling Batt, for example, deliver greater R-value in less space, so builders can increase R-values and still maintain adequate space for ventilation.

Knauf Insulation **QuietTherm®** EcoBatt insulation's excellent acoustical properties reduce sound transmission when properly installed in partition walls, ceilings and floor assemblies. It is primarily used in light commercial applications.

Knauf Insulation Staple-Free

EcoBatt insulation is flangeless kraft-faced batts which friction fit between wood studs, eliminating the need to staple in place. These batts are designed for use in wood framed construction where the stud spacing is no more than 16" on center.

Residential Applications

Knauf Insulation offers a full line of standard and high-density EcoBatt batts and blankets with a wide range of sizes and R-values. Available unfaced, or with kraft or flame-rated (FSK) foil facings, Knauf Insulation residential insulation can be used for cavity walls, floors, ceilings, attics, basements and crawlspaces. It is highly resilient, recovering quickly to full thickness. It also greatly reduces the transmission of noise.

Light Commercial Applications

This full line of standard and high-density EcoBatt batts and blankets for wood and metal frame construction is available unfaced or with kraft, foil or flame-rated (FSK) foils facings. Knauf Insulation's commercial building insulation can be used for exterior and partition walls, floors, crawlspaces and a variety of ceiling applications.

Manufactured Housing Applications

Knauf Insulation Manufactured Housing products include a full line of EcoBatt batts and blankets with a wide range of R-values, lengths and widths. It is designed to work efficiently with pre-manufactured structures of all widths. Available unfaced in widths up to 192" (4.88 m) or with kraft facing in widths up to 24" (610 mm), it can be used for cavity walls, partition walls, floors and ceiling applications.

Acoustical Performance

Knauf Insulation's EcoBatt and QuietTherm EcoBatt insulation provide excellent acoustical properties and will reduce sound transmission when properly installed in partition walls and acoustical ceiling and floor systems. Knauf Insulation acoustical/thermal insulation can improve STC ratings in wood stud construction by 3 to 5 points and metal stud construction by 8 to 10 points depending upon the complexity of the wall configurations, R-values and layers of insulation. The STC Ratings table, right, illustrates the improved STC Ratings in a commercial application using Knauf Insulation acoustical/thermal insulation compared to no insulation.



Glass Mineral Wool and Mold

Glass mineral wool insulation will not sustain mold growth. However, mold can grow on almost any material when it becomes wet and contaminated. Carefully inspect any insulation that has been exposed to water. If it shows any sign of mold, it must be discarded. If the material is wet, but shows no evidence of mold, it should be dried rapidly and thoroughly. If it shows signs of facing degradation from wetting, it should be replaced.

Technical Data

Surface Burning Characteristics

- Unfaced and flame-rated (FSK) foil faced products do not exceed 25 Flame Spread, 50 Smoke Developed when tested in accordance with ASTM E 84.
- Kraft facing will burn and should not be left exposed.

Thermal Value

- Thermal resistivity (R-value) is determined using industry standard test method ASTM C 518.

Water Vapor Permeance (ASTM E 96)

- Kraft faced products have a water vapor permeance of 1.0 or less.
- FSK foil faced products have ratings of .04.
- Foil faced products have ratings of .05.

Water Vapor Sorption (ASTM C 1104)

- Less than 5% by weight.

Corrosion (ASTM C 665)

- No greater than sterile cotton.

Microbial Growth (ASTM C 1338)

- Does not support microbial growth.

Noncombustible (ASTM E 136)

- Unfaced insulation is non-combustible.



Specification Compliance

- ASTM C 665; Type I, Class A, Category 1, (unfaced)
- ASTM C 665; Type II, Class C, Category 1, (Kraft faced)
- ASTM C 665; Type III, Class A, Category 1, (FSK-25 foil faced)
- ASTM C 665; Type III, Class B, Category 1, (foil faced)
- Verified formaldehyde-free by GREENGUARD Environmental Institute
- GREENGUARD Certified
- GREENGUARD Gold Certified
- California Energy Commission
- MEA #498-90-M
- State of Minnesota

Features and Benefits

Proven Performance

- Preferred by professional installers concerned with quality, appearance and productivity.
- Excellent acoustical properties reduce sound transmission in the home when properly installed in partition walls and ceiling and floor systems.

Superior Handling

- All Knauf Insulation faced products feature an extra wide stapling flange for faster and easier installation.
- Highly resilient insulation recovers quickly to full thickness for a snug fit and superior finished aesthetics.
- Consistent quality materials made of resilient fibers cut easily, install fast with low dust.
- Durable facing resists tears and is marked in one-foot increments for faster field fabrication.

(Features and benefits continued on the back)

STC Ratings				
	With insulation	No insulation	With insulation	No insulation
Wood Frame, 2 x 4 (3½" - 4" Batt)	(with ½" gypsum wallboard both sides)		(with ⅝" gypsum wallboard both sides)	
Single studs/Single layer gypsum	38	35	38	34
Single studs/Resilient channel	47	39	52	40
Staggered studs/Single layer gypsum	49	39	51	43
Double stud walls/Single layer gypsum	57	46	56	45
Steel Frame (2½" studs) (3½" - 4" Batt)	(with ½" gypsum wallboard both sides)		(with ⅝" gypsum wallboard both sides)	
Single layer gypsum	45	36	47	39
Double layer gypsum one side/ Single layer gypsum other side	50	39	52	44
Double layer both sides	56	45	57	48
Steel Frame (3½" studs) (3½" - 4" Batt)	(with ½" gypsum wallboard both sides)		(with ⅝" gypsum wallboard both sides)	
Single layer gypsum	47	39	50	39
Double layer gypsum one side/ Single layer gypsum other side	52	42	55	47
Double layer both sides	56	50	58	52

We will be using kraft-faced R-21HD insulation for our walls, R-26 for our floor, and R-38 for our ceiling (all wood-frame)

Knauf Insulation EcoBatt® Insulation with ECOSE® Technology

Wood Frame Construction						
R-Value	Thickness	Width	Unfaced	Kraft	Foil	FSK-Foil
R-11	3.5" (89 mm)	11", 15", 16", 19", 23", 24" (279, 381, 406, 483, 584, 610 mm)	•	•	•	•
R-13	3.5" (89 mm)	11", 15", 16", 19", 23", 24" (279, 381, 406, 483, 584, 610 mm)	•	•	•	•
R-15HD*	3.5" (89 mm)	11", 15", 19", 23" (279, 381, 483, 584 mm)	•	•		
R-19	6.25" (159 mm)	11", 15", 16", 19", 23", 24" (279, 381, 406, 483, 584, 610 mm)	•	•	•	•
R-20	5.5" (140 mm)	15", 23" (381, 584 mm)	•	•		
R-21HD*	5.5" (140 mm)	15", 23" (381, 584 mm)	•	•		
R-22	6.5" (165 mm)	15", 16", 19", 23" (381, 406, 483, 584 mm)	•	•		
R-23	5.5" (140 mm)	15" (381 mm)	•	•		
R-25	8" (203 mm)	15", 23" (381, 584 mm)	•			
R-26	9" (229 mm)	16", 24" (406, 610 mm)	•	•		
R-30HD*	8.25" (210 mm)	15", 23" (381, 584 mm)	•	•		
R-30	10" (254 mm)	11", 16", 19", 24" (279, 406, 483, 610 mm)	•	•	•	•
R-38HD*	10.25" (261 mm)	15", 23" (381, 584 mm)	•	•		
R-38	12" (305 mm)	16", 24" (406, 610 mm)	•	•		•
R-49	13.75" (349 mm)	24" (610 mm)	•	•		
Metal Frame Construction						
R-Value	Thickness	Width	Unfaced	Kraft	Foil	FSK-Foil
R-8QT**	2.5" (64 mm)	16", 24" (406, 610 mm)	•			
R-11QT**	3.5" (89 mm)	16", 24" (406, 610 mm)	•	•		
R-13QT**	3.5" (89 mm)	16", 24" (406, 610 mm)	•	•		
R-19QT**	6.25" (159 mm)	16", 24" (406, 610 mm)	•	•		
Manufactured Housing Rolls						
R-Value	Thickness	Width	Unfaced	Kraft	Foil	FSK-Foil
R-5	1.5" (38 mm)	15" (381 mm)	•			
R-7	2.25" (64 mm)	15", 90", 96" (381, 2286, 2438 mm)	•			
R-11	3.5" (89 mm)	15", 48", 72", 84", 88", 96" (381, 1219, 1829, 2134, 2235, 2438 mm)	•	•		
R-13	3.5" (114 mm)	15" (381 mm)	•	•		
R-19	6.25" (159 mm)	15", 23", 48", 92.5" (381, 584, 1219, 2349 mm)	•	•		

Manufacturing Housing Rolls available as custom orders in R-14, R-22, R-25 and R-30

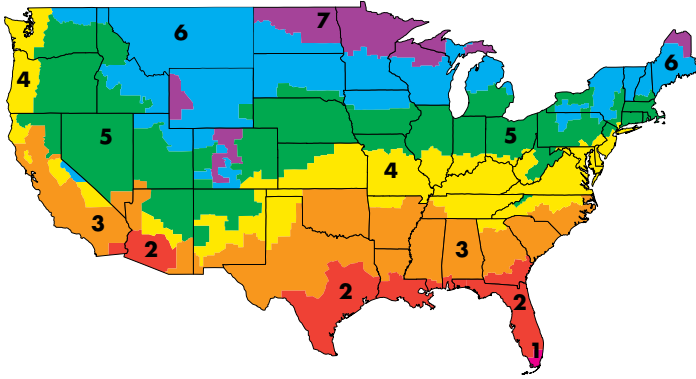
*HD-High Density Insulation

**QT-QuietTherm Insulation

* Items not listed are deemed to be custom products. Please contact your Knauf Insulation Territory Manager to inquire about ordering custom products.

This chart is meant as a quick reference guide. Please check with your sales representative for a full product offering.

2012 International Energy Conservation Code Climate Zones



All of Alaska is in Zone 7 except for the following boroughs in Zone 8: Bethel, Dillingham, Fairbanks N Star, Nome, North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, Yukon-Koyukuk.

Zone 1 includes Hawaii, Guam, Puerto Rico and the Virgin Islands.

New Wood-Framed Houses						
Zone	Heating System	Attic	Cathedral Ceiling	Wall		Floor
				Cavity	Insulation Sheathing	
1	All	R-30 to R-49	R-22 to R-38	R-13 to R-15	None	R-13
2	Gas, oil, heat pump	R-30 to R-60	R-22 to R-38	R-13 to R-15	None	R-13, R-19, R-25
	Electric furnace					
3	Gas, oil, heat pump	R-30 to R-60	R-22 to R-38	R-13 to R-15	None	R-25
	Electric furnace					
4	Gas, oil, heat pump	R-38 to R-60	R-30 to R-38	R-13 to R-15	R-2.5 to R-6	R-25 to R-30
	Electric furnace				R-5 to R-6	
5	Gas, oil, heat pump	R-38 to R-60	R-30 to R-38	R-13 to R-15	R-2.5 to R-6	R-25 to R-30
	Electric furnace		R-30 to R-60	R-13 to R-21	R-5 to R-6	
6	All	R-49 to R-60	R-30 to R-60	R-13 to R-21	R-5 to R-6	R-25 to R-30
7	All	R-49 to R-60	R-30 to R-60	R-13 to R-21	R-5 to R-6	R-25 to R-30
8	All	R-49 to R-60	R-30 to R-60	R-13 to R-21	R-5 to R-6	R-25 to R-30

Existing Wood-Framed Houses			
Zone	Add Insulation to Attic		Floor
	Uninsulated Attic	Existing 3-4 Inches of Insulation	
1	R-30 to R-49	R-25 to R-30	R-13
2	R-30 to R-60	R-25 to R-38	R-13 to R-19
3	R-30 to R-60	R-25 to R-38	R-19 to R-25
4	R-30 to R-60	R-38	R-25 to R-30
5-8	R-49 to R-60	R-38 to R-49	R-25 to R-30

Wall Insulation: Whenever exterior siding is removed on an

Uninsulated wood-frame wall:

- Drill holes in the sheathing and blow insulation into the empty wall cavity before installing the new siding, and
- Zones 3-4: Add R5 insulative wall sheathing beneath the new siding.
- Zones 5-8: Add R5 to R6 insulative wall sheathing beneath the new siding.

Insulated wood frame wall:

- For Zones 4-8: Add R5 insulative sheathing before installing the new siding

Reference: DOE/CE-0180 2008. Insulation Fact Sheet



EcoBatt® Insulation

- Combines sand and recycled post-consumer glass with ECOSE Technology for greater sustainability
- Legendary handling characteristics
- Saves hundreds of times more energy in use than required manufacturers
- Natural brown color—assures no phenol, formaldehyde, acrylics or artificial colors are used to manufacture EcoBatt insulation

ECOSE® Technology

- Up to 70% less embodied energy than traditional binders
- Contains no phenol, formaldehyde, acrylics or artificial colors
- No petroleum-based chemicals. Converts rapidly renewable bio-based materials into a totally inert polymer for superior environmental sustainability

For more information call (800) 825-4434, ext. 8485

or visit us online at www.knaufinsulation.us



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Fax (317) 398-3675

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Website www.knaufinsulation.us

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(Continued from pg. 5)

Convenient Packaging, Easier Handling

- Knauf Insulation EcoBatt insulation is packaged in a strong, white poly bag that offers excellent protection from abuse, dust and moisture.
- Our packages feature complete installation instructions and a highly visible R-value label which follows industry standards and makes Knauf Insulation product sizes and specifications easy to read.
- Knauf Insulation's unitized packaging saves time at the jobsite and space in the warehouse.
- Master bag batt units ensure reduced handling costs with greater compression—more square feet per bag, more square feet per truckload, fewer trips to the job site and less warehouse space for storage.

Superior Service and Support

- Prompt, on-time delivery helps control inventory costs and meet customer expectations.
- Our committed network of distributors assures fast order fulfillment and faster inventory turns.
- 24/7 access to product submittals ensures product acceptance and helps meet quotation deadlines.

Notes

The chemical and physical properties of Knauf Insulation EcoBatt insulation represent typical average values determined in accordance with accepted test methods. The data is supplied as technical service and is subject to change without notice. References to numerical flame spread ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with your Knauf Insulation sales representative to assure information is current.



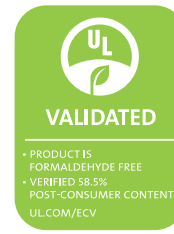
GREENGUARD Gold

Knauf Insulation achieved GREENGUARD Gold Certification and is verified to be formaldehyde free.

GREENGUARD Certification Program

Products are certified to GREENGUARD standards for low chemical emissions into indoor air during product usage. For more information, visit ul.com/gg.

Knauf Insulation has achieved a UL Environment claim validation for over 50% post-consumer recycled glass content in our insulation products.



LEED Eligible Product

Use of this product may help building projects meet green building standards as set by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

MR Credit 4.1 - 4.2 Recycled Content
MR Credit 5.1 - 5.2 Regional Materials



SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: ICC-ES evaluation reports for water-resistive barrier.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIERS

- A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.
- B. Building Paper: Kraft building paper with not less than 50 lbf/in. tensile strength, 1-hour water resistance, and 75 g/sq. m x 24 h water-vapor transmission.
- C. Building Wrap: ASTM E 1677, Type I air barrier; with water-vapor permeance not less than 56 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A); flame-spread and smoke-developed indexes not greater than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 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. **DuPont Building Innovations: E. I. du Pont de Nemours and Company.**

2.2 ACCESSORIES

- A. Flexible Flashing: Adhesive butyl rubber compound, bonded to plastic film or spunbonded polyolefin, with an overall thickness of 0.030 inch or less.
 - 1. Butyl Rubber:
 - a. **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:
 - 1) **DuPont Building Innovations: E. I. du Pont de Nemours and Company.**
- B. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Building Paper Installation:

1. Apply building paper immediately after sheathing is installed.
2. Apply horizontally with a 2-inch overlap and a 6-inch end lap.
3. Seal seams, edges, fasteners, and penetrations with tape.
4. Extend into jambs of openings and seal corners with flashing tape.

B. Building Wrap Installation:

1. Apply building wrap immediately after sheathing is installed.
2. Seal seams, edges, fasteners, and penetrations with building wrap tape.
3. Extend into jambs of openings and seal corners with building wrap tape.

C. Flexible Flashing Installation:

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

END OF SECTION 07 25 00

DuPont™ Tyvek® HomeWrap®

PHYSICAL PROPERTIES DATA SHEET

PROPERTIES	METHOD	DUPONT™ TYVEK® HOMEWRAP®
Air Penetration Resistance	ASTM E2178 (cfm/ft ² @1.57 psf)	< .004
	Gurley Hill (TAPPI T-460) (sec/100cc)	1200
	ASTM E1677	Type 1
Water Vapor Transmission	ASTM E96-05 Method A (g/m ² -24 hrs) (perms)	400 56
	Method B (g/m ² -24 hrs) (perms)	370 54
Water Penetration Resistance	ATTCC 127 (cm)	250
Basis Weight	TAPPI T-410 (oz/yd ²)	1.8
Breaking Strength	ASTM D882 (lbs/in)	30/30
Tear Resistance (Trapezoid)	ASTM D1117 (lbs)	8/6
Surface Burning Characteristics	ASTM E84 Flame Spread Index	15 Class A
	Smoke Developed Index	15 Class A
Ultra Violet Light Exposure (UV)		120 days (4 months)

Test results shown represent roll averages. Individual results may vary either above or below averages due to normal manufacturing variations, while continuing to meet product specifications.

For more information about DuPont™ Tyvek® Weatherization Systems, please call 1-800-44-Tyvek or visit us at www.Construction.Tyvek.com

WARNING: DuPont™ Tyvek® is combustible and should be protected from an open flame and other high heat sources. If the temperature of DuPont™ Tyvek® reaches 750 °F (400 °C), it will burn and the fire may spread and fall away from the point of ignition.



The miracles of science™

07 27 00 Air Barrier (Tyvek HomeWrap)

DuPont™
Tyvek®
HomeWrap®

1 of 1

1 of 1

SECTION 074646 - FIBER-CEMENT SIDING

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data, Samples, and ICC-ES evaluation reports.
- B. Warranties: Manufacturer's standard from in which siding manufacturer agrees to repair or replace siding that fails in materials or workmanship within 25 years. Failures include, but are not limited to, cracking, deforming, or otherwise deteriorating beyond normal weathering.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fiber-Cement Siding: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84. Factory primed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. James Hardie Building Products, Inc.
 - 2. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186.
 - 3. Panel Pattern: **48-inch-** (1219-mm-) wide sheets with smooth texture.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
 - 4. Moldings and trim.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fiber-cement siding and related accessories.

1. Install fasteners no more than 24 inches (600 mm) o.c.

END OF SECTION 074646

SECTION 07 54 23 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Shop Drawings of tapered insulation and ICC-ES evaluation reports for components of membrane roofing system.
- B. Warranties: Manufacturer's standard form or customized, without monetary limitation, signed by roofing manufacturer agreeing to repair leaks due to defects in materials or workmanship for period of 15 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.
- C. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980.
- D. ENERGY STAR Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- E. Energy Performance: Three-year, aged, solar reflectance not less than 0.55 and emissivity not less than 0.75 or aged, Solar Reflectance Index of not less than 64.
- F. Exterior Fire-Test Exposure: ASTM E 108, Class B.

2.2 ROOFING MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. GAF Materials Corporation.
- B. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.
 - 1. Thickness: 60 mils, nominal.
 - 2. Exposed Face Color: White.

- C. Auxiliary Materials: Recommended by roofing system manufacturer for intended use and as follows:
 - 1. Sheet Flashing: Unreinforced TPO sheet flashing, [55 mils] <Insert value> thick, minimum, of same color as sheet membrane.
 - 2. Bonding Adhesive: Manufacturer's standard.
- D. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.
 - 1.

2.3 ROOF INSULATION

- A. R-38 Eco-Batt insulation (see cut sheet for further details)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install TPO sheet according to roofing system manufacturer's written instructions and as follows:
 - 1. Adhered Sheet Installation: Apply bonding adhesive to substrate and underside of sheet and allow to partially dry. Do not apply bonding adhesive to splice area of sheet.
 - 2. Mechanically Fastened Sheet Installation: Secure one edge of sheet using fastening plates or battens centered within the membrane splice, and mechanically fasten sheet to roof deck.
- B. Seams: Clean seam areas, overlap membrane roofing, and hot-air-weld side and end laps of membrane roofing and sheet flashings. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
- C. Spread sealant bed over deck drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.
- D. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

END OF SECTION 07 54 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Coordinate installation of sheet metal flashing and trim with adjoining roofing and wall materials, joints, and seams to provide a leakproof, secure, and noncorrosive installation.
- C. Fabricator Qualifications: For copings and low-slope roof edge flashings that are SPRI ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.
- D. Warranty on Finishes: Manufacturer agrees to repair or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Standard: Comply with NRCA's "The NRCA Roofing Manual" SMACNA's "Architectural Sheet Metal Manual" and CDA's "Copper in Architecture Handbook" unless otherwise indicated. Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. FM Approvals' Listing: Manufacture and install roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-120. Identify materials with name of fabricator and design approved by FM Approvals.
- C. SPRI Wind Design Standard: Manufacture and install low-slope roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: 6.4 psi.

2.2 SHEET METAL

- A. Copper: ASTM B 370; Temper H00 or H01, cold rolled, not less than 16 oz./sq. ft..
 - 1. Prepatinated Finish: Verdigris, prepatinated according to ASTM B 882.
 - 2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.
- B. Metallic-Coated Steel Sheet: Galvanized steel sheet, ASTM A 653/A 653M, G90, or aluminum-zinc alloy-coated steel sheet, ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; 0.022-inch nominal thickness.

1. Finish: Manufacturer's standard epoxy primer and silicone-modified, polyester-enamel topcoat.
2. Concealed Finish: Manufacturer's standard white or light-colored acrylic or polyester backer finish.

2.3 ACCESSORIES

- A. Self-Adhering, High-Temperature Sheet Underlayment: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F and passes after testing at minus 20 deg F; ASTM D 1970.
- B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.
- C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.
 1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
 2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 3. Fasteners for Copper: Copper, hardware bronze, or Series 300 stainless steel.
 4. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 5. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.
 6. Fasteners for Metallic-Coated Steel Sheet: Hot-dip galvanized steel or Series 300 stainless steel.
- D. Solder for Copper: ASTM B 32, Grade Sn50.
- E. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
- F. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

- A. Fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to the design, dimensions, geometry, metal thickness, and other characteristics of item indicated.
- B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that are capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."
- D. <Insert list of items required, identify sheet metal from which each is to be fabricated, and reference appropriate plate number of cited sheet metal standard, if not detailed on Drawings>.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with cited sheet metal standards. Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.
- B. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- C. Seams: Fabricate nonmoving seams with flat-lock seams.[For aluminum, form seams and seal with epoxy seam sealer. Rivet joints for additional strength.]
- D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to a width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
 - 1. Do not solder metallic-coated steel
 - 2. Do not use torches for soldering.
 - 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- E. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating.
 - 1. Coat concealed side of aluminum with bituminous coating where it contacts wood, ferrous metal, or cementitious construction.

END OF SECTION 07 62 00

07 65 00 Flexible Flashing (Dupont FlexWrap)

DuPont Flashing Systems

PHYSICAL PROPERTIES DATA SHEET

Product Data

PROPERTIES	DUPONT™ FLEXWRAP™ NF	DUPONT™ FLEXWRAP™ RW	DUPONT™ FLASHING TAPE
Face Sheet	Micro-creped, polyethylene laminate (white)	Elasticized polyethylene laminate (white)	Polypropylene film
Adhesive*	Butyl Rubber (black)	Butyl Rubber (black)	Butyl Rubber (black)
Thickness	64 mil (1,620 microns)	70 mil (1,775 microns)	20 mil (507 microns)
Release Liner	1-piece, heavy-duty siliconized paper for 6-inch width product; 2-piece, heavy-duty siliconized paper for 9-inch width product	Custom-designed, multi-piece, heavy-duty siliconized paper	1-piece heavy-duty siliconized paper
Dimensions	6- or 9-inch width x 75 feet length	9-inch width x 6-inch length custom folded pieces	4, 6, or 9-inch width x 100 feet
Applications	Round top or custom shaped windows, 3-D sill protection, wall interruptions: i.e. dryer vents, hose bibs. Suitable for use on substrates where fasteners cannot be applied.	Corner pieces for sill and head of recessed windows. Available in single-stud or double-stud versions.	Jamb and heads of rectangular windows and doors.

PROPERTIES	DUPONT™ STRAIGHTFLASH™	DUPONT™ STRAIGHTFLASH™ VF
Face Sheet	Spunbonded polyethylene laminate (white)	Spunbonded polyethylene laminate (white)
Adhesive*	Butyl rubber (black)	Transposed dual sided adhesive for continuous integration; Butyl rubber (black)
Thickness	30 mil (760 microns)	30 mil (760 microns)
Release Liner	2-piece, heavy-duty siliconized, scored release paper	2-piece, heavy-duty siliconized, scored release paper
Dimensions	4-inch width x 150 feet length 9-inch width x 125 feet length	6-inch width x 125 feet length
Applications	Jamb and heads of rectangular windows.	Brick mold, non-integral flanged and non-flanged rectangular windows and doors.

* Adhesive system is based on 100% butyl elastomer with no asphalt/modified bitumen components.

Performance Testing

INSTALLED SYSTEM WATER INTRUSION TESTING (Tested with no exterior cladding)	
ASTM E-331	NO leakage at 300 Pa
ASTM E-331 after thermal aging (0-160°F)	NO leakage at 300 Pa
WATER VAPOR PERMEABILITY (ASTM E-96)	
	< 1 perm (< 60 ng/Pa.sec.m ²)
APPLICATION TEMPERATURE	
	Best when installed above 25°F (consult DuPont for primer recommendations)
UV RESISTANCE	
	Cover within 120 days
DUPONT FLASHING SYSTEMS PRODUCTS MEET THE	
AAMA 711-07 MATERIAL STANDARD AT THE HIGHEST CLASSIFICATION LEVELS:	Class A (no primer) Level 3 Thermal Exposure (80°C/176°F for 7 days)

For more information about DuPont Flashing Systems, please visit us at www.Construction.Tyvek.com or call 1-800-44-Tyvek

WARNING: DuPont Flashing Systems products and their release paper are slippery and should not be walked on. Remove release paper from work area immediately.

DuPont Flashing Systems products are combustible and should be protected from flame and other high heat sources. If the temperature of DuPont Flashing Systems products reach 700°F (307°C) they will burn and the fire may spread and fall away from the point of ignition.



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07 65 00 Flexible Flashing (Dupont FlexWrap)

DuPont
Flashing Systems

1 of 1

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Warranties: Provide manufacturer's standard written warranty, without monetary limitation, signed by manufacturer agreeing to promptly repair or replace roof specialties that show evidence of deterioration of factory-applied finishes for the period of 20 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. SPRI Wind Design Standard: Manufacture and install tested according to SPRI ES-1 and capable of resisting design pressures indicated on Drawings.

2.2 ROOF SPECIALTIES

- A. Gutters and Downspouts:
 - 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. Spears.
 - 2. Gutters: Manufactured in uniform section lengths, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish expansion joints and expansion-joint covers.
 - a. Gutter Style: Rectangular.
 - b. TPO coated, Zinc-Galvanized Steel: 20 Gauge thick.
 - c. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
 - 3. Downspouts: Plain round PVC with mitered elbows. Furnish wall brackets of same material as downspouts, with anchors.
 - a. Formed PVC clear UVR rated.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces. Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped.
 1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
- D. Night Sky Sprinklers: Manufactured units, flat spray.
 1. Toro MPR Plus
- E. Piping for Night Sky sprinklers: Manufactured units, UVR PVC.

2.3 MATERIALS

- A. Prepainted, Zinc-Coated Steel Sheet: ASTM A 653/A 653M, G90 coating designation. Prepare, pretreat, and apply coating to comply with ASTM A 755/A 755M.
 1. Finish: Manufacturer's standard two-coat fluoropolymer system with color coat containing not less than 70 percent PVDF resin by weight; complying with AAMA 621.
- B. TPO Sheeting: ASTM D 226/D 226M, Type II (No. 30).
- 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 Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel.
 3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant.
- E. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

PART 3 - EXECUTION

3.1 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 stainless-steel roof specialties with bituminous coating where they will contact wood, ferrous metal, or cementitious construction.
- C. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

- D. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- E. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless indicated.
- F. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches, except where pretinned surface would show in finished Work.
- H. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
- I. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
- J. Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

END OF SECTION 07 71 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and color Samples.
- B. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

- A. Low-Emitting Materials: Sealants shall comply with the following limits for VOC content:
 - 1. Architectural Sealants: 250 g/L.
 - 2. Nonmembrane Roof Sealants: 300 g/L.
 - 3. Single-Ply Roof Membrane Sealants: 450 g/L.
 - 4. Other Sealants: 420 g/L.
 - 5. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 6. Sealant Primers for Porous Substrates: 775 g/L.
 - 7. Modified Bituminous Sealant Primers: 500 g/L.
 - 8. Other Sealant Primers: 750 g/L.
- B. Low-Emitting Materials:
 - 1. Exterior reactive sealants shall have a VOC content of not more than 50 g/L or 4 percent by weight, whichever is greater.
 - 2. Other exterior caulks and sealants shall have a VOC content of not more than 30 g/L or 2 percent by weight, whichever is greater.
 - 3. Interior sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.
- D. Sealant for General Exterior Use Where Another Type Is Not Specified[, **One of the Following**]:
 - 1. Single-component, neutral-curing silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT.

- a. **Products:** Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) DAP; Dynaflex 230.
- E. Sealant for Use in Interior Joints in Ceramic Tile and Other Hard Surfaces in Kitchens and Toilet Rooms and around Plumbing Fixtures:
 - 1. Single-component, mildew-resistant silicone sealant, ASTM C 920, Type S; Grade NS; Class 25; for Use NT; formulated with fungicide.
 - a. **Products:** Subject to compliance with requirements, provide one of the following:
 - 1) GE; Silicone II.
- F. Sealant for Interior Use at Perimeters of Door and Window Frames:
 - 1. Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1) DAP; Alex Plus.

2.2 MISCELLANEOUS MATERIALS

- A. Provide sealant backings of materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.
- D. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with ASTM C 1193.
- B. Install sealant backings to support sealants during application and to produce cross-sectional shapes and depths of installed sealants that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.



Technical Bulletin

2400 Boston Street, Suite 200, Baltimore, Maryland 21224
Phone: 410-675-2100 or 800-543-3840

Revised: 9/8/11

DAP[®] ALEX PLUS[®] Acrylic Latex Caulk Plus Silicone – Clear

- **Waterproof Seal**
- **Paintable**
- **Cured Caulk is Mold & Mildew Resistant**
- **Excellent Flexibility**
- **Easy Water Clean-Up**
- **Indoor/Outdoor Use**
- **Exceeds ASTM C834**

Packaging: 10.1 fl. oz. (300 mL) cartridge
Color: Clear
UPC Number: 7079818072, 7079818156, 7079818660, 7079811521, 7079811427, 7079874252, 7079818071

Company Identification:

Manufacturer: DAP Products Inc., 2400 Boston St., Ste. 200, Baltimore, Maryland 21224
Usage Information: Call 1-888-DAP-TIPS or visit dap.com & click on "Ask the Expert"
Order Information: 800-327-3339
Fax Number: 410-534-2650

Product Description:

ALEX PLUS[®] Acrylic Latex Caulk Plus Silicone is a professional quality caulking product formulated to last. It is an all-purpose adhesive caulk ideal for a wide variety of applications for interior and exterior use. ALEX PLUS[®] contains silicone, which allows for excellent adhesion and flexibility to resist expansion and contraction without cracking. It provides a waterproof seal and prevents air and moisture from passing through cracks and joints thereby improving energy efficiency. Cured caulk is mildew resistant. ALEX PLUS[®] is paintable with latex and oil-based paints. It is easy to use, easy to tool, low in odor, cleans up easily with soap and water and has a low VOC content.

Suggested Uses:

Ideal for caulking and sealing:

- *Windows and door frames*
- *Eaves*
- *Baseboards*
- *Pipes*
- *Molding*
- *Vents*
- *Siding and trim*
- *Corner Joints*
- *Ducts*

Adheres to:

- Wood
- Brick
- Drywall
- Metal
- Painted Surfaces
- Glass
- Plaster
- Most common building materials

Performance Characteristics:

- Exceeds ASTM C834.
- Contains silicone to improve adhesion and flexibility.
- Resists cracking and chalking.
- Tack-free in 30 minutes.

Surface Preparation & Application:

1. Surface must be clean, dry and free of old caulk, dirt, dust, debris and grease.
2. Cut nozzle at a 45° angle to desired bead size.
3. Puncture inner foil seal.
4. Load cartridge into caulking gun.
5. Fill gap with caulk, pushing caulk ahead of nozzle.
6. If necessary, smooth bead with finishing tool.
7. Clean up excess uncured caulk with a damp sponge before it skins over. Cured caulk must be cut or scraped away.
- 8. Allow caulk to dry clear before painting with latex or oil-based paints.**
9. Reseal cartridge for storage and reuse.

For Best Results:

- *Apply in temperatures above 40°F.*
- *Do not apply when rain or freezing temperatures are forecasted before full cure can occur.*
- *Do not use below waterline or for marine or automotive applications.*
- *Do not use for filling butt joints, surface defects, for tuck pointing or expansion joints.*
- *Joint size should not exceed 1/2" wide x 1/2" deep. If joint depth exceeds 1/2", use backer rod material.*
- ***Caulk applies white and dries clear in 7 – 14 days (depending on joint depth, temperature and humidity).***
- *Store away from extreme heat or cold.*

Physical & Chemical Characteristics:

Vehicle:	Siliconized Acrylic Polymer
Tooling Time:	10 minutes
Tack-Free Time:	30 minutes
Paintable:	Yes
Service Temperature Range (cured caulk):	-20°F to 180°F
Application Temperature Range:	40°F to 100°F
Coverage:	10.1 fl. oz. = 55 linear ft. at a 3/16" diameter bead (three average size doors or four average size windows)
Dynamic Joint Movement:	± 12%
Odor:	Very Mild
Consistency:	Smooth and Creamy
Volatile:	Water
Flash Point:	None
Specific Gravity:	1.02 ± 0.01
Solids:	54% ± 1% by weight
Weight per Gallon:	8.50 ± 0.05 lbs./gal.

Freeze Thaw Stability:

Passes 5 Cycles @ 0°F

Shelf Life:

12 months

MSDS No:

00010019001

Clean Up:

Clean up excess uncured caulk with a damp sponge before it skins over. Wash hands with warm water and soap. Excess dried caulk must be cut or scraped away.

Safety:

See product label and Material Safety Data Sheet (MSDS) for safety information. You can request an MSDS by visiting our website at dap.com or by calling 1-888-DAP-TIPS.

35 Year Satisfaction Guarantee:

If product fails to perform when used as directed, return used container and sales receipt to DAP Products Inc., Technical Customer Service, 2400 Boston St., Ste. 200, Baltimore, MD 21224 for replacement product or sales price refund. DAP is not liable for incidental or consequential damages.





Technical Bulletin

2400 Boston Street, Suite 200, Baltimore, Maryland 21224

Phone: 410-675-2100 or 800-543-3840

Revised: 5/28/14

DAP[®] DYNAFLEX 230[®] 100% Waterproof Window, Door & Trim Sealant – White & Colors

- Meets ASTM C920, Class 25
- Silicone Tough
- Superior Flexibility & Crack Proof
- Seals Joints up to 1" Wide
- Paintable & Water Clean-Up
- Interior/Exterior
- Ideal for Composite Wood and PVC Trimboard

Packaging: 10.1 fl. oz. (300 mL) cartridge, 5.5 fl. oz. (162 mL) squeeze tube
Color: White, Almond, Gray, Clay, Black, Brown, Cedar Tan, Dark Bronze
UPC Number: 70798 18300, 70798 18306, 70798 18301, 70798 18416, 70798 18280,
 70798 18302, 70798 18412, 70798 18303, 70798 18285

Company Identification:

Manufacturer: DAP Products Inc., 2400 Boston St., Ste. 200, Baltimore, Maryland 21224

Usage Information: Call 1-888-DAP-TIPS or visit dap.com & click on "Ask the Expert"

Order Information: 800-327-3339

Fax Number: 410-534-2650

Also, visit the DAP website at www.dap.com.

Product Description:

DAP[®] DYNAFLEX 230[®] 100% WATERPROOF WINDOW, DOOR & TRIM SEALANT is DAP's most advanced latex sealant technology. DAP[®] DYNAFLEX 230[®] is a premium latex sealant with the performance characteristics of non-industrial acetoxy silicone products. It combines the outstanding durability, adhesion and flexibility of a silicone with the easy tooling, paintability, low odor and water clean-up of a latex sealant. It is highly flexible to handle joint movement caused by variations in temperature and humidity without cracking. It provides a long-lasting, durable seal that is 100% waterproof and weatherproof. Ideal for sealing air leaks around windows, doors, siding, trim and baseboards to improve the energy efficiency of a home and reduce utility costs. Cured sealant is mold and mildew resistant. Interior/exterior use. Meets ASTM Specification C920.

Suggested Uses:

Ideal for Caulking and Sealing:

- | | | |
|---------------------|-----------------|-------------------------|
| • Windows and doors | • Pipes | • Siding and trim |
| • Molding | • Butt joints | • Tuck-pointing |
| • Baseboards | • Corner joints | • Other gaps and cracks |
| • Vents | | |

Outstanding Adhesion to:

- *Wood*
- *Aluminum*
- *Vinyl*
- *Plaster and drywall*
- *Painted surfaces*
- *Metal*
- *Glass*
- *Masonry*
- *Stucco*
- *Composite*
- *Brick*
- *Concrete*
- *Most plastics*
- *Stone*
- *PVC Trimboard*

Performance Characteristics:

- Meets the requirements of ASTM C920 standard specification for Elastomeric joint sealants, Type S, Grade NS, Class 25. Use NT, G, A and M.
- Meets the performance specifications of Federal Spec TT-S-00230c (COMNBS0), Type II, Class A.
- Exceeds ASTM Spec C834 Standard Specification for Latex Sealants.
- Tack free in 30 minutes.
- Paintable with latex or oil-based paints.
- Easy water clean-up.

Surface Preparation & Application:

1. Surface must be clean, dry and free of all old caulk, dirt, dust and grease.
2. Remove cap (from squeeze tube). Cut nozzle at a 45° angle to desired bead size.
3. Load into caulking gun if using the cartridge.
4. Fill gap with sealant, pushing sealant ahead of nozzle.
5. For a neat finish, smooth bead of sealant with a finishing tool.
6. Clean up excess uncured sealant with a damp cloth before it skins over (15 minutes). Cured sealant must be cut or scraped away.
7. Allow sealant to dry 2-4 hours before painting with latex or oil-based paints. Cool or humid conditions or type of paint used may require longer dry time.
8. Reseal squeeze tube/cartridge for storage and reuse.

For Best Results:

- Apply in temperatures above 40°F (4.44 °C).
- Do not apply if rain or freezing temperatures are forecasted before full cure can occur. Cold weather and high humidity will slow down cure time.
- Do not use below waterline or for marine or automobile applications, or filling surface defects.
- Joint size should not exceed 1” (2.54 cm) wide by 1/2” (1.30 cm) deep. If joint depth exceeds 1/2” (1.30 cm), use foam backer rod.
- Store sealant away from extreme heat or cold.

Typical Physical & Chemical Characteristics:

Tooling Time:	10 Minutes
Tack-Free Time:	30 Minutes
Dynamic Joint Movement:	± 25%
Paintable:	Yes
Odor:	Very Mild
Consistency:	Smooth and Creamy
Vehicle:	Advanced Acrylic Polymer
Volatile:	Water
Flash Point:	None
Filler:	Calcium Carbonate
Density:	1.44
Solids:	78.0% by weight

Typical Physical & Chemical Characteristics (continued):

Weight per Gallon:	12.0lbs./gal. (1.44 kg/L)
Temperature Service Range:	- 30°F to 180°F (-34.50 to 82.20 °C)
Temperature Application Range:	40°F to 100°F (4.44 to 37.78 ° C)
Freeze Thaw Stability:	Passes 5 Cycles @ 0°F (-17.78 °C)
Shelf Life:	12 Months
Coverage:	5.5 fl. oz.: 30 linear ft. at a 3/16" diameter bead (9.14 m at a 0.47 cm bead size); 10.1 fl. oz.: 55 linear ft. at a 3/16" bead size. (16.76 m at a 0.47 cm bead size)
SDS No:	00010001001

Clean-Up:

Clean up excess uncured sealant with a damp cloth or sponge before it skins over. Wash hands with warm water and soap. Dried material must be cut or scraped away.

Safety:

WARNING: Irritant. May cause eye, skin and respiratory irritation, or allergic skin reaction. Harmful if swallowed. Use only with adequate ventilation. Ensure fresh air entry during application and drying. Avoid breathing vapors. Avoid contact with eyes and skin. Wear gloves and safety glasses. Wash thoroughly after handling. **WARNING:** This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. **FIRST AID:** SKIN: Wash thoroughly. EYE: immediately flood w/large quantities of water. INHALATION: Remove to fresh air. INGESTION: DO NOT INDUCE VOMITING. Get medical attention if complications arise from any exposure. **For emergencies**, call your poison control center at 1-800-222-1222. See Safety Data Sheet (SDS) for additional information. See product label and Safety Data Sheet (SDS) for safety information. You can request an SDS by visiting our website at www.dap.com or by calling **1-888-DAP-TIPS**.

50-Year Satisfaction Guarantee:

If product fails to perform during guarantee period when used as directed, return used container and sales receipt to DAP Products Inc., Technical Customer Service, 2400 Boston St., Ste. 200, Baltimore, MD 21224 for purchase price refund. DAP is not liable for incidental or consequential damages.



07 92 16 Rigid Joint Sealants (GESilicone)

Silicone Product Guide

GE Supreme PAINTABLE Silicone *Less Stress, Less Mess – Exceptional Performance*

Supreme Paintable combines the performance of a silicone with the easy-to-apply, paintable characteristics of an acrylic caulk. It is ready fast and has a smooth texture for easy application and tooling.



GE Kitchen & Bath Supreme Paintable Silicone

- 30-minute shower-ready
- 30-minute paint-ready
- 10-year mold-free product protection
- Pro-like results – not sticky/stringy; smoothes easily; goes where it belongs



SKU	Color	Size	Pack	UPC Code
M90025-30	White	Caulker	12	077027250305

GE Window & Door Supreme Paintable Silicone

- 30-minute rain-ready
- 30-minute paint-ready
- Pro-like results – not sticky/stringy; smoothes easily; goes where it belongs



SKU	Color	Size	Pack	UPC Code
M90026-30	White	Caulker	12	077027260304

GE Supreme Silicone *Slashes Wait Times, Helps Block Weather and Water*

GE Supreme Silicone caulks are making life even easier for consumers and pros with shorter wait times and outstanding durability. In as little as 30 minutes, these caulks are ready for water exposure to get the job done faster, save time and money, and still provide the same reliable protection.

GE Kitchen & Bath Supreme Silicone

- 30-minute shower-ready
- 10-year mold-free product protection
- 100% Silicone



SKU	Color	Size	Pack	UPC Code
M90006-30	Clear	Caulker	12	077027900064
M90007-30	White	Caulker	12	077027900071
M90010	Almond	Caulker	12	077027900101
M90011	White	Squeeze	12	077027900118

GE Window & Door Supreme Silicone

- 30-minute rain-ready
- Extra flex – for extreme joint movement, harsh weather and temperature fluctuations
- 100% Silicone



SKU	Color	Size	Pack	UPC Code
M90016-30	Clear	Caulker	12	077027900163
M90015-30	White	Caulker	12	077027900156

To order call Momentive Customer Service toll-free at 866-275-4372. Fax orders to Customer Service at 614-986-2489. For additional information visit www.gesalants.com.

GE Silicone II* *Convenient, Protective and Hard-working*

For decades, GE Silicone II caulk has been working hard. The combination of speed and durability is of the utmost importance to consumers and pros alike. Some products may offer one or the other, but Silicone II delivers on both - permanently. Because 100% silicone is waterproof, flexible and shrink-/crack-proof, it will never crack, crumble or degrade, so the benefits last.

GE Silicone II Kitchen & Bath

- 3-hour shower-ready
- 5-year mold-free product protection
- 100% Silicone

We will be using this version.

SKU	Color	Size	Pack	UPC Code
GE5040	Clear	Caulker	12	077027050400
GE5070	White	Caulker	12	077027050707
GE5060	Almond	Caulker	12	077027050608
GE284	Clear	Squeeze	12	077027002843
GE281	White	Squeeze	12	077027002812
GE286	Almond	Squeeze	12	077027002867



GE Silicone II Window & Door

- 3-hour rain-ready
- Sun-/freeze-proof
- 100% Silicone

SKU	Color	Size	Pack	UPC Code
GE5000	Clear	Caulker	12	077027050004
GE5010	White	Caulker	12	077027050103
GE5030	Black	Caulker	12	077027050301
GE5080	Brown	Caulker	12	077027050806
GE50.08	Light Gray	Caulker	12	077027050097
GE5096	Almond	Caulker	12	077027050967
GE500	Clear	Squeeze	12	077027005004



GE Silicone II Paintable Silicone

- 3-hour rain-ready
- 30-minute paint-ready



SKU	Color	Size
GE7000	White	Caulker

GE Silicone II Specialty Caulk

- 3-hour rain-ready
- Sun-/freeze-proof

SKU	Color	Size
GE50G.01	Gutter & Flashing - Clear	Caulker
GE5020	Concrete & Masonry - Light Gray	Caulker
GE5050	Aluminum & Metal - Metallic Gray	Caulker
GE285	Aluminum & Metal - Metallic Gray	Squeeze
GE283	Gasket & Seal - Black	Squeeze



GE Silicone I* *Permanently Waterproof*

Caulk that keeps water out is a necessity in areas that will be exposed to water, such as windows, doors, kitchens and baths, so a permanently waterproof caulk is needed. Silicone I is 100% silicone, meaning it provides excellent adhesion and durability and is impervious to water.

GE Silicone I Kitchen & Bath

- Permanently Waterproof
- 100% Silicone

SKU	Color	Size	Pack	UPC Code
GE612	Clear	Caulker	12	077027006124
GE712	White	Caulker	12	077027007121
GE360	Clear	Squeeze	12	077027003604



GE Silicone I Window & Door

- Permanently Weatherproof
- 100% Silicone

SKU	Color	Size	Pack	UPC Code
GE012A	Clear	Caulker	12	077027000122
GE112A	White	Caulker	12	077027001129
GE312A	Black	Caulker	12	077027003123
GE412A	Bronze	Caulker	12	077027004120



Advantage* *All-Purpose Silicone*

07 92 16 Rigid Joint Sealants (GE Silicone II)

SKU	Color	Size	Pack	UPC Code
M60.01	Clear	Caulker	12	077027000603
M60.02	White	Caulker	12	077027000602

See individual product labels for additional information, including specific warranty terms and product application conditions, including temperature and humidity, and/or other use requirements or specifications with respect to our claims.

DIVISION 08 OPENINGS

08 01 14	Door Hardware Lever 1, 2, 3
08 01 71	Front Door Hardware
08 14 00	Wood Doors
08 36 16	Interior Doors
08 51 13	Aluminum Windows (Awning Windows)
08 62 50	Tubular Daylighting Device

08 01 14 DOOR HARDWARE - LEVER

Schlage | Model # F170 LAT 619 | Internet # 203730192

Latitude SATIN CHROME Dummy Lever

\$12.70 /each

FINISH: SATIN CHROME



QTY: 2



SPECIFICATIONS

■ DIMENSIONS

Assembled Depth (in.)	2.6 in	Lever housing height (in.)	2.8
Assembled Height (in.)	2.8 in	Lever housing width (in.)	4.9
Assembled Width (in.)	4.9 in	Maximum door thickness (in.)	1.8
Cross bore diameter (in.)	1	Projection (in.)	2.6
Lever grip length (in.)	3.9		

■ DETAILS

Application Type	Dummy	Lever material	Zinc
Commercial/Residential	Residential	Lever style	Straight
Door Handing	Universal/Reversible	Lock Type	Unkeyed
Door Locks & Knobs Product Type	Levers	Material	Other
Finish	SATIN CHROME	Minimum door thickness (in.)	1.3
Hardware Finish Family		Product Weight (lb.)	1 lb
Hardware Included	Yes	Returnable	90-Day
Interior/Exterior	Interior	Security/ANSI Grade	N/A

Latitude SATIN CHROME Keyed Entry Lever**\$55.98** /each

SATIN CHROME

QTY: 2

**SPECIFICATIONS****■ DIMENSIONS**

Assembled Depth (in.)	2.375 in	Lever grip length (in.)	4.0
Assembled Height (in.)	2.75 in	Maximum door thickness (in.)	1.8
Assembled Width (in.)	5 in	Projection (in.)	2.3
Bore hole diameter (in.)	1	Strike height (in.)	2.3
Cross bore diameter (in.)	2.125	Strike width (in.)	0.9
Housing height (in.)	2.8	Throw length (in.)	0.4
Housing width (in.)	4.8		

■ DETAILS

Application Type	Entry	Lever material	Brass
Backset size (in.)	Adjustable	Lever style	Straight
Commercial/Residential	Residential	Lock Type	Keyed Entry
Door Handing	Universal/Reversible	Material	Solid Brass
Door Locks & Knobs Product Type	Levers	Minimum door thickness (in.)	1.4
Finish	Satin Nickel	Product Weight (lb.)	1.6 lb
Hardware Finish Family	Nickel	Security/ANSI Grade	ANSI Grade II (Better)
Hardware Included	Yes	Strike	Round corner
Interior/Exterior	Interior/Exterior	Total number of keys included	2

08 01 14 DOOR HARDWARE - LEVER 3

Schlage | Model # F40 LAT 619 | Internet # 203730166 | Store SKU # 995329

Latitude SATIN CHROME Bed and Bath Lever

\$34.98 /each

FINISH: SATIN CHROME



QTY: 4



SPECIFICATIONS

DIMENSIONS

Assembled Depth (in.)	2.6 in	Lever housing width (in.)	4.9
Assembled Height (in.)	2.8 in	Maximum door thickness (in.)	1.8
Assembled Width (in.)	4.9 in	Projection (in.)	2.6
Cross bore diameter (in.)	1	Strike height (in.)	2.3
Lever grip length (in.)	3.9	Strike width (in.)	0.9
Lever housing height (in.)	2.8	Throw length (in.)	0.4

DETAILS

Application Type	Privacy	Lever style	Straight
Commercial/Residential	Residential	Lock Type	Unkeyed
Door Handing	Universal/Reversible	Material	Other
Door Locks & Knobs Product Type	Levers	Minimum door thickness (in.)	1.3
Finish	SATIN CHROME	Product Weight (lb.)	1.6 lb
Hardware Finish Family		Returnable	90-Day
Hardware Included	Yes	Security/ANSI Grade	ANSI Grade II (Better)
Interior/Exterior	Interior	Strike	Round corner
Lever material	Zinc		

08 01 71 FRONT DOOR HARDWARE

Schlage | Model # FE469NX LAT 619 CEN | Internet # 204793914

Connect Century Satin Nickel Touchscreen Deadbolt with Alarm and Handle set with Latitude Interior Lever



\$299.99 /each QTY: 2

- Keyless convenience
- Can be managed remotely
- Fits most residential door preps

SPECIFICATIONS

DIMENSIONS

Assembled Depth (in.)	4.5 in	Assembled back width (in.)	3
Assembled Height (in.)	21.75 in	Assembled front depth (in.)	4.5
Assembled Width (in.)	5.125 in	Assembled front height (in.)	9.25
Assembled back depth (in.)	1.875	Assembled front width (in.)	5.125
Assembled back height (in.)	8.25		

DETAILS

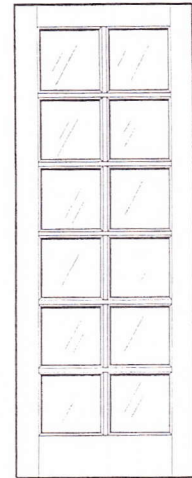
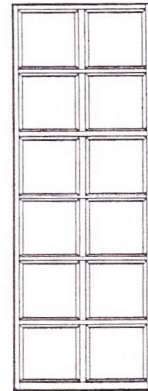
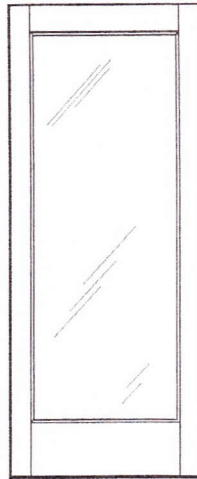
Alarm	Yes	Interior/Exterior	Interior/Exterior
Automatic relocking	Yes	LED backlight	Yes
Batteries Included	Yes	Low battery indicator light	Yes
Battery Type Required	AA	Material	Other
Commercial Hardware Type	Cylinders	Maximum user codes	30
Commercial/Residential	Residential	Number of Batteries Required	4
Door Handing	Universal/Reversible	Number of Buttons	12
Door Locks & Knobs Product Type	Deadbolts	Product Weight (lb.)	9.25 lb
Electronic	Yes	Returnable	90-Day
Finish	Satin Nickel	Security/ANSI Grade	ANSI Grade I (Best)
Hardware Finish Family	Nickel	Timed entry allowance (sec.)	20
Hardware Included	Yes		

ABS - AMERICAN BUILDING SUPPLY, INC.

08 14 00 WOOD DOOR

8/0 HIGH

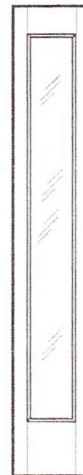
Specie : Douglas Fir
 Thickness : 1-3/4"
 Stiles : 5-1/2" Ultra Block
 Top Rail : 4-9/16"
 Bottom Rail : 9-3/8"
 Glass : 3/4" IG
 All measurements
 include sticking



SIZE	7002	12 LIGHT	7012 WLO
	ULTRA BLOCK	SNAP-IN-GRILL	ULTRA BLOCK
2/0 x 8/0	\$ 671.00		
2/4 x 8/0	\$ 709.00		
2/6 x 8/0	\$ 709.00		\$ 1,128.00
2/8 x 8/0	\$ 709.00		
3/0 x 8/0	\$ 709.00 ✓	\$ 259.00	\$ 1,128.00

084

Specie : Douglas Fir
 Thickness : 1-3/4"
 Stiles : 2-7/8"
 Top Rail : 4-9/16"
 Bottom Rail : 9-7/8"
 Glass : 3/4" IG
 All measurements
 include sticking



SIZE	7701
1/2 x 8/0-1/2	\$ 516.00

085

Sacramento
 Phone: 916-379-4200
 Fax: 916-379-4285

Simpson

M·A·S·T·E·R·M·A·R·K[®]
 HANDCRAFTED DOORS FOR AMERICA'S FINE HOMES

3/30/15
 Simpson Exterior S&R
 Page 43

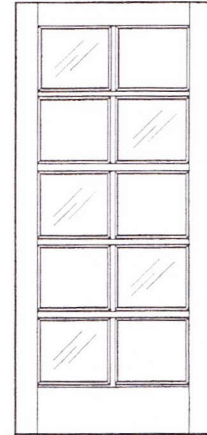
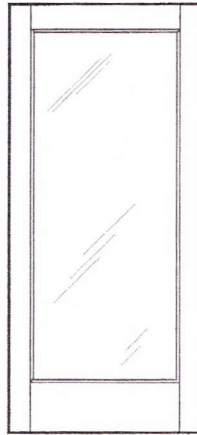
ABS - AMERICAN BUILDING SUPPLY, INC.

08 14 00 WOOD DOOR

WATER BARRIER THERMAL DOORS



Specie : Douglas Fir/MDO
 Thickness : 1-3/4"
 Stiles : 5-1/2" Ultra Block
 Top Rail : 4-9/16"
 Bottom Rail : 9-3/8"
 Glass : 3/4" IG
 SDL Bar : 7/8" (37010)
 All measurements
 include sticking

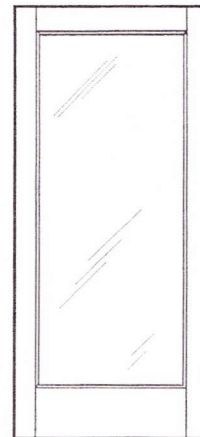
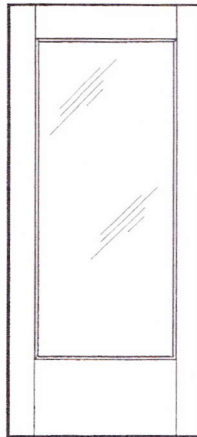


SIZE	7002	7002	37010
	WATER BARRIER	WATER BAR, LOW E	WATER BARRIER, LOW E SIMULATED DIVIDED LITE
2/6 x 6/8	\$ 631.00	\$ 782.00	\$ 1,158.00
2/8 x 6/8	\$ 631.00	\$ 782.00	\$ 1,158.00
3/0 x 6/8	\$ 631.00	\$ 782.00	\$ 1,158.00

050

ADA THERMAL DOORS

Specie : Douglas Fir
 Thickness : 1-3/4"
 Stiles : 5-1/2"
 Top Rail : 6-9/16"
 Bottom Rail : 7037 - 18-1/2"
 7002 ADA - 11-3/8"
 Glass : 3/4" IG
 All measurements
 include sticking



SIZE	7037	7002 ADA ULTRA BLOCK
3/0 x 6/8	\$ 675.00	\$ 532.00 ✓
2/6 X 7/0		\$ 532.00
2/8 X 7/0		\$ 532.00
3/0 x 7/0	\$ 715.00	\$ 532.00

095

Sacramento
 Phone: 916-379-4200
 Fax: 916-379-4285

Simpson
M·A·S·T·E·R·M·A·R·K
 HANDCRAFTED DOORS FOR AMERICA'S FINE HOMES

3/30/15
 Simpson Exterior S&R
 Page 23

ABS - AMERICAN BUILDING SUPPLY, INC.

08 36 16 INTERIOR DOORS

UNFINISHED FLUSH DOORS

1-3/8 SOLID CORE	LAUAN (SE)	BIRCH (SE)	RED OAK (SE)
1/6 x 6/8		\$ 147.90	
1/8 x 6/8		\$ 148.00	
1/10 x 6/8		\$ 148.00	
2/0 x 6/8	\$ 118.60	\$ 148.00	\$ 165.80
2/2 x 6/8		\$ 156.60	
2/4 x 6/8	\$ 140.40	\$ 156.60	\$ 174.50
2/6 x 6/8	\$ 151.30	\$ 160.20	\$ 178.00
2/8 x 6/8	\$ 156.80	\$ 167.20	\$ 185.20
2/10 x 6/8		\$ 179.70	
3/0 x 6/8	\$ 173.10	\$ 179.70	\$ 197.40
2/6 x 7/0		\$ 192.20	
2/8 x 7/0		\$ 201.50	
3/0 x 7/0		\$ 214.10	
2/0 x 8/0		\$ 229.00	
2/4 x 8/0		\$ 239.10	
2/6 x 8/0		\$ 243.20	
2/8 x 8/0		\$ 251.30	
3/0 x 8/0		\$ 265.40	

1-3/4 SOLID CORE (20 MIN RATED)	LAUAN (SE)	BIRCH (SE)	RED OAK (SE)
2/0 x 6/8		\$ 158.40	
2/4 x 6/8		\$ 167.20	
2/6 x 6/8	\$ 155.70	\$ 170.70	\$ 191.10
2/8 x 6/8	\$ 161.10	\$ 177.90	\$ 198.40
2/10 x 6/8		\$ 190.40	
3/0 x 6/8	\$ 178.10	• \$ 190.40 ✓	• \$ 211.00
3/6 x 6/8		\$ 251.00	
4/0 x 6/8		\$ 258.20	
2/0 x 7/0		\$ 169.80	
2/4 x 7/0		\$ 178.70	
2/6 x 7/0		\$ 182.30	\$ 203.90
2/8 x 7/0		\$ 190.70	\$ 211.40
3/0 x 7/0	\$ 199.50	• \$ 202.10	• \$ 224.20
3/6 x 7/0		\$ 263.00	
4/0 x 7/0		\$ 270.20	
3/0 x 8/0		• \$ 249.80	• \$ 269.80

• AVAILABLE IN BEVEL 2 SIDES 3/16" UNDER





003

ADD FOR TYPE 1 GLUE ON FACE TO CORE (NO EXTERIOR WARRANTY)

\$ 3.00 NET

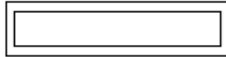
Sacramento
 Phone: 916-379-4200
 Fax: 916-379-4285

3/2/15
 Flush Wood Doors
 Page 3

LINE NO.	LOCATION SIZE INFO	BOOK CODE DESCRIPTION	NET UNIT PRICE	QTY	EXTENDED PRICE
Line-1	BEDROOM 2 Rough Opening: 18 X 72	Frame Size: 17 1/2 x 71 1/2 Actual Size: 17 1/2 -in X 71 1/2 -in Premium Aluminum Fixed Window Nail Fin (1 3/8" setback), Clear Class II Ext/Clear Class II Int , Low-E 366 Clear Argon 0 - 3500 feet Crate for Shipping US National-AAMA PG50, DP+50/-50, PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW			
					
	Viewed from Exterior. Scale: 1/4" = 1'				
			\$242.24	1	\$242.24
Line-2	BEDROOM 1 Rough Opening: 16 X 72	Frame Size: 15 1/2 x 71 1/2 Actual Size: 15 1/2 -in X 71 1/2 -in Premium Aluminum Fixed Window Nail Fin (1 3/8" setback), Clear Class II Ext/Clear Class II Int , Low-E 366 Clear Argon 0 - 3500 feet Crate for Shipping US National-AAMA PG50, DP+50/-50, PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW			
					
	Viewed from Exterior. Scale: 1/4" = 1'				
			\$242.24	1	\$242.24
Line-3	LIVING BEDROOMS,KITCHEN Rough Opening: 30 X 72	VSH3072 Frame Size: 29 1/2 x 71 1/2 Actual Size: 29 1/2 -in X 71 1/2 -in Premium Aluminum Single Hung Window 1" Nail Fin Clear Class II Ext/Clear Class II Int , Vent Height = 36 , Low-E 366 Clear Argon 0 - 3500 feet Standard Screen with Fiberglass Mesh, Silver Interior Hardware Cam Lock(s), 1 Lock, *Meets 5.0 sqft Egress (1st Floor)*, Crate for Shipping US National-AAMA PG20, DP+20/-20, PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW			
					
	Viewed from Exterior. Scale: 1/4" = 1'				
			\$365.24	6	\$2,191.44
Line-4	LIVING BEDROOMS,KITCHEN Rough Opening: 30 X 72	VSH3072 Frame Size: 29 1/2 x 71 1/2 Actual Size: 29 1/2 -in X 71 1/2 -in Premium Aluminum Single Hung Window 1" Nail Fin Clear Class II Ext/Clear Class II Int , Vent Height = 36 , Low-E 366 Clear Tempered , Argon 0 - 3500 feet Standard Screen with Fiberglass Mesh, Silver Interior Hardware Cam Lock(s), 1 Lock, *Meets 5.0 sqft Egress (1st Floor)*, Crate for Shipping US National-AAMA PG20, DP+20/-20, PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW			
					
	Viewed from Exterior. Scale: 1/4" = 1'				
			\$447.45	1	\$447.45

Line-5 KITCHEN

Rough Opening: 72 X 18



Viewed from Exterior. Scale: 1/4" = 1'

VFW7218

Frame Size: 71 1/2 x 17 1/2

Actual Size: 71 1/2 -in X 17 1/2 -in

Premium Aluminum Fixed Window 1" Nail Fin Clear Class II Ext/Clear

Class II Int ,

Low-E 366 Clear Argon 0 - 3500 feet

Crate for Shipping

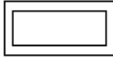
US National-AAMA PG50, DP+50/-50,

PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW

\$243.46 1 \$243.46

Line-6 BATHROOM

Rough Opening: 36 X 18



Viewed from Exterior. Scale: 1/4" = 1'

VFW3618

Frame Size: 35 1/2 x 17 1/2

Actual Size: 35 1/2 -in X 17 1/2 -in

Premium Aluminum Fixed Window 1" Nail Fin Clear Class II Ext/Clear

Class II Int ,

Low-E 366 Clear Argon 0 - 3500 feet

Crate for Shipping

US National-AAMA PG50, DP+50/-50,

PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW

\$169.34 1 \$169.34

Line-7

Crate & Freight from Vista to Davis

\$575.00 1 \$575.00

Line-3 LIVING BEDROOMS,KITCHEN

Rough Opening: 30 X 72



Viewed from Exterior. Scale: 1/4" = 1'

VSH3072

Frame Size: 29 1/2 x 71 1/2

Actual Size: 29 1/2 -in X 71 1/2 -in

Premium Aluminum Single Hung Window 1" Nail Fin Clear Class II

Ext/Clear Class II Int , Vent Height = 36 ,

Low-E 366 Clear Argon 0 - 3500 feet

Standard Screen with Fiberglass Mesh,

Silver Interior Hardware Cam Lock(s), 1 Lock, *Meets 5.0 sqft Egress

(1st Floor)*,

Crate for Shipping

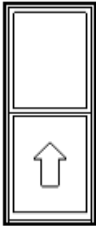
US National-AAMA PG20, DP+20/-20,

PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW

\$365.24 6 \$2,191.44

Line-4 LIVING BEDROOMS,KITCHEN

Rough Opening: 30 X 72



Viewed from Exterior. Scale: 1/4" = 1'

VSH3072

Frame Size: 29 1/2 x 71 1/2

Actual Size: 29 1/2 -in X 71 1/2 -in

Premium Aluminum Single Hung Window 1" Nail Fin Clear Class II

Ext/Clear Class II Int , Vent Height = 36 ,

Low-E 366 Clear Tempered , Argon 0 - 3500 feet

Standard Screen with Fiberglass Mesh,

Silver Interior Hardware Cam Lock(s), 1 Lock, *Meets 5.0 sqft Egress

(1st Floor)*,

Crate for Shipping

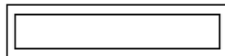
US National-AAMA PG20, DP+20/-20,

PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW

\$447.45 1 \$447.45

Line-5 KITCHEN

Rough Opening: 72 X 18



Viewed from Exterior. Scale: 1/4" = 1'

VFW7218

Frame Size: 71 1/2 x 17 1/2

Actual Size: 71 1/2 -in X 17 1/2 -in

Premium Aluminum Fixed Window 1" Nail Fin Clear Class II Ext/Clear

Class II Int ,

Low-E 366 Clear Argon 0 - 3500 feet

Crate for Shipping

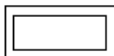
US National-AAMA PG50, DP+50/-50,

PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW

\$243.46 1 \$243.46

Line-6 BATHROOM

Rough Opening: 36 X 18



Viewed from Exterior. Scale: 1/4" = 1'

VFW3618

Frame Size: 35 1/2 x 17 1/2

Actual Size: 35 1/2 -in X 17 1/2 -in

Premium Aluminum Fixed Window 1" Nail Fin Clear Class II Ext/Clear

Class II Int ,

Low-E 366 Clear Argon 0 - 3500 feet

Crate for Shipping

US National-AAMA PG50, DP+50/-50,

PEV 2015.2.0.1279/PDV 6.342 (04/21/15) SW

\$169.34 1 \$169.34

Line-7

Crate & Freight from Vista to Davis

\$575.00 1 \$575.00



SECTION 08625

TUBULAR DAYLIGHTING DEVICE

Display hidden notes to specifier. (Don't know how? [Click Here](#))

**** NOTE TO SPECIFIER ** Solatube International, Inc.; residential and commercial tubular daylighting devices.**

This section is based on the products of Solatube International, Inc., which is located at:

Solatube International
2210 Oak Ridge Way
Vista, CA 92081-8341
Toll Free Tel: 888-765-2882
Tel: (760) 477-1120
Fax: (760) 597-4488
Email: commsales@solatube.com
Web: www.solatube.com
[\[Click Here\]](#) for additional information.

Solatube Daylighting Systems (DS) use advanced optics to significantly improve the way daylight is harnessed. Solatube International has added breakthrough technology throughout the system to capture more sunlight on the roof, transfer more sunlight through the tubing and effectively diffuse the light in the building interior. Solatube Daylighting Systems set performance standards never seen before. Highly effective and simple to install, these models can transform dark interior rooms and light more expansive spaces when used in multiples, creating a unique architectural effect.

Solatube Daylighting Systems can accommodate virtually any ceiling configuration including suspended ceilings, finished drywall ceilings, and open ceilings making them appropriate for a wide variety of commercial and residential applications, including office, retail, warehouse, industrial, education, healthcare facilities, multifamily housing, and custom homes. These Daylighting Systems provide significant energy savings, improved environments, and high-quality lighting.

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tubular daylighting device, consisting of roof dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.

**** NOTE TO SPECIFIER ** Delete the following paragraph if no daylight dimmers, security bars, light fixtures or ventilation accessories are specified.**

- B. Accessories.

1.2 RELATED SECTIONS

**** NOTE TO SPECIFIER ** Delete any sections below not relevant to this project; add others as required.**

- A. Section 07311 - Asphalt Shingles: Flashing of skylight base.
- B. Section 07320 - Roof Tiles: Flashing of skylight base.
- C. Section 07510 - Built-Up Bituminous Roofing: Flashing of skylight base.
- D. Section 07530 - Electrometric Membrane Roofing: Flashing of skylight base.
- E. Section 07550 - Modified Bituminous Membrane Roofing: Flashing of skylight base.
- F. Section 07600 – Flashing: Metal flashings.
- G. Section 08620 - Unit Skylights: Skylights without reflective tube.
- H. Section 08630 - Metal Framed Skylights.
- I. Section 15810 - Ducts: Fan vent duct and connections.
- J. Section 16150 - Equipment Wiring: Electrical connections.
- K. Section 16500 – Lighting Equipment and Controls: Light bulbs and lamps.

1.3 REFERENCES

**** NOTE TO SPECIFIER ** Delete references from the list below that are not actually required by the text of the edited section.**

- A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008a.
- C. ASTM A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process; 2006.
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process; 2007.
- E. ASTM A792/A 792M – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
- F. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.
- G. ASTM E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System; 2006.
- H. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors; 2002.

- I. ASTM E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000.
- J. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
- K. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane
- L. ASTM D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position; 2006.
- M. ASTM D-1929 - Test Method for Ignition Properties of Plastics; 1996 (2001).
- N. UL 181 - Factory Made Air Ducts and Air Connectors
- O. ICC AC-16 - Acceptance Criteria for Plastic Skylights; 2008.
- P. Florida Building Code TAS 201 – Impact Test Procedures.
- Q. Florida Building Code TAS 202 – Criteria for Testing Impact and Non Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
- R. Florida Building Code TAS 203 – Criteria for Testing Products Subject to Cyclic Wind Pressure Loading

1.4 PERFORMANCE REQUIREMENTS

- A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:
 - 1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
 - 2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.
 - 3. Uniform Load Test:

**** NOTE TO SPECIFIER ** Select the following Paragraph for use with Solatube Model 160 DS or 290 DS. Delete if not applicable.**

- a. No breakage, permanent damage to fasteners, hardware parts, or damage to make system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 60 psf (2.87 kPa) in accordance with ICC AC-16 Section A, or Negative Load of 70 psf (3.35 kPa) if tested per ICC AC-16 Section B.
- b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

**** NOTE TO SPECIFIER ** Select the following Paragraphs for use with Solatube Models 750 DS-O and 750 DS-C with Polycarbonate Inner Dome Glazing or Models 290 DS and 160 DS with Acrylic Inner Dome Glazing. Delete if not applicable.**

4. Hurricane Resistance:
 - a. Meets Florida Building Code TAS, 201, TAS, 202 and TAS 203 for Impact and non impact components.
 - b. Meets ASTM E 1886 and ASTM E1996 for missile and cyclic pressure differential testing.
5. Fire Testing:
 - a. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the 2006 International Building Code.
 - b. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.
 - c. Smoke Density - Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C.
 - d. Rate of Burn and/or Extent - Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
 - e. Rate of Burn and/or Extent - Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.
- D. Verification Samples: As requested by Architect.
- E. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

**** NOTE TO SPECIFIER ** Delete the following paragraphs if LEED is not applicable. Several opportunities exist for LEED credits when using daylighting systems specified. Contact Solatube International, Inc. for additional information.**

- F. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
 1. List of Daylight Credits available for the products specified.
 2. Data on Energy Optimization Performance Credits for the products specified.
 3. Data on Regional Credits which may be available for the project location. (LEED 2.1)
 4. Data on Perimeter and Non-Perimeter Controllability of Systems for use of Daylight Dimmer option with the products specified.
 5. Data on potential Innovation in Design Credits which may be available for the innovative use of the products specified.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

- A. Daylighting Device: Manufacturer's standard warranty for 10 years.

**** NOTE TO SPECIFIER ** Delete if optional electric components are not required.**

- B. Electrical Parts: Manufacturer's standard warranty for 5 years, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. ASD. Tel. Toll Free: 888-765-2882. Tel: (760) 477-1120. Fax: (760) 597-4488. Email: commsales@solatube.com. Web: www.solatube.com.

**** NOTE TO SPECIFIER ** Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.**

- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.
- D. General Contractor will bear responsibility for costs associated with substitution review.
- E. Requests for substitutions will be considered provided a lighting layout with photometric data is supplied to demonstrate light levels will meet original design intent.

2.2 TUBULAR DAYLIGHTING DEVICES

- A. Tubular Daylighting Devices General : Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

**** NOTE TO SPECIFIER ** Brighten Up Series Solatube Model 160 DS used for daylighting systems with suspended or hard ceilings.**

- B. Brighten Up Series: Solatube Model 160 DS, 10 Inch (250 mm) Daylighting System.
 - 1. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
 - a. Outer Dome Glazing: Type DA, 0.125 inch (3 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
 - b. Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.

**** NOTE TO SPECIFIER ** Select the following paragraph if required. Delete if not required. Acrylic Shock Inner Dome meets Florida Building Code High Velocity Wind Zone and Texas Department of Insurance Impact Resistant zone requirements. Use Shock Inner Domes only in high velocity wind zones.**

- c. Optional Shock Inner Dome Glazing: Type DI, 0.115 inch (2.9 mm) minimum thickness classified as CC1 material. High impact injection molded acrylic required for high velocity wind zones.
 - d. LightTracker Reflector: Aluminum sheet, thickness 0.015 inch (0.4 mm) with Spectralight Infinity. Positioned in dome to capture low angle sunlight.
 - 2. Flashing Base: One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube.
 - a. Base Material: Sheet steel, corrosion resistant, meeting ASTM A 653/A 653M or ASTM A 463/A 463M or ASTM A792/A 792M, 0.028 inch (0.7 mm) plus or minus .006 inch (.015 mm) thick.

**** NOTE TO SPECIFIER ** Select one or more of the following flashing paragraphs and delete those not required. Steel bases are available both flat and pitched. For a different roof slope use the base that is the closest fit but be aware that the skylight dome will not be mounted precisely level.**

- b. Base Flat: Flat Type F4, no pitch 4 inches (102 mm) high.
 - c. Base Flat: Flat Type F6, no pitch 6 inches (152 mm) high.
 - d. Base Pitched: Pitched Type FP, 22.5 degrees slope from horizontal, 4 inches (102 mm) high.
 - e. Tile Roof No Pitch: No Pitch Type FT, 4 inches (102 mm) high. . Tile Roof Counter-Flashing: corrugated aluminum 1100-0, 0.020 inch (.508 mm).
 - f. Tile Roof Pitched: Pitched Type FPT, 22.5 degrees slope from horizontal, 4 inches (102 mm) high. . Tile Roof Counter-Flashing: corrugated aluminum 1100-0, 0.020 inch (.508 mm).

**** NOTE TO SPECIFIER ** The following flashing paragraphs are optional. Select those required and delete those not required. Flashing insulator is intended to seal the roof opening and prevent condensation forming on the flashing interior from exposure to humid air in unventilated spaces. Metal roof flashing kit is available for sealing base flat or pitched flashing specified above.**

- g. Flashing Insulator: Type F1. Thermal isolation material for use under flashing.
 - h. Metal Roof Flashing Kit: Type MR. Includes Butyl tape, flashing screws, speed nuts, corner washers and polyurethane sealant.

**** NOTE TO SPECIFIER ** Select the following dome edge protection band paragraph when roof is fire rated. Delete if not required.**

- i. Dome Edge Protection Band: Type PB, For fire rated roofs. Aluminized steel. Nominal thickness of 0.028 inches (0.7 mm).

**** NOTE TO SPECIFIER ** Select one of the following turret extension paragraphs and delete those not required. If more than one size is required indicate requirements on the Drawings.**

3. Roof Flashing Turret Extensions: Provide manufacturer's standard extensions for applications requiring:
 - a. Type T2: Additional lengths of 2 inches (50 mm) extension.
 - b. Type T4: Additional lengths of 4 inches (100 mm) extension.
 - c. Type T12: Additional lengths of 12 inches (300 mm) extension.
 - d. Type T24: Additional lengths of 24 inches (600 mm) extension.
 - e. Type T36: Additional lengths of 36 inches (900 mm) extension.
 - f. Type T48: Additional lengths of 48 inches (1200 mm) extension.
4. Tube Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact acrylic; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.
5. Reflective Extension Tube: Aluminum sheet, thickness 0.015 inch (0.4 mm).
 - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 80.2 percent.
 - b. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308.
 - c. Tube Diameter: Approximately 10 inches (250 mm).
6. Reflective 30 degree Adjustable tube: Aluminum sheet, thickness .015 inch (0.4 mm)
 - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 80.2 percent.

**** NOTE TO SPECIFIER ** The following paragraph is optional. Delete if not required.**

7. Reflective 90 degree Adjustable tube: Aluminum sheet, thickness .018 inch (0.5 mm)
 - a. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface Visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum (400 nm to 2500 nm) less than 80.2 percent.
 - b. Extension Tube Angle Adapter: Provide manufacturer's standard adaptors for applications requiring:
 - 1) Type A1 one 0 to 90 degree extension tube angle adapter.
 - 2) Type A2 two 0 to 90 degree extension tube angle adapters.
8. Ceiling Ring: Injection molded, impact resistant acrylic. Nominal thickness is 0.110 inches (2.8 mm).
9. Dual Glazed Diffuser Assembly:

**** NOTE TO SPECIFIER ** Select one of the following lower glazing diffuser or decorative fixture lens paragraphs and delete those not required.**

- a. Lower glazing with integral injection molded acrylic Dress Ring classified as CC2 material. Nominal thickness is 0.110 inches (2.8 mm):
 - 1) Classic Vusion Diffuser: Molded acrylic plastic classified as CC2 material (nominal thickness 0.090 inches (2.29 mm) with injection molded acrylic Diffuser Trim Ring. Type L4.
 - 2) Classic OptiView (Fresnel Lens) Diffuser: Molded polycarbonate plastic classified as CC1 material, nominal thickness 0.022

inches (0.61 mm) with injection molded acrylic Diffuser Trim Ring. Type L1.

- 3) JustFrost Decorative Fixture: Full-tempered glass lens (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners. Type L9.
 - 4) TierDrop Decorative Fixture: Three layers of full-tempered frosted glass lens (nominal thickness is 0.16 inches (4 mm)). Bottom layer is continuous with two stepped full-tempered glass rings on top and decorative metal fasteners. Type L10.
 - 5) OptiView Decorative Fixture: Molded polycarbonate plastic Fresnel Lens classified as CC1 material (nominal thickness is 0.022 inches (0.61 mm)) with full-tempered frosted glass bezel (nominal thickness is 0.16 inches (4 mm)), and decorative metal fasteners. Type L11.
- b. Upper glazing: PET GAG plastic with EPDM low density sponge seal to minimize condensation and bug, dirt, and air infiltration per ASTM E283. The nominal thickness is 0.039 inches (0.99 mm).

**** NOTE TO SPECIFIER ** Select one of the following effect lens and delete those not required. The Natural Effect Lens provides brilliant white natural daylight. The Softening Effect Lens creates a subtle, softer natural lighting effect.**

- 1) Natural Effect Lens: Type LN.
- 2) Softening Effect Lens: Type LS.

**** NOTE TO SPECIFIER ** The following accessories are optional. Select those required and delete those not required.**

10. Accessories:
 - a. Lighting Fixture for 160 DS Model: Bracket mounted inside system just above diffuser; UL listed.

**** NOTE TO SPECIFIER ** Delete one of the following two paragraphs. Note that lamps are not provided with fixture.**

- 1) Universal: Type INC, for one 23 W maximum CFL, maximum total length 4-3/4 inch, ceramic screw-in lamp holder, medium base, one lamp.
- 2) Compact Fluorescent: Type CFL, dedicated compact fluorescent fixture, for one 26 W, 4-pin lamp.
- 3) Electrical Requirements: 110 V, 15 amp GFCI circuit for damp and wet conditions.

**** NOTE TO SPECIFIER ** Select the following dimmer control paragraph for use with Solatube Model 160-DS only. Delete if not applicable.**

- b. Local Dimmer Control utilizing a butterfly baffle design of Spectralight Infinity reflective material to minimize shadowing when in use. Provided with dimmer switch and cable.
 - 1) Daylight Dimmer: Type D Electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; Maximum current draw of 50 ma per unit; controlled by low voltage, series Type T02: circuited, 4 conductor, 22 gauge cable; providing daylight output between 2 and 100 percent.
 - 2) Switch: Type SW, Manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer. Note: A maximum of 10 units can be connected to one switch.
 - 3) Cable: Type CA, Two conductor, 22 gauge, low voltage cable (500 ft.) for multiple unit DC connections.
- c. Wire Suspension Kit: Type E, Use the wire suspension kit when additional bracing to the structure is required,

**** NOTE TO SPECIFIER ** Exhaust duct is not supplied by Solatube.**

- d. Exhaust Fan: Type VEN, permanently lubricated in-line fan motor, 110 cfm (52 L/s) capacity.
 - 1) Exhaust Duct: Flexible, Class 1, in accordance with UL 181. Provide as specified in Section 15810.
 - 2) Air Intake trim: Injection molded impact resistance acrylic with trim to fit installation conditions.

**** NOTE TO SPECIFIER ** Vent cap is optional, delete if not required.**

- 3) Exhaust Vent Cap: Low-profile roof cap Type RV.

**** NOTE TO SPECIFIER ** Delete one of the following two paragraphs.**

- 4) Electrical Requirements: 115 V; install fan on same switch as internal light fixture.
- 5) Electrical Requirements: 115 V; wall switch.

2.3 ACCESSORIES

- A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.
- B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.
- C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- 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.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

3.4 PROTECTION

- A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

DIVISION 09 FINISHES

09 29 00	Gypsum Board
09 64 53	Resilient Wood Flooring Assemblies
09 65 13.13	Baseboard
09 91 23	Interior Paint

Gold Bond[®] BRAND High Strength LITE[™] Gypsum Board

Description

Gold Bond[®] High Strength LITE[™] is a specialty gypsum board that is formulated to be 25% lighter than original 1/2" High Strength Gypsum Board. The result is a superior board that is lighter in weight, sag resistant and easier to handle.

High Strength LITE is encased in heavy, natural-finish, 100% recycled paper on the face and back sides. The face paper is folded around the long edges to reinforce and protect the core, and the ends are square-cut and finished smooth. For speed of installation, GridMarX guide marks are printed on the paper surface.

Long edges of the panels are tapered or square. Tapered edges allow joints to be reinforced, with ProForm[®] Joint Tape and concealed with ProForm[®] Ready Mix, Easy Finish Ready Mix or ProForm[®] Quick Set Setting Joint Compounds.

Basic Uses

High Strength LITE Gypsum Board can be used for walls and ceilings in non-fire rated single layer construction where framing members are spaced up to 24" o.c. Because it can be installed on both walls and ceilings, it eliminates the need for two different types of gypsum board on the job.

Features/Benefits

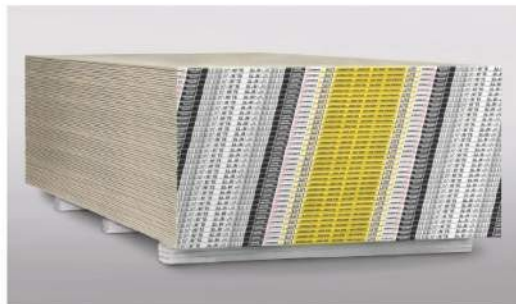
- 25% lighter than original 1/2" High Strength Gypsum Board.
- Can be used on walls and ceilings.
- Lighter weight results in easier handling.
- Excellent working properties including improved score and snap, reduced dust and improved strength to weight ratio.
- Excellent sag resistance. Test results show overall sag on tested assembly to be equivalent to 5/8" Type X gypsum board.
- GridMarX guide marks are printed on the paper surface allowing the installer to quickly identify fastener lines for stud and joist framing. GridMarX also assist with quick identification of nail/screw patterns.
- High Strength LITE Gypsum Board is GREENGUARD[®] Children & Schools[®] Certified for indoor air quality.
- GREENGUARD[®] Certified as a low-emitting material. Meets CHPS and CA Section 01350.



Technical Data

PHYSICAL PROPERTIES		
Thickness, nominal	1/2" Regular (12.7 mm)	
Width, nominal	4' (1219 mm)	54" (1372 mm)
Length, standard	8' (2438 mm)	12' (3657 mm)
	10' (3048 mm)	14' (4267 mm)
	12' (3657 mm)	
Weight, lbs./sq. ft., nominal	1/2" Regular 1.3 - 1.4	
Edges	Tapered	
Surface Burning Characteristics (per ASTM E 84)	Flame Spread: 15 Smoke Developed: 0	

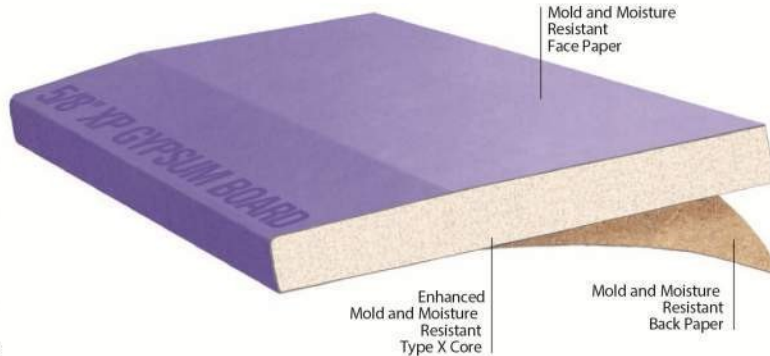
APPLICABLE STANDARDS AND REFERENCES	
ASTM C 1396	
ASTM C 840	
Gypsum Association GA-216	
Gypsum Association GA-214	
National Gypsum Company	Gypsum Construction Guide



Gold Bond[®] BRAND XP[®] Gypsum Board

Description

Gold Bond[®] XP[®] Gypsum Board was developed as an improved moisture resistant board offering the same advantages of traditional moisture resistant board with added mold resistance in the core and paper. XP Gypsum Board consists of a specially treated, fire resistant, gypsum core encased in a heavy, mold/mildew/moisture resistant, 100% recycled, PURPLE paper on the face side and a heavy mold/mildew/moisture resistant, 100% recycled, gray paper on the back side.



XP Gypsum Board was designed to provide extra protection against mold and mildew compared to standard wallboard products. The face paper is folded around the long edges to reinforce and protect the core, and the ends are square-cut and finished smooth. Long edges of the panels are tapered.

Tapered edges allow joints to be reinforced with ProForm[®] Joint Tape and concealed with ProForm[®] Ready Mix, EasyFinish Ready Mix or ProForm[®] Quick-Set[®] Joint Compounds.

For optimum mold and mildew performance, National Gypsum recommends ProForm[®] XP Ready Mix.

Gold Bond[®] XP Fire-Shield Gypsum Board features a Type X core to provide additional fire resistance ratings when used in tested systems.

Gold Bond[®] XP Fire-Shield C Gypsum Board Panels have a specially formulated Type X core to achieve superior performance when used in specific fire-rated assemblies where the weight and number of wallboard layers are a concern.

Features/Benefits

- Resists the growth of mold per ASTM G 21 with a score of 0, the best possible score.
- Resists the growth of mold per ASTM D 3273 with a score of 10, the best possible score.
- XP Gypsum Board is moisture resistant and can be used as a tile backerboard in dry areas or areas with limited water exposure such as toilet/sink areas and areas above tile in tubs and showers.
- Panels are for use in interior areas.
- UL Classified for fire resistance, surface burning characteristics and noncombustibility.
- Scores and snaps easily, no special handling requirements.
- Less than 5% water absorption per ASTM C 473.

Fire Resistance Ratings

Fire resistance ratings represent the results of tests on assemblies made up of specific materials in a specific configuration. When selecting construction designs to meet certain fire resistance requirements, caution must be used to ensure that each component of the assembly is the one specified in the test. Further precautions should be taken that assembly procedures are in accordance with those of the tested assembly. For copies of specific tests, call 1-800-NATIONAL For fire safety information, see nationalgypsum.com.

Technical Data

PHYSICAL PROPERTIES		
Thickness, nominal	1/2" (12.7 mm)	5/8" (15.9 mm)
Width, nominal	48" (1220 mm)	48" (1220 mm)
Length, standard	8' through 12' (2438 mm – 3657 mm)	
Weight, lbs./sq. ft., nominal	1.5 – 1.6	2.2
Edges	Tapered	
Surface Burning Characteristics (per ASTM E 84)	Flame spread: 15 Smoke developed: 0	
Packaging	2 pcs./bundle	

MAXIMUM FRAMING SPACING – For Single Layer XP [®] Gypsum Board			
	Gypsum Board Thickness	Gypsum Board Orientation to Framing	Maximum Framing Spacing
Ceilings:	1/2" (12.7 mm)	Parallel	16" (406 mm) o.c.
	1/2" (12.7 mm)	Perpendicular	24" (610 mm) o.c.
	5/8" (15.9 mm)	Parallel	16" (406 mm) o.c.
Walls:	5/8" (15.9 mm)	Perpendicular	24" (610 mm) o.c.
	1/2" (12.7 mm)	Perpendicular or Parallel	24" (610 mm) o.c.
	5/8" (15.9 mm)	Perpendicular or Parallel	24" (610 mm) o.c.

NOTE: On ceilings to receive hand or spray applied, water based texture material, XP Gypsum Board products shall be applied perpendicular to framing.

APPLICABLE STANDARDS AND REFERENCES	
ASTM C 1396/ASTM C 473	
ASTM C 840	
ASTM D 3273	
ASTM G 21	
Gypsum Association GA-216	
Gypsum Association GA-214	
National Gypsum Company	<i>Gypsum Construction Guide</i>



Gold Bond® BRAND Fire-Shield® Gypsum Board

DESCRIPTION

Gold Bond® BRAND Fire-Shield® Gypsum Board was developed to work in combination with other products in an assembly to retard heat transfer through the assembly. Fire-Shield gypsum boards are made with cores formulated to offer greater fire resistance than regular gypsum board. Generically, these fire resistant boards that are used to delay heat transfer to structural members are designated as "type X" products.

The Gypsum core of Fire-Shield Gypsum Board works as a natural "sprinkler system." Gypsum naturally contains about 21 percent water. When the board is heated, the water in the core begins to evaporate and is released as steam, retarding heat transfer. Fire-Shield gypsum board remains noncombustible. However, as shrinkage occurs because of the loss of water volume, cracks occur which permit passage of fire and heat. To lessen this process, Fire-Shield gypsum board is formulated by adding noncombustible fibers to the gypsum to help maintain the integrity of the core as water volume is lost while providing greater resistance to heat transfer.

TECHNICAL DATA

SYSTEM BURNING CHARACTERISTICS

ASTM E84
Flame Spread: 15
Smoke Developed: 0

According to ASTM C 1396, the standard for gypsum board, type X gypsum board must provide at least: a one-hour fire resistance rating for 5/8" board, or a 3/4-hour fire resistance rating for 1/2" board applied in a single layer nailed on each face of load-bearing wood framing members when tested in accordance with the requirements of Methods of Fire Test of Building Constructions and Materials (ASTM designation E 119).

For additional fire protection, Gold Bond Fire-Shield C products are formulated with a mineral core additive which expands when subjected to heat which aids in holding the gypsum board together.

Fire-Shield gypsum boards also can be used as column protection, delaying the rapid transfer of heat to reduce the likelihood that structural members will lose strength and fail to carry the intended load.

FIRE RESISTANCE RATINGS

Fire resistance ratings represent the results of tests on assemblies made up of specific materials in a specific configuration. When selecting construction designs to meet certain fire resistance requirements, caution must be used to insure that each component of the assembly is the one specified in the test. Further, precaution should be taken that assembly procedures are in accordance with those of the tested assembly. (For copies of specific tests, call 1-800-NATIONAL.)

WEIGHTS

1/2" Type C - 1.9 lbs/SF
5/8" Type X - 2.2 lbs/SF
5/8" Type C - 2.2 lbs/SF

For fire safety information, go to www.nationalgypsum.com.

RECOMMENDATIONS

Examine and inspect materials to which gypsum board is to be applied. Remedy all defects prior to installation of drywall. Any defects in the finished installation due to misaligned framing or other cause will be the responsibility of the work performed under that section of the specification and such defects shall be remedied under that section of the specification.

Gypsum board shall be applied first to ceiling at right angles to framing members, then to walls. Boards of maximum practical length shall be used so that an absolute minimum number of end joints occur. Board edges shall be brought into contact with each other but shall not be forced into place.

SPECIFICATIONS

THE FOLLOWING PARAGRAPHS ARE FOR INSERTION INTO SECTIONS OF GENERIC SPECIFICATIONS OR GENERIC /PROPRIETARY SPECIFICATIONS COVERING GYPSUM BOARD PRODUCTS. THE NATIONAL GYPSUM PRODUCT NAME FOLLOWS THE GENERIC DESCRIPTION IN PARENTHESES

PART 2 PRODUCTS

2.01 MATERIALS

A. Fire-Resistant Gypsum Board: A gypsum core gypsum board with additives to enhance fire resistance of the core and surfaced with paper on front, back, and long edges and complying with ASTM C 1396, type X.

1. Thickness: 1/2" (Gold Bond® BRAND Fire-Shield C Gypsum Board), 5/8" (Gold Bond® BRAND Fire-Shield Gypsum Board), or 5/8" (Gold Bond® BRAND Fire-Shield C Gypsum Board)
2. Width: 4'
3. Length: 6' through 16'
(1/2" Fire-Shield C Gypsum Board,
5/8" Fire-Shield Gypsum Board)
Length: 8' through 14'
(5/8" Fire-Shield C Gypsum Board)
4. Edges: Square, Tapered, or Beveled Tapered (Sta-Smooth Edge)

PART 3 EXECUTION

3.01 INSTALLATION

A. General: In accordance with the manufacturer's recommendations, National Gypsum Company "Gypsum Construction Guide."

Gypsum board joints at openings shall be located so that no end joint will align with edges of opening unless control joints will be installed at these points. End joints shall be staggered, and joints on opposite sides of a partition shall not occur on the same stud.

Gypsum board shall be held in firm contact with the framing member while fasteners are being driven. Fastening shall proceed from center portion of the board toward the edges and ends. Fasteners shall be set with the heads slightly below the surface of the gypsum board in a dimple formed by the hammer or power screwdriver. Care shall be taken to avoid breaking the face paper of the gypsum board. Improperly driven nails or screws shall be removed.

See page 63, *Environmental Conditions and Limitations*.

09 64 33 Flooring

STRIATIONS BBT® | MIGRATIONS® BioBased Tile®



BioBased Tile® (BBT) with patent-pending BioStride® polymer, is made with rapidly renewable, US-grown plant ingredients. Armstrong offers BBT as a non-PVC product option at an affordable price point. With the same proven, long product life as other resilient flooring materials, BBT has more than 5 times greater resistance to impact and more than 2.5 times greater resistance to cracking than standard composition tile. Migrations easily transitions from Imperial Texture® and is available in 12" x 12" format. Striations offers a unique linear visual in a 12" x 24" format. Armstrong® BBT is NSF/ANSI 332 Gold Level Certified and Striations was awarded Bronze in the 2011 International Design Awards (IDA).

PRODUCT INFORMATION					
Construction	BioBased Tile				
Product Line	Striations Migrations				
International Product Specifications	ASTM F 2982				
Overall Thickness	1/8 in. (3.2 mm)				
Wear Layer Thickness	1/8 in. (3.2 mm)				
Finish	Fast Start Factory Finish				
Installation	Full Spread Adhesives – S-525 High-Moisture, S-700 Thin Spread				
Maintenance Options	Polish				
PACKAGING					
Tile Sizes	Migrations – 12 in x 12 in. (305 mm x 305 mm) Striations – 12 in. x 24 in. (305 mm x 610 mm)				
Tiles Per Carton	Migrations – 45 (45 sq. ft.) Striations – 22 (44 sq. ft.)				
Shipping Weight	Migrations – 63 lbs. (28.6 kg) Striations – 61 lbs. (27.7 kg)				
PERFORMANCE	TEST METHOD	MINIMUM REQUIREMENT	PERFORMANCE VS. REQUIREMENT		
ASTM F 2982	Thickness	ASTM F 386	Nominal ± 0.005 in.	Meets	
	Size	ASTM F 2055	± 0.016 in. per linear foot	Exceeds	
	Squareness	ASTM F 2055	0.010 in. max	Exceeds	
	Indentation – One Minute	ASTM F 1914	≤ 0.012 in.	Exceeds	
	Indentation – Ten Minutes	ASTM F 1914	≤ 0.015 in.	Exceeds	
	Static Load Limit @ 250 PSI	ASTM F 970	≤ 0.005 in.	Exceeds	
	Impact	ASTM F 1265	No cracks beyond limit after 12 drops	Exceeds	
	Deflection	ASTM F 1304	1.0 in. minimum	Exceeds	
	Dimensional Stability	ASTM F 2199	≤ 0.028 in. per linear feet	Meets	
	Chemical Resistance	ASTM F 925	No more than slight change in surface dulling, attack or staining	Meets or Exceeds	
	Resistance to Heat	ASTM F 1514	ΔE ≤ 8	Exceeds	
	Resistance to Light	ASTM F 1515	ΔE ≤ 8	Exceeds	
	Supplementary	Fire Test Data – Flame Spread	ASTM E 648	0.45 watt/cm ² or more Class I	Meets
		Fire Test Data – Smoke Evolution	ASTM E 662	450 or less	Meets
Fire Test Data – Canada		CAN/ULC S-102.2	Use dependant	Flame Spread – 0 Smoke Developed – 25	
Regional Materials		LEED® MR5.0	Meets Guidelines	Meets	
Recycled Content		LEED MR4.0	Meets Guidelines	Meets	
Rapidly Renewable Materials		LEED MR6.0	Meets Guidelines	Meets	
Certified Low Emitting Product		LEED EQ4.3	Meets Guidelines	Meets	
Certified Low Emitting Adhesive		LEED EQ4.1	Meets Guidelines	Meets	
Indoor Air Quality		FloorScore™	Meets Certification Guidelines	Certified	
Indoor Air Quality		CHPS 01350	Meets Certification Guidelines	Certified	
NSF/ANSI 332	Sustainability Assessment	Meets Certification Guidelines	Gold Level Certified		
WARRANTY					
5-Year Commercial Warranty when installed in accordance with Armstrong's Guaranteed Installation Systems manual, F-5061.					
LINKS					
Installation Instructions – www.armstrong.com/pdbupimages/200838.pdf					
Maintenance Information – www.armstrong.com/pdbupimages/197956.pdf					
View the full line – www.armstrong.com/commercialflooringna/products/biobased-tile					
Email Techline – www.armstrong.com/commercialflooringna/contact_techline.jsp					

WARRANTY			
5-Year Commercial Warranty when installed in accordance with Armstrong's Guaranteed Installation Systems manual, F-5061.			
LINKS			
Installation Instructions – www.armstrong.com/pdbupimages/200838.pdf			
Maintenance Information – www.armstrong.com/pdbupimages/197956.pdf			
View the full line – www.armstrong.com/commercialflooringna/products/biobased-tile			
Email Techline – www.armstrong.com/commercialflooringna/contact_techline.jsp			

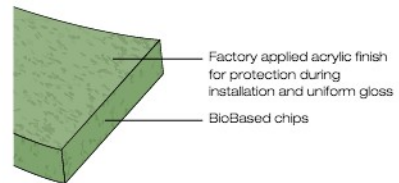
STRIATIONS BBT® | MIGRATIONS®
BioBased Tile®



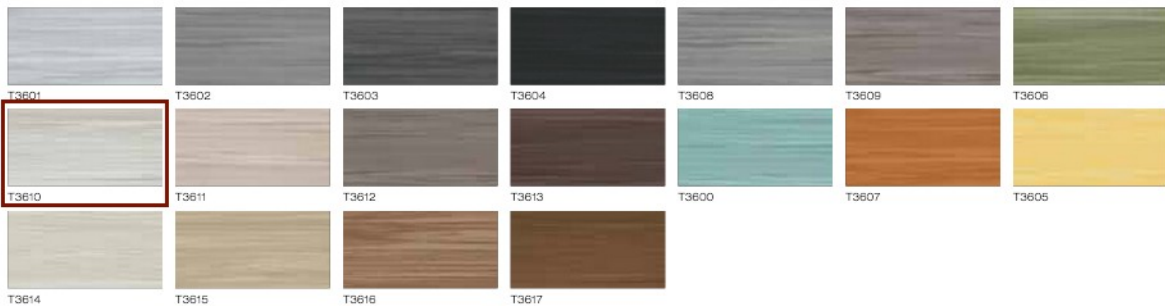
Sustainability Facts

Serving Striations Migrations	As Served
Certified to meet LEED® EQ Credit: Low Emitting Interiors	✓
Pre-Consumer Recycled Content	10%
Regional Materials*	Jackson, MS
Rapidly Renewable Materials	2%
Adhesives Certified to meet LEED® EQ Credit: Low Emitting Interiors	✓
FloorScore™ Certified to CDPH Standard Method V1.1-2010	✓
Green Guide for Healthcare GGHC IEQ4.3	✓
Collaborative for High Performance Schools CHPS-IEQ2.2 & LABS-21 IEQ4.3	✓
U.S. Green Building Council Member	✓
Canada Green Building Council Member	✓
NSF/ANSI 332 Gold Level Certified	✓

*Depends on project location



Striations



Migrations



www.armstrong.com/commercialflooring • 1 877 276 7876

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GRAFTON



**Grafton Gesso Coated Architectural
Baseboards 16'**

Baseboard 1/2" x 3 1/4" x 16'

SKU: 10104881

Color: White



Benjamin Moore®

ben®

100% ACRYLIC EXTERIOR

FLAT FINISH 541

Features

- Low temperature application down to 40°F (4.4°C)
- Resistant to peeling and cracking
- Excellent hide and color retention
- Blister resistant
- Resists new mildew formation
- Soap and water clean-up
- 25 Year warranty

General Description

A premium quality 100% acrylic latex flat house paint designed for application to a wide variety of exterior surfaces such as wood, hardboard, vinyl and aluminum siding, shingles, unglazed brick, concrete, stucco, cinder block, and primed metal. Provides a breathable surface for maximum durability.



SUMMER NIGHTS - 777

Recommended For

For exterior surfaces such as new or previously painted wood, hardboard siding, cured masonry, and unglazed brick.

Limitations

- Do not apply when air and surface temperatures are below 40°F (4.4°C).
- Not for interior use

Product Information

Colors: —Standard:

541 01 White.
(May be tinted with up to 2.0 fl. oz. of Benjamin Moore® Gennex® colorants per gallon.)

—Tint Bases:

Benjamin Moore® Gennex® bases 1X (Pastel), 2X (Medium), 3X (Deep), 4X (Ultra)

—Special Colors:

Contact your Benjamin Moore Representative

Certification:

VOC Compliant in all regulated areas

Master Painters Institute MPI # 10

Technical Assistance:

Available through your local authorized independent Benjamin Moore® retailer. For the location of the retailer nearest you, call 1-800-826-2623, see www.benjaminmoore.com, or consult your local Yellow Pages.

Technical Data

Pastel Base

Vehicle Type	100% Acrylic Latex
Pigment Type	Titanium Dioxide
Volume Solids	34.5%
Coverage per Gallon at Recommended Film Thickness	350 – 475 Sq. Ft.
Recommended Film Thickness	
– Wet	3.8 mils
– Dry	1.3 mils
Depending on surface texture and porosity. Be sure to estimate the right amount of paint for the job. This will ensure color uniformity and minimize the disposal of excess paint.	
Dry Time @ 77°F (25°C) @ 50% RH	
– To Touch	1 Hour
– To Recoat	4 Hours
Painted surfaces can be washed after two weeks. High humidity and cool temperatures will result in longer dry, recoat and service times.	
Dries By	Evaporation, Coalescence
Viscosity	105 ± 3 KU
Flash Point	N/A
Gloss / Sheen	Flat (2 – 3 @ 85°)
Surface Temperature at Application	
– Min.	40°F
– Max	90°F
Thin With	See Chart
Clean Up Thinner	Clean Water
Weight Per Gallon	11.06 lbs
Storage Temperature	
– Min.	40°F
– Max	95°F
Volatile Organic Compounds (VOC)	
44 Grams/Liter	.37 lbs./Gallon

◊Reported values are for Pastel Base. Contact Benjamin Moore for values of other bases or colors.

1200 Interior/Exterior Remanufactured Eggshell Latex Finish

CHARACTERISTICS:

- Remanufactured
- Contains a minimum of 50% post-consumer paint
- Environmentally Preferred
- Excellent Quality
- Interior/Exterior Latex Eggshell Finish
- Excellent Adhesion
- Durable
- Easy Application
- Soap & Water Clean-Up
- Low Odor

CERTIFICATIONS:

- 1st Quality REMANUFACTURED

PHYSICAL PROPERTIES:

- Finish: Eggshell
- Sheen @ 60° ----- 7-14%

VOLUME SOLIDS:

- Approximately 35%

COLORS:

BENJAMIN MOORE
COLOR MATCH



CALM - OC 22

STARDUST - 2108-40

VISCOSITY:

Package Viscosity 90-100 KU

PERFORMANCE PROPERTIES:

Approximately 300-400 sq. ft. per gallon depending on substrate and application method, porosity and surface texture. Approximate coverage for each coat.

Recommended Dry Film Thickness

- 1.5 to 1.7 MILS DFT per coat

MILDEW RESISTANT:

This coating contains agents that inhibit the growth of mildew on the surface of this coating.

DRYING TIME:

To Touch ----- 30-60 minutes
To Re-coat ----- 5-6 hours

Lower temperatures, humidity, thicker film or improper ventilation will increase these times.

PREPARATION & PRIMING

BLOCK: (Prime with appropriate primer)
Allow new block to cure before Application of primers and finish coats. Remove loose mortar and patch all voids with appropriate patching or caulking material. Clean surface to remove dirt, Efflorescence, grease, oil, wax, mildew or other foreign matter.

CONCRETE: (Prime with appropriate primer)
Allow new concrete to cure for 60 days before application of primer and finish coats. Patch all voids with the appropriate patching or caulking material. Power-wash all tilt-up and poured in place concrete to remove any bond-breakers or other construction residue. Clean the surface to remove any dirt, efflorescence, grease, oil, wax, mildew or other foreign material.

METAL: (Prime with appropriate primer)
Apply finish to primed or previously painted metal with no visible rust. Scrape, power tool clean and sand the surface to remove any dirt, grease, oil, rust, mill scale, loose shop primer or other foreign matter.

STUCCO: (Prime with appropriate primer)
Allow new stucco to cure before application of finish coats. Patch all voids with the appropriate patching or caulking material. Clean the surface to remove any dirt, efflorescence, grease, oil, wax, mildew or other foreign material. Best results are obtained when surface is back-rolled.

WOOD: (Prime with appropriate primer)
Patch all voids with the appropriate patching or caulking material. Clean the surface to remove any dirt, grease, oil, wax, mildew or other foreign matter.

PREVIOUSLY PAINTED SURFACES:
Patch all voids with the appropriate patching or caulking material. Wash, rinse, scrape, sand and clean the surface to remove any chalk, dirt, grease, oil, wax, mildew, loose paint or other foreign material.

APPLICATION:

METHODS:
Product may be applied with brush, roller or airless sprayer. Maintain a "wet edge" and apply coating uniformly.

THINNING:
Product intended for use at package Consistency. If thinning is desired, do not thin more than 1/2 pint per gallon.

CLEAN-UP:
Clean up equipment and area with soapy water.

Application:
Do not apply where material, air or surface Temperature is below 50° F Surfaces and ambient temperatures must be between 48° F and 100° F, 5° above dew point and remain above 48° F for a minimum of four hours after application. All paint products should be tested for adhesion, appearance, color and compatibility prior to application.

PERSONAL:
Paint may be irritating to eyes, nose and skin. Avoid contact with eyes. In case of eye contact, flush at least fifteen minutes and call a physician immediately.

STORAGE:
KEEP FROM FREEZING STORE ABOVE 50° F

MAXIMUM VOC:
<150 GRAMS PER LITER

CAUTION:
Avoid contact with eyes, skin and clothing. Do not take internally. Wash thoroughly after handling. Close container after each use. For additional safety information consult the Material Safety Data Sheet (MSDS)

KEEP OUT OF REACH OF CHILDREN.
USE ONLY WITH ADEQUATE VENTILATION.

DIVISION 10 SPECIALITIES

10 21 13	Kohler Toilet
10 21 16.13	Shower and Dressing Compartments
10 28 16	Bath Accessories (Countertops, Bath Surround, and Shower)
10 28 16	Cleansing Room Shower Head
10 84 16.13	Bath Controls
10 84 13	Exterior Lighting
10 84 16	Recessed Lighting

10 21 13 Toilet

KOHLER®

Kelston®
Comfort Height® Toilet
K-3755

Features

- Vitreous china.
- Two-piece toilet.
- Comfort Height® Elongated bowl.
- AquaPiston® flushing system.
- Includes left-hand polished chrome trip lever.
- 1.28 gpf (4.8 lpf).
- 2-1/8" (54 mm) fully glazed trapway.
- 12" (305 mm) rough-in.
- Less seat and supply.
- 11" (279 mm) x 8-3/4" (222 mm) water area.
- 30" (762 mm) x 16-3/4" (425 mm) x 30-1/2" (775 mm).
- Floor mount / Floor outlet.

Recommended Accessories

K-7637 Angle Supply with Stop (single)

Optional Accessories

K-4650 Toilet Seat

K-9385 Left-hand Trip Lever

Components

Product includes:

K-4306 Toilet Bowl

K-4469 Toilet Tank

Additional included component/s: Tank cover, Trip lever, Bolt cap accessory pack, and Tank accessory pack.



ADA








Codes/Standards

ASME A112.19.2/CSA B45.1
DOE - Energy Policy Act 1992
EPA WaterSense®
ADA
ICC/ANSI A117.1

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color	Code	Description
	0	White
	96	Biscuit
	47	Almond
	NY	Dune
	95	Ice™ Grey
	G9	Sandbar
	7	Black Black™

10 21 13 Toilet

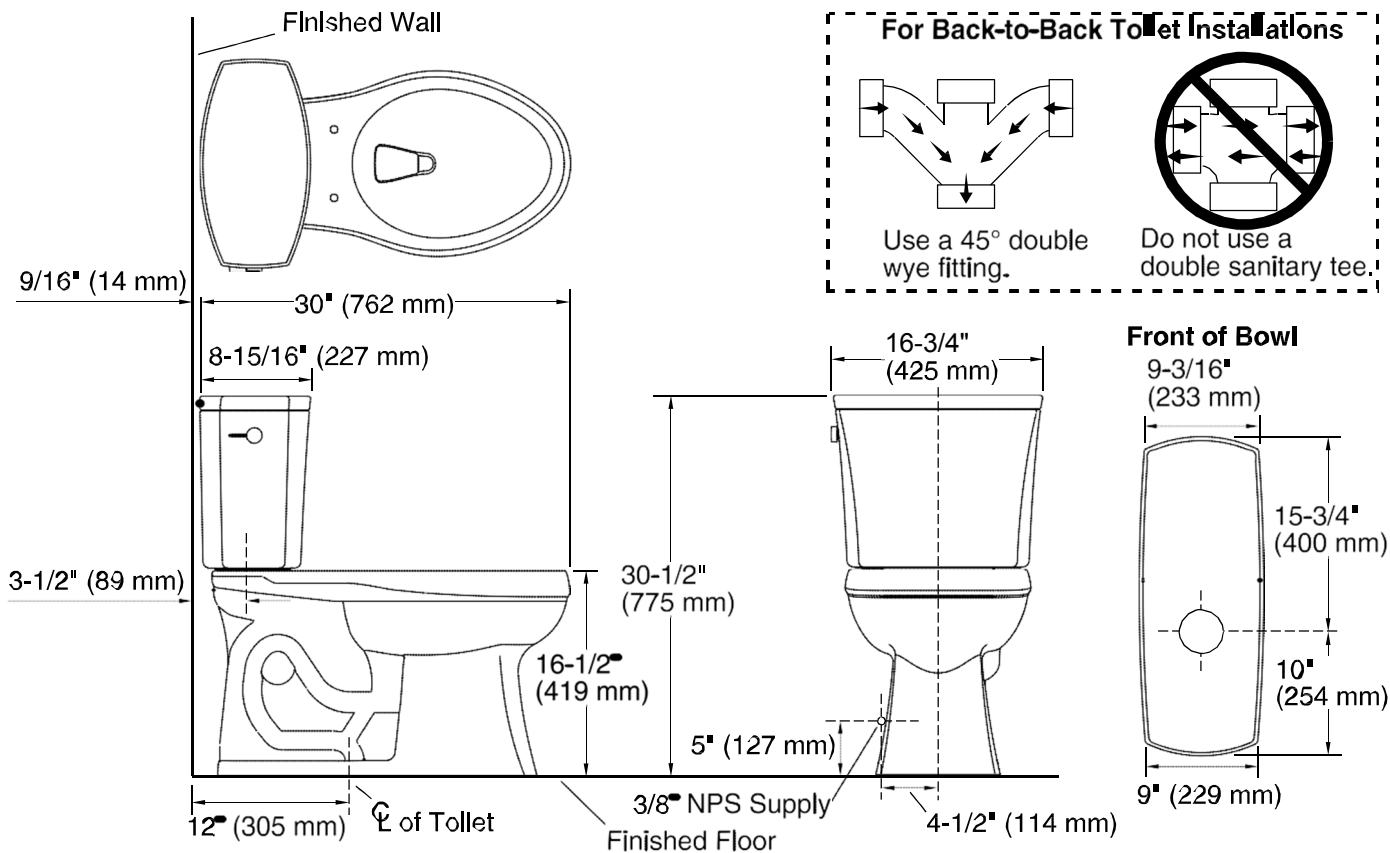
USA/Canada: 1-800-4KOHLER (1-800-456-4537)
www.kohler.com 12-18-
2014 02:49

THE BOLD LOOK
OF **KOHLER**®

10 21 13 Toilet

KOHLER®

Kelston®
Comfort Height® Toilet
K-3755



Technical Information

All product dimensions are nominal.

Toilet type:	Two-piece
Bowl shape:	Elongated front
Flush type:	AquaPiston
Trap passageway:	2-1/8" (54 mm)
Water Consumption	
Full:	1.28 gpf (4.8 lpf)
Water surface size:	11" x 8-3/4" (279 mm x 222 mm)
Rim to water surface:	6" (152 mm)
Rough-in:	12" (305 mm)
Seat-mounting holes:	5-1/2" (140 mm)

Notes

Install this product according to the installation

guide.

For back-to-back toilet installations: Use only a 45° double wye fitting.

The model is acceptable for left-hand Accessible compartment installations only.

ADA compliant when installed to the specific requirements of these regulations.

The Model Plumbing Codes require the installation of elongated open-front toilet seats on public bathrooms.

10 21 13 Toilet

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
www.kohler.com 12-18-
2014 02:49

THE BOLD LOOK
OF **KOHLER**®

10 21 16.13 Shower Material



Single Panel Shower Walls

SWANSTONE WALL PANELS

WARRANTY

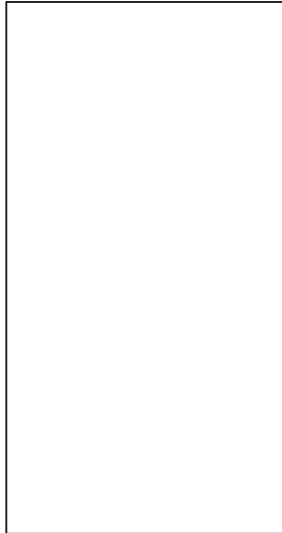
Limited Lifetime – Residential
Limited 25-year – Commercial

Manufactured from Swanstone solid surface
(See page 2 for detailed information.)

Recommended for high-use traffic areas and commercial surfaces.

FEATURES

- Reinforced solid surface means color and texture run all the way through and cannot wear away.
- Will not mold or mildew, no grout to clean.
- Ideal for remodeling, panels glue up over existing surface.
- Coordinates with other Swanstone bath products.
- Can be easily trimmed to fit any shower application.
- Widest range of sizes to fit most any project.
- Heat resistant—walls can handle steamer units.
- Compression molding means superior durability.



Single Panel Shower Walls

- 36" wide x 72" high (914 mm x 1829 mm)
- 60" wide x 72" high (1524 mm x 1829 mm)
- 36" wide x 96" high (914 mm x 2438 mm)
- 48" wide x 96" high (1219 mm x 2438 mm)
- 62" wide x 96" high (1574 mm x 2438 mm)

SPECIFICATIONS

Single Panel Shower Walls

Model	Part	Nominal Dimensions	Ship Wt. Lb.	Ship FedEx	Carton Dims. In.	Cu. Ft.
SS-3672-1	SS0367201	36" W x 72" H	53	-	74 x 45 x 4	7.71
SS-6072-1	SS0607201	60" W x 72" H	117	-	78 x 66 x 4	9.29
SS-3696-1	SS0369601	36" W x 96" H	84	-	98 x 38 x 4	8.62
SS-4896-1	SS0489601	48" W x 96" H	96	-	98 x 56 x 4	12.75
SS-6296-1	SS0629601	62" W x 96" H	108	-	102 x 68 x 4	16.06

Kit Includes: One flat wall panel. It may be necessary to combine cartons to accommodate desired installation area. No installation materials provided. Order one **SS-72** installation kit per panel, except for 48" panel, which needs two kits per panel.

Packaging: Each kit is packed in an individual carton.

ACCESSORIES

See pages 59-60 for complete listing of all wall accessories.

STANDARDS AND RATINGS

American Society of Testing and Materials (ASTM) E-84: Class A Flame Spread Rating

American National Standard Institute—ANSI Z124.6

International Association of Plumbing and Mechanical Officials (IAPMO)—Listed

cUPC listed—Certified to CSA Test Standard B45.5 by IAPMO

Uniform Plumbing Code (UPC)

COLORS

(See inside back cover for color sample.)

Solid Colors: · Golden Steppe (128)

- White (010)
- Bone (037)
- Bisque (018)
- Bright White (137)
- Pearl (138)
- Gray Granite (042)
- Ice (130)
- Indian Grass (071)
- Mountain Haze (129)
- Night Sky (012)

Aggregate Colors:

- Acorn (123)
- Almond Galaxy (046)
- Arctic Granite (035)
- Baby's Breath (168)
- Barley (091)
- Bermuda Sand (040)
- Canyon (124)
- Caraway Seed (169)
- Cloud Bone (126)
- Cloud White (125)
- Cornflower (063)
- Glacier (121)
- Pebble (072)
- Prairie (122)
- Sierra (094)
- Tahiti Desert (050)
- Tahiti Gray (053)
- Tahiti Ivory (059)
- Tahiti Matrix (058)
- Tahiti Sand (051)
- Tahiti Terra (055)
- Tahiti White (011)
- Tundra (131)
- Winter Wheat (060)

For a complete list of tests and results see the Technical Data Sheet.

SUPPORT DOCUMENTS

Installation instructions available at swanstone.com.

MAINTENANCE AND CLEANING INFORMATION

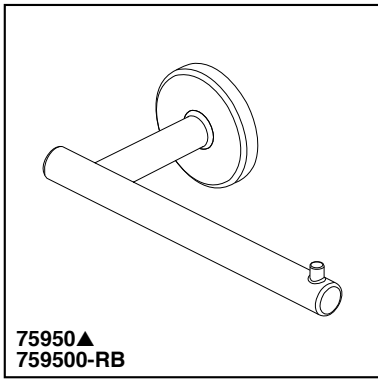
Clean regularly with common household liquid cleaners and rinse within five minutes of application. Occasional scrubbing with abrasive cleaners ensures that the original luster will be maintained. **Do not** use "leave on" cleaning products, such as automatic spray shower cleaners. Prolonged contact with harsh chemicals could have an adverse reaction over time and discolor surfaces. **Do not** use cleaning agents that caution use on acrylic, polyester or plastics.

 **MADE IN USA**

42 | 095-10-14

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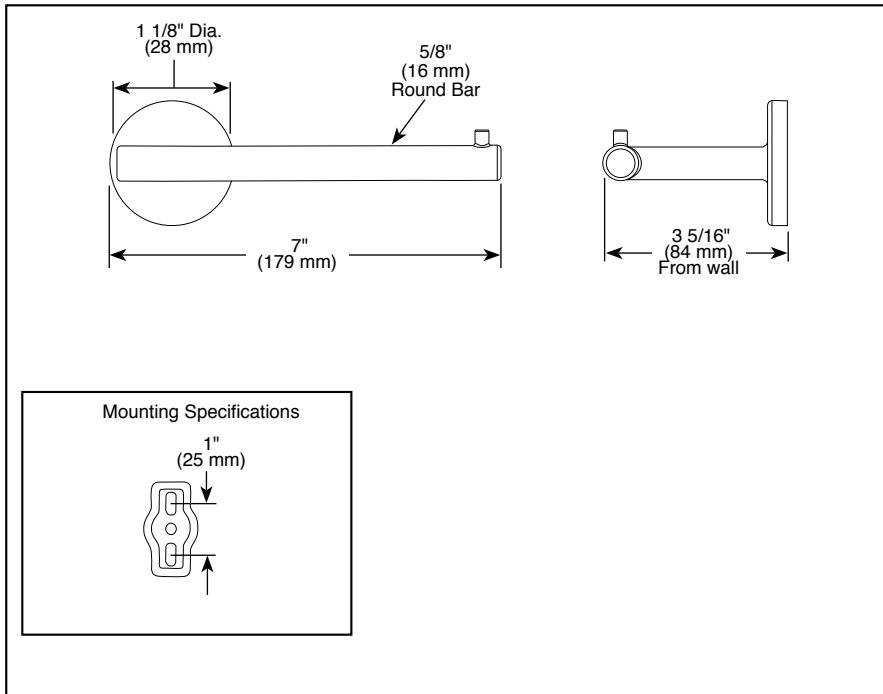
10 28 13 TOILET ACCESSORIES - TISSUE HOLDER



ACCESSORIES

- Trinsic® Bath Collection
- Tissue Holder

Submitted Model No.: _____
 Specific Features: _____



▲ Designate Proper Finish Suffix

STANDARD SPECIFICATIONS:

- Wood blocking is preferable behind all wall surfaces. If wood blocking is not available, the following fasteners are suggested: Tile/Masonry-Plastic or lead Anchors Plaster/drywall-Toggle bolts.
- Mounting hardware and mounting template included with product.

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.

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.specselect.com for finish options and product availability.

DSP-A-75950 Rev. A



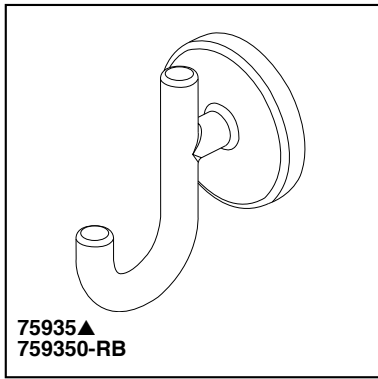
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 140 Business Park Drive
 Winston-Salem, NC 27107
 800.542.3789
www.libertyhardware.com
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10 28 16 BATH ACCESSORIES - ROBE HOOK



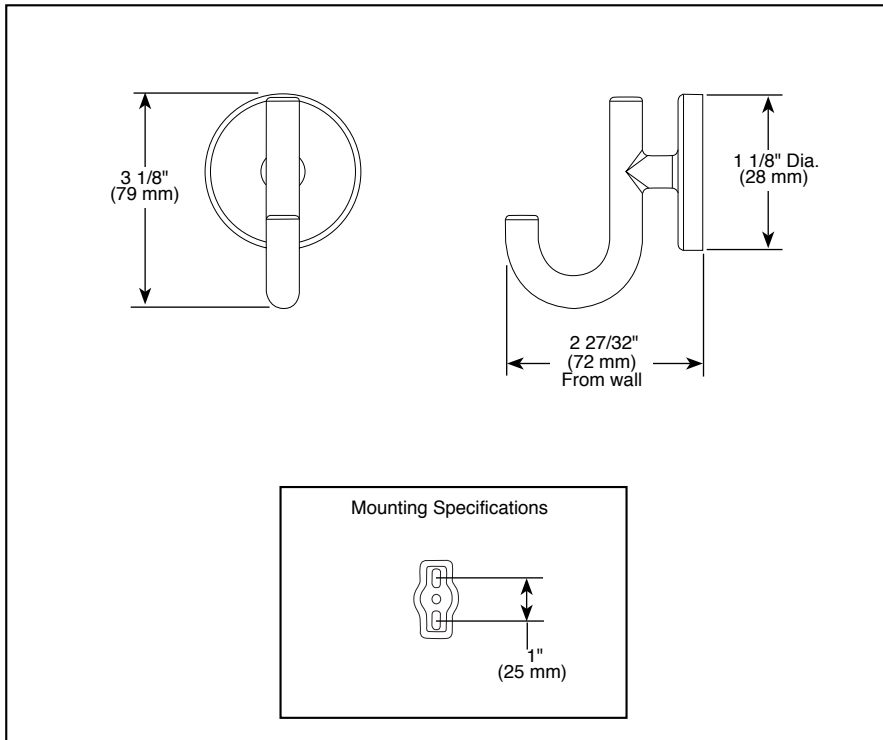
ACCESSORIES

- Trinsic® Bath Collection
- Robe Hook



Submitted Model No.: _____
Specific Features: _____

QTY: 5



▲ Designate Proper Finish Suffix

STANDARD SPECIFICATIONS:

- Wood blocking is preferable behind all wall surfaces. If wood blocking is not available, the following fasteners are suggested: Tile/Masonry-Plastic or lead Anchors Plaster/drywall-Toggle bolts.
- Mounting hardware and mounting instructions included with product.

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.



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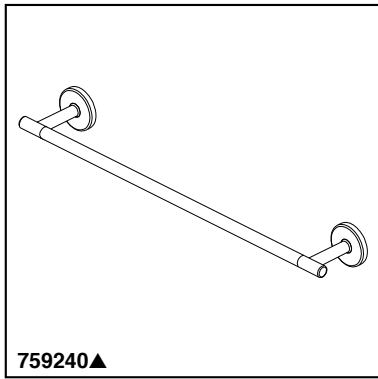
Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.specselect.com for finish options and product availability.

10 28 16 BATH ACCESSORIES - TOWEL BAR 2



ACCESSORIES

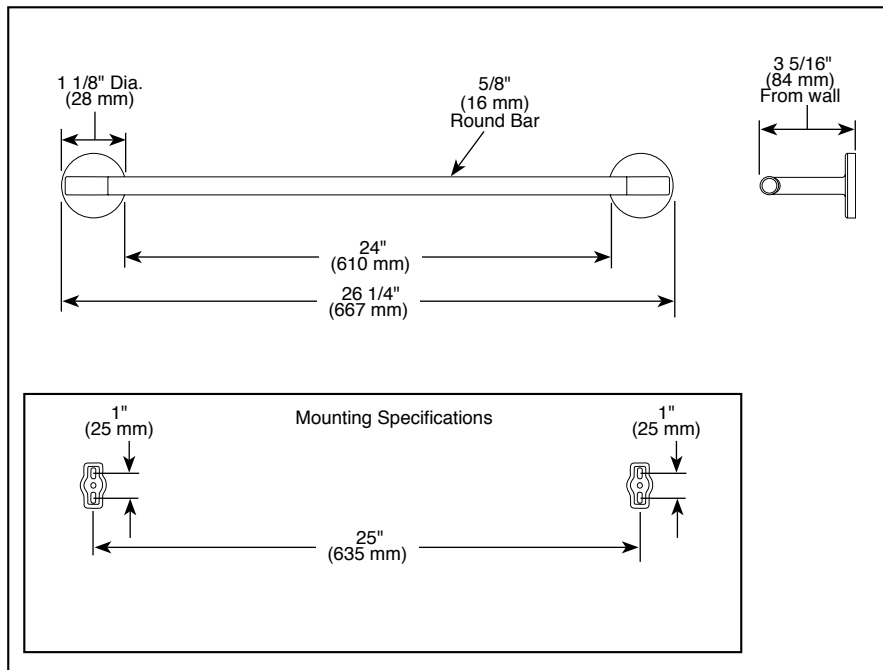
- Trinsic® Bath Collection
- 24" Towel Bar



QTY: 1

Submitted Model No.: _____

Specific Features: _____



STANDARD SPECIFICATIONS:

- Wood blocking is preferable behind all wall surfaces. If wood blocking is not available, the following fasteners are suggested: Tile/Masonry-Plastic or lead Anchors Plaster/drywall-Toggle bolts.
- Mounting hardware and mounting template included with product.

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.

▲ Designate Proper Finish Suffix



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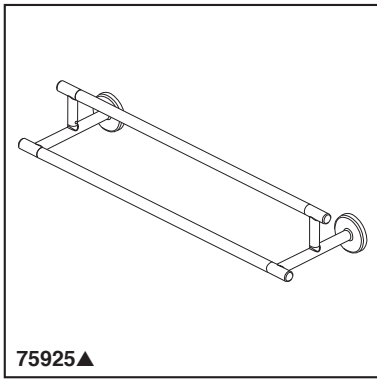
Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.specselect.com for finish options and product availability.

10 28 16 BATH ACCESSORIES - TOWEL BAR 3



ACCESSORIES

- Trinsic® Bath Collection
- Double Towel Bar

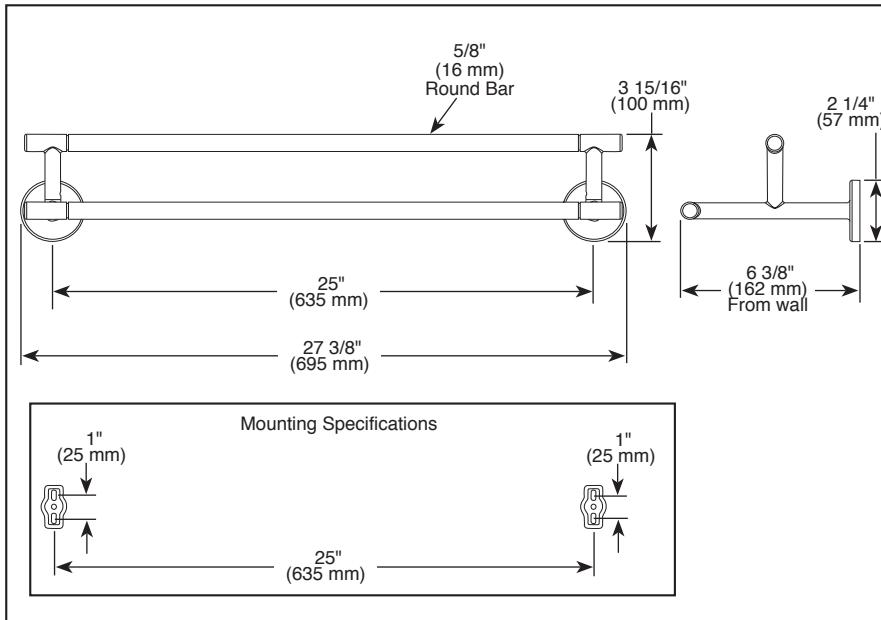


75925▲

Submitted Model No.: _____

Specific Features: _____

QTY: 2



▲ Designate Proper Finish Suffix

STANDARD SPECIFICATIONS:

- Wood blocking is preferable behind all wall surfaces. If wood blocking is not available, the following fasteners are suggested: Tile/Masonry-Plastic or lead Anchors Plaster/drywall-Toggle bolts.
- Mounting hardware and mounting template included with product.

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.

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.

DSP-A-75925 Rev. B



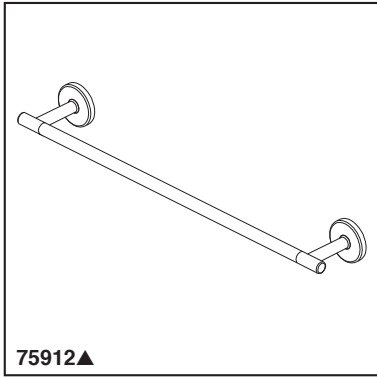
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10 28 16 BATH ACCESSORIES - TOWEL BAR



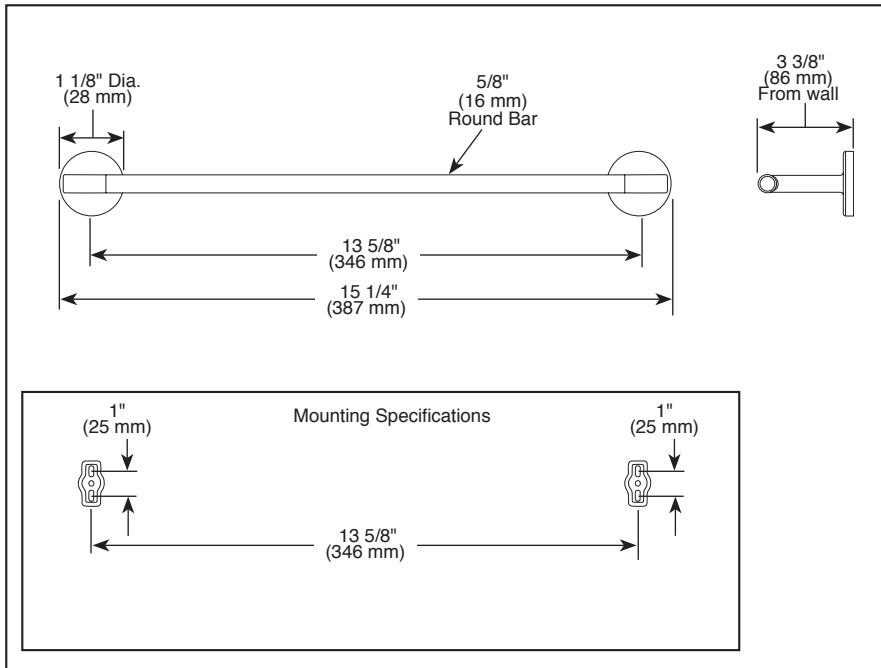
ACCESSORIES

- Trinsic® Bath Collection
- Towel Bar



Submitted Model No.: _____

Specific Features: _____



STANDARD SPECIFICATIONS:

- Wood blocking is preferable behind all wall surfaces. If wood blocking is not available, the following fasteners are suggested: Tile/Masonry-Plastic or lead Anchors Plaster/drywall-Toggle bolts.
- Mounting hardware and mounting template included with product.

▲ Designate Proper Finish Suffix

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.



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Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.

DUPONT - CORIAN RAINCLOUD



Corian® Solid Surface

SPEC DATA

This Spec-Data sheet conforms to editorial style prescribed by The Construction Specifications Institute. The manufacturer is responsible for technical accuracy.

1. Product name

DuPont™ Corian® Solid Surface

2. Manufacturer

E. I. du Pont de Nemours and Company Inc. (Surfaces division)

European headquarter:
Du Pont de Nemours International
S.A. (Surfaces division)
2, Chemin du Pavillon
P.O. Box 50
CH-1218 Le Grand Saconnex,
Geneva - Switzerland

3. Product description

Basic use

DuPont™ Corian® is an advanced composite product used as a decorative material in a variety of residential and commercial applications. Corian® offers design versatility, functionality and durability. Supplied in sheets and shapes, it can be fabricated with conventional woodworking tools into virtually any design. Corian® is the original solid surface material made only by DuPont. It is widely accepted as a material for countertops, vanity tops, tub/shower walls, kitchen sinks, vanity basins and laboratory bench tops in numerous markets including lodging, healthcare, banks, boutiques, restaurants.

Composition

DuPont™ Corian® is a solid, non-porous, homogeneous surfacing material, composed of $\pm 1/3$ acrylic resin (also known as PolyMethyl MethAcrylate or PMMA), and $\pm 2/3$ natural minerals. These minerals are composed of Aluminium TriHydrate (ATH) derived from bauxite, an ore from which aluminium is extracted. For more information on the composition of the material, please consult the Corian® Material Safety Data Sheets (MSDS) available via the msds.dupont.com site or via your local supplier.

Standard products

DuPont™ Corian® Sheets
Available in various standard thicknesses, easily cut to size by professional fabricators. All colours in the standard colour palette are available in 12 x 760 x 3658mm sheets.

Some of these colours are also available in various other sizes.

Some standard dimensions of DuPont™ Corian® sheets are:

- 4mm sheet: 930 x 2490mm
- 6mm sheet: 760 x 2490mm
930 x 2490mm
- 12mm sheet: 760 x 3658mm
930 x 3658mm
- 19mm sheet: 760 x 3658mm

Check with your supplier for the latest product offering.

DuPont™ Corian® Shape Products
A wide range of DuPont™ Corian® shapes, made using injection moulding technology, is available in

4 solid colours for custom integration with Corian® sheets to create an entire, continuous surface. This includes vanity basins in solid colours for bathrooms, and single and double sinks for kitchens, bars and small wash-up areas, hospitals and laboratories. Seamed undermounting technique eliminates rims that trap dirt and water, minimising cleaning and maintenance and providing improved hygiene. Care, maintenance and installation instructions are included in the packaging. Appropriate accessory products, including installation hardware, are available and recommended for residential kitchens only.

The colours of Corian®

The colours of Corian® allow for an almost unlimited working palette. You can choose a single colour; a neutral basis for design; or experiment with eye-catching harmonies. DuPont™ Corian® can also be used as inlays, accents, or as a versatile complement to other materials like metal, wood, stone, etc.

For complete information on colours, refer to the latest leaflet about the colours of Corian® or to the www.corian.com website. Hues, patterns and textures are related by style and character. Dark, heavily pigmented colours of Corian® will show scratches, dust and ordinary wear and tear more readily than lighter, textured colours. These colours are recommended for applications where surface contact is light or for use as inlays and accent colours.



corian.

Custom sheets

DuPont can manufacture Corian® sheets in custom colours, patterns and dimensions, within manufacturing capability limits and based on a minimum order quantity.

Limitations

Contact a local specialist, distributor or fabricator of Corian® or the Information Centre for DuPont™ Corian®. Although DuPont™ Corian® can withstand high temperatures, it should be protected with hot pads or heat shields against direct heat.

Use of 4mm and 6mm sheets should be restricted to vertical applications or certain furniture applications only. The choice between 12mm and 19mm is generally based on performance and cost considerations.

Due to the complex blending of natural minerals and man-made acrylics, slight colour variations may be found within a sheet or from sheet to sheet of same colour. Therefore, checking for colour matching is an essential element of sheet inspection before starting fabrication.

DuPont™ Corian® is non-porous so spills and stains will not be absorbed into the material. However, some chemicals can stain, discolour or damage the surface of Corian®. These chemicals include strong acids (like concentrated sulphuric acid), ketones (like acetone), chlorinated solvents (like chloroform) or strong solvent combinations (like paint remover). The extent of the damage will depend on the length of contact. Except for paint remover, short periods of contact will not usually cause severe damage to Corian®. Acid drain cleaners should not be used as they can damage both Corian® and any plastic plumbing beneath. Corian® is not recommended for use in photographic processing laboratories. More information can be found in the section "Chemical Resistance of Corian® Products". In some hospitals and laboratories where strong disinfectants come in contact with DuPont™ Corian®, it is recommended

that solid colours are used and extended contact is avoided.

4. Performance properties and characteristics

Typical performance properties of DuPont™ Corian® are shown in Table 1. The performance of Corian® sheets may vary according to the thickness of the material (4mm, 6mm, 12mm or 19mm), its aesthetics and surface finish.

Since its introduction in 1967, DuPont™ Corian® has proven itself to be remarkably durable, versatile and easy to live with in both the home and commercial environments.

Colours and patterns run through the entire thickness of the material and cannot wear away or delaminate. Joints can be glued inconspicuously, making virtually unlimited surfaces possible.

Surfaces in Corian® are renewable, meaning they can be fully restored with ordinary mild abrasive cleansers and a scouring pad. Cigarette burns, for example, can be easily removed in this way. Damage caused by abuse can usually be repaired on site without having to completely replace the material.

DuPont™ Corian® surfaces are hygienic. Because it is a non-porous material, bacteria and mould cannot be trapped and proliferate in its joints, nor underneath the surface.

Corian® is an inert and non-toxic material. Under normal temperature conditions, it does not emit gases. When burned, it releases mainly Carbon Oxides and the smoke generated is optically light and does not contain toxic halogenated gases. Because of these properties, Corian® is used in public spaces and delicate applications such as airport check-in counters, wall and work surfaces in hospitals and hotels.

DuPont™ Corian® can be thermoformed in wooden or metal moulds at controlled temperatures in order to create various 2D and 3D design objects. Embossing effects

can also be created using Bas Relief technique.

The translucency of DuPont™ Corian® is especially striking in the lighter colours as well as in thinner sheets. Many designers are using it to create lamps or lighting effects in various applications. The new colour family, called as Translucent Series, consists of 6 colours in 6mm and 12mm sheets featuring enhanced translucency to be used to create special lighting effects.

Inlaying DuPont™ Corian® with different materials or with different colours of Corian® is possible and can enhance the inherent beauty of the material. Inlays and logos can also be created on Corian® using dye sublimation or direct printing techniques.

5. Fabrication and installation

Detailed information on the fabrication and installation of DuPont™ Corian® is available in the fabrication and installation booklets on Corian® as well as in technical bulletins.

Seams

To minimise material usage and facilitate installation, a corner block of Corian® should be made square (butt) rather than mitred. The edges to be joined should be straight, smooth and clean. Some seams need to be reinforced (see fabrication manual for details). Joints should only be made with "Joint Adhesive for DuPont™ Corian®". Cutouts should be made with a router equipped with a sharp carbide bit, with a minimum diameter of 10mm. All corners of a cutout must be rounded to 5mm radius and the edges smoothed, both on top and bottom, all around a cutout. "L" and "U" shaped corners need smooth, 5mm radius inside corners. For hob cutouts, corners should be reinforced with a Corian® corner block. See fabrication manual for more details.

Some colours of Corian® that feature random veins and irregular patterns require special considerations regarding the seams. Please refer to the related

technical bulletin for best practices in fabrication of these colours.

Sealants and adhesives

Corian® is compatible with many commercially available caulks and sealants. However, the specially developed silicone sealant sold by DuPont or its distributors is recommended for best performance and colour match. Vertical panels of Corian® may be installed over suitable substrates, including water-resistant gypsum board, marine-grade plywood and ceramic tiles. In case a support is needed, apply perimeter frame or full support direct to Corian® using large beads of flexible adhesive leaving a space with a minimum thickness of 1.5mm.

For making seams in countertops, repairs and custom edges, "Joint adhesive for Corian®" in matching colour should be used.

When used in accordance with manufacturer's instructions, it provides a smooth and inconspicuous joint. Joint adhesive for Corian® is available from DuPont or its distributors.

Clearances

The minimum expansion clearance for Corian® is $35 \times 10^{-6} \times (\text{length of the piece of Corian®}) \times (\text{biggest temperature range expected in } ^\circ\text{C})$ in mm. Joints to be caulked should be approximately 1.5mm wide to allow satisfactory caulk penetration and expansion.

Precautions

Product dimensions are nominal. If tolerances are critical, review your needs with a specialist of Corian®.

6. Availability and cost

Availability

DuPont™ Corian® and accessory products are readily available through a worldwide network of Distributors and certified Fabricators/Installers. Please check the Yellow Pages or call the Information Centre for DuPont™ Corian® for the name of a local distributor.

Cost

Cost varies with thickness and width as well as custom fabrication and installation details. Contact the Information Centre for DuPont™ Corian® for the names of certified Dealers, Fabricators/Installers, who can supply price information.

7. Warranty

Ten-year warranty DuPont offers Corian® with two levels of warranty protection. The limited "Product" warranty is standard for all Corian® products and ensures that all products will be free from manufacturing defects for a period of 10 years after purchase. A higher level of protection, the 10 year limited "Installed" warranty, is available through fabricators member of the "Corian® Quality Network". This "Installed" warranty expands the "Product" warranty to ensure that both the fabrication and the installation of the finished product will be free from defect. With two levels of warranty protection available, you can value engineer warranty coverage for each project. Feel free to discuss your needs with a local specialist of Corian®.

8. Maintenance

Preventing damage to Corian®

Avoid prolonged exposure to strong chemicals such as acids, bases, and organic solvents. Spills should be cleaned up promptly. Refer to Table 3 for additional details regarding chemical exposures, clean up, and general maintenance. In case of exposure outside the specifications listed in the Class I Reagents section, the 10 year limited product warranty will be void and handled as a case of abuse. While unaffected by minor impacts, Corian® can be damaged by heavy impacts, especially from pointed objects. Corian® can also be damaged by excessive heat. A local specialist of Corian® can help you include appropriate heat management into your designs.

Repairing Corian®

DuPont™ Corian® provides superior value by being inconspicuously repairable in most cases. Minor cuts, scratches, and stains can be removed by owners using fine sandpaper and Scotch-Brite™ pads. Deeper cuts or impact damage such as cracks may require a licensed service centre or a Corian® Quality Network member to make inconspicuous repairs.

9. Technical services

There is a Technical Support Team for Europe, Middle East and Africa.

10. Additional information

DuPont has many bulletins which give additional information about Corian® and its properties, including removal of radioactive compounds and HIV (AIDS virus) in healthcare facilities, as well as weatherability and VOC rating. Also available are bulletins, which detail fabrication, installation, repair, and proper use of accessories.

11. Legal

This information corresponds to our current knowledge on the subject.

It is offered solely to provide possible suggestions for your own experimentation. It is not intended, however, to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. This information may be subject to revision as new knowledge and experience becomes available, since we cannot anticipate all variations in actual end-use of this information. Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe any patent right.

Table 1: performance properties of DuPont™ Corian® products

PROPERTY	TEST METHOD	TYPICAL RESULTS		UNITS	*
		6mm sheet	12mm sheet		
Density	DIN ISO 1183	1.73 – 1.76	1.68 – 1.75	g/cm ³	1
Flexural modulus	DIN EN ISO 178	8920 – 9770	8040 – 9220	MPa	1
Flexural strength	DIN EN ISO 178	49.1 – 76.4	57.1 – 74.0	MPa	1
Elongation at break	DIN EN ISO 178	0.58 – 0.94	0.76 – 0.93	%	1
Compressive strength	EN ISO 604	178 – 179	175 – 178	MPa	1
Resistance to impact (spring load)	DIN ISO 4586 T11	> 25	>25	N	1
Resistance to impact (ball drop)	DIN ISO 4586 T12	> 120	>120	cm	1
Surface hardness (Mohs index)	DIN EN 101	2-3	2-3		1
Resistance to surface wear	DIN ISO 4586 T6	63 – 75	58 – 63	Lost weight mm ² /100 rev.	1
Resistance to boiling water-increase in weight	DIN ISO 4586 T7	0.1 – 0.7	0.1 – 0.3	%	1
Resistance to boiling water-surface change	DIN ISO 4586 T7	No visible change	No visible change		1
Dimensional stability at 20°C	DIN ISO 4586 T10	< 0.16	< 0.16	% change in length	1
Resistance to dry heat-180°C	DIN ISO 4586 T8	4-5 slight change	4-5 slight change		1
Lightfastness (Xenon arc)	DIN ISO 4586 T16	> 6	> 6	Blue wool scale	1
Anti-slip properties-with 100 µm	DIN 51130:1992-11	5.8° – do not pass R9 requirement (6° min)		° angle	2
Anti-slip properties-with 120 µm	DIN 51130:1992-11	7.6° – pass R9 requirement (6° min)		° angle	2
Anti-slip properties-with 150 µm	DIN 51130:1992-11	8.1° – pass R9 requirement (6° min)		° angle	2
Resistance to bacteria and fungi	DIN EN ISO 846	Does not support microbial growth			3
Electrostatic surface behaviour	DIN IEC 61 340-4-1		> 1 x 10 ¹²	Ω	4

(1) test report Q IWQ MBL 733 1785-1 (for classification according to DIN EN 438 part 1 & 7) from LGA –Germany/04-2004

(2) test report BMW 0411048-03 from LGA-Germany/03-2004

(3) test report 5642219 from LGA-Germany 03/2004

(4) test report EMA-SMG-814 1131 IWQ-MBL 734 1109 from LGA-Germany/03-2004

Table 2: fire properties of DuPont™ Corian® products

PROPERTY	STANDARD	CLASS/ RESULTS	PRODUCT	Type/Area of application	*
Euroclass for Reaction to fire	EN 13501-1	C-s1,d0	Standard grade, all colours, 6 & 12mm	With any substrate of A2 or better fire performance	1
Euroclass for Reaction to fire	EN 13501-1	C-s1,d0	Standard grade, all colours, 12mm	On a substrate with a fire performance of D or better. (wood based substrate)	2
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	FR grade colours, 12mm	With any substrate of A2 or better fire performance	3
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	FR Grade, GW, 12mm	Applied on aluminium profiles with a gap of 50mm	4
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	Standard grade, GW, 12mm, 930mm wide	Applied on aluminium profiles with an airgap and with mineral wool insulation	5
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	Glacier Ice, 6mm (Illumination series)	Installed with an airgap in the back	6
Fire behaviour	BS 476 part 6&7	Class 0	FR grade, GW, 12mm	Not specified (material test)	7
Flammability test	DIN 4102-1	B1	FR Grade, Genesis colours	With a distance of >40mm from other materials	8
Reaction to fire - M Classification	NF P 92-501	M2	Standard Grade, 12mm	Not specified (material test)	9
Reaction to fire - M Classification	NF P 92-501	M2	CW, 6mm	Not specified (material test)	10
Smoke index - F Classification	NF F 16-101	F0	CW, 6 & 12mm	Not specified (material test)	11
Calorific potential	EN ISO 1716	9.15 KJ/g	12mm, CW	Not specified (material test)	12
Fire test - Aviation	JAR/FAR - AITM	Pass	FR Grade	Aviation	13
Fire test - Railroad	DIN 5510-2 / DIN 54837	S 4, SR 2, ST 2	12mm	Railroad vehicle	14
Smoke toxicity	DIN 5510-2 / EN ISO 5659-2	Pass	12mm	Railroad vehicle	15

(1) classification report E131025 from Warrington Fire Research-UK/03-2003

(2) classification report 13126E from Warringtonfiregent-Belgium/02-2008

(3) classification report E131024 from Warrington Fire Research-UK/03-2003

(4) classification report 13448C from Warringtonfiregent-Belgium/12-2008

(5) classification report 13700C from Warringtonfiregent-Belgium/03-2009

(6) classification report 230006665 from MPA NRW-Germany/09-2008

(7) test reports 154054 & 154053 from Warringtonfire-UK/09-2006

(8) test report 230005623 from MPA NRW-Germany/2006

(9) classification report 14540-09 from SNPE-France/04-2009

(10) classification report 1226105 from SNPE-France/05-2005

(11) classification reports 11625-04 & 12261-05 from SME/SNPE-France/03-2004 & 05-2005

(12) test report 11624-04 from SNPE-France/03-2004

(13) test report 05-0530 from Fire Test Laboratory Airbus Deutschland GmbH – 2005

(14) test report P60-08-0018 (test according to DIN 54837, classification according to DIN 5510-2) from RST-Germany/01-2008

(15) test report P60-08-3107 (test according to EN ISO 5659, evaluation according to DIN 5510-2) from RST-Germany/02-2008.

Chemical resistance of DuPont™ Corian® products

CLASS I reagents

The following reagents show no permanent effect on Corian® sheet when left in contact for periods of 16 hours.

The chemical residues can be removed with a **wet Scotch-Brite™ pad and bleaching cleanser**. Sometimes, minimal effects have been observed, particularly those indicated by footnotes (*).

Table 3: CLASS I reagents

<ul style="list-style-type: none">• Acetic Acid (10%)• Acetone**• Acrodine Orange• AG Eosin Blue (5%)• AG Gentian Violet• Ammonia (10%)• Ammonium Hydroxide (5, 28%**)• Amyl Acetate• Amyl Alcohol• Aromatic Ammonia• Ball Point Pen• Benzene**• "Betadine" Solution• Bite Registration Accelerator (2% Eugenol)• Bite Registration Base• Bite Registration Mix (50/50)• Bleach (Household Type)• Blood• B-4 Body Conditioner• Butyl Alcohol• Carbon Disulphide• Carbon Tetrachloride***• "Cavity" in Phenol• Citric Acid (10%)• Caulk IRM (with or w/o ZnO)• Calcium Thiocyanate (78%)• Cigarette (Nicotine)• Coffee• Cooking Oils• Copalite Intermediary Varnish• Cotton Seed Oil• Crystal Violet• Cupra Ammonia• Debacterol• Dimethyl Formamide• Dimethylene Blue• Dishwashing Liquids/Powders• "Dry Bond" Dental Adhesive• Eosine• Equalizing Accelerator (23% Eugenol)• Equalizing Base• Ethyl Alcohol (Ethanol)**• Ethyl Acetate	<ul style="list-style-type: none">• Ethyl Ether**• Eucalyptol• "Eugenol" (with or w/o ZnO)• Ferric Chloride• "Fisher" Formaldehyde (40%)• Food Colouring• Formaldehyde• Gasoline• Gentian Violet• Hair Dyes• Household Soaps• Hydrochloric Acid (20, 30%)• Hydrogen Peroxide• Introfiant Arterial Chemical• Iodine (1% in alcohol)***• "Kelviscera" Cavity• Kerosene• Ketchup• Lemon Juice• Lipstick• Liquid shoe polish• "Luralite" Accelerator (16% Eugenol)• "Luralite" Base• Lye (1%)• "Lysol" Brand Cleaner• Mercurochrome (2% in water)***• Methanol**• Methyl Ethyl Ketone• Methyl Orange (1%)• Methyl Red (1%)• Mineral Oil• Munsel's Solution• Mustard• Nail Polish• Nail Polish Remover (Acetone)• Naphthalene (Naphtha)• Neotopanel• n-Hexane• Nitric Acid 6%• Olive Oil• Pencil Lead• Perchloric Acid• Permaflow Preinjection• "Permaglow" Arterial Fluid• Permanent Marker Ink• Peroxide	<ul style="list-style-type: none">• Phenolphthalein (1%)• Phosphorus Pentoxide• Picric Acid• "Procaine"• Potassium Permanganate (2%)• Restorative Anti-dehydrant• Saffron• Salt (Sodium Chloride)• Shoe Polish• Silica Dental Cement (liquid)• Silver Nitrate (10%)• Soapless Detergents• Sodium Bisulphate• Sodium Hydroxide Solution (5, 10, 25, 40%**)• Sodium Hydroxide Flake**• Sodium Hypochlorite (5%)• Sodium Sulphate• Solitine solvent• Soy Sauce• Sugar (Sucrose)• Sulphuric Acid (25, 33, 60%)• Tannic Acid• Tea• Tetra Hydrofuran• Tetramethyl Rhodamine Isothiocyanate• "Thymol" in Alcohol• Tincture of Iodine• Tincture of Mercurochrome• Tincture of Merthiolate• Toluene***• Tomato Sauce• Trichloroethane• Trisodium Phosphate (30%)• Trypan Blue• Urea (6%)• Uric Acid• Urine• Vinegar• Washable inks• Wine (all varieties)• Wright's Stain• Xylene• Zephiran Chloride• Zinc Chloride• Zinc Oxide (paste, ointment)
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* May cause surface etching or deglossing after 16 hours exposure

** May cause slight lightening after 16 hours exposure

*** May cause slight darkening after 16 hours exposure.

CLASS II reagents

Corian® is not recommended for working areas where CLASS II reagents may come in contact with Corian®.

The 10 Year Limited Installed and Product warranty does NOT apply where class II reagents come in contact with Corian®.

The occasional stain that might result from inadvertent exposure to Class II reagents can often be removed. Scrubbing with household cleanser will remove light stains. More stubborn surface stains will require sanding with fine to coarse sandpaper.

The following residues may require sanding for complete removal:

- Acetic Acid (90, 98 %)
- Acid Drain Cleaners
- Aqua Regia Cleaner
- Chlorobenzene
- Chloroform (100 %)
- Chromic Trioxide Acid
- Cresol
- Dioxane
- Ethyl Acetate
- Equalizing Mix (50/ 50)
- Formic Acid (50, 90 %)
- Furfural
- Glacial Acetic Acid
- Giemsa
- Hexaphene Autopsy/Viscera Treatment
- Hydrofloric Acid (48 %)
- Luralite Mix (50/ 50)
- Methylene Chloride-Based

Scotch-Brite™ is trademark of 3M.

Products

- Paint Removers
- Brush Cleaners
- Some Metal Cleaners
- Nitric Acid (25, 30, 70 %)
- Phenol (40, 85 %)
- Phosphoric Acid (75, 90 %)
- Photographic Film Developer (used)
- Sulphuric Acid (77, 96 %)
- Trichloroacetic Acid (10, 50 %)

Specialised products

Biochemistry staining agents in most instances will stain Corian® after a few minutes' exposure. However, the stains are generally removable by prompt scrubbing with acetone as indicated below.

- Giemsa
- Trypan Blue - Stains removed with acetone
- Acridine Orange
- Safranine
- Crystal Violet - Stain incompletely removed with acetone

The following dental treatment materials will degloss, etch, or slightly stain Corian® Surfaces. Affected areas may be restored by scrubbing with a Scotch-Brite™ cleaning pad.

- Copalite Intermediary Varnish
- Caulk IRM (with or without ZnO)
- Eugenol (with or without ZnO)
- Luralite accelerator (16 % Eugenol)
- Luralite base
- Solitine solvent

- Equalizing accelerator (23 % Eugenol)
- Equalizing base
- Bite registration base
- Bite registration accelerator (2 % Eugenol)
- Bite registration mix (50/50)

Stains caused by the following dental treatment materials may require light to moderate sanding for removal:

- Luralite mix (50/50)
- Equalizing mix (50/50)

Note:

- Products that are not listed may be similar to the ones that are. Please compare the ingredients listed on their label or in their Material Safety Data Sheet to the ones mentioned.
- The published data are for 16 hours exposure time. In reality exposure can be much longer. A leaking hand-soap dispenser may cause a liquid puddle under it for weeks and months. Similarly some containers have poorly designed spouts/caps from which product leaks every time they are used, so that they stand constantly in their spill. If needed, a drip cup or a spill tray in a suitable material would address these situations.
- The resistance to staining of Joint Adhesive is slightly less than that of Corian® sheet and shape.
- Our draining accessories are recommended for residential kitchens only!

For more information, please visit our web site:

www.corian.com



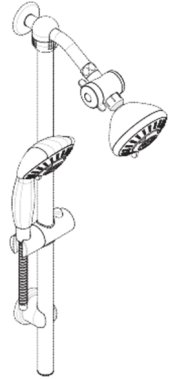
The miracles of science™

10 28 16 Cleansing Room Shower Head

Pfister

Slide Bar Kit

016-HH2CFinish(C)q



Specifications

- Pforever Warranty®

Features

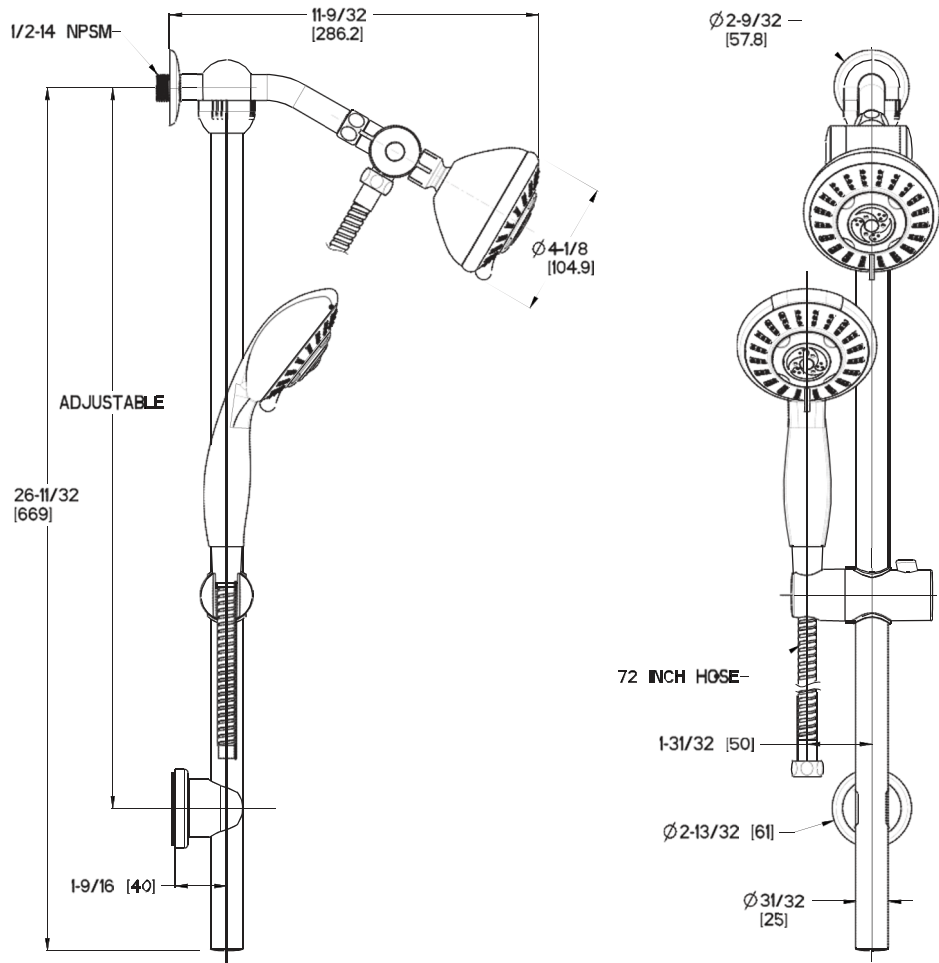
- 72" Mylar Hose
- Adjustable Heights Handheld
- Mounting Hardware Included
- Multi-Function Shower Head
- All Metal Construction
- Pforever Warranty®

Code Compliance

Pfister products are designed and manufactured in compliance with the following standards and codes:

- IAPMO Certified
- CSAB125 Certified
- ASMEA112.18.1

Dimensions



10358-00

1-800-PFAUCET (732-8238) · pfisterfaucets.com/support

October 4, 2013

SS-016-HH2X

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Iyla™ Diverter Trim

- 016-TR1C Finish (C) ∞
- 016-TR1D Finish (D) ∞
- 016-TR1K Finish (K) ∞
- 016-TR1Y Finish (Y) ∞



Specifications

s All Metal Construction

Features

- s All Metal Construction
- s PforeverWarranty®

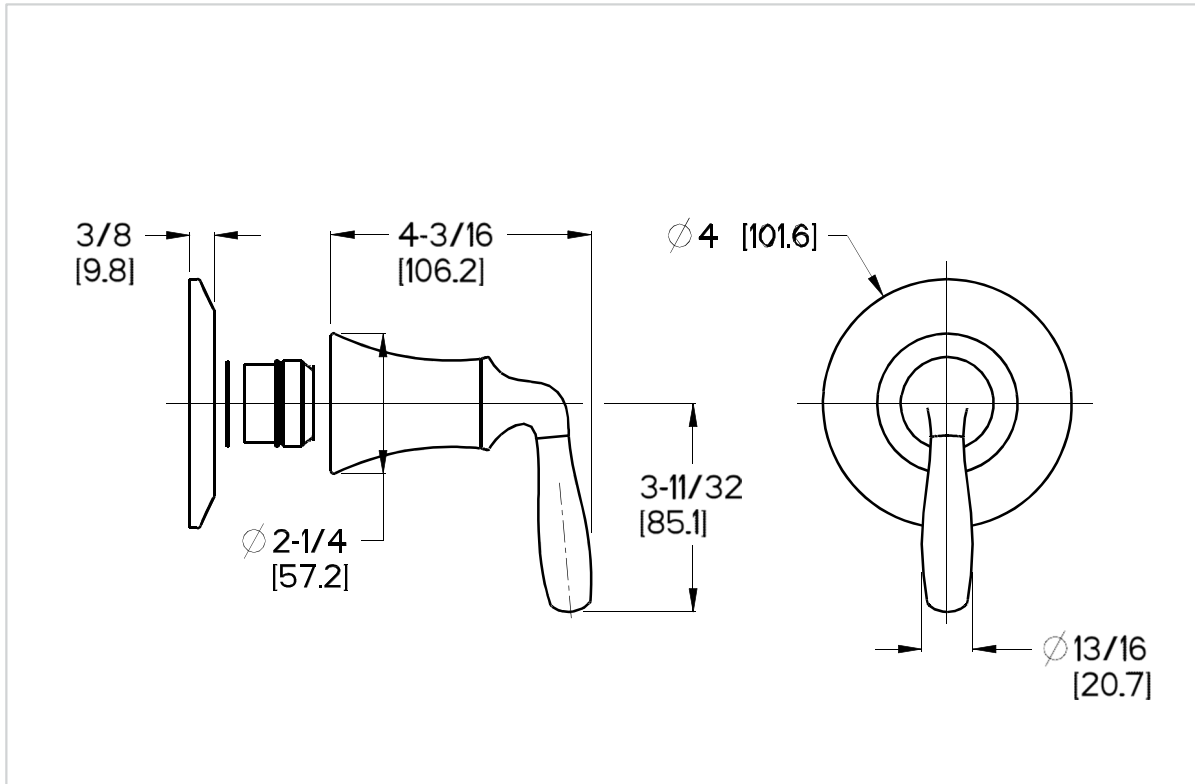
Code Compliance

Pfister products are designed and manufactured in compliance with the following standards and codes:



- s IAPMO Certified
- s CSA B125 Certified
- s ASME A112.18.1
- s ADA Compliant-ANSI A117.1 (Lever handles only)

Dimensions



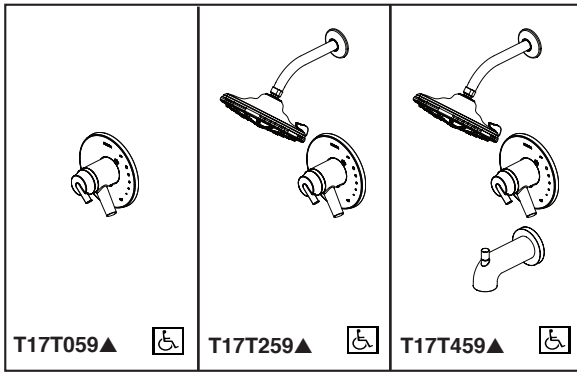
10420-00

10 28 16.13 Bath Controls (732 8238) s QTJTUFSGBVDFUT.DPNITVQQPSU

Copyright © 2013, Pfister

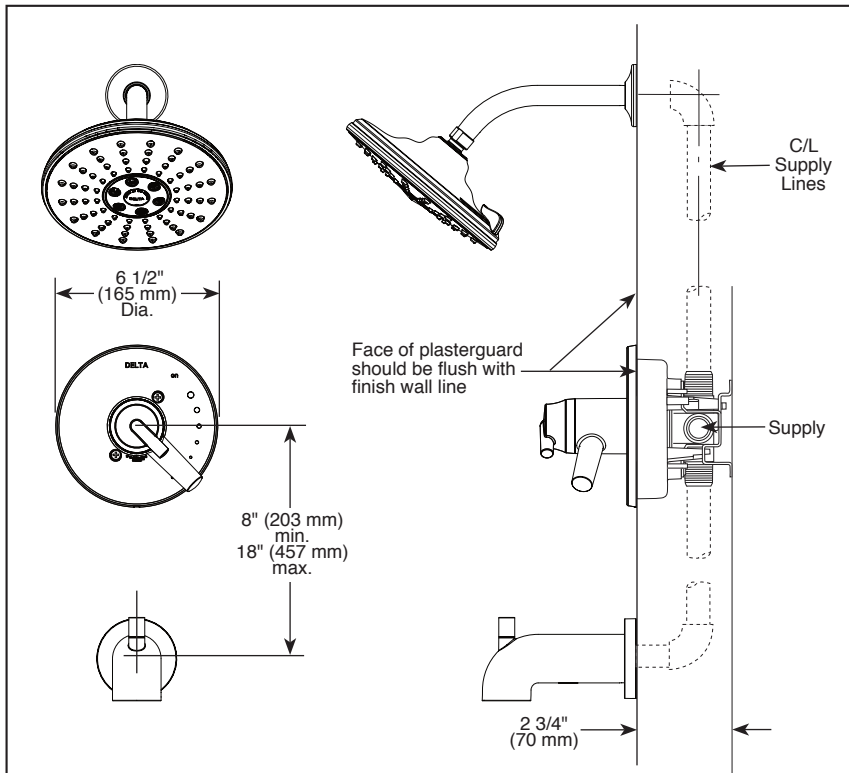
SS-016-TR1X

10 28 19 TUB AND SHOWER ENCLOSURES

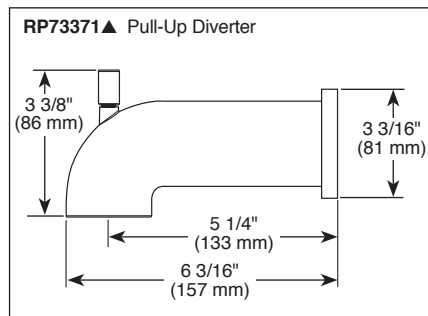
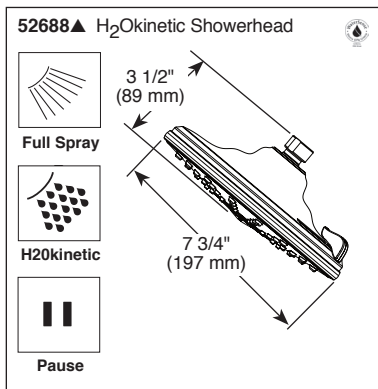


Submitted Model No.: _____

Specific Features: _____



▲ Designate Proper Finish Suffix



TUB AND SHOWER FAUCET TRIM

- Trinsic® Series
- Valve Only (T17T059)
- Shower Only (T17T259)
- Tub/Shower (T17T459)

FEATURES:

- TempAssure® 17T thermostatic valve cartridge

STANDARD SPECIFICATIONS:

- Thermostatic wax element maintains the outlet temperature to $\pm 3.6^{\circ}\text{F}$
- Back-to-back installation capability
- Lever volume control handle; temperature adjustment dial
- Red/blue indicator markings
- Field adjustable to limit handle rotation into hot water zone
- All parts replaceable from the front of the valve
- Available extension kit (RP75136) adds up to 1 3/8" installation depth
- Three setting H₂Okinetic Technology® showerhead; 2.0 gpm @ 80 PSI, 7.6 L/Min @ 550 kPa
- For use with MultiChoice® Universal rough valve body (R10000 Series) ordered separately

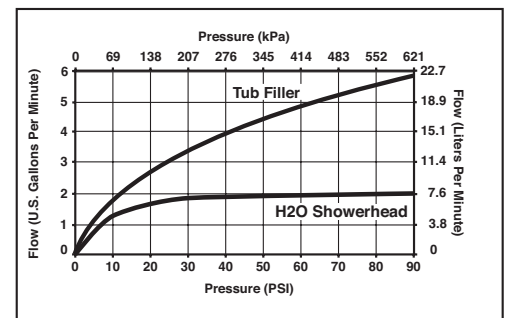
WARRANTY

- Lifetime limited warranty on parts (other than electronic parts and batteries) and finishes; or, for commercial users, for 5 years from date of purchase.
- 5 year limited warranty on electronic parts (other than batteries); or, for commercial users, for 1 year from the date of purchase. No warranty is provided on batteries.



COMPLIES WITH:

- ASME A112.18.1 / CSA B125.1
- ASSE 1016
- ☑ Indicates compliance to ICC/ANSI A117.1 - Valve control only
- EPA WaterSense®



55 E 11th Street, Indianapolis, Indiana 46280
 350 South Edgeware Road, St. Thomas, ON N5P 4L1
 © 2015 Masco Corporation of Indiana

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.

DSP-B-T17T059 Rev. A

10 84 13 EXTERIOR LIGHTING - WALL SCONCE

Rectangles ADA Wall Sconce

By Justice Design Group



LIGHT + LIVING

Call Us 877.445.4486

Product Options

Size: Small

Option: Perforations

Details

White ceramic shade
Rectangular metal wall plate
Paintable Bisque finish
UL Listed for wet locations
ADA Compliant
Made in USA

Dimensions

Small Option Fixture : Height 9.5", Width 5.25", Depth 4"

Lighting

Small option utilizes one 100 Watt 120 Volt Type A19 Medium Base Incandescent lamp (not included).
Large option utilizes one 100 Watt 120 Volt Type A19 Medium Base Incandescent lamp (not included).

Additional Details

Product URL:

<http://www.lumens.com/rectangles-ada-wall-sconce-by-justice-design-group-uu449928.html>

Rating: UL Listed Wet

Product ID: uu449928



Notes:

Prepared by:

Prepared for:

Project:

Room:

Placement:

Approval:



Created August 15th, 2015

10 84 16 Recessed Lighting

Commercial Electric | Model # CER6730AWH27 | Internet # 204726945 | Store SKU # 126878

5 in. and 6 in. White Recessed LED Trim with 90 CRI, 2700K

★★★★★ (240) | Customer Images (8) | Write a Review | Questions & Answers (18)

\$19.98 / each






PRODUCT OVERVIEW Model # CER6730AWH27 | Internet # 204726945 | Store SKU # 126878

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.

- 2700K soft white light, 670 Lumens, 90 CRI
- 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 and damp 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 50,000 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

Info & Guides

-  **Energy Guide**
-  **Instructions / Assembly**
-  **Warranty**

You will need Adobe® Acrobat® Reader to view PDF documents. [Download](#) a free copy from the Adobe Web site.

SPECIFICATIONS

■ DIMENSIONS

Aperture width (in.)	6.0	Assembled Depth (in.)	7.50 in
Assembled Height (in.)	2.75 in	Assembled Width (in.)	7.50 in
Size	6 in.		

■ DETAILS

Actual Color Temperature (K)	2700	Adjustable Lamp Head	No
Color Rendering Index	90	Color Temperature	Soft White
Fixture Finish	White	Fixture finish family	White
Light Output (lumens)	670	Light Source	LED
Product Weight (lb.)	1.25 lb	Returnable	90-Day

■ WARRANTY / CERTIFICATIONS

Certifications and Listings	1-UL Listed,ETL Listed	Manufacturer Warranty	5-year limited warranty
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DIVISION 11 EQUIPMENT

11 30 13.13	Residential Kitchen Appliances (Oven-Stove)
11 20 13.13	Residential Kitchen Appliances (Dishwasher)
11 20 13.13	Residential Kitchen Appliances (Microwave)
11 20 13.13	Residential Kitchen Appliances (Refrigerator)
11 20 13.13	Residential Kitchen Appliances (Dryer)
11 20 13.13	Residential Kitchen Appliances (Washer)
11 30 34	Residential Ceiling Fan
11 31 00	Residential Appliances_SP
11 32 13	Kitchen Sink

We wrote the book on quiet. The next chapter is flexibility.

Bosch Dishwashers

We will be using the Bosch
SGE63E06UC model.

-Team Aggie Sol



BOSCH

Invented for life

The quietest dishwasher brand¹ in the U.S. offers a third rack for more capacity and flexibility.

Dishwasher Specifications



Recessed Handle



Bar Handle



Recessed Handle



Recessed Handle



Bar Handle

	Ascenta®			Ascenta®			Ascenta®		
Model Numbers	SHE3AR75UC SHE3AR72UC SHE3AR76UC SHX3AR75UC ¹ SHX3AR72UC ¹ SHX3AR76UC ¹	Stainless Steel White Black Stainless Steel White Black	Recessed Handle Recessed Handle Recessed Handle Bar Handle Bar Handle Bar Handle	SHE3ARL5UC SHE3ARL2UC SHE3ARL6UC	Stainless Steel White Black	Recessed Handle Recessed Handle Recessed Handle	SHE3AR55UC SHE3AR52UC SHE3AR56UC SHX3AR55UC SHX3AR52UC SHX3AR66UC	Stainless Steel White Black Stainless Steel White Black	Recessed Handle Recessed Handle Recessed Handle Bar Handle Bar Handle Bar Handle
Key Features	50 dBA–Quietest Brand*		50 dBA–Quietest Brand*		50 dBA–Quietest Brand*				
	Manual Height Adjustment Upper Rack		Manual Height Adjustment Upper Rack		Manual Height Adjustment Upper Rack				
	Bosch Exclusive 24/7 Overflow Leak Protection		Bosch Exclusive 24/7 Overflow Leak Protection		Bosch Exclusive 24/7 Overflow Leak Protection				
	Self-Latching Door		Self-Latching Door		Self-Latching Door				
Design	Stainless Steel Tall Tub with Polypropylene		Stainless Steel Tall Tub with Polypropylene		Stainless Steel Tall Tub with Polypropylene				
	14 Place Setting Capacity		14 Place Setting Capacity		14 Place Setting Capacity				
	Multi-function LED with Remaining Time		Multi-function LED with Remaining Time		Multi-function LED with Remaining Time				
	Manual Height Adjustment Upper Rack		Manual Height Adjustment Upper Rack		Manual Height Adjustment Upper Rack				
	Long Silverware Basket		Long Silverware Basket		Long Silverware Basket				
Performance	50 dBA–Quietest Brand		50 dBA–Quietest Brand		50 dBA–Quietest Brand				
	6 Programs and 2 Options		5 Programs and 2 Options		4 Programs and 2 Options				
	Load Sensor Automates Wash Temperature		Load Sensor Automates Wash Temperature		Load Sensor Automates Wash Temperature				
	Sanitize Option Eliminates Bacteria and Enhances Drying Results		Sanitize Option Eliminates Bacteria and Enhances Drying Results		Sanitize Option Eliminates Bacteria and Enhances Drying Results				
Efficiency	279 kwh/yr–ENERGY STAR®		279 kwh/yr–ENERGY STAR®		279 kwh/yr–ENERGY STAR®				
	EcoSense® Reduces Energy Usage up to 20%		EcoSense® Reduces Energy Usage up to 20%		EcoSense® Reduces Energy Usage up to 20%				
	Half Load Cycle for Small Loads		Half Load Cycle for Small Loads		Half Load Cycle for Small Loads				
Convenience	Three-, Six-, Nine-hour Delay Start Timer		Three-, Six-, Nine-hour Delay Start Timer		Three-, Six-, Nine-hour Delay Start Timer				
	Bosch Exclusive 24/7 Overflow Leak Protection		Bosch Exclusive 24/7 Overflow Leak Protection		Bosch Exclusive 24/7 Overflow Leak Protection				
	Self-Latching Door		Self-Latching Door		Self-Latching Door				
	Express Wash–In 30 Minutes or Less		Express Wash–In 30 Minutes or Less		Express Wash–In 30 Minutes or Less				

Special Application Dishwasher Specifications



Recessed Handle



Bar Handle



Custom Panel



Recessed Handle



Custom Panel

	ADA Compliant 18"			ADA Compliant 24"		
Model Numbers	SPE5ES55UC SPX5ES55UC SPV5ES53UC	Stainless Steel Stainless Steel Custom Panel	Recessed Handle Bar Handle Custom Panel	SGE63E15UC SGE63E06UC SGV63E03UC	Stainless Steel Black Custom Panel	Recessed Handle Recessed Handle Custom Panel
Key Features	46 dBA–Quietest Brand*			49 dBA–Quietest Brand*		
	ADA Compliant for Lower Countertop Installation			ADA Compliant for Lower Countertop Installation		
	Solid Base Contains Sound & Prevents Leaks			Solid Base Contains Sound & Prevents Leaks		
	RackMatic® on Upper Rack–3 Height Adjustments and Up to 9 Possible Rack Positions			Manual Height Adjustment Upper Rack		
	AquaStop® Plus Leak Protection Works 24/7			AquaStop® Plus Leak Protection Works 24/7		
	Water Softener Ensures Perfect Shine			Water Softener Ensures Perfect Shine		
Design	Stainless Steel Euro Tub (Shorter Height)			Stainless Steel Euro Tub (Shorter Height)		
	Premium Racks with Single-Flexible Silverware Basket			Premium Racks with Single-Flexible Silverware Basket		
	9 Place Setting Capacity			14 Place Setting Capacity		
	LED Remaining Time Display			LED Remaining Time Display		
	RackMatic® on Upper Rack–3 Height Adjustments and Up to 9 Possible Rack Positions			Manual Height Adjustment Upper Rack		
	Flexible Silverware Basket			Flexible Silverware Basket		
Performance	46 dBA–Quietest Brand			49 dBA–Quietest Brand		
	4 Programs and 3 Options			6 Programs and 5 Options		
	Load Sensor Automates Wash Temperature			Load Sensor Automates Wash Temperature		
	Sanitize Option Eliminates Bacteria and Enhances Drying Results			Sanitize Option Eliminates Bacteria and Enhances Drying Results		
				Eco Cycle		
Efficiency	259 kwh/yr–ENERGY STAR®			234 kwh/yr–ENERGY STAR®		
	EcoSense® Reduces Energy Usage up to 20%			EcoSense® Reduces Energy Usage up to 20%		
	Half Load Option for Small Loads			Half Load Option for Small Loads		
Convenience	24 h Delay Start Timer			24 h Delay Start Timer		
	AquaStop® Plus Leak Protection Works 24/7			AquaStop® Plus Leak Protection Works 24/7		
	Express Wash–In 30 Minutes or Less			Express Wash–In 30 Minutes or Less		

Colors



Stainless Steel
(SPX5ES55UC Model Shown)



Custom Panel
(SPV5ES53UC Model Shown)



Stainless Steel
(SGE63E15UC Model Shown)



Black
(SGE63E06UC Model Shown)

¹ Does not include Multi-function LED with Remaining Time.
* Based on an average of sound ratings contained in major brand's websites. Major brands defined as TraQline Top 10 brands, September 2013.

* Based on an average of sound ratings contained in major brand's websites. Major brands defined as TraQline Top 10 brands, June 2013.



Dishwasher Technical Details

Special Application Dishwasher

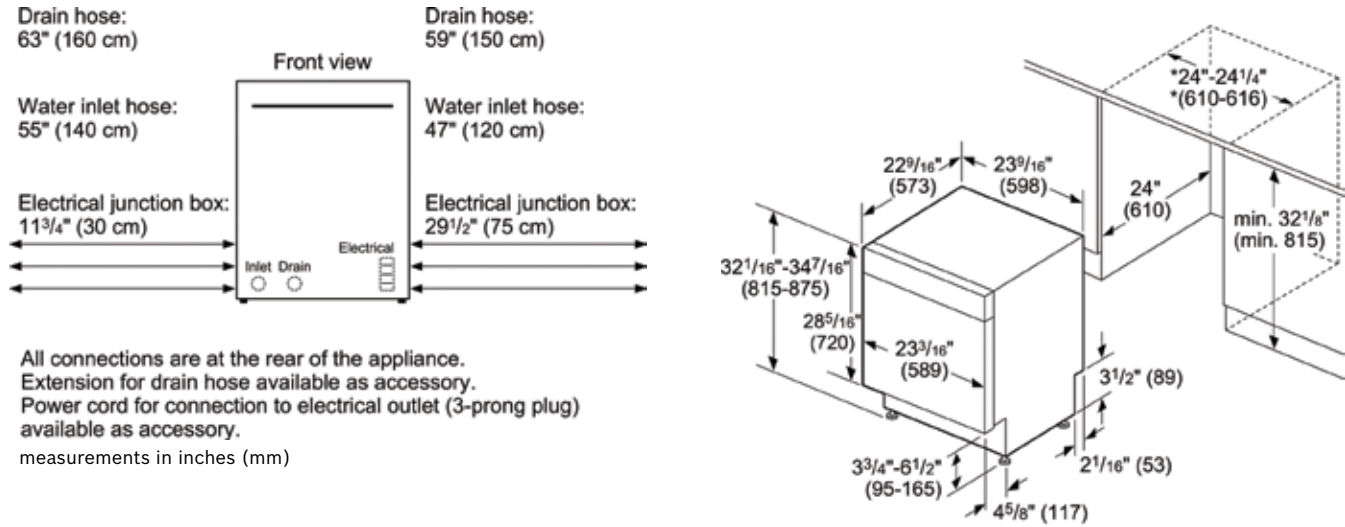
	DLX	Main	Ascenta® DLX	Ascenta®	Ascenta®	Ascenta®	Ascenta® DLX	Ascenta®	Ascenta®	ADA Special Application	ADA Special Application	ADA Special Application	ADA Special Application
Model	300 Series	300 Series	Ascenta®	Ascenta®	Ascenta®	Ascenta®	Ascenta®	Ascenta®	Ascenta®	18" ADA	18" ADA	24" ADA	24" ADA
Stainless Steel	SHX53TL5UC	SHX53T55UC	SHX4AT75UC	SHX4AT55UC	SHE3AR75UC	SHX3AR75UC	SHE3ARL5UC	SHE3AR55UC	SHX3AR55UC	SPE5ES55UC	SPX5ES55UC	SGE63E15UC	
White					SHE3AR72UC	SHX3AR72UC	SHE3ARL2UC	SHE3AR52UC	SHX3AR52UC				
Black					SHE3AR76UC	SHX3AR76UC	SHE3ARL6UC	SHE3AR56UC	SHX3AR56UC			SGE63E06UC	SGV63E03UC
Custom panel	SHV53TL3UC	SHV53T53UC		SHV4AT53UC*							SPV5ES53UC		
Silence													
dBA	46	46	49	49	50	50	50	50	50	46	46	49	49
InfoLight®	■	■	■	■						■	■		■
Design													
Type	Bar Handle / Custom Panel	Bar Handle / Custom Panel	Bar Handle	Bar Handle / Custom Panel	Recessed Handle	Bar Handle	Recessed Handle	Recessed Handle	Bar Handle	Recessed Handle	Bar Handle / Custom Panel	Recessed Handle	Custom Panel
New Deeper Stainless Steel Tub	■	■											
Stainless Steel TallTub with PP *			■	■	■	■	■	■	■				
Stainless Steel TallTub										■	■	■	■
Control	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons	Buttons
Display Type	LED	LED	LED	LED	LED	LED	LED	LED	LED	LED	LED	LED	LED
Wash Cycles	4	4	4	4	6	6	5	4	4	4	4	6	6
Heavy	■	■	■	■	■	■	■	■	■	■	■	■	■
Auto	■	■	■	■	■	■	■	■	■	■	■	■	■
Normal	■	■	■	■	■	■	■	■	■	■	■	■	■
Delicate					■	■						■	■
Express					■	■	■					■	■
Half Load					■	■	■	■	■				
Rinse / Rinse & Hold	■	■	■	■						■	■		
Glass												■	■
Options	5	4	5	4	2	2	2	2	2	3	3	5	5
Delay Start	24 h	24 h	24 h	24 h	3/6/9 h	3/6/9 h	3/6/9 h	3/6/9 h	3/6/9 h	24 h	24 h	24 h	24 h
Half Load			■	■						■	■	■	■
Delicate	■	■	■	■									
Sanitize	■	■	■	■	■	■	■	■	■	■	■	■	■
Extra Shine®	■	■		■									
Extra Dry			■	■									
SpeedPerfect™	■												
Eco												■	■
Extra Wash												■	■
Efficiency													
Energy – kWh / year	259	259	279	279	279	279	279	279	279	259	259	234	234
ENERGY STAR® Qualified	■	■	■	■	■	■	■	■	■	■	■	■	■
Safety													
Leak Protection	24/7 AquaStop®	24/7 AquaStop®	24/7 Overflow	24/7 Overflow	24/7 Overflow	24/7 Overflow	24/7 Overflow	24/7 Overflow	24/7 Overflow	24/7 AquaStop® Plus	24/7 AquaStop® Plus	24/7 AquaStop® Plus	24/7 AquaStop® Plus
PerfectDoor	■	■	■	■	■	■	■	■	■	■	■	■	■
Self-latching Door	■	■	■	■	■	■	■	■	■	■	■	■	■
ChildLock					■	■	■	■	■			■	■
Washer Sensor													
EcoSense	■	■	■	■	■	■	■	■	■	■	■	■	■
Load Size Sensor	■	■	■	■	■	■	■	■	■	■	■	■	■
Variable Spray Pressure	■	■	■	■	■	■	■	■	■	■	■	■	■
Place Setting Capacity	15	15	14	14	14	14	14	14	14	9	9	14	14
Upper Rack													
Adjustability	3-Step RackMatic®	Manual	2-Step RackMatic®	2-Step RackMatic®	Manual	Manual				3-Step RackMatic®	3-Step RackMatic®	Manual	Manual
Detergent Tray	■	■	■	■	■	■				■	■	■	■
Handle	Detergent Tray	Detergent Tray			Detergent Tray	Bosch Plastic				Bosch Plastic	Bosch Plastic	Detergent Tray	Detergent Tray
Flip Tines	2	2	2	2	1	1	1	1	1	2	2	2	2
Cup Shelves	2	2	2	2	2	2	1	1	1	2	2	2	2
Lower Rack													
Handle	Handle Wire	Handle Wire	Handle Wire	Handle Wire	Handle Wire	Handle Wire				Bosch Plastic	Bosch Plastic		
Flip Tines					1	1				2	2	2	2
Silverware Basket	Long	Long	Duo-Flex	Long	Long	Long	Long	Long	Long	Flexible	Flexible	Flexible	Flexible
Silverware Basket Cover	■	■	■	■	■	■	■	■	■	■	■	■	■
Display													
Remaining Time	■	■	■	■	■	■				■	■	■	■
Sanitized Indicator Light	■	■	■	■	■	■	■	■	■	■	■	■	■
Rinse Aid Indicator Light	■	■	■	■	■	■	■	■	■	■	■	■	■
End of Cycle Indicator	■	■	■	■	■	■	■	■	■	■	■	■	■
Features													
Water Softener										■	■	■	■
EcoSilence™ Two-Pump Motor System	■	■	■	■	■	■	■	■	■	■	■	■	■
Triple Filtration System	■	■	■	■	■	■	■	■	■	■	■	■	■
Flow Through Water Heater	■	■	■	■	■	■	■	■	■	■	■	■	■
Five Level Wash	■	■	■	■	■	■	■	■	■	■	■	■	■
Condensation Drying	■	■	■	■	■	■	■	■	■	■	■	■	■
Other													
Extra Tall Item Sprinkler												■	■
End of Cycle Sound	■	■	■	■								■	■
Power Cord with Junction Box Incl.	■	■								■	■	■	■
Water Hose 1/2" x 14'	■	■								■	■	■	■

*Q3 2014, Limited availability

Dishwasher Dimensions and Installation

Special Application / ADA Dishwashers

SGE63E15UC, SGE63E06UC

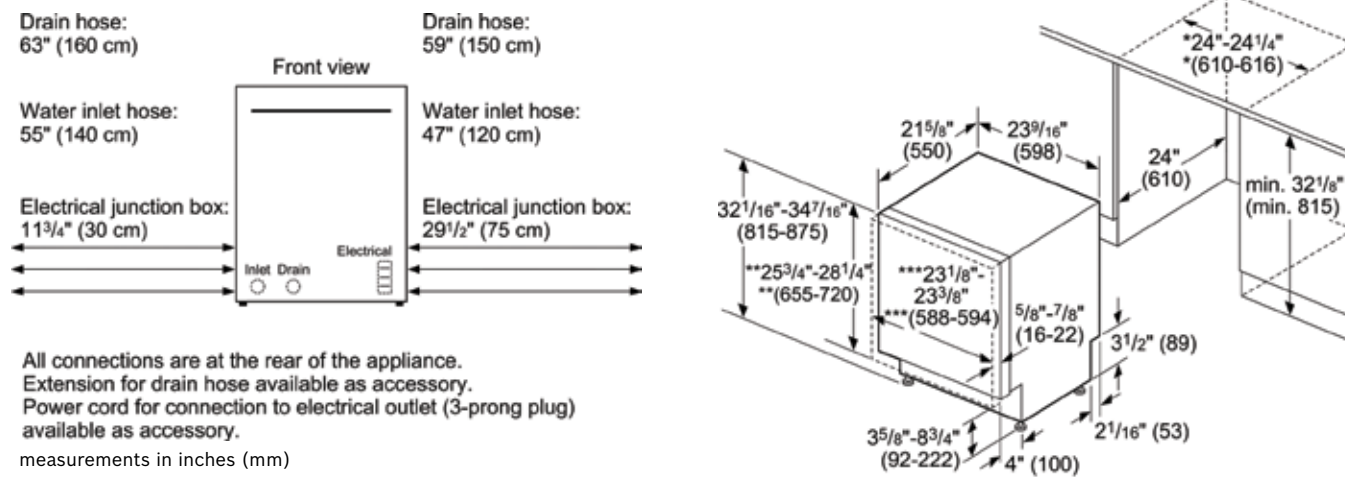


All connections are at the rear of the appliance.
Extension for drain hose available as accessory.
Power cord for connection to electrical outlet (3-prong plug) available as accessory.

measurements in inches (mm)

* 23⁹/₁₆" (600) without decor strips
measurements in inches (mm)

SGV63E03UC



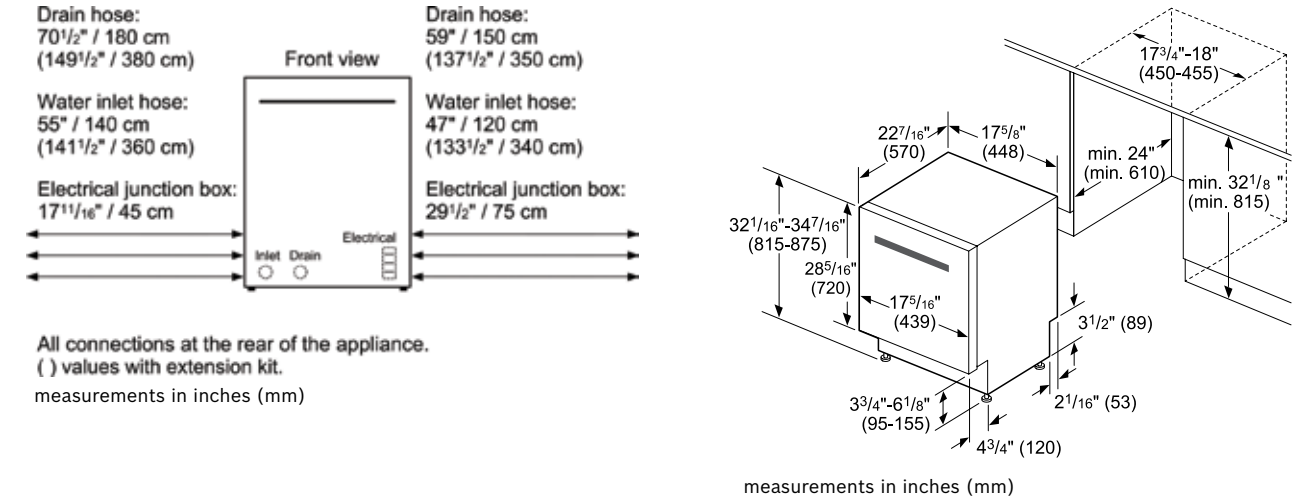
All connections are at the rear of the appliance.
Extension for drain hose available as accessory.
Power cord for connection to electrical outlet (3-prong plug) available as accessory.

measurements in inches (mm)

* 23⁵/₈" (600 mm) without decor strips
** measured from the bottom edge of the countertop panel recommended 3/4" (20 mm), panel weight 6-18 lbs (2.5-8.5 kg)
*** 24" (610 mm) wide panel may be used depending on cabinet design
measurements in inches (mm)

Special Application / 18" Dishwashers

SPE5ES55UC, SPX5ES55UC

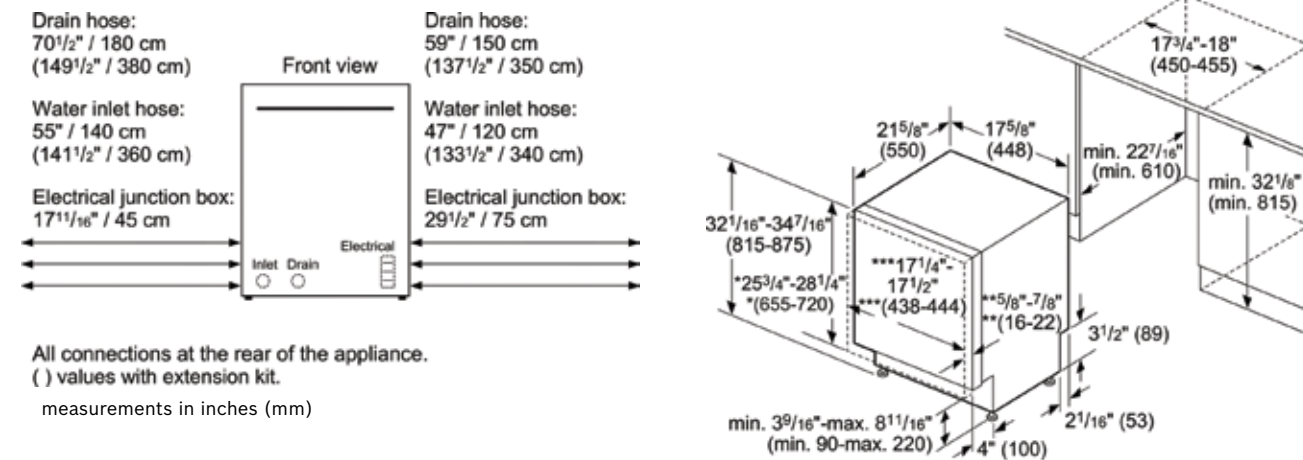


All connections at the rear of the appliance.
() values with extension kit.

measurements in inches (mm)

measurements in inches (mm)

SPV5ES53UC



All connections at the rear of the appliance.
() values with extension kit.

measurements in inches (mm)

* measured from the bottom edge of the countertop panel
** panel weight 6-16 lb (2.5-7.5 kg)
*** 18" (450 mm) wide panel may be used depending on cabinet design
measurements in inches (mm)

11 30 13.13 Residential Kitchen Appliances: Microwave

Panasonic



1.2 Cu. Ft. Countertop/Built-In Microwave with Inverter Technology NN-SN661S Stainless

Model: NN-SN661S

Size	
Type	Family Size
Installation	Counter Top
Oven Capacity	1.2 cu. ft.
Cooking Power	1200 Watts
Turntable Diameter	13-1/2"
Panasonic Technology	
Panasonic Inverter	Inverter
Prestige Genius Sensor	Genius
Design	
Color	Stainless Steel
Control Panel	Flat Panel Membrane
Display Panel	Green 4-Digit Display
Cooking Options	Microwave Cooking
Style	
Door Front	Stainless Steel
Door Window	Black
Exterior Wrap	Silver
Door Release	Push Button
Oven Interior	Epoxy
Performance	
Power Setting	10 Levels
Multi-stage Cooking	3 Stages
Automatic Turntable	Revolving & Removable
Menu Action Screen	
Programmable Features	
Sensor Cook	Sensor 12 Menu Items
Sensor Reheat	Yes
More / Less Control	Yes
Inverter Turbo Defrost	Yes
Keep Warm Button	Yes

Popcorn Button	Yes
Quick Minute	Yes
Delay Start	Yes
Delay Timer	Yes
Recipe Store	
Function Key	
Specifications	
Power Requirements	120V 60Hz; 12.7A, 1460 Watts; AC only
Exterior Dimensions H x W x D (in.)	12 1/4 x 20 11/16 x 15 13/16
Cavity Dimensions H x W x D (in.)	9 15/16 x 13 15/16 x 14 3/8
Weight	25.5 lbs.

Your Store:
West Sacramento, CA

11 30 13.13 Residential Kitchen Appliances (Oven-Stove)



Frigidaire EasyCare Smooth Surface 4.6-cu ft Self-Cleaning Slide-In Electric Range (Stainless Steel) (Common: 30-in; Actual: 30-in)

Item #: 634971 | Model #: LFES3025PF



\$1,349.00

Was: \$1,499.00

Save 10% thru 03/10/2015

Get 5%* Off Every Day or Special Financing**
Minimum Purchase Required

Your order will be ready for pickup from Lowe's Of West Sacramento, CA by 03/20/2015.

FREE

Lowe's Truck Delivery

Your order will be ready for delivery to you from Lowe's Of West Sacramento, CA by 03/20/2015.

Parcel Shipping

Unavailable for This Order

Sent by carriers like UPS, FedEx, USPS, etc.

Tweet 0 +1 3 email

Frigidaire EasyCare Smooth Surface 4.6-cu ft Self-Cleaning Slide-In Electric Range (Stainless Steel) (Common: 30-in; Actual: 30-in) **\$1,349.00**

Description

EasyCare Smooth Surface 4.6-cu ft Self-Cleaning Slide-In Electric Range (Stainless Steel) (Common: 30-in; Actual: 30-in)

- EasyCare™ Stainless Steel resists fingerprints and is easy to clean
- Bigger window, better view - Lowe's exclusive bigger window provides a better view so you can see your dish without opening the door
- Our large capacity oven gives you room to cook more at once
- Extra large 12-in element gives you more flexibility to fit larger pots and pans
- Quick clean for a quick, light oven cleaning
- Delay clean allows you to set the oven to begin cleaning on your schedule
- Ready-Select® controls allow you to easily control your cooking temperature
- ADA compliant - meets the appliance standards in the Americans with Disabilities Act Accessibility Guidelines
- Built with American Pride - designed, engineered and assembled in the USA

Specifications

Lowe's Exclusive	Yes	Hot Surface Indicator Lights	Yes
Range Size (Inches)	30	Number of Oven Racks	2
Oven Capacity (Cu. Feet)	4.6	Half/Split Rack	No
Appliance Color/Finish	Stainless steel	Glide/Rollout Racks	No
Cleaning Method	Self-cleaning	Number of Oven Rack Positions	5
Cooking Surface Type	Smooth surface	Oven Door Lock	No
Convection Element Type	None	Time Bake	Yes
Induction Heating	No	Delay Bake	No
Element #1 Size (Inches)	12	Favorite Setting	No
Element #1 Type	Standard	Keep Warm Setting	No
Element #1 Wattage (Watts)	2700	Sabbath Mode	No
Element #2 Size (Inches)	6	Proofing	No
Element #2 Type	Standard	Dehydration	No
Element #2 Wattage (Watts)	1200	Automatic Shut-Off	No
Element #3 Size (Inches)	6-in/9-in	Temperature-Sensor Baking	No
Element #3 Type	Dual	Oven Meat Probe	No
Element #3 Wattage (Watts)	3000	Digital Display	Yes
Element #4 Size (Inches)	7	Interior Light(s) Type	Halogen
		Light(s) Control	Oven light switch

3-Year Major Appliance Extended Protection Plan (\$1,000-\$1,499.99)	\$79.97
5-Year Major Appliance Extended Protection Plan (\$1,000-\$1,499.99)	\$119.97

Element #4 Type	Standard	Height (Inches)	35.625
Element #4 Wattage (Watts)	1500	Width (Inches)	30
Element #5 Size (Inches)	N/A	Depth (Inches)	28.3215
Element #5 Type	N/A	Manufacturer Color/Finish	EasyCare Stainless Steel
Element #5 Wattage (Watts)	0	Cooktop Size (Inches)	30
Element #6 Size (Inches)	N/A	Cooktop Size Group	Medium (24 - 34 inches)
Element #6 Type	N/A	Power Element	No
Element #6 Wattage (Watts)	0	Simmer Element	No
Oven Window	Yes	Number of Elements/Cooking Zones	4
Oven Control Type	Electronic touch pad	Manufacturer's Warranty (Parts)	1-year limited
Hidden Bake Element	No	Manufacturer's Warranty (Labor)	1-year limited
Glass Door	Yes	Color/Finish Family	Steel- Stainless
Warming Drawer	No	CSA Safety Listing	No
Automatic Convection Conversion	No	ETL Safety Listing	No
Adjustable Cleaning Levels	Yes	UL Safety Listing	Yes
Self-Cleaning Drip Bowls	No	ADA Compliant	Yes
Self-Cleaning Oven Racks	No	Power Cord Included	No (sold separately)
Control Lockout	Yes	Sub-Brand	N/A
Handle Color	Stainless steel	Series	EasyCare
Cooking Surface Control Type	Knobs		
Control Location	In front of elements		

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****Privacy Statement (updated February 19, 2015)**



11 30 13.13 Residential Kitchen Appliances (Refrigerator)

Top Mount Refrigerators

FFHT1621QS/W/B

16 Cu. Ft. Top Mount



Product Dimensions

Height (Including Hinges & Rollers)	65-1/8"
Width	28"
Depth (Including Door)	29-7/8"

More Easy-To-Use Features

Full-Width Wire Freezer Shelf
Gives you a way to organize items in your freezer better so you can find food quickly.

Garage-Ready
Our top freezer offers the flexibility to work in your home or in your garage. It's built to handle extreme temperature conditions.

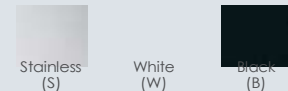
Ready-Select® Controls

A.D.A. - Compliant¹
With accessible shelving, and controls that are positioned within arm's reach and allow one-hand operation, our top-freezer refrigerator is A.D.A.-Compliant.

ENERGY STAR®



Available in:



Signature Features

ENERGY STAR®-Qualified

Maximize your energy and dollar savings with ENERGY STAR®-Qualified Appliances.

Bright Lighting

Our bright lighting makes it easy to see what's inside.

Reversible Door

Door can be installed to open left or right based on your needs.

Store-More™ Humidity-Controlled Crisper Drawers

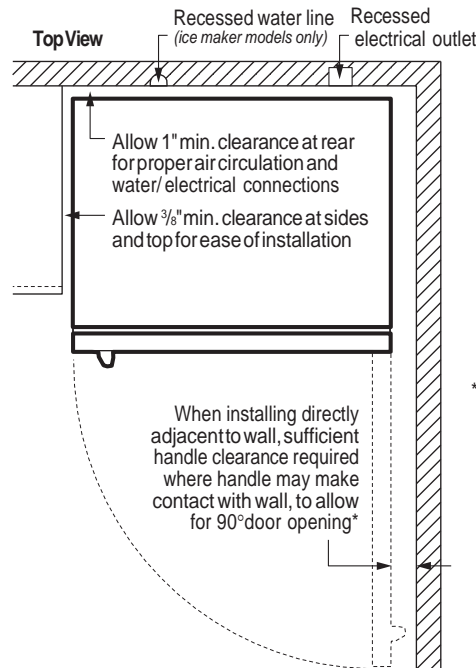
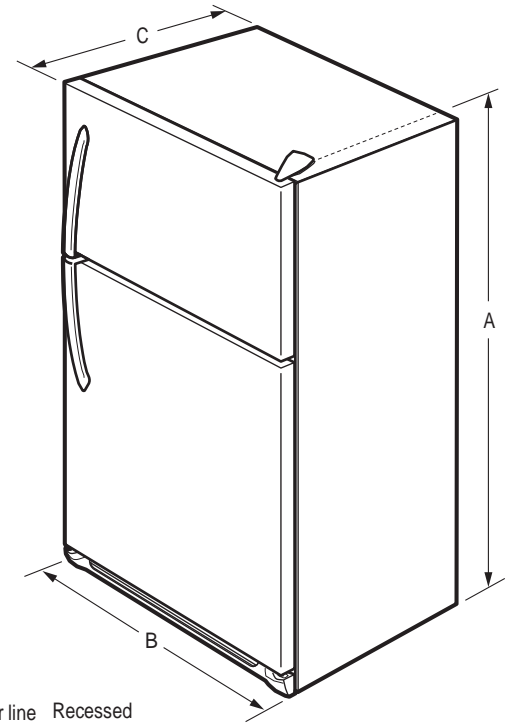
Our humidity-controlled crisper drawers are designed to keep your fruits and vegetables fresh so you don't have to worry about stocking up.

¹When properly installed, this model is A.D.A.-qualified based on the United States Access Board's A.D.A./A.B.A. Accessibility Guidelines and the Department of Justice's 2010 A.D.A. Standards for Accessible Design.

Features	
Door Design	Square
Door Handle Design	Color-Coordinated
Cabinet Finish (Textured)	Color-Coordinated
Door Stops	Yes
Door Hinge Covers	Color-Coordinated
Door Reverse Option	Yes
Left-Swing Door	
Rollers – Front / Rear	Fixed / Yes
Sound Package	
Toe Grille	Color-Coordinated
Garage-Ready	Yes
Refrigerator Features	
Interior Lighting	Bright
Refrigerator Shelves	2 Full-Width Glass
Cool Zone™ Drawer	
Wine/Can Rack	
Store-More™ Crisper Drawers	2 Clear
Humidity Controls	2
Dairy Compartment	Clear Dairy Door
Door Bins	3 Full-Width White
Door Racks	
Non-Slip Bin Liner	
Tall Bottle Retainers	
Gallon Door Storage	1
Freezer Features	
Door Bins	
Door Racks	2 Full-Width White
Freezer Shelves	1 Full-Width Wire
Factory Ice Maker w/ Large Ice Bin	Optional (PN # IM115)
Lighting	
Certifications	
A.D.A.-Compliant ¹	Yes
ENERGY STAR®	Yes
Specifications	
Total Capacity (Cu. Ft.)	16.3
Refrigerator Capacity (Cu. Ft.)	12.6
Freezer Capacity (Cu. Ft.)	3.7
Power Supply Connection Location	Right Bottom Rear
Water Inlet Connection Location	Bottom Right
Voltage Rating	120V / 60Hz / 15A
Connected Load (kW Rating) @ 120 Volts ²	.72
Amps @ 120 Volts	6.0
Minimum Circuit Required (Amps)	15
Shipping Weight (Approx.)	190 Lbs.

¹When properly installed, this model is A.D.A.-qualified based on the United States Access Board's A.D.A./A.B.A. Accessibility Guidelines and the Department of Justice's 2010 A.D.A. Standards for Accessible Design.

²For use on adequately wired 120V, dedicated circuit having 2-wire service with a separate ground wire. Appliance must be grounded for safe operation.



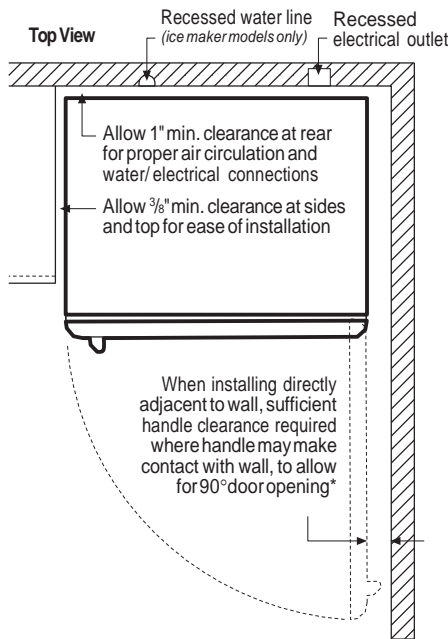
* When installing refrigerator adjacent to wall, cabinet or other appliance that extends beyond front edge of unit, 20" minimum clearance recommended to allow for optimum 140° door swing, providing complete crisper access and removal. (Absolute 3" minimum clearance will ONLY allow for 90° door swing which will provide limited crisper access with restricted removal.)

NOTE: For planning purposes only. Always consult local and national electric and plumbing codes. Refer to Product Installation Guide for detailed installation instructions on the web at frigidaire.com.

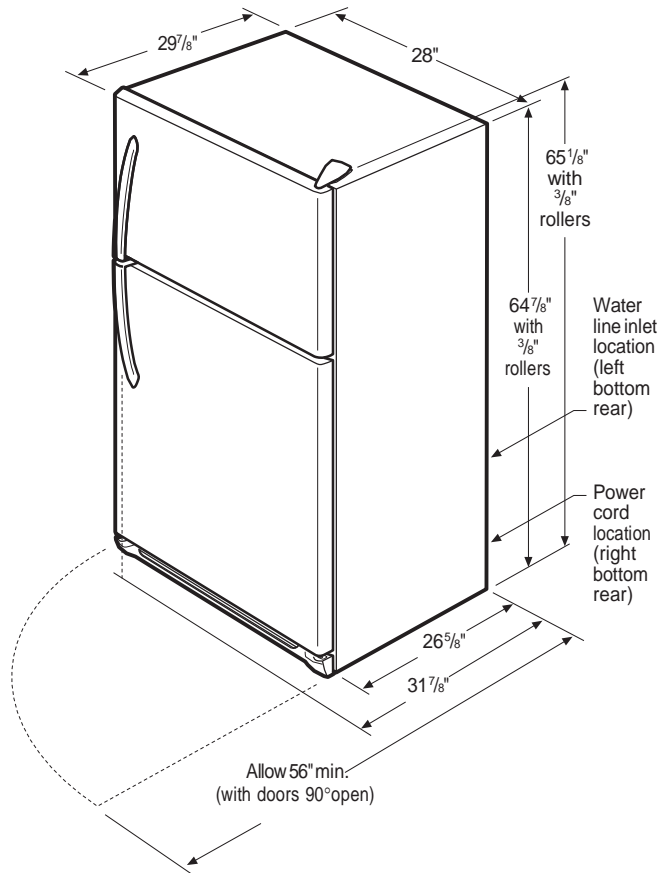


Product Dimensions	
A-Height (Incl. Hinges & Rollers)	65-1/8"
B-Width	28"
C-Depth (Incl. Door)	29-7/8"
Depth with Door Open 90°	56"

Accessories information available on the web at frigidaire.com



*When installing refrigerator adjacent to wall, cabinet or other appliance that extends beyond front edge of unit, 20" minimum clearance recommended to allow for optimum 140° door swing, providing complete crisper access and removal. (Absolute 3" minimum clearance will ONLY allow for 90° door swing which will provide limited crisper access with restricted removal.)



Top Mount Refrigerator Specifications

- Product Shipping Weight (approx.) – 190 Lbs.
- An electrical supply with grounded three-prong receptacle is required. The power supply circuit must be installed in accordance with current edition of National Electrical Code (NFPA 70) and local codes & ordinances.
- Voltage Rating – 120V/60 Hz/15 Amps
- Connected Load (kW Rating) @ 120 Volts = .72kW
- Amps @ 120 Volts = 6.0 Amps
- Always consult local and national electric & plumbing codes.
- Floor should be level surface of hard material, capable of supporting fully loaded refrigerator.
- Minimum 3/8" clearance required for sides and top of refrigerator with 1" clearance at rear to allow for ease of installation, proper air circulation, and plumbing/ electrical connections.
- When installing refrigerator adjacent to wall, cabinet or other appliance that extends beyond front edge of unit, 20" minimum clearance recommended to allow for optimum 140° door swing, providing complete crisper access and removal. (Absolute 3" minimum clearance will ONLY allow for 90° door swing which will provide limited crisper access with restricted removal.)

- To ensure optimum performance, do not install in areas where temperature drops below 55°F or rises above 110°F and avoid installing in direct sunlight or close proximity to range, dishwasher or other heat source.
- For proper ventilation, front grille MUST remain unobstructed.
- Recess electrical outlet when possible.
- Optional Ice Maker Kit (PN # IM115) available for installation in ice maker-ready models only.
- Water recess on rear wall recommended to prevent water line damage.
- Water Pressure – Cold water line must provide between 30 and 100 pounds per square inch (psi).
- Copper tubing with 1/4" O.D. recommended for water supply line with length equal to distance from rear of unit to household water supply line plus 7 additional feet. Optional Water Supply Installation Kits available.

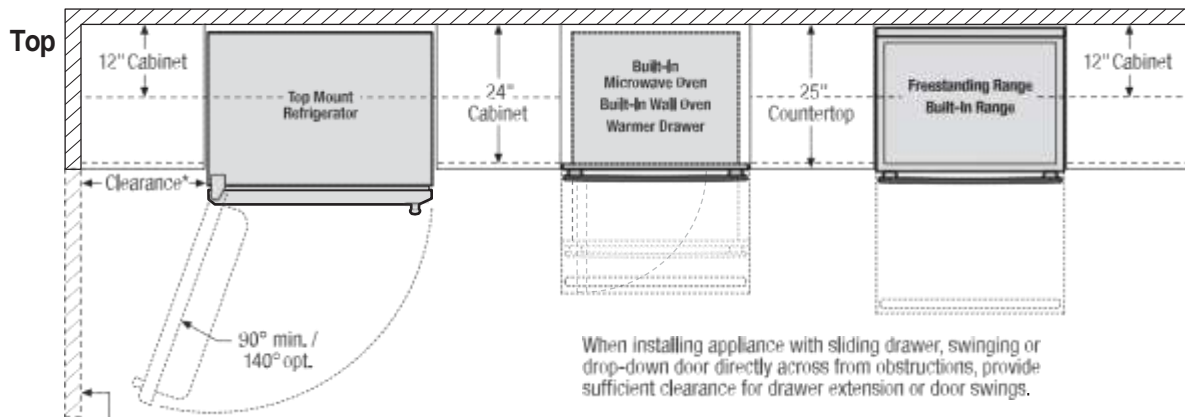
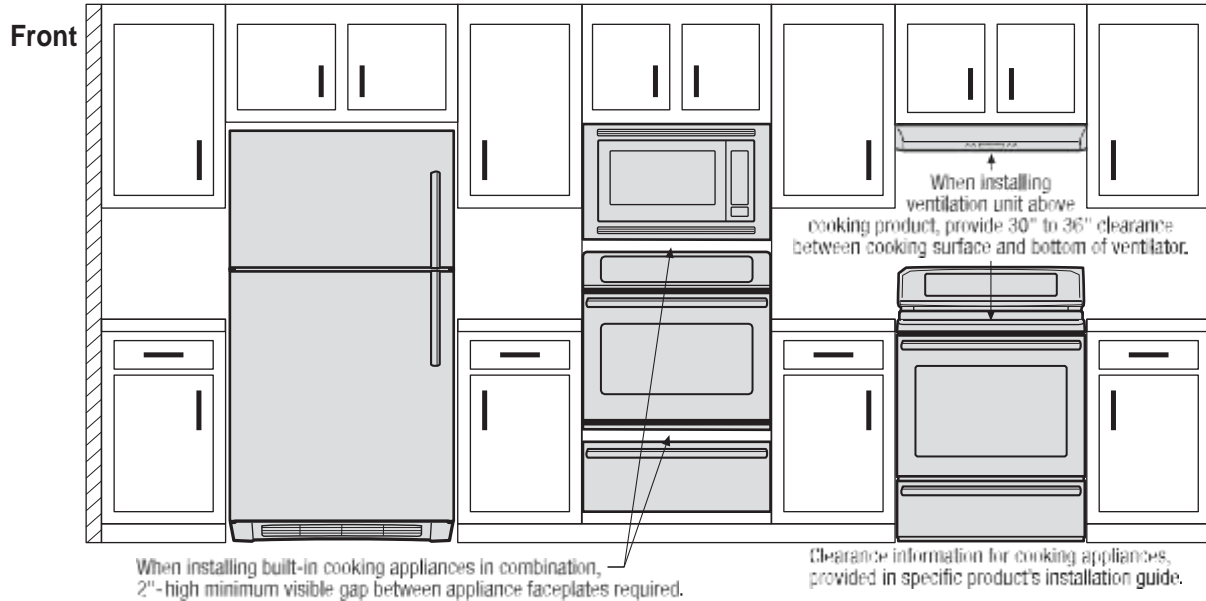
Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.

Optional Accessories

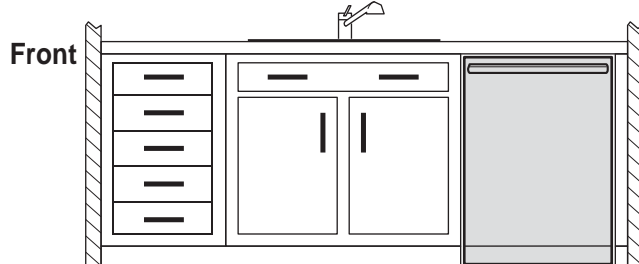
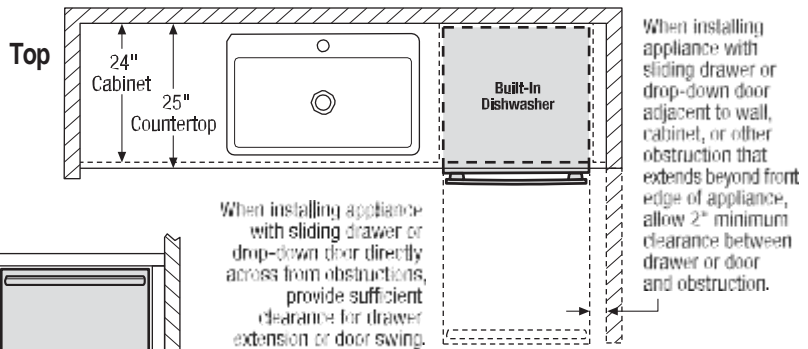
- Ice Maker Kit – (PN # IM115).



Use these dimensions and clearance instructions for planning purposes only. For detailed installation instructions, refer to installation guide, packed with product, or on the web at frigidaire.com.



*When installing top mount refrigerator adjacent to wall, cabinet or other appliance that extends beyond front edge of unit, 20" minimum clearance recommended to allow for optimum 140° door swing, providing complete crisper access and removal. (Absolute 3" minimum clearance will ONLY allow for 90° door swing which will provide limited crisper access with restricted removal.)





11 30 13.23 Residential Laundry Appliances (Dryer)

Front Load Dryer

FFQE5000QW

6 Dry Cycles
7.0 Cu. Ft. D.O.E. Electric



Optional SpaceWise® Pedestal Drawer Shown

Signature Features

Quick Dry

Dries even extra-large loads quickly and efficiently.

One-Touch™ Wrinkle Release

Prevents wrinkles, so your clothes look great every time. The Wrinkle Release System finishes by tumbling without heat.

Large Dryer Capacity

Finish more laundry in less time with our 7.0 cu. ft. D.O.E. dryer capacity.

Reversible Door

Choose which direction you want the door to open to accommodate your space.

Product Dimensions

Height	36"
Width	27"
Depth	30-9/16"

More Easy To Use Features

Precision Dry™ Moisture Sensor
Dries even extra-large loads quickly and efficiently.

Timed Dry Cycles

Multiple Dryness Levels

Ready-Select® Controls
Easily select options with the touch of a button.

Auto Dry Cycles

Control Lock

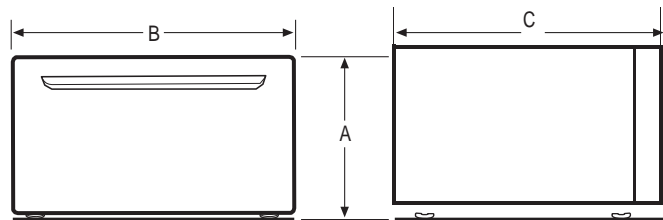
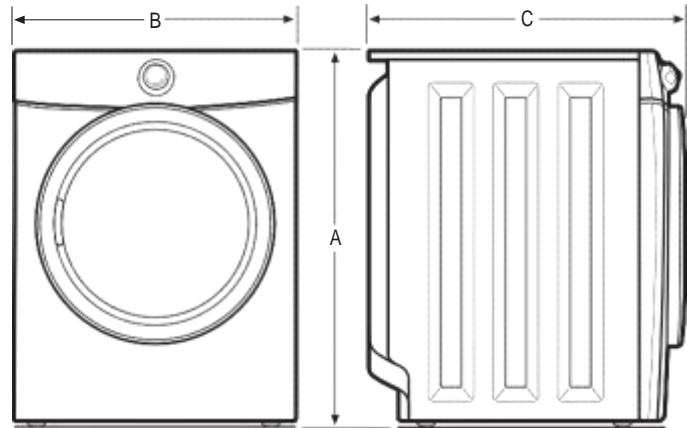
Dryness Selections
Allow for better control over fabric care and the drying process. More Dry, Normal, Less Dry or Damp can be selected. More Dry is ideal for towels while Damp is perfect for items that will be ironed.

Available in:

Classic
White
(W)

Features	
Total Capacity D.O.E. (Cu.Ft.)	7.0
Controls	Ready-Select®
Dryer Drum Interior	Painted Steel
Interior Light	Yes
Door Trim	White
Ready Steam™	
DrySense™ Technology	Yes
Wrinkle Release Technology	Yes
TimeWise® Technology	Yes
Precision Moisture Sensor	Yes
Time Remaining Indicator	Yes
Cycle Status Lights	Yes
Cycle Signal	Chime
Cycle Signal "On/Off"	Yes
Cycle Signal Volume Control	
Control Lock	Yes
Start /Pause /Cancel Buttons	Yes
Energy Saver Option	
DelayStart	
Tumble Speed (RPM)	50
Reversible Door	Yes
Lint Screen	Yes
Sound Package	SilentDesign™
Adjustable Leveling Legs	Yes
Cycles	
Dry Cycles	6
Specialty Cycles	0
Options	
Temperature Selections	5
Dryness Level Selections	4
Timed Dry	30, 60, 90
Optional Accessories	
Dryer Stacking Kit	PN # STACKIT4X
15" Frigidaire® Pedestal Drawers	
Classic White (W)	PN # CFPWD15W
Mobile Home Installation Kit	PN # 137067200
Drying Rack	PN # 137067300
Certifications	
NSF® Certified Sanitize	
Specifications	
Maximum Exhaust Duct Length¹ (Ft.)	64
Power Supply Connection Location	Right Bottom Rear
Voltage Rating	240V / 60Hz / 30A
Connected Load (kW Rating) @ 240 Volts	5.4
Amps @ 240 Volts	24
Heating Element @ 240 Volts (Watts)	4,700
Shipping Weight (Approx.)	140 Lbs.

¹Rigid metal duct preferred, semi-rigid optional and allow deductions for elbows and vents. Refer to Installation Guide on web for additional information.

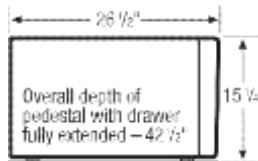
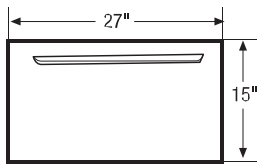
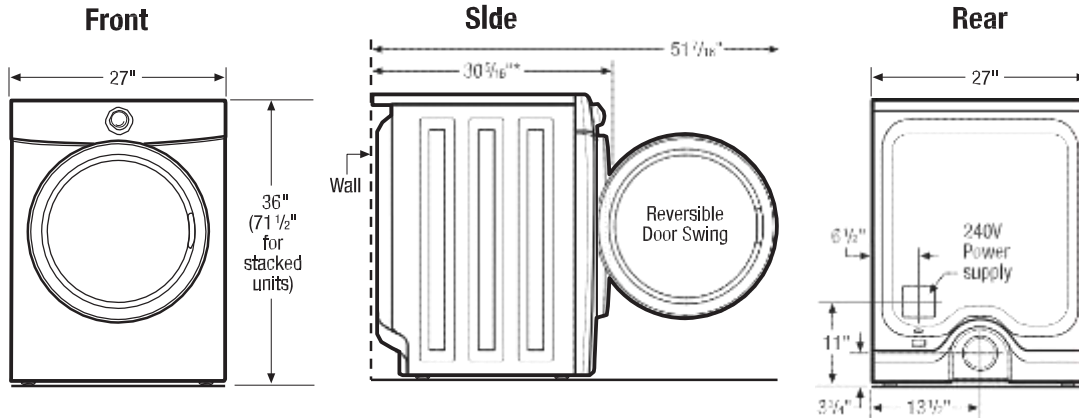


NOTE: For planning purposes only. Always consult local and national electric codes. Refer to Product Installation Guide for detailed installation instructions on the web at frigidaire.com.



Product Dimensions	
A-Height (Single)	36"
Height (Stacked)	71-1/2"
B-Width	27"
C-Depth	30-9/16"
Depth with Door Open 90°	51-7/16"
Pedestal Dimensions	
A-Height	15-1/4"
B-Width	27"
C-Depth	26-1/2"
Depth with Drawer Fully Extended	42-1/2"

Accessories information available on the web at frigidaire.com

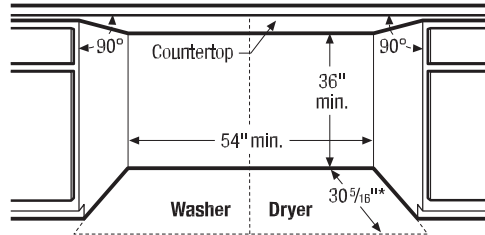


15" Pedestal Drawer Installation

Elevates dryer height to 51 1/4". For detailed pedestal installation, refer to instructions included with pedestal or on web. **Note:** Pedestal installation requires modified utility hookup locations. For details, refer to Product Installation Guide on web.

Built-In Installations

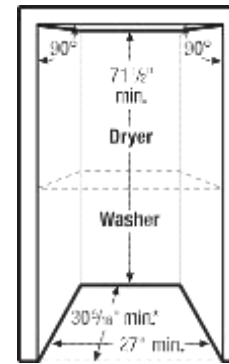
For built-in installations, NO minimum clearance required around sides or backs of units. For closet installation, allow additional 1" clearance between fronts of units and door. Location of plumbing, exhaust and utility hookups MUST be considered in built-in installations. For additional installation details, refer to Product Installation Guides on web.



Side-by-Side Units in Under-Counter Installation

Can be installed with standard countertop and/or cabinetry.

* To achieve minimal installation depth dimensions, dryer MUST be vented straight back. For installation with quick-turn 90° elbow, refer to Product Installation Guide on web for approximate clearances incurred with multi-directional exhausting options in freestanding, pedestal-mounted, or stacked installation.



Stacked Units in Recessed or Closet Installation

For detailed stacked installation, refer to instructions included with Stacking Kit or on web. **Note:** Stacked installation requires modified utility hookup locations for dryer. For details, refer to Product Installation Guide on web.

Front Load Dryer Specifications

- Product Shipping Weight (approx.) – 140 Lbs.
- An electrical supply with grounded three-prong receptacle is required.
- Voltage Rating – 240V/ 60 Hz/ 30 Amps
- Single phase 3- or 4-wire cable, 240 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line. (Do not use same circuit as washer.)
- Connected Load (kW Rating) @ 240 Volts = 5.4 kW
- Amps @ 240 Volts = 24 Amps
- Dryer MUST employ a 3-conductor NEMA 10-30 type SRDT or 4-conductor NEMA 14-30 type SRDT or ST (as required), rated at 240 volt AC minimum, 30 amp power supply cord marked for use with clothes dryers (not supplied).
- Grounding through neutral link prohibited in specific applications and certain locales, requiring use of 4-wire system. (For detailed electrical requirements, refer to Product Installation Guide on web.)
- Always consult local and national electric & plumbing codes.
- Can be installed alone, with or without optional 15" Pedestal Drawer, or stacked above matching Frigidaire® Washer, which requires installation of optional Dryer Stacking Kit. (For installation details, refer to instructions included with optional pedestal or stacking kit or on web.)
- Can be built in with matching Frigidaire® Washer in under-counter, recessed or closet installation. (Refer to Built-In Installations on this page for cutout dimensions. For additional installation details, refer to Product Installation Guide on web.)
- Closet installation requires vented door with 2 unobstructed louvered openings, minimum 60 sq. in. each, located 3" from top and bottom of door. Full-length 120 sq. in. opening also acceptable. Allow additional 1" clearance between fronts of units and closed door.

- Do NOT install in area exposed to dripping water or outdoor weather conditions; where gasoline or other flammables are kept or stored; or where dryer comes in contact with curtains, drapes or anything that will obstruct flow of combustion and ventilation air.
- For garage installation, dryer MUST be located minimum 18" above floor.
- Floor MUST be solid with 1" maximum slope. Do NOT install on carpeted surface.
- Dryer MUST exhaust to outside of building, NOT into any concealed space.
- Exhaust installation requires minimum 4"-diameter rigid or semi-rigid metal duct with approved, unobstructed vent hood having swing-out damper(s). If installing rigid metal duct (preferred), do not exceed MAXIMUM venting run length of 64 ft., allow deductions for elbows and vents. If installing semi-rigid metal duct, do not exceed MAXIMUM venting run length of 8 ft., always allow deductions for elbows and vents (Refer to Product Installation Guide on web for additional information). Do NOT use flexible plastic or metal foil duct and use shortest run possible.
- Leveling legs supplied to level dryer properly and reduce excessive noise and vibration.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.

Optional Accessories

- Dryer Stacking Kit – (PN # STACKIT4X).
- 15" Classic White Pedestal Drawer – (PN # CFPWD15W).
- Mobile Home Installation Kit – (PN # 137067200).
- Drying Rack – (PN # 137067300).





11 30 13.23 Residential Laundry Appliances (Washer)

Front Load Washer

FFFW5000QW

7 Wash Cycles
3.9 Cu. Ft. D.O.E.



Optional SpaceWise® Pedestal Drawer Shown

Signature Features

Advance Rinse Technology

Final rinse uses fresh water to ensure whiter whites and reduce allergens.

Stainless Steel Drum

Smooth, durable interior is rust-proof and won't snag clothes.

Large Capacity

Finish more in less time with our 3.9 cu. ft. D.O.E. capacity — the washer can fit two baskets of laundry in a single load.

Tumble Action Cleaning System

By removing the agitator, you can count on the tumble action to wash gently and rinse completely, ensuring your clothes feel fresher and last longer.

Product Dimensions

Height	36"
Width	27"
Depth	30-9/16"

More Easy To Use Features

ENERGY STAR®-Qualified

Stain Clean Option

Delay Start

Begin your washing cycle at the time that works best with your schedule.

End-Of-Cycle Signal Ready-

Select® Controls

It's easy to get laundry started with just the touch of a button.

TimeWise® Technology

Wash time equals dry time — so you don't wait for clothes to dry.

SilentDesign™

Designed for quiet operation.

Stay-Fresh™ Antimicrobial Seal

Auto Options

Automatic Water Level Control

Optional Pedestal Drawer

Vibration Control System

Advanced vibration control keeps even oversized loads balanced for smooth, quiet operation. Ideal for second floor installation.

Add-a-Garment

With just the touch of a button, easily add an extra piece to the washer once a cycle has started.

ENERGY STAR®

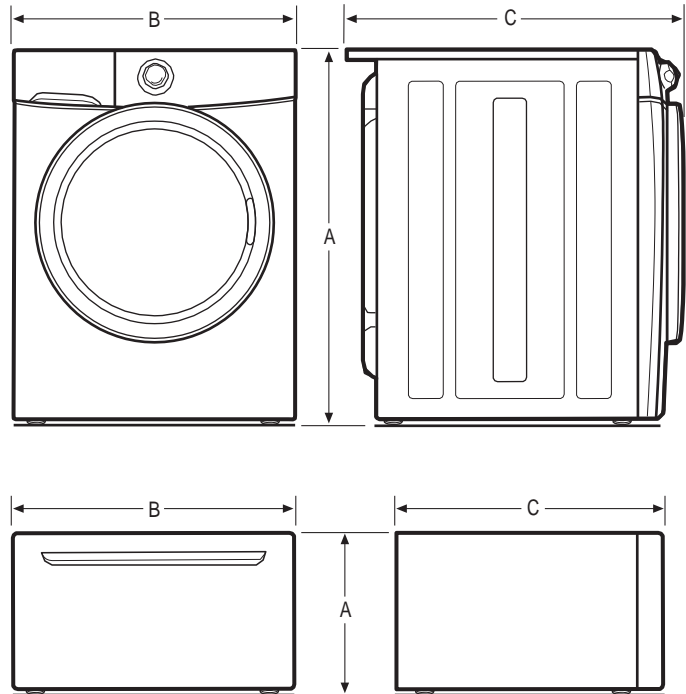


Available in:

Classic White (W)

Features	
Total Capacity D.O.E. (Cu.Ft.)	3.9
Controls	Ready-Select®
Washer Drum Interior	Stainless Steel
Lifetime Warranty Tub	Yes
Interior Light / Door Trim	No/White
Vibration Control System	Yes
Advanced Rinse Technology	Yes
TimeWise® Technology	Yes
Ready Clean™ / Ready Steam™	
Fresh Water Rinse Option	Yes
Stay-Fresh™ Door Seal	Yes
Automatic Temperature Control	Yes
Automatic Water Level Adjustments	Yes
Auto Prewash Detergent Dispenser	
Auto Bleach Dispenser	Yes
Auto Detergent Dispenser	Yes
Auto Fabric Softener Dispenser	Yes
Time Remaining Indicator	Yes
Cycle Status Lights	Yes
Cycle Signal / Cycle Signal "On/Off"	Chime / Yes
Cycle Signal Volume Control	
Door Lock Indicator Light	Yes
Control Lock / Stay Put Door	Yes / Yes
Start / Pause / Cancel Buttons	Yes
Energy Saver Option	Yes
Delay Start	Up to 10 Hours
Integral Water Heater	
Tumble Speed (RPM)	Variable
Spin Speed (Maximum RPM)	1,200
Sound Package	SilentDesign™
Adjustable Leveling Legs	Yes
Cycles	
Wash Cycles / Specialty Cycles	7 / 0
Options	
Water Temperature Selections	5
Water Levels	Automatic / Max Fill
Spin Speed / Soil Level Selections	5 / 5
Allergen	
Optional Accessories	
Dryer Stacking Kit	PN # STACKIT4X
15" Frigidaire® Pedestal Drawers	
Classic White (W)	PN # CFPWD15W
Mobile Home Installation Kit	PN # 137067200
Drain Hose Extension Kit	PN # 137098000
6' Stainless Steel Washer Fill Hose (2 pack)	PN # 5305516562
4' Rubber Washer Fill Hose (2 pack)	PN # 5308815006
Certifications	
ENERGY STAR®	Yes
NSF® Certified Sanitize / Allergen	
Specifications	
Power Supply Connection Location	Right Top Rear
Water Inlet Connection Location	Left Top Rear
Voltage Rating	120V / 60Hz / 1.5A
Connected Load (kW Rating) @ 120 Volts¹	1.1
Watts @ 120 Volts / Amps @ 120 Volts	1,100 / 10
Minimum Circuit Required (Amps)	15
Shipping Weight (Approx.)	222 Lbs.

For use on adequately wired 120V, dedicated circuit having 2-wire service with a separate ground wire. Appliance must be grounded for safe operation.

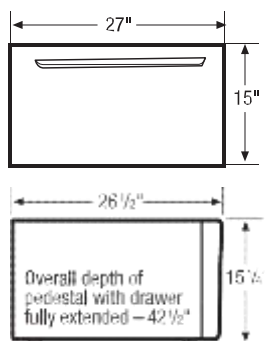
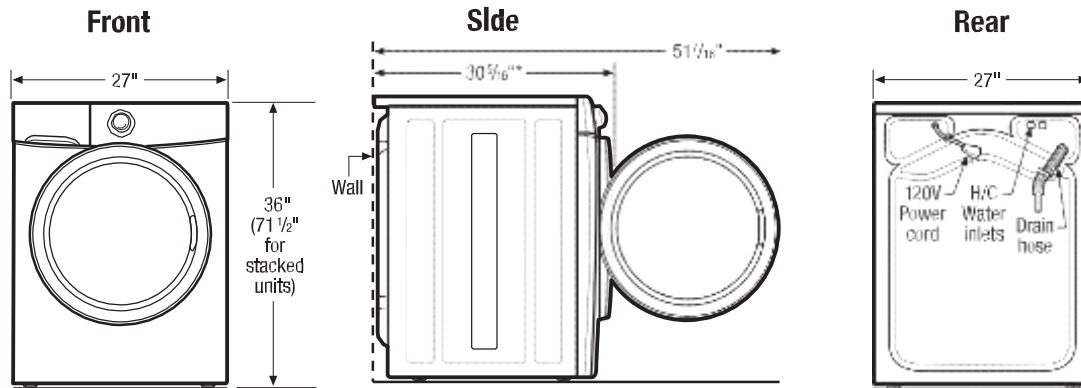


NOTE: For planning purposes only. Always consult local and national electric and plumbing codes. Refer to Product Installation Guide for detailed installation instructions on the web at frigidaire.com.



Product Dimensions	
A-Height (Single)	36"
Height (Stacked)	71-1/2"
B-Width	27"
C-Depth	30-9/16"
Depth with Door Open 90°	50-13/16"
Pedestal Dimensions	
A-Height	15-1/4"
B-Width	27"
C-Depth	26-1/2"
Depth with Drawer Fully Extended	42-1/2"

Accessories information available on the web at frigidaire.com

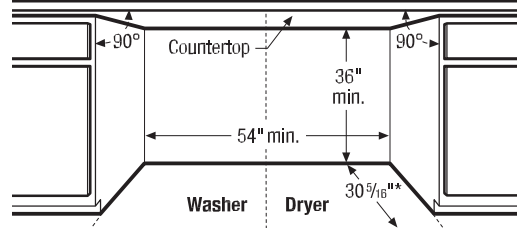


15" Pedestal Drawer Installation

Elevates washer height to 51 1/4". For detailed pedestal installation, refer to instructions included with pedestal or on web. **Note:** Pedestal installation requires modified utility hookup locations. For details, refer to Product Installation Guide on web.

Built-In Installations

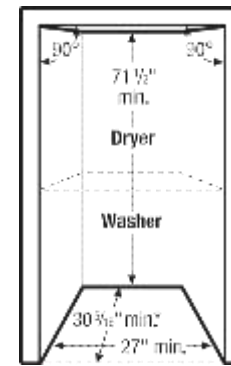
For built-in washer/non-steam dryer installations, NO minimum clearance required around sides or backs of units (see built-in illustrations). For washer installation with steam dryer, additional 3/4" steam hose clearance required at back of dryer. For closet installation, allow additional 1" clearance between fronts of units and door. Location of plumbing, exhaust and utility hookups MUST be considered in built-in installations. For additional installation details, refer to Product Installation Guides on web.



Side-by-Side Units in Under-Counter Installation

Can be installed with standard countertop and/or cabinetry.

* To achieve minimal installation depth dimensions, dryer MUST be vented straight back. For installation with quick-turn 90° elbow, refer to Product Installation Guide on web for approximate clearances incurred with multi-directional exhausting options in freestanding, pedestal-mounted, or stacked installation.



Stacked Units in Recessed or Closet Installation

For detailed stacked installation, refer to instructions included with Stacking Kit or on web. **Note:** Stacked installation requires modified utility hookup locations for dryer. For details, refer to Product Installation Guide on web.

Front Load Washer Specifications

- Product Shipping Weight (approx.) – 222 Lbs.
- An electrical supply with grounded three-prong receptacle is required. The power supply circuit must be installed in accordance with current edition of National Electrical Code (ANSI/NFPA 70) and local codes & ordinances. (Do not use same circuit as dryer.)
- Voltage Rating – 120V/60 Hz/15 Amps
- Amps @ 120 Volts = 10 Amps
- Equipped with 120V 3-wire power supply cord, approx. 60" long.
- Always consult local and national electric & plumbing codes.
- To maximize detergent effectiveness, ambient temperature should never be below 60° F.
- Can be installed alone, with or without optional 15" Pedestal Drawer, or stacked below matching Frigidaire® Dryer, which requires installation of optional Dryer Stacking Kit. (For installation details, refer to instructions included with optional pedestal or stacking kit or on web.)
- Can be built in with matching Frigidaire® Dryer in under-counter, recessed or closet installation. (Refer to Built-In Installations on this page for cutout dimensions. For additional installation details, refer to Product Installation Guide on web.)
- Closet installation requires vented door with 2 unobstructed louvered openings, minimum 60 sq. in. each, located 3" from top and bottom of door. Full-length 120 sq. in. opening also acceptable. Allow additional 1" clearance between fronts of units and closed door.
- Do NOT install in area exposed to dripping water or outdoor weather conditions, or where gasoline or other flammables, including automobiles, are kept or stored.

- Floor MUST be solid with 1" maximum slope. To minimize vibration or movement, reinforcement of floor may be necessary. Do NOT install on carpeted surface.
- Leveling legs supplied to level washer properly and reduce excessive noise and vibration.
- H/C water faucets MUST be installed within inlet hose length of washer's water inlet and MUST be 3/4" to connect to inlet hoses.
- Water pressure MUST be between 30 and 120 psi with NOT more than 10 psi pressure difference between hot and cold.
- Drain required with standpipe diameter of 1-1/4" min. and height of 24" min./96" max. capable of eliminating 17 gallons per minute. Attached 59" drain hose can reach 74"-high standpipe. For higher standpipe, optional Drain Hose Extension Kit available.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.

Optional Accessories

- Dryer Stacking Kit – (PN # STACKIT4X).
- 15" Classic White Pedestal Drawer – (PN # CFPWD15W).
- Mobile Home Installation Kit – (PN # 137067200).
- Drain Hose Extension Kit – (PN # 137098000).
- 6' Stainless Steel Washer Fill Hose (2 pack) – (PN # 5305516562).
- 4' Rubber Washer Fill Hose (2 pack) – (PN # 5308815006).



Home Decorators Collection | Model # SW1422MBK | Internet # 205805876 | Store SKU # 1001236066

Merwry 52 in. Matte Black Indoor LED Ceiling Fan**\$119.00** /eachFIXTURE COLOR/FINISH: **Black****SPECIFICATIONS****■ DIMENSIONS**

Assembled Depth (in.)	15.50 in	Downrod Length (in.)	4.5
Assembled Height (in.)	15.50 in	Fan Blade Length (in.)	52
Assembled Width (in.)	52.00 in	Fan Blade Width (in.)	52
Ceiling Fan Width (in.)	52		

■ DETAILS

Airflow (CFM)	5468	Included	Bulbs Included,Downrod Included,Hardware Included,Remote Control Included
Blade Color Family	Black	Indoor/Outdoor	Indoor
Bulb Type	LED	Light Type	Integrated
Color Family	Nickel	Motor Speed (RPM)	200
Color/Finish	Brushed Nickel	Mounting Options	Standard
Commercial / Residential	Residential	Number of Blades	5
Damp/Wet Rating	Dry	Product Weight (lb.)	15.8 lb
Dual Fan Heads	No	Pull Chain	No
Features	Integrated LED,Quick Install,Reversible Motor	Remote Control	Yes
Finish	Brushed Nickel	Returnable	90-Day
Finish Family	Brushed Nickel	Reverse Airflow	Yes
Fixture Color/Finish	Brushed Nickel	Reversible Two-Sided Blades	No
Glass Style	Contemporary	Timer	No
Housing Color Family	Nickel		

SECTION 11 31 00 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Allowances: See Section 01 20 00 "Price and Payment Procedures" for appliance allowances.
- B. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

- A. Regulatory Requirements: Comply with the following:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC A117.1.
- C. Electric Range: 30-inch-wide, freestanding range with 4 burners and self-cleaning oven with broiler unit.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Kenmore, Model 95103
 - 2. Color: Stainless Steel.
- D. Microwave Oven: Freestanding microwave oven, [1.5-cu. ft.] <1.2-cu. ft.> capacity, <1200> W.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Panasonic, Model NN-SN661S.
 - 2. Color: Stainless Steel.
- E. Refrigerator/Freezer: Freestanding, frost-free, two-door refrigerator with side-by-side freezer, [baked-enamel-on-steel] [polystyrene] [ABS thermoplastic-copolymer] interior cabinet liners.

1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. BOSCH Home Appliances Model, B22CS50SNS
 2. Color: Stainless Steel.
 3. Fresh Food Compartment Volume: 13.3 cu. ft.
 4. Freezer Compartment Volume: 8.4 cu. ft.
 5. Shelf Area: Four adjustable glass shelves
 6. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- F. Dishwasher: Built-in, undercounter, automatic dishwasher, sized to replace 24-inch-base cabinet, 5 wash cycles with hot-air and heat-off drying cycles, [**porcelain-enamel tub and door liner**] [**polypropylene tub and door liner**] [**stainless-steel tub and door liner**] [**porcelain-enamel tub and molded-plastic door liner**], [**nylon-coated sliding dish racks**] [**PVC-coated sliding dish racks**].
1. Manufacturers: Subject to compliance with requirements, provide the following:
 - a. BOSCH Home Appliances Model SHX68E05UC.
 2. Color: Stainless steel.
 3. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- G. Clothes Washer: Freestanding, front-loading, automatic clothes washer with 3.2-cu. ft. capacity Stainless-steel tub and 7 wash cycles including regular, delicate, and permanent press; [**1/3-hp**] [**1/2-hp**] [**3/4-hp**] reversible motor.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Frigidaire; Model FFFW5000QW
 2. Color: White.
 3. Energy Performance: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
- H. Electric Clothes Dryer: Freestanding, front-loading clothes dryer, 7-cu. ft. capacity with Steel interior.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Frigidaire.
 2. Color: White.

PART 3 - EXECUTION

3.1 INSTALLATION

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

END OF SECTION 11 31 00

11 32 13 Kitchen Sink



Features

- 18-gauge stainless steel
- Top-mount or under-mount
- Includes installation hardware
- Small single bowl
- 25" (635 mm) x 22" (559 mm)

TOP-MOUNT/UNDER-MOUNT KITCHEN SINK

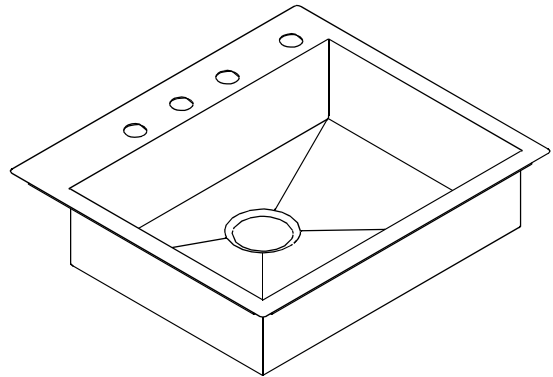
K-3894

ADA

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ADA
- ICC/ANSI A117.1
- 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-3894-4	Top-mount/under-mount kitchen sink – 4-hole	<input type="checkbox"/> NA
Optional Accessories		
K-6645	Bottom bowl rack	<input type="checkbox"/> ST
K-8801	Duostrainer [®] sink strainer	<input type="checkbox"/> CP <input type="checkbox"/> Other _____
1131881	Hardware kit for countertops with a 2-1/2" (64 mm) thickness or less	<input type="checkbox"/> NA

Product Specification

The top-mount or under-mount kitchen sink shall be made of 18-gauge stainless steel. Sink shall include installation hardware. Sink shall have a small single bowl. The sink shall be 25" (635 mm) in length, 22" (559 mm) in width. Sink shall be Kohler Model K-3894-

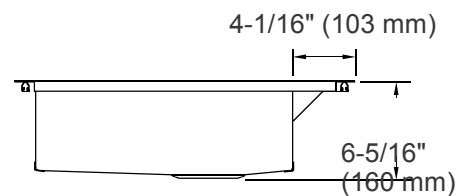
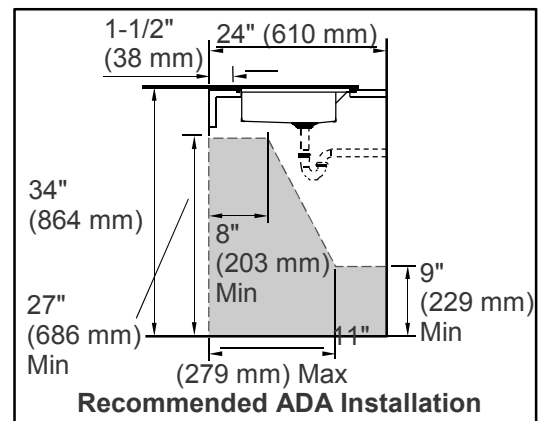
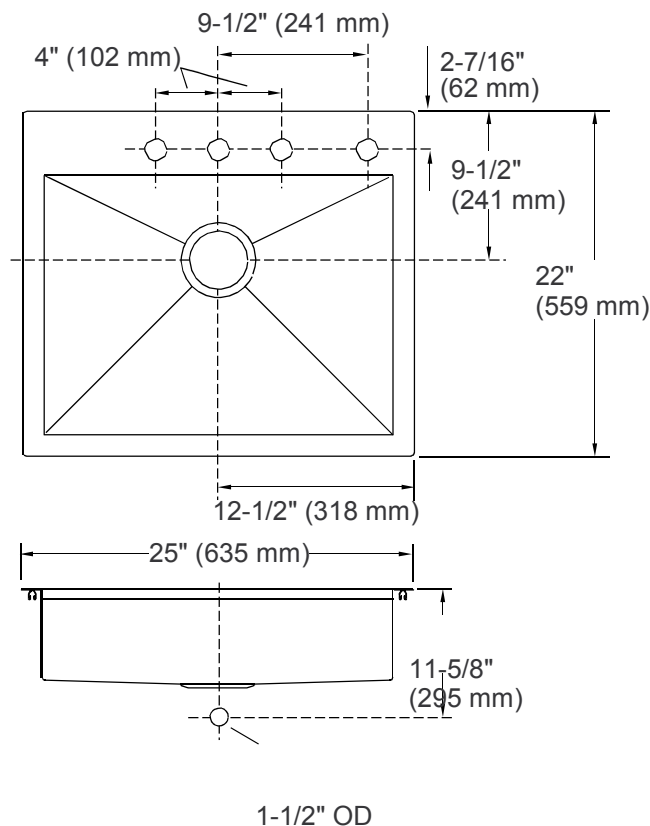
Technical Information

Fixture*:	
Bowl area	22-1/4" (565 mm) x 16-9/16" (421 mm)
Water depth	6" (152 mm)
Drain hole	Ø 3-5/8" (92 mm)
* Approximate measurements for comparison only.	
Included components:	
Hardware kit – self-rimming	1130570
Cut-out template	1130822

Installation Notes

Install this product according to the installation guide.

For under-mount installation, counter top thickness can not be greater than 1" (25 mm) for **ADA** compliance.



Product Diagram

DIVISION 12 FURNISHINGS

12 36 61

Kitchen Countertops

DUPONT - CORIAN RAINCLOUD



Corian® Solid Surface

SPEC DATA

This Spec-Data sheet conforms to editorial style prescribed by The Construction Specifications Institute. The manufacturer is responsible for technical accuracy.

1. Product name

DuPont™ Corian® Solid Surface

2. Manufacturer

E. I. du Pont de Nemours and Company Inc. (Surfaces division)

European headquarter:
Du Pont de Nemours International
S.A. (Surfaces division)
2, Chemin du Pavillon
P.O. Box 50
CH-1218 Le Grand Saconnex,
Geneva - Switzerland

3. Product description

Basic use

DuPont™ Corian® is an advanced composite product used as a decorative material in a variety of residential and commercial applications. Corian® offers design versatility, functionality and durability. Supplied in sheets and shapes, it can be fabricated with conventional woodworking tools into virtually any design. Corian® is the original solid surface material made only by DuPont. It is widely accepted as a material for countertops, vanity tops, tub/shower walls, kitchen sinks, vanity basins and laboratory bench tops in numerous markets including lodging, healthcare, banks, boutiques, restaurants.

Composition

DuPont™ Corian® is a solid, non-porous, homogeneous surfacing material, composed of $\pm 1/3$ acrylic resin (also known as PolyMethyl MethAcrylate or PMMA), and $\pm 2/3$ natural minerals. These minerals are composed of Aluminium TriHydrate (ATH) derived from bauxite, an ore from which aluminium is extracted. For more information on the composition of the material, please consult the Corian® Material Safety Data Sheets (MSDS) available via the msds.dupont.com site or via your local supplier.

Standard products

DuPont™ Corian® Sheets
Available in various standard thicknesses, easily cut to size by professional fabricators. All colours in the standard colour palette are available in 12 x 760 x 3658mm sheets.

Some of these colours are also available in various other sizes.

Some standard dimensions of DuPont™ Corian® sheets are:

- 4mm sheet: 930 x 2490mm
- 6mm sheet: 760 x 2490mm
930 x 2490mm
- 12mm sheet: 760 x 3658mm
930 x 3658mm
- 19mm sheet: 760 x 3658mm

Check with your supplier for the latest product offering.

DuPont™ Corian® Shape Products
A wide range of DuPont™ Corian® shapes, made using injection moulding technology, is available in

4 solid colours for custom integration with Corian® sheets to create an entire, continuous surface. This includes vanity basins in solid colours for bathrooms, and single and double sinks for kitchens, bars and small wash-up areas, hospitals and laboratories. Seamed undermounting technique eliminates rims that trap dirt and water, minimising cleaning and maintenance and providing improved hygiene. Care, maintenance and installation instructions are included in the packaging. Appropriate accessory products, including installation hardware, are available and recommended for residential kitchens only.

The colours of Corian®

The colours of Corian® allow for an almost unlimited working palette. You can choose a single colour; a neutral basis for design; or experiment with eye-catching harmonies. DuPont™ Corian® can also be used as inlays, accents, or as a versatile complement to other materials like metal, wood, stone, etc.

For complete information on colours, refer to the latest leaflet about the colours of Corian® or to the www.corian.com website. Hues, patterns and textures are related by style and character. Dark, heavily pigmented colours of Corian® will show scratches, dust and ordinary wear and tear more readily than lighter, textured colours. These colours are recommended for applications where surface contact is light or for use as inlays and accent colours.



corian.

Custom sheets

DuPont can manufacture Corian® sheets in custom colours, patterns and dimensions, within manufacturing capability limits and based on a minimum order quantity.

Limitations

Contact a local specialist, distributor or fabricator of Corian® or the Information Centre for DuPont™ Corian®. Although DuPont™ Corian® can withstand high temperatures, it should be protected with hot pads or heat shields against direct heat.

Use of 4mm and 6mm sheets should be restricted to vertical applications or certain furniture applications only. The choice between 12mm and 19mm is generally based on performance and cost considerations.

Due to the complex blending of natural minerals and man-made acrylics, slight colour variations may be found within a sheet or from sheet to sheet of same colour. Therefore, checking for colour matching is an essential element of sheet inspection before starting fabrication.

DuPont™ Corian® is non-porous so spills and stains will not be absorbed into the material. However, some chemicals can stain, discolour or damage the surface of Corian®. These chemicals include strong acids (like concentrated sulphuric acid), ketones (like acetone), chlorinated solvents (like chloroform) or strong solvent combinations (like paint remover). The extent of the damage will depend on the length of contact. Except for paint remover, short periods of contact will not usually cause severe damage to Corian®. Acid drain cleaners should not be used as they can damage both Corian® and any plastic plumbing beneath. Corian® is not recommended for use in photographic processing laboratories. More information can be found in the section "Chemical Resistance of Corian® Products". In some hospitals and laboratories where strong disinfectants come in contact with DuPont™ Corian®, it is recommended

that solid colours are used and extended contact is avoided.

4. Performance properties and characteristics

Typical performance properties of DuPont™ Corian® are shown in Table 1. The performance of Corian® sheets may vary according to the thickness of the material (4mm, 6mm, 12mm or 19mm), its aesthetics and surface finish.

Since its introduction in 1967, DuPont™ Corian® has proven itself to be remarkably durable, versatile and easy to live with in both the home and commercial environments.

Colours and patterns run through the entire thickness of the material and cannot wear away or delaminate. Joints can be glued inconspicuously, making virtually unlimited surfaces possible.

Surfaces in Corian® are renewable, meaning they can be fully restored with ordinary mild abrasive cleansers and a scouring pad. Cigarette burns, for example, can be easily removed in this way. Damage caused by abuse can usually be repaired on site without having to completely replace the material.

DuPont™ Corian® surfaces are hygienic. Because it is a non-porous material, bacteria and mould cannot be trapped and proliferate in its joints, nor underneath the surface.

Corian® is an inert and non-toxic material. Under normal temperature conditions, it does not emit gases. When burned, it releases mainly Carbon Oxides and the smoke generated is optically light and does not contain toxic halogenated gases. Because of these properties, Corian® is used in public spaces and delicate applications such as airport check-in counters, wall and work surfaces in hospitals and hotels.

DuPont™ Corian® can be thermoformed in wooden or metal moulds at controlled temperatures in order to create various 2D and 3D design objects. Embossing effects

can also be created using Bas Relief technique.

The translucency of DuPont™ Corian® is especially striking in the lighter colours as well as in thinner sheets. Many designers are using it to create lamps or lighting effects in various applications. The new colour family, called as Translucent Series, consists of 6 colours in 6mm and 12mm sheets featuring enhanced translucency to be used to create special lighting effects.

Inlaying DuPont™ Corian® with different materials or with different colours of Corian® is possible and can enhance the inherent beauty of the material. Inlays and logos can also be created on Corian® using dye sublimation or direct printing techniques.

5. Fabrication and installation

Detailed information on the fabrication and installation of DuPont™ Corian® is available in the fabrication and installation booklets on Corian® as well as in technical bulletins.

Seams

To minimise material usage and facilitate installation, a corner block of Corian® should be made square (butt) rather than mitred. The edges to be joined should be straight, smooth and clean. Some seams need to be reinforced (see fabrication manual for details). Joints should only be made with "Joint Adhesive for DuPont™ Corian®". Cutouts should be made with a router equipped with a sharp carbide bit, with a minimum diameter of 10mm. All corners of a cutout must be rounded to 5mm radius and the edges smoothed, both on top and bottom, all around a cutout. "L" and "U" shaped corners need smooth, 5mm radius inside corners. For hob cutouts, corners should be reinforced with a Corian® corner block. See fabrication manual for more details.

Some colours of Corian® that feature random veins and irregular patterns require special considerations regarding the seams. Please refer to the related

technical bulletin for best practices in fabrication of these colours.

Sealants and adhesives

Corian® is compatible with many commercially available caulks and sealants. However, the specially developed silicone sealant sold by DuPont or its distributors is recommended for best performance and colour match. Vertical panels of Corian® may be installed over suitable substrates, including water-resistant gypsum board, marine-grade plywood and ceramic tiles. In case a support is needed, apply perimeter frame or full support direct to Corian® using large beads of flexible adhesive leaving a space with a minimum thickness of 1.5mm.

For making seams in countertops, repairs and custom edges, "Joint adhesive for Corian®" in matching colour should be used.

When used in accordance with manufacturer's instructions, it provides a smooth and inconspicuous joint. Joint adhesive for Corian® is available from DuPont or its distributors.

Clearances

The minimum expansion clearance for Corian® is $35 \times 10^{-6} \times (\text{length of the piece of Corian®}) \times (\text{biggest temperature range expected in } ^\circ\text{C})$ in mm. Joints to be caulked should be approximately 1.5mm wide to allow satisfactory caulk penetration and expansion.

Precautions

Product dimensions are nominal. If tolerances are critical, review your needs with a specialist of Corian®.

6. Availability and cost

Availability

DuPont™ Corian® and accessory products are readily available through a worldwide network of Distributors and certified Fabricators/Installers. Please check the Yellow Pages or call the Information Centre for DuPont™ Corian® for the name of a local distributor.

Cost

Cost varies with thickness and width as well as custom fabrication and installation details. Contact the Information Centre for DuPont™ Corian® for the names of certified Dealers, Fabricators/Installers, who can supply price information.

7. Warranty

Ten-year warranty DuPont offers Corian® with two levels of warranty protection. The limited "Product" warranty is standard for all Corian® products and ensures that all products will be free from manufacturing defects for a period of 10 years after purchase. A higher level of protection, the 10 year limited "Installed" warranty, is available through fabricators member of the "Corian® Quality Network". This "Installed" warranty expands the "Product" warranty to ensure that both the fabrication and the installation of the finished product will be free from defect. With two levels of warranty protection available, you can value engineer warranty coverage for each project. Feel free to discuss your needs with a local specialist of Corian®.

8. Maintenance

Preventing damage to Corian®

Avoid prolonged exposure to strong chemicals such as acids, bases, and organic solvents. Spills should be cleaned up promptly. Refer to Table 3 for additional details regarding chemical exposures, clean up, and general maintenance. In case of exposure outside the specifications listed in the Class I Reagents section, the 10 year limited product warranty will be void and handled as a case of abuse. While unaffected by minor impacts, Corian® can be damaged by heavy impacts, especially from pointed objects. Corian® can also be damaged by excessive heat. A local specialist of Corian® can help you include appropriate heat management into your designs.

Repairing Corian®

DuPont™ Corian® provides superior value by being inconspicuously repairable in most cases. Minor cuts, scratches, and stains can be removed by owners using fine sandpaper and Scotch-Brite™ pads. Deeper cuts or impact damage such as cracks may require a licensed service centre or a Corian® Quality Network member to make inconspicuous repairs.

9. Technical services

There is a Technical Support Team for Europe, Middle East and Africa.

10. Additional information

DuPont has many bulletins which give additional information about Corian® and its properties, including removal of radioactive compounds and HIV (AIDS virus) in healthcare facilities, as well as weatherability and VOC rating. Also available are bulletins, which detail fabrication, installation, repair, and proper use of accessories.

11. Legal

This information corresponds to our current knowledge on the subject.

It is offered solely to provide possible suggestions for your own experimentation. It is not intended, however, to substitute for any testing you may need to conduct to determine for yourself the suitability of our products for your particular purposes. This information may be subject to revision as new knowledge and experience becomes available, since we cannot anticipate all variations in actual end-use of this information. Nothing in this publication is to be considered as a license to operate under or a recommendation to infringe any patent right.

Table 1: performance properties of DuPont™ Corian® products

PROPERTY	TEST METHOD	TYPICAL RESULTS		UNITS	*
		6mm sheet	12mm sheet		
Density	DIN ISO 1183	1.73 – 1.76	1.68 – 1.75	g/cm ³	1
Flexural modulus	DIN EN ISO 178	8920 – 9770	8040 – 9220	MPa	1
Flexural strength	DIN EN ISO 178	49.1 – 76.4	57.1 – 74.0	MPa	1
Elongation at break	DIN EN ISO 178	0.58 – 0.94	0.76 – 0.93	%	1
Compressive strength	EN ISO 604	178 – 179	175 – 178	MPa	1
Resistance to impact (spring load)	DIN ISO 4586 T11	> 25	>25	N	1
Resistance to impact (ball drop)	DIN ISO 4586 T12	> 120	>120	cm	1
Surface hardness (Mohs index)	DIN EN 101	2-3	2-3		1
Resistance to surface wear	DIN ISO 4586 T6	63 – 75	58 – 63	Lost weight mm ² /100 rev.	1
Resistance to boiling water-increase in weight	DIN ISO 4586 T7	0.1 – 0.7	0.1 – 0.3	%	1
Resistance to boiling water-surface change	DIN ISO 4586 T7	No visible change	No visible change		1
Dimensional stability at 20°C	DIN ISO 4586 T10	< 0.16	< 0.16	% change in length	1
Resistance to dry heat-180°C	DIN ISO 4586 T8	4-5 slight change	4-5 slight change		1
Lightfastness (Xenon arc)	DIN ISO 4586 T16	> 6	> 6	Blue wool scale	1
Anti-slip properties-with 100 µm	DIN 51130:1992-11	5.8° – do not pass R9 requirement (6° min)		° angle	2
Anti-slip properties-with 120 µm	DIN 51130:1992-11	7.6° – pass R9 requirement (6° min)		° angle	2
Anti-slip properties-with 150 µm	DIN 51130:1992-11	8.1° – pass R9 requirement (6° min)		° angle	2
Resistance to bacteria and fungi	DIN EN ISO 846	Does not support microbial growth			3
Electrostatic surface behaviour	DIN IEC 61 340-4-1		> 1 x 10 ¹²	Ω	4

(1) test report Q IWQ MBL 733 1785-1 (for classification according to DIN EN 438 part 1 & 7) from LGA –Germany/04-2004

(2) test report BMW 0411048-03 from LGA-Germany/03-2004

(3) test report 5642219 from LGA-Germany 03/2004

(4) test report EMA-SMG-814 1131 IWQ-MBL 734 1109 from LGA-Germany/03-2004

Table 2: fire properties of DuPont™ Corian® products

PROPERTY	STANDARD	CLASS/ RESULTS	PRODUCT	Type/Area of application	*
Euroclass for Reaction to fire	EN 13501-1	C-s1,d0	Standard grade, all colours, 6 & 12mm	With any substrate of A2 or better fire performance	1
Euroclass for Reaction to fire	EN 13501-1	C-s1,d0	Standard grade, all colours, 12mm	On a substrate with a fire performance of D or better. (wood based substrate)	2
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	FR grade colours, 12mm	With any substrate of A2 or better fire performance	3
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	FR Grade, GW, 12mm	Applied on aluminium profiles with a gap of 50mm	4
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	Standard grade, GW, 12mm, 930mm wide	Applied on aluminium profiles with an airgap and with mineral wool insulation	5
Euroclass for Reaction to fire	EN 13501-1	B-s1,d0	Glacier Ice, 6mm (Illumination series)	Installed with an airgap in the back	6
Fire behaviour	BS 476 part 6&7	Class 0	FR grade, GW, 12mm	Not specified (material test)	7
Flammability test	DIN 4102-1	B1	FR Grade, Genesis colours	With a distance of >40mm from other materials	8
Reaction to fire - M Classification	NF P 92-501	M2	Standard Grade, 12mm	Not specified (material test)	9
Reaction to fire - M Classification	NF P 92-501	M2	CW, 6mm	Not specified (material test)	10
Smoke index - F Classification	NF F 16-101	F0	CW, 6 & 12mm	Not specified (material test)	11
Calorific potential	EN ISO 1716	9.15 KJ/g	12mm, CW	Not specified (material test)	12
Fire test - Aviation	JAR/FAR - AITM	Pass	FR Grade	Aviation	13
Fire test - Railroad	DIN 5510-2 / DIN 54837	S 4, SR 2, ST 2	12mm	Railroad vehicle	14
Smoke toxicity	DIN 5510-2 / EN ISO 5659-2	Pass	12mm	Railroad vehicle	15

(1) classification report E131025 from Warrington Fire Research-UK/03-2003

(2) classification report 13126E from Warringtonfiregent-Belgium/02-2008

(3) classification report E131024 from Warrington Fire Research-UK/03-2003

(4) classification report 13448C from Warringtonfiregent-Belgium/12-2008

(5) classification report 13700C from Warringtonfiregent-Belgium/03-2009

(6) classification report 230006665 from MPA NRW-Germany/09-2008

(7) test reports 154054 & 154053 from Warringtonfire-UK/09-2006

(8) test report 230005623 from MPA NRW-Germany/2006

(9) classification report 14540-09 from SNPE-France/04-2009

(10) classification report 1226105 from SNPE-France/05-2005

(11) classification reports 11625-04 & 12261-05 from SME/SNPE-France/03-2004 & 05-2005

(12) test report 11624-04 from SNPE-France/03-2004

(13) test report 05-0530 from Fire Test Laboratory Airbus Deutschland GmbH – 2005

(14) test report P60-08-0018 (test according to DIN 54837, classification according to DIN 5510-2) from RST-Germany/01-2008

(15) test report P60-08-3107 (test according to EN ISO 5659, evaluation according to DIN 5510-2) from RST-Germany/02-2008.

Chemical resistance of DuPont™ Corian® products

CLASS I reagents

The following reagents show no permanent effect on Corian® sheet when left in contact for periods of 16 hours.

The chemical residues can be removed with a **wet Scotch-Brite™ pad and bleaching cleanser**. Sometimes, minimal effects have been observed, particularly those indicated by footnotes (*).

Table 3: CLASS I reagents

<ul style="list-style-type: none">• Acetic Acid (10%)• Acetone**• Acrodine Orange• AG Eosin Blue (5%)• AG Gentian Violet• Ammonia (10%)• Ammonium Hydroxide (5, 28%**)• Amyl Acetate• Amyl Alcohol• Aromatic Ammonia• Ball Point Pen• Benzene**• "Betadine" Solution• Bite Registration Accelerator (2% Eugenol)• Bite Registration Base• Bite Registration Mix (50/50)• Bleach (Household Type)• Blood• B-4 Body Conditioner• Butyl Alcohol• Carbon Disulphide• Carbon Tetrachloride***• "Cavity" in Phenol• Citric Acid (10%)• Caulk IRM (with or w/o ZnO)• Calcium Thiocyanate (78%)• Cigarette (Nicotine)• Coffee• Cooking Oils• Copalite Intermediary Varnish• Cotton Seed Oil• Crystal Violet• Cupra Ammonia• Debacterol• Dimethyl Formamide• Dimethylene Blue• Dishwashing Liquids/Powders• "Dry Bond" Dental Adhesive• Eosine• Equalizing Accelerator (23% Eugenol)• Equalizing Base• Ethyl Alcohol (Ethanol)**• Ethyl Acetate	<ul style="list-style-type: none">• Ethyl Ether**• Eucalyptol• "Eugenol" (with or w/o ZnO)• Ferric Chloride• "Fisher" Formaldehyde (40%)• Food Colouring• Formaldehyde• Gasoline• Gentian Violet• Hair Dyes• Household Soaps• Hydrochloric Acid (20, 30%)• Hydrogen Peroxide• Introfiant Arterial Chemical• Iodine (1% in alcohol)***• "Kelviscera" Cavity• Kerosene• Ketchup• Lemon Juice• Lipstick• Liquid shoe polish• "Luralite" Accelerator (16% Eugenol)• "Luralite" Base• Lye (1%)• "Lysol" Brand Cleaner• Mercurochrome (2% in water)***• Methanol**• Methyl Ethyl Ketone• Methyl Orange (1%)• Methyl Red (1%)• Mineral Oil• Munsel's Solution• Mustard• Nail Polish• Nail Polish Remover (Acetone)• Naphthalene (Naphtha)• Neotopanel• n-Hexane• Nitric Acid 6%• Olive Oil• Pencil Lead• Perchloric Acid• Permaflow Preinjection• "Permaglow" Arterial Fluid• Permanent Marker Ink• Peroxide	<ul style="list-style-type: none">• Phenolphthalein (1%)• Phosphorus Pentoxide• Picric Acid• "Procaine"• Potassium Permanganate (2%)• Restorative Anti-dehydrant• Saffron• Salt (Sodium Chloride)• Shoe Polish• Silica Dental Cement (liquid)• Silver Nitrate (10%)• Soapless Detergents• Sodium Bisulphate• Sodium Hydroxide Solution (5, 10, 25, 40%**)• Sodium Hydroxide Flake**• Sodium Hypochlorite (5%)• Sodium Sulphate• Solitine solvent• Soy Sauce• Sugar (Sucrose)• Sulphuric Acid (25, 33, 60%)• Tannic Acid• Tea• Tetra Hydrofuran• Tetramethyl Rhodamine Isothiocyanate• "Thymol" in Alcohol• Tincture of Iodine• Tincture of Mercurochrome• Tincture of Merthiolate• Toluene***• Tomato Sauce• Trichloroethane• Trisodium Phosphate (30%)• Trypan Blue• Urea (6%)• Uric Acid• Urine• Vinegar• Washable inks• Wine (all varieties)• Wright's Stain• Xylene• Zephiran Chloride• Zinc Chloride• Zinc Oxide (paste, ointment)
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* May cause surface etching or deglossing after 16 hours exposure

** May cause slight lightening after 16 hours exposure

*** May cause slight darkening after 16 hours exposure.

CLASS II reagents

Corian® is not recommended for working areas where CLASS II reagents may come in contact with Corian®.

The 10 Year Limited Installed and Product warranty does NOT apply where class II reagents come in contact with Corian®.

The occasional stain that might result from inadvertent exposure to Class II reagents can often be removed. Scrubbing with household cleanser will remove light stains. More stubborn surface stains will require sanding with fine to coarse sandpaper.

The following residues may require sanding for complete removal:

- Acetic Acid (90, 98 %)
- Acid Drain Cleaners
- Aqua Regia Cleaner
- Chlorobenzene
- Chloroform (100 %)
- Chromic Trioxide Acid
- Cresol
- Dioxane
- Ethyl Acetate
- Equalizing Mix (50/ 50)
- Formic Acid (50, 90 %)
- Furfural
- Glacial Acetic Acid
- Giemsa
- Hexaphene Autopsy/Viscera Treatment
- Hydrofloric Acid (48 %)
- Luralite Mix (50/ 50)
- Methylene Chloride-Based

Products

- Paint Removers
- Brush Cleaners
- Some Metal Cleaners
- Nitric Acid (25, 30, 70 %)
- Phenol (40, 85 %)
- Phosphoric Acid (75, 90 %)
- Photographic Film Developer (used)
- Sulphuric Acid (77, 96 %)
- Trichloroacetic Acid (10, 50 %)

Specialised products

Biochemistry staining agents in most instances will stain Corian® after a few minutes' exposure. However, the stains are generally removable by prompt scrubbing with acetone as indicated below.

- Giemsa
- Trypan Blue - Stains removed with acetone
- Acridine Orange
- Safranine
- Crystal Violet - Stain incompletely removed with acetone

The following dental treatment materials will degloss, etch, or slightly stain Corian® Surfaces. Affected areas may be restored by scrubbing with a Scotch-Brite™ cleaning pad.

- Copalite Intermediary Varnish
- Caulk IRM (with or without ZnO)
- Eugenol (with or without ZnO)
- Luralite accelerator (16 % Eugenol)
- Luralite base
- Solitine solvent

- Equalizing accelerator (23 % Eugenol)
- Equalizing base
- Bite registration base
- Bite registration accelerator (2 % Eugenol)
- Bite registration mix (50/50)

Stains caused by the following dental treatment materials may require light to moderate sanding for removal:

- Luralite mix (50/50)
- Equalizing mix (50/50)

Note:

- Products that are not listed may be similar to the ones that are. Please compare the ingredients listed on their label or in their Material Safety Data Sheet to the ones mentioned.
- The published data are for 16 hours exposure time. In reality exposure can be much longer. A leaking hand-soap dispenser may cause a liquid puddle under it for weeks and months. Similarly some containers have poorly designed spouts/caps from which product leaks every time they are used, so that they stand constantly in their spill. If needed, a drip cup or a spill tray in a suitable material would address these situations.
- The resistance to staining of Joint Adhesive is slightly less than that of Corian® sheet and shape.
- Our draining accessories are recommended for residential kitchens only!

Scotch-Brite™ is trademark of 3M.

For more information, please visit our web site:

www.corian.com



The miracles of science™

TOOLS & ACCESSORIES

(CONTINUED)



We will be using 1.25" Standard tube clamps



J Hangers with Nails		
JHANG12	½" J Hanger with Nail	50/250
JHANG34	¾" J Hanger with Nail	50/150
JHANG10	1" J Hanger with Nail	50/150
CTS Tubing Strap Hangers with Nail - Max. 160°F		
STRP12N	½" CTS Tube Strap Hanger with Nail	100/1000
STRP34N	¾" CTS Tube Strap Hanger with Nail	50/500
STRP10N	1" CTS Tube Strap Hanger with Nail	25/250
CTS Tube Drive Hook with Nail - Max. 160°F		
XTAH38	⅜" PEX Tube Drive Hook with Nail	100/1000
XTAH12	½" PEX Tube Drive Hook with Nail	100/1000
XTAH34	¾" PEX Tube Drive Hook with Nail	100/1000
XTAH10	1" PEX Tube Drive Hook with Nail	50/500
Metal Support Bends		
MSBEND38	⅜" PEX Metal Support Bend	50/50
MSBEND12	½" PEX Metal Support Bend	50/50
MSBEND12N	½" PEX Metal Support Bend with Nail Plate	25/25
MSBEND34	¾" PEX Metal Support Bend	25/25
MSBEND10	1" PEX Metal Support Bend	25/25
CTS Tubing Insulators		
PINS12	½" Tube Insulator	50/500
PINS34	¾" Tube Insulator	50/500
PINS10	1" Tube Insulator	25/250
Tube Clamps		
PINSC12	½" Standard Tube Clamp	100/1000
PINSC34	¾" Standard Tube Clamp	100/1000
PINSC10	1" Standard Tube Clamp	50/500
PINSC114	1¼" Standard Tube Clamp	25/250
Nylon Ties		
NYTIE8	Nylon Ties 8" x ⅜" 50 lbs max.	100/2500
NYTIE14.5	Nylon Ties 14½" x ⅜" 40 lbs max.	100
NYTIE21	Nylon Ties 21" x ⅝" 175 lbs max.	50/500
NYTIE36	Nylon Ties 36" x ⅝" 175 lbs max.	50/250
Poly Test Plugs		
XPPG12	½" Plug	100/1000
XPPG34	¾" Plug	100/1000

Photographs of fittings, adapters, manifolds and tools are for illustration purposes only. Actual products may vary. Fittings, adapters, manifolds and tools may be manufactured by third parties.

DIVISION 21 FIRE SUPPRESSION

21 05 29	Hangers and Supports for Fire-Suppression Piping and Equipment
21 10 00	Water-Based Fire Suppression Systems (Sprinklers)
21 10 00	Water-Based Fire Suppression Systems_SP
21 10 00	Water-Based Fire Suppression Systems-Bronze Ball Valves
21 13 13	Electric Drive Centrifugal Fire Pump
21 24 16	Dry Chemical Fire Extinguishing Equipment



Worldwide
Contacts

www.tyco-fire.com

RAPID RESPONSE Series LFII Residential Sprinklers 3.0 K-factor Pendent Wet Pipe Systems

General Description

The TYCO RAPID RESPONSE Series LFII Residential Pendent Sprinklers (TY1234) are decorative, fast response, frangible bulb sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels. When aesthetics and optimized flow characteristics are key considerations, the Series LFII (TY1234) should be the first choice.

The 3.0 K-factor of the Series LFII Residential Pendent Sprinkler has been designed to optimize flows (that is, to avoid over discharging) specifically for small coverage areas up to 14 ft. x 14 ft. (4,3 m x 4,3 m). The required residential flow rates can then be delivered with the use of smaller pipe sizes and reduced water supply requirements.

The Series LFII Residential Sprinklers are intended for use in the following scenarios:

- wet pipe residential sprinkler systems for one-and two-family dwellings and mobile homes per NFPA 13D
- wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R
- wet pipe sprinkler systems for the residential portions of any occupancy per NFPA 13

The recessed version of the Series LFII Residential Pendent Sprinkler is intended for use in areas with finished ceilings. It employs a two-piece Style 20 Recessed Escutcheon.

The Recessed Escutcheon provides 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush ceiling position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the pipe drops to the sprinklers must be cut.

The Series LFII Residential Pendent Sprinkler has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

The Series LFII Residential Pendent Sprinklers (TY1234) described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

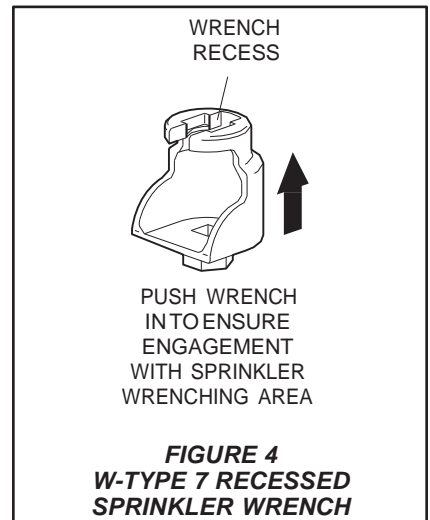
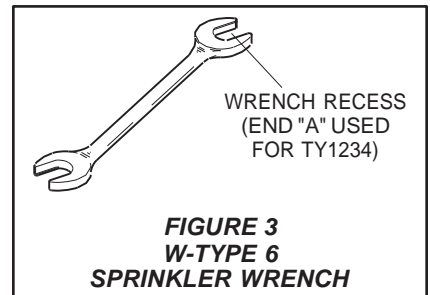
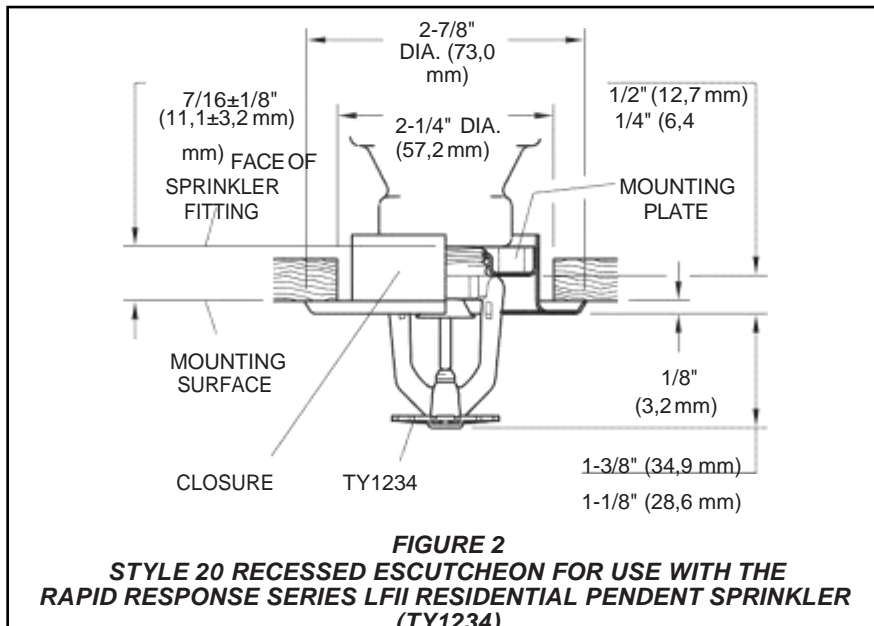
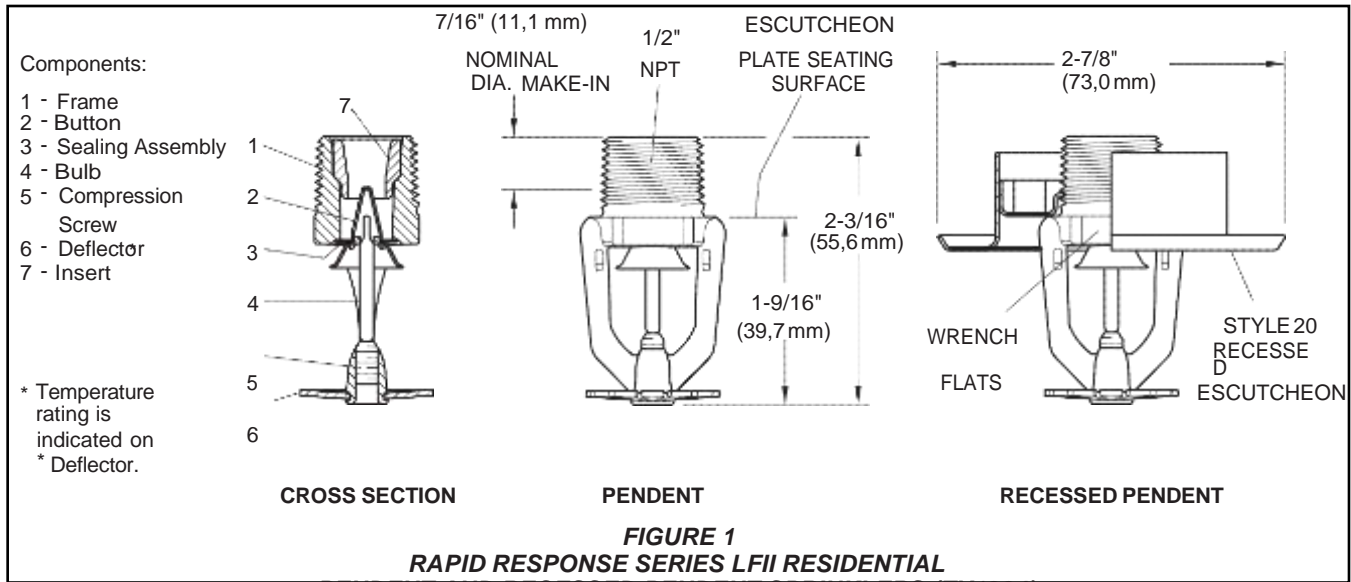


Sprinkler Identification Number (SIN)

TY1234

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate



Technical Data

Approvals

UL and C-UL Listed
NSF Certified to NSF/ANSI 61

For details on these approvals, refer to the Design Criteria section.

Maximum Working Pressure

175 psi (12,1 bar)

Discharge Coefficient

K=3.0 GPM/psi^{1/2} (43,2 LPM/bar^{1/2})

Temperature Rating

155°F (68°C) or 175°F (79°C)

Finishes

Natural Brass
Signal White
Chrome Plated

Physical Characteristics

Frame Brass
Button Copper
Sealing Assembly Beryllium Nickel w/TEFLON
Bulb 3 mm Glass
Compression Screw Bronze
Defl ctor Bronze

Max. Coverage Area ^(a) Ft. x Ft. (m x m)	WET PIPE SYSTEM Minimum Flow and Residual Pressure ^(b, c)					Deflector to Ceiling	Installation Type	Minimum Spacing Ft. (m)	
	Ordinary Temp. Rating 155°F (68°C)		Intermediate Temp. Rating 175°F (79°C)		Flow GPM (L/min)				Pressure PSI (bar)
	Flow GPM (L/min)	Pressure PSI (bar)	Flow GPM (L/min)	Pressure PSI (bar)					
12 x 12 (3,7 x 3,7)	8 (30,3)	7.1 (0,49)	8 (30,3)	7.1 (0,49)	Smooth Ceilings 1-1/4 to 4 inches Beamed Ceilings per NFPA 13D or 13R 1-1/4 to 1-3/4 inches below bottom of beam.	Recessed using Style 20 Escutcheon or non-recessed per NFPA 13D, 13R, or 13	8 (2,4)		
14 x 14 (4,3 x 4,3)	11 (41,6)	13.4 (0,92)	11 (41,6)	13.4 (0,92)					
16 x 16 (4,9 x 4,9)	13 (49,2)	18.8 (1,29)	13 (49,2)	18.8 (1,29)					
18 x 18 (5,5 x 5,5)	17 (64,3)	32,1 (2,21)	18 (68,1)	36.0 (2,48)					

- (a) For coverage area dimensions less than or between those indicated, use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.
- (b) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design under the Design Criteria section.
- (c) For NFPA 13 residential applications, the greater of 0.1 gpm/ft² over the design area or the flow in accordance with the criteria in this table must be used.

TABLE A
WET PIPE SYSTEM
SERIES LFII RESIDENTIAL PENDENT AND RECESSED PENDENT SPRINKLERS (TY1234)
NFPA 13D, 13R, AND 13 HYDRAULIC DESIGN CRITERIA

Operation

The glass bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, allowing the sprinkler to activate and flow water.

Design Criteria

The TYCO RAPID RESPONSE Series LFII Residential Pendent Sprinklers (TY1234) are UL and C-UL Listed for installation in accordance with the following criteria.

Residential Sprinkler Design Guide

When conditions exist that are outside the scope of the provided criteria, refer to the Residential Pendent Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the local authority having jurisdiction.

System Type

Only wet pipe systems may be utilized.

Ceiling Types

Smooth flat horizontal, or beamed, or sloped, in accordance with the 2013 Edition of NFPA 13D, 13R, or 13 as applicable.

Hydraulic Design (NFPA 13D and 13R)

The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of design sprinklers as specified in NFPA 13D or NFPA 13R.

Hydraulic Design (NFPA 13)

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Table A for NFPA 13D and 13R as a function of TFP402 temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/ft.² over the "design area" comprised of the four most hydraulically demanding sprinklers for actual coverage areas protected by the four sprinklers.

Obstruction to Water Distribution

Sprinklers are to be located in accordance with the obstruction rules of NFPA 13D, 13R, and 13 as applicable for residential sprinklers as well as

with the obstruction criteria described within the TYCO technical data sheet TFP490.

Operational Sensitivity

Sprinklers are to be installed with a deflector-to-ceiling distance of 1-1/4 to 4 inches.

Sprinkler Spacing

The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area being hydraulically calculated (e.g., a maximum of 12 feet for a 12 ft. x 12 ft. coverage area, or 16 feet for a 16 ft. x 16 ft. coverage area.) Refer to Table A.

Installation

The TYCO RAPID RESPONSE Series LFII Residential Pendent Sprinklers (TY1234) must be installed in accordance with this section:

General Instructions

Do not install any bulb-type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm).

A leak-tight 1/2 inch NPT sprinkler joint should be obtained by applying a minimum-to-maximum torque of 7 to 14 ft.-lbs. (9,5 to 19,0 Nm). Higher levels of torque can distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under-or over-tightening the Sprinkler. Re-adjust the position of the sprinkler fitting to suit.

Series LFII Residential Pendent Sprinklers

The Series LFII Residential Pendent Sprinklers must be installed in accordance with the following instructions.

Step 1. Install pendent sprinklers in the pendent position with the deflector parallel to the ceiling.

Step 2. With pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step 3. Wrench-tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Figure 3). With reference to Figure 1, apply the W-Type 6 Sprinkler Wrench to the wrench flats.

Series LFII Residential Recessed Pendent Sprinklers

The Series LFII Recessed Pendent Sprinklers must be installed in accordance with the following instructions.

Step A. Install recessed pendent sprinklers in the pendent position with the deflector parallel to the ceiling.

Step B. After installing the Style 20 Mounting Plate over the sprinkler threads and with pipe thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting.

Step C. Wrench-tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Figure 4). With reference to Figure 1, apply the W-Type 7 Recessed Sprinkler Wrench to the sprinkler wrench flats.

Step D. After installing the ceiling applying the finish coat, slide on the Style 20 Closure over the Series LFII Sprinkler and push the Closure over the Mounting Plate until the flange comes in contact with the ceiling.

Care and Maintenance

The TYCO RAPID RESPONSE Series LFII Residential Pendent Sprinklers (TY1234) must be maintained and serviced in accordance with this section:

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this decision.

Absence of the outer piece of an escutcheon, which is used to cover a clearance hole, can delay sprinkler operation in a fire situation.

The owner must assure that the sprinklers are not used for hanging any objects and that the sprinklers are only cleaned by means of gently dusting with a feather-duster. Otherwise, non-operation in the event of a fire or inadvertent operation may result.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section.)

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or sprinkler manufacturer regarding any questions.

Automatic sprinkler systems are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and Part Number (P/N).

Sprinkler Assembly

Specify: Series LFII (TY1234), K=3.0, Residential Pendent Sprinkler, (specify) temperature rating, (specify) finish, and P/N (specify).

155°F (68°C)

Natural Brass P/N 51-010-1-155
Signal White (RAL 9003). P/N 51-010-4-155
Chrome Plated P/N 51-010-9-155

175°F (79°C)

Natural Brass P/N 51-010-1-175
Signal White (RAL 9003). P/N 51-010-4-175
Chrome Plated P/N 51-010-9-175

Recessed Escutcheon

Specify: Style 20 Recessed Escutcheon with (specify*) finish, and P/N (specify*).

*Refer to Technical Data Sheet TFP770.

Sprinkler Wrench

Specify: W-Type 6 Sprinkler Wrench for use with Series LFII Pendent Sprinklers, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench for use with Series LFII Recessed Pendent Sprinklers, P/N 56-850-4-001.

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

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data for valves, sprinklers, specialties, and alarms.
2. 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.
3. Submit test reports and certificates as described in NFPA 13.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design and Installation Approval: Acceptable to authorities having jurisdiction.
- B. Hydraulically design sprinkler systems according to NFPA 13.
- C. Comply with NFPA 13 NFPA 13R and NFPA 70.
- D. UL-listed and -labeled and FM-approved pipe and fittings.

2.2 PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.
- B. Copper Tube: ASTM B 88, Type L or M; drawn temper.
- C. 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.
- D. Cast-Iron Threaded Flanges: ASME B16.1, Class 250, raised ground face, bolt holes spot faced.
- E. Cast-Iron Threaded Fittings: ASME B16.4, Class 250, standard pattern.
- F. Grooved-End Fittings: UL-listed and FM-approved, ASTM A 536, Grade 65-45-12 ductile iron or ASTM A 47, Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.
- G. Grooved-End Couplings: UL 213, ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing, with enamel finish. Include gaskets, bolts, and accessories.

- H. Wrought-Copper Fittings: ASME B16.22, streamlined pattern.
- I. Steel Press-Seal Fittings: UL 213, FM approved, 175-psig pressure rating, for use with Schedule 5, plain-end, steel pipe and fittings; with butylene O-rings, and pipe stop.
- J. 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.
- K. Provide hangers, supports, and seismic restraints with UL listing and FM approval for fire-protection systems.

2.3 VALVES

- A. Two-Piece Ball Valves with Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. NIBCO INC. Model KT-585-70-UL.
 - 2. Description: UL 1091, and FM Global Class Number 1112, Forged brass or bronze, 175 psig working pressure.
 - 3. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
 - 4. End Connections for Valves NPS 2-1/2: Grooved ends.

2.4 SPRINKLERS

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Tyco Fire & Building Products LP; Residential Pendent Sprinklers Model TY2234.
- B. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide" listing published by FM Global.
 - 1. Pressure Rating for Residential Sprinklers: 175 psig maximum.
 - 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Residential Applications: NFPA 13D.
 - 2. Early-Suppression, Fast-Response Applications: UL 1767.
 - 3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes: White finish.
- E. Sprinkler Escutcheons (for Ceiling and Sidewall Mounted): Plastic, white finish, one piece, flat.

- F. Sprinkler Cabinets: Finished steel cabinet and hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and one wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on Project.

2.5 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.
- C. Sleeves:
 - 1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
 - 2. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
- D. Escutcheons and Floor Plates:
 - 1. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
 - 2. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 3. Install floor plates for piping penetrations of equipment-room floors.
 - 4. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- E. Install unions at final connection to each piece of equipment.

3.2 SERVICE-ENTRANCE PIPING

- A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

- C. Connect sprinkler piping to water-service piping for service entrance to building.
- D. Install shutoff valve,[backflow preventer, pressure gage, drain, and other accessories indicated] [shutoff valve, check valve, pressure gage, and drain] at connection to water-service piping.

3.3 SPRINKLER PIPING INSTALLATION

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

3.4 SPRINKLER SCHEDULE

- A. Rooms without Ceilings: Upright sprinklers.
- B. Rooms with Suspended Ceilings: Pendent sprinklers.
- C. Wall Mounting: Sidewall sprinklers.
- D. Sprinklers Subject to Freezing: Upright, pendent, or sidewall dry sprinklers as indicated.
- E. Special Applications: Extended coverage or quick-response sprinklers as indicated.
- F. Sprinkler Finishes: Chrome plated in finished spaces, rough bronze in unfinished spaces, and white in residential spaces. Provide escutcheons in finished and residential spaces.
- G. Install sprinklers in suspended ceilings in center of long dimension of ceiling panels.

3.5 PIPING SCHEDULE

- A. Use steel pipe with threaded, press-seal, roll-grooved, or cut-grooved joints.
 - 1. For steel pipe joined by threaded fittings, use Schedule 40.
 - 2. For steel pipe joined by welding or roll-grooved pipe and fittings, use Schedule 10.
 - 3. For steel pipe NPS 2 and smaller, joined by press-seal fittings, use Schedule 5 pipe, fabricated with manufacturer's press-seal tools.
- B. Use copper tube with wrought-copper fittings and brazed joints.
- C. Use CPVC plastic pipe and fittings and metal-to-plastic transition fittings with solvent-cemented joints.
- D. Pipe between Fire Department Connections and Check Valves: Use galvanized-steel pipe with flanged or threaded joints.
- E. Install shutoff valve, check valve, pressure gage, drain, and other accessories indicated at connection to water service piping.

3.6 TESTING

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

END OF SECTION 21 10 00

300 PSI WWP Bronze Ball Valves

Fire Protection Valve • two-Piece Body • Chrome Plated Ball •
Blowout-Proof Stem • reinforced PtFe Seats

300 PSI/20.7 Bar Non-Shock Cold Water

CO_NFO_RMS to MSS SP-110 • UL Listed† •
FM APPROVED†



KT-585-70-UL

¼" - 1" Full Port
Threaded

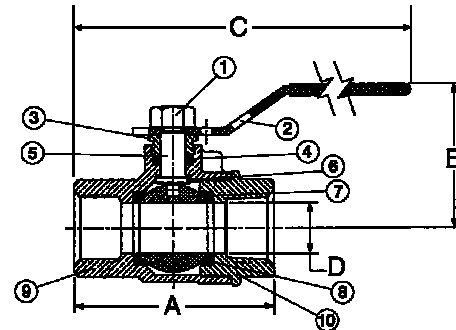
KT-580-70-UL

1¼" - 2" Standard Port
Threaded

MATERIA L I S T

PART	SPeCIFICATION
1. Handle Nut	Zinc Plated Steel
2. Handle with Plastisol Grip	Zinc Plated Steel Clear Chromate
3. Threaded Pack Gland	Brass ASTM B16
4. Packing	PTFE
5. Stem	Silicon Bronze ASTM B371 Alloy C69430 or ASTM B99 Alloy C65100
6. Thrust Washer	Reinforced PTFE
7. Ball	Brass ASTM B124 Alloy C37700 or ASTM B16 Alloy C36000 with Hard Chrome Plate
8. Seat Ring (2)	Reinforced PTFE
9. Body	Cast Red Bronze ASTM B584 Alloy C84400
10. Body End Piece	Cast Red Bronze ASTM B584 Alloy C84400

¼" and ¾" size only has A304 stainless steel grounding washer.



We will use 1" for fire supply

DIMENSIONS—WEIGHTS—QUANTITIES

Size	KT-585-70-UL Dimensions										Box Qty.	Master Ctn. Qty.
	A		B		C		D Port		Weight			
In. mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.		
¼ 8	2.00	51	1.75	44	5.00	127	.38	10	.45	.20	10	100
⅜ 10	2.00	51	1.75	44	5.00	127	.38	10	.45	.20	10	100
½ 15	2.44	62	1.88	48	5.19	132	.50	13	.64	.29	10	100
¾ 20	2.94	75	2.25	57	6.25	159	.75	19	1.33	.60	5	50
1 25	3.34	85	2.38	59	6.44	164	1.00	25	1.79	.81	5	20

Size	KT-580-70-UL Dimensions										Box Qty.	Master Ctn. Qty.
	A		B		C		D Port		Weight			
In. mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.		
1¼ 32	3.94	100	2.63	67	6.75	171	1.00	25	2.17	.99	5	20
1½ 40	4.31	110	3.00	76	8.91	228	1.25	32	3.27	1.49	5	20
2 50	4.63	117	3.25	83	9.06	230	1.50	38	5.09	2.31	5	10
*2½ 65	5.84	148	3.53	90	9.66	245	2.00	51	8.25	3.79	2	6
*3 80	7.09	202	4.41	112	11.53	293	2.50	64	15.65	7.11	1	4

KT-585-70-UL
Full Port
NPT x NPT

KT-580-70-UL
Standard Port
NPT x NPT

† UL Listed, FM Approved for drain and drain use (UL Subject 258) - 585-70-UL ¼" thru 1" - 580-70-UL 1¼" thru 2".

* 2½"-3" supplied as T-580-70-UL subject to AHJ approval.

DO NOT USE FOR NATURAL GAS





Econo

Residential Fire Protection Pump System

We will be using the XPS 14 model



General Air Products, Inc. has expanded its residential pump line with the addition of the Econo RFP System for NFPA 13D applications. The Econo RFP System is designed to provide all 13D required features and functionality at the lowest possible cost without compromising the high level of quality the industry has come to expect from General Air Products.

As with all of the RFP Systems the Econo consists of a stainless steel pump, non-ferrous components and an industrial duty pressure switch. The Econo RFP System differs from the rest of our 13D Pump line in that it doesn't consist of much more than that – this is how we make sure that no matter how tight your budget is, the Econo is the right product for you.

Features:

- Stainless Steel Pump
- Non-Ferrous Piping System
- Heavy Duty Pressure Switch
- Liquid Filled Gauge
- Water Delivery Pressure Gauge
- Locking Ball Valve
- Water Hammer Arrestor
- Drain Valve
- Check Valve

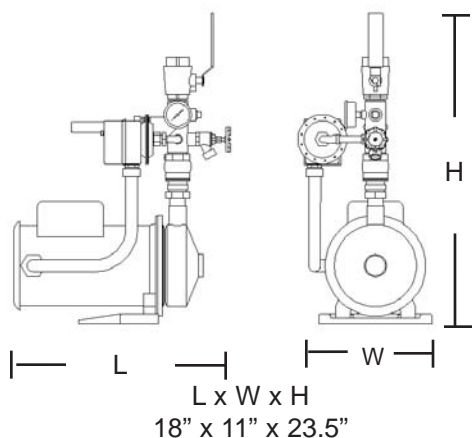
Model Number	AMP Draw*	Weight (lbs.)
XPS11	9.8	49
XPS14	9.8	70
XPS15	9.8	70
XPS18	13.8	77
XPS19	13.8	77

***Standard RFP System Voltage is 230/1/60. For other voltage requirements, consult factory.**

All information subject to change without notice.

Use the chart to select the correct unit for your application.

Example: Your system has a flow of 30 gallons per minute (GPM) at 45 PSI the correct selection would be a XPS18. Consult factory for confirmation of best selection.



PSIG	Feet of Head	Flow (GPM)						
		20	25	30	35	40	45	50
25	58	XPS11	XPS11	XPS14	XPS14	XPS15	XPS15	XPS15
30	69	XPS14	XPS14	XPS14	XPS14	XPS15	XPS15	XPS15
35	81	XPS14	XPS14	XPS14	XPS15	XPS15	XPS18	XPS18
40	92	XPS14	XPS14	XPS14	XPS18	XPS18	XPS18	XPS18
45	104	XPS14	XPS14	XPS18	XPS18	XPS18	XPS18	XPS19
50	116	XPS14	XPS18	XPS18	XPS18	XPS18	XPS18	XPS19



21 24 16 - Dry Chemical Fire-Extinguishing Equipment

ABC DRY CHEMICAL

PAGE 1 of 1



Amerex Corporation

RUGGED

- 6 Year Warranty
- Stored Pressure Design
- Dependable Drawn Steel Cylinders
- Durable High Gloss Polyester Powder Paint
- All Metal Valve Construction

Brass Valve - Heavy Duty

- Chrome Plated Brass Valve Body
- Stainless Steel Handle & Lever

Aluminum Valve - Light to Medium Duty

- Anodized Aluminum Valve Body
- Anodized Aluminum Handle & Lever

- Temperature Range -65°F to 120°F

USER FRIENDLY

- Easy and More Economical to Maintain and Service
- Large Loop Pull Pin
- Bar Coded and Bi-lingual Labels

OPTION

- USCG Approved with Bracket Listed on UL Label



Aluminum Valve

- B417/T
- B500/T
- B402/T
- B443
- B456
- A411



Brass Valve

- B424
- B461
- B441
- 423



Available in Wheeled and Stationary Extinguishers

ABC or Multi-Purpose extinguishers utilize a specially fluidized and siliconized mono ammonium phosphate dry chemical. It chemically insulates Class A fires by melting at approximately 350°F and coats surface to which it is applied. It smothers and breaks the chain reaction of Class B fires and will not conduct electricity back to the operator.

Largest selection of size and extinguisher options available

AGENT TYPE	ABC DRY CHEMICAL									
	NOZZLE	ANODIZED ALUMINUM					CHROME PLATED BRASS			
		HOSE & NOZZLE					HOSE & NOZZLE			
MODEL NUMBER	B417/B417T	B500/B500T	B402/B402T	B443	B456	A411	B424	B461	B441	423
UL & ULC RATING	1A-10B-C	2A-10B-C	3A-40B-C	3A-40B-C	4A-80B-C	10A-120B-C	2A-10B-C	3A-40B-C	4A-80B-C	10A-120B-C
CAPACITY (LBS.)	2.5	5	5	6	10	20	5	6	10	20
SHIPPING WT. (LBS.)	5.25/5.5	9.25/9.5	9.25/9.5	12.75	18	38	10.5	13.75	19	39
HEIGHT (IN.)	15.5	15.25	15.25	16	20	24	15.5	16.25	20.5	24
WIDTH (IN.)	5.75	7.25	7.25	7.75	7.75	10.25	8	8.5	8.75	10.25
DEPTH (IN.)	3	4.25	4.25	5	5	7	4.25	5	5	7
RANGE (INITIAL- FT)	9-15	12-18	12-18	15-21	15-21	15-21	12-18	15-21	15-21	15-21
DISCHARGE TIME (SEC.)	10	14	14	14.5	20	30	14	14	20	30
FM APPROVED	YES	YES		YES		YES		YES		YES
OPTIONAL CHROME CYLINDER	YES	YES	YES	YES	YES		YES	YES	YES	
INCLUDED BRACKET		WALL/VEHICLE		WALL	WALL		WALL			

Manufactured and Tested to ANSI/UL Standards
Complies with NFPA 10 Standard
ISO-9001 / ISO-14001 Certified
UL LISTED

CONFORMS TO TEST STANDARDS:

CAN/ULC-S504 - ANSI/UL299 &
CAN/ULC-S508 - ANSI/UL711

10

MADE IN U.S.A.

DIVISION 22 PLUMBING

22 07 00	Plumbing Insulation_SP
22 07 19	Plumbing Piping Insulation
22 07 19	Plumbing Piping Insulation (Aluminum Foil Tape)
22 07 19	Plumbing Piping Insulation (Vinyl Pipe Insulation Tape)
22 11 16	Domestic Water Piping_SP
22 11 16	Domestic Water Piping (Fire and Domestic Return)
22 11 23	Doestic Water Pumps_SP
22 11 23	Domestic Water Pumps (Jet Pump and Pressure Tank Combo)
22 12 19	Facility Ground-Mounted, Potable-Water Storage Tanks (Greywater Tank)
22 12 19	Facility Ground-Mounted, Potable-Water Storage Tanks (Primary Supply Tank)
22 13 16	Sanitary Waste and Vent Piping
22 13 16	Sanitary Waste and Vent Piping_SP
22 13 23	Domestic Water Pump
22 30 00	Plumbing Manifold
22 33 00	Electric Domestic Water Heaters_SP
22 33 30.16	Storage Electric Domestic Water Heater (Nexus Water Heater)
22 33 30.26	Residential, Collector to Tank, Heat Exchanger Coil, Electric Domestic Water Heater (Nexus Collection Tank)
22 40 00	Plumbing Fixtures_SP
22 41 00	Bathroom Shower Head
22 41 16	Residential Lavatories and Sinks-Kitchen
22 41 19	Residential Bathtub (Kohler)
22 41 23	Cleansing Room. Pfister Adjustable Shower. Polished Chrome
22 41 23	Kohler Bathroom
22 41 39	Pfister Bathroom Sink Faucet

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less according to ASTM E 84.
- B. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less according to ASTM E 84.

2.2 INSULATION MATERIALS

- A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- B. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
 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. Pratt Retail Specialties.

2.3 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.4 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

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. [Avery Dennison Corporation, Specialty Tapes Division.](#)
- b. [Ideal Tape Co., Inc., an American Biltrite Company.](#)
- c. Owens Corning.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

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. 3M.
- b. [Ideal Tape Co., Inc., an American Biltrite Company.](#)

2. Width: 3 inches.

3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 PIPE 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 Section 07 84 13 "Penetration Firestopping."
- D. Flexible Elastomeric Insulation Installation:
 - 1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Polyolefin Insulation Installation:
 - 1. Seal split-tube longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 - 2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of polyolefin pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- F. Interior Piping System Applications: Insulate the following piping systems:
 - 1. Domestic hot water.
 - 2. Recirculated domestic hot water.
 - 3. Roof drain bodies and horizontal rainwater leaders of storm water piping.
 - 4. Exposed water supplies and sanitary drains of fixtures for people with disabilities.
- G. Do not apply insulation to the following systems, materials, and equipment:
 - 1. Sanitary drainage vent piping.
 - 2. Drainage piping located in crawlspaces downstream of final heat exchanger unless otherwise indicated.
 - 3. Chrome-plated pipes and fittings, except for plumbing fixtures for people with disabilities and where thermodynamically advantageous.

3.2 EQUIPMENT INSULATION SCHEDULE

- A. Domestic water and domestic hot-water hydropneumatic tank insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Polyolefin: 1 inch thick or as needed.
- B. Domestic hot-water storage tank insulation shall be the following:
 - 1. Mineral-Fiber Tank: 4 inches thick.
- C. Domestic water storage tank insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber Pipe and Tank: 4 inch thick.
3. Polyolefin: 1 inch thick.

3.3 INDOOR PIPING INSULATION SCHEDULE

A. Unless otherwise indicated, do not install insulation on the following:

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

B. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch 1 inch thick.
 - b. Polyolefin: 3/4 inch 1 inch thick.
2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Polyolefin: 1 inch thick.

C. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 Or 1" PEX and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3/4 inch 1 inch thick.
 - b. Polyolefin: 3/4 inch 1 inch thick.
2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Polyolefin: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Polyolefin: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch, 3/4 inch, or 1 inch thick.
 - b. Polyolefin: 1/2 inch, 3/4 inch, or 1 inch thick.

END OF SECTION 22 07 00



Aluminum Foil Tape

425 • 427

Technical Data

April, 2008

Product Description 3M™ Aluminum Foil Tapes 425 and 427 are 5 mil nominal dead soft aluminum foil backing combined with a transparent acrylic adhesive. 3M aluminum foil tape 427 offers an easy-release liner.

Product Construction	Backing	Adhesive	Color	Liner	Standard Roll Length
	Dead soft aluminum	Acrylic	Shiny silver	Easy-release paper (3M aluminum foil tape 427)	60 yds. (55 m)

Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

	ASTM Test Method
Adhesion to Steel:	D-3330
3M aluminum foil tape 425	47 oz./in. width (51 N/100 mm)
3M aluminum foil tape 427	50 oz./in. width (55 N/100 mm)
Tensile Strength:	30 lbs./in. width (525 N/100 mm)
Backing Thickness:	2.8 mils (0.07 mm)
Total Tape Thickness:	4.6 mils (0.12 mm)
Liner Thickness:	D-3652
3M aluminum foil tape 427	3.1 mils (0.08 mm)
Elongation at Break:	8%
Temperature Use Range:	-65° to 300°F (-54° to 149°C)
Water Vapor Transmission Rate:	0.1g H ₂ O/100 sq. in./24 hrs. (1.55 g/m ² /24 hrs.)
Approximate Weight:	0.013 lbs./yd./in. width (4.77 gms/m/24 mm)

Features

- Flame resistant. Meets U.L. 746C (File E 122798) and 723, Class “L” low flammability rating (File R 7311).
- 3M aluminum foil tape 425 can be certified to meet SAE-AMS-T-23397 and L-T-80B.
- Meets requirements of F.A.R. 25.853(a).
- The very low moisture vapor transmission rate makes these tapes a good sealant.
- The acrylic adhesive, combined with the durable aluminum backing, offers ideal properties for long serviceable life in and outdoors.
- Good candidate as a maskant in electroplating of aluminum because it will not contaminate the bath.
- Aluminum backing provides excellent reflection of both heat and light.
- Best results obtained when applied to a clean, dry surface above 32°F (0°C).

IMPORTANT: These tapes are not intended for medical usage. Neither 3M nor the Food and Drug Administration have evaluated or reviewed this tape for medical application. 3M does not recommend or endorse the usage of the aluminum tape for medical application. User assumes all risk and liability whatsoever in connection with usage of product in a medical application.

3M™ Aluminum Foil Tape

425 • 427

Application Ideas

- Aircraft paint stripping maskant.
- Moisture barrier in “white goods” appliances.
- General purpose heat reflector and heat dissipator.
- Mechanically hold wires and cooling coils in “white goods” appliances.
- Repair tears on truck trailers and aircraft.
- Splicing of thin gauge foils.
- General purpose holding, patching, sealing applications – indoors and out.

Storage

Store under normal conditions of 60° to 80°F (16° to 27°C) and 40 to 60% R.H. in the original carton.

Shelf Life

To obtain best performance, use this product within 24 months from date of manufacture.

Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Warranty, Limited Remedy, and Disclaimer

Many factors beyond 3M's control and uniquely with user's knowledge and control can affect the use and performance of a 3M product in a particular application. User is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application. Unless an additional warranty is specifically stated on the applicable 3M product packaging or product literature, 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If the 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability

Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

ISO 9001:2000

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2000 standards.



Industrial Adhesives and Tapes Division

3M Center, Building 21-1W-10, 900 Bush Avenue
St. Paul, MN 55144-1000
800-362-3550 • 877-369-2923 (fax)
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2 of 2
2 of 2



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22 07 19 Plumbing Pipe Insulation (Vinyl Pipe Insulation Tape)

X 108 ft, White



[See more Pipe Insula...](#)



Pipe Insulation Tape, 1 In x 108 ft, White

by OWENS CORNING

Technical Specifications

Zoro #: G3720753 | Mfr #: PVC201

Includes: Vinyl Film Tape with Pressure Sensitive Adhesive

For Use On: Pipe Fitting Insulation

Item: Pipe Insulation Tape

Length: 108 ft.

Material: Vinyl

Color: White

Width: 1"

Temp. Range: 1 to 150 Degrees F

Zoro Number: G3720753

Mfr Number: PVC201

Product Description

Pipe Insulation Tape, Length 108 ft., Width 1 In., Color White, Material Vinyl, Temp. Range 1 to 150 Degrees F, For Use On Pipe Fitting Insulation, Includes Vinyl Film Tape with Pressure Sensitive Adhesive

22 07 19 Plumbing Piping Insulation Vinyl Pipe Insulation Tape

22 07 19 Plumbing Piping Insulation



More saving.
More doing:

Your Store: **Woodland #1068**
Use Current Location or [find store](#)

Pratt Retail Specialties | Model # 420504 | Internet # 205034318 | Store SKU # 419949





1 in. x 6 ft. Polyethylene Pipe Insulation

★★★★★ | [Write the First Review](#) | [Ask a Question](#)

\$1.28 / each



MORE IN THIS COLLECTION FROM PRATT RETAIL SPECIALTIES (7)

<p>YOUR CURRENT PRODUCT</p>  <p>\$1.28 /each</p> <p>Pratt Retail Specialties 1 in. x 6 ft....</p> <p>• In Store Only</p>	 <p>\$2.79 /each</p> <p>Pratt Retail Specialties 1 in. x 6 ft....</p> <p>Select This Item</p>	 <p>\$80.91 /case</p> <p>Pratt Retail Specialties 1 in. x 6 ft....</p> <p>Select This Item</p>	 <p>\$7.25 /each</p> <p>Pratt Retail Specialties 1 in. x 6 ft....</p> <p>Select This Item</p>
---	---	---	---

1 of 3

0 Item(s) Selected

[ADD ITEMS TO CART](#)

PRODUCT OVERVIEW | Model # 420504 | Internet # 205034318 | Store SKU # 419949 | Store SO SKU # 420504

1/2 in. Wall 1 in. x 6 ft. Polyethylene pipe insulation is a flexible and easy to apply tubing product. Used to reduce unwanted heat gain or loss, decrease plumbing noise and maximize energy savings. It can be used on hot and cold water lines, refrigeration lines, air conditioning lines and underground lines.

- Made of polyethylene
- Pre-slit so they slip onto pipes quickly and easily
- Best application where temperature does not exceed 82 degree C or below -68 degree C
- R-value 3.21

22 07 19 Plumbing Piping Insulation

1 of 2

SPECIFICATIONS

DIMENSIONS

Assembled Depth (in.)	2 in	Product Height (in.)	2
Assembled Height (in.)	72 in	Product Length (in.)	72
Assembled Width (in.)	2 in	Product Width (in.)	2
Maximum compatible pipe size (in.)	1		

DETAILS

Accessory Type	Insulation	Pipe or Fitting Product Type	Accessory
Compatible Pipe Material	Copper	Product Weight (lb.)	.11 lb
Fire rated	No	R Value	3.21
Minimum compatible pipe size (in.)	1	Self-sealing	No

WARRANTY / CERTIFICATIONS

ENERGY STAR Certified	No	Manufacturer Warranty	NONE
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How can we improve our product information? [Provide feedback.](#)

SHIPPING AND DELIVERY OPTIONS

Store Exclusive. This item is available for purchase in select stores only.



EVERPEX

MEETS ASTM F876 AND F877.



JM Eagle's EverPEX cross-linked polyethylene tubing is suitable for use in applications including hot and cold plumbing, radiant heating, snow melting, solar/swimming pool heating, and agriculture and turf.

DESCRIPTION

JM Eagle's EverPEX product is available in ¼- through 2-inch diameters, in red, white and blue, in both sticks and coils.

EverPEX tubing is manufactured in accordance with ASTM F876 and F877 specifications and carries applicable NSF, UP code and cNSF (CSA B137.5) listing. All EverPEX tubing is produced in copper tube sizes (CTS) with SDR-9 class, rated at 160 psi at 73 degrees F, 100 psi at 180 degrees F, and 80 psi at 200 degrees F.

Insert fittings conform to ASTM F1807 and carry NSF UP Code or CSA listings.

BENEFITS

JM Eagle's EverPEX product is flexible yet strong for all your plumbing and heating needs.

- Its light weight and inherent flexibility make it easy to install.
- It is environmentally friendly and lead-free, and requires no solvents or cements in installation.
- Extremely resistant to corrosion and bursting, it provides long-term durability.
- Its exceptional temperature resistance makes it suitable for use with water up to 200 degrees F and in applications where ambient temperatures drop below freezing.
- It has a high capacity for expansion and is compatible with existing copper tubing, CPVC and other CTS pipe.

PLEASE CONTACT YOUR JM EAGLE REPRESENTATIVE OR VISIT WWW.JMEAGLE.COM FOR MORE INFORMATION.



EVERPEX

SUBMITTAL AND DATA SHEET

We will be using 3/4" PEX for our domestic supply, and 1/2" PEX for our fire supply.

Coils
Meet with ASTM F876 and F877
80 psi @ 200°F
100 psi @ 180°F

160 psi @ 73°F
CTS-OD, SDR-9
NSF-pw, NSF CL-TD,
cNSF, UP Code

Straight Lengths
Meet with ASTM F876 and F877
80 psi @ 200°F
100 psi @ 180°F

160 psi @ 73°F
CTS-OD, SDR-9
cNSF, UP Code

PART #	PRODUCT DESCRIPTION	MINIMUM WALL THICKNESS	COIL SIZE	WEIGHT PER COIL (LB)
64683	EverPEX™ Nominal 1/4" (0.375" OD)	0.062"	100'	2.61
180687			300'	7.83
63933			500'	13.05
63974			1,000'	26.10
64725	EverPEX™ Nominal 3/8" (0.500" OD)	0.062"	100'	4.06
65466			300'	12.18
64014			500'	20.30
64055			1,000'	40.60
64766	EverPEX™ Nominal 1/2" (0.625" OD)	0.062"	100'	5.25
64097			300'	15.75
64139			500'	26.25
64170			1,000'	52.50
64808	EverPEX™ Nominal 5/8" (0.750" OD)	0.083"	100'	7.49
180695			300'	22.47
64212			500'	37.45
64253			1,000'	74.90
64840	EverPEX™ Nominal 3/4" (0.875" OD)	0.097"	100'	10.21
64337			300'	30.63
64295			500'	51.05
64378			1,000'	102.10
64881	EverPEX™ Nominal 1" (1.125" OD)	0.125"	100'	16.91
65508			300'	50.73
64410			500'	84.55
64451			1,000'	169.10
64923	EverPEX™ Nominal 1 1/4" (1.375" OD)	0.153"	100'	25.29
65540			300'	75.87
64493			500'	126.45
64535			1,000'	252.90
64964	EverPEX™ Nominal 1 1/2" (1.625" OD)	0.181"	100'	35.35
65581			300'	106.05
64576			500'	176.75
64618			1,000'	353.50
180703	EverPEX™ Nominal 2" (2.125" OD)	0.248"	100'	60.30
180711			300'	180.90
180729			500'	301.50
180737			1000'	603.00

PART #	PRODUCT DESCRIPTION	MINIMUM WALL THICKNESS	STRAIGHT LENGTH	WEIGHT PER PIECE (LB)
65607	EverPEX™ Nominal 1/4" (0.375" OD)	0.062"	5'	0.13
65615			10'	0.26
65045			20'	0.52
65623	EverPEX™ Nominal 3/8" (0.500" OD)	0.062"	5'	0.20
65631			10'	0.41
65086			20'	0.81
65649	EverPEX™ Nominal 1/2" (0.625" OD)	0.062"	5'	0.26
65656			10'	0.53
65128			20'	1.05
72603	EverPEX™ Nominal 5/8" (0.750" OD)	0.083"	5'	0.37
72611			10'	0.75
65169			20'	1.50
65664	EverPEX™ Nominal 3/4" (0.875" OD)	0.097"	5'	0.51
65672			10'	1.02
65201			20'	2.04
65680	EverPEX™ Nominal 1" (1.125" OD)	0.125"	5'	0.85
65698			10'	1.69
65243			20'	3.38
72629	EverPEX™ Nominal 1 1/4" (1.375" OD)	0.153"	5'	1.26
72637			10'	2.53
65284			20'	5.06
72645	EverPEX™ Nominal 1 1/2" (1.625" OD)	0.181"	5'	1.77
72652			10'	3.54
65326			20'	7.07
180745	EverPEX™ Nominal 2" (2.125" OD)	0.248"	5'	3.02
180752			10'	6.03
180760			20'	12.06

Revised 11/1/2010. This information may have been updated. Please download the latest version at

22 11 23 Jet Pump & Pressure Tank Combo

Complete Jet & Tank System

For Deep or Shallow Wells

Superior Performance

At depths to water of 70' or less

Compact System

Complete system with pressure gauge, pressure switch, pressure regulator, jet kit and all necessary connectors from pump to tank

Heavy-Duty Dual-Voltage Motor

Preset at 115V

Durable Construction

Heavy-duty cast iron pump housing

Precharged Pressure Tank with 15-Gallon Equivalent Capacity

Corrosion-resistant, heavy-gauge steel construction with baked-on finish



1/2 HP 5 GPM
FP420515H

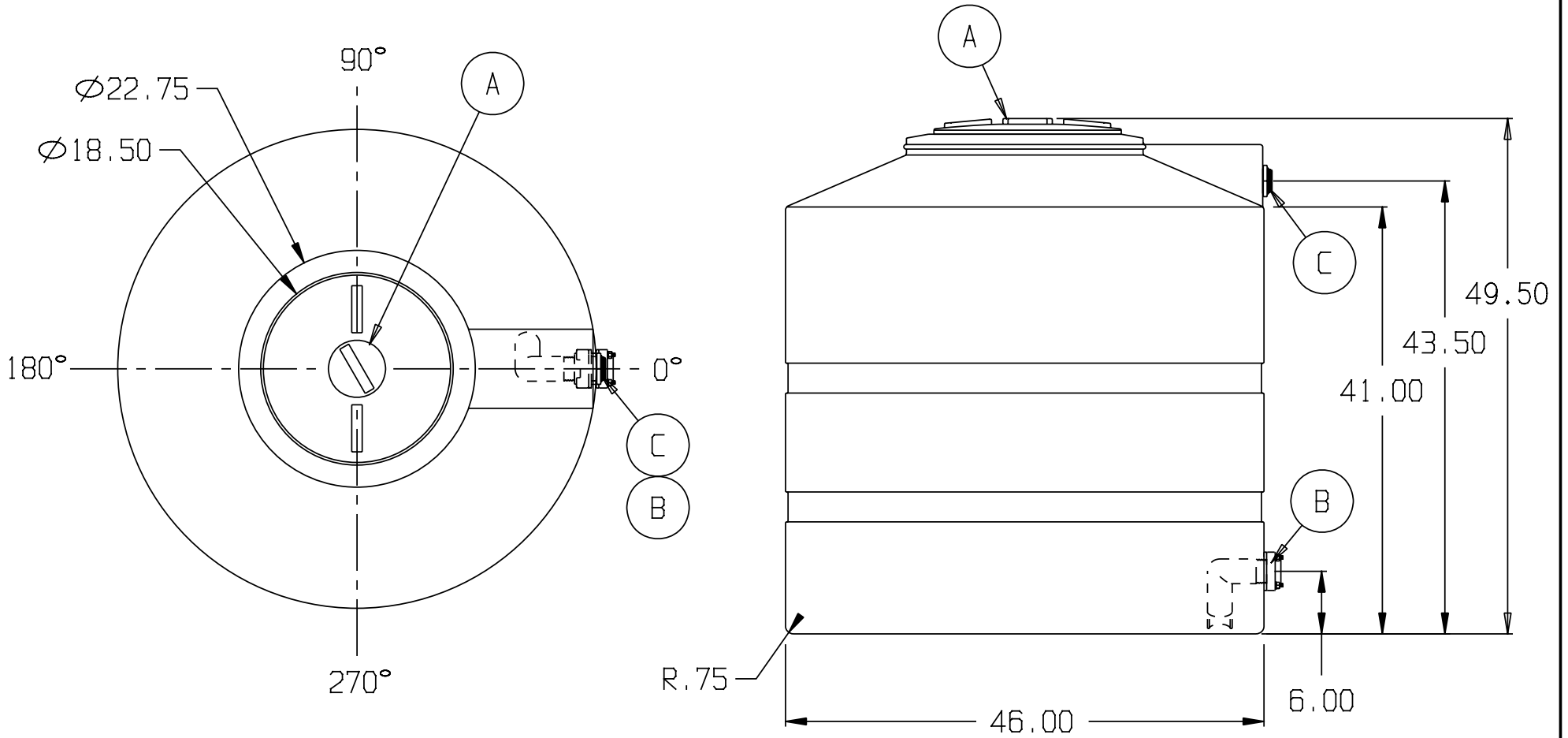
PERFORMANCE

MODEL/ UPC	HP	GPM	VOLTS	GALLONS PER MINUTE PUMPED AT DIFFERENT DEPTHS TO WATER IN FEET										PRESS. SHUTOFF AT MAX DEPTH	PRESS. SWITCH		CARTON DIMS. (IN INCHES)	WEIGHT (LBS.)
				0'	5'	10'	15'	20'	30'	40'	50'	60'	70'		ON	OFF		
FP420515H 022315361713	1/2	8.5	230/115	-	-	-	-	-	5.0	4.0	3.0	2.5	2.0	77 PSI	30	50	23.25 x14 x 26.88	56
Deep Well with 4" diameter casing or larger																		
Shallow Well of 25' or less				10	9.5	9	8	6.5	-	-	-	-	-	54 PSI				

Includes:

Factory-installed 30/50 preset pressure switch, detailed owner's manual

22 12 19 Facility Ground-Mounted, Potable-Water Storage Tanks (Greywater Tank)



- A. 18" PE THREADED-VENTED MANWAY W/15" ACCESS [P/N 34700087]
- B. 2" PP DBL FLANGED BOLTED SHORT SIPHON TUBE ASSY W/EPDM GASKETS & SS BOLTS [P/N 34700842]
- C. 1-1/2" PE SII THREADED BH FTG W/EPDM GASKET [P/N 34300008]

SNYDER INDUSTRIES INC.

(all dimensions in inches)

PART # TANK: 8040000W--

REF#: 00000

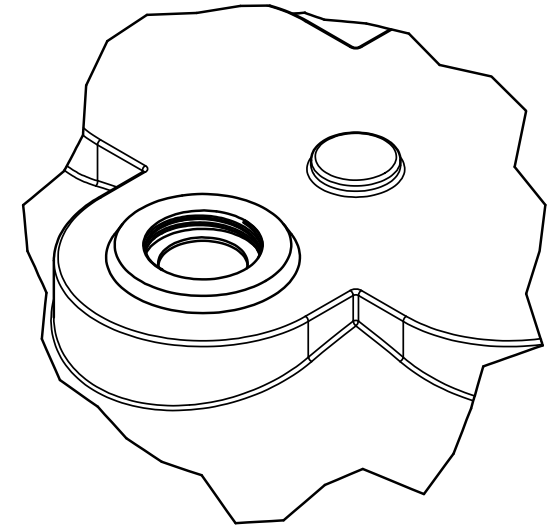
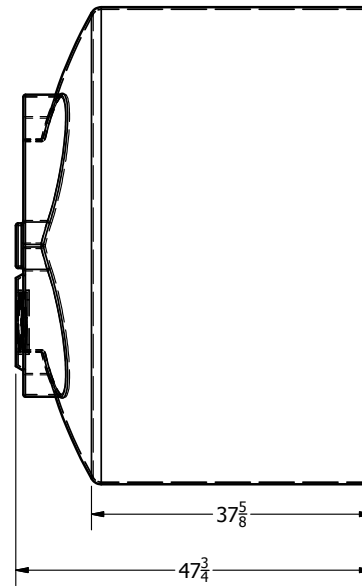
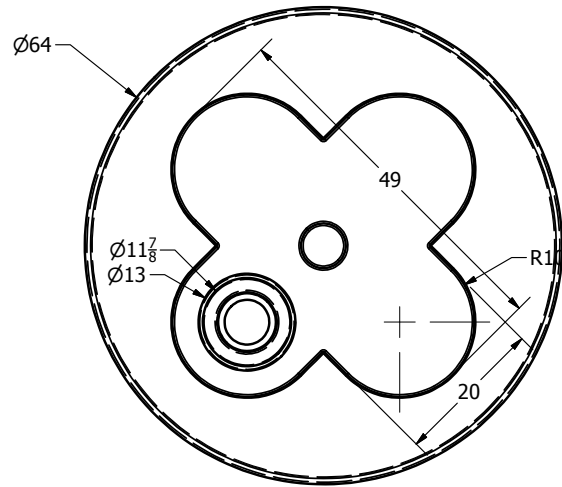
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09/19/05

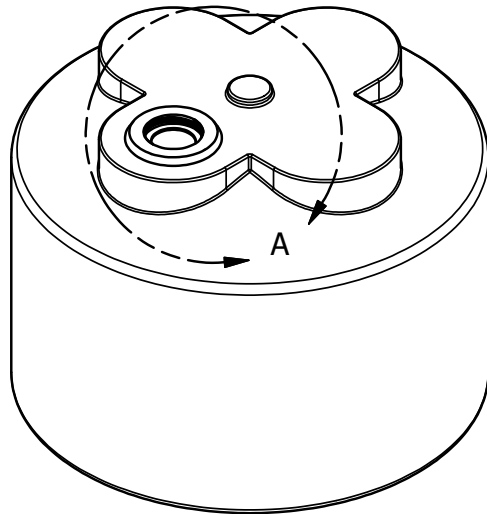
300 GALLON WATER TANK


BASE FITTINGS TO BE LEFT INSTALLED AT TIME OF SHIPMENT PER SII PROCEDURE

22 12 19 Facility Ground-Mounted, Potable-Water Storage Tanks (Primary Supply Tank)



DETAIL A
SCALE 0.12 : 1



DRAWN Todd Bolzer	11/23/2011	 NORWESCO, INC., ST. BONIFACIUS, MN		
CHECKED		TITLE		
QA		600 GALLON VERTICAL TANK X 64 DIAMETER		
MFG				
APPROVED				
		SIZE B	DWG NO 43800 BLACK	REV A
		SCALE: 1/16	SHEET 1 OF 1	



▶ ABS DWV PIPE

Streamline® employs proprietary manufacturing technologies and processes to produce our Streamline ABS DWV pipe with consistent and dense cellular structure, plus a uniform pipe wall thickness for uncompromising, reliable performance – and an attractive appearance. Smooth, consistent interior walls provide for full flow and increased resistance to corrosion and scaling. Dense and uniform cellular (foam) structure results in a stronger, more reliable and quiet product, and uniform interior and exterior wall skins improve joint strength and reliability. Finally, our relentless attention to quality and detail means our customers will enjoy the best pipe in the industry.



- Smooth and consistent interior wall provides for full flow, resistance to corrosion or scaling
- Smooth and consistent exterior wall provides for easy and reliable joining, joint performance, and attractive appearance
- Dense and uniform cellular (foam) structure provides, reliable, strong, and quiet product
- Uniform interior and exterior wall skin for a strong and reliable joint
- 25 year warranty

A BRAND OF MUELLER INDUSTRIES 

Distributed by Mueller Streamline Co. • 8285 Tournament Drive, Memphis, TN 38125 • 800-348-8464 • www.muellerindustries.com • MLT-099

Manufacturing

- Modern, state of the art manufacturing processes provide for highest quality product
- Responsive and high capacity facility to meet customer needs

- Only West Coast manufacturer of both ABS DWV Pipe and Fittings
- Local manufacturing provides responsive distribution and service
- Local and responsive factory representatives and other support staff

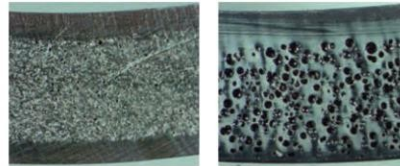
Codes & Standards

- ASTM Standard F628
- National Plumbing Code
- Uniform Plumbing Code
- International Plumbing Code
- One and Two Family Dwelling Code
- National Standard Plumbing Code
- Standard Plumbing Code



Comparison

Cross-section zoom of Streamline manufactured cellular core pipe as compared to a leading competitor



Streamline

Other

We will be using 2" ABS domestic return piping.

ABS DWV PIPE - 20 FT							
ABS DWV Schedule 40 Cellular Core, Plain End, Black, ASTM F-628							
Nom. Size	Length A	Avg. OD (inches)	Min. Wall Thickness	Feet Per Lift	Pieces Per Lift	Weight (lbs) Per 100 ft	Truckload % Per Lift
1-1/2"	20 ft.	1.900	0.145	5,180	259	27.3	5
2"	20 ft.	2.375	0.154	3,340	167	37.8	5
3"	20 ft.	3.500	0.216	1,500	75	74.5	5
4"	20 ft.	4.500	0.237	960	48	103.9	5
6"	20 ft.	6.625	0.280	360	18	186.9	5

ABS DWV PIPE - 10 FT							
ABS DWV Schedule 40 Cellular Core, Plain End, Black, ASTM F-628							
Nom. Size	Length A	Avg. OD (inches)	Min. Wall Thickness	Feet Per Lift	Pieces Per Lift	Weight (lbs) Per 100 ft	Truckload % Per Lift
1-1/2"	10 ft.	1.900	0.145	2,590	259	27.3	2.5
2"	10 ft.	2.375	0.154	1,760	167	37.8	2.5
3"	10 ft.	3.500	0.216	750	75	74.5	2.5
4"	10 ft.	4.500	0.237	480	48	103.9	2.5
6"	10 ft.	6.625	0.280	180	18	186.9	2.5

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product.
2. For solvent cements and adhesive primers, documentation including printed statement of VOC content.
3. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1.2 FIELD CONDITIONS

- ##### A. Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service and do not proceed without written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water 4.3 psi.
- ##### B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- ##### C. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- ##### D. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components.

2.2 PIPES AND FITTINGS

A. CISPI, Hubless-Piping Couplings:

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- B. ABS Plastic, DWV Pipe and Fittings: ASTM D 2235, Schedule 40, plain ends with ABS socket-type, DWV pipe fittings.
1. Solvent Cement: ASTM D 2235.
 - a. ABS solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Comply with requirements in Section 22 11 13 "Facility Water Distribution Piping" for basic piping installation requirements.
- B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Section 22 11 13 "Facility Water Distribution Piping" for wall penetration systems.
- C. 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 two 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.
- D. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- E. Install ABS soil and waste drainage and vent piping according to ASTM D 2235.
- F. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- G. Comply with requirements in Section 22 11 13 "Facility Water Distribution Piping" for basic piping joint construction.
- H. Comply with requirements in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

3.2 PIPE SCHEDULE

- A. Aboveground Applications: Schedule 40 ABS plastic pipe and fittings with solvent-cemented joints.

END OF SECTION 22 13 16



22 30 00 Plumbing Manifold

PureFlow[®] MANABLOC[®] Manifold Control Unit For ViegaPEX[™], ViegaPEX[™] Ultra and FostaPEX[®] SDR-9 Cross-linked Polyethylene (PEX)

Scope

This specification designates requirements for the PureFlow MANABLOC Manifold Plumbing Control Unit. The MANABLOC parallel water distribution system supplies water to individual plumbing fixtures through dedicated ports and distribution lines. Each port (outlet) is equipped with a built-in shut-off valve to provide control for each fixture from a central location. The MANABLOC has separate hot and cold water inlets and ports to manage the entire plumbing system. A variety of fitting options are available for the MANABLOC distribution ports, including PEX Compression, Bronze PEX Press, Brass PEX Crimp and PolyAlloy PEX Crimp fittings. These distribution connections come complete with the MANABLOC when ordered. However, supply connections and fixture transition fittings are not included with the unit but are available separately.

Materials

The modular MANABLOC sections are molded from polysulfone (PLS) plastic. This material is used extensively in the medical industry and is highly resistant to hot water, chlorine and other chemicals typically found in potable water systems. The other components making up the MANABLOC consist of corrosion-resistant metals and engineered plastics that have been chosen specifically for each purpose. The stiffener used in the compression port fitting assembly is manufactured from 304 stainless steel.

Marking and Certification

MANABLOC units are marked with the product name, unit part number, material designation, production date and marks of third-party certifications by NSF International (NSF-pw) to ASTM F877 and ANSI/NSF standards 14 and 61, CSA B137.5 Warnock Hersey, and are listed with IAPMO as meeting the requirements of the Uniform Plumbing Code.

Recommended Uses

The MANABLOC is recommended for use in hot and cold potable water distribution systems in single and multifamily dwellings, as well as multiple-unit structures (apartments, condos, hotels, motels, etc.). Maximum pressure/temperature rating is 100 psi @ 180°F. The MANABLOC is not to be used directly in line with hot water domestic recirculation loops. PureFlow MANABLOC system components are not interchangeable with components and tubing from other suppliers. For information on other hot and cold applications not listed here, consult with your Viega representative.

Handling and Installation

The MANABLOC must be protected from UV exposure and petroleum products that can damage them. Use of these materials in hot and cold water distribution systems must be in accordance with good plumbing practices, applicable code requirements, and current installation practices available from Viega. Contact a Viega representative or the applicable code enforcement bureau for information about approvals for specific applications.

Capacities and K-Factor

Specifications	English Units	SI
Main Waterway (each side)	1-1/4"	31.8mm
Main Inlet/Outlet Connection	1" Male NPSM	-
Fixture Ports	3/8" CTS and 1/2" CTS	9.5mm and 12.7mm
Fixture Port Rating (each)	3/8" - 2.5 GPM	3/8" - 9.5 LPM
(@ 8 FPS tubing velocity)	1/2" - 4 GPM	1/2" - 15.1 LPM
Fixture Port K-Factor	3/8" - .35	3/8" - 1.66 x 10 ⁻³
	1/2" - .21	1/2" - 9.997 x 10 ⁻⁴
	(PSI=KxGPM ²)	(BAR=KxLPM ²)



VIEGA
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Fax: 1-800-976-9817

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1 of 3



TechData

PRODUCT SPECIFICATION SHEET

Main Bore Flow Capacity (each side) (2006 IPC Table 604.10.1)
Main Bore Through Feed K Factor
(36 Ports with "Y" Block)
WSFU Capacity (each side) (2006 IPC, table E103.3)

31 GPM
0.012
(PSI=KxGPM²)
60

117.3 LPM
 56.98×10^{-6}
(BAR=KxLPM²)
-





TechData

PRODUCT SPECIFICATION SHEET



Quality Assurance

When the product is marked with the ASTM F877 designation, it affirms that all MANABLOC manifold control units are factory-assembled and pretested prior to delivery to the field. Viega utilizes protective packaging to reduce risk of damage during shipping and storage. MANABLOC manifolds are not intended to be fabricated or disassembled in the field. MANABLOC manifolds are intended for potable water use only.

Certification

NSF-pw - NSF International Performance and Health Effects

(Standards 14 & 61)



- IAPMO Certified



- Intertek Testing Services (Warnock Hersey) - certification to CSA B137.5

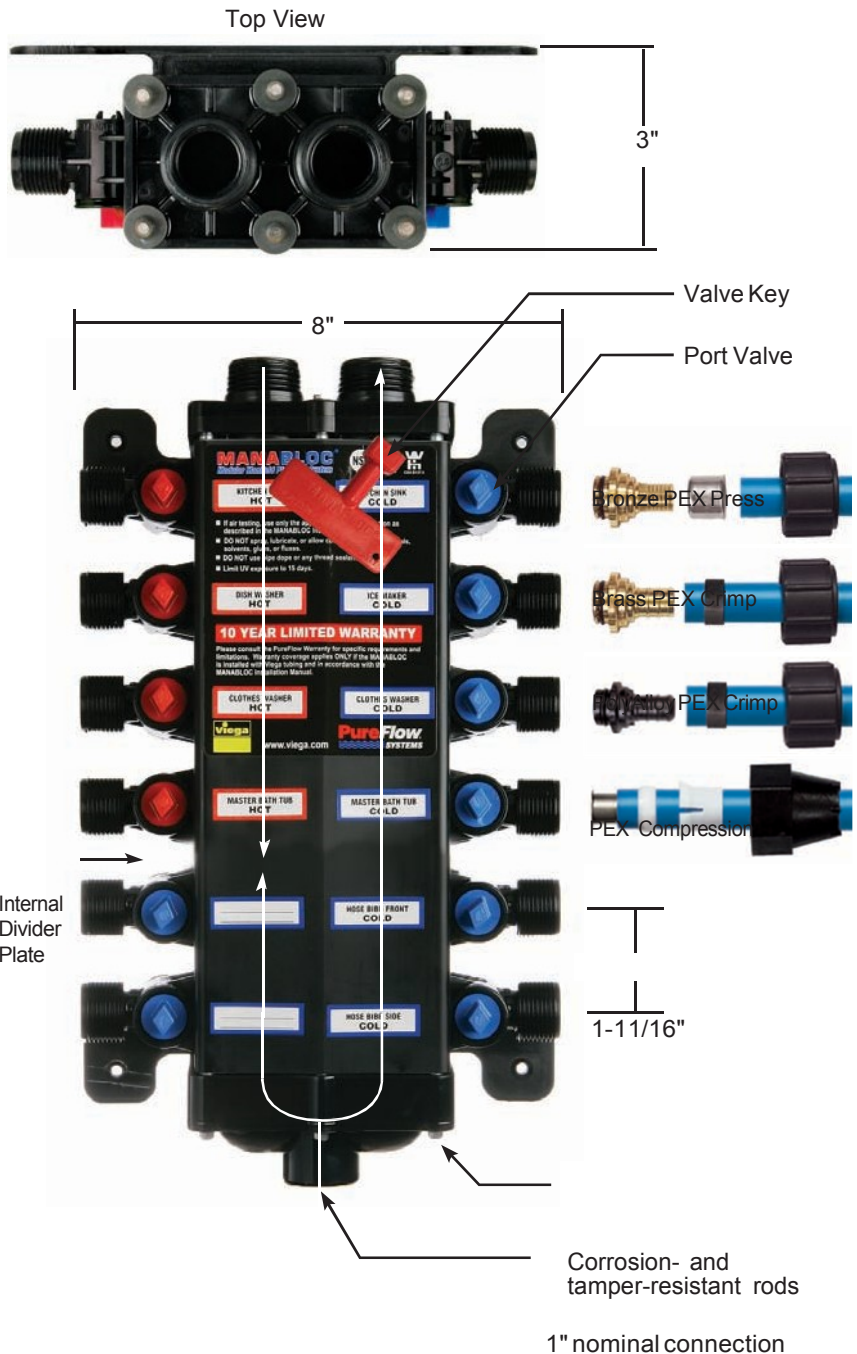
MANABLOC Dimensions

Total Ports	Length
14	15 - 15/16"
18	19 - 3/8"
24	24 - 3/8"
30	29 - 1/2"
36	34 - 3/8"

Dimensions reflect stock MANABLOC sizes.

MANABLOC Pressure Drop Table Expressed as PSI Drop Through Port

Port Size	Rated Flow	PSI Drop
3/8"	2.5 gpm	2 psi
1/2"	4 gpm	3.4 psi



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SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type and size of domestic-water heater and control wiring schematic.
2. Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."
 - a. Seismic Qualification Certificates: For commercial domestic-water heaters, accessories, and components, from manufacturer.
3. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

- ##### B. Warranties: Submit a written warranty executed by manufacturer agreeing to repair or replace water heaters that fail in materials or workmanship within five years from date of Substantial Completion. Failures include, but are not limited to, tanks and elements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.
- C. Comply with performance efficiencies prescribed in ASHRAE 90.2, "Energy Efficient Design of New Low-Rise Residential Buildings."

2.2 WATER HEATERS, GENERAL

- A. Insulation: Suitable for operating temperature and required insulating value. Include insulation material that surrounds entire tank except connections and controls.
- B. Anode Rods: Factory installed, magnesium.
- C. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure

setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

- D. Drain Valve: Factory or field installed.

2.3 ELECTRIC WATER HEATERS

- A. Residential, Small-Capacity, Electric Heat Recovery (Hybrid), Domestic-Water Heaters:

- 1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:

- a. Nexus.

- B. Standard UL 174, 80-gal. capacity; steel with 150-psig working-pressure rating. One electric, screw-in, immersion-type heating element and one refrigerant condenser water heating element with adjustable thermostat for each element and wiring arrangement for nonsimultaneous operation with maximum 30-A circuit. Refrigerant pump is to be fused and circuit protected separately from heating element per NEC.

- C. Light-Commercial, Grey Water Storage Tank:

- 1. **Manufacturers:** Subject to compliance with requirements, provide products by the following:

- a. Nexus.

- D. Standard UL 174 but listed by manufacturer for commercial applications; 75-gal. capacity. HDPE tank with 5-psig non-pressurized rating, GREY WATER labeled. Multiple electric, screw-in, immersion-type pump with adjustable pressure for grey water and wiring arrangement for operation with maximum 10-A circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install temperature and pressure relief valves and extend to closest floor drain.
- B. Install vacuum relief valves in cold-water-inlet piping.
- C. Install shutoff and three-way switching valves and unions at hot- and cold-water piping connections.
- D. Make piping connections with dielectric fittings where dissimilar piping materials are joined.
- E. Electrically ground heaters, pumps, and control units according to authorities having jurisdiction.

- F. Connect heater control to heater pumps and control input wiring per included control wiring schematic.

END OF SECTION 22 33 00

Nexus eWater™
Home Water & Energy Recycling

NEXheater



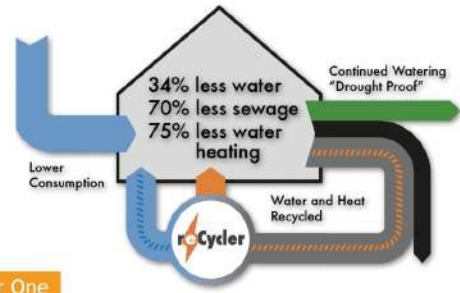
The NEXheater ONE

The NEXheater One is your Home Energy Recycler. It captures and reuses the energy found abundantly in water going "down the drain" in your home.

The NEXheater One uses time-tested heat pump technology to capture, transfer and store the abundant energy found in warm drain water. The heat pump evaporator sits in a drain water collection tank (sold separately), where it extracts heat and transfers it to refrigerant gas. The gas moves to an 80-gallon storage cylinder where the heat is released by the heat pump condenser and stored in water until later reuse.

In heavy use, the NEXheater One will reduce your home's net energy budget by over 3,000 kwh annually.

Did we mention that the NEXheater One doubles as an ultra-efficient Water Heater?



Nexus NEXheater One	
Water Heating Performance	
COP ¹	4.0
Heating input capacity	3160W (average)
Compressor input power ^{2,3}	790W (max), 400 W (min)
Booster heater input power	400
Default hot water output temperature	120 degrees F
Temperature control range	110-135 degrees F
Control type	Digital Control
Operating pressure (maximum)	150 psi
Greywater temperature range	38-120 degrees F
TECHNOLOGY	
Compressor	Panasonic
Evaporator	Proprietary design
Condenser	Therma-Stor proprietary design
Refrigerant gas	410A
Refrigerant rated operating pressure	450 psi
DIMENSIONS	
Storage volume	80 gallons
Height	73"
Diameter	24"
POWER REQUIREMENTS	
Dedicated circuit requirement	208-230 V, 60Hz 1 Phase
Peak starting load	19 Amps
Maximum continuous draw	3.5 Amps (compressor), 20 Amps (inc booster element)
TANK CONSTRUCTION	
Cylinder	Steel
Lining	Glass
Insulation	R-16 (2" foam urethane)
Condenser jacket	Brazed plate
OTHER INSTALLATION REQUIREMENTS	
Front clearance	3 feet
CERTIFICATION	UL



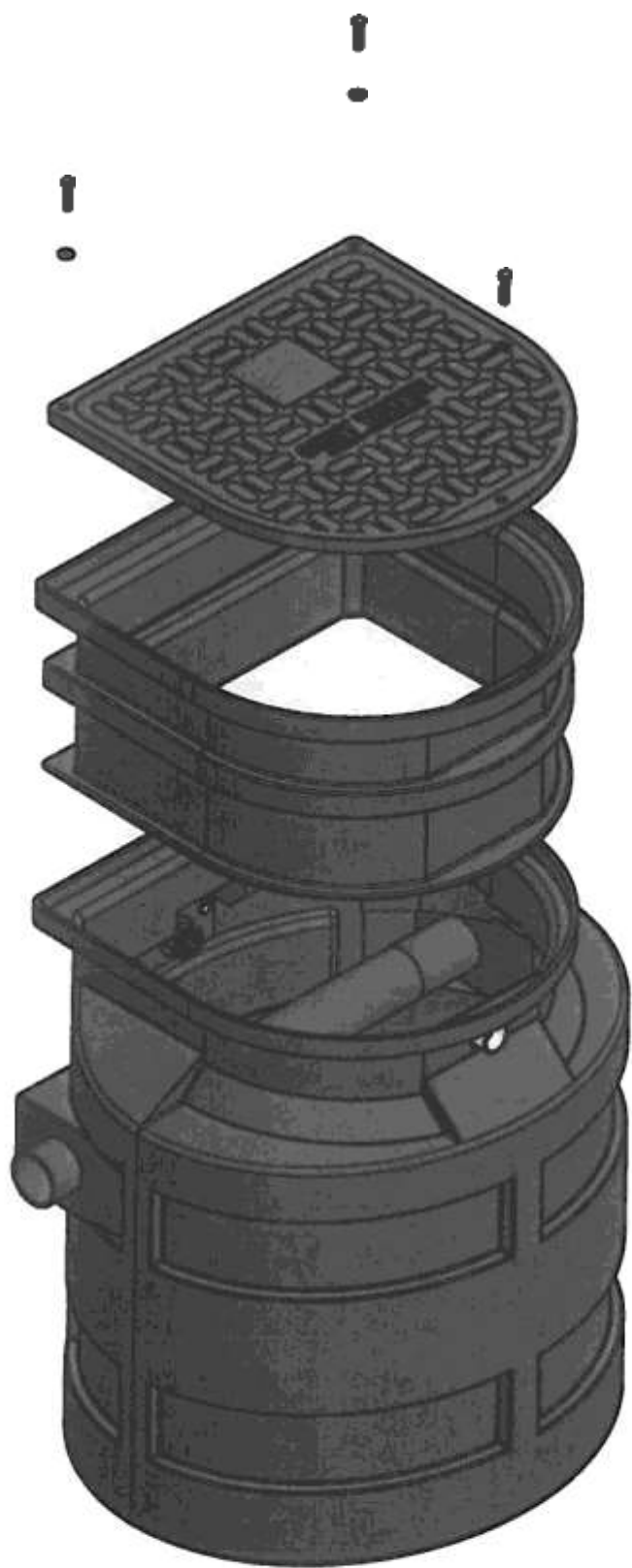
1. Test point 78 °F / 26 °C grey water starting temp (ending temp 43 °F / 6 °C), heating up water from 78.5 °F / 26 °C to 125 °F / 52
2. Tgrey = 38 °F / 3 °C, Twater = 135 °F / 57 °C / 240 V
3. Tgrey = 100 °F / 38 °C, Twater = 78 °F / 26 °C / 240 V)



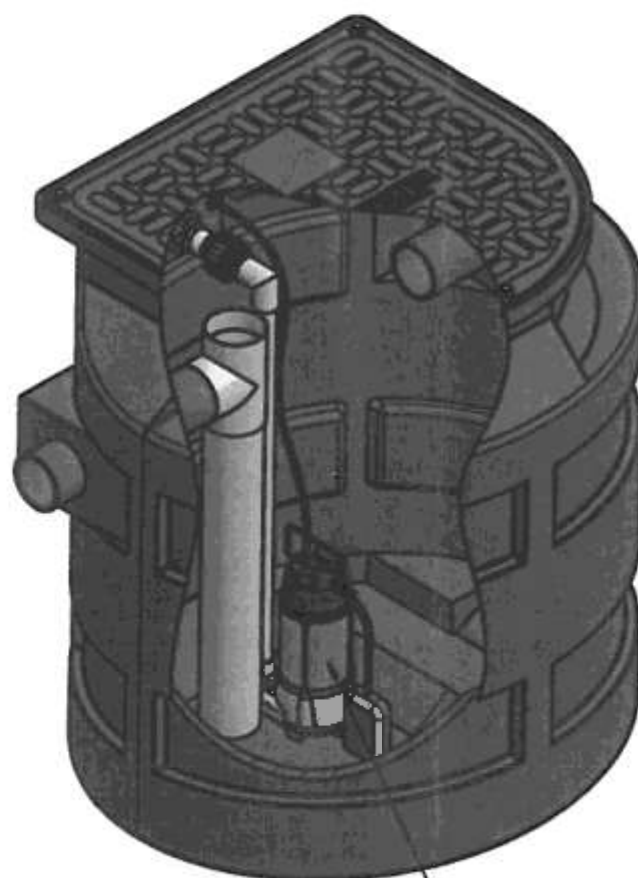
Australia
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Bob Hitchner
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 E: bob@nexusewater.com

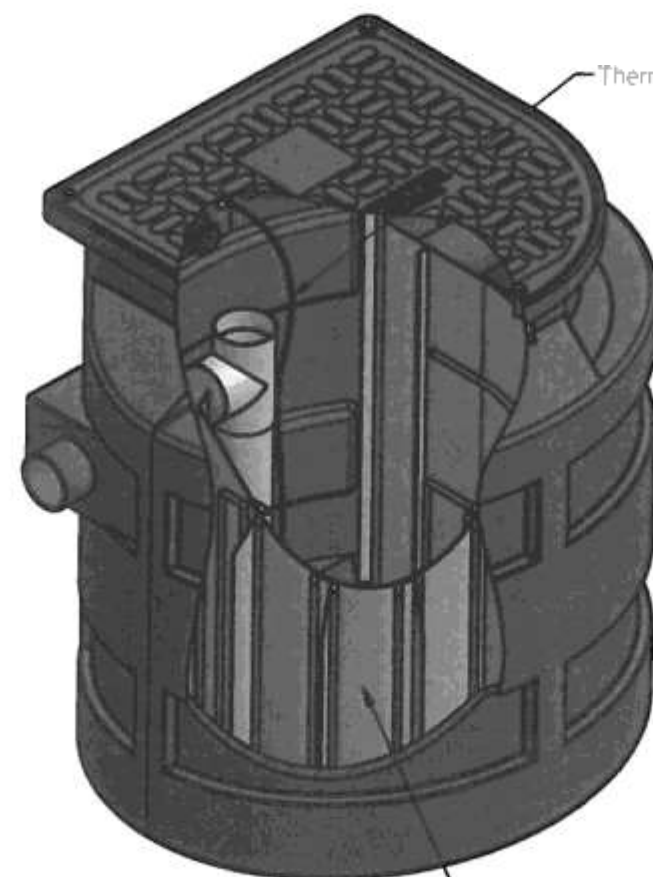
6 Nexus Hub with Extension



Nexus Hub with reCycler components installed



Nexus Hub with reHeater components installed



Submersible Pump (sold separately with the reCycler product package)

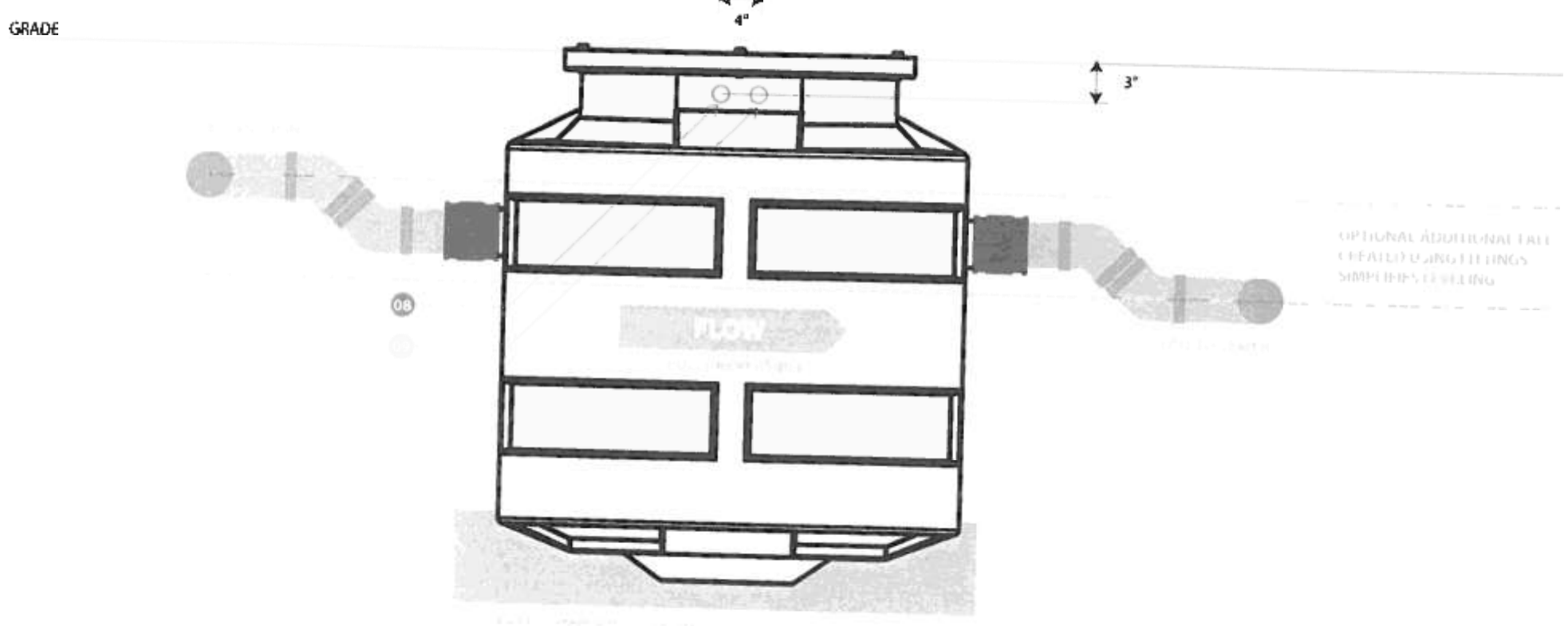
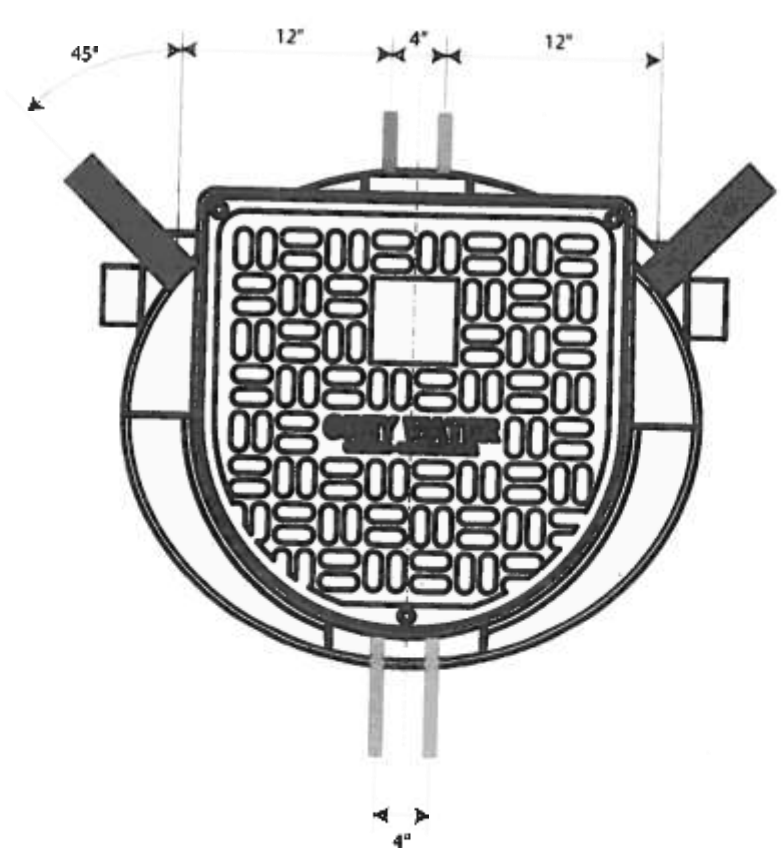
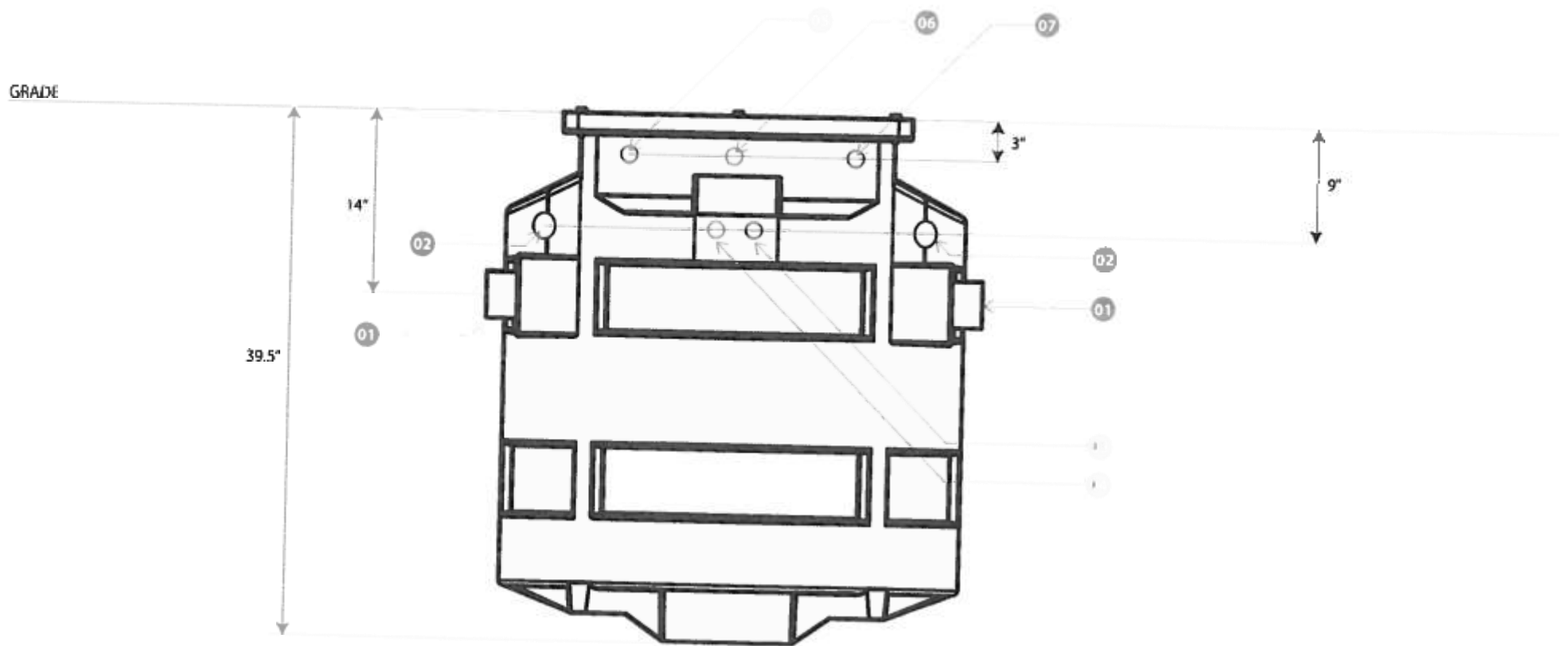
Heat Exchanger (sold separately with the reHeater product package)

The Nexus Hub Intake and Overflow flow direction can be reversed

Designed by Andrew	Checked by	Approved by	Date	Date 1/05/2013	Size A3
		Designed by Nexus eWater www.nexusewater.com andrew@nexusewater.com +1 415 533 6642 +61 404 848 462		The Nexus Hub Hub Assembly V4-1	
				Edition	Sheet 2 / 3

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NOTE

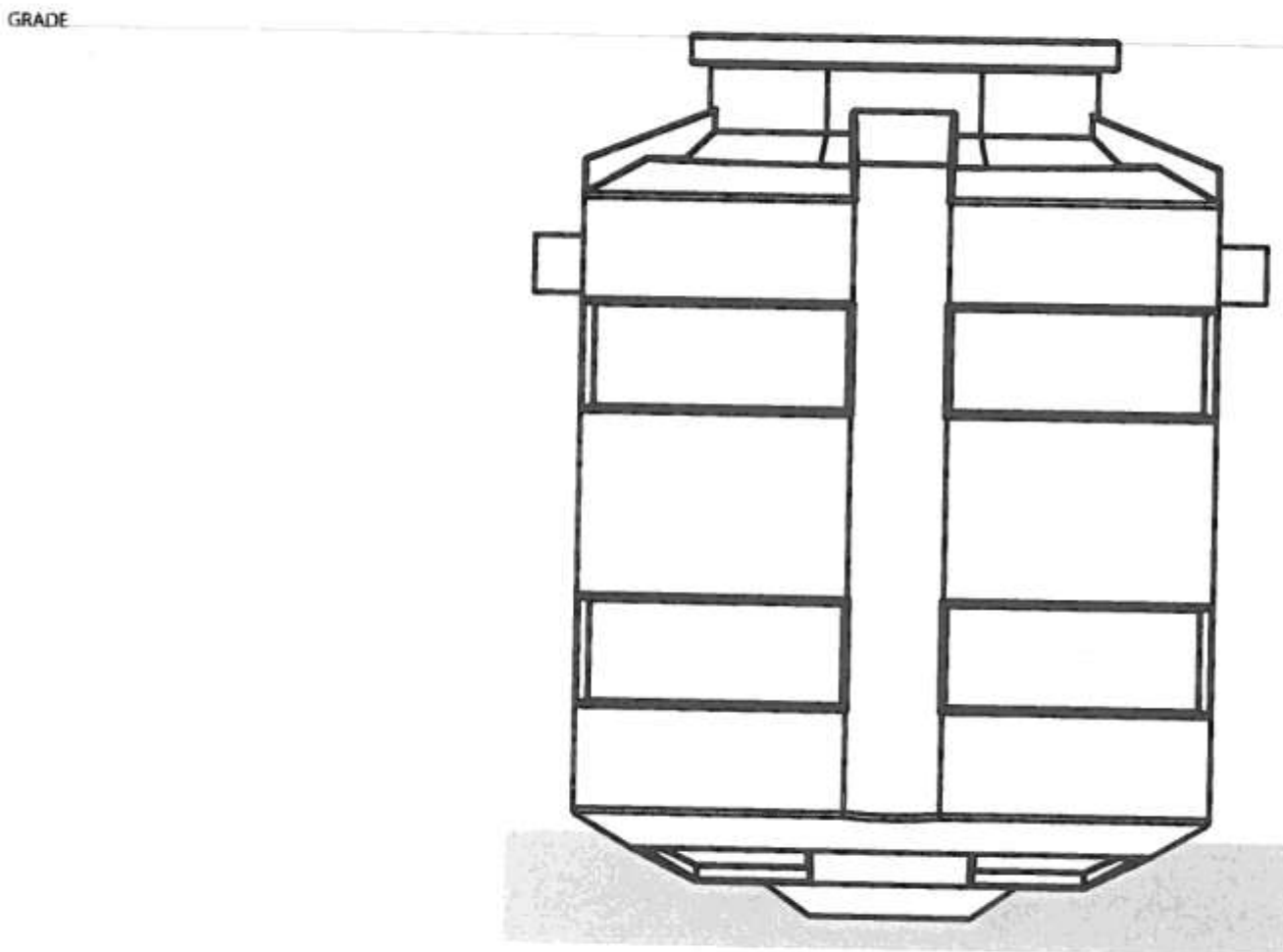
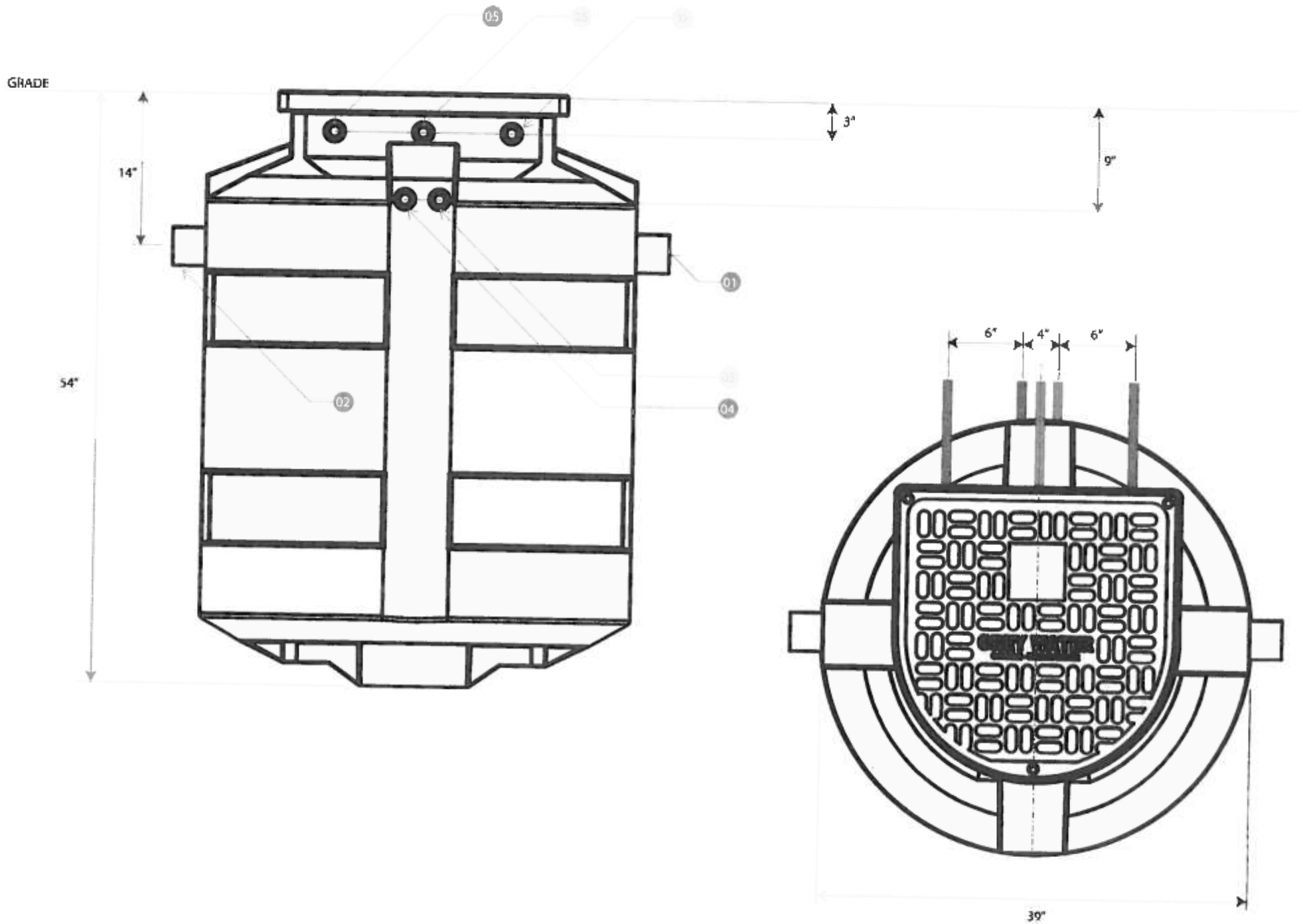
- 01 - INLET/OUTLET (REVERSIBLE)
- 02 - VENT CONNECTION (USE LEFT OR RIGHT)
- 03 - PUMPED GREY WATER OUT (TO NEXTREATER)
- 04 - 110V ELECTRICAL SUPPLY (FROM NEXTREATER)
- 05 - ***NOT USED, CAPPED INSIDE***
- 06 - ***NOT USED, CAPPED INSIDE***
- 07 - ***NOT USED, CAPPED INSIDE***
- 08 - LIQUID REF. LINE (FROM NEXHEATER)
- 09 - SUCTION REF. LINE (TO NEXHEATER)

CONNECTION/SPECIFICATION

- 3" ABS PIPE, CONNECT WITH 3" RUBBER SLEEVE AND CLAMPS
- 2" FEMALE THREAD, MEMBRANE DRILLED OUT TO ACTIVATE, VENT THROUGH ROOF
- 3/4" FEMALE THREAD, PIPE TO NEXTREATER (SEE 'E')
- 3/4" FEMALE THREAD, CONDUIT TO NEXTREATER (SEE 'G')

- 1/2" COPPER TUBE, DRILLED AND SEALED ONSITE BY NEXUS, IN CONDUIT TO NEXHEATER (SEE 'CC')
- 3/8" COPPER TUBE, DRILLED AND SEALED ONSITE BY NEXUS, IN CONDUIT TO NEXHEATER (SEE 'BB')

*ALL THREADS IN US SIZES

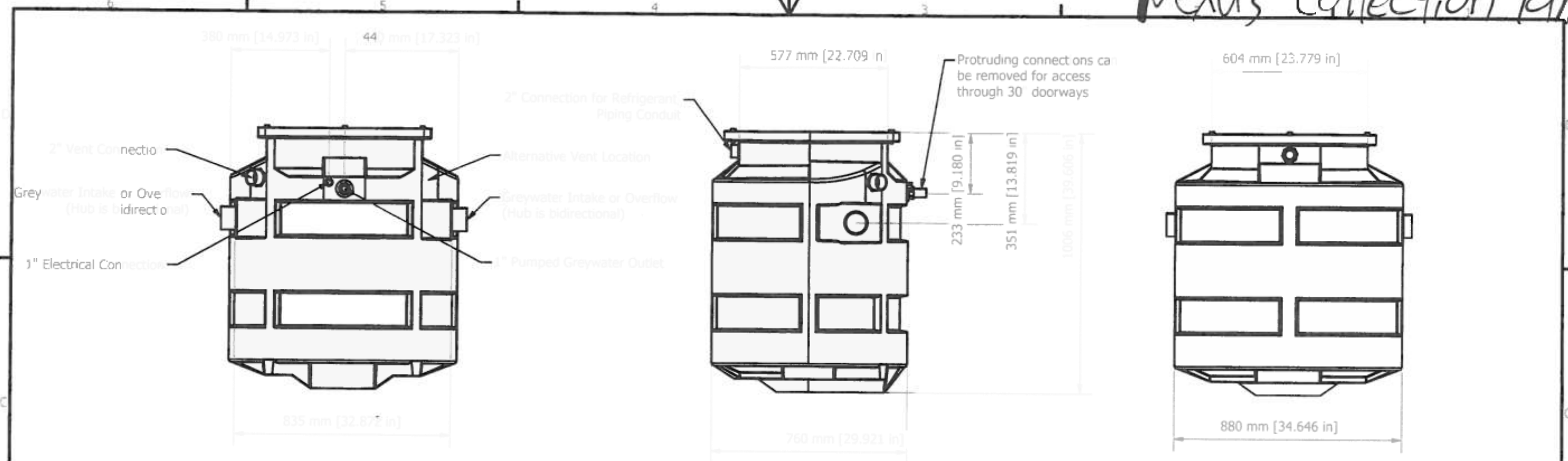


- NOTE
- 01 - VENT
 - 02 - RAINWATER CONNECTION (CAP IF UNUSED)
 - 03 - PUMPED GREY WATER OUT (TO NEXTREATER, TOILETS)
 - 04 - 110V ELECTRICAL SUPPLY (FROM PANEL, 10A)
 - 05 - POTABLE WATER SUPPLY
 - 06 - 24V ELECTRICAL (COMMUNICATIONS, FROM NEXTREATER)
 - 07 - PUMPED GREY WATER IN (FROM NEXTREATER)

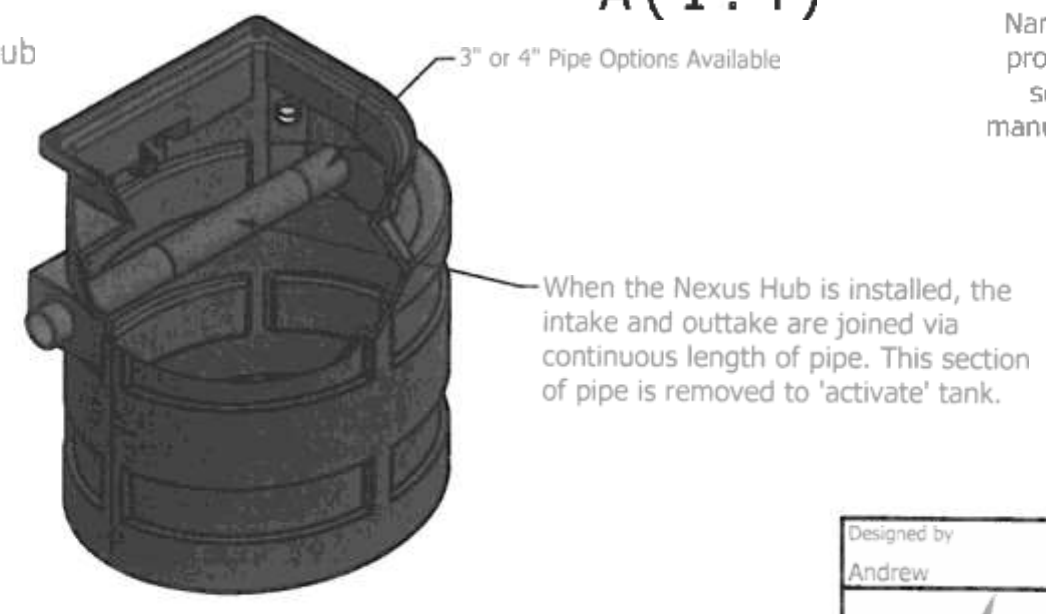
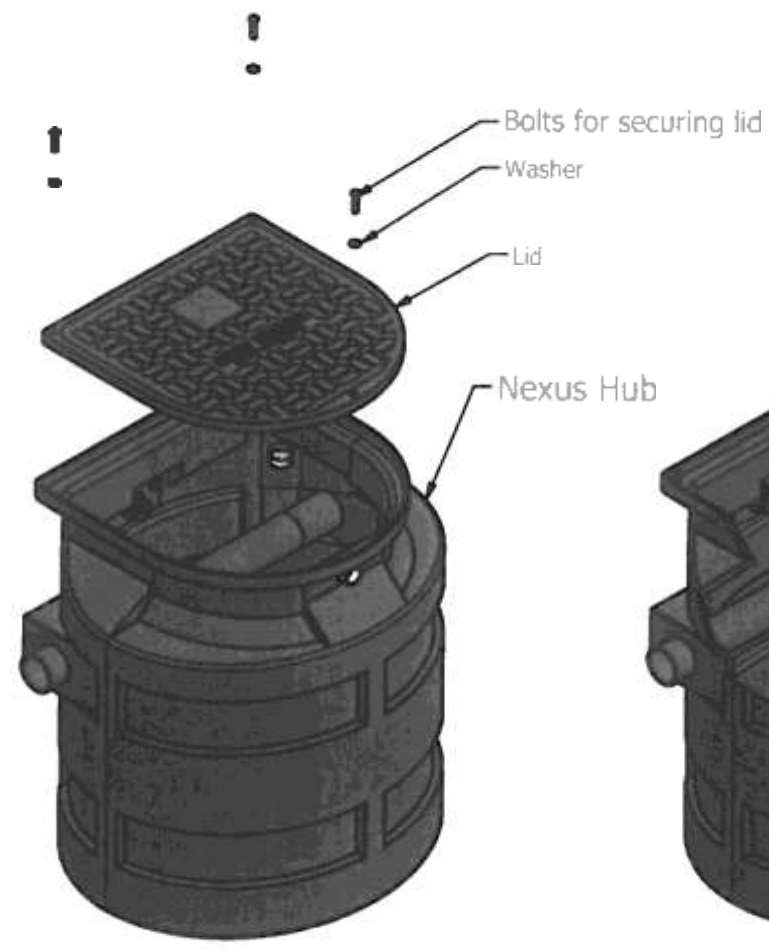
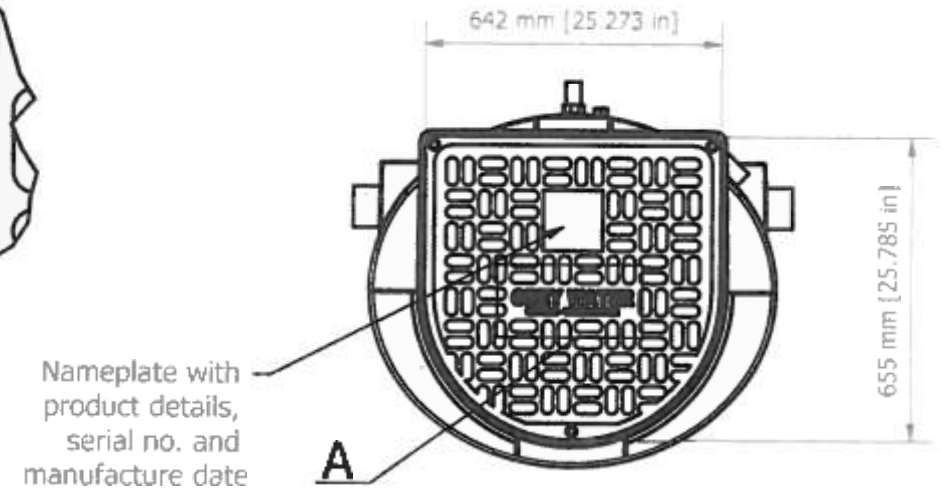
- CONNECTION/SPECIFICATION
- 3" ABS PIPE, CONNECT WITH 3" RUBBER SLEEVE AND CLAMPS, GLUE CAP ON UNUSED SIDE
 - 2" FEMALE THREAD, MEMBRANE DRILLED OUT TO ACTIVATE, VENT THROUGH ROOF
 - 3/4" FEMALE THREAD, PIPE TO NEXTREATER (SEE 'A')
 - 3/4" FEMALE THREAD, CONDUIT TO PANEL
 - 3/4" FEMALE THREAD
 - 3/4" FEMALE THREAD, CONDUIT TO NEXTREATER (SEE 'H')
 - 3/4" FEMALE THREAD, PIPE TO NEXTREATER (SEE 'B')

*ALL THREADS IN US SIZES

Nexus Collection Tank



A (1:4)



Capacity	75 Gallon (US)
Material	HDPE
Country	USA

Designed by Andrew	Checked by	Approved by	Date	Date 1/05/2013	Size A3
		The Nexus Hub			
Hub Assembly V4-1			Edition	Sheet 1 / 3	

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SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data for each type of plumbing fixture, including trim, fittings, accessories, appliances, appurtenances, equipment, and supports.
2. Documentation indicating flow and water consumption requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 WATER CLOSETS

- A. Water Closets: Floor-mounted, floor-outlet, close-coupled (gravity tank), vitreous china. 10 21 13.
 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. Kohler Co.
 2. Standards: ASME A112.19.2/CSA B45.1, ICC/ANSI A117.1, and ADA. Elongated rim contour, siphon-jet bowl type, close-coupled gravity tank, floor-mounted, floor outlet.

2.3 TOILET SEATS <included see 10 21 13>

- A. 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:

1. [Kohler Co.](#)
- B. Standard: IAPMO/ANSI Z124.5. Elongated, solid plastic closed front with cover with bumpers and hardware, Residential class.

2.4 LAVATORIES

A. Enameled Cast-Iron Lavatories, Counter Mounted:

1. [Manufacturers:](#) Subject to compliance with requirements, provide products by the following:
 - a. [Kohler Co.](#)
2. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron or steel lavatories.
3. Shape: Rectangular.

2.5 LAVATORY FAUCETS

A. General-Duty, Copper- or Brass-Underbody Faucets:

1. [Manufacturers:](#) Subject to compliance with requirements, provide products by the following:
 - a. Kohler.
2. Standard: ASME A112.18.1/CSA B125.1; solid-brass underbody and brass cover plate.
3. Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
4. Type: Center set with central inlets and without pop-up waste.
5. Finish: Polished chrome plate.
6. Handle(s): Single-lever toggle Single, push-pull and twist.
7. Maximum Flow Rate: 1.5 gpm.
8. Drain: Pop up with NPS 1-1/4 tailpiece, included with faucet.
9. Trap: Polished Chrome plated, with slip-joint inlet and wall flange.
10. Supply and Drain Insulation: Soft-plastic covering; removable at stops.
11. Fixture Support: Exposed arm for wall-mounting, lavatory-type fixture. Include steel uprights and feet.

2.6 SHOWERS: FACTORY FABRICATED CABINET

- A. [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:
 1. Kohler.
- B. Shower Enclosure: Composite, ADA access..

1. Accessibility Options: Include grab bar and bench.

2.7 SHOWER BASINS

A. PMMA (Acrylic) Shower Basins:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. American Standard America.
2. Standard: ANSI Z124.1.3 for PMMA bases.
3. Bathing Surface: Slip resistant according to ASTM F 462.
4. Shower Base Receptor: Included with enclosure with threshold matching enclosure and slip-resistant surface. Include integral corrosion-resistant-metal drain with removable strainer and NPS 2 bottom outlet.
5. Type: Accessible.

2.8 SHOWER FAUCETS

A. Single-Handle, Temperature-Balance Bath Controls:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Pfister.
2. ADA Compliant ANSI A117.1, NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
3. Antiscald-type faucet; maximum 2.5-gpm flow rate.
 - a. Include ball, gate, or globe valves on supplies if check stops are not included with faucet.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Shower Arm, Flow-Control Fitting: 1-1/2 gpm.
4. Drain: Included with bathtub.

2.9 BATHTUBS

A. PMMA (Acrylic) Bathtubs Drawing 22 41 19:

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

- a. [Kohler Co.](#)
2. Standard: ANSI Z124.1.2 for PMMA plastic bathtubs. Slip-resistant bathing surface according to ASTM F 462..

2.10 KITCHEN SINKS

A. Stainless-Steel Kitchen Sinks:

1. [Manufacturers:](#) Subject to compliance with requirements, provide products by the following:
 - a. [Kohler Co.](#)
 2. Counter-mounting, self-rimming type, thick, bowl(s).
 3. Bowl, center.
 - a. Drain(s): 3-1/2-inch removable, chrome-plated, brass crumb cup with.
 - b. Drain location: Near back of bowl.

2.11 SINK FAUCETS

A. Commercial, Solid-Brass Faucets:

1. [Manufacturers:](#) Subject to compliance with requirements, provide products by the following:
 - a. [Kohler Co.](#)
 2. Type: Center set with central inlets,.
 3. Finish: Polished chrome plate.
 4. Handle(s): Single-lever toggle.
 5. Spout: Swing gooseneck with 1-1/2-gpm laminar flow.
 6. Maximum flow rate 1.8-gpm flow rate.

2.12 FITTINGS

A. Supply Fittings:

1. Standards: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water. ASME A112.18.1/CSA B125.1.
2. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
3. Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.
4. Risers: ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

B. WASTE FITTINGS

1. Standard: ASME A112.18.2/CSA B125.2.
2. Drain: Grid type with NPS 1-1/2 straight tailpiece for standard kitchen sinks.
3. Trap Sizes: NPS 1-1/2 by NPS 1-1/4.
4. Material: Chrome-plated,; and chrome-plated-brass or -steel wall flange. Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange. Or ASTM F 409 ABS or PVC, one or two-piece trap and waste to wall and wall flange.

2.13 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
1. Characteristics: Nonshrink; recommended for interior and exterior applications.
 2. Design Mix: 5000-psi, 28-day compressive strength.
 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fitting insulation kits on fixtures for people with disabilities.
- B. Install fixtures with flanges and gasket seals.
- C. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- D. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- E. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.
- F. Fasten floor-mounted fixtures to substrate. Fasten fixtures having holes for securing fixture to wall construction to reinforcement built into walls.
- G. Fasten wall-mounted fittings to reinforcement built into walls.
- H. Fasten counter-mounting plumbing fixtures to casework.
- I. Secure supplies to supports or substrate within pipe space behind fixture.
- J. Set shower receptors and mop basins in leveling bed of cement grout.

- K. Install individual supply inlets, supply stops, supply risers, and tubular brass traps with cleanouts at fixture.
- L. Install water-supply stop valves in accessible locations.
- M. Install traps on fixture outlets. Omit traps on fixtures having integral traps. Omit traps on indirect wastes unless otherwise indicated.
- N. Install disposers in sink outlets. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- O. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.
- P. Install hot-water dispensers in back top surface of sink or in counter with spout over sink.
- Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons where required to conceal protruding pipe fittings.
- R. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.
- S. Install piping connections between plumbing fixtures and piping systems and plumbing equipment. Install insulation on supplies and drains of fixtures for people with disabilities.
- T. Ground equipment.
- U. Test drain pipe obstruction by draining a minimum water volume of 1.25 times the drain pipe volume capable of being held by the drain piping from the drain fixture to the utility service connection or equivalent.

END OF SECTION 22 40 00

22 41 19 Kohler Bathtub

KOHLER®

Archer®
5' Drop-In Bath
K-1946-L

Features

- Comfort Depth® design offers a convenient 19-inch step-over height while retaining the same depth as a standard 21-inch bath.
- Molded lumbar support offers extra comfort while bathing.
- Slotted overflow allows for deep soaking.
- Tile flange helps prevent water from seeping behind wall and simplifies alcove installation.
- Textured bottom surface
- Left-hand drain.
- Coordinates with other products in the Archer collection.
- 60" (1524 mm) x 30" (762 mm) x 19" (483 mm)

Material

- ExoCrylic™

Installation

- Three-wall alcove.

Required Accessories

K-7271 Slotted Overflow Bath Drain

or

K-7272 Slotted Overflow Bath Drain



ADA

Codes/Standards

CSA B45.5/IAPMO Z124

ADA

ICC/ANSI A117.1











KOHLER® One-Year Limited Warranty

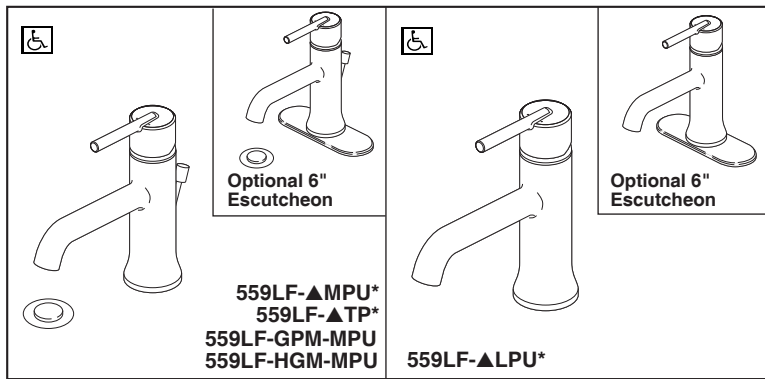
See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color Code Description

	0	White
	96	Biscuit
	47	Almond
	NY	Dune
	95	Ice™ Grey
	G9	Sandbar
	33	Mexican Sand™
	K4	Cashmere
	58	Thunder™ Grey
	7	Black Black™

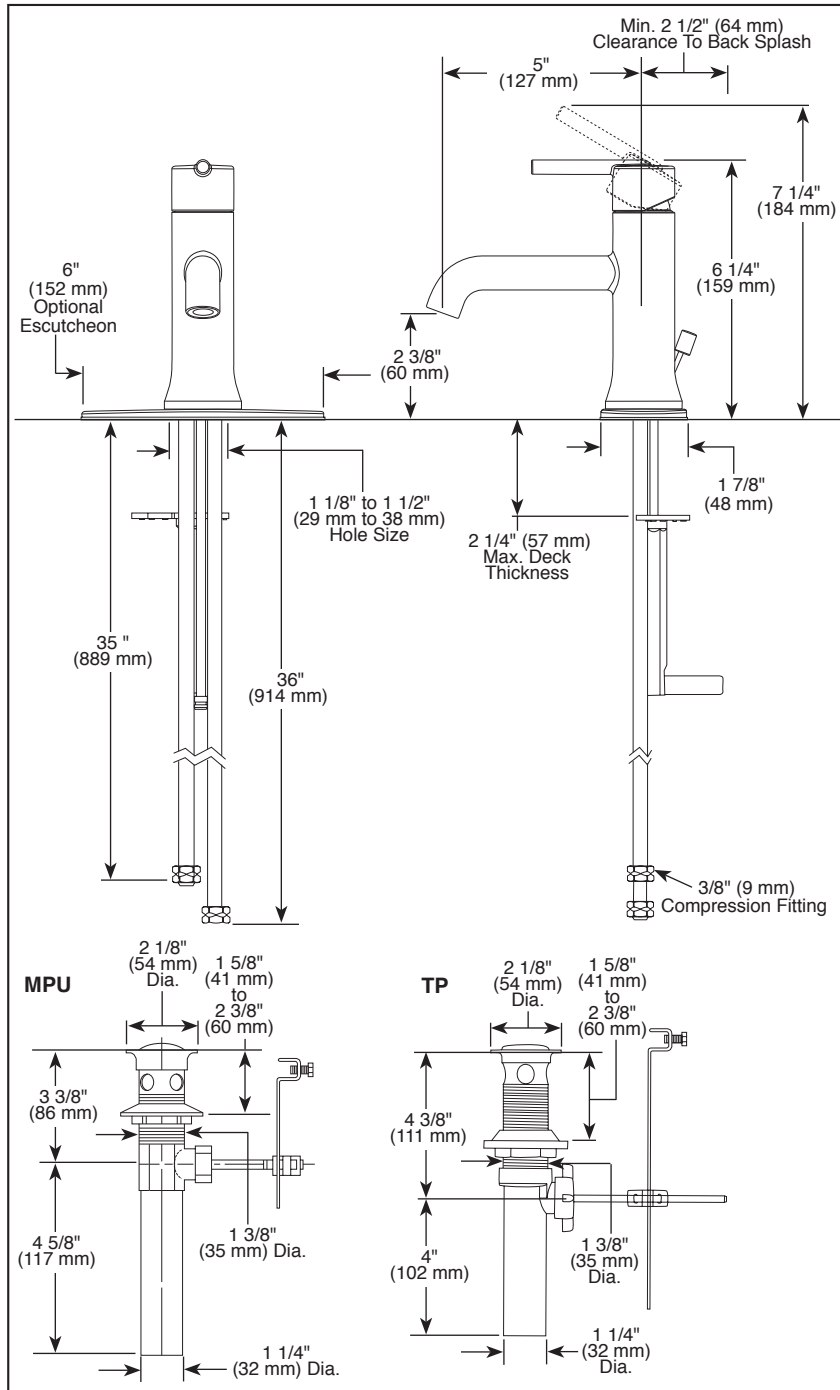


LAVATORY FAUCETS

- Trinsic® Collection
- Single Handle Deck Mount
- 1 or 3 Hole Mount (Optional 6" Escutcheon Included)

Submitted Model No.: _____

Specific Features: _____



STANDARD SPECIFICATIONS:

- Single handle lavatory deck faucet.
- 1 or 3 hole mount (6" escutcheon plate included).
- Solid brass body.
- 5" (127 mm) long spout.
- Lever handle. Control mechanism is the diamond embedded ceramic disc cartridge.
- Red/blue markings on handle for hot/cold identification.
- Control handle shall return to neutral position when valve is turned off.
- Maximum flow rate 1.5 gpm @ 60 PSI, 5.7 L/min @ 414 kPa.
- GPM indicates max. 1.0 gpm @ 60 PSI, 3.8 L/min @ 414 kPa.
- HGM indicates max. 0.5 gpm @ 60 PSI, 1.9 L/min @ 414 kPa.
- 3/8" O.D. straight, staggered pex supply tubes 35" (889 mm) and 36" (914 mm) long.
- Models with suffix "MPU" have metal drain with pop-up type fitting with plated flange and stopper.
- Models with suffix "TP" have 50/50 pop-up type fitting with plated flange and stopper.
- Models with suffix "LPU" are less pop-up.

WARRANTY

- Lifetime limited warranty on parts (other than electronic parts and batteries) and finishes; or, for commercial users, for 5 years from the date of purchase.
- 5 year limited warranty on electronic parts (other than batteries); or for commercial users, for 1 year from the date of purchase. No warranty is provided on batteries.



COMPLIES WITH:

- ASME A112.18.1 / CSA B125.1
- ASME A112.18.2 / CSA B125.2
- ASME A112.18.6

♿ Indicates compliance to ICC/ANSI A117.1

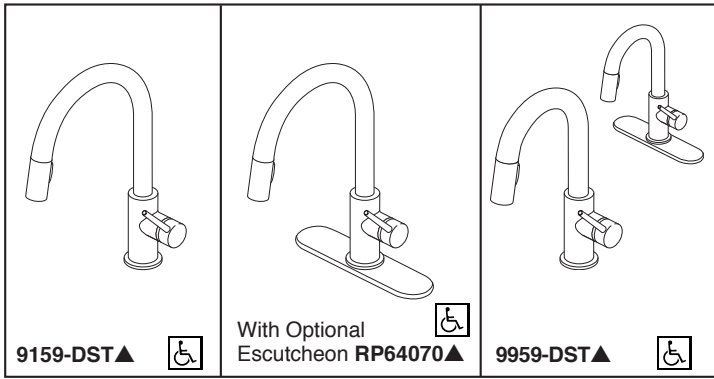
- * EPA WaterSense®
- Verified compliant with .25% weighted average Pb content regulations.



55 E. 111th Street, Indianapolis, Indiana 46280
 350 South Edgeware Road, St. Thomas, Ontario Canada N5P 4L1
 © 2015 Masco Corporation of Indiana

▲ Designate Proper Finish Suffix

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.



Submitted Model No.: _____

Specific Features: _____

DELTA
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:

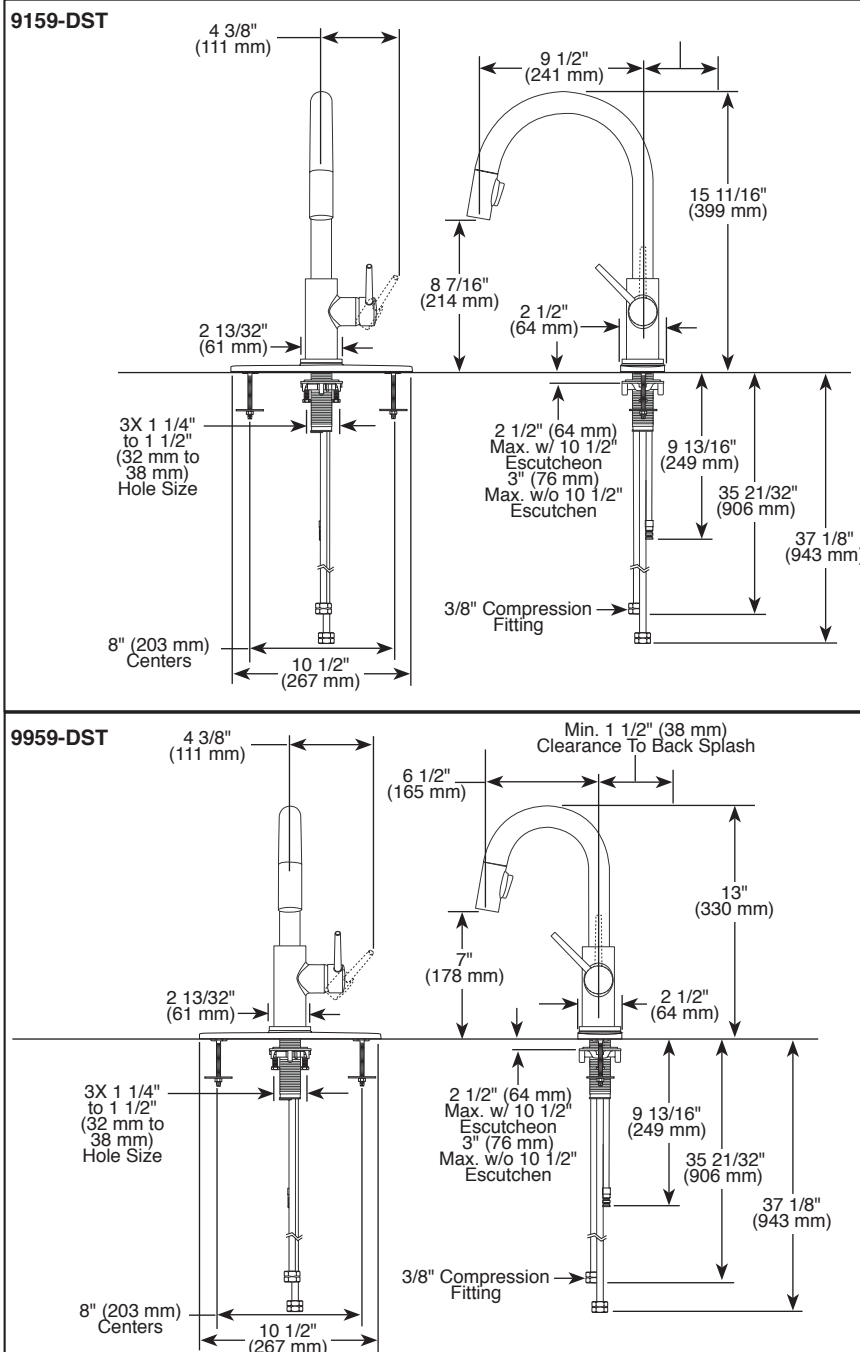
- Single handle, 2-function pull-down kitchen faucets for exposed mounting on single or three hole sinks.
- Solid brass fabricated body.
- 15 11/16" (399 mm) high, 9 1/2" (241 mm) long, spout swings 360°.
- Lever handle. Control mechanism shall be full-motion valve cartridge.
- Touch-Clean® sprayhead.
- 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.
- Maximum 1.80 gpm @ 60 psi, 6.8 L/min @ 414 kPa

WARRANTY

- Lifetime limited warranty on parts (other than electronic parts and batteries) and finishes: or, for commercial users, for 5 years from date of purchase.
- 5 year limited warranty on electronic parts (other than batteries); or, for commercial users, for 1 year from the date of purchase. No warranty is provided on batteries.

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.

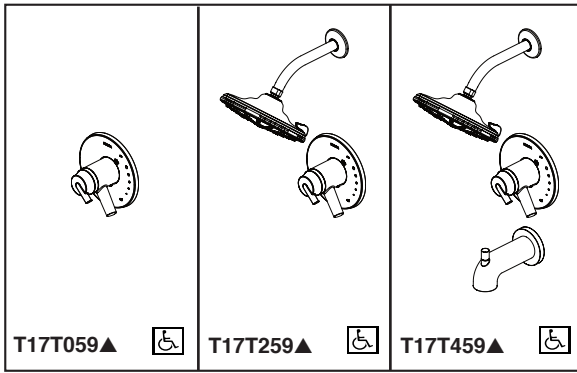


▲ Designate proper finish suffix

Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.



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Submitted Model No.: _____
 Specific Features: _____



TUB AND SHOWER FAUCET TRIM

- Trinsic® Series
- Valve Only (T17T059)
- Shower Only (T17T259)
- Tub/Shower (T17T459)

FEATURES:

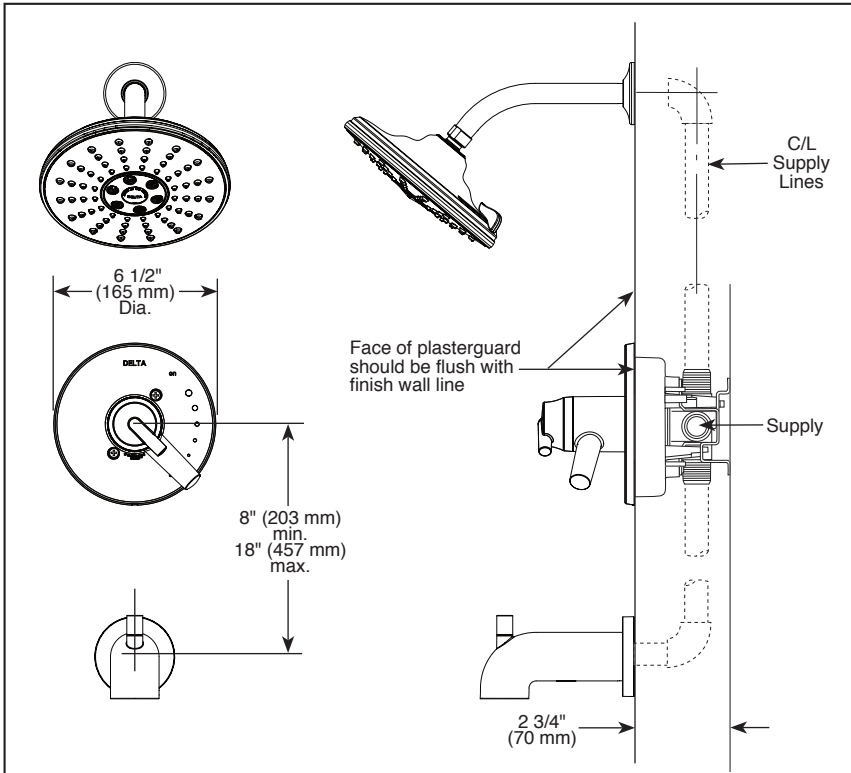
- TempAssure® 17T thermostatic valve cartridge

STANDARD SPECIFICATIONS:

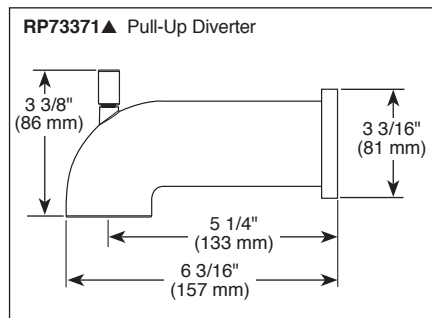
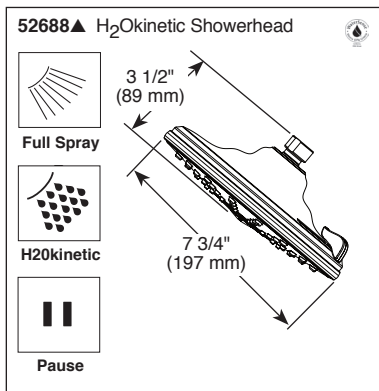
- Thermostatic wax element maintains the outlet temperature to $\pm 3.6^{\circ}\text{F}$
- Back-to-back installation capability
- Lever volume control handle; temperature adjustment dial
- Red/blue indicator markings
- Field adjustable to limit handle rotation into hot water zone
- All parts replaceable from the front of the valve
- Available extension kit (RP75136) adds up to 1 3/8" installation depth
- Three setting H₂Okinetic Technology® showerhead; 2.0 gpm @ 80 PSI, 7.6 L/Min @ 550 kPa
- For use with MultiChoice® Universal rough valve body (R10000 Series) ordered separately

WARRANTY

- Lifetime limited warranty on parts (other than electronic parts and batteries) and finishes; or, for commercial users, for 5 years from date of purchase.
- 5 year limited warranty on electronic parts (other than batteries); or, for commercial users, for 1 year from the date of purchase. No warranty is provided on batteries.

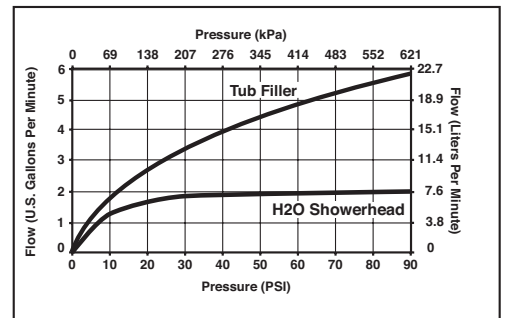


▲ Designate Proper Finish Suffix



COMPLIES WITH:

- ASME A112.18.1 / CSA B125.1
- ASSE 1016
- Indicates compliance to ICC/ANSI A117.1 - Valve control only
- EPA WaterSense®



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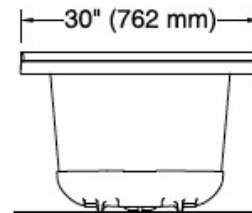
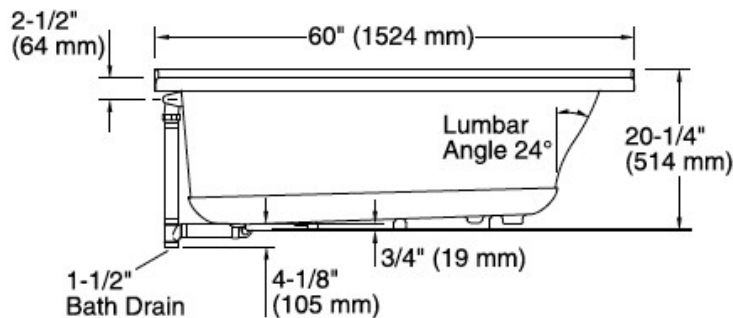
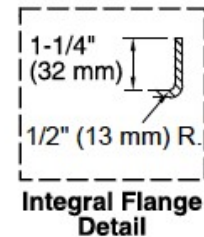
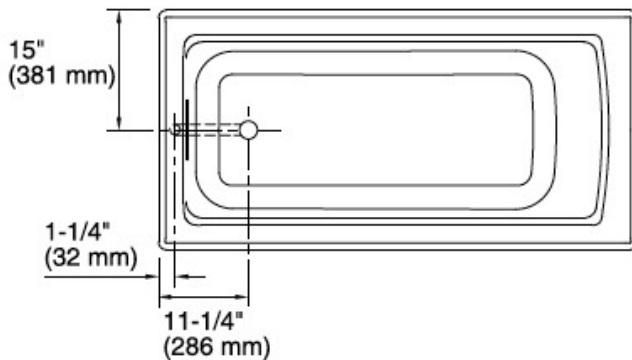
Delta reserves the right (1) to make changes in specifications and materials, and (2) to change or discontinue models, both without notice or obligation. Dimensions are for reference only. See current full-line price book or www.deltafaucet.com for finish options and product availability.

22 41 19 Kohler Bathtub

KOHLER®

Archer®
5' Drop-In Bath
K-1946-L

No change in measurements if connected with drain illustrated. (K-7272)



Technical Information

All product dimensions are nominal.

Installation:	3-Wall Alcove, Drop-in
Drain location:	Left
Basin area, bottom:	45-1/8" x 19-11/16" (1146 mm x 500 mm)
Basin area, top:	52-1/8" x 22-1/16" (1324 mm x 560 mm)
Weight:	58 lbs (26.3 kg)
Minimum floor load:	45 lbs/ft ² (219.7 kg/m ²)
Water depth:	15-1/8" (384 mm)
Water capacity:	57 gal (215.8 L)

Notes

Install this product according to the installation guide.

The hot water supply should be 70% of the capacity of the bath or greater. Installations will vary.

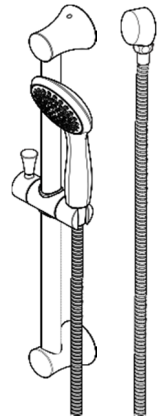
ADA compliant when installed to the specific requirements of these regulations.

22 41 23 Adjustable Shower

Pfister

Iyla™ Adjustable Slide Bar Kit

- G16-3TRC Finish(C) q
- G16-3TRD Finish(D) q
- G16-3TRK Finish(K) q
- G16-3TRY Finish(Y) q



Specifications

Features

- 60" Hose
- Pforever Warranty®

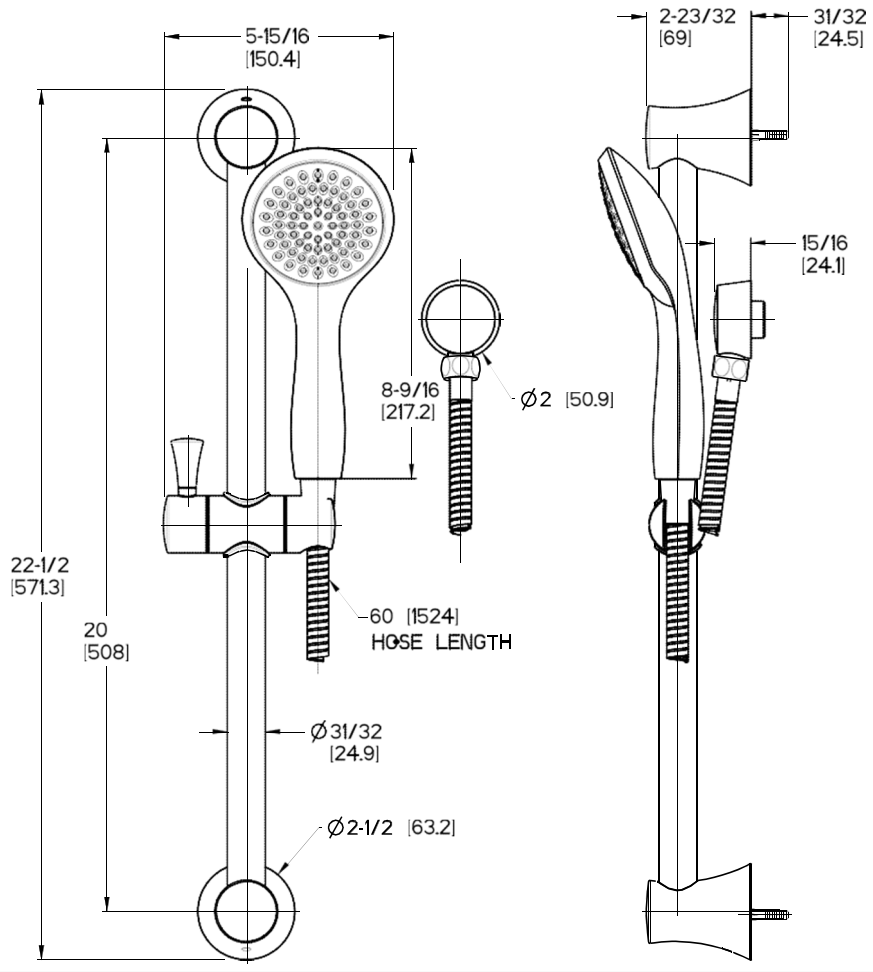
Code Compliance

Pfister products are designed and manufactured in compliance with the following standards and codes:

- IAPMO Certified
- CSAB125 Certified
- ASMEA112.18.1
- Cal Green Compliant
- EPA WaterSense Certification 1.5 gpm, 5.7L/Min
- ADA Compliant-ANSI A117.1 (Lever handles only)



Dimensions



10420-00

1-800-PFAUCET (732-8238) · pfisterfaucets.com/support
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November 21, 2013

SS-G16-3TRX

22 41 23 Kohler Bathtub Sink

KOHLER®

Archer® Under-Mount Bathroom Sink K-2355

Features

- Vitreous china.
- Under-mount
- With overflow.
- Without faucet holes.
- Includes 1193643 clamp assembly.
- 19-7/8" (505 mm) x 15-5/16" (389 mm) x 7-1/2" (191 mm)

Recommended Accessories

K-8998 P-Trap

Components

Additional included component/s: Basin clamp assembly.



ADA

Codes/Standards

ASME A112.19.2/CSA B45.1

ADA

ICC/ANSI A117.1

All applicable US Federal and State material regulations

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color	Code	Description
	0	White
	96	Biscuit
	47	Almond
	NY	Dune
	95	Ice™ Grey
	G9	Sandbar
	33	Mexican Sand™
	K4	Cashmere
	58	Thunder™ Grey
	7	Black Black™

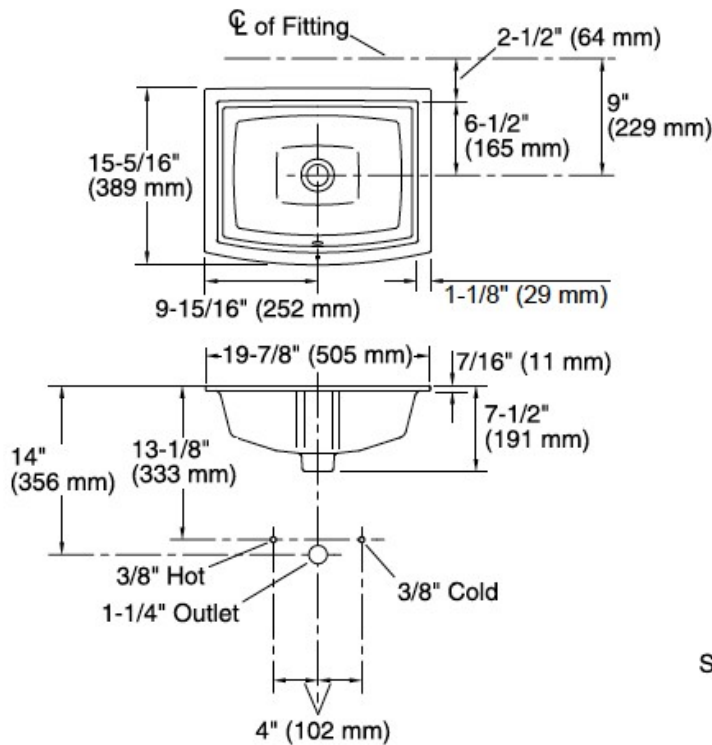
22 41 23 Kohler Bathtub Sink

KOHLER®

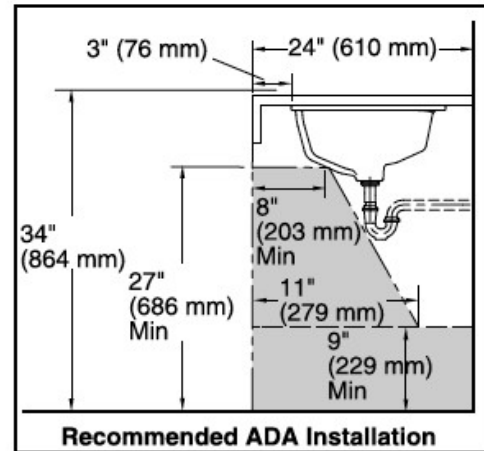
Archer®

Under-Mount Bathroom Sink

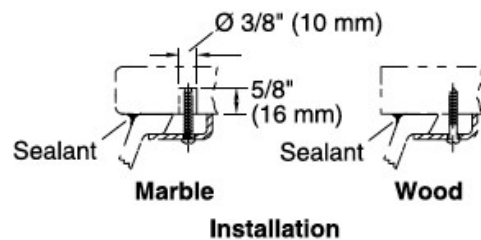
K-2355



Standard Installation



Recommended ADA Installation



Installation

Technical Information

All product dimensions are nominal.

Bowl configuration:	Single
Installation:	Under-mount
Bowl area (Only)	Length: 17-5/8" (448 mm) Width: 13" (330 mm) Water depth: 3-3/4" (95 mm)
Drain hole:	1-3/4" (44 mm)
Template:	Under-mount, 1224722-7, required, not included

Notes

Install this product according to the installation guide.

NOTICE: Countertop manufacturer or cutter must use the cut-out template provided with the product, or a current one provided by Kohler Co. (call 1-800-4-KOHLER). Kohler Co. is not responsible for cutout errors when the incorrect cut-out template is used.

ADA compliant when installed to the specific requirements of these regulations.

22 41 39 Bathroom Faucet


SPECIFICATION SUBMITTAL

Highlights

- Meets EPA Watersense Certification 1.5gpm, 5.7L/Min
- Lead Free Compliant
- ADA Compliant

Code Compliance

Price Pfister products are designed and manufactured in compliance with the following standards and codes:

- IAPMO certified
- ASME A112.18.1
- CSA B125 certified
- ANSI A117.1 (Lever handles only) 

42 Series

CONTEMPRA™

Single Control Lavatory Faucet

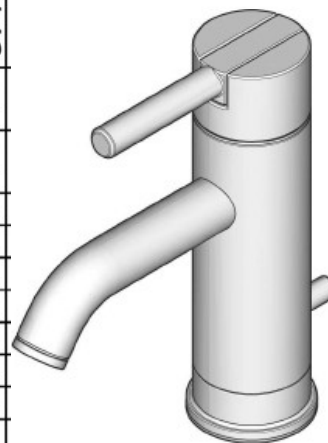
Single Control

1 or 3-Hole Installation

Ceramic Disc Valve

Finishes		GT 42-NC00
Polished Chrome		X

Features		GT 42-NC00
Complete Collection with Coordinating Lavatory and Tub & Shower Options		X
Complete Collection with Coordinating Roman Tub and Tub & Shower Options		X
WaterSense & Lead-Free Compliant		X
1.5 GPM Flow Rate		X
Lever Handle		X
Includes Metal Supply Nuts		X
Single-Post Mounting		X
Lead Free Compliant		X
ADA Compliant		X
Meets EPA Watersense Certification 1.5gpm, 5.7L/Min		X
Metal Pop-Up		X
Fixed Spout		X
Single Control Ceramic Disc Valve		X
WaterSense Compliant		X
Step-By-Step Installation Instructions		X
Pforever Warranty®		X
10 Year Commercial Warranty		X



GT42-NC00

GT42-NK00

For 0.5gpm Please order aerator insert part# 941-818

DIVISION 23 HVAC

23 05 23	General Duty Valves for HVAC Piping_SP
23 05 29	Hangers and Supports for HVAC Piping and Equipment_SP
23 05 48	Vibration and Seismic Controls for HVAC Piping and Equipment_SP
23 05 93	Testing, Adjusting, and Balancing for HVAC_SP
23 07 00	HVAC Insulation_SP
23 09 13.23	Sensors and Transmitters (Chilled Water Storage Tank Sensor)
23 09 13.33	HVAC Control Valves
23 21 13.13	Hydronic Piping (Radiant Heating + Cooling Underfloor)
23 21 13.23	Aboveground Hydronic Piping
23 21 16	Hydronic Piping Specialities (Radiant Pump Flanges)
23 21 23.13	In-Line Centrifugal Hydronic Pump (Radiant Pump)
23 23 00	Refrigerant Piping
23 23 00	Refrigerant Piping_SP
23 33 46	Flexible Ducts
23 34 23	HVAC Power Ventilators
23 38 13	Kitchen Hood
23 62 00	Packaged Compressor and Condensor Units_SP
23 81 46	Water Source Unitary Heat Pump (Rheem EcoSense)
23 83 16	Radiant Heating Hydronic Piping_SP
23 83 16	Radiant Heating Hydronic Piping (Sioux Chief Manifold)

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

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of valve indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. ASME Compliance:
 1. ASME B1.20.1 for threads for threaded end valves.
 2. ASME B16.1 for flanges on iron valves.
 3. ASME B16.5 for flanges on steel valves.
 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 5. ASME B16.18 for solder-joint connections.
 6. ASME B31.1 for power piping valves.
 7. ASME B31.9 for building services piping valves.

2.2 GENERAL-DUTY VALVES

A. One-Piece, Bronze Ball Valves with Bronze Trim:

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. **NIBCO INC.**
2. Standard: MSS SP-110.
3. CWP Rating: 600 psig.
4. Seats: PTFE or Reinforced PTFE.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Valve Sizes: Same as upstream piping unless otherwise indicated.
- B. Valves in Insulated Piping: With 2-inch stem extensions.
- C. Use gate and ball valves for shutoff duty; globe and ball for throttling duty.
- D. Locate valves for easy access and provide separate support where necessary.
- E. Install valves for each fixture and item of equipment.
- F. Install three-valve bypass around each pressure-reducing valve using throttling-type valves.
- G. Install valves in horizontal piping with stem at or above center of pipe.
- H. Install valves in a position to allow full stem movement.
- I. Install check valves for proper direction of flow in horizontal position with hinge pin level.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of product indicated.
2. Hangers and Supports:
 - a. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - b. Welding certificates.
 - c. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hangers and Supports for Plumbing Piping Equipment:

1. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - a. Design supports for multiple pipes capable of supporting combined weight of supported systems and system contents.
 - b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - c. Design seismic-restraint hangers and supports for piping and equipment, and obtain approval from authorities having jurisdiction.

2.2 HANGERS AND SUPPORTS FOR HVAC

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.
- C. Fastener Systems:
1. Verify suitability of fasteners in this article for use in lightweight concrete or concrete slabs less than 4 inches thick.
 2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.
 3. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless-steel anchors, for use in hardened portland cement concrete; with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.
- D. Miscellaneous Materials:
1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
 2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - a. Properties: Nonstaining, noncorrosive, and nongaseous.
 - b. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

- A. Install piping free of sags and bends.
- B. Install fittings for changes in direction and branch connections.

3.2 HANGERS AND SUPPORTS

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

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

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each product indicated.
2. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
3. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Seismic-Restraint Loading:
 1. Site Class as Defined in the IBC: D.
 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 1.0.
 - c. Component Amplification Factor: 1.0.
 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 0.489g.
 4. Design Spectral Response Acceleration at 1-Second Period: 1.02g.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2.2 VIBRATION ISOLATORS

A. Elastomeric Isolation Pads:

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. [California Dynamics Corporation.](#)
 - b. [Vibration Eliminator Co., Inc.](#)
 - c. [Vibration Isolation.](#)
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 3. Size: Factory- or field-cut to match requirements of supported equipment.
 4. Pad Material: Oil and water resistant with elastomeric properties, infused, nonwoven cotton or synthetic fibers.
 5. Surface Pattern, any of the following: Smooth, Ribbed, or Waffle pattern.
 6. Load-bearing metal plates adhered to pads.

B. Restrained Elastomeric Isolation Mounts: .

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. [California Dynamics Corporation.](#)
 - b. [Kinetics Noise Control, Inc.](#)
2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

PART 3 - EXECUTION

3.1 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.4 HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment.

1. Equipment Location: The Mechanical Room.
2. Pads:
 - a. Material: Neoprene or Rubber.
 - b. Thickness: 1.25 inches.
 - c. Number of Pads: 1 thick.
3. Isolator Type: Foam Pad.
4. Base Type: Insert Rubber isolator.
5. Minimum Deflection: 1.5 inches.
6. Component Importance Factor: 1.5.
7. Component Response Modification Factor: 1.0.
8. Component Amplification Factor: 1.0.

END OF SECTION 23 05 48

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Certified TAB reports.
 - 2. Documentation of work performed per ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."
- B. TAB Firm Qualifications: NEBB or TABB certified.
- C. TAB Report Forms: Standard TAB contractor's forms approved by Architect.
- D. Perform TAB after leakage and pressure tests on water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine the approved submittals for HVAC systems and equipment.
- C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- D. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- E. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- F. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- G. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.

2. Dampers and valves are in the position indicated by the controller.
3. Integrity of dampers and valves for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

H. Report deficiencies discovered before and during performance of test and balance procedures.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

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

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

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

- H. Check for proper sealing of air duct system.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data; number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 - 1. Open all manual valves for maximum flow.
 - 2. Check liquid level in expansion tank.
 - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
 - 4. Set system controls so automatic valves are wide open to heat exchangers.
 - 5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.5 TOLERANCES

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

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product Data: For each type of product indicated.
 - 2. For adhesives and sealants, documentation including printed statement of VOC content.
- 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

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics:
 - 1. Indoor Insulation and Related Materials: To be factory-labeled designating maximum flame-spread index of 25 or less and smoke-developed index of 50 or less according to ASTM E 84.
 - 2. Outdoor Insulation and Related Materials: To be factory labeled designating maximum flame-spread index of 75 or less and smoke-developed index of 150 or less according to ASTM E 84.

2.2 INSULATION MATERIALS

- A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- B. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 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. [Aeroflex USA, Inc.](#)
 - b. [Armacell LLC.](#)
- C. Polyolefin Insulation: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armacell LLC.
 - b. Nomaco Insulation.

- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 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. Aeroflex USA, Inc.
 - b. Foster Brand; H. B. Fuller Construction Products.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- E. Factory-Applied Jackets: When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

PART 3 - EXECUTION

3.1 INSULATION INSTALLATION

- A. Comply with requirements of the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards" for insulation installation on pipes and equipment.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall, Partition, and Floor Penetrations: Install insulation continuously through penetrations. Seal penetrations. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- D. Flexible Elastomeric Insulation Installation:
 1. Seal longitudinal seams and end joints with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
 2. Insulation Installation on Pipe Fittings and Elbows: Install mitered sections of pipe insulation. Secure insulation materials and seal seams with adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Mineral-Fiber Insulation Installation:

1. Insulation Installation on Straight Pipes and Tubes: Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
3. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
4. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
5. For ducts and plenums with surface temperatures below ambient, install a continuous, unbroken vapor barrier.

F. Polyolefin Insulation Installation:

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

G. Plenums and Ducts Requiring Insulation:

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

H. Plenums and Ducts Not Insulated:

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

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

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

3.2 HVAC PIPING INSULATION SCHEDULE

A. Chilled Water: Insulation shall be one of the following:

1. Flexible Elastomeric: 3/8 inch thick.
2. Polyolefin: [**1 inch**] <Insert dimension> thick.

B. Heating-Hot-Water Supply and Return: Insulation shall be the following:

- C. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Polyolefin: 1 inch thick.

- D. Refrigerant Suction and Hot-Gas Flexible Tubing: Insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Polyolefin: 1 inch thick.

END OF SECTION 23 07 00

RANCO ETC COMMERCIAL TEMPERATURE CONTROLS

RANCO ETC COMMERCIAL TEMPERATURE CONTROLS

The Ranco ETC is a microprocessor-based family of temperature controls designed to provide on/off control for commercial heating, cooling, air conditioning and refrigeration applications. With its wide temperature range, one and two stage capability, selectable heating/cooling modes and multi-voltage input, the ETC is one of the most versatile temperature controls available.

DIGITAL DISPLAY

Unlike many electronic controls, the ETC is simple to install and set up. One finger is all you need to program it. The standard digital display and keypad allow the user to adjust the temperature settings with 1° resolution. Setpoint temperature, differential and mode of operation (heating or cooling) can all be selected using the keypad and display.

When not in the programming mode, the display gives a constant readout of the sensor temperature. Annunciators on the liquid crystal display also indicate when the relay is energized.

CHOICE OF ONE OR TWO STAGE MODELS

The ETC line includes both one and two stage models. On two stage controls, each stage can be set independently thus eliminating the bothersome task of calculating interstage temperatures. And two stage models can be set up with overlapping heating or cooling stages.

REMOTE TEMPERATURE SENSING

The ETC is capable of remote temperature sensing up to 400 feet away from the control when using standard 22 gauge sensor wire.

BUILT-IN SAFETY

Every ETC model is equipped with diagnostic programs that check for hardware, software or system problems and display different error codes to indicate where the trouble is.

The ETC also has a keypad lockout switch to prevent tampering with the control settings by unauthorized personnel. The switch, which is located inside the enclosure, can be used to disable the keypad function.

OPTIONAL ANALOG OUTPUT

ETC models are available with a 0 to 10 volt analog output that can be used for remote temperature indication or as input to a central monitoring system. This signal is a linear representation of the sensor temperature with 0 volt = -30°F and 10 volts = 220°F.



SPECIFICATIONS

Temperature setpoint range	-30° to 220°F
Differential range	1°F to 30°F
Input power requirements	120 or 208/240 VAC (24 VAC optional)
Sensor	Thermistor, 2" long x 1/4" dia. with 8' cable
Control Ambient Temperatures	
Operating	-20°F to 140°F
Storage	-40°F to 176°F
Ambient humidity	0 to 95% RH, non-condensing
Enclosure	NEMA 1, plastic (NEMA 4X optional)
Dimensions	NEMA 1 models, 6.52" high x 2.7" wide x 2.48" deep NEMA 4X models, 7.84" high x 2.7" wide x 2.48" deep
0 to 10 V output impedance	1 K ohms
Agency Approvals	UL listed, file E94419, Guide XAPX CSA certified, file LR68340. class 4813 02
Switch action	SPDT

RELAY OUTPUT RATINGS - NO (NC):

	ONE STAGE		TWO STAGE	
	120V	208/240V	120V	208/240V
Full load amps	16 (5.8) A	8 (2.9) A	9.8 (5.8) A	4.0 (2.9) A
Locked rotor amps	96 (34.8) A	48 (17.4) A	58.8 (34.8) A	29.4 (17.4) A
Resistive amps	15 (5.8) A	8 (2.9) A	9.8 (5.8) A	4.9 (2.9) A
Horsepower	1 (1/4) HP	1 (1/4) HP	1/2 (1/4) HP	1/2 (1/4) HP
Pilot duty	125VA at 120/208/240 VAC			

ORDERING DATA

UNI-LINE ORDER NO.	NUMBER OF STAGES	ENCLOSURE	INPUT VOLTAGE	0 TO 10 VOLT OUTPUT
ETC-111000	ONE	NEMA 1	120/208/240 VAC	NO
ETC-111100				YES
ETC-112000			24 VAC	NO
ETC-112100				YES
ETC-141000	TWO	NEMA 4	120/208/240 VAC	NO
ETC-211000		NEMA 1		YES
ETC-211100			24 VAC	NO
ETC-212000				YES
ETC-212100			NEMA 4	120/208/240 VAC
ETC-241000				



Submittal Data Information

101-140

Zone Sentry® Ball Valve Zone Valve

Effective: October 21, 2011

Supersedes: July 28, 2011

Job: _____ Engineer: _____ Contractor: _____ Rep: _____

ITEM NO.	MODEL NO.	

Product Specifications

Max. Operating Pressure...300 PSI (2100 kPa)
 Max. Shutoff Pressure125 PSI (875 kPa)
 Max Ambient Temp.....135°F
 Fluid Temperature Range...20-220°F (7°-105°C)
 Service.....Water or Water/Glycol up to 50% Glycol Close Systems (Open System — Option Available)
 Ball Rotation Speed.....(90° turn), Approximately (after charge time)
 Electrical Rating.....24 VAC, 60Hz 0.48 Amps
 Power Consumption1.14 W, 0.48 Amps (Charging)
 Power Consumption.....1.44W, 0.06 Amps (Power On)
 Heat Anticipator Setting...0.5 Amps
 End Switch Rating.....1 Amp @ 24 VAC

Materials of Construction, Actuator:

Body High Performance Engineered Polymer
 Gears High Performance Internally Lubricated Engineered Polymer

Materials of Construction, Standard Valve:

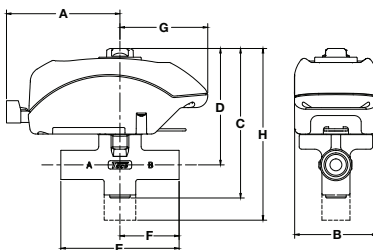
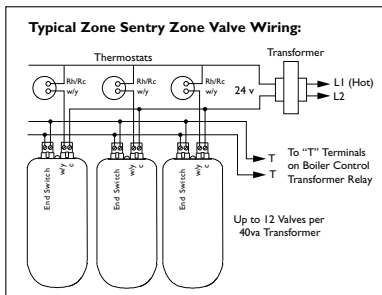
BodyForged Brass
 StemBrass
 Press Ring.....Brass
 BallBrass (Chrome Plated)
 Seat.....Modified Teflon®
 O-RingsEPDM

Application:

Taco Zone Sentry® Zone Valves provide on-off, normally open or normally closed control in both open and closed hydronic systems. The Taco Zone Sentry valve can be used in a wide variety of applications, specifically designed for use in heating systems and in chilled water systems where condensation is present. It is primarily used in baseboard, fan coils, radiators, convectors, air handlers, heat pumps and radiant applications. Refer to the Product Specifications section for choosing the correct model valve for your application.

Ease of Installation / Operation:

The Taco Zone Sentry® is the most technologically advanced zone valve ever made. It's also simple to install and operate. The valve can be installed in any direction, in any orientation. We then went a step further, allowing the operator to be mounted to the 2-way valve body in either direction, great for those tight baseboard jobs. Snap-in quick connects on the back of the valve make for a simple, secure and fast wiring hook-up. A green LED light shows full functionality of the valve's operation and thermostat status. Under a no power situation the manual override button located on the top of the valve allows the ball to be rotated up to 90° and is also marked with a slot to indicate the position of the valve.



Valve Size	2-WAY Cv (Kv) / Ft. of Pipe Equiv.**	Close-Off Pressure (kPa)	3-WAY Cv (Kv) / Ft. of Pipe Equiv.**
1/2"	4.9 (4.3) / 9.5	0-125 psi (0-862 kPa)	1.5 (1.3) / 111
3/4"	10.3 (8.9) / 8.4	0-125 psi (0-862 kPa)	3.3 (2.8) / 82
1"	8.9 (7.7) / 47.4	0-125 psi (0-862 kPa)	3.0 (2.6) / 411

**At 4' per second (Max. recommended residential flow rate).

Zone Sentry® Dimensions: (FOR REFERENCE PURPOSES)

Valve Size	A		B		C		D		E (Sweated)		E (Threaded)		F		G		H (3-way)	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1/2"	3"	76.2	2.375"	60.3	4.125"	104.7	3.06"	77.72	3.125"	79.3	4.750"	120.6	1.562"	39.7	2.312"	58.7	5.06"	128.5
3/4"	3"	76.2	2.375"	60.3	4.125"	104.7	3.12"	79.25	3.125"	79.3	3.312"	84.1	1.562"	39.7	2.312"	58.7	5.37"	136.4
1"	3"	76.2	2.375"	60.3	4.125"	104.7	3.12"	79.25	3.875"	98.4	3.875"	98.4	1.875"	47.6	2.312"	58.7	5.50"	139.7

using 1"

NPT Models	Standard 2-Way	Sweat Models
Z050T2	1/2" 2-way	Z050C2
Z075T2	3/4" 2 way	Z075C2
Z100T2	1" 2-way	Z100C2

Consult factory for additional model numbers.



NPT Models	Standard 3-Way	Sweat Models
Z050T3	1/2" 3-way	Z050C3
Z075T3	3/4" 3-way	Z075C3
Z100T3	1" 3-way	Z100C3

We will be using the RPLS730B model!



RPLS730B / RPLS731B 7-Day Programmable Timer for Lights and Motors

7-Day Programmable Timer

FOR SECURITY, CONVENIENCE AND ENERGY SAVINGS



RPLS730B (white)



RPLS731B (light almond)

KEY FEATURES

- For use with lights and motors up to 2400 W, 1HP on 120V
- No minimum wattage required
- 7-day programming (up to 7 on and 7 off times per week)
- Hidden programming buttons
- Sleek design mounts flush with wall plate
- Single pole installation (requires neutral wire)
- Manual override enables load to be turned on/off without affecting programming
- Built-in rechargeable battery
- Programming protected during power outages
- Can also be used like a conventional on/off switch
- * **Does not include wallplate**



Single pole

CFL compatible



Designed in Canada. Made in China.

Automation and Control Solutions

Honeywell
1985 Douglas Drive North
Golden Valley, MN 55422-3992
800-468-1502
yourhome.honeywell.com

67-6521 CB
March 2011

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23 09 23 Direct-Digital Control System for HVAC

SPECIFICATIONS

MODEL RPLS730B

Unit



Qty.	1
Dim. WxHxD (in.)	6.7 x 9.1 x 1.9
Carton Wt. (lbs.)	0.77
Cu. Ft.	0.07

MODEL RPLS731B

Unit



Qty.	1
Dim. WxHxD (in.)	6.7 x 9.1 x 1.9
Carton Wt. (lbs.)	0.77
Cu. Ft.	0.07

Retail Package

Qty.	5
Dim. WxHxD (in.)	8.7 x 14.6 x 9.8
Carton Wt. (lbs.)	3.86
Cu. Ft.	0.72

RPLS730B1000



RPLS731B1009



Honeywell

23 21 13 Hydronic Piping (Radiant Heating + Cooling Piping)



Effective Oct. 19, 2009
 Supercedes June 14, 2007
 1830 Centennial Ave.
 Hastings, NE 68901
 Ph: 402-462-2227
 Fax: 402-462-5529
 Toll Free: 866-851-2227
 centennialplastics.com

CenCore HDPE

HDPE 3408/3608 — ASTM D2239 and ASTM D2737

- Flexible polyethylene pipe and tubing
- Produced from only the finest virgin material
- Backed by a **50-YEAR WARRANTY**
- **Natural Virgin Core with Blue Virgin Exterior**

We will be using the 100/125 psi piping.

100/125 PSI	ASTM D2239	SIDR11.5	Premium Grade				
		1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
O.D.		0.742"	.968"	1.231"	1.620"	1.890"	2.427"
I.D.		0.622"	.824"	1.049"	1.380"	1.610"	2.067"
Wall		0.060"	.072"	.091"	.120"	.140"	.180"
Wt/Ft		0.057#	.090#	.143#	.246#	.330#	.544#
Coil Lengths		100-400 ft.	100-400 ft.	100-300 ft.	100-300 ft.	100-250 ft.	100-200 ft.

160 PSI	ASTM D2239	SIDR9	Premium Grade				
		1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
O.D.		N/A	1.008"	1.283"	1.686"	1.968"	2.527"
I.D.		N/A	.824"	1.049"	1.380"	1.610"	2.067"
Wall		N/A	.092"	.117"	.153"	.179"	.230"
Wt/Ft		N/A	.116#	.186#	.320#	.430#	.710#
Coil Lengths		N/A	100-400 ft.	100-300 ft.	100-300 ft.	100-250 ft.	100-200 ft.

200 PSI*	ASTM D2239	SIDR7	Premium Grade				
		1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
O.D.		N/A	1.060"	1.349"	1.774"	2.070"	2.657"
I.D.		N/A	.824"	1.049"	1.380"	1.610"	2.067"
Wall		N/A	.118"	.150"	.197"	.230"	.295"
Wt/Ft		N/A	.152#	.246#	.424#	.578#	.952#
Coil Lengths		N/A	100-400 ft.	100-300 ft.	100-300 ft.	100-250 ft.	100-200 ft.

200 PSI*	ASTM D2737	SDR9 CTS	Premium Grade				
		1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
O.D.		.625"	.875"	1.125"	1.375"	1.625"	2.125"
I.D.		.487"	.681"	.875"	1.069"	1.263"	1.653"
Wall		.069"	.097"	.125"	.153"	.181"	.236"
Wt/Ft		.053#	.103#	.170#	.254#	.353#	.602#
Coil Lengths		100-400 ft.	100-400 ft.	100-300 ft.	100-300 ft.	100-250 ft.	100-200 ft.

Note: CenCore SIDR 11.5, SIDR 9 and SIDR 7 are suitable for connections with insert fittings and clamps.
 Note: CenCore SDR 9 CTS is suitable for connections with CTS compression fittings.



CenCore HDPE is tested and certified to NSF Standard 14 and meets requirements of AWWA C901
 § CenCore HDPE is certified to the Uniform Plumbing Code™

Product also Certified to NSF/ANSI Standard 61, Annex G (weighted average lead content of <=0.25%) and is in compliance with California's Health & Safety Code Section 116875 (commonly known as AB1953).



SOLVENT WELD

DWV

SUBMITTAL AND DATA SHEET

JM EAGLE™ PVC SCHEDULE 30/DWV FOR DRAIN, WASTE, VENT PIPE

Specifications: ASTM D2949 ::

Listed : ANSI/NSF-DWV, Standard 14

NOM. PIPE SIZE (IN)	O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	WATER PRESSURE RATING AT 23°C (73°F)	APPROX. WEIGHT (LBS/FT)
3	3.250	2.980	0.125	None	0.800

:: Cell Class 12454 I.D. : Inside Diameter O.D. : Outside Diameter T. : Wall Thickness

The 1/2" ID pipe will be used for the night sky supply while the 2" ID pipe will be used for the downspout. All exposed pipes will be covered with UV resistant type.

JM EAGLE™ PVC SCHEDULE 40/DWV PIPE

Specifications: ASTM D1785 & ASTM D2665 ::

Listed : ANSI/NSF-PW NSF-DWV Standard 61, Standard 14

NOM. PIPE SIZE (IN)	O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	WATER PRESSURE RATING AT 23°C (73°F)	APPROX. WEIGHT (LBS/FT)
1/2	0.840	0.609	0.109	600	0.164
3/4	1.050	0.810	0.113	480	0.218
1	1.315	1.033	0.133	450	0.324
1 1/4	1.660	1.363	0.140	370	0.439
1 1/2	1.900	1.593	0.145	330	0.525
2	2.375	2.049	0.154	280	0.705
2 1/2	2.875	2.445	0.203	300	1.118
3	3.500	3.042	0.216	260	1.463
4	4.500	3.998	0.237	220	2.083
6	6.625	6.031	0.280	180	3.663
8	8.625	7.942	0.322	160	5.512
10	10.750	9.976	0.365	140	7.815
12	12.750	11.889	0.406	130	10.333
14	14.000	13.073	0.437	130	12.220
16	16.000	14.940	0.500	130	15.980

:: Standard Color: White, Standard Length 10' & 20', Plain End and Belled End.
Purple color for reclaim, contact your sales rep for availability.

JM EAGLE™ PVC SCHEDULE 40/DWV CELLULAR CORE PIPE

Specifications: ASTM F891 ::

Listed : ANSI/NSF-DWV Standard 14

NOM. PIPE SIZE (IN)	O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	APPROX. WEIGHT (LBS/FT)
1 1/2	1.900	1.593	0.145	0.383
2	2.375	2.049	0.154	0.500
3	3.500	3.042	0.216	1.050
4	4.500	3.998	0.237	1.450
6	6.625	6.031	0.280	2.450

:: Standard Color: White, Standard Length: 10' & 20', Plain End and Belled End
* Prior to ordering or specifying, please consult JM Eagle™ for product and/or listing availability.
I.D. : Inside Diameter O.D. : Outside Diameter T. : Wall Thickness

Revised 1/16/2018. This information may have been updated. Please download the latest version at www.jmeagle.com/onesheets.

freedom Flanges® Bronze Half-Unions

- Taco's new flanges fit all 00® circulators, and free you from scraped knuckles and jury-rigged tools of yesteryear! Their Easy-On / Easy-Off and sweat designs make quick work of pump installation and maintenance. Now available in Cast Iron, Stainless Steel or Bronze.
- New bronze half-unions and shut-off unions allow for easy installation and service of Taco's 003 & 006 Union Connection models. Available in 1/2" and 3/4", threaded or sweat connections.



Submittal Data Information

Cast Iron and Stainless Steel *freedom* Flanges®

At last, freedom from scraped knuckles and jury-rigged tools. Taco's new flanges give you lots of ways to make quick work of your installation:

- Fits All 00® circulators
- Easy-On, Easy-Off with a common Adjustable Wrench
- Available in:
 - Cast Iron, 3/4" - 2"
 - Bronze Threaded, 3/4" - 2"
 - Bronze Sweat, 1/2" - 1-1/2"
 - Stainless Steel, 3/4" - 2"



Cast Iron *freedom* Flanges®

Cast Iron Freedom Flange® Sets (005 thru 0011, 0013, 0014, 110-113, 1400-10, 1400-20, 1400-45, 1400-50)

Figure	Product #	Size A	B	C	D	E	F	G	H
A	110-251F	3/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	3/8"	3-1/8"
A	110-252F	1" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	3/8"	3-1/8"
A	110-253F	1-1/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	3/8"	3-1/8"
A	110-254F	1-1/2" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	3/8"	3-1/8"

Cast Iron Freedom Flange® Sets (0012/HV, 1400-30, 1400-40)

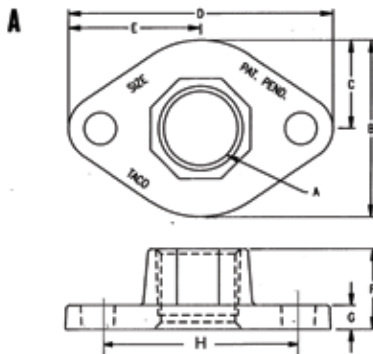
Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1540F	1-1/4" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-3/16"	9/16"	3-7/16"
A	194-1542F	1-1/2" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-3/16"	9/16"	3-7/16"

* 1-1/2" Flange set included in each 0012-F4 box.

Cast Iron Freedom Flange® Sets (0012/2", 1400-50/2)

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1543F	1-1/2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	9/16"	4-1/8"
A	194-2124F	2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	9/16"	4-1/8"

** 2" Flange set included in each 0012-F4-1 box.



Stainless Steel *freedom* Flanges®

Stainless Steel Freedom Flange® Sets for (005, 007-0011, 0013, 0014, 110-113, 1400-10/20/45/50)

Figure	Product #	Size A	B	C	D	E	F	G	H
A	110-251SF	3/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	7/32"	3-1/8"
A	110-252SF	1" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	7/32"	3-1/8"
A	110-253SF	1-1/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	7/32"	3-1/8"
A	110-254SF	1-1/2" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	7/32"	3-1/8"

0012 Stainless Steel Freedom Flange® Sets for (0012/HV, 1400-30/40)**

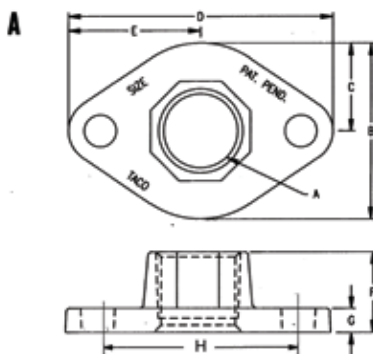
Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1540SF	1-1/4" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1"	7/32"	3-7/16"
A	194-1542SF	1-1/2" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1"	7/32"	3-7/16"

*** 1-1/2" Flange set included in each 0012-SF4 box.

0012 Stainless Steel Freedom Flange® Sets (0012/2", 1400-50/2)****

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-2124SF	2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1"	7/32"	4-1/8"

**** 2" Flange set included in each 0012-SF4-1 box.

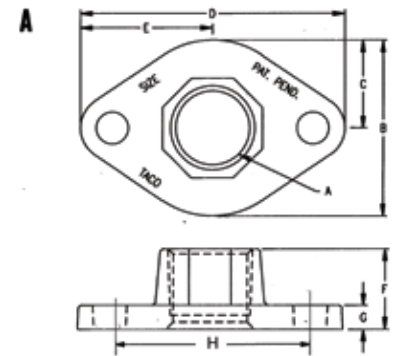




Bronze *freedom* Flanges®

Bronze Threaded Freedom Flange® Sets (005, 007-0011, 0013, 0014, 110-113)

Figure	Product #	Size A	B	C	D	E	F	G	H
A	110-251BF	3/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-252BF	1" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"
A	110-253BF	1-1/4" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-7/16"	3/8"	3-1/8"
A	110-254BF	1-1/2" NPT	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-7/16"	3/8"	3-1/8"



0012 Bronze Threaded Freedom Flange® Sets (0012/HV, 1400-30/40)***

Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1540BF	1-1/4" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-9/16"	9/16"	3-7/16"
A	194-1542BF	1-1/2" NPT	2-15/16"	1-15/32"	4-3/4"	2-3/8"	1-9/16"	9/16"	3-7/16"

*** 1-1/2" Flange set included in each 0012-BF4 box.

0012 Bronze Freedom Flange® Sets (0012/2")****

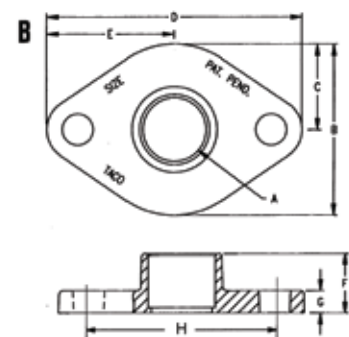
Figure	Product #	Size A	B	C	D	E	F	G	H
A	194-1543BF	1-1/2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	9/16"	4-1/8"
A	194-2124BF	2" NPT	3-5/8"	1-13/16"	5-9/16"	2-25/32"	1-3/4"	9/16"	4-1/8"

**** 2" Flange set included in each 0012-BF4-I box.

We will be using 1/2" and 3/4" bronze sweated freedom flanges

Bronze Sweat Freedom Flange® Sets (005, 006, 007-0011, 0013, 0014, 110-113, 1400-10/20/45/50)

Figure	Product #	Size A	B	C	D	E	F	G	H
B	110-522BSF	1/2" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	7/8"	3/8"	3-1/8"
B	110-523BSF	3/4" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	7/8"	3/8"	3-1/8"
B	110-524BSF	1" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1"	3/8"	3-1/8"
B	110-525BSF	1-1/4" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/8"	3/8"	3-1/8"
B	110-526BSF	1-1/2" Swt	2-3/4"	1-3/8"	4-1/8"	2-1/16"	1-1/4"	3/8"	3-1/8"



Submittal Data Information Bronze Half-Unions, Shut-Off Unions

Submittal Data # 100-069
Supersedes: 4/1/03

Effective: 7/22/08

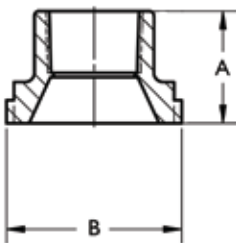
The perfect union! Match up our new Bronze Half Unions or Shut-Off Unions with Taco's 003 & 006 Union Connection models for an easy-to-service installation.

Features

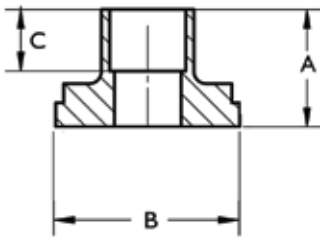
- Fits all 003 & 006 Union Connection models
- Easy-to-Install, Easy-to-Service
- Available in 1/2" or 3/4" sizes
- Sweat, Threaded and Shut-off options



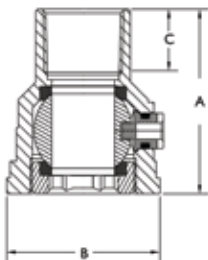
Threaded Half Union



Sweat Half Union



Bronze Shut-Off Union



Bronze Half-Union Set

Product #	Size	A	B	C
110-556	1/2" NPT	15/16"	1-1/2"	—
110-557	3/4" NPT	15/16"	1-1/2"	—
110-558	1/2" Swt	15/16"	1-1/2"	1/2"
110-559	3/4" Swt	15/16"	1-1/2"	3/4"



Bronze Shut-Off Union

Product #	Size	A	B	C
258-1	1/2" NPT	1-7/8"	1-1/2"	—
258-2	3/4" NPT	1-7/8"	1-1/2"	—
258-3	1/2" Swt	1-7/8"	1-1/2"	1/2"
258-4	3/4" Swt	1-7/8"	1-1/2"	3/4"



Model 0013 Cartridge Circulator

The High Velocity series Taco 0013 Cartridge Circulator is designed for quiet, efficient operation in high head / high flow applications for Large Residential / Light Commercial Hydronic heating, Radiant heating, Chilled Water cooling and Domestic fresh water systems. The exclusive ACB anti-condensate baffle with ambient air flow prevents the build up of condensate on the motor windings when pumping chilled water. Its unique field-serviceable cartridge contains all moving parts. Replacing the cartridge rebuilds the circulator. With no mechanical seal, the self-lubricating, maintenance free design provides unmatched reliability. Compact and lightweight, with excellent performance characteristics, the 0013 is ideal for high efficiency jobs where space is a premium. Available in Cast Iron, Bronze or Stainless Steel construction.



23 21 23. 13 In-Line Centrifugal Hydronic Pump (Radiant Pump) Submittal Data # D-064 Supersedes: 10/01/02 Effective: 10/29/08

Submittal Data Information Model 0013 Cartridge Circulator

Features

- Exclusive ACB Anti-Condensate Baffle with Ambient Air Flow-Protects motor windings against condensate buildup
- High Velocity Performance-Compact design
- Quiet, Efficient operation
- Direct Drive-Low Power consumption
- Unique Replaceable Cartridge design-field serviceable
- Self lubricating
- No Mechanical Seal
- Unmatched reliability - Maintenance free
- Universal Flange to Flange dimensions
- Cast Iron, Bronze or Stainless Steel Construction

Materials of Construction

ACB Baffle	Non-Ferrous
Casing (Volute):	Cast Iron, Bronze or 304 Stainless Steel
Stator Housing:	Aluminum
Cartridge:	Stainless Steel
Impeller:	Non-Metallic
Shaft:	Ceramic
Bearings:	Carbon
O-Ring & Gaskets:	EPDM

Model Nomenclature

- F – Cast Iron, Flanged
 - BF – Bronze, Flanged
 - SF – 304 Stainless Steel, Flanged
- Variations:**
- Z – Zoning Circulator
 - J – Bronze Cartridge with Cast Iron Casing

Performance Data

- Flow Range: 0 – 34 GPM
- Head Range: 0 – 33 Feet
- Minimum Fluid Temperature: 40°F (4°C)
- Maximum Fluid Temperature: 230°F (110°C)
- Maximum Working Pressure: 125 psi
- Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged



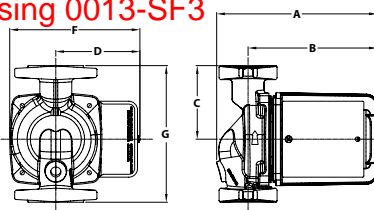
Application

The Taco 0013 is specifically designed for high head / high flow applications in Large Residential and Light Commercial systems. Ideal for high pressure drop Boilers, Fan Coil units, Heat Exchangers, larger Radiant systems, Heat Recovery and Geothermal systems. The Bronze or Stainless Steel 0013 should be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0013 to easily replace other models. Compact, low power consumption design makes it ideal for high-efficiency jobs.

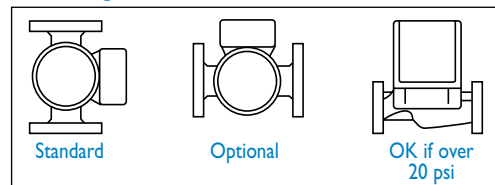
Pump Dimensions & Weights

Model	Casing	A		B		C		D		F		G		Ship Wt.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0013-F3	Cast Iron	7-1/2	191	6-3/8	162	3-1/2	89	3-7/8	98	6	152	6-1/2	165	12.0	5.5
0013-BF3	Bronze	7-1/2	191	6-3/8	162	3-1/2	89	3-7/8	98	6	152	6-1/2	165	12.0	5.5
0013-SF3	St. Steel	7-1/2	191	6-3/8	162	3-1/2	89	3-7/8	98	6	152	6-1/2	165	11.5	5.2

using 0013-SF3



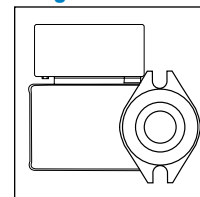
Mounting Positions



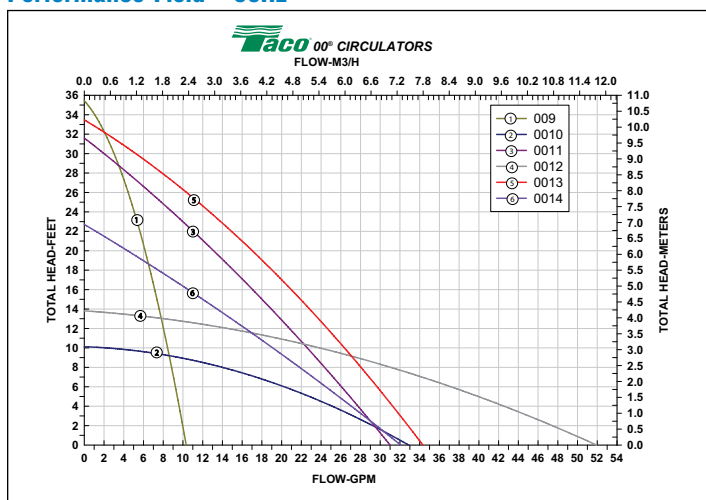
Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
All Models	115	60	1	2.0	3250	1/6
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Flange Orientation



Performance Field - 60Hz



Copper Tube Coils

Utility



APPLICATIONS

- Ice maker kits
- Low pressure water supply lines
- Low pressure compressed air

NOTE:

Plumbing and mechanical codes govern what types of products may be used for applications. Local codes should always be consulted for minimum requirements.

Our alloy C12200 seamless copper tubing is packaged and distributed in the USA and is produced in compliance with the applicable chemical and mechanical properties of ASTM standards.

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SPECIFICATIONS

Alloy C12200 (DHP)
NSF/ANSI Standard 61 Certified

TUBE MARKING

Color marking or incising are not applicable to utility tube.

1002 Industrial Way
Crothersville, IN 47229
866.572.3776 | FAX 812.793.2626

www.cerroretail.com

REV: 06/2013

Copper Tube Coils

Utility

cerro
Plumbing®

PRODUCT NUMBER	DESCRIPTION	DIMENSIONS		LENGTH (ft)	UPC CODE
		ID (in)	OD (in)		
PCLA-250U005	1/4" OD X 5'	1/8	1/4	5	662386030516
PCLA-250U010	1/4" OD X 10'	1/8	1/4	10	662386030424
PCLA-375U010	3/8" OD X 10'	1/4	3/8	10	662386030417
PCLA-500U010	1/2" OD X 10'	3/8	1/2	10	662386050057
PCLA-625U010	5/8" OD X 10'	1/2	5/8	10	662386050064
PCLA-250U020	1/4" OD X 20'	1/8	1/4	20	662386030448
PCLA-375U020	3/8" OD X 20'	1/4	3/8	20	662386030431
PCLA-500U020	1/2" OD X 20'	3/8	1/2	20	662386050071
PCLA-625U020	5/8" OD X 20'	1/2	5/8	20	662386050088

We will be using the 1/2" OD x 20' piping for the gas line (Nexus Collection Tank to Nexus Water Heater) and the 5/8" OD by 20' piping for the liquid line (Nexus Water Heater to Nexus Collection Tank).

1002 Industrial Way
Crothersville, IN 47229
866.572.3776 | FAX 812.793.2626

www.cerroretail.com

REV: 06/2013

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line-Test Pressure for Refrigerant R-134a:

1. Suction Lines for Air-Conditioning Applications: 115 psig.
2. Suction Lines for Heat-Pump Applications: 225 psig.
3. Hot-Gas and Liquid Lines: 225 psig.

B. Line-Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

C. Line-Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

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

2.2 TUBES AND FITTINGS

- ##### A. Copper Tube: ASTM B 88, Types K and L and ASTM B 280, Type ACR.

- ##### B. Wrought-Copper Fittings and Unions: 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.

2.3 VALVES AND SPECIALTIES

- A. Welded steel with corrosion-resistant coating and socket ends; 500-psig operating pressure; 240 deg F operating temperature.

2.4 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
 - 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. DuPont Fluorochemicals Div.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with requirements in Section 23 05 00 "Common Work Results for HVAC" for basic piping installation requirements.
- B. Install wall penetration system at each pipe penetration through foundation wall. Make installation watertight. Comply with requirements in Section 23 05 00 "Common Work Results for HVAC" for wall penetration systems.
- C. Install refrigerant piping and charge with refrigerant according to ASHRAE 15.
- D. Belowground, install copper tubing in PVC conduit. Vent conduit outdoors.
- E. Insulate suction lines to comply with Section 23 07 00 "HVAC Insulation."
- F. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- G. Install solenoid valves upstream from each thermostatic expansion valve. Install solenoid valves in horizontal lines with coil at top.
- H. Install thermostatic expansion valves as close as possible to distributors on evaporator coils.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

- J. Install strainers upstream from and adjacent to solenoid valves, thermostatic expansion valves, and compressors unless they are furnished as an integral assembly for device being protected.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

END OF SECTION 23 23 00



DUCTWORK

Metal • Flexible • Accessories



POLICIES AND PROCEDURES

EFFECTIVE DATE: March 1, 2007 (replaces all previous)

CATALOG NUMBER: D2007

STANDARD DISCOUNTS FROM LIST: All products 50-10% discount when bought in standard factory packs.

TERMS: Net 30 days... 1/2% LATE CHARGE FOR ALL PAST DUE AMOUNTS.

MINIMUM ORDER: \$100.00 net minimum. A \$10.00 minimum order charge will be added to orders less than \$100.00.

PRICING & SPECIFICATIONS: Prices are F.O.B. point of origin. Prices and product specifications are subject to change without notice. Prices on all shipments to be those in effect at time of shipment.

FREIGHT ALLOWANCE (48 Adjacent States): Under 500 lbs. (all products mixed) - FREIGHT COLLECT. 500 Lbs. (all products mixed) - F.O.B. point of origin, FREIGHT PREPAID.

(Alaska, Hawaii & International): Orders of 500 lbs. or more will be shipped F.O.B. point of origin - FREIGHT PREPAID to any port within the 48 adjacent states. Customer pays freight beyond.

PICKUP ALLOWANCE: Locations 200 miles or less from plant - 2%. More than 200 miles from the plant - 4%

FREIGHT CLAIMS: The customer is responsible for filing claims for shortages or damage in transit, whether visible or concealed. LL Building Products, Inc.'s responsibility ceases when the carrier signs for the shipment in good order.

RETURNED GOODS: Prior approval and Returned Goods Authorization (RGA) Number are required before returning any merchandise. Contact Customer Service Department for approval, instructions, and RGA number. Unauthorized returns will be refused and no credit issued. For approved returns, make certain that the RGA number is clearly visible. All authorized returns are subject to a 25% restocking charge

CREDITS: Credits of any kind must be approved by LL Building Products, Inc. management. Field sales representatives are not authorized to issue credits. Deductions from invoices without reference to an approved credit memo will be disallowed.

FULL TERMS AND CONDITIONS SHALL BE INCLUDED WITH YOUR INVOICE.

LIMITED WARRANTY

LL Building Products Inc. warrants that, at the time of delivery, its products conform to LL Building Products' specifications therefor. THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. It is Purchaser's sole responsibility to determine the suitability of any LL Building Product for any particular application. Recommendations made by LL Building Products are believed to be reliable, but LL Building Products makes NO WARRANTY OF RESULTS to be obtained. PURCHASER'S SOLE AND EXCLUSIVE REMEDY, regardless of the theory on which a claim may be based, including, without limitation, negligence, contract, breach of warranty, strict product liability or misrepresentation, IS THE REPLACEMENT OF THIS PRODUCT or, in the alternative, the original purchase price of this product. EXCLUDING the costs of labor to remove or reinstall the product or field repair expenses. In NO event shall LL Building Products be liable for INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR PUNITIVE DAMAGES.

Purchaser must notify LL Building Products, in writing, of any claim at 295 McKoy Road, Burgaw, NC 28425 within 30 days of discovery of any alleged manufacturing defect. After the product claimed to be defective is inspected by a LL Building Products salesman or official, who authorizes its return, Purchaser must return the product to the factory of original shipment, as part of the claims procedure.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

OTHER FINE PRODUCTS FROM LL BUILDING PRODUCTS, INC.

- Power Attic Ventilators
- Static Ventilation Products
- Whole House Fans
- Ornamental Iron
- Chimney Caps
- Furnace Pipe & Fittings
- Flexible Duct

Manufactured by
LL BUILDING PRODUCTS, INC.
 Subsidiary of GAFMC

295 McKoy Road, Burgaw, NC 28425 (910)815-2600 (800)668-8514 FAX: (910)259-7428

Contents

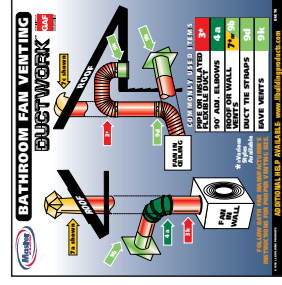
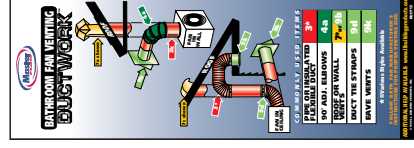
Plenums & Air Returns	3	Register Boxes	11 - 12
Starting Collars and Take-Offs	3 - 4	Rooftop Venting	13 - 15
Trunk and Branch Lines	5 - 6	Heavy Gauge (24 & 26) Systems	15 - 16
Transitions and Connectors	6 - 8	Miscellaneous Items	15 - 19
In Wall Duct Systems	8 - 10	Manufactured Housing Systems	19

Always follow local building codes and wear proper protective equipment when handling and installing ductwork.

Merchandising, Packaging & Education

Signs

Our signs help your customer make the right decision to finish their job. And the color coded system leads the customer right to the color family.



Packaging

Our attractive cartoning system will improve the look and organization of your aisle display by breaking up the "sea of metal". These boxes allow LL Building Products to fit up to 30% more product in the same space allocated to your current program.



Education

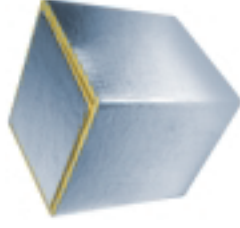
Our easy to use Ductwork manual and DVD will help your store personnel learn how products are used and in turn can lead your customer to the proper item. Education is the key and this manual (available in English and Spanish) acts as a handy reference tool for those "technical questions". We install confidence and your customer installs Ductwork!



Plenums & Air Returns

This section, color-coded burgundy, includes products that attach directly to the furnace or are used for return air.

Ductboard Plenums



- For constructing air supply plenums.
- Pre-cut for easy assembly.
- Secure with approved foil tape.

Model #	Size	R-Value	Thickness	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
4DPK24X24X24	24" x 24" x 24"	R-4.2	1"	3 (25.0)	96324 1

Return Air Boxes



- Provides collecting port for central return duct.

Model #	Size	Depth	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RAB24X14	24" x 14"	3"	4 (18.0)	94810 1

Galvanized Panning



- To create a run of rectangular duct between studs.
- 30 gauge galvanized steel.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
GP16X35	16" x 35"	6 (13.7)	93740 2

Starting Collars and Take-Offs

This section, color-coded orange, includes round and rectangular starting collars and take-offs.

Click Starting Collars - Deluxe



- For transition from internally lined 1" or 1 1/2" ductboard plenums to round pipe or insulated flexible duct. Can also be used with unlined plenums.
- Snap together.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
SCF4	4"	12 (4.0)	93140 0
SCF5	5"	12 (4.9)	93150 9
SCF6	6"	24 (10.0)	93160 8
SCF7	7"	12 (6.3)	93170 7
SCF8	8"	12 (7.5)	93180 6
SCF10	10"	6 (5.0)	93190 5
SCF12	12"	6 (6.0)	93200 1
SCF14	14"	6 (7.0)	93210 0

Ductboard Starting Collars



- For transition from ductboard plenums, internally lined plenums or insulated register boxes to round pipe or insulated flexible duct. Can also be used with unlined plenums.
- Extra long tabs to fit all ductboard thicknesses through 1 1/2" (R-6.0 value)

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
DSCF4	4"	6 (2.0)	93144 8
DSCF5	5"	6 (3.0)	93154 7
DSCF6	6"	20 (13.4)	93164 6
DSCF7	7"	8 (6.6)	93174 5
DSCF8	8"	14 (11.6)	93184 4
DSCF10	10"	6 (7.8)	93194 3
DSCF12	12"	6 (9.3)	93204 9
DSCF14	14"	6 (10.0)	93214 0

Starting Collars and Take-Offs

This section, color-coded orange, includes round and rectangular starting collars and take-offs.

Air-Tite Take-Offs



- Provides transition from flat surface to insulated flexible duct or round pipe.
- Tacky gasket provides excellent seal.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
ATTO6	6"	10 (7.5)	93240 7
ATTO8	8"	7 (8.0)	93242 1
ATTO10	10"	6 (8.0)	93244 5
ATTO12	12"	6 (9.5)	93246 9

Saddle Air-Tite Take-Offs



- Provides transition from round surface to insulated flexible duct or round pipe.
- Tacky gasket provides excellent seal.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
SATTO6	6"	10 (7.5)	93262 9

Side Take-Offs



- For transition from air plenums or rectangular duct to round pipe or insulated flexible duct.
- Crimped collars for interlocking fit.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
STO6	6"	10 (9.0)	93094 6

Top Take-Offs



- For transition from air plenums or rectangular duct to round pipe or insulated flexible duct.
- RSC is a "Scotty" take off.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
TTO6	6"	12 (14.0)	93114 1
RSC7X6	6"	6 (7.0)	93166 0

Rectangular Take-Offs - Straight



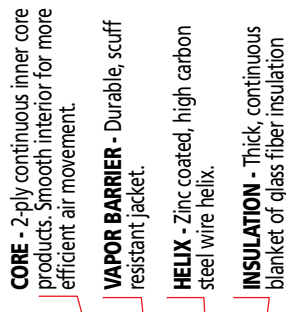
- For transition from plenums to rectangular duct.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RTO12X8	12" x 8"	6 (8.5)	93122 6
RTO14X8	14" x 8"	6 (9.5)	93123 3
RTO16X8	16" x 8"	6 (10.0)	93124 0

Trunk and Branch Lines

This section, color-coded red, includes insulated flexible duct, round pipe and rectangular duct.

Insulated Flexible Duct



- Approval codes:
- Meets UL - 181 Class 1 Air Duct
 - NFPA 90A + 90B
 - SBCC, ICBO, BOCA
 - California Bureau of Home Furnishing & Thermal Insulation

PERFORMANCE DATA:

R-VALUE: As measured per the ADC test method and ASTM C518

MAXIMUM FLAME SPREAD: 25

MAXIMUM SMOKE DEVELOPED: 50

TEMPERATURE RANGE: -20°F to 250°F

CORE: Two plies of polyester film which encapsulate galvanized steel wire helix

THERMAL CONDUCTANCE: C = 23

VELOCITY: 4,000 FPM maximum

Model # Series	Vapor Barrier	R-Value	Glass Fiber Insulation	Indoor Use	Outdoor Use
F6IFD	Metalized single strand fiberglass yarns for added strength and tear resistance	6.0	2" thick	x	--
8IFD	Durable black polyethylene jacket with UV inhibitors	8.0	3" thick	x	--
MIF	Extra heavy black polyethylene jacket with UV inhibitors	4.2	1 1/4" thick	x	x

Metalized Jacket R6.0 Insulated Flexible Duct



- Metalized jacket.
- 2" glass fiber R-Value 6.0

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
F6IFD4X300	4" Diam. - 25 ft. Metalized	1 (10.0)	92206 4
F6IFD5X300	5" Diam. - 25 ft. Metalized	1 (11.5)	92214 9
F6IFD6X300	6" Diam. - 25 ft. Metalized	1 (11.5)	92224 8
F6IFD7X300	7" Diam. - 25 ft. Metalized	1 (12.5)	92234 7
F6IFD8X300	8" Diam. - 25 ft. Metalized	1 (13.0)	92244 6
F6IFD10X300	10" Diam. - 25 ft. Metalized	1 (16.0)	92254 5
F6IFD12X300	12" Diam. - 25 ft. Metalized	1 (19.0)	92264 4
F6IFD14X300	14" Diam. - 25 ft. Metalized	1 (26.0)	92274 3

Black Jacket R8.0 Insulated Flexible Duct



- Black polyethylene jacket.
- 3" glass fiber R-Value 8.0

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
8IFD4X300	4" Diam. - 25 ft. Black	1 (12.0)	92152 4
8IFD6X300	6" Diam. - 25 ft. Black	1 (13.8)	98652 3
8IFD7X300	7" Diam. - 25 ft. Black	1 (15.0)	98654 7
8IFD8X300	8" Diam. - 25 ft. Black	1 (17.5)	98656 1
8IFD10X300	10" Diam. - 25 ft. Black	1 (22.5)	98658 5
8IFD12X300	12" Diam. - 25 ft. Black	1 (26.3)	98660 8

Trunk and Branch Lines

This section, color-coded red, includes insulated flexible duct, round pipe and rectangular duct.

Round Metal Pipe



- Snap lock design.
- Crimped end with stop-bead for easy interlocking fit.
- Galvanized steel construction.
- Cut to length with tin snips.

NOTE: For heavy (24 or 26 gauge) pipe, see Heavy Gauge Section - page 15.

3 Foot Sections: 30 Gauge

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
BCP3X36	3"	20 (28.4)	92140 1
BCP4X36	4"	20 (36.4)	92150 0
BCP5X36	5"	20 (44.4)	92070 1
BCP6X36	6"	20 (52.4)	92160 9
BCP7X36	7"	20 (60.2)	92170 8
BCP8X36	8"	20 (68.2)	92180 7
CP10X36	10"	10 (42.0)	92012 1
CP12X36	12"	10 (50.0)	92022 0

5 Foot Sections: 30 & 28 Gauge

Model #	Gauge	Diam.	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
CP3X60	30	3"	10 (24.0)	92080 0
CP4X60	30	4"	10 (31.0)	92090 9
CP5X60	30	5"	10 (36.0)	92100 5
CP6X60	30	6"	10 (42.0)	92110 4
CP7X60	30	7"	10 (52.0)	92120 3
CP8X60	30	8"	10 (58.0)	92130 2
CP10X60	30	10"	10 (74.0)	92014 5
CP12X60	28	12"	10 (96.0)	92024 4
CP14X60	28	14"	10 (132.0)	92034 3

Rectangular Duct



- Main trunk lines for system supply.
- Snaps together - no tools needed.
- Notched corners for connecting sections, or use cleats.
- 28 gauge galvanized steel.

SOLD IN HALF SECTIONS
For "S" and Drive Cleats see page 18.

Model #	Length	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RD12X8X48	4 ft.	12" x 8"	6 (34.0)	95010 4
RD14X8X48	4 ft.	14" x 8"	6 (37.0)	95015 9
RD16X8X48	4 ft.	16" x 8"	6 (39.0)	95020 3
RD24X8X48	4 ft.	24" x 8"	6 (48.0)	95030 2

Transitions and Connectors

This section, color-coded dark green, includes elbows, reducers, tees, wyes and other accessories.

Standard 90 Degree Round Adjustable Elbows

- Used to make angular turns in runs of pipe.
- Adjustable to any angle through 90°.



NOTE: For heavy gauge 90 degree Elbows, see page 15.

23 33 46 Flexible Duct

4/10

Transitions and Connectors

This section, color-coded dark green, includes elbows, reducers, tees, wyes and other accessories.

Round Reducer/Incraser



- Used to reduce or increase diameter of pipe.
- Collar edges hemmed for added strength and safety.

NOTE: For 26 gauge reducer/ increasers, see page 16.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
R4X3	4" to 3"	24 (8.0)	92550 8
R5X4	5" to 4"	12 (5.5)	92560 7
R6X4	6" to 4"	12 (6.5)	92570 6
R6X5	6" to 5"	12 (7.5)	92580 5
R7X4	7" to 4"	12 (7.5)	92598 0
R7X6	7" to 6"	12 (7.5)	92590 4
R8X6	8" to 6"	12 (9.5)	92600 0
R8X7	8" to 7"	12 (9.5)	92630 7
R10X8	10" to 8"	6 (5.5)	92610 9
R12X10	12" to 10"	6 (8.3)	92620 8
R14X12	14" to 12"	6 (12.5)	92640 6

Standard "Stub" Wyes



- Also called Wye Joints or Reducing Laterals.
- Used primarily for heating & air conditioning application for transition from one pipe to two pipes.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
Y4X4X4	4" to 4" x 4"	6 (8.3)	92508 9
Y6X6X6	6" to 6" x 6"	6 (12.0)	92518 8
Y8X6X6	8" to 6" x 6"	6 (12.3)	92510 2
Y8X8X8	8" to 8" x 8"	6 (12.3)	92514 0
Y10X8X8	10" to 8" x 8"	4 (14.0)	92520 1
Y12X10X10	12" to 10" x 10"	4 (16.0)	92532 4
Y14X12X10	14" to 12" x 10"	6 (22.5)	92540 9

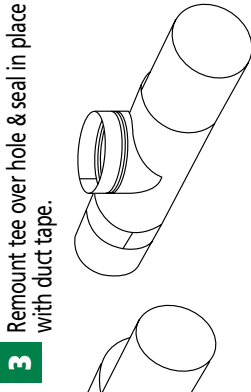
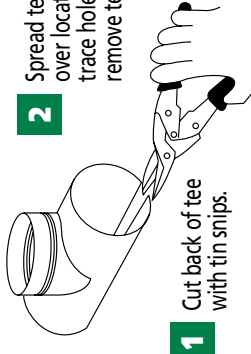
Round Tees



- Used for venting bath & kitchen fans as well as heating & air conditioning applications.
- For 90 degree branch with same diameters.
- Use reducers/increasers to modify multiple pipe size connections.
- (28 gauge for 10" diameters & larger)

NOTE: For 26 gauge tees, see page 16.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
T3X3X3	3"	6 (3.5)	92410 5
T4X4X4	4"	6 (4.0)	92420 4
T5X5X5	5"	6 (7.0)	92430 3
T6X6X6	6"	6 (7.0)	92440 2
T8X8X8	8"	6 (10.3)	92460 0
T10X10X10	10"	6 (16.5)	92470 9
T12X12X12	12"	6 (22.0)	92480 8



NOTE: 90 degree Tee Saddles can be made from Standard Tees as shown.

Tee Saddles



- Used to splice into an existing run of round pipe of equal or large diameter.
- 90 degree angle branch.

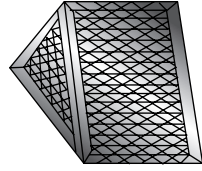
Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
TS6	6" to 6"	6 (4.5)	92490 7
TS8X6	8" to 6"	6 (5.5)	92500 3

6

7

This section, color-coded dark green, includes elbows, reducers, tees, wyes and other accessories.

Ductboard Triangular Terminal Boxes



- Pre-cut for easy assembly using approved foil tape.
- FSK reinforced backing.

Model #	R-Value	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
DTTB15	R-6.0	15"	6 (18.0)	96320 3

In Wall Duct Systems

This section, color-coded purple, includes rectangular stack (riser) and oval duct components

Rectangular Stack (Riser) Duct



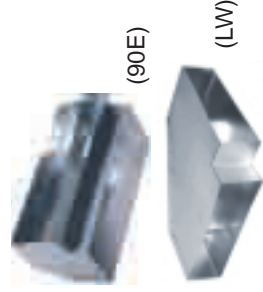
- For use between wall studs for venting:
 - Kitchen & bath fans
 - Range hoods;
 - Heating & air conditioning supply & return ducts.
- Snap together - no tools needed.
- Can be cut to length with tin snips.

SOLD IN HALF SECTIONS

For "S" and Drive Cleats see page 18.

Model #	Length	Dimensions	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RD2.25X12X24	2 ft.	2 1/4" x 12"	12 (13.0)	92185 2
RD3.25X10X36	3 ft.	3 1/4" x 10"	18 (30.0)	92190 6
RD3.25X12X36	3 ft.	3 1/4" x 12"	12 (23.0)	92196 8
RD3.25X14X36	3 ft.	3 1/4" x 14"	12 (27.3)	92200 2
RD3.25X10X60	5 ft.	3 1/4" x 10"	12 (38.0)	92194 4
RD3.25X12X60	5 ft.	3 1/4" x 12"	12 (40.0)	92174 6
RD3.25X14X60	5 ft.	3 1/4" x 14"	12 (48.0)	92204 0

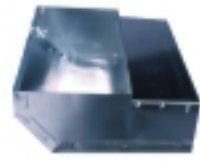
Rectangular Stack Elbows



- Used with rectangular stack duct for 90 degree turns.
- Available in short way and long way configurations.

Model #	Size and Configuration	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
90E3.25X10	3 1/4" x 10" Short	6 (6.0)	92380 1
90E3.25X12	3 1/4" x 12" Short	6 (7.0)	92382 5
LW90E10X3.25	10" x 3 1/4" Long	6 (9.0)	92390 0

Rectangular Stack Heads



- For transition from rectangular stack duct to air register or grill (normally side wall registers).
- "SHW" model includes tabs for easy joist attachment.

Model #	Stack Duct Dimensions	Register Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
SH10X6	3 1/4" x 10"	10" x 6"	8 (12.0)	93270 4
SH14X6	3 1/4" x 14"	14" x 6"	5 (9.4)	93290 2
SHW12X6 (w/tabs)	2 1/4" x 12"	12" x 6"	12 (17.4)	933265 0

Stack Boots - Straight



- For straight line transition from round pipe or insulated flexible duct to rectangular stack duct.

Model #	Pipe Diameter	Stack Duct Dimensions	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
SB12X2.25X6	6"	12" x 2 1/4"	12 (16.8)	93080 9
SB10X3.25X4	4"	10" x 3 1/4"	16 (17.5)	93002 1
SB10X3.25X5	5"	10" x 3 1/4"	14 (15.0)	93012 0
SB10X3.25X6	6"	10" x 3 1/4"	12 (13.0)	92990 2
SB10X3.25X7	7"	10" x 3 1/4"	10 (10.2)	93000 7

23 33 46 Flexible Duct

In Wall Duct Systems

This section, color-coded purple, includes rectangular stack (riser) and oval duct components

Stack Boots - 90 Degree



- For right angle transition from round pipe or insulated flexible duct to rectangular stack duct.

Model #	Pipe Diameter	Stack Duct Dimensions	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
90SB10X3.2X6	6"	10 x 3 1/4"	9 (11.0)	93040 3

Rectangular Stack Duct Caps



- Used to terminate or block off a run of rectangular stack duct.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
DC3.25X10	3 1/4" x 10"	6 (1.2)	93712 9
DC3.25X12	3 1/4" x 12"	6 (1.3)	93714 3

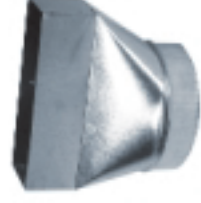
Rectangular Stack Duct Starting Collars



- For transition from plenum or flat surface to stack duct.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
SCF3.25X10	3 1/4" x 10"	6 (6.0)	93230 8

Fan Boots



- For transition from Range Hood Top 3 1/4" x 10" opening to round pipe.
- Crimped collar.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
FB3.25X10X7	7"	12 (14.5)	93652 8

Oval Pipe



- For use between walls for supplying air to high wall registers or to other floors.
- Efficient alternative to rectangular stack (riser) duct.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OP6X60	6" x 5 ft.	10 (43.0)	98500 7

Oval 90 Degree Vertical Elbows



- For changing the vertical direction of a run of oval pipe.

Model #	Fits Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OV90E6	6"	12 (8.7)	98520 5

In Wall Duct Systems

This section, color-coded purple, includes rectangular stack (riser) and oval duct components.

Oval 90 Degree Flat Elbows



- For changing the horizontal direction of a run of oval pipe.

Model #	Fits Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OF90E6	6"	12 (10.5)	98530 4

Oval Stack Heads With Wings



- Provide right angle transition from oval pipe to side wall register.
- Built-in wings for easy attachment to wall studs.

Model #	Oval Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OSHW10X6X6	10" x 6" to 6"	8 (11.0)	98540 3
OSHW12X6X6	12" x 6" to 6"	6 (8.9)	98550 2

Oval To Round Boots - Straight



- Provide straight transition from round pipe or insulated flexible duct to oval pipe.

Model #	Oval to Round Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OTRB6	6" to 6"	8 (6.6)	98560 1

Oval To Round Boots - 90 Degree



- Provide right angle transition from round pipe or insulated flexible duct to oval pipe.

Model #	Oval to Round Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OTR90B6	6" to 6"	10 (9.5)	98570 0

Oval To Round Boots - End



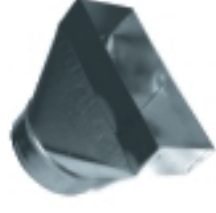
- For transition from round pipe or insulated flexible duct to oval pipe.

Model #	Oval to Round Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
OTREB6	6" to 6"	8 (5.4)	98580 9

Register Boxes

This section, color-coded blue, includes all styles and configurations of register boxes.

Universal (Straight) Register Boxes



- For transition from round pipe or insulated flexible duct to air register or grill.

Model #	Register Size	Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RB8X4X5	8" x 4"	5"	10 (7.0)	92744 1
RB8X8X6	8" x 8"	6"	6 (7.5)	92646 8
RB10X2.25X6	10" x 2 1/4"	6"	6 (7.0)	92650 5
RB12X2.25X6	12" x 2 1/4"	6"	6 (7.0)	92660 4
RB10X4X4	10" x 4"	4"	12 (12.5)	92674 1
RB10X4X5	10" x 4"	5"	12 (14.0)	92676 5
RB10X4X6	10" x 4"	6"	12 (14.5)	92680 2
RB10X6X6	10" x 6"	6"	14 (14.0)	92690 1
RB10X10X8	10" x 10"	8"	6 (9.4)	92644 4
RB12X4X5	12" x 4"	5"	9 (9.0)	92704 5
RB12X4X6	12" x 4"	6"	9 (13.0)	92700 7
RB12X6X6	12" x 6"	6"	6 (9.0)	92710 6
RB14X6X8	14" x 6"	8"	8 (12.8)	92740 3
RB14X8X8	14" x 8"	8"	10 (17.5)	92742 7

90 Degree Register Boxes



- For right angle transition from round pipe or insulated flexible duct to air register or grill.

Model #	Register Size	Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
90RB12X2.2X6	12" x 2 1/4"	6"	6 (10.0)	92760 1
90RB10X4X5	10" x 4"	5"	10 (16.0)	92774 8
90RB10X4X6	10" x 4"	6"	10 (16.3)	92780 9
90RB10X6X6	10" x 6"	6"	8 (14.0)	92790 8
90RB12X4X5	12" x 4"	5"	9 (14.8)	92808 0
90RB12X4X6	12" x 4"	6"	9 (15.3)	92800 4
90RB12X6X6	12" x 6"	6"	7 (12.8)	92810 3

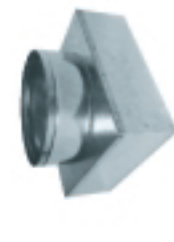
End Register Boxes



- For right angle center-end transition from round pipe or insulated flexible duct to air register or grill.

Model #	Register Size	Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
ERB10X2.25X6	10" x 2 1/4"	6"	6 (7.5)	92860 8
ERB12X2.25X6	12" x 2 1/4"	6"	6 (8.8)	92870 7
ERB10X4X5	10" x 4"	5"	6 (6.5)	92876 9
ERB10X4X6	10" x 4"	6"	6 (7.0)	92862 2
ERB10X6X6	10" x 6"	6"	6 (8.0)	92872 1
ERB12X4X6	12" x 4"	6"	6 (8.3)	92880 6

Ceiling Register Boxes



- For transition from round pipe or insulated flexible duct to air register or grill.

Model #	Register Size	Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
CRB6X6X6	6" x 6"	6"	6 (6.0)	94505 6
CRB10X10X8	10" x 10"	8"	6 (9.0)	94532 2

This section, color-coded blue, includes all styles and configurations of register boxes.

Insulated Register Boxes



- For transition from round pipe or flexible duct to air register or grill.
- Insulated...no need to wrap. Insulation serves as noise deadener and helps control condensation.
- 1" fiberglass insulation inside lining with vapor barrier.

Register Box Saddles



- Horizontal transition from round pipe to air register or grill.
- Can be cut down if necessary.

Ductboard Insulated Register Boxes



- 1 3/8" ductboard insulation R value 6.0.
- For transition from round pipe or flexible duct to air register or grill.
- Pre-insulated...no need to wrap.
- Insulation serves as noise deadener and helps control condensation.

Snap On Rails for register box



- Easy method to attach flanged register boxes to joists of other nailing surfaces.

Universal (Straight) Register Boxes with Flange



- For transition from round pipe or insulated flexible duct to air register or grill.
- Built-in flange to provide:
 - Area for register screws, sheet rock frame, nailing area for joists.
 - Ability to install box before drywalling.

Model #	Register Size	Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
IRB8X4X4	8" x 4"	4"	6 (9.8)	92910 0
IRB8X4X5	8" x 4"	5"	6 (9.8)	92912 4
IRB10X6X6	10" x 6"	6"	8 (18.0)	92970 4
IRB12X6X6	12" x 6"	6"	8 (19.0)	92980 3
IRB12X6X7	12" x 6"	7"	6 (14.3)	92930 8
IRB12X6X8	12" x 6"	8"	6 (14.3)	92950 6
IRB14X6X8	14" x 6"	8"	5 (13.3)	92960 5

Model #	Register Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RBS10X4	10" x 4"	6 (8.0)	93942 0
RBS12X4	12" x 4"	6 (9.5)	93944 4

Model #	Register Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
DIRB6X6	6" x 6"	9 (18.8)	92894 3
DIRB8X4	8" x 4"	12 (24.8)	92914 8
DIRB8X8	8" x 8"	9 (25.4)	92904 9
DIRB10X6	10" x 6"	6 (17.0)	92974 2
DIRB10X8	10" x 8"	6 (19.9)	93018 2
DIRB10X10	10" x 10"	6 (22.8)	92994 0
DIRB12X6	12" x 6"	6 (19.0)	92984 1
DIRB12X8	12" x 8"	6 (22.5)	92954 4
DIRB12X12	12" x 12"	4 (17.0)	92944 5

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
6SOR24	24" length	6 (18.0)	92966 7

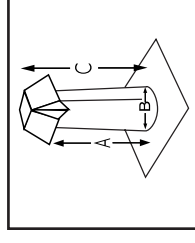
Model #	Register Size	Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RBF8X4X6	8" x 4"	6"	6 (8.0)	93852 2
RBF10X4X6	10" x 4"	6"	12 (17.5)	93850 8
RBF10X6X6	10" x 6"	6"	12 (17.0)	93860 7
RBF12X4X6	12" x 4"	6"	6 (11.0)	93870 6
RBF12X6X6	12" x 6"	6"	5 (8.5)	93880 5
RBF12X12X8	12" x 12"	8"	6 (15.5)	93910 9
RBF14X6X7	14" x 6"	7"	6 (13.0)	93892 8
RBF14X6X8	14" x 6"	8"	4 (8.7)	93890 4
RBF14X8X8	14" x 8"	8"	7 (14.5)	93900 0

This section, color-coded yellow, includes all products installed on or above the roof.

Roof Jacks with Vent Caps



- Available in 28 and 26 gauge galvanized steel.
- Used to receive and cover venting duct pipe from kitchen & bath fans, and for attic ventilation.
- Built-in roof flashing -- press sealed design for maximum leak protection.
- Made for 4/12 roof pitch. Adapts to roof pitches from 3/12 to 5/12. Exception no 5/12. Exception no pitch models.
- Includes cap for rain, snow and debris protection.



28 GAUGE

Model #	Fits Pipe Diam.	Base Size	DIMENSIONS			Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
			A	B	C		
RJVC3	3"	12" x 12"	8.5"	5.125"	10.25"	6 (13.8)	93600 9
RJVC4	4"	13" x 13"	8.125"	6.125"	10.25"	6 (15.0)	93610 8
RJVC6	6"	15" x 15"	8.25"	8.125"	10.75"	6 (21.5)	93630 6
RJVC7	7"	15" x 15"	6.625"	8.125"	9"	6 (24.0)	93640 5
RJVC8	8"	18" x 18"	9.75"	10.125"	12.5"	6 (29.0)	93650 4

26 GAUGE

26RJVC4	4"	13" x 13"	8.125"	6.125"	10.125"	6 (16.0)	93602 3
26RJVC5	5"	15" x 15"	8.825"	7.125"	10.5"	6 (18.0)	93606 1
26RJVC6	6"	15" x 15"	8.25"	8.125"	10.75"	6 (22.0)	93608 5
26APV10	10"	16" x 16"	10 3/8"	9 7/8"	12"	6 (27.0)	94325 0

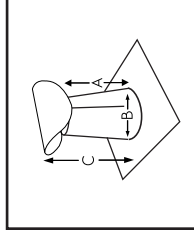
26 GAUGE - FLAT

F26RJVC4	4"	13" x 13"	7.625"	7.125"	10.125"	6 (16.0)	93618 4
F26RJVC5	5"	15" x 15"	8.125"	7.125"	9.875"	6 (18.0)	93626 9
F26RJVC6	6"	15" x 15"	8.25"	8.125"	10.75"	6 (22.0)	93628 3
F26APV10	10"	16" x 16"	10"	9 7/8"	11 3/4"	10 (40.5)	00203 2

Roof Jacks with Wagon Caps



- Used to receive and cover venting duct pipe from kitchen & bath fans, and for attic ventilation.
- Built-in roof flashing -- press sealed design for maximum leak protection.
- Made for 4/12 roof pitch. Tapered stack adapts to roof pitches from 3/12 to 5/12.
- Includes cap for rain, snow and debris protection.



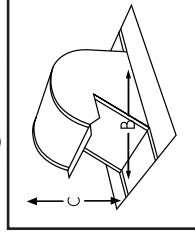
28 GAUGE

Model #	Fits Pipe Diam.	Base Size	DIMENSIONS			Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
			A	B	C		
RJWC4	4"	13" x 13"	6.875"	6.125"	8.5"	6 (11.5)	93980 2
RJWC7	7"	15" x 15"	6.375"	8.125"	9.75"	6 (16.0)	93990 1

Goose Neck Vents



- **GALVANIZED**
- Heavy duty screen for small animal protection.
- Works well on all pitched roofs.
- Ample flashing for leak protection.
- **ALUMINUM/BLACK**
- Heavy duty screen for small animal protection.
- Great for appliance venting.
- Includes Damper.



26 GAUGE GALVANIZED

Model #	Fits Pipe Diam.	Base Size	DIMENSIONS			Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
			B	C			
GNV4	4"	11.625" x 9.12"	4.125" x 6.5"	6.375"	6 (9.8)	93604 7	
GNV6	6"	11.75" x 11.25"	6.125" x 6.625"	6.25"	6 (10.5)	93614 6	
GNV10	10"	16" x 16"	10" x 10"	8.75"	6 (22.5)	93644 4	

Kitchen/Bath Exhaust Vents Aluminum

GNV4A	4"	9" x 12"	4" Round	6"	6 (3.9)	00232 2
GNV10A	10"	16" x 12"	10" Round	7.75"	6 (12.0)	00549 1

Galvanized - Black

GNV4BL	4"	9" x 12"	4" Round	6"	6 (8.4)	00547 7
GNV10BL	10"	16" x 12"	10" Round	7.75"	6 (14.5)	00548 4



Roof Top Venting

This section, color-coded yellow, includes all products installed on or above the roof.

Vent Caps



- To cap pipes through roof for rain, snow, and debris protection.

30 GAUGE

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
VC3	3"	15 (8.7)	93510 1
VC4	4"	10 (7.5)	93520 0
VC5	5"	10 (7.5)	93530 9
VC6	6"	7 (7.5)	93540 8
VC7	7"	6 (6.6)	93550 7
VC8	8"	6 (12.3)	93560 6

Adjustable Versa Caps



- Recommended for flue, hot stack or B-vent installations.
- Non-clogging positive draft design.
- Clamp fittings adjustable for all standard sizes.
- Aluminum or galvanized construction.



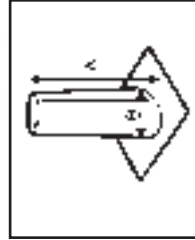
UL Listed for aluminum models.

Model #	Const.	For Pipe w/ Outside Diameter	Double Wall Metal Pipe	Single Wall Metal Pipe	J-M Trans-site	Overall Height	Overall Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
3050	aluminum	2 7/8" - 4 7/8"	3" & 4"	3" & 4"	3" & 4"	4 1/2"	6 5/8"	12 (6.5)	17200 1
5070	aluminum	4 7/8" - 6 7/8"	5" & 6"	5" & 6"	5" & 6"	4 3/4"	9 1/2"	12 (10.7)	17210 0
7090	aluminum	6 7/8" - 8 7/8"	7" & 8"	7" & 8"	7" & 8"	5 7/8"	11 5/8"	12 (16.5)	17220 9
9011	aluminum	8 7/8" - 10 7/8"	9" & 10"	9" & 10"	9" & 10"	6 1/2"	12 3/4"	6 (12.0)	17230 8
1200	aluminum	11 7/8" - 14"	12"	12"	12"	8 11/16"	17 9/16"	2 (7.0)	17240 7
3050G	galvanized	2 7/8" - 4 7/8"	3" & 4"	3" & 4"	3" & 4"	4 1/2"	6 5/8"	12 (13.0)	17250 6
5070G	galvanized	4 7/8" - 6 7/8"	5" & 6"	5" & 6"	5" & 6"	4 3/4"	9 1/2"	12 (20.5)	17260 5
7090G	galvanized	6 7/8" - 8 7/8"	7" & 8"	7" & 8"	7" & 8"	5 7/8"	11 5/8"	12 (31.0)	17270 4

Roof Flashing with Tapered Stacks



- Used as boot flashings around pipes extending through roof.
- Tapered stack adapts to roof pitches from 3/12 to 5/12.
- Built-in roof flashing - press sealed design for maximum leak protection.



28 GAUGE

Model #	Fits Pipe Diam.	Base Size	DIMENSIONS		Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
			A	B		
RFTS1/2	1/2"	12" x 12"	4.625"	6.625"	6 (5.0)	93432 6
RFTS3/4	3/4"	12" x 12"	3.875"	3.625"	6 (5.0)	93430 2
RFTS1	1"	12" x 12"	4.25"	3.625"	6 (5.0)	93440 1
RFTS3	3"	12" x 12"	6.125"	5.125"	12 (16.0)	93450 0
RFTS4	4"	13" x 13"	6.375"	6.125"	12 (17.5)	93460 9
RFTS5	5"	15" x 15"	6.25"	7.125"	6 (11.0)	93470 8
RFTS6	6"	15" x 15"	6.75"	8.125"	6 (12.0)	93480 7
RFTS7	7"	15" x 15"	6.5"	8.125"	6 (16.0)	93482 1

Storm Collars



- For rain, snow and debris protection.
- Adjustable for various pitches.

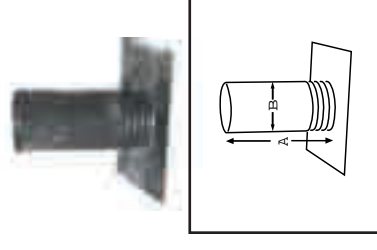
28 GAUGE

Model #	Fits Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
SMC3	3"	6 (1.8)	93800 3
SMC4	4"	6 (2.0)	93780 8
SMC5	5"	6 (2.5)	93788 4
SMC6	6"	6 (2.5)	93790 7

Roof Top Venting

This section, color-coded yellow, includes all products installed on or above the roof.

Lead Roof Flashings



- Used as boot flashings around pipes extending through roof.
- Designed to adjust to most roof pitches.

Model #	Fits Pipe Diam.	Base Size	DIMENSIONS		Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
			A	B		
LRF1.5	1 1/2"	8.5" x 10.5"	10.5"	1.5"	12 (36.0)	00132 5
LRF2	2"	8.5" x 10.5"	10.5"	2"	12 (39.0)	00133 2
LRF3	3"	10.5" x 12"	10.5"	3"	6 (27.0)	00136 3
LRF4	4"	10.5" x 12"	10.5"	4"	6 (30.0)	00137 0

Heavy Gauge (24 & 26) Systems

This section, color-coded gray, includes heavy duty 24 and 26 gauge items.

Round Metal Pipe



- Crimped end with stop-bead for easy interlocking fit.
- Heavier gauge for venting of boilers, furnaces, and hot water heaters.

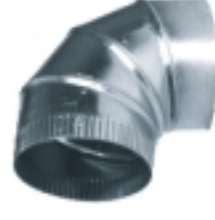
26 Gauge

Model #	Diam.	Length	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
26CP3X24	3"	2 ft.	10 (13.8)	92000 8
26CP4X24	3"	2 ft.	10 (18.0)	92018 3
26CP5X24	3"	2 ft.	10 (18.9)	92028 2
26CP6X24	3"	2 ft.	10 (23.7)	92038 1
26CP7X24	3"	2 ft.	10 (25.2)	92048 0
26CP8X24	3"	2 ft.	10 (31.6)	92058 9

Aluminum

Model #	Diam.	Length	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
AP3X24	3"	2 ft.	10 (5.4)	99018 6
AP4X24	4"	2 ft.	10 (6.9)	99020 9

Adjustable Elbows



- Adjustable to 90 degree angle.
- Crimped end for interlocking fit.
- Heavier gauge for venting of boilers, furnaces and hot water heaters.

26 Gauge

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
26B90E3	3"	24 (12.0)	92296 5
26B90E4	4"	24 (17.0)	92302 3
26B90E5	5"	24 (22.0)	92322 1
26B90E6	6"	24 (26.0)	92336 8
2690E7	7"	12 (17.0)	92342 9
2690E8	8"	12 (21.0)	92354 2

Aluminum

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
A90E3	3"	12 (2.0)	99022 3
A90E4	4"	12 (2.9)	99024 7

Heavy Gauge (24 & 26) Systems

This section, color-coded gray, includes heavy duty 24 and 26 gauge items.

Tees



- Used for venting bath and kitchen fans, and for heating and air conditioning applications.
- Use reducers to modify multiple pipe size connections.

26 Gauge

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
26T6X6X6	All 6"	6 (9.2)	92444 0

Reducers



- Used to reduce or increase round pipe from larger to smaller diameter.
- Collar edges hemmed for added strength and better fit.

26 Gauge

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
26R4X3	4" to 3"	12 (6.0)	92552 2
26R6X4	6" to 4"	12 (9.7)	92572 0

Aluminum

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
AR4X3	4" to 3"	12 (3.8)	99026 1

Miscellaneous Items

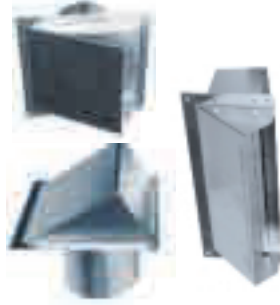
Galvanized Flat Sheet



- Make your own custom fittings.
- Can be cut to size for any application.
- 30 gauge galvanized steel.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
GFS24X362PK	24" x 36"	6 (43.0)	02907 7
GFS36X48	36" x 48"	20 (90.0)	93706 8

Wall Vents



- Used outside sidewall termination of kitchen and bath fans, range hoods and microwave venting.
- WVA 3.25 x 10
- Spring controlled damper
- Foam gasket for tighter seal and quiet operation.
- Aluminum construction. (except WVA4BL - galvanized).
- Gravity Damper on all except WVA3.25x10.
- Screen on WVA4 & 4BL.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
WVA4	4" Round Wall	6 (6.0)	77777 0
WVA6	6" Round Wall	6 (7.0)	93750 1
WVA7	7" Round Wall	6 (7.5)	93760 0
WVA3.25X10	3 1/4" x 10" Rect. Wall	6 (5.7)	93770 9
WVA4BL	4" Round Wall - Black	6 (6.0)	99909 7

Miscellaneous Items

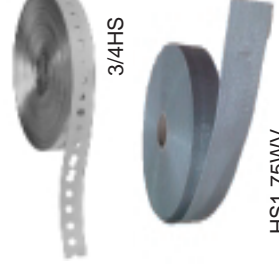
Fresh Air Vents



- Used to intake air into a combustion system or where fresh air intake is needed.
- Built in bird screen.
- Galvanized steel construction.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
FAV4	4"	6 (6.6)	93772 3
FAV5	5"	6 (7.4)	93774 7
FAV6	6"	6 (7.8)	93776 1

Straps and Hangers



- STR36 used to connect insulated flexible duct to fittings.
- Others used to hang round pipe or rectangular duct or plumbing pipe, depending on the item.
- Helps prevent sagging over long runs.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
STR36	Plastic Tie Straps 36" - 8 per pkg.	12 pkgs. (4.0)	93410 4
3/4HS	Perforated Metal Hanging straps - 3/4" x 100 ft.	10 pkgs. (33.0)	95400 3
HS1.75WV	Woven Vinyl Hanger Straps 1 3/4" x 100 yds.	12 ea. (20.5)	95506 2
6DH12	12" Perforated Steel Strap 6 per pkg.	12 pkgs. (15.0)	95406 5

Flexible Duct Connector



- Coupling used to connect two sections of insulated flexible duct.
- Crimped on both sides for an easy fit.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
FC4	4"	24 (6.6)	93422 7
FC6	6"	24 (16.8)	93426 5

Ceiling Collars (Escutcheons)



- Used as finishing piece where pipe passes through ceiling, wall or floor.

Model #	Fits Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
CC4	4"	6 (1.5)	93370 1
CC6	6"	6 (1.5)	93380 0

Round Duct Caps

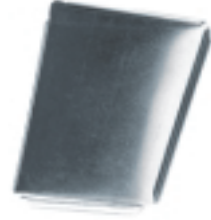


- Used to terminate round pipe run.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
DC3	3"	6 (2.0)	93710 5
DC4	4"	6 (2.5)	93720 4
DC5	5"	6 (2.5)	93722 8
DC6	6"	6 (2.5)	93730 3
DC7	7"	6 (3.0)	93724 2
8DC	8"	6 (3.0)	93732 7
DC10	10"	6 (6.0)	93734 1
DC12	12"	6 (7.5)	93736 5

Miscellaneous Items

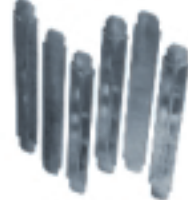
Rectangular Duct Caps



- Used to terminate rectangular duct run.
- 28 gauge galvanized steel.

Model #	Duct Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RDC12X8	12" x 8"	6 (5.0)	95210 8
RDC14X8	14" x 8"	6 (6.0)	95215 3
RDC16X8	16" x 8"	6 (6.0)	95220 7
RDC24X8	24" x 8"	6 (7.5)	95230 6

"S" & Drive Cleats



- For joining pieces of rectangular or rectangular stack duct.
- Galvanized steel construction.
- NOTE: CSH10 and CD10 sold in packages of 6.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
CSH10	Hemmed "S" Cleat 10"	12 pkgs. (8.0)	94100 3
CS60	"S" Cleat - 60"	24 ea. (25.7)	94890 3
CD10	Drive Cleat - 10"	12 pkgs. (10.0)	95960 2
CD60	Drive Cleat - 60"	24 ea. (20.0)	95970 1

Dampers



- For balancing and adjusting air flow in individual runs of round pipe.
- Spring loaded hardware for easy mounting into existing round pipe.

Model #	Fits Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
D-4	4"	6 (1.2)	93310 7
D-6	6"	6 (2.0)	93330 5
D-8	8"	6 (2.5)	93350 3

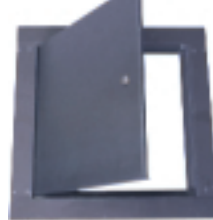
Bathroom Fan Eave Vents



- Used to vent bathroom exhaust through the eaves.
- 4" length.
- White plastic construction - matches most eaves color.
- Easy installation with router saw.

Model #	Fits Pipe Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
BFEV3	3"	12 (3.8)	92324 5
BFEV4	4"	12 (4.0)	92325 2

Access Door



- Maintenance door for normally inaccessible areas.
- Insulated to reduce vibration and noise.
- All steel construction.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
AD24X48	24" x 48"	20 (11.0)	02890 2
AD30X42	30" x 42"	20 (12.0)	02891 9
AD30X48	30" x 48"	20 (14.0)	02892 6

Insulated Duct Sleeve and Wrap



- Convenient sizes for smaller jobs.
- Easy installation for new and existing ductwork.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
INSLV6	6" Sleeve x 5 ft. Length	9 (18.0)	02332 7
INSLV8	8" Sleeve x 5 ft. Length	9 (18.0)	02331 0
INSWRP60	60 sq. ft. Wrap 2" x 30"	3 (24.0)	02333 4

23 33 46 Flexible Duct

Miscellaneous Items

Fiberglass Weave



- Use with water based adhesive sealant to reinforce seams.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
FGW3	3 x 150 ft.	24 rolls (12.0)	99300 2

Water Based Adhesive Sealant/Mastic



- Use to seal all ductwork seams.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
WBA10.5	10.5 oz. Tube	12 Tubes (8.0)	26954 1
WBA50	1/2 Gallon Tub	8 tubs (45.6)	99200 5

Hex Type Screws



- No. 8 x 3/4" piercing, slotted hex head.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
HT8X.75	No. 8 x 3/4" 100 per pack	21 packs (6.0)	99100 8

Manufactured Housing Systems (Mobile Home)

This products in this section are designed specifically for use in manufactured and mobile home HVAC systems.

Insulated Flexible Duct



- Heavy black polyethylene jacket with UV inhibitors.
- 1 1/4" thick
- R-Value: 4.2
- For use outdoors or indoors.

Model #	Description	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
MIF12X300	12" Diameter-25 ft length-Black	1 (18.5)	92262 0
MIF14X300	14" Diameter-25 ft. length-Black	1 (20.0)	92272 9

Return Air Filter Boxes



- For use with self contained air conditioning units.
- Transition from floor grille to insulated flexible duct return line.
- Filter not included.

Model #	Size	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
RA12X20X12	12" x 20" x 12"	3 (10.5)	94240 6

Floor Grill



- For air conditioning return air systems.
- Rigid smooth surface.
- Brown enamel finish.
- Mounts to return air filter box.

Model #	Diameter	Factory Pack (Wgt. - lbs.)	UPC Item Code (050206)
FG12X20	12" x 20"	6 (40.0)	94440 0



Humidity Sensing Recessed Fan / Fluorescent Light

MODEL 744SFLNT

DESCRIPTION

TRIM RING BAFFLE:

- Polymeric construction with matte white finish
- Recessed styling, mounts flush with finished ceiling
- Integrated humidity sensor

LAMP:

- Uses R30-shaped, 2700K, 16W, high efficacy, compact fluorescent lamp with GU24 base (included)

BLOWER:

- Plug-in, permanently lubricated, motor
- Dynamically balanced centrifugal blower wheel for quiet, efficient performance
- Quiet operation

HOUSING:

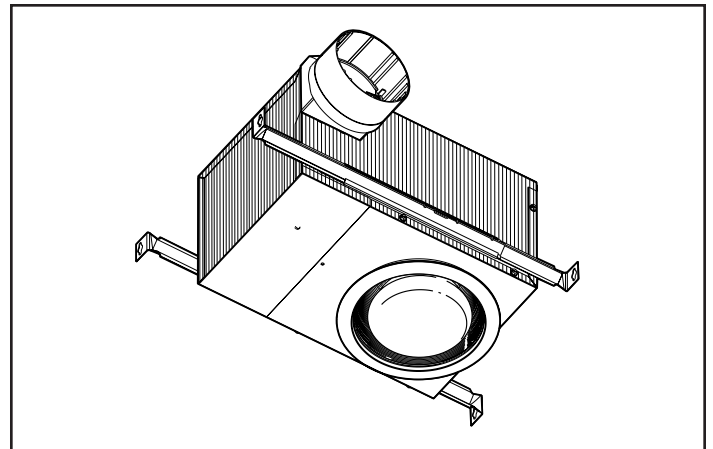
- Fits in 2" x 8" construction
- Rugged, 26 gage, galvanized steel construction
- 4" round, polymeric duct connector with 2" tapered sleeve and no metallic clatter
- Adjustable mounting brackets span up to 24"

CONTROLS: (purchase separately)

- Model VS-96 - One rocker switch with "on" indicator light
- Model VS-86SN - Two rocker switches - fits single outlet box

AUTOMATIC CONTROL:

- Humidity control automatically turns fan ON when either of these conditions is detected:
 - a rapid to moderate (user adjustable) increase of humidity
 - humidity above user-adjustable set-point (50%-80% RH)
- Two wire manual operation for odor control - Turns fan ON when power line through wall switch is cycled ON, OFF and back ON
- Remains ON for a user-adjustable 5 to 60 minutes after humidity has stabilized and is below set-point or after manually initiated through power line cycling
- Saves energy because unit runs only for the time required. A unit controlled with a wall timer may keep fan ON longer than required or turn it OFF before room is sufficiently ventilated



U.L. Listed for use in insulated ceilings (TYPE I.C.)

U.L. Listed for use over bathtubs and showers when connected to a GFCI protected branch circuit.

ENERGY STAR qualified.

Broan-NuTone LLC Hartford, Wisconsin www.nutone.com 800-558-1711
Broan-NuTone Canada Mississauga, Ontario www.nutone.ca 877-896-1119

REFERENCE	QTY.	REMARKS	Project	
			Location	
			Architect	
			Engineer	
			Contractor	
			Submitted by	Date

**HUMIDITY SENSING RECESSED
FAN / FLUORESCENT LIGHT
MODEL 744SFLNT**

TYPICAL SPECIFICATION

Fan / Light shall be NuTone Model 744SFLNT as manufactured by NuTone according to specifications listed:

Fan/Light shall have corrosion resistant steel housing and adjustable mounting brackets.

Motor assembly to be removable and permanently lubricated.

Non-metallic damper/duct connector to be included.

Fan and Light to operate separately or in combination.

Fan / Light must use an R30-shaped, 2700K, 16W, high efficacy, GU24-based, compact fluorescent lamp.

Air delivery shall be no less than 70 CFM and sound level no greater than 1.5 Sones. All air and sound ratings shall be certified by HVI.

Fan / Light must be U.L. and cU.L. Listed for use in insulated ceilings (Type I.C.).

Fan / Light must be ENERGY STAR qualified.

The unit will have a control that will automatically turn fan ON when humidity increase is rapid to moderate (user adjustable), or when humidity is higher than user-adjustable set-point (50%-80% Relative Humidity), or when supply power is cycled from ON (for more than a second) to OFF (for less than a second) and back ON. It shall be user-adjustable to turn OFF 5 to 60 minutes after humidity has stabilized and is below user-adjustable set-point, or after manually initiated by supply power cycling.

INSTALLATION

Complete installation instructions are included with each Humidity Sensing Recessed Fan / Light.

SPECIFICATIONS

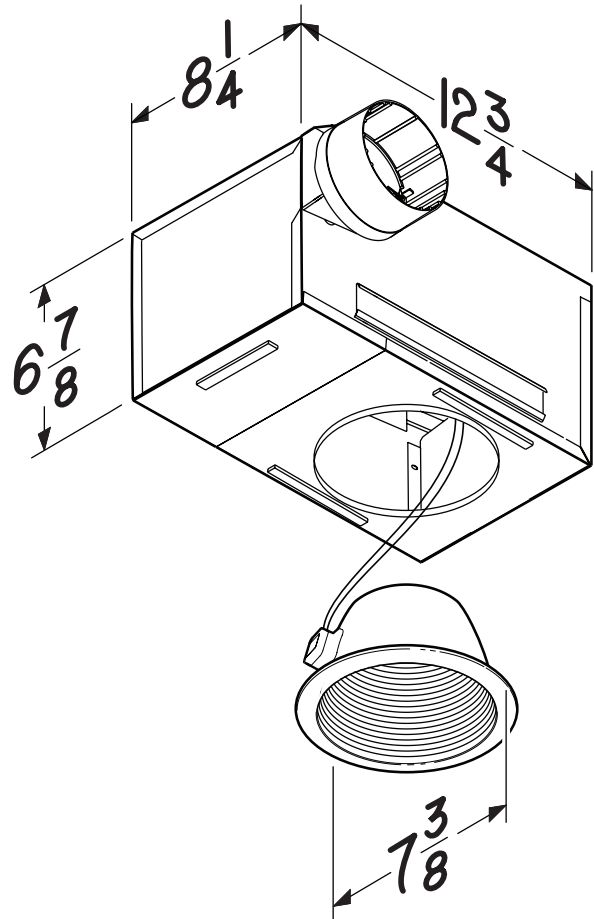
MODEL	VOLTS	AMPS*
744SFLNT	120	0.7

STATIC PRESSURE	CFM	SONES	FAN WATTS	DUCT
0.10	70	1.5	34.4	4" Round
0.25	55			

* Total Connected Load



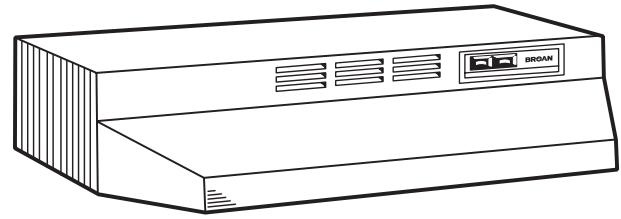
HVI-2100 CERTIFIED RATINGS comply with new testing technologies and procedures prescribed by the Home Ventilating Institute, for off-the-shelf products, as they are available to consumers. Product performance is rated at 0.1 in. static pressure, based on tests conducted in a state-of-the-art test laboratory. Sones are a measure of humanly-perceived loudness, based on laboratory measurements.





SPECIFICATION SHEET

41000 SERIES TWO-SPEED NON-DUCTED RANGE HOOD



Broan's most economical non-ducted hood with filtration of airborne cooking contaminants.

FEATURES

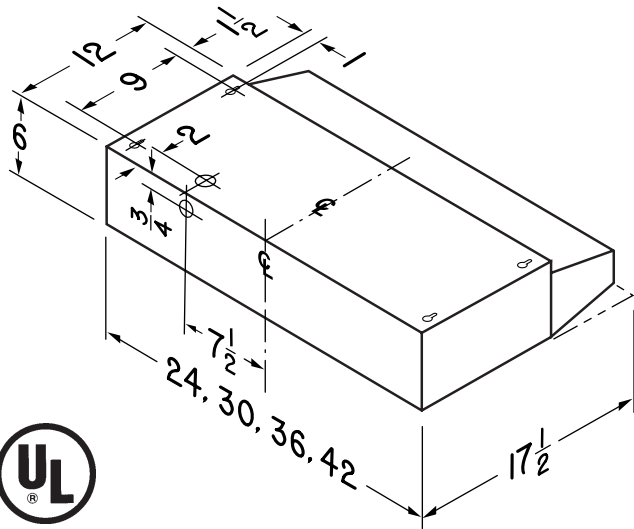
- Rocker-type fan and light switches
- Polymeric blade and light lens (accepts up to 75W bulb)
- Non-ducted filter – effective non-ducted filtration system removes smoke and odors
- Mitered sides and hemmed bottom for safety and good looks
- Contemporary styling in White, Almond, Black and Stainless Steel
- Available in 24", 30", 36", and 42" widths
- Special Order Size: 21"

SPECIFICATIONS

VOLTS	AMPS	RPM
120	2.0	2850

TYPICAL SPECIFICATION

- Range hood shall be Broan Model 41000.
- Unit shall be non-ducted and have a non-ducted filter.
- Motor to be permanently lubricated. RPM not to exceed 2850.
- Unit shall have a two-speed fan switch and separate light switch.
- Sides shall be mitered and bottom edge hemmed – with no sharp edges.
- Unit shall be U.L. listed.



Broan-NuTone LLC, 926 West State Street, Hartford, Wisconsin 53027 (1-800-637-1453)

REFERENCE	QTY.	REMARKS	Project	
			Location	Architect
			Engineer	
			Contractor	
			Submitted by	Date

SECTION 23 62 00 - PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product Data: For each type of product indicated.
 - 2. Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.
- B. Warranties: Submit a written warranty, signed by manufacturer, agreeing to repair or replace components that fail within five years after Substantial Completion.

PART 2 - PRODUCTS

2.1 Domestic Hybrid Water Heater Rheem EcoSense:

- A. 2.45 energy factor.
- B. Heat supply for radiant floor heating.

2.2 PERFORMANCE REQUIREMENTS

- A. Verify performance according to ARI 210/240.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with ASHRAE 15.
- D. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.3 CAPACITIES AND CHARACTERISTICS

- A. Heating:
 - 1. Capacity: 175 Btu/h.
 - 2. Ambient-Air Temperature: 70 deg F.
 - 3. Power Input: 1.5 kilowatts.
- B. Single-Point Electrical Connection:

1. Volts: 240.
2. Phase: Single.
3. Hertz: 60.
4. Full-Load Amperes: 20 Amps.
5. Minimum Circuit Ampacity: 1 Amps.
6. Maximum Overcurrent Protection: 20 Amps.

PART 3 - EXECUTION

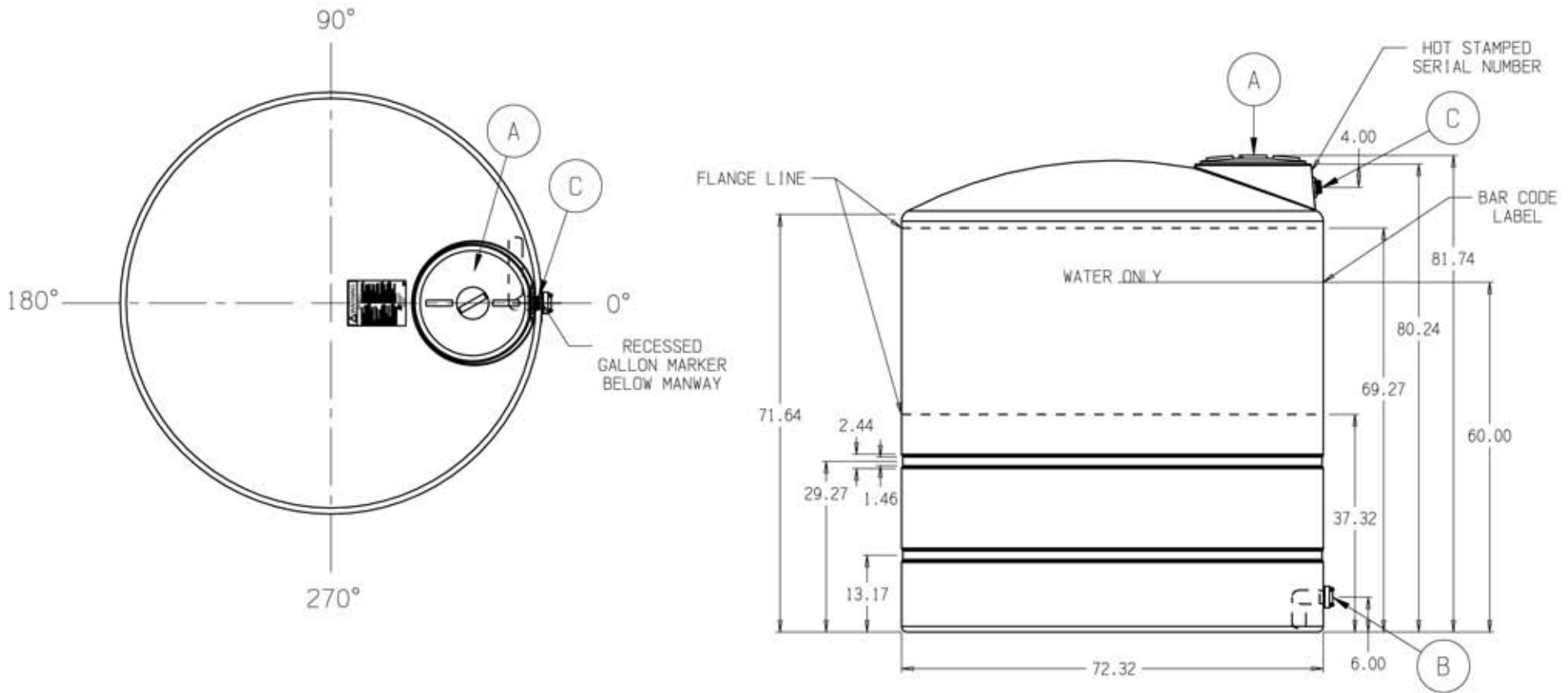
3.1 INSTALLATION

- A. Install units level and plumb. Maintain recommended clearances.
- B. Install ground-mounted units on 4-inch-thick, reinforced-concrete base. Anchor unit to base using inserts or anchor bolts.
- C. Install roof-mounted units on mechanical equipment curb. Anchor unit to structural frame with removable fasteners.
- D. Install electrical devices according to NFPA 70.

END OF SECTION 23 62 00

23 71 16 Chilled Water Thermal Storage Tank

SNYDER INDUSTRIES INC.



- A. 18" PE THREADED-VENTED MANWAY W/15" ACCESS [P/N 34700087]
- B. 2" PP DBL FLANGED BOLTED LONG SIPHON TUBE ASSY W/EPDM GASKETS & SS BOLTS [P/N 34700841]
- C. 1-1/2" PP T x T BH BANJO FTG W/EPDM GASKET [P/N 34100144]

* BASE FITTINGS TO BE LEFT INSTALLED AT TIME OF SHIPMENT PER SII PROCEDURE
 * Consult Snyder's Guidelines for Use and Installation prior to delivery.
 Available on-line at www.snydernet.com

(all dimensions in inches)
 PART # TANK: 1007400W42xx & 998xx

1300 VERTICAL WATER TANK [BLK & GDD]

1 of 1

REF#: 0000

11/16/10

Rheem EcoSense® Hybrid Heat Pump

Our most advanced, energy-efficient electric water heater – its 2.45 Energy Factor lowers energy costs

Efficiency

- High 2.45 EF reduces operating cost \$329 annually compared to a standard 50-gallon electric model

Performance

- 8700 Btu/h compressor: the most powerful in its class – more heat can be created by the heat pump and less by the costly electric elements. This translates into significant fuel saving in real life applications. For still more savings, the Rheem EcoSense hybrid has a wider temperature operating range, which means the heat pump can be used to heat water more days throughout the year.
- Ambient operating range: 37-120° F is widest in class, offering more days of HP operation annually; designed to meet Northern Climate Spec (Tier 1)

Operation Modes

- Energy Saver
- Heat Pump Only
- High Demand
- Electric Heat Only
- Vacation: 2-28 days (or placed on hold indefinitely)

Full-Color LCD Display



- Intuitive, back lit touch screen with diagnostics

Easy Installation

- Easy access side connections
- Narrow 21" diameter, fits through access doors
- Easily replaces a standard electric water heater

Plus...

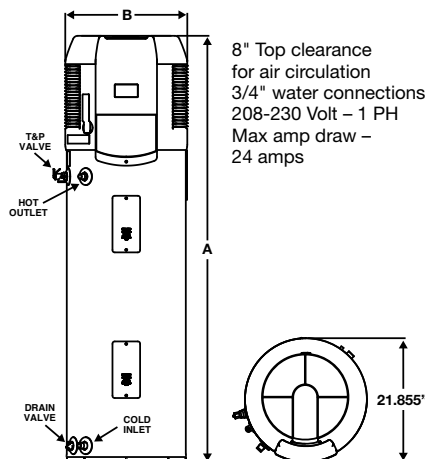
- EcoNet™ compatible for future integration with home automation, energy management and demand response systems
- Patented magnesium anode rod with resistor extends the life of the tank
- 3/4" NPT water inlet, outlet and condensate drain connections
- Incoloy stainless steel resistor elements; dry-fire protection
- Easy access, top mounted washable air filter
- 2-1/2" Non-CFC foam insulation
- Brass drain valve
- Temperature and pressure relief valve

Warranty

- 12-Year limited tank and parts warranty*

*See Residential Warranty Certificate for complete information

Units meet or exceed ANSI requirements and have been tested according to D.O.E. procedures. Units meet or exceed the energy efficiency requirements of NAECA, ASHRAE standard 90, ICC Code and all state energy efficiency performance criteria.



Rheem EcoSense Hybrid Heat Pump Water Heater

50-Gallon Capacity
208-230 Volt / 1 PH / 24 Amps
Electric



GET IT INSTALLED THE HOME DEPOT

DESCRIPTION				DIMENSIONS (SHOWN IN INCHES)				ENERGY INFORMATION		
GAL. CAP.	MODEL NUMBER	COMPRESSOR BTU/H	FIRST HOUR RATING GPH	RECOVERY IN GPH @90° F RISE	HEIGHT A	DIAMETER B	UNIT WT. (LBS)	APPROX. SHIP WT. (LBS)	ENERGY SAVER	AVG. ANN. OPER. COST
50	HB50ES	8700	57	21	75-1/2	21	180	248	2.45 EF	\$191

Energy Factor and Average Annual Operating Costs based on D.O.E. (Department of Energy) test procedures. D.O.E. national average fuel rate electricity 10.65¢/KWH.

Visit homedepot.com/waterheaters to learn more.

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23 81 46 Water Source Unitary Heat Pump Water Heater



Rheem EcoSense® Hybrid Heat Pump

Full-Color LCD Display Screens



Start Up Screen

← Press "Standby" to start

Energy Saver Mode 1
Best energy efficiency for typical hot water demands

Home Screen
Factory set to default to the "Energy Saver" mode screen



Modes 2-5



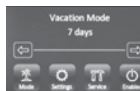
HP Only Mode:
Provides highest energy efficiency when hot water demands are low



High Demand Mode:
Right selection for very high demand (simultaneous operation of multiple hot water fixtures)

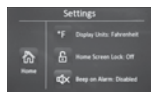


Electric Heat Mode:
Operates like a standard electric water heater; no heat pump



Vacation Mode:
Can be set from 2 to 28 days (82°) or placed on "hold" indefinitely

Settings



- Select scale: Fahrenheit or Celsius
- Lock or unlock the home screen; Setting screen remains unlocked
- Enable/disable beeping alarm

Service



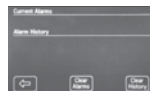
Current status of HB50ES hybrid water heater



Displays model & serial nos., SW version; change network instance or run a test



Shows temperatures in tank, ambient air, suction, evaporator and discharge



Displays current alarms and past alarms; ability to clear all alarms

Enabled



Press to toggle between Enabled & Standby

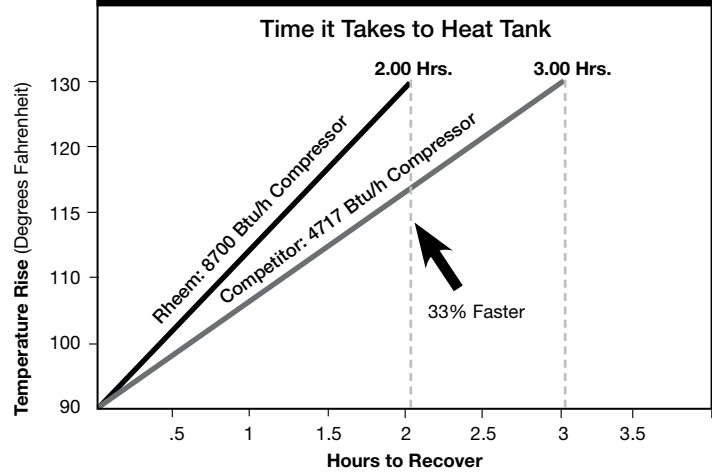
- Enabled: heats water
- Standby: doesn't heat water

Note: "Modes" can't be selected when unit is in "Standby"



Heat Pump Only Mode: Tank Recovery

Rheem Hybrid (50 gal) vs. Competitor Hybrid (50 gal)



In keeping with its policy of continuous progress and product improvement, Rheem reserves the right to make changes without notice.

Rheem Water Heating • 101 Bell Road
Montgomery, Alabama 36117-4305 • 1.800.621.5622

Rheem Canada Ltd./Ltée • 125 Edgeware Road, Unit 1
Brampton, Ontario L6Y 0P5 • 1.800.268.6966

Visit homedepot.com/waterheaters to learn more.

PRINTED IN U.S.A. 07/13 WP FORM NO. THD102-65

23 81 46 Water Source Unitary Heat Pump Water Heater



MANIFOLD - ASTM F1807 PEX CRIMP

672 SERIES

PowerPEX™

SPECIFICATION

Sioux Chief ASTM F1807 manifolds shall be used in plumbing systems for safe distribution of hot or cold water. Manifolds shall be used in new construction or remodel applications. Manifolds can be utilized in various layouts and shall provide appropriate water distribution to supply fixtures through 3/4" or 1" trunk lines. F1807 manifolds shall be offered with or without valves and in various outlet multiples. Trunk lines can be formed to provide sweat connections, spun reduced, spun closed, or provided with F1807 inlets/outlets. Each manifold shall be assembled with no lead solder or braze and tested by Sioux Chief prior to shipment.

MATERIALS

Trunk: Copper

End Outlet: Copper or C69300* Brass

Branch: Copper or C69300* Brass

Solder: No Lead

*693 brass used in brazed configurations

APPLICATIONS

For use with hot and cold water distribution systems.

OPERATING TEMPERATURE/PRESSURE

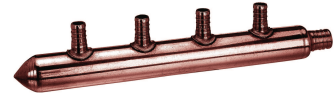
35°F - 140°F / 20 psi - 60 psi

CERTIFICATIONS

complies with NSF 14 and 61.



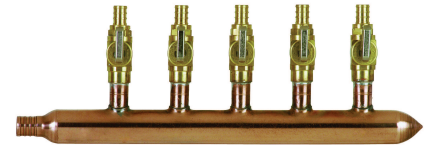
Item # Submitted _____
Job Name _____
Location _____
Engineer _____
Contractor _____
PO# _____ TAG _____



672X0490



672X0699



672XV0590

Create Item Number

672 ABC

e.g. 672X0490 = 1" L copper trunk, 4 1/2" ASTM F1807 no lead branches, 3/4" PEX inlet x spun closed
Additional options available at www.siouxchief.com

- | | | |
|--|---|--|
| <p>A Manifold Type</p> <ul style="list-style-type: none"> <input type="checkbox"/> X F1807 branch NL(No Lead) <input type="checkbox"/> XV F1807 branch & Valve <input type="checkbox"/> XGV F1807 NL branch & Valve <input type="checkbox"/> C Compression PEX <input type="checkbox"/> CV Comp. PEX valve <input type="checkbox"/> CB Comp. PEX balancing valve <input type="checkbox"/> BXT Slab Manifold/Multi-port tee | <p>B Branch multiples</p> <ul style="list-style-type: none"> <input type="checkbox"/> 02 2 branches <input type="checkbox"/> 03 3 branches <input type="checkbox"/> 04 4 branches <input type="checkbox"/> 06 6 branches <input type="checkbox"/> 08 8 branches <input type="checkbox"/> 10 10 branches <input type="checkbox"/> 12 12 branches <input type="checkbox"/> 13 13 branches, etc | <p>C Trunk type</p> <ul style="list-style-type: none"> <input type="checkbox"/> 90 1" L, 3/4" PEX x Spun Closed <input type="checkbox"/> 99 1" L, 3/4" PEX x 3/4" PEX <input type="checkbox"/> 77 1" L, 1" PEX x 1" PEX <input type="checkbox"/> 70 1" L, 1" PEX x Spun Closed <input type="checkbox"/> 30 1" L, 3/4" Male Sweat x Spun Closed <input type="checkbox"/> 40 1" L, 1" Male Sweat x Spun Closed <input type="checkbox"/> 97 1" L, 3/4" PEX x 1" PEX <input type="checkbox"/> 44 1" L, 1" Male Sweat x 1" Male Sweat <input type="checkbox"/> 10 1" L, 1" Female Sweat x Spun Closed |
|--|---|--|

SECTION 23 83 16 - RADIANT-HEATING HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

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

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. High-Density Polyethylene (HDPE) Pipe and Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Centennial Plastics INC. HDPE: Crosslinked HPDE inner and outer for service at 100 psig and 180 deg F.
 - b. Oxygen Barrier: Limit oxygen diffusion through tubes to maximum 0.10 mg per cu. m/day at 104 deg F according to DIN 4726.
2. Fittings: ASTM F 1807, copper with stainless-steel crimps or clamps.

2.2 PIPING SPECIALTIES

- A. Floor Mounting Tracks: Aluminum or plastic channel track, with slot spacing at 3-inch intervals.
- B. Heat-Emission Plates: 1/16-inch-thick formed aluminum suitable for radiant heating piping, used on underside of wood floor, allowing even heat transfer and enhanced heat exchange.

2.3 DISTRIBUTION MANIFOLDS

- A. Modular plastic with three-way mixing valve, main shutoff and balancing valves with thermometers, zone shutoff and balancing valves with flow meter, and identification plate.
 1. Mixing Valves: Minimum 125 psig, 230 deg F operating pressure and temperature, brass or cast-bronze body, EPDM seals, and threaded connections.
 2. Identification Plate: Valve plate shall identify room served and loop number.
 3. If more than one loop serves a room, provide identification plates on manifolds to identify rooms served.

2.4 CONTROLS

A. Thermostats:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Nest Labs.
2. Wall Mounting: 50 to 90 deg F, standard 24 V, three wire.

B. Precipitation and Temperature Sensor: Microprocessor-based control with manual on, automatic, and standby-reset switch. Precipitation and temperature sensors shall sense the surface conditions of pavement and shall be programmed to operate pump and zone control valves.

C. Radiant Heating Control Sequence: Flow-through radiant heating piping is modulated to satisfy space thermostat.

D. Snow-Melting Control Sequence: Flow-through, snow-melting piping is modulated to satisfy precipitation and temperature sensor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install piping downstream from manifolds without joints.

B. Secure piping at 18 inches o.c. and at center of turns or bends.

C. Secure piping in concrete floors by attaching pipes to concrete reinforcement using nylon cable ties. Maintain 4-inch minimum cover.

1. Install a sleeve of foam-type insulation around tubing and extending 3 inches on each side of slab joints to protect the tubing passing through joints.

D. Secure piping in level-fill concrete floors (not reinforced) by attaching pipes to subfloor using tracks, clamps, or staples. Maintain 4-inch minimum cover.

1. Install a sleeve of foam-type insulation around tubing and extending 4 inches on each side of slab joints to protect the tubing passing through joints.

E. Install heat-emission plates on underside of wood subfloor with space between each plate for plate expansion.

F. Install manifolds in accessible locations.

G. Fill system with 100% water solution.

END OF SECTION 23 83 16

DIVISION 25 INTEGRATED AUTOMATION

25 55 00

Integrated Automation Control of HVAC (Touch-Screen Thermostat)



Radio Thermostat Company of America

CT80 Communicating Touch Screen Thermostat



- Controls Five Stages of Heat
- External Humidifier and Dehumidifier Control
- Text Message Capable
- Giant Touch Screen Display

Technical Specifications

Physical - Operational Characteristics

Height	4.56" (116.0 mm)
Width	5.57" (141.50 mm)
Thickness	1.38" (35mm)
Operating Temperature	32°F ~ 122°F (0°C ~ 50°C)
Storage Temperature	-4°F ~ 158°F (-20°C ~ 70°C)
Shock (Non-Operating)	10 free drops (1 corner, 3 edges plus 6 faces) per ISTA-1A
Vibration	14,200 circular impacts per ISTA-1A
Display	160x110 dot matrix LCD with white backlight
Touch Screen	Yes
Setpoint Accuracy	1° F (0.5°C)
Ambient Temperature Display Accuracy	0.5° F (0.5°C)
Remote Control	Yes via Wi-Fi or 2 USNAP ports
Power Requirements	C-Wire Input: AC: 12V~40V DC: 12V~40V

CT80 Communicating Touch Screen Thermostat

Compatible Systems

Heat (Fossil or Electric)	Up to 5 Stages (3)
Cool	Up to 2 Stages
Heat Pump	Up to 2 Stages
Electric Aux Heat	Up to 3 Stages
Hybrid (Fossil Aux Heat)	Up to 3 Stages
Forced Air Zoned Heat	Up to 3 Stages
Forced Air Zoned Cool	Up to 2 Stages
2 Wire Hydro Valves	Yes
3 Wire Hydro Valves	Yes
Millivolt Heat	Yes
External Humidifier Control	Yes
External Dehumidifier Control	Yes
External Air Baffle Control	Yes

Reliability

Operational Lifetime	15 years
Relays	250,000 cycles
Compressor	8,000/year
Heating	8,000/year
Fan	16,000/year
Contact Rating	(@ 24VAC)
G, W, W2,W3,Y,Y2,DH,H,EX,O/B	2A carry, 5 A surge
Power-on Time	Continuous
Immunity to Voltage Dips	70% 10ms, 40% 50ms
Electrostatic Discharge (Contact)	8KV
Electrostatic Discharge (Air)	20KV

Z-Wave Radio Specifications

Frequency (US)	908.42 MHz
Generic Device Type	Thermostat
Specific Device Type	Thermostat General v2
Node Type (C-Wire)	Enhanced Routing Slave
Node Type (Battery)	FLIRS
Z-Wave API	v5.03
Z-Wave Chipset	ZM3102N

ZigBee Radio Specifications

Profiles	Home Automation, Smart Energy
Output Power	20.45 dBm
Receive Sensitivity	-97.56 dBm
Over-the-Air Upgradeable	Yes

Wi-Fi Radio Specifications

Wi-Fi Radio	802.11b/g
Local API	JSON
Provisioning	Ad-hoc network
Cloud Service Provider	Yes
25 95 60 Integrated Automation Control of HVAC	Yes
Touch-Screen Filterable	Yes
Over-the-Air Upgradeable	Yes

Installer Setup Options

HVAC Setup by Interview
HVAC Fast Setup
Swing from .5°F ~ 3°F
Multiple Recovery Settings (FAST/ECON)
Differential Temperature Setpoint Control
UV Bulb Replacement Indicator
Filter Timer Replacement Indicator
Humidity Pad Replacement Indicator
Dynamic Humidity Controls w/ and w/o HVAC
External Dehumidifier w/ or w/o FAN
Radio Network Setup

Homeowner Setup Options

True Auto
Screen Contrast Adjustment
Night Light
12/24 Time/Day with Autoset from Internet
Simple Screen Mode with Limited UI
Interview 4 Period Program
Calendar Programming Periods (up to 7 per day)
Program Schedule (EPA default)
Two 7 Day Selectable Programs (A/B)
Holiday Program
Vacation Mode
Hold
Remote HOME / AWAY Set Points
Energy Price Offset (Save Energy)
Radio Information Display
Radio Network Setup
Fan On/Auto/Circulate Timer /Fresh Air
Fresh Air as 1st Stage
EMER Select (Aux Heat only)
Automatic EMER (Heat Pump Systems)
Multi-Level Locks with Simple UI
Calibrate Feature
Text Messaging Capability
Energy Price Indicators
Grid Status Indicators (Red, Yellow, Green)

DIVISION 26 ELECTRICAL

26 01 10	Operation and Maintenance of Medium Voltage Distribution
26 05 13.16-14	AWG THHN
26 05 26	Grounding and Bonding for Electrical Systems_SP
26 05 29	Hangers and Supports for Electrical Systems_SP
26 05 33	Raceways and Boxes for Electrical Systems_SP
26 05 33.16	1 Inch Conduit for Electrical Systems
26 05 33.16	Junction Box NEMA 3R
26 05 44	Sleeves and Sleeve Seals for Electrical Raceways and Cabling_SP
26 24 16	Switchboards and Panelboards (Siemens Load Center)
26 27 13	Electricity Metering_SP
26 27 16	Weatherproof Outlet Cover
26 27 26	GFCI Outlet
26 27 26	Wiring Devices_SP
26 27 26	Wiring Devices Tamper Resistant GFCI Wall Outlets
26 27 26	WP Outlet WR899-W
26 28 16	Enclosed Switches and Circuit Breakers_SP
26 28 16.13	Low Voltage Circuit Protective Devices (AFCI Breakers)
26 28 16.13	Low Voltage Circuit Protective Devices (GFCI Breakers)
26 28 16.16	Enclosed Switch AC Disconnect
26 31 00	Photovoltaic Collectors
26 31 00	Photovoltaic Collectors_SP
26 33 43	Battery Charger (Electric Vehicle)
26 43 13	Transient Voltage Suppression for Low Voltage Electrical Power Circuits_SP
26 50 00	Lighting_SP
26 50 00	Interior Lighting (Recessed Lighting Including Bathroom)
26 51 13	Interior Lighting Fixtures Lamps & Ballasts (Bathroom Sconce)
26 51 13	Interior Lighting Fixture, Lamps, & Ballasts (Kitchen, Under Cabinet)
26 56 00	Exterior Lighting (Wall Mounted)

- 90°C Dry or Wet/600 Volts
- Gasoline and Oil Resistant II
- Machine Tool Wire: 90°C Dry
- Appliance Wire: 105°C Dry
- Rated THHN/THWN-2: 90°C Dry or Wet

- **No pulling lube required**
- Sequential footage markings —1 AWG and larger
- Max Print[®] for easy ID

APPLICATIONS

- 600 volt building wire for use in commercial and industrial applications as specified in the NEC[®]
- 8-1 AWG is marked VW-1
- 1/0—750 MCM rated for CT use
- 8 AWG –750 MCM in black; Rated sunlight resistant
- Pulling lube is not required.

Service Feed

Product Code	Conductors		Covering		Approx O.D. Inches	Allowable Ampacities*			Approx Net Wt. lbs./m ft.
	AWG Size	No. of Strands	PVC Ins. Mils.	Nylon Jkt. Mils.		60°C **	75°C ***	90°C ****	
112-40XX	8	19	30	5	0.217	40	50	55	63
112-42XX	6	19	30	5	0.253	55	65	75	96

2601 10 Operation and Maintenance of Medium Voltage Distribution

CONDUCTORS

- Uncoated copper per ASTM-B3, ASTM-B787 (6 AWG-500 MCM) & ASTM-B8 (600 MCM-750 MCM)

INSULATION

- Color coded, heat and moisture resistant PVC (polyvinyl chloride)

SLP-JACKET™

- Using Cerro Wire's SLP-Jacket™ (Self-Lubricating Polymer) Technology, Cerro Wire SLPWire™ THHN is self lubricated.
- Nylon (polyamide), color coded

INDUSTRY STANDARDS

- UL 83: File No. E15119
- UL 1063 (MTW): File No. E85964
- AWM: File No. E11829
- Canadian Standard C22.2 No. 75 and CSA Bulletin No. 1451
- ASTM: B3, B8, B787
- WC70/ICEA S-95-658
- Federal Specification A-A-59544
- NFPA70: National Electrical Code[®]

SURFACE PRINT

- Sample: CERRO WIRE VINYLON -A 350 KCMIL (UL) MTW OR THWN-2 OR THHN OR GASOLINE AND OIL RESISTANT II OR AWM FOR CT USE SUNLIGHT RESISTANT 600V—C(UL) TWN75 OR T90 NYLON

112-46XX	2	19	50	7	0.380	95	115	130	233
112-47XX	1	19	50	7	0.440	110	130	150	299
112-50XX	1/0	19	50	7	0.480	125	150	170	371
112-52XX	2/0	19	50	7	0.524	145	175	195	459
112-54XX	3/0	19	50	7	0.575	165	200	225	571
112-56XX	4/0	19	50	7	0.630	195	230	260	710
112-60XX	250	37	60	8	0.700	215	255	290	848
112-64XX	300	37	60	8	0.750	240	285	320	1006
112-68XX	350	37	60	8	0.802	260	310	350	1166
112-72XX	400	37	60	8	0.847	280	335	380	1324
112-80XX	500	37	60	8	0.930	320	380	430	1640
112-84XX	600	61	70	9	1.030	355	420	475	1988
112-88XX	750	61	70	9	1.136	400	475	535	2459

XX Color Add Code (see chart)

* Per Table 310-16 NEC[®]

** For termination to equipment for circuits rated 100 amperes or less, or marked for size 14 through 1 AWG conductors. Also for MTW used in wet locations or exposed to oil or coolant.

*** For termination to equipment for circuits rated over 100 amperes or marked for conductors larger than 1 AWG. Also for THWN-2 exposed to oil or coolant and MTW in dry locations.

**** For THHN used in dry locations and THWN-2 used in wet or dry locations. For ampacity derating purposes.

Color availability:

- 8 AWG & 6 AWG are available in black, white, red, blue, green, orange, yellow, brown, purple and gray.
- 4 AWG through 600 MCM are available in black, white, red, blue, green, orange, yellow, brown and gray.
- 750 MCM is available in black and in white, red, blue, green, orange, yellow, brown and gray by special order only.
- Color add code is as follows: black—01, white—02, red—03, blue—04, green—05, orange—06, yellow—07, brown—08, purple—09 and gray—10.

Cerro Wire LLC

1099 Thompson Road, SE

Hartselle, AL 35640

U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON 2015

Phone 800.523.3869 | Fax 877.877.9563

www.cerrowire.com



188 of 220

Made in USA



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1 of 2

Rev 01-14-11

Wire – THHN Type and MTW Type

26 05 13.16 14 AWG THHN



THHN10GYL



THHN4BK



MTW16WH



MTW10WH

Applications

Type THHN building wire is intended for general purpose applications as defined by the National Electrical Code (NEC). It is appropriate for new construction or rewiring for 600-volt applications. When used as type THHN, the conductor is suitable for use in wet or dry locations at temperatures not to exceed 90°C or not to exceed 75°C in oil or coolants. When used as type MTW, the conductor is suitable for use in dry locations at 90°C, or not to exceed 60°C in wet locations or where exposed to oils or coolants.

Type MTW conductors are primarily used in control cabinets, in machine tool applications and appliance wiring applications at temperatures -25°C to 90°C. They comply with the National Electrical Code (NEC) and NFPA Standard 79. Voltage rating for all applications is 600 volts.

THHN and MTW wire is sold in 500 foot spools; certain sizes are also available in 2500 foot reels.

Features

Conductors

- THHN: stranded, uncoated copper conductors per ASTM-B3, ASTM-B787 and ASTM-B8
- MTW: bare, annealed copper per ASTM-B3, -B8 and -B787

Insulation

Color-coded, Polyvinyl Chloride (PVC) heat- and moisture-resistant, flame-retardant compound per UL 1063 and UL 83

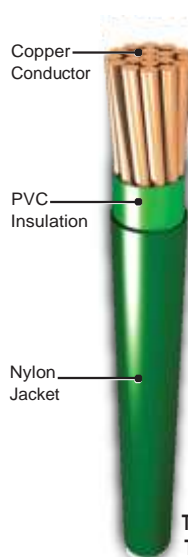
Jacket

THHN wire has a tough, polyamide, Nylon outer covering per UL 1063 and UL 83. Slick Nylon outer jacket for easy pulling

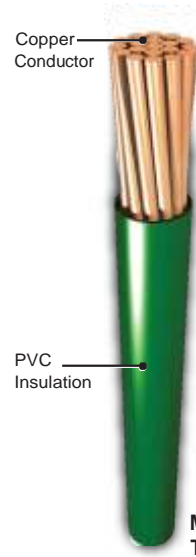
Ratings

VW-1 rated 14 AWG - 4 AWG
6 AWG and larger is rated for sunlight resistance in all colors All sizes are rated "gasoline and oil resistant II"

Please Note: Our prices on wire are closely tied to the market price for copper. This allows us to offer the best savings possible if conditions are favorable; however, it also means that our prices may increase if market conditions warrant.



THHN Type



MTW Type

Wire – THHN Type



Company Information

Terminal Blocks

Power Distribution Blocks

Wiring Accessories

ZIPLink Connection System

Multi-wire Connectors

Sensor Cables and Connectors

M12 Junction Blocks

Panel Interface Connectors

Wiring Duct

Cable Ties

Wire

Flexible Cord

Multi-conductor Flex Cable

Data Cables

Wire Management Products

Power Supplies

DC Converters

Transformers and Filters

Circuit Protection

Tools

Test Equipment

Enclosures

Enclosure Climate Control

Safety: Electrical Components

Safety: Protective Wear

Terms and Conditions

Type THHN Wire Specifications											
Size (AWG or kcmil)	Number of Strands	Cross-sectional Area (mm ²)	Insulation Thickness (inches)		Overall Outside Diameter		Allowable Ampacities*			Approximate Weight (lbs) 500'/2500'	Standard Packaging spool/reel
			PVC	Nylon	(inches)	(mm)	60°C	75°C	90°C		
14	19	6.258	0.015	0.004	0.109	2.77	15	15	15	7.8/42.2	500' or 2500'. Some colors not offered in 2500' reel.
12	19	8.581	0.015	0.004	0.127	3.23	20	20	20	11.7/61.4	
10	19	13.61	0.020	0.004	0.160	4.07	30	30	30	18.7	500'
8	19	23.61	0.030	0.005	0.212	5.39	40	50	55	31.4	
6	19	32.71	0.030	0.005	0.248	6.30	55	65	75	48.5	
4	19	53.16	0.040	0.006	0.317	8.06	70	85	95	75.4	

**Note: Allowable ampacity shown above is per the 2005 National Electrical Code. The above data is approximate and subject to normal manufacturing tolerances.*

Type THHN Wire										
Part Number	Color	Gauge	Description	Spool/Reel Length	Approx. Weight	Price				
THHN14BK	Black	14 AWG	Type THHN copper wire, 19 strands, 600 Volts	500'	7.8lbs.	\$62.00				
THHN14WH	White					\$62.00				
THHN14RD	Red					\$62.00				
THHN14BL	Blue					\$62.00				
THHN14GN	Green					\$62.00				
THHN14YL	Yellow					\$62.00				
THHN14OR	Orange					\$62.00				
THHN14BN	Brown					\$62.00				
THHN14PL	Purple					\$62.00				
THHN14GY	Gray					\$62.00				
THHN14GYL	Green/Yellow stripe					\$62.00				
THHN14BW	Blue/White stripe					\$62.00				
THHN12BK	Black	12 AWG	Type THHN copper wire, 19 strands, 600 Volts	500'	11.7 lbs	\$92.00				
THHN12WH	White					\$92.00				
THHN12RD	Red					\$92.00				
THHN12BL	Blue					\$92.00				
THHN12GN	Green					\$92.00				
THHN12YL	Yellow					\$92.00				
THHN12OR	Orange					\$92.00				
THHN12BN	Brown					\$92.00				
THHN12GY	Gray					\$92.00				
THHN12GYL	Green/Yellow stripe					\$92.00				
THHN10BK	Black					10 AWG	Type THHN copper wire, 19 strands, 600 Volts	500'	18.7 lbs	\$142.00
THHN10WH	White									\$142.00
THHN10GN	Green	\$142.00								
THHN10YL	Yellow	\$142.00								
THHN10OR	Orange	\$142.00								
THHN10BN	Brown	\$142.00								
THHN10GYL	Green/Yellow stripe	\$142.00								
THHN8BK	Black	8 AWG	Type THHN copper wire, 19 strands, 600 Volts	500'	31.4lbs					\$239.00
THHN8GN	Green					\$239.00				
THHN8GYL	Green/Yellow stripe					\$239.00				
THHN6BK	Black	6 AWG	Type THHN copper wire, 19 strands, 600 Volts	500'	48.5 lbs	\$363.00				
THHN4BK	Black	4 AWG	Type THHN copper wire, 19 strands, 600 Volts	500'	75.4 lbs	\$659.00				

Book 3 (14.1)

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data for each type of product indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. 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:
 - 1. Burndy; Part of Hubbell Electrical Systems.

2.3 GROUNDING MATERIALS

- A. Conductors: Solid for No. 8 AWG and smaller; stranded for No. 6 AWG and larger unless otherwise indicated.
 - 1. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable code or authorities having jurisdiction.
 - 2. Bare, Solid-Copper Conductors: Comply with ASTM B 3.
 - 3. Bare, Stranded-Copper Conductors: Comply with ASTM B 8.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.
- B. Pipe and Equipment Grounding-Conductor Terminations: Bolted.
- C. Underground Connections: Welded.
- D. Connections to Structural Steel: Bolted.
- E. Install grounding conductors routed along shortest and straightest paths possible unless otherwise indicated or required by code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- F. Install ground rods driven into ground until tops are 2 inches below final grade or 4 inches above finished floor slab unless otherwise indicated.
- G. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape.
- H. Make connections without exposing steel or damaging coating if any.
- I. Install bonding straps and jumpers in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
- J. Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
- K. Bond to equipment mounted on vibration isolation hangers and supports so vibration is not transmitted to rigidly mounted equipment.
- L. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding-conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- M. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.

1. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
2. Perform tests by fall-of-potential method according to IEEE 81.
3. Report measured ground resistances that exceed 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END

OF

SECTION

26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Product Data for steel and nonmetallic slotted support systems.
2. Shop Drawings signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents. The rated strength of supports are to be adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

B. Comply with NFPA 70.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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. GS Metals Corp.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least one surface.

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. Fabco Plastics Wholesale Limited.

- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings.
- E. Mounting, Anchoring, and Attachment Components:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. 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:
 - 1) MKT Fastening, LLC.
 - 2) Simpson Strong-Tie Co., Inc.
 - 2. Mechanical-Expansion Anchors: Insert-wedge type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. 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:
 - 1) ITW Ramset/Red Head; Illinois Tool Works, Inc.
 - 2) MKT Fastening, LLC.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Separate dissimilar metals and metal products from contact with wood or cementitious materials by painting each metal surface in area of contact with a bituminous coating or by other permanent separation.

- C. Raceway Support Methods: In addition to methods described in NECA 1 and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- D. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.
- E. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- F. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. To Steel: Welded, threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 6. To Light Steel: Sheet metal screws.
 - 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount on slotted-channel racks attached to substrate.
- G. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.2 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Shop Drawings for custom enclosures and cabinets.
- B. Seismic qualification certificates for enclosures, cabinets, conduit racks, and mounting provisions.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Allied Tube & Conduit; a part of Atkore International.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Galvanized Rigid Conduit: Comply with ANSI C80.1 and UL 6.
- D. Intermediate Metal Conduit (IMC): Comply with ANSI C80.6 and UL 1242.
- E. Electrical Metallic Tubing (EMT): Comply with ANSI C80.3 and UL 797.
- F. Flexible Metal Conduit (FMC): Comply with UL 1; zinc-coated steel.
- G. Liquidtight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket, complying with UL 360.
- H. Raceway Fittings: Specifically designed for raceway type used in Project.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. 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:
 - 1. Hoffman; a brand of Pentair Equipment Protection.
 - 2. MonoSystems, Inc.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 Type 3R Type 4 unless otherwise indicated, and sized according to NFPA 70.

1. Fittings: Specifically designed for raceway type used in Project.
2. Covers: [**Hinged type**] [**Screw-cover type**] unless otherwise indicated.
3. Finish: Manufacturer's standard enamel finish.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. **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:
1. [Erickson Electrical Equipment Company](#).
 2. [Hubbell Incorporated](#).
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Outdoor Raceways Applications:
1. Exposed or Concealed: IMC.
 2. Underground, Single Run: RNC.
 3. Connection to Vibrating Equipment: LFMC.
 4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.
- B. Indoor Raceways Applications:
1. Exposed or Concealed: EMT.
 2. Connection to Vibrating Equipment: FMC; in wet or damp locations, use LFMC.
 3. Damp or Wet Locations: IMC.
 4. Boxes and Enclosures: Metallic, NEMA 250, Type 1, unless otherwise indicated.
- C. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- E. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch-thick concrete cover.
1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 2. Space raceways laterally to prevent voids in concrete.

3. Install conduit larger than 1-inch trade size, parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- F. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- G. Install pull wires in empty raceways.
- H. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch maximum length of flexible conduit.
- I. Install raceways and cables concealed within finished walls, ceilings, and floors unless otherwise indicated.
- J. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- K. Installation of Hangers and Supports:
1. Comply with NECA 1 and NECA 101 for installation requirements, except as specified in this article.
 2. 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.
 3. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, as permitted in NFPA 70.
 4. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.
 5. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
 6. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods, unless otherwise indicated or required by Code:
 - a. To Wood: Fasten with lag screws or through bolts.
 - b. To New Concrete: Bolt to concrete inserts.
 - c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - d. To Existing Concrete: Expansion anchor fasteners.
 - e. To Steel: Welded, threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

ALLIED E-Z PULL[®] EMT

Page 1 of 2

Quality Electrical Metallic Tubing... With the E-Z Pull[®] interior coating!

Allied E-Z Pull[®] EMT has a special low friction ID coating that greatly improves the slip properties between conduit and wire. E-Z Pull[®] EMT, wire pulls through the conduit smoothly and easily.

Allied E-Z Pull[®] EMT combines strength with ductility, resulting in faster and easier installations. It provides easy bending, cutting and joining while resisting flattening, kinking and splitting, creating smooth, continuous raceways for fast wire pulling.



- E-Z Pull[®] special low friction ID coating
- Patented Flo-Coat[®] triple layer OD protection
- High grade durable & ductile steel for long life
- U.L. listed & meets all applicable standards
- Available in size 1/2 to 4

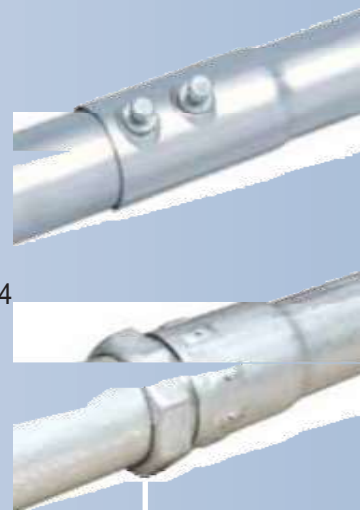
If you require kwik installations... Get Kwik-Fit[®] EMT & Compression EMT!

Innovations from the conduit leaders at Allied.

Kwik-Fit[®] EMT has an integral steel set-screw coupling formed on one end of each length of EMT. Trade sizes 2-4

Kwik-Fit[®] Compression EMT has an integral steel compression fitting formed on one end of each length of EMT. Trade sizes 2 1/2-4

Kwik products are U.L. listed which ensures an all steel system Both conduit and coupling for excellent strength and ground return, as well as economy. Contact Allied for details.



Contact your local Allied Tube & Conduit electrical distributor, or visit www.alliedeg.com.

ALLIED E-Z PULL[®] EMT



We're using 1/2 and 1 in our electrical plan.

E-Z Pull[®] EMT Specifications

Manufactured for Long Life

Allied EMT is precision manufactured from high grade mild strip steel for exceptional durability and long-lasting life. Allied EMT is hot galvanized using Allied's patented in-line Flo-Coat[®] process. This process combines zinc, a conversion coating, and a clear organic polymer top-coat to form a triple layer of protection against corrosion and abrasion.

EMI SHIELDING

Allied EMT greatly reduces electromagnetic fields, effectively shielding computers and sensitive electronic equipment from the electromagnetic interference caused by power distribution systems.

FULL CODES & STANDARDS COMPLIANCE

Allied EMT is listed to Underwriters Laboratories Safety Standard UL 797 and meets ANSI C80.3, which have been adopted as federal specifications in lieu of WWC 563. EMT is recognized as an equipment grounding conductor by NEC Section 250-118. Documentation for compliance with NEC Article 250 is also available in the **GEMI** (Grounding and Electro-Magnetic Interference) analysis software and related research studies found at the www.alliedeg.com website.

Installation of EMT shall be in accordance with the National Electrical Code and the UL listing information. Allied EMT is listed in category FJMX. Master bundles conform to NEMA Standard RN2.

SPECIFICATION DATA

To specify Allied EMT, include the following: Electrical Metallic Tubing shall be equal to that manufactured by Allied Tube & Conduit Corporation. EMT shall be hot galvanized steel O.D. with an organic corrosion resistant I.D. coating and shall be produced in accordance with U.L. Safety Standard #797 and ANSI C80.3 and shall be listed by a nationally recognized testing laboratory with follow-up service.

Where **Kwik-Fit[®]** EMT is used it shall also meet U.L. Safety Standard #514-B. Note that these U.L. and ANSI standards have been adopted by the federal government and separate military specifications no longer exist.

- Allied Tube & Conduit - Electrical
16100 S. Lathrop Avenue, Harvey, IL 60426
Tel. 800-882-5543 Fax 708-339-0615



Weights and Dimensions for Electrical Metallic Tubing

Trade Size Designator		Approx. Wt. Per 100 Ft. (30.5M)		Nominal Outside Diameter ¹		Nominal Wall Thickness		Quantity In Master Bundle	
U.S.	Metric	lb.	kg.	in.	mm	in.	mm	ft.	m
1/2	16	30	13.6	0.706	17.9	0.042	1.07	7000	2135.0
3/4	21	46	20.9	0.922	23.4	0.049	1.25	5000	1525.0
1	27	67	30.4	1.163	29.5	0.057	1.45	3000	915.0
1-1/4	35	101	45.8	1.510	38.4	0.065	1.65	2000	610.0
1-1/2	41	116	52.6	1.740	44.2	0.065	1.65	1500	457.5
2	53	148	67.1	2.197	55.8	0.065	1.65	1200	366.0
2-1/2	63	216	98.0	2.875	73.0	0.072	1.83	610	186.1
3	78	263	119.3	3.500	88.9	0.072	1.83	510	155.6
3-1/2	91	249	158.3	4.000	101.6	0.083	2.11	370	112.9
4	103	393	178.2	4.500	114.3	0.083	2.11	300	91.5

¹Outside diameter tolerances:

+/- .005 in. (.13mm) for trade sizes 1/2 (16mm) through 2 (53mm);
 +/- .010 in. (.25mm) for trade sizes 2-1/2 (63mm);
 +/- .015 in. (.38mm) for trade size 3 (78mm);
 +/- .020 in. (.51mm) for trade sizes 3-1/2 (91mm) and 4 (103mm).

NOTE: Length = 10 ft. (3.05m) with a tolerance of ± .25 in. (6.35 mm)

Weights and Dimensions for Kwik-Fit EMT

Trade Size Designator		Approx. Wt. Per 100 Ft. (30.5M)		Nominal Outside Diameter ¹		Nominal Wall Thickness		Quantity In Master Bundle	
U.S.	Metric	lb.	kg.	in.	mm	in.	mm	ft.	m
2	53	148	67.1	2.197	55.8	0.065	1.65	500	152.4
2-1/2	63	216	98.0	2.875	73.0	0.072	1.83	350	106.8
3	78	263	119.3	3.500	88.9	0.072	1.83	300	91.5
3-1/2	91	349	158.3	4.000	101.6	0.083	2.11	250	76.3
4	103	393	178.2	4.500	114.3	0.083	2.11	250	76.3

¹Outside diameter tolerances:

+/- .005 in. (.13mm) for trade size 2 (53mm);
 +/- .010 in. (.25mm) for trade size 2-1/2 (63mm);
 +/- .015 in. (.38mm) for trade size 3 (78mm);
 +/- .020 in. (.51mm) for trade sizes 3-1/2 (91mm) and 4 (103mm).

NOTE: Length = 10 ft. (3.05m) with a tolerance of ± .25 in. (6.35 mm)

For more information, contact Allied at **(800) 882-5543**,
 or visit our website at www.alliedeg.com

ALLIED ELECTRICAL™ Group

- Allied Tube & Conduit • AFC Cable Systems[®] • Power-Strut[®] Metal & Fiberglass Framing • Cope[®] Cable Tray

Kwik-Fit, E-Z Pull, Allied Tube & Conduit, AFC Cable Systems, Power-Strut, Cope, and Allied Electrical Group are trademarks or registered trademarks of Tyco and/or its affiliates in the United States and in other countries. All other brand names, product names, or trademarks belong to their respective owners.

Junction Boxes

Type 3 Screw Cover - Gasketed

Data Sheet

Type 1, 3, & 3R Enclosures



Application

- Used as wiring boxes, junction and pull boxes
- Intended for indoor or outdoor use
- Protects against windblown dust, rain, sleet, external ice formation and dripping non-corrosive liquids

Standards

- UL 508 listed, Type 3 and Type 12
- Conforms to NEMA standard for Type 3 and Type 12

Finish

- Bright galvanized finish
- Zinc-rich coating over all external welds

Accessories

- Ground lug kit
- See Accessories section

Construction

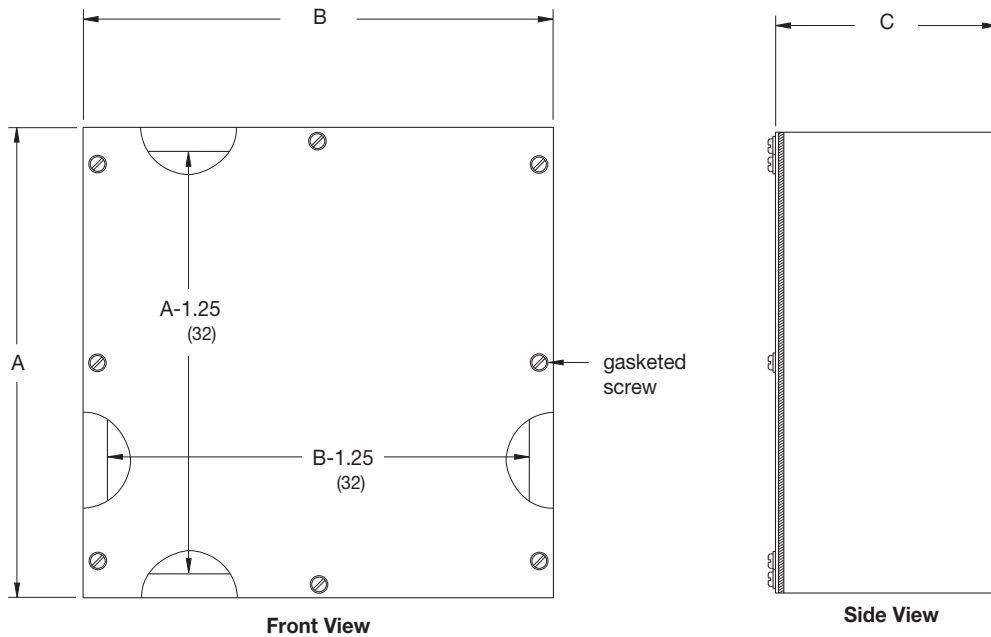
- Enclosure and cover are fabricated from code gauge G-90 grade galvanized steel, (see table, page 61)
- All continuous welded seams are finished smooth
- Enclosure standard without knockouts
- Cover is attached with gasketed screws
- Cover has a fixed, oil and water resistant gasket
- #10-32 weldnut is furnished for optional ground lug kit

Discount Schedule: A2

Subclass: ARO

Notes: Cooper B-Line can provide special sizes, finishes and other modifications. Consult the factory for your special requirements.

Junction Boxes Type 3 Screw Cover - Gasketed Illustration Sheet and Catalog Number



Type 1, 3, & 3R Enclosures

Enclosure Catalog Number	Enclosure Size Height x Width x Depth A x B x C		Body Gauge	Cover Gauge
	in.	mm		
444 SCG	4.00 x 4.00 x 4.00	102 x 102 x 102	14	14
664 SCG	6.00 x 6.00 x 4.00	152 x 152 x 102	14	14
864 SCG	8.00 x 6.00 x 4.00	203 x 152 x 102	14	12
884 SCG	8.00 x 8.00 x 4.00	203 x 203 x 102	14	12
1084 SCG	10.00 x 8.00 x 4.00	254 x 203 x 102	14	12
10104 SCG	10.00 x 10.00 x 4.00	254 x 254 x 102	14	12
12124 SCG	12.00 x 12.00 x 4.00	305 x 305 x 102	14	12
666 SCG	6.00 x 6.00 x 6.00	152 x 152 x 152	14	12
886 SCG	8.00 x 8.00 x 6.00	203 x 203 x 152	14	12
10106 SCG	10.00 x 10.00 x 6.00	254 x 254 x 152	14	12
12106 SCG	12.00 x 10.00 x 6.00	305 x 254 x 152	14	12
12126 SCG	12.00 x 12.00 x 6.00	305 x 305 x 152	14	12
16126 SCG	16.00 x 12.00 x 6.00	406 x 305 x 152	14	12
16166 SCG	16.00 x 16.00 x 6.00	406 x 406 x 152	14	10
18186 SCG	18.00 x 18.00 x 6.00	457 x 457 x 152	14	10
20166 SCG	20.00 x 16.00 x 6.00	508 x 406 x 152	14	10
24246 SCG	24.00 x 24.00 x 6.00	610 x 610 x 152	14	10
12128 SCG	12.00 x 12.00 x 8.00	305 x 305 x 203	14	10
20208 SCG	20.00 x 20.00 x 8.00	508 x 508 x 203	14	10
24208 SCG	24.00 x 20.00 x 8.00	610 x 508 x 203	14	10
24248 SCG	24.00 x 24.00 x 8.00	610 x 610 x 203	14	10
242412 SCG	24.00 x 24.00 x 12.00	610 x 610 x 305	14	10
303012 SCG	30.00 x 30.00 x 12.00	762 x 762 x 305	14	10
363612 SCG	36.00 x 36.00 x 12.00	914 x 914 x 305	14	10

Notes: Dimensions are in inches. Millimeters shown are for reference only. Data subject to change without notice.

Selection and application guide



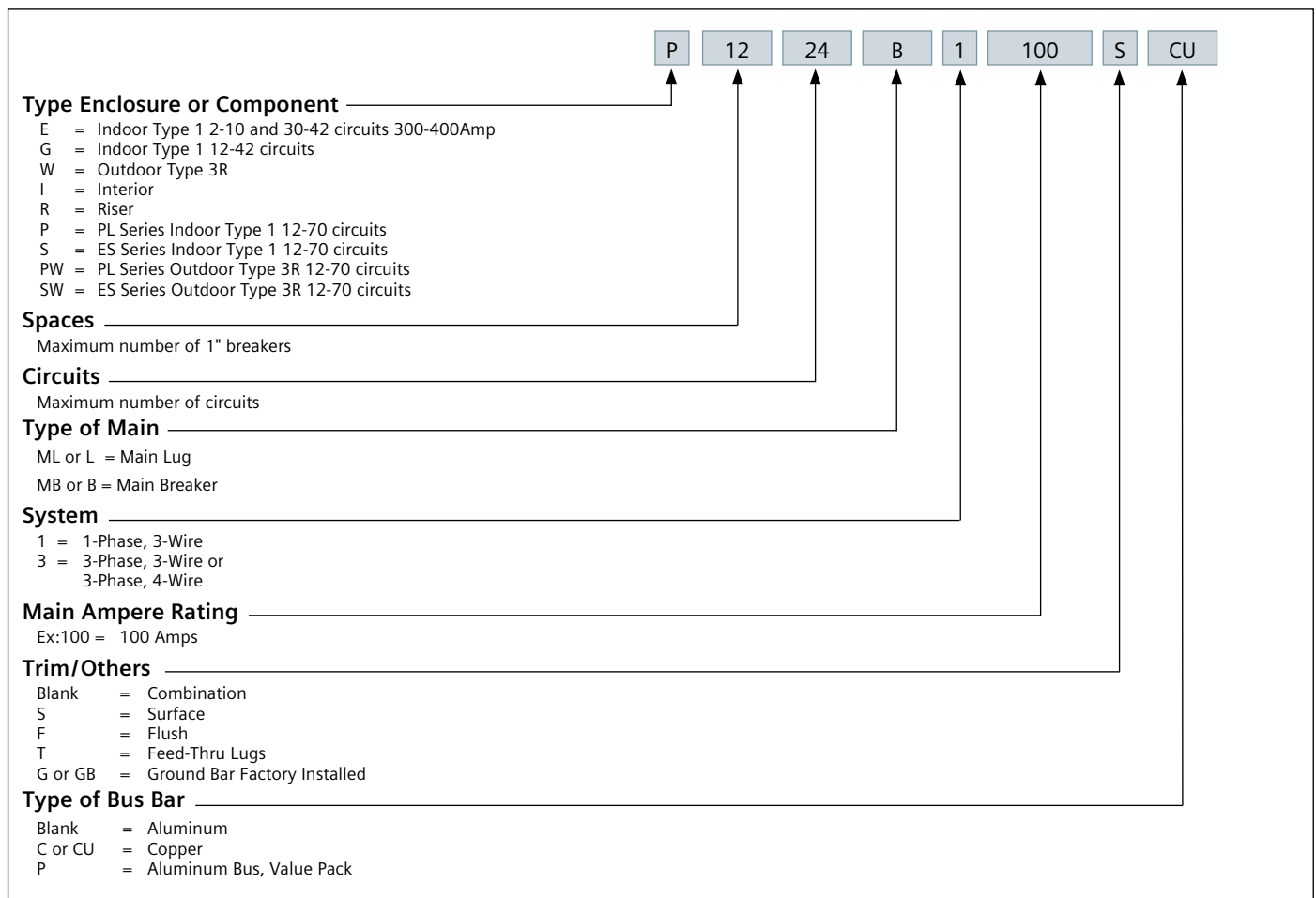
Siemens PL and ES Series Load Centers™

www.usa.siemens.com/loadcenters

SIEMENS

Load Centers

Catalog Numbering System



Products Shown In Sections 1 of this Speedfax Meet or Exceed the Following Standards.

- UL50 — Electric Cabinets and Boxes
- UL67 — Electric Panelboards
- UL486 — Wire Connectors
- UL489 — Molded-Case Circuit Breakers
- UL869 — Service Equipment
- UL943 — Ground Fault interrupters (Class A — Personnel Protection)
- Federal Specification W-P-115b — Panel Power Distribution
- Federal Specification W-C-375B — Circuit Breakers
- NEC
- NEMA 250

Underwriters' Laboratories, Inc. Reference File Numbers:

- Series Connected Circuit Breaker
Information is recognized by UL under file #E10848(N)
- Load Centers Listed by UL under file #E10703
- Load Centers UL recognized components found under file #E10703, Volume 6 and 7. (Also referenced under the recognized components directory — section QEUY2)
- EQ Circuit Breakers are Listed by UL under file #E82615

Load Centers

Siemens PL Series and ES Series Load Centers Overview

PL Series:

- Convertible
- Invertible
- Insta-wire neutrals & grounds
- Ground bars included
- Copper busbars
- Dual neutrals on all configurations
- Carton-in-carton packaging
- Lifetime warranty

We are using the PL series



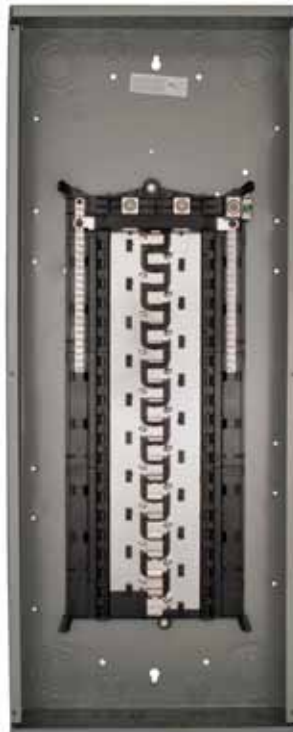
PL Series 1-phase



PL Series 3-phase

ES Series:

- Invertible
- Insta-wire neutrals & grounds
- Aluminum busbars
- Single sided neutral on 24 circuits and below
- Single piece carton packaging
- 10 year warranty



ES Series 1-phase



ES Series 3-phase

PL Series Load Centers

Features

Invertible for bottom feed application.

All devices are provided with 2 factory installed ground bars.

Combination head screw on the neutrals, ground, trim, upper pan, and bond screw provide installation flexibility.

A rigid, sturdy base pan provides the ruggedness required for the most harsh applications.

Copper Bus

All devices convertible from main lug to main breaker and vice versa.

Mounting tabs on the trim hold it in place on the load center, freeing up both hands to drive the trim screws.

The pre-positioned bond screw eliminates bond strap/screw assemblies, and reduces the risk of losing components in the field.

The patented INSTA-WIRE™ neutral/ground system allows for faster installation because screws are backed out, ready for wire insertion. The visible neutral and grounds system aids in the insertion of conductors.

The outdoor enclosure has a slide hinge door for the easiest installation and can be removed by backing out only one screw.

PL Series Load Centers ship with trims packaged separately.

PL Series Load Centers

Product Offering

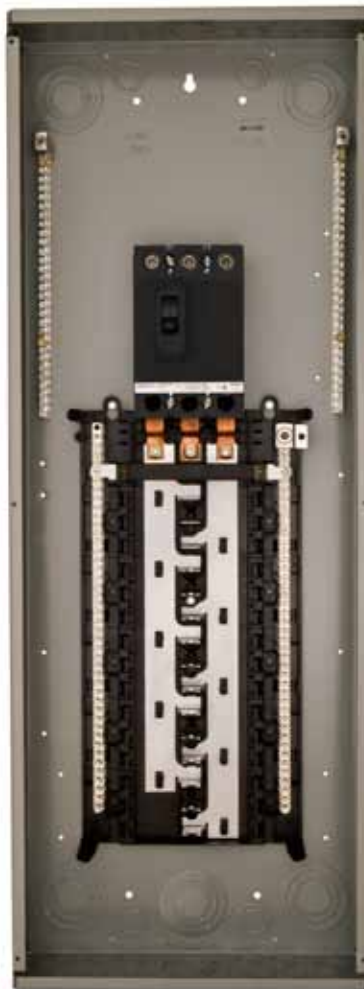
The PL Series Load Center product line provides a wide array of variation to meet any application need.

The following offering is available in the PL Series product line:

- 12-70 Circuits/Spaces
- Indoor and Outdoor enclosures
- 100 to 225 Amp
- Main Lug and Main Breakers
- Un-assembled offering in 3-phase



PL Series
1-phase Main Lug



PL Series
3-phase Main Breaker



Un-assembled 3-phase

PL Series 1-Phase Main Lug & Main Breaker Load Centers

1-phase, 3-wire SN, 120/240 Volts AC

Main Breaker/Convertible Load Centers^①

12-70 Circuits / 100-225 Amperes

Copper Bus^⑦

60/75°C Rated 22,000A IR^②

Branch Circuits			Indoor Enclosure – NEMA Type 1		Outdoor Enclosure – NEMA Type 3R	
Amp Rating	No. of Spaces	No. of Circuits	Catalog Number	Enclosure Height (inches) ^③	Catalog Number	Enclosure Height (inches) ^④
100	12	24	P1224B1100CU	18	PW1224B1100CU	21
100	16	24	P1624B1100CU	21	PW1624B1100CU	23
100	20	20	P2020B1100CU	24	PW2020B1100CU	27
100	20	24	P2024B1100CU	24	—	—
100	24	24	P2424B1100CU	24	—	—
100	30	30	P3030B1100CU	30	—	—
100	30	40	—	—	PW3040B1100CU NEW!	35
125	30	30	P3030B1125CU	30	PW3040B1125CU NEW!	35
150	20	30	P2030B1150CU	24	—	—
150	20	30	—	—	PW2030B1150CU NEW!	27
150	30	30	P3030B1150CU	30	—	—
150	30	40	—	—	PW3040B1150CU NEW!	35
200	20	40	P2040B1200CU	30	PW2040B1200CU	27
200	30	40	P3040B1200CU	36	PW3040B1200CU	35
200	30	40	P3040B1200 ^⑤	36	—	—
200	40	40	P4040B1200CU	36	PW4040B1200CU	38
200	40	40	P4040B1200 ^⑤	36	—	—
200	54	70	P5470B1200CU NEW!	44	—	—
225	42	60	P4260B1225CU	39	PW4260B1225CU	42
225	54	70	P5470B1225CU	44	—	—

Single phase factory installed 22kA IR main circuit breaker offers 22/10kA IR series combination rating when using 10kA type QP, QT, QPF, QE, QN, and QAF/QAFC branch breakers.

Main Lug/Convertible Load Centers^⑥

12-70 Circuits / 125-225 Amperes

Copper Bus^⑦

60/75° Rated 100,000A IR

Branch Circuits			Indoor Enclosure - NEMA Type 1		Outdoor Enclosure - NEMA Type 3R	
Amp Rating	No. of Spaces	No. of Circuits	Catalog Number	Enclosure Height (inches) ^③	Catalog Number	Enclosure Height (inches) ^④
125	12	12	P1212L1125CU ^⑤	18	PW1212L1125CU ^⑤	21
125	12	24	P1224L1125CU ^⑤	18	PW1224L1125CU ^⑤	21
125	16	24	P1624L1125CU	21	PW1624L1125CU	23
125	20	20	P2020L1125CU	24	—	—
125	20	24	P2024L1125CU	24	—	—
125	24	40	P2440L1125CU	24	—	—
125	30	40	P3040L1125CU	30	PW3040L1125CU	35
125	40	40	P4040L1125CU	36	—	—
150	20	30	P2030L1150CU	24	PW2030L1150CU	27
200	12	24	P1224L1200CU	24	PW1224L1200CU ^⑤	23
200	20	40	P2040L1200CU	30	PW2040L1200CU	27
200	24	40	P2440L1200CU	30	—	—
200	30	30	P3030L1200CU	36	—	—
200	30	40	P3040L1200CU	36	PW3040L1200CU	35
200	30	40	P3040L1200 ^⑤	36	—	—
200	30	54	P3054L1200CU	36	PW3054L1200CU	35
200	40	40	P4040L1200CU	36	PW4040L1200CU	38
200	40	40	P4040L1200 ^⑤	36	—	—
225	12	24	—	—	PW1224L1225CU	23
225	42	60	P4260L1225CU	39	PW4260L1225CU	42
225	54	70	P5470L1225CU	44	—	—

① Suitable for use as service equipment.

② May be installed on higher rated systems when protected by a circuit breaker with a higher AIR rating.

③ Indoor enclosures are 14 1/4" wide by 3 7/8" deep.

④ Outdoor enclosures are 14 1/2" wide by 4 1/4" deep.

⑤ Suitable for use as service entrance equipment when not more than six main disconnecting means are provided. See article 230.71 of the NEC[®].

⑥ 125A load centers will accept MBK100A and MBK125A. 150A load centers will accept MBK150A. 200A load centers will accept MBK200A and MBK150A. 225A load centers will accept MBK225A, MBK200A, MBK150A.

⑦ Copper bus load centers are recommended for those applications where the environment may be severe (i.e. far and coastal areas).

⑧ Includes all PL Series features with aluminum bussing.

PL Series Single Phase Special Application Load Centers

1-phase, 3-wire SN, 120/240 Volts AC

Split Ground Series Main Lug Convertible Load Centers **Copper Bus**
12-60 Circuits / 125-200 Amperes **60/75° Rated, 100,000A IR**

Branch Circuits			Indoor Enclosure – NEMA Type 1	
Amp Rating	No. of Spaces	No. of Circuits	Catalog Number	Enclosure Height (inches) ^②
125	12	24	P1224L1125CUSG	18
125	16	24	P1624L1125CUSG	21
125	20	30	P2030L1125CUSG	24
125	24	30	P2430L1125CUSG	24
150	20	30	P2030L1150CUSG	24
200	30	40	P3040L1200CUSG	36
200	30	40	P3040L1200SG ^①	36
200	40	40	P4040L1200CUSG	36
200	40	40	P4040L1200SG ^①	36
225	40	60	P4260L1225CUSG	39



Split Ground Load Centers have factory installed 100% neutral with factory bonded 75% ground. No neutral tie strap.

Split Ground Series Main Breaker Convertible Load Centers **Copper Bus**
40 Circuits / 200 Amperes **60/75° Rated, 22,000A IR^③**

Branch Circuits			Indoor Enclosure – NEMA Type 1	
Amp Rating	No. of Spaces	No. of Circuits	Catalog Number	Enclosure Height (inches) ^②
200	40	40	P4040B1200CUSG	36

Outdoor Trailer Panels **Copper Bus**
16 Circuits / 200 Amperes **60/75° Rated, 22,000A IR**

Amp Rating	No. of Spaces	No. of Circuits	Catalog Number	Main Breaker	Enclosure Height (inches) ^④
200	8	16	PW0816L1200TC	MBK150A or MBK200A Field Installed	23
200	8	16	PW0816B1200TC	MBK200A Factory Installed	23

Load Centers with White Trim^⑤ **Copper or Aluminum Bus^⑦**
40 Circuits / 200 Amperes **60/75° Rated 22,000A IR**

Branch Circuits			Indoor Enclosure - NEMA Type 1		
Amp Rating	Main Lug / Main Breaker	No. of Spaces	No. of Circuits	Catalog Number	Enclosure Height (inches) ^②
200	Main Breaker	30	40	P3040B1200W NEW!	36
200	Main Breaker	40	40	P4040B1200W NEW!	36
200	Main Breaker	40	40	P4040B1200CUW NEW!	36

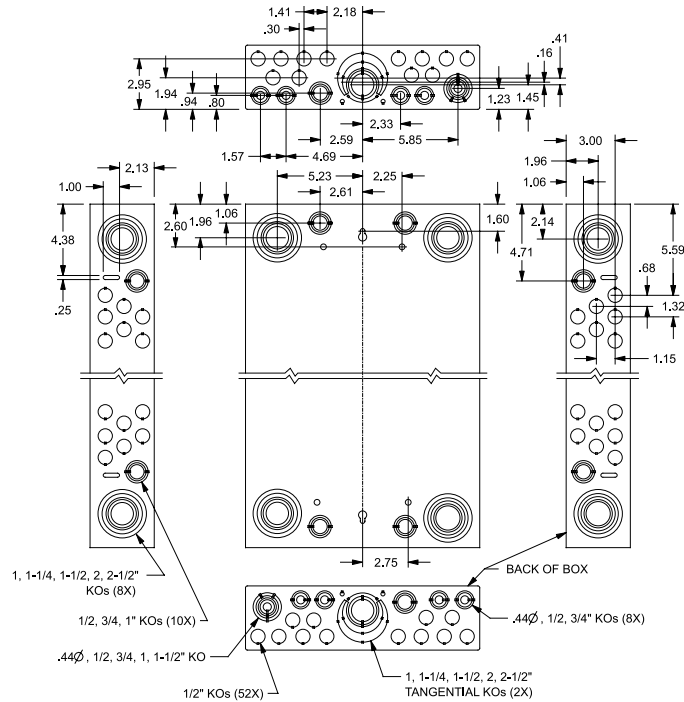
① Includes all PL Series features with aluminum bussing.
 ② Indoor enclosures are 14 1/4" wide by 3 7/8" deep.

③ May be installed on higher rated systems when protected by a circuit breaker with a higher AIR rating.
 ④ Outdoor enclosures are 14 1/2" wide by 4 1/4" deep.
 ⑤ Main lug panel rated 100,000A IR.

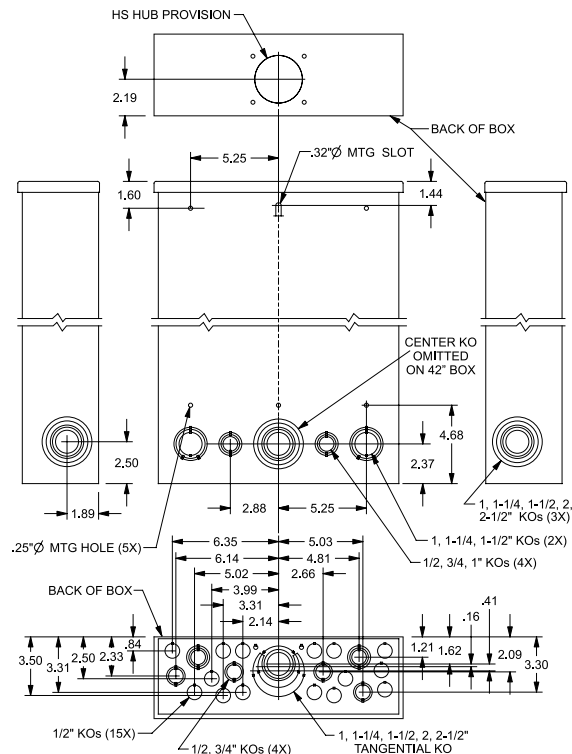
⑥ Load centers with white trim have increased lead time of 3-4 weeks. Sold in pallet quantities only.
 ⑦ Load centers with CUW suffix indicates copper bus with white trim. Load centers with W suffix only indicates aluminum bus with white trim.

Load Centers

1-Phase Indoor and 1-Phase & 3-Phase Outdoor Enclosures—Knockout Diagrams



**ES, PL, and Generator Ready
 1 Phase Load Centers
 Indoor**



**ES, PL, and Generator Ready
 1 and 3 Phase Load Centers
 Outdoor**

Siemens Industry, Inc.
5400 Triangle Parkway
Norcross, GA 30092

1-800-241-4453
info.us@siemens.com

www.usa.siemens.com/loadcenters

Subject to change without prior notice
Order No.: RPSA-ESPLS-0512
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The information provided in this brochure contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

All product designations may be trademarks or product names of Siemens AG or supplier companies whose use by third parties for their own purposes could violate the rights of the owners.

SECTION 26 27 13 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data and Shop Drawings.
- B. Coordinate with utility companies for services and components they furnish.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Meters will be furnished by utility company.
- B. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- C. Meter Sockets: Comply with requirements of electrical power utility company.
- D. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.
- E. Modular Meter Center: Factory-coordinated assembly of a main service terminal box with lugs only disconnect device, wireways, tenant meter socket modules, and tenant feeder circuit breakers arranged in adjacent vertical sections. Assembly shall be complete with interconnecting buses and other features as specified below:
 - 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. General Electric Company; GE Energy Management - Electrical Distribution.
 - b. Siemens Energy.
 - 2. Comply with requirements of utility company for meter center.
 - 3. Housing: NEMA 250, Type 3SX enclosure.
 - 4. Minimum Short-Circuit Rating: 42,000 A symmetrical at rated voltage.
 - 5. Main Disconnect Device: Circuit breaker, series-combination rated for use with downstream feeder and branch circuit breakers.
 - 6. Surge Protective Device: Integrally mounted, complying with UL 1449 Type 1.

7. Tenant Feeder Circuit Breakers: Series-combination-rated molded-case units, rated to protect circuit breakers in downstream tenant and to house loadcenters and panelboards that have 10,000-A interrupting capacity.
 - a. Identification: Provide legend identifying tenant's address.
 - b. Physical Protection: Tamper resistant, with hasp for padlock.
8. Meter Socket: Rating coordinated with indicated tenant feeder circuit rating.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads, and extend grounding connections as required by utility company.
- C. Install modular meter center according to NECA 400 switchboard installation requirements.

END

OF

SECTION

26 27 13

26 27 16 WEATHERPROOF OUTLET ENCLOSURE



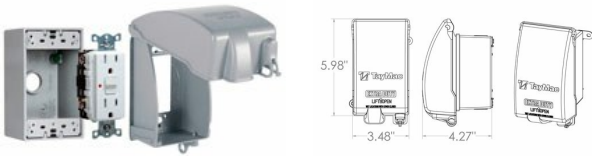
RACO TAYMAC BELL

www.hubbell.com

METALLIC FLIP AND METAL IN-USE COVERS

Complete Metal While-In-Use Cover Kits- Extra Duty®

C09.1



Catalog #: MKG4280S

APPLICATIONS

Flip covers designed for use whenever weatherproof protection is required for an outdoor receptacle. While-In-Use covers designed for use whenever weatherproof protection is required while a receptacle is in use.

PRODUCT FEATURES

- High quality Hubbell WRTR device included
- Heavy duty die-cast metal construction
- Includes attached gasket and mounting hardware
- Combo includes receptacle and cover / Kit includes box, receptacle and cover
- Lockable tab
- Premium Powder Coat

UL LISTED

File E212332

NEMA

3R Rated

NEC

2014 Compliant (article 406.9A & B) Extra Duty Rated

US PATENTS

D 569,811; 6,420,653

GENERAL PRODUCT INFORMATION

Color: Gray

CONFIGURATION

Gangs: 1

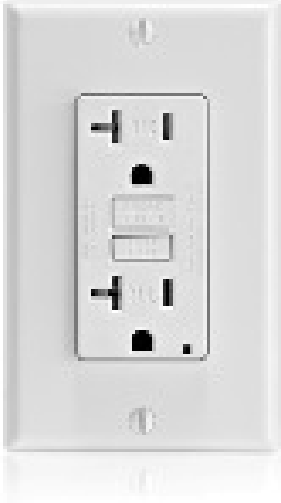
PRODUCT MEASUREMENTS

Depth: 3-1/2 in.
Wt. Ea. (Lbs.): 2.15

PACKAGING

Package Type: Shrink
Std. Pkg.: 4
Product UPC-A Labeled: Yes
Weight (Lbs. Per/C): 215
Ship Carton Length (in.): 25.75
Ship Carton Width (in.): 7.13
Ship Carton Height (in.): 12.13
Ctn Weight (Lbs.): 8.6
Pallet Qty: 160
UPC Number: 092326113120
I2of5: 30092326113121

X7899-W



UPC Code: 07847751382

Country of Origin: China

NEMA: 5-20R



GFCI Receptacles

Brand Features

Slim is in. New SmartlockPro Slim GFCIs Install Easily Industry-leading quality, professional grade lockout action, and the slimmest profile on the market make SmartlockPro Slim GFCIs the smartest choice in ground fault circuit interrupter protection. Faster and easier to install in any wallbox because depth is reduced, the slim GFCIs flush mount to the wall with minimal protrusion for a sleek, finished look. Enhanced features include external back wiring for positive indication the wire is properly seated, exceptional resistance to wire pullout and the ability to withstand high torque. Tamper-Resistant to meet 2008 NEC Requirements for new or renovated residential construction.

Item Description

20 Amp, 125 Volt Receptacle/Outlet, 20 Amp Feed-Through, Tamper-Resistant, SmartlockPro Slim GFCI, Monochromatic, back and side wired, nylon wallplate/faceplate, screws and self grounding clip included - White

Technical Information

AC Horsepower Ratings

At Rated Voltage: 1 HP

Electrical Specifications

Dielectric Voltage: Withstands 1250VAC per UL 943 and CSA-C22.2 No. 144.1-06

Short Circuit Current Rating: 10KA

Temperature Rise: Max 30C after 100 cycles OL at 150 percent rated current

Environmental Specifications

Flammability: Rated V-2 per UL94

Operating Temperature: -35C to +66C

Material Specifications

Face Material: Thermoplastic

Body Material: Polycarbonate

Line Contacts: Brass Triple-Wipe

Terminal Screws: Plated Steel

Grounding Screw: Plated Steel

Yoke: Zinc-Plated Steel

Clamps: Brass

Notes: w/ Wallplate

Mechanical Specifications

Terminal ID: Brass-Hot, Green-Ground, Silver-Neutral

Terminal Accom.: 14-10 AWG

Product ID: Ratings are permanently marked on device

Product Features

Grounding: Self-Grounding

Feature: Tamper-Resistant

Amperage: 20 Amp

Voltage: 125 Volt

NEMA: 5-20R

Pole: 2

Standards and Certifications

NEMA: WD-6

ANSI: C-73

UL498: Yes

CSA C22.2 No. 42: Yes

NOM: 057

UL 943: File E48380

MIL-SPEC: A-A-55459-SB

Fed Spec WC-596: Yes

CSA-C22.2 No. 144.1-06: File LR-57811

Trip Level: Class A, 5mA plus or minus
1mA

Wire: 3

Termination: Back & Side

Face Material: Thermoplastic

Body Material: Polycarbonate

Color: White

Strap Material: Galvanized Steel

Standards and Certifications: UL/CSA

Fed Spec WC-596: Yes

Warranty: 2-Year Limited

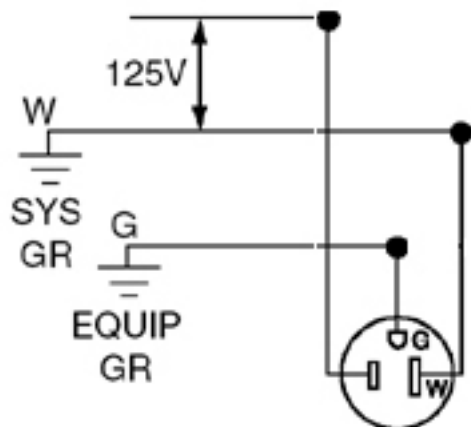
Notes: w/ Wallplate

Grade: Residential

Features and Benefits

- Reduced depth of SmartlockPro® Slim GFCI makes it easier to install in any electrical box, even shallow ones.
- Terminals allow for easy wiring options – back and side wire capable.
- External back wire clamps provide visual indication of proper wire seating.
- Withstands high torque and resists wire pullout.
- Standard brass self-grounding clip.
- Automatically test the GFCI every time the RESET button is pushed in. The GFCI will not reset if the GFCI circuit is not functioning properly.
- By blocking reset of the GFCI if protection has been compromised, SmartlockPro® Slim GFCI reduces the possibility of end-users incorrectly assuming that a reset GFCI outlet is providing ground fault protection when it actually is not.
- A line-load reversal diagnostic feature is provided which prevents the GFCI from being reset and stops power from being fed to the GFCI receptacle face or through to downstream devices. A green LED indicator on the GFCI's face also illuminates to alert the installer to the line-load wiring reversal.
- Trip threshold meets or exceeds UL requirements for tripping time.
- Improved immunity to high-frequency noise reduces nuisance tripping.
- Advanced electronics design provides superior resistance to electrical surges and over-voltages.
- Compatible with all Decora devices and wallplates; available in select Decora colors.
- UL Fed Spec WC-596 rated.

Wiring Diagram



5-15R

SPECIFICATION SUBMITTAL

JOB NAME: <input style="width: 90%;" type="text"/>	CATALOG NUMBERS: <input style="width: 60%;" type="text"/> <input style="width: 35%;" type="text"/>	
JOB NUMBER: <input style="width: 90%;" type="text"/>	<input style="width: 25%;" type="text"/>	<input style="width: 25%;" type="text"/>

Leviton Manufacturing Co., Inc.

201 North Service Road, Melville, NY 11747
 Telephone: 1-800-323-8920 · FAX: 1-800-832-9538 · Tech Line (8:30AM-7:30PM E.S.T. Monday-Friday): 1-800-824-3005

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SmartlockPro® Slim GFCI with Audible Trip Alert



Instant Audible Alert Indicates Power Interruption

GFCI protection is vital to ensure electrical safety in both residential and commercial settings. A power interruption due to a ground fault provides important protection to people but can shut down freezers, sump pumps and other necessary equipment if left undetected. Often, however, GFCIs in garages, basements or large commercial kitchens may be located in an out-of-the-way place such as a back corner or storage area making daily visual checks for tripping unlikely. The new SmartlockPro Slim GFCI with Audible Alert is the smart solution.

When a condition exists causing the SmartlockPro Slim GFCI with Audible Alert to trip, users will be alerted by the sounding of an audible alarm. This audible alert indicates that power has been disconnected from loads plugged into or fed from the GFCI so users can immediately assess the reason and reset the device. The GFCI with Audible Alert offers all the outstanding benefits you expect from SmartlockPro products, including our patented reset/lockout feature. Plus, the slim profile is compact and easy to install in any wallbox, even shallow ones.

- NEC® requirement for garages, basements, commercial kitchens and other critical loads
- Audible alert indicates the device needs to be reset



Features and Benefits

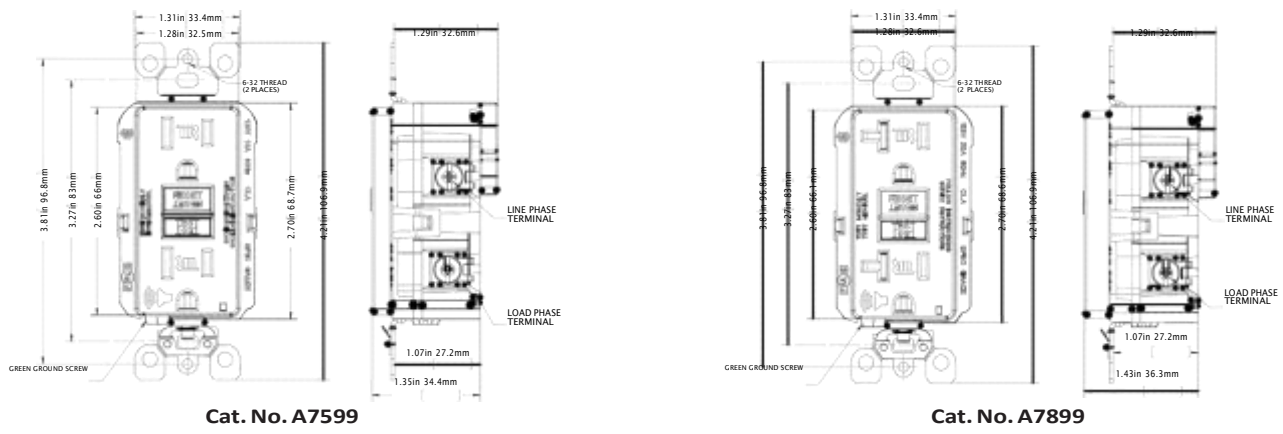
- GFCI**
- Slim design is easy to install in any wallbox
 - External wiring clamps show proper wire seating
 - Standard self-grounding clip
 - Tamper-resistant to meet the latest National Electrical Code® child safety requirements
 - Reset lockout prevents reset if the GFCI is damaged and cannot respond to a ground fault
 - Impact resistant face and body
 - Limited Two-Year Warranty

- Audible Alarm**
- Audible alarm sounds when the GFCI trips, providing an alert that power has been disconnected from load(s) plugged into or fed from the GFCI*
 - Indicator light provides visual status
- *Audible alarm will NOT sound if the circuit breaker has tripped and disconnected power.*

- Agency Standards and Certifications**
- UL Standard 943 Class A (GFCI) and 498 (Receptacle)
 - UL Listed (File #E48380)
 - CSA C22.2-No. 144.1-06 (GFCI) and No. 42 (Receptacle)
 - CSA Listed (File #LR-57811)
 - NOM-003:ANCE
 - Meets Federal Specification WC-596

INDICATOR LIGHT AND AUDIBLE ALERT			
GFCI Status	Light	Audible Alert	Power
GFCI Properly Wired			
Tripped (RESET button out)	On	On	Off
Set (RESET button in)	Off	Off	On
GFCI Miswired (line/load reversed)			
Tripped (RESET button out)	Off	Off	OFF- Review instructions for correct wiring
Set (RESET button in)	n/a - will not reset	n/a - will not reset	

Dimensional Drawing



Ordering Information

Description	Rating	Cat. No.	Color
Tamper-Resistant Slim Series GFCI with Audible Trip Alert	15A-125V Receptacle, 20A-125V Feed-Through	R02-A7599-0KW 001-A7599-00I 002-A7599-00W 006-A7599-00T	White Ivory White Light Almond
	20A-125V Receptacle, 20A-125V Feed-Through	R02-A7899-0KW 001-A7899-00I 002-A7899-00W 006-A7899-00T	White Ivory White Light Almond

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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.
- B. Comply with NFPA 70.

2.2 DECORATOR-STYLE DEVICES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect / Designer unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
- B. Tamper-Resistant and Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6, Configuration 5-15R, and UL 498. Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
 - 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. Eaton (Arrow Hart).
 - b. Pass & Seymour/Legrand (Pass & Seymour).
- C. GFCI, Non Feed-Through-Type Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6, Configuration 5-15R, UL 498, and UL 943 Class A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Leviton Manufacturing Co., Inc.

- D. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
 - 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. [Eaton \(Arrow Hart\)](#).
 - b. [Leviton Manufacturing Co., Inc.](#)

2.3 RESIDENTIAL DEVICES

- A. Device Color: As selected by Architect/Designer unless otherwise indicated or required by NFPA 70 or device listing.
- B. Residential-Grade, Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498. Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
 - 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. [Eaton \(Arrow Hart\)](#).
 - b. [Leviton Manufacturing Co., Inc.](#)
- C. Weather-Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6, Configuration 5-20R, and UL 498. Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [Eaton \(Arrow Hart\)](#).
 - b. [Leviton Manufacturing Co., Inc.](#)
- D. Fan Switch: 120-V, full-wave, solid-state units with integral, quiet on-off switches, audible frequency, and EMI/RFI filters. Comply with UL 1917.

2.4 WALL PLATES

- A. Wall Plates, Finished Areas (any of the following, see design documents): Smooth, high-impact thermoplastic, Ribbed plastic, Satin-finish stainless steel, Brushed brass, lacquered, Polished brass, lacquered, fastened with metal screws having heads matching plate color.
- B. Wall Plates, Unfinished Areas: Smooth, high-impact thermoplastic with metal screws.

- C. Wall Plates, Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet locations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- C. Select device colors and wall plates as follows:
 - 1. For plastic covers, match device color.
 - 2. In dark-paneled walls, use brown devices.
 - 3. Above kitchen counters, use white devices and wall plates.
 - 4. Consult design documents for device and faceplate preferred colors.
- D. Install unshared neutral conductors on line and load side of dimmers.
- E. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top unless otherwise indicated. Group adjacent devices under single, multigang wall plates.

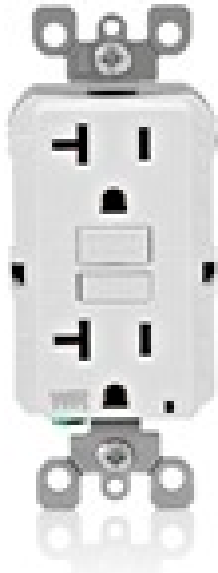
END

OF

SECTION

26 27 26

WR899-W



Color:  White

UPC Code: 07847755983

Country of Origin: China

NEMA: 5-20R



GFCI Receptacles

Brand Features

Slim is in. New SmartlockPro Slim GFCIs Install Easily Industry-leading quality, professional grade lockout action, and the slimmest profile on the market make SmartlockPro Slim GFCIs the smartest choice in ground fault circuit interrupter protection. Faster and easier to install in any wallbox because depth is reduced, the slim GFCIs flush mount to the wall with minimal protrusion for a sleek, finished look. Enhanced features include external back wiring for positive indication the wire is properly seated, exceptional resistance to wire pullout and the ability to withstand high torque. When it comes to outdoor GFCI protection, it's smart to choose SmartlockPro Slim Weather-Resistant GFCI Receptacles which meet the latest NEC requirements. * Important: Don't forget that a cover must be used with GFCI receptacles that are located in damp or wet locations per NEC Section 406.8.

Item Description

20 Amp, 125 Volt Receptacle/Outlet, 20 Amp Feed-Through, SmartLock Pro Slim Weather-Resistant GFCI, Monochromatic, back and side wired, wallplate/faceplate sold separately - White

Technical Information

AC Horsepower Ratings

At Rated Voltage: 1 HP

Electrical Specifications

Dielectric Voltage: Withstands 1250VAC per UL 943 and CSA-C22.2 No. 144.1-06

Short Circuit Current Rating: 10KA

Temperature Rise: Max 30C after 100 cycles OL at 150 percent rated current

Environmental Specifications

Flammability: Rated V-2 per UL94

Operating Temperature: -35C to +66C

Material Specifications

Face Material: Polypropylene

Body Material: Polycarbonate

Line Contacts: Brass Triple Wipe .031 Thick

Terminal Screws: Stainless Steel

Grounding Screw: Stainless Steel

Yoke: Stainless Steel

Clamps: Brass

Notes: Wallplate Sold Separately

Mechanical Specifications

Terminal ID: Brass-Hot, Green-Ground, Silver-Neutral

Terminal Accom.: 14-10 AWG

Product ID: Ratings are permanently marked on device

Product Features

Feature: SmartlockPro® Slim

Amperage: 20 Amp

Voltage: 125 Volt

NEMA: 5-20R

Standards and Certifications

NEMA: WD-6

ANSI: C-73

UL498: Yes

CSA C22.2 No. 42: Yes

NOM: 057

UL 943: File E48380

MIL-SPEC: A-A-55459-SB

CSA-C22.2 No. 144.1-06: File LR-57811

Fed Spec WC-596: Yes

Pole: 2
Wire: 3
Trip Level: Class A, 5mA plus or minus 1mA
Termination: Back & Side
Face Material: Polypropylene
Body Material: Polycarbonate
Grounding: Green Ground Screw
Color: White
Strap Material: Stainless Steel
Standards and Certifications: UL/CSA
Fed Spec WC-596: Yes
Warranty: 2-Year Limited
Notes: Wallplate Sold Separately
Grade: Residential

Features and Benefits

- Reduced depth of SmartlockPro® Slim GFCI makes it easier to install in any electrical box, even shallow ones.
- Terminals allow for easy wiring options – back and side wire capable.
- External back wire clamps provide visual indication of proper wire seating.
- Withstands high torque and resists wire pullout.
- Automatically test the GFCI every time the RESET button is pushed in. The GFCI will not reset if the GFCI circuit is not functioning properly.
- By blocking reset of the GFCI if protection has been compromised, SmartlockPro® Slim GFCI reduces the possibility of end-users incorrectly assuming that a reset GFCI outlet is providing ground fault protection when it actually is not.
- A line-load reversal diagnostic feature is provided which prevents the GFCI from being reset and stops power from being fed to the GFCI receptacle face or through to downstream devices. A green LED indicator on the GFCI's face also illuminates to alert the installer to the line-load wiring reversal.
- Trip threshold meets or exceeds UL requirements for tripping time.
- Improved immunity to high-frequency noise reduces nuisance tripping.
- Advanced electronics design provides superior resistance to electrical surges and over-voltages.
- Compatible with all Decora devices and wallplates; available in select Decora colors.
- UL Fed Spec WC-596 rated.

SPECIFICATION SUBMITTAL

JOB NAME: <input style="width: 95%; height: 20px;" type="text"/>	CATALOG NUMBERS: <input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>	
JOB NUMBER: <input style="width: 95%; height: 20px;" type="text"/>	<input style="width: 60%; height: 20px;" type="text"/>	<input style="width: 35%; height: 20px;" type="text"/>

Leviton Manufacturing Co., Inc.

201 North Service Road, Melville, NY 11747

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Leviton Manufacturing of Canada, Ltd.

165 Hymus Boulevard, Pointe Claire, Quebec H9R 1E9 · Telephone: 1-800-469-7890 ·

FAX: 1-800-824-3005 · www.leviton.com/canada

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Visit our Website at: www.leviton.com

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SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Nonfusible Switches, 600 A and Smaller: UL 98 and NEMA KS 1, Type GD or Type HD, with lockable handle interlocked with cover in closed position.

- 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. Eaton.
- b. General Electric Company; GE Energy Management - Electrical Distribution.
- c. Siemens Energy.

- B. Shunt-Trip Switches: Comply with UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

- 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. Bussmann, an Eaton business.

2.3 MOLDED-CASE CIRCUIT BREAKERS

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

- a. Eaton.
- b. General Electric Company; GE Energy Management - Electrical Distribution.
- c. Siemens Energy.

- B. Description: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with field-adjustable instantaneous trip settings.
 - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
 - 5. GFEP Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
- C. Features and Accessories:
 - 1. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - 2. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.4 ENCLOSURES

- A. NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.5 SUPPORT AND ANCHORAGE COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly, and provide finish suitable for the environment in which installed.
 - 1. Channel Dimensions: Selected for structural loading and applicable seismic forces.
- B. Raceway and Cable Supports: As described in NECA 1.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.
- D. Mounting, Anchoring, and Attachment Components:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, high strength; complying with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.
8. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings and matched to type and size of anchor bolts and studs used.
9. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings and matched to type and size of attachment devices used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Install electrical equipment to allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
- C. Install electrical equipment to provide for ease of disconnecting the equipment with minimum interference to other installations.
- D. Install electrical equipment to allow right of way for piping and conduit installed at required slope.
- E. Install electrical equipment to ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.
- F. Install required supporting devices in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- G. Install fuses in fusible devices.
- H. Comply with NECA 1.

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections, and prepare test reports:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END

OF

SECTION

26 28 16

1 & 2 Pole Combination Type Arc-Fault Circuit Interrupters

Plug-in and Bolt-on

Data Sheet



Features

- Available in 1 & 2 Pole, 15A & 20A
- New and improved electronics
- 1/4" more wiring bend space than our previous design
- Both lugs at the same angle - for easier wiring
- Plug-in or bolt-on branch circuit breakers for Siemens single phase load centers or panelboards
- LED trip indicator – a Siemens exclusive!
- Available with interrupting rating of 10kA, 22kA or 65kA
- UL Listed
- Ratings:
 - HACR
 - SWD
- 120 Volts AC
- Wire range:
 - #14 – #8 AWG Cu
 - #12 – #8 AWG Al
- Torque rating: 25 lb. in.

1-Pole Plug-in Arc-Fault Circuit Interrupters

Catalog number	Ampere rating	Interrupting rating	UL type
QA115AFC	15	10kA	QAF2
QA120AFC	20	10kA	
QA115AFCH	15	22kA	QAFH2
QA120AFCH	20	22kA	
QA115AFCHH	15	65kA	HQAF2
QA120AFCHH	20	65kA	

1-Pole Bolt-on Arc-Fault Circuit Interrupters

Catalog number	Ampere rating	Interrupting rating	UL type
BA115AFC	15	10kA	BAF2
BA120AFC	20	10kA	
BA115AFCH	15	22kA	BAFH2
BA120AFCH	20	22kA	
BA115AFCHH	15	65kA	HBAF2
BA120AFCHH	20	65kA	

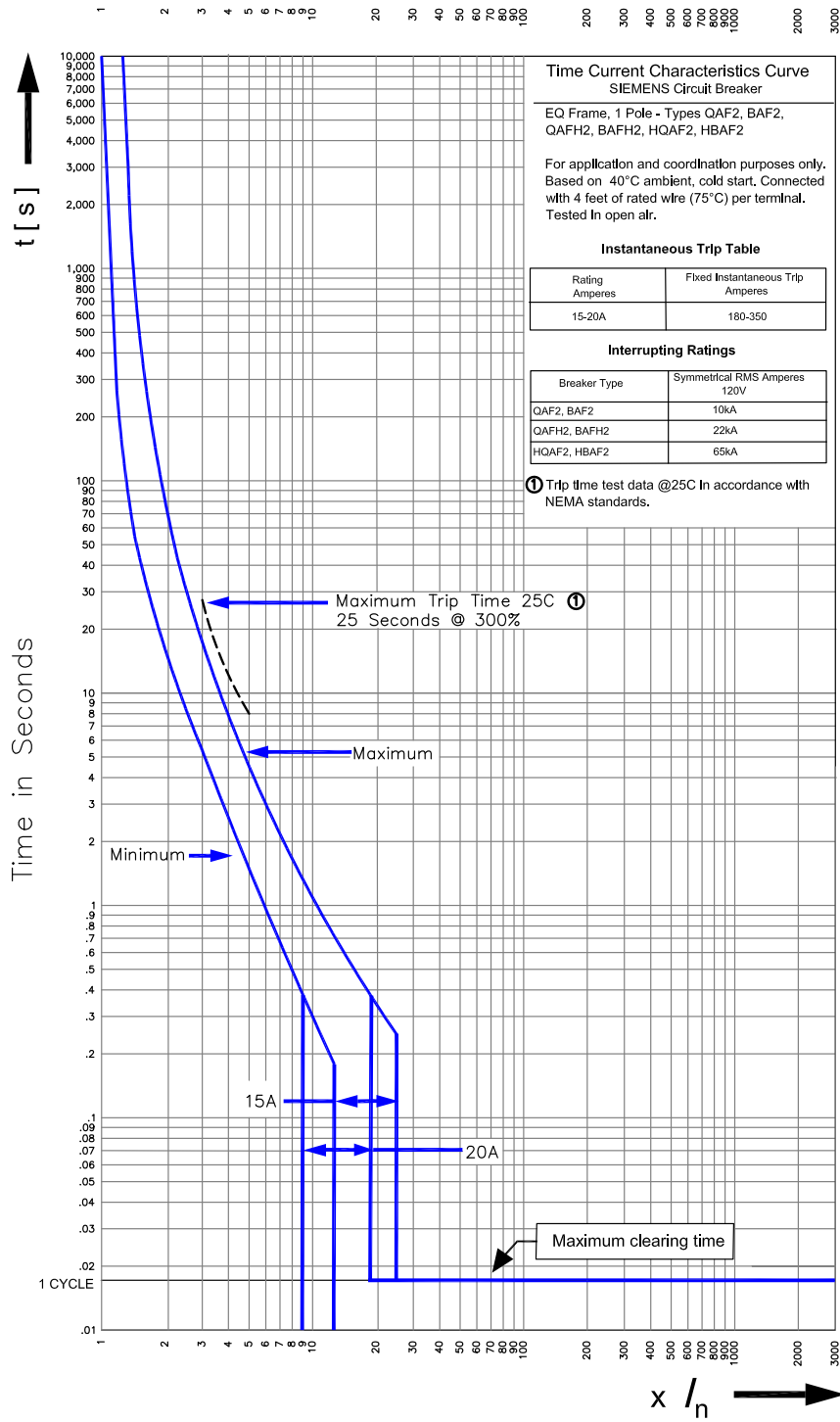
2-Pole Plug-in Arc-Fault Circuit Interrupters

Catalog number	Ampere rating	Interrupting rating	UL type
Q215AFC	15	10kA	QAF
Q220AFC	20	10kA	
Q215AFCH	15	22kA	QAFH
Q220AFCH	20	22kA	

2-Pole Bolt-on Arc-Fault Circuit Interrupters

Catalog number	Ampere rating	Interrupting rating	UL type
B215AFC	15	10kA	BAF
B220AFC	20	10kA	
B215AFCH	15	22kA	BAFH
B220AFCH	20	22kA	

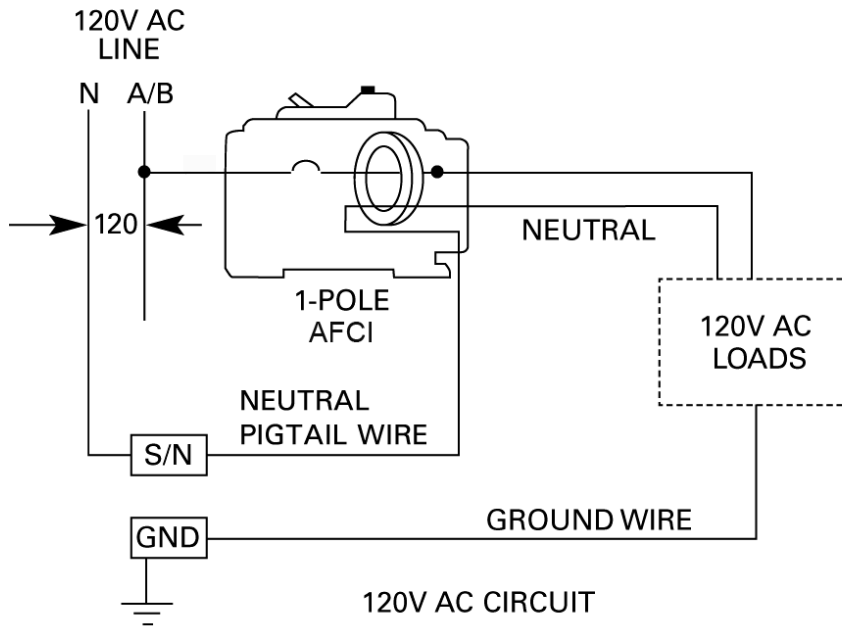
Time Current Characteristic Curves



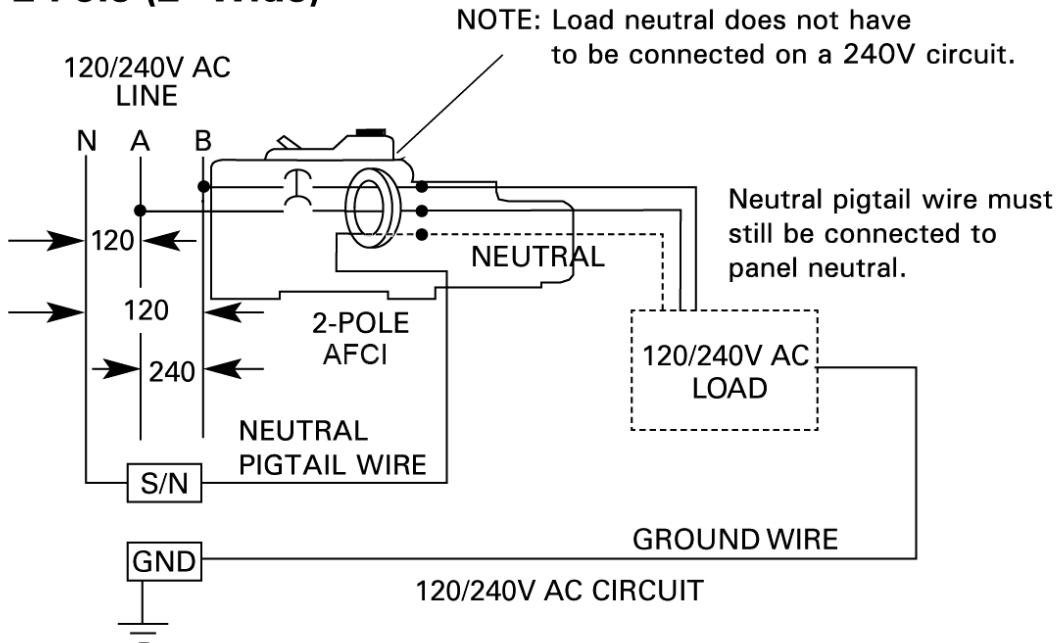
Multiples of Continuous Current Rating

Wiring diagram

1-Pole (1" Wide)

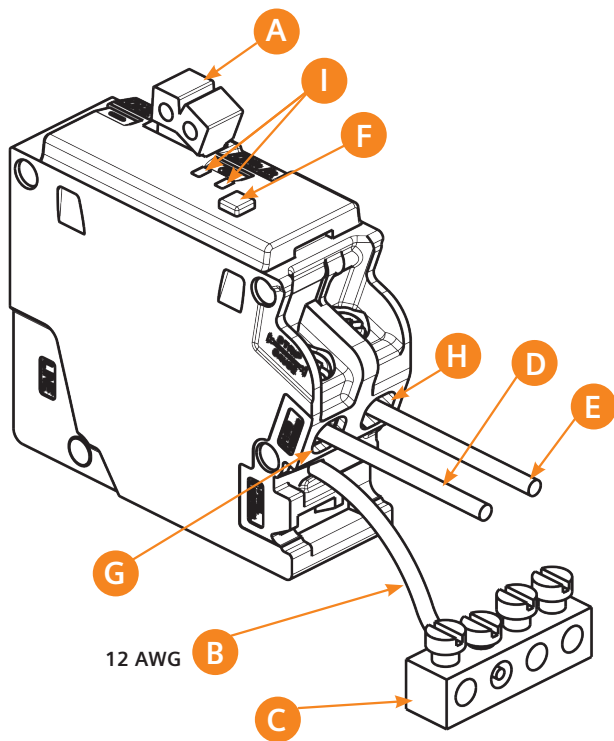


2-Pole (2" Wide)

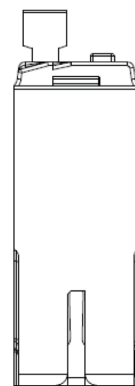
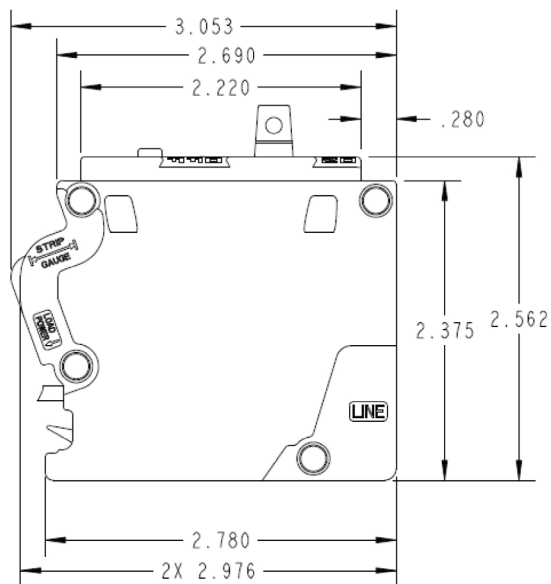
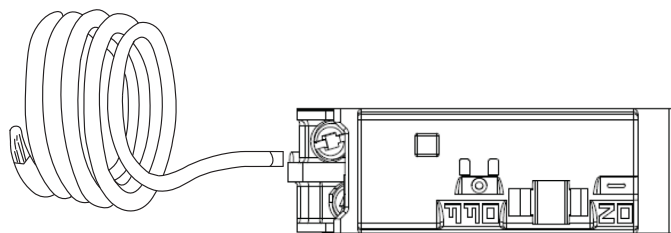


Dimensions

1-Pole

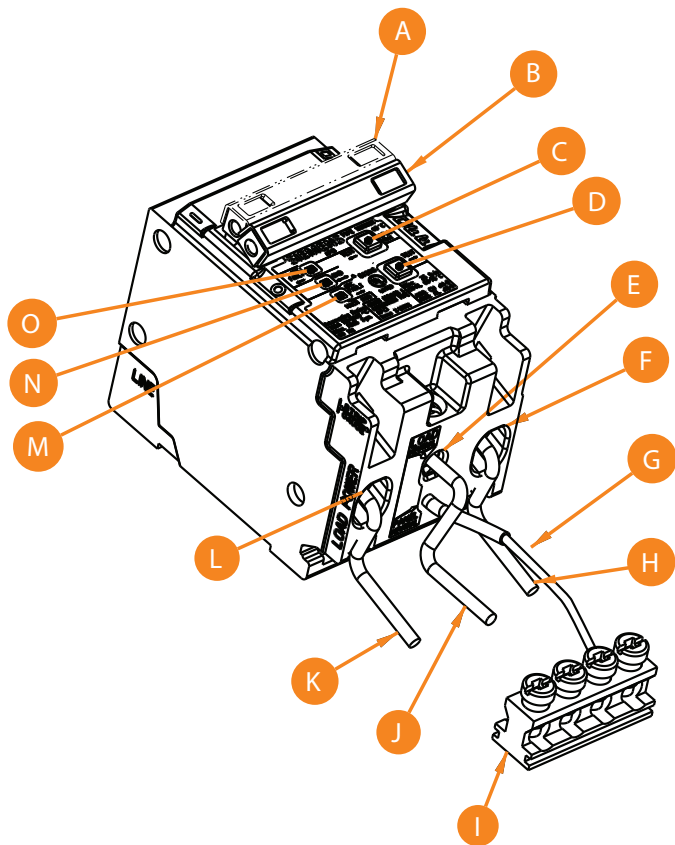


A	Breaker handle
B	Neutral (pig-tail) wire
C	Panel neutral
D	Load neutral wire
E	Load power wire
F	Blue test button
G	Neutral terminal
H	Load terminal
I	2 yellow LEDs

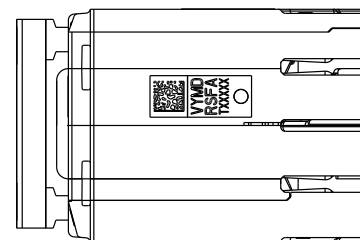
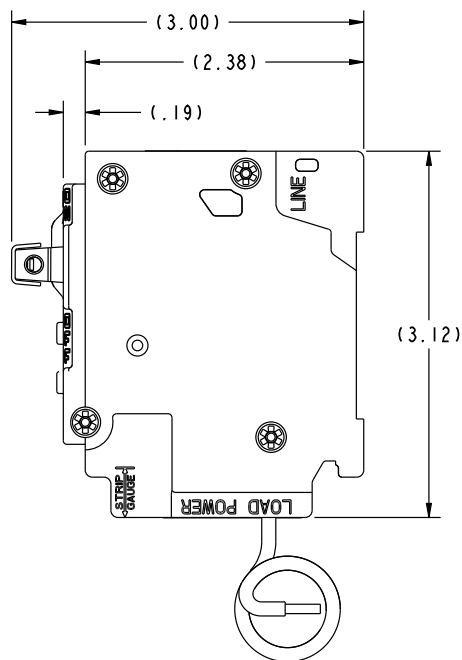
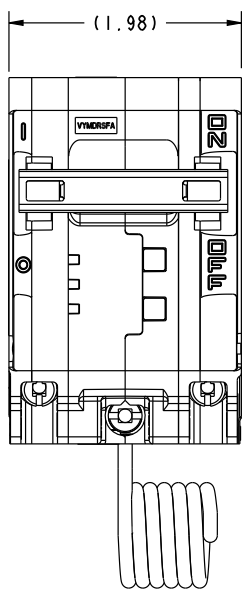


Dimensions

2-Pole



A	Handle tripped center position
B	Breaker handle
C	Blue test button
D	Blue test button
E	Neutral terminal
F	Load terminal
G	Neutral (pig tail) wire
H	Load power wire
I	Panel neutral
J	Load neutral wire
K	Load power wire
L	Load terminal
M	LED trip indicator
N	LED trip indicator
O	LED trip indicator



Siemens Industry, Inc.
5400 Triangle Parkway
Norcross, GA 30092

1-800-241-4453
info.us@siemens.com

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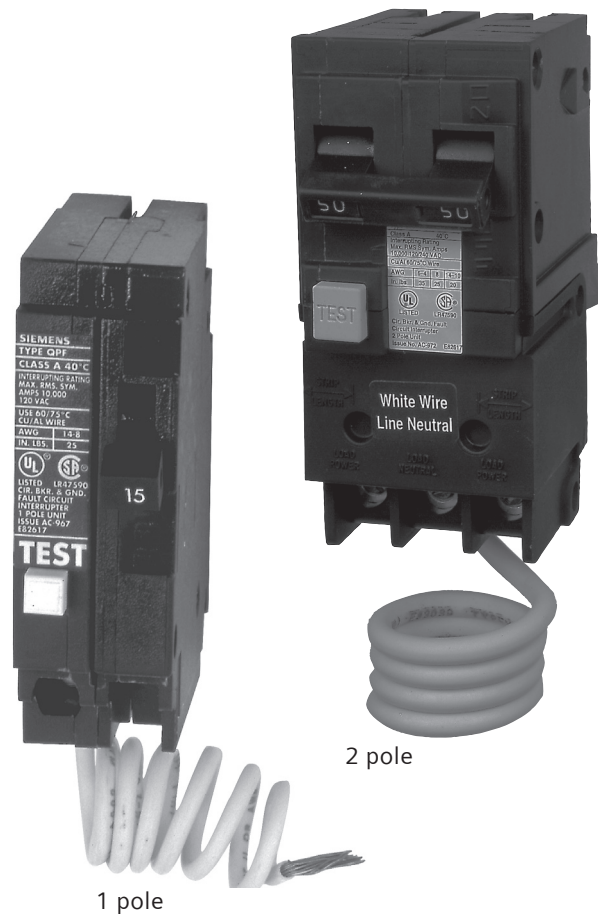
The information provided in this brochure contains merely general descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

All product designations may be trademarks or product names of Siemens AG or supplier companies whose use by third parties for their own purposes could violate the rights of the owners.

Circuit Breaker and Ground Fault Circuit Interrupter

Features

- Available in 1-pole (15-30A) and 2-pole (15-60A) through 60 amp rating
- Available in 10 kA and 22 kA ("H") interrupting rating
- Suitable for a variety of construction applications: spas, hot tubs, kitchens, bathrooms, etc.
- Resists false tripping (shielded to prevent RF interference)
- Standard 1 inch per pole format with plug-in design
- UL Listed and CSA Certified
- Also available in BLF type (low tab bolt-on)
- Provides Class A GFCI protection
- HACR rated



Siemens GFCI circuit breakers are UL Listed and CSA Certified as Class A devices. Current imbalances of 4-6 milliamps or more between load conductors will cause the ground fault sensor to trip the circuit breaker.

Note: A load neutral is not required on the circuit. However, the white line neutral (pigtail) must be connected to the panel neutral for the device to function.

The Siemens 2-pole GFCI circuit breaker can be installed on a 120/240V AC single phase, 3 wire system, the 120/240V AC portion of a 240/120 volt, 3 phase, 4 wire system, or on a 208Y/120 volt, 3 phase, 4 wire system. When installed on these systems, protection is provided for 2 wire, 240V AC or 208V AC circuits; 3 wire, 120/240V AC circuits.

The Siemens 1-pole GFCI circuit breaker is to be installed only on a single phase 120/240V AC system.

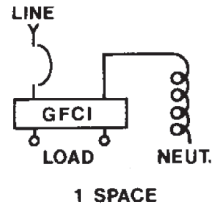
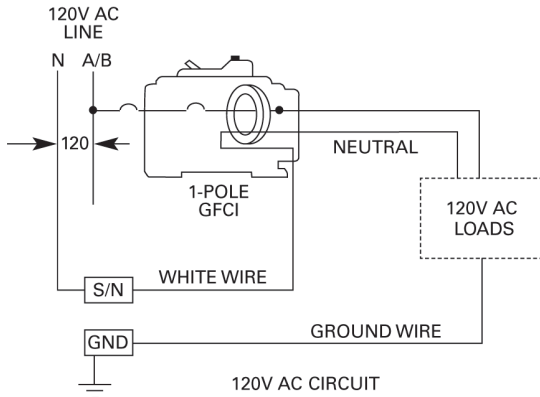
Data Sheet

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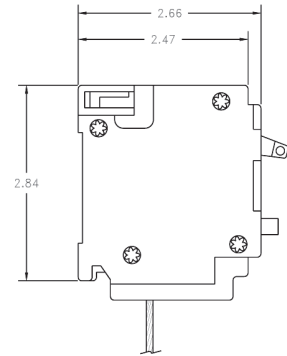
Wiring Diagrams

1-Pole (1" Wide)

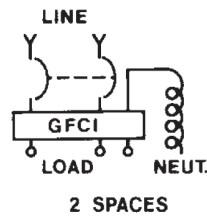
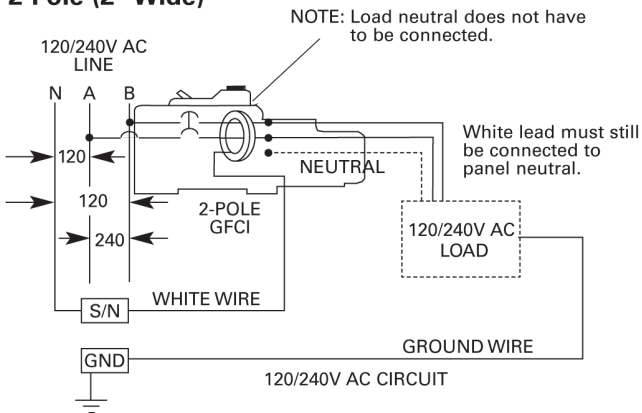


Dimensions

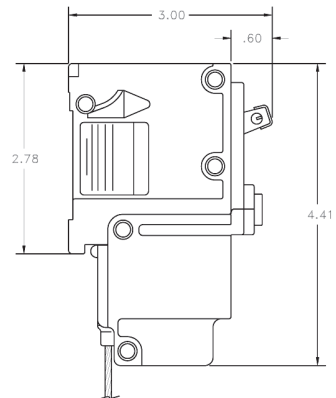
1-Pole (1" Wide)



2-Pole (2" Wide)



2-Pole (2" Wide)



UL Listed for 60°C or 75°C wire.

Selection Information

1 Pole, 120V AC, 60Hz
Standard Package - 1 (Approx. Wt. - 15 lbs.)^①

Ampere Rating	Catalog Number	Shipping Carton	Connector CU	Wire Range AL
15	QF115	30	#14 - #8	#14 - #8
20	QF120	30	#14 - #8	#14 - #8
30	QF130	30	#14 - #6	#12 - #6

^① Shipping carton weight

2 Pole, 120/240V AC, 60Hz
Standard Package - 1 (Approx. Wt. - 10 lbs.)^①

Ampere Rating	Catalog Number	Shipping Carton	Connector CU	Wire Range AL
15	QF215	10	#14 - #10	#14 - #8
20	QF220	10	#14 - #10	#14 - #8
30	QF230	10	#14 - #4	#14 - #4
40	QF240	10	#14 - #4	#14 - #4
50	QF250	10	#14 - #4	#14 - #4
60	QF260	10	#14 - #4	#14 - #4

^① Shipping carton weight

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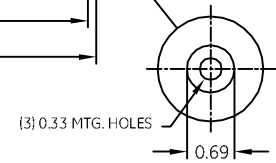
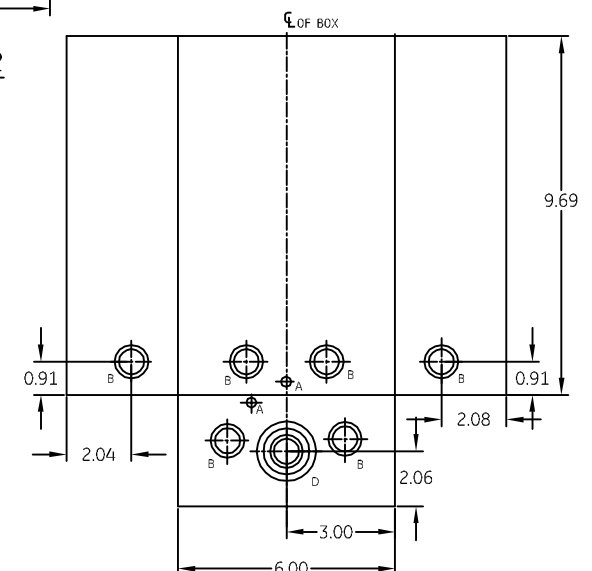
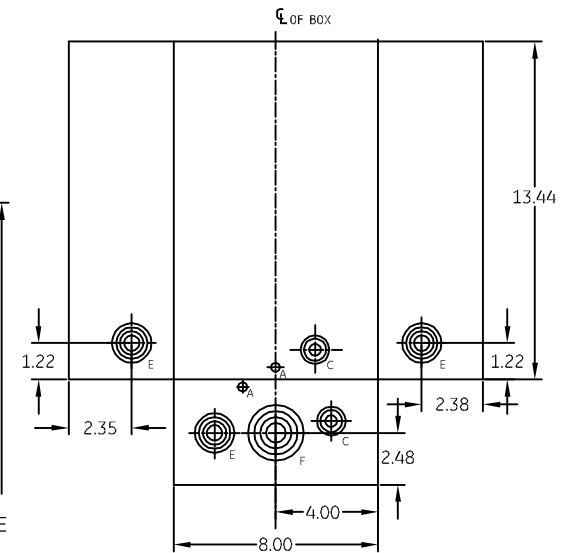
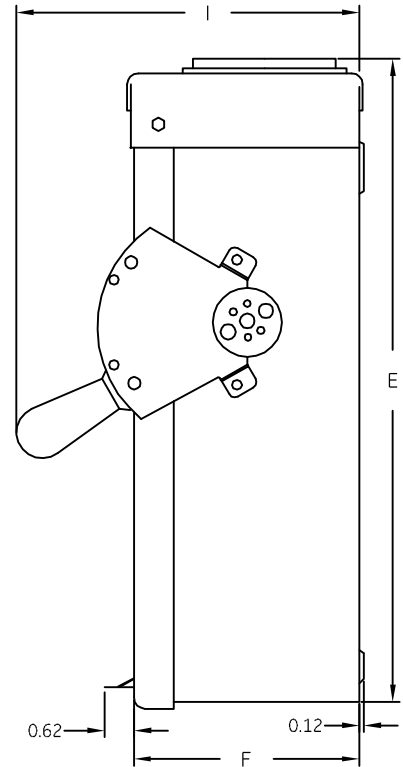
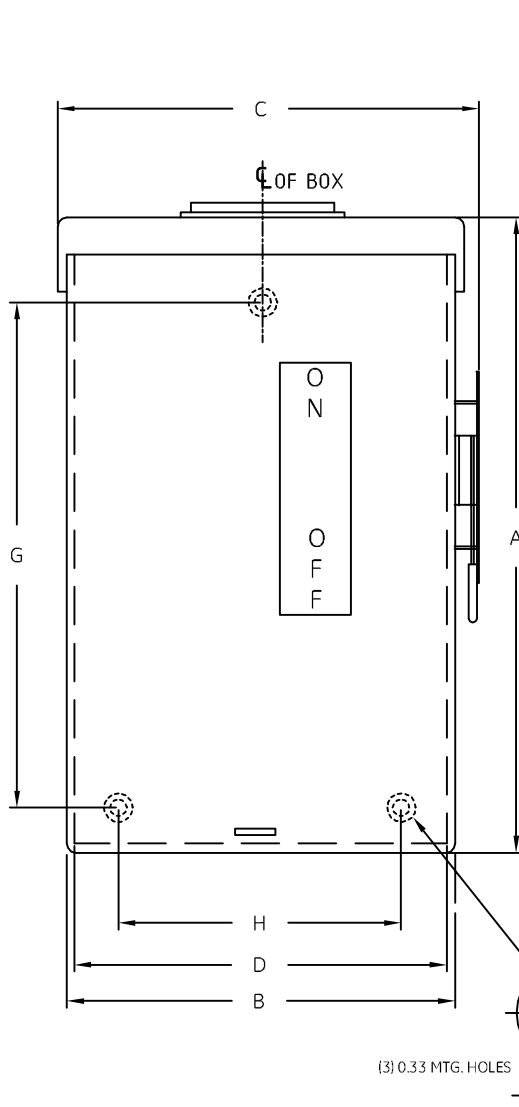
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26 28 16.16 ENCLOSED SWITCH - AC DISCONNECT



NOTE:
1. ALL DIMENSIONS ARE IN INCHES.
2. ALL DIMENSIONS HAVE ± 0.125 TOLERANCE.

DIMENSION TABLE											
	MOD.	KO VIEW	A	B	C	D	E	F	G	H	I
TGN3321R/ TG4321R/ TG3221R	8	1	9.78	6.38	6.84	6.12	10.12	3.31	7.69	4.50	6.25
TG4322R/ TG3222R/ TGN3322R	8	2	13.68	8.38	8.75	8.12	13.86	3.88	11.19	6.50	7.88

KNOCKOUT TABLE			
SYM.	SIZE	QTY.	
		VIEW 1	VIEW 2
A	9/32 KO	2	2
B	1/2 X 3/4 KO	6	-
C	1/2 X 3/4 X 1 KO	-	2
D	3/8 X 1/2 X 3/4 X 1 KO	1	-
E	1/2 X 3/4 X 1 X 1 1/4 KO	-	3
F	3/4 X 1 X 1 1/4 X 1 1/2 KO	-	1

imagination at work

OUTLINE DRAWING-HEAVY DUTY SAFETY SWITCH
30 & 60A, NEMA -TYPE 3R ENCLOSURE

DWG NO. 10103091SH103	DATE 08/14/2009	REV 02
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26 31 00 Photovoltaic Collectors

PAGE 1 of 3

SUNPOWER

MORE ENERGY. FOR LIFE.™

Extended Data – E-Series Residential;

SPR-E20-327, SPR-E19-315,

SPR-E20-245, SPR-E18-235

ADDITIONAL MODULE PARAMETERS AND INFORMATION

TESTS AND CERTIFICATIONS	
Standard tests	UL 1703, IEC 61215, IEC 61730
Quality tests	ISO 9001:2008, ISO 14001:2004
EHS Compliance	RoHS, OHSAS 18001:2007
Ammonia test	IEC 62716
Salt-spray test	IEC 61701 (max. severity)
PID test	Potential-Induced Degradation free – 1000V

WARRANTY, IMPACT RESISTANCE, FUSE RATING, J-BOX	
WARRANTIES	25-YEAR LINEAR POWER WARRANTY 25-YEAR LIMITED PRODUCT WARRANTY
Impact Resistance	(hail) 25mm (1 inch) diameter at 23 m/s (52 mph)
Max Series Fuse	20 Amp rating
Connectors	MC4 Compatible with cable lengths, 700mm (128 cell) and 1000mm (96 & 72 cell)
Junction Box	For J-Box specifics, please contact your regional sales team

E-SERIES MAJOR GLOBAL MARKET LISTINGS		
Residential Modules	96-Cell Modules	72-Cell Modules
*Major Market Listings	CEC, JET, KEMCO, MCS, FSEC, CSA, UL, TUV	CEC, JET, MCS, FSEC, CSA, UL, TUV

*Platforms options available in listed markets, but every individual sku may not be available in each referenced market

PLATFORM ELECTRICAL DATA

STC Values

Module	Platform (Number of cells)	At Standard Test Conditions							
		Nominal Power	Power Tolerance (%)	Rated Voltage (Vmp)	Rated Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current, Isc (A)	Max System Voltage UL (Vmax)	Max System Voltage IEC (Vmax)
SPR-E20-327	96	327	+5/-0	54.7	5.98	64.9	6.46	600	1000
SPR-E19-315	96	315	+5/-0	54.7	5.76	64.6	6.14	600	1000
SPR-E20-245	72	245	+5/-0	40.5	6.05	48.8	6.43	600	1000
SPR-E19-235	72	235	+5/-0	40.5	5.80	48.4	6.18	600	1000

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PAGE 2 of 3

PLATFORM ELECTRICAL DATA (continued)

TEMPERATURE COEFFICIENTS & EFFICIENCY REFERENCES

Module	At Standard Test Conditions		Basic Temperature Data				Efficiency Numbers		
	Nominal Power	Avg Power	Current (Isc) Temp. Coeff. (mA/°C)	Voltage (Voc) Temp. Coeff. (mV/°C)	Power Temp. Coeff. (%/°C)	NOCT @ 20°C (Value +/- 2 °C)	Average Power Efficiency (%)	Nominal Peak Power per Unit Area (W/m ²)	Nominal Peak Power per Unit Area (W/ft ²)
SPR-E20-327	327	333	3.5	-176.6	-0.38%	45.0	20.4%	204.2	19.0
SPR-E19-315	315	321	3.5	-176.6	-0.38%	45.0	19.7%	196.8	18.3
SPR-E20-245	245	249	3.5	-132.5	-0.38%	45.0	20.0%	200.2	18.6
SPR-E19-235	235	242	3.5	-132.5	-0.38%	45.0	19.5%	194.5	18.1

PLATFORM PERFORMANCE AT NOCT

(800 W/m², 20°C ambient, 1 m/s wind speed)

Module	At STC	Nominal Electrical data at NOCT (NOCT: 800W/m ² , 20°C amb. Temp., 1m/s wind speed)					
		NOCT P _{nom}	NOCT V _{mpp}	NOCT I _{mpp}	NOCT V _{oc}	NOCT I _{sc}	NOCT % of rated
SPR-E20-327	327	248	51.5	4.82	60.8	5.22	75.9%
SPR-E19-315	315	239	51.5	4.64	60.5	4.97	75.9%
SPR-E20-245	245	182	37.4	4.88	45.7	5.20	74.4%
SPR-E19-235	235	175	37.4	4.68	45.3	5.00	74.4%

PLATFORM PERFORMANCE AT LOW IRRADIANCE

(200 W/m²; 25°C cell temperature, air mass 1.5 SSID*)

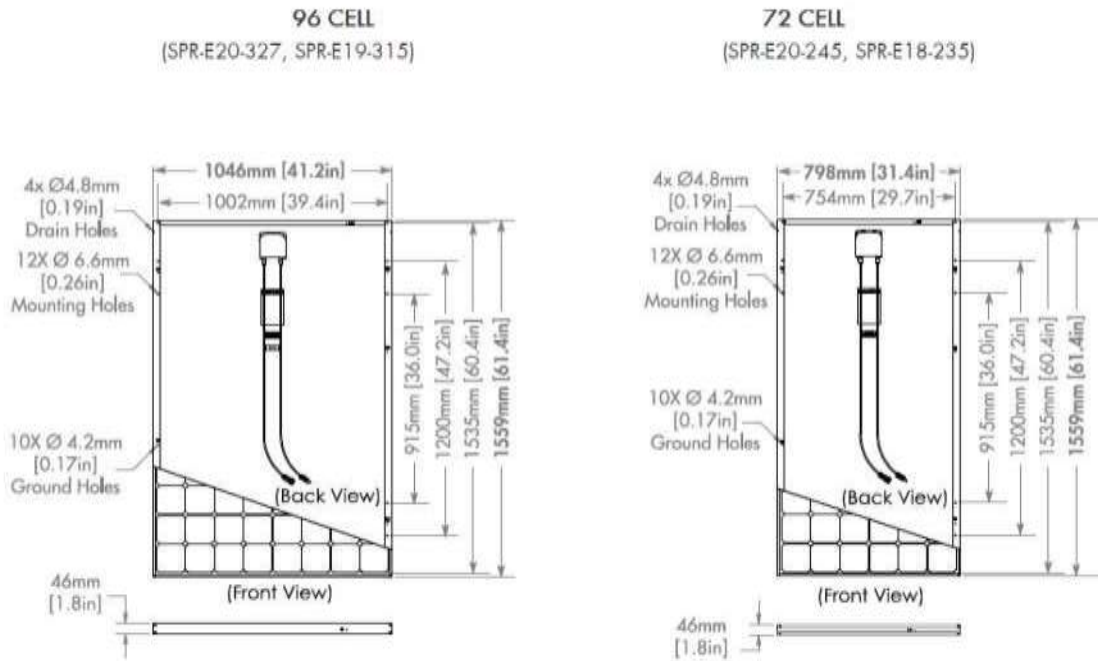
Module	At STC	Irradiance vs. Power at Low Irradiance (200W/m ² and @25°C [SNL coefficients])			
		Low irradiance P _{mpp} (W)	Low irradiance V _{mpp} (V)	Low irradiance I _{mpp} (A)	Pctg. of nominal power
SPR-E20-327	327	62.8	52.0	1.21	19.2%
SPR-E19-315	315	60.5	52.0	1.16	19.2%
SPR-E20-245	245	47.0	38.5	1.22	19.2%
SPR-E19-235	235	45.1	38.5	1.17	19.2%

*SSID = Solar Spectral Irradiance Distribution

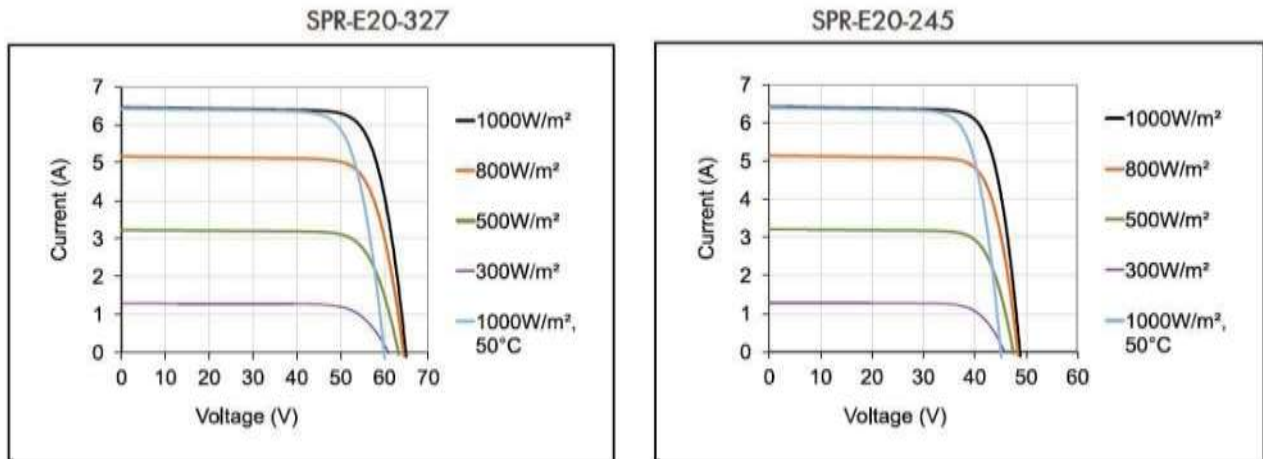
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PAGE 3 of 3

MODULE PLATFORM DIMENSIONS



IV CURVES OF PRIMARY PLATFORM MODELS



SECTION 26 31 00 - PHOTOVOLTAIC COLLECTORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals:
 - 1. Product Data: For each type of product.
 - 2. Shop Drawings: For photovoltaic (PV) modules.
- B. Warranty: Manufacturer agrees to repair or replace components of PV modules that fail in materials or workmanship within specified warranty period of twenty five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Nationally Recognized Testing Laboratory Listing: Entire assembly shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for electrical and fire safety, according to UL 1703.
- B. FM approved for NFPA 70, Class 1, Division 2, Group C and Group D hazardous locations.

2.2 PHOTOVOLTAIC COLLECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. SunPower Corporation.

2.3 SYSTEM DESCRIPTION

- A. Grid-Tied PV System: An array of 21 modules to generate a total nominal 6867-rated W connected via a utility meter to the electrical utility.
- B. Front Panel:
 - 1. Glass: antireflective coating.
 - 2. 0.125-inch-thick glass.
- C. Backing Material:
 - 1. Tempered glass.
 - 2. 0.125-inch-thick glass; white.

- D. Bypass Diode Protection: Internal.
- E. Junction Box:
 - 1. Size: 2.65 X 4.54 X 6.37, NEMA 250 compliant Type 2, 4, 5, 6, 12, 13.
- F. Output Cabling:
 - 1. Quick, multiconnect, polarized connectors.
 - 2. Two-Conductor Harness: No traditional return wire is needed from the end of a row back to the source combiner.
- G. Series Fuse Rating: 20 A.

2.4 CAPACITIES AND CHARACTERISTICS

- A. Minimum Electrical Characteristics:
 - 1. Rated Open Circuit Voltage (V_{oc}): 64.9 V dc.
 - 2. Maximum System Voltage: 600 V dc.
 - 3. Maximum Power at Voltage (V_{pm}): 45 V dc.
 - 4. Short-Circuit Temperature Coefficient: 3.5 mA/deg C.
 - 5. Rated Short-Circuit Current (I_{sc}): 6.46 A.
 - 6. Maximum System: 600 V dc.
 - 7. Rated Operation Current (I_{mp}): 4.82 A.
 - 8. Maximum Power at Standard Test Conditions Defined in IEC 61215 (P_{max}): 327 Watts.
- B. Normal Operating Temperature Characteristics (NOTC):
 - 1. Temperature at Nominal Operating Cell Temperature: 20 deg C.

2.5 MODULE FRAMING

- A. PV laminates mounted in anodized extruded-aluminum frames.
 - 1. Entire assembly UL listed for electrical and fire safety, according to UL 1703, complying with IEC 61215.
 - 2. Finish: Anodized aluminum.

2.6 ARRAY CONSTRUCTION

- A. Framing:
 - 1. Material: Extruded aluminum.
 - 2. Maximum System Weight: Less than 4 lb/sq. ft.
- B. Roof Mounting:
 - 1. Wind-tunnel tested to 110-mph wind.

2. Service Life: 25 years.

2.7 INVERTER

- A. Control Type: [Pulse-width-modulation control] [Maximum-power-point-tracker (MPPT) control].
- B. Inverter Electrical Characteristics:
 1. Maximum V_{oc} : 600 V dc.
 2. PV Start Voltage: 250 V dc.
 3. MPPT Voltage Range: 250 - 480 V dc.
 4. Maximum Input Current: 25 V dc.
 5. Number of Independent MPPT Circuits: 4.
 6. Nominal Output Voltage: 208, 240, 277 V ac.
 7. Maximum Output Current: 29, 25, 22 Amps @ 208, 240, 277 Volts respectively.
 8. Peak Efficiency: 97 percent.
 9. NEMA 250 Enclosure Rating: 3R.
- C. Operating Conditions:
 1. Operating Ambient Temperatures: Minus 4 to plus 122 deg F.
 2. Relative Humidity: Zero to 95 percent, noncondensing.
- D. Charge controllers shall have the following:
 1. Overcurrent protection.
 2. Generator input breaker box.
 3. Automatic transfer relay.
 4. Digital display.
 5. Transformer.
 6. Disconnect switch.
 7. Surge overload protection.
- E. Enclosure: NEMA 250, Type 3R; enclosure material to be steel.
- F. Protective Functions:
 1. AC over/under voltage.
 2. AC over/under frequency.
 3. Ground over current.
 4. Overtemperature.
 5. AC and dc overcurrent.
 6. DC over voltage.
- G. Disconnects:
 1. Low-voltage disconnect.
 2. Low-voltage reconnect.
 3. High-temperature disconnect.

4. High-temperature reconnect.

H. Regulatory Approvals:

1. IEEE 1547.1.
2. IEEE 1547.3.
3. UL 1741.

I. Characteristics:

1. Inverter Dimensions: 9.5 X 18.4 X 24.1 inches.
2. Inverter Weight: 141 lb.

2.8 MOUNTING STRUCTURES

A. Roof Mount: Extruded aluminum, four rails, and roof standoffs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine roofs, supports, and supporting structures for suitable conditions where PV system will be installed. Do not begin installation until mounting surfaces have been properly prepared.
- B. Install arrays per manufacturer's written instructions.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
 1. Perform tests and inspections with the assistance of a factory-authorized service representative.

END

OF

SECTION

26 31 00

LCS-25

26 33 43 Battery Charger (Electric Vehicle)



**ALSO AVAILABLE
AS PLUG-IN!**

SMALL. RELIABLE. BUILT TO AUTOMOTIVE STANDARDS. The LCS-25 from ClipperCreek is the ideal solution for home charging. Since the last thing you need is one more item in your garage, ClipperCreek has packed close to 5kW of power in this small package. Quickly install and you are on your way!

- **LOW PROFILE** – One of the smallest units in the industry
- **QUALITY** – Technology that works for the life of your current plug-in vehicle and then some
- **CONVENIENT** – 25 feet of charging cable for installation and operation flexibility
- **DURABLE** – Rugged, fully sealed NEMA 4 enclosure for installation anywhere
- **RELIABLE** – Backed by ClipperCreek's 3-year warranty



LCS-25

PRODUCT OVERVIEW

QUESTIONS? TO ORDER!

Call ClipperCreek Today!

530-887-1674

www.clippercreek.com



Optional Holster
for wall mount

ELECTRICAL SPECIFICATIONS

- **Service:** 208/240V, 25A, dedicated circuit
- **Charge current or output power:** 208/240V, 20A max
- **Service ground monitor:** Constantly checks for presence of proper safety ground
- **Automatic circuit reclosure after minor power faults**
- **Charge Circuit Interruption Device:** Ground fault protection with fully automated self-test - eliminates manual user testing

MATERIAL SPECIFICATIONS

- Indoor/outdoor rated fully sealed (NEMA 4) enclosure
- Operating Temperatures at -22°F to 122°F (-30°C to 50°C)
- 11" L x 4" W x 3" D (279mm L x 102mm W x 76mm D)
- Installation: Hardwire or plug connected
- 3' of installation conduit, pigtail supplied
- Optional holster
- ETL Listed

AVAILABLE AS



PLUG-IN

model: LCS-25P

NEMA 16-30

NEMA 14-30

NEMA 14-50

NEMA 6-50

CODES AND STANDARDS

- **UL 2594** Electric Vehicle Supply Equipment
- **UL 2231** Personal Protection Device (i.e., CCID Hardware)
- **UL 1998** Standard for Safety-Related Software
- **NEC 625** Electric Vehicle Charge System
- **SAE-J1772™** Electric Vehicle Conductive Charge Coupler



SECTION 26 43 13 - TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.
- B. Comply with IEEE C62.41.2, and test devices according to IEEE C62.45.
- C. Comply with UL 1449.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. 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:
 - 1. Eaton Corporation.
 - 2. GE Zenith Controls.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Siemens Industry, Inc.
- B. Surge Protective Devices (SPD): Field-mounted, complying with UL 1449 Type 1.
 - 1. Comply with IEEE C62.41, Category C, 200-kA short-circuit current rating.
 - 2. Non-modular type with the following features and accessories:
 - a. Integral disconnect switch.
 - b. LED indicator lights for power and protection status.
- C. Protection modes and UL 1449 voltage protection rating (VPR) for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall be as follows:
 - 1. Line to Neutral: 1200 V for 480Y/277 V.
 - 2. Line to Ground: 1800 V for 480Y/277 V.
 - 3. Line to Line: 2000 V for 480Y/277 V.

D. Protection modes and UL 1449 Vpk for 240/120 V, single-phase, three-wire circuits shall be as follows:

1. Line to Neutral: 600 V.
2. Line to Ground: 1000 V.
3. Line to Line: 1000 V.

2.3 PANELBOARD SUPPRESSORS

A. 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:

1. [ABB France.](#)
2. [Eaton Corporation.](#)
3. [Leviton Manufacturing Co., Inc.](#)
4. [Siemens Industry, Inc.](#)

B. SPDs: Field-mounted, complying with UL 1449 Type 1.

1. Comply with IEEE C62.41, Category C, 200-kA short-circuit current rating.
2. Non-modular type with the following features and accessories:
 - a. Integral disconnect switch.
 - b. LED indicator lights for power and protection status.

C. Protection modes and UL 1449 Vpk for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 1200 V for 480Y/277 V.
2. Line to Ground: 1800 V for 480Y/277 V.
3. Neutral to Ground: 1000 V for 480Y/277 V.
4. Line to Line: 2000 V for 480Y/277 V.

D. Protection modes and UL 1449 Vpk for 240/120-V, single-phase, three-wire circuits shall be as follows:

1. Line to Neutral: 600 V.
2. Line to Ground: 1000 V.
3. Neutral to Ground: 600 V.
4. Line to Line: 1000 V.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not energize or connect service entrance equipment panelboards to their sources until transient-voltage surge-suppression devices are installed and connected.

END

OF

SECTION

26 43 13

JUNO

Project: _____

Fixture Type: _____

Location: _____

Contact/Phone: _____

6" IC 600 LUMEN LED DOWNLIGHT NEW CONSTRUCTION LENSED TRIMS



PRODUCT DESCRIPTION

Dedicated LED, Air-Loc® sealed new construction housing with integral light engine • Shallow housing allows for fit in 2 x 6 construction • Can be completely covered with insulation • Fully sealed housing stops infiltration and exfiltration of air, reducing heating and air cooling costs without the use of additional gaskets • LED housing is designed to provide 50,000 hours of life and is compatible with many standard Juno trims • 5 year limited warranty on LED components.

ENVIRONMENTALLY FRIENDLY, ENERGY EFFICIENT

- No harmful ultraviolet or infrared wavelengths
- No lead or mercury
- Comparable light output to 65W BR30 incandescent while consuming less than 11W*



PRODUCT SPECIFICATIONS

LED Light Engine LED array integrated to one piece high purity aluminum, thermally conductive housing provides uninterrupted heat transfer to ensure long life of the LED • Replaceable light engine mounts directly to housing and incorporates the latest generation, high lumen output LED array • LEDs are binned to standards that exceed ENERGY STAR® requirements yielding superior fixture to fixture color uniformity • 2700K, 3000K, 3500K, or 4100K color temperatures available • 83 CRI typical.

Optical System Computer-optimized reflector design with high reflectance white finish coupled with a high transmission diffusing lens conceals the LEDs and produces uniform aperture luminance • Wide flood distribution shipped as standard with optional optic accessories available and sold separately.

Aesthetic Trim Selections Compatible with wide selection of existing Juno trims • Shadow free, knife edge design blends seamlessly into ceiling. • Trims are wet location approved for covered ceiling applications.

LED Driver Choice of dedicated 120 volt driver or universal voltage driver that accommodates input voltages from 120-277 volts AC at 50/60Hz • Power factor > 0.9 at 120V input • 120 volt only driver is dimmable with the use of most incandescent, magnetic low voltage and electronic low voltage wall box dimmers • Universal voltage driver is dimmable with the use of most 0-10V wall box dimmers • For a list of compatible dimmers, see [JUNOLEDG3-DIM](#) • Mounted between the j-box and housing for easy access and cool operation.

Life Rated for 50,000 hours at 70% lumen maintenance.

Labels Certified to the high efficiency requirements of California T24-2008 with select trims • UL listed for U.S. and Canada through-branch wiring, wet locations (covered ceilings) • Union made • UL and cUL.

Testing All reports are based on published industry procedures; field performance may differ from laboratory performance.

Product specifications subject to change without notice.

HOUSING FEATURES

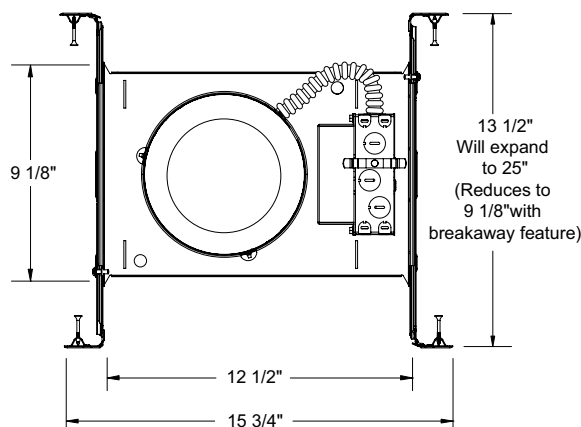
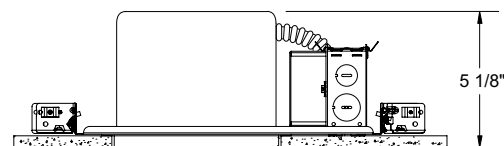
Housing Designed for use in IC (insulated ceiling) or non-IC construction • Aluminum housing sealed for Air-Loc® compliance • Housing is vertically adjustable to accommodate up to a 2" ceiling thickness.

Junction Box Pre-wired junction box provided with (5) ½" and (1) ¾" knockouts, (4) knockouts for 12/2 or 14/2 NM cable and ground wire • UL listed and cUL listed for through-branch wiring, maximum 8 #12 branch circuit conductors • Junction box provided with removable access plates • Knockouts equipped with pryout slots • Quick connect electrical connectors supplied as standard for fast, secure installation.

Mounting Frame 22-gauge die-formed galvanized steel mounting frame • Rough-in section (junction box, mounting frame, housing and bar hangers) fully assembled for ease of installation.

Real Nail 3 Bar Hangers Telescoping Real Nail 3® system permits quick placement of housing anywhere within 24" O.C. joists or suspended ceilings • Includes removable nail for repositioning of fixture in wood joist construction • Integral T-bar notch and clip for suspended ceilings • Design covered under Patents US5,505,419 and D552,969.

DIMENSIONS



6 7/8" CEILING CUTOUT

ELECTRICAL DATA

Dedicated 120V Only Driver Option

120V	
Input Power	10.5W (+/-5%)
Input Current - Max	0.10A
Frequency	50/60Hz
EMI/RFI	FCC Title 47 CFR, Part 15, Class B (residential)
Minimum starting temp	-20°C

ELECTRICAL DATA

Universal Voltage

	120V	277V
Input Power	12W (+/-5%)	12.3W (+/-5%)
Input Current - Max	0.11A	0.055A
Frequency	50/60Hz	50/60Hz
EMI/RFI	FCC Title 47 CFR, Part 15, Class A (commercial)	FCC Title 47 CFR, Part 15, Class A (commercial)
Minimum starting temp	-40°C	-40°C

* Nominal input wattage @ 120-volt operation with dedicated 120-volt driver under stable operating conditions.

6" IC 600 LUMEN LED DOWNLIGHT NEW CONSTRUCTION

IC22LEDG3 RECESSED HOUSING LENSED TRIMS

ORDERING INFORMATION: Housing, trim and accessories each ordered separately.

Example: **IC22LEDG3-3K-1**

Housing	Color Temperature	Input Voltage
IC22LEDG3	27K 2700K 3K 3000K 35K 3500K 41K 4100K	1 Dedicated 120V Only (Forward Phase + ELV dimmable) U Universal Voltage, 120-277V (0-10V dimmable)

Example: **2330W-WH**

Trim/Description		
	20-WH 20-PW	Albalite Shower/Closet Light
	21-WH 21-PW	Drop Opal Shower/Closet Light
	22-WH	Fresnel
	239-WH ¹ *	Frosted Lens
	242-WH 242-SC 242-ABZ	Shower Trim Frosted Lens with Clear Center
	243-WH *	Decorative Swirled Etched Opal Glass
	2330-WH *	White Baffle, Regressed Frosted Dome Lens with Reflector
	2330B-WH *	Black Baffle, Regressed Frosted Dome Lens with Reflector
	6101-ABZ * 6101-SC * 6101-WH *	Beveled Frame - Frosted Dome Lens with Reflector

ACCESSORIES

Catalog No.	Description
LEDOPTICG3-M	Medium Flood Optic (50°)
LEDOPTICG3-N	Narrow Flood Optic (37°)
LEDOPTICG3-S	Spot Optic (10°)

To order, specify catalog number.

UL Listed for use in wet location.

¹ Universal Voltage: T24 @ 41K only

* Do not use reflector shipped with trim for LED housing.

Trim Size: 2330 - 7³/₈" O.D.; 239, 242, 243, 9900 - 7⁵/₈" O.D.; 6101 - 7³/₄" O.D.; 20, 21, 22 - 8" O.D.

Trim Finish: ABZ - Classic Aged Bronze, SC - Satin Chrome, WH - White, PW - Plastic White (Polycarbonate material shower trim).

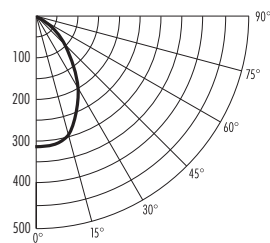
Note: In Canada when insulation is present, Type IC fixtures must be used.

JUNO IC housings meet IECC Energy Code requirements per ASTM E283.

Air-Loc® rated trims are pre-gasketed for minimum air leakage with IC housings.

PHOTOMETRIC REPORT

Test Report #: PT10111804
Catalog No: IC22LEDG3-35K
with 239-WH Trim
and standard wide flood optic
Luminaire Spacing Criterion: 1.02
Luminaire LPW: 49.7



CANDLEPOWER DISTRIBUTION (Candelas)

Degrees Vertical	0°
0	327
5	323
15	297
25	244
35	166
45	97
55	57
65	34
75	19
85	4
90	0

Multiplier: 27K - 0.90
3K - 0.97
41K - 1.04

AVERAGE INITIAL FOOTCANDLES

Multiple Units (Square Array, 60'x60' room)
Ceiling 80% Wall 50% Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	36	30	26
5.0'	23	19	16
6.0'	16	13	11
7.0'	13	11	9
8.0'	10	8	7
9.0'	8	6	6
10.0'	6	5	4

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixture
0-30°	228	N/A	44.1
0-40°	332	N/A	64.2
0-60°	458	N/A	88.7
0-90°	517	N/A	100.0

INITIAL FOOTCANDLES (One Unit, 10.6W, 70.6° Beam)

Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Beam Diameter
4	20.4	5.7'
6	9.1	8.5'
8	5.1	11.3'
10	3.3	14.2'

LUMINANCE (Average cd/m²)

Degrees	Average Luminance
45	7557
55	5448
65	4458
75	3936
85	2666

Fixtures tested to IES recommended standard for solid state lighting per LM-79-08. Photometric performance on a single unit represents a baseline of performance for the fixture. Results may vary in the field.



1300 S. Wolf Road • Des Plaines, IL 60018 • Phone (847) 827-9880 • Fax (847) 827-2925
220 Chrysler Drive • Brampton, Ontario • Canada L6S 6B6 • Phone (905) 792-7335 • Fax (905) 792-0064

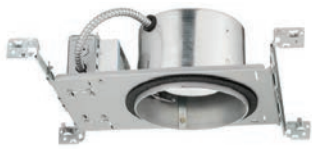
26 50 00 Interior Lighting

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6" IC-Rated 600 Lumen Generation 3 LED Downlight Ordering Information

For new construction or remodel applications, you can add energy-efficient LED lighting from Juno. 6" housing is compatible with a variety of trims to complement virtually any design.

6" New Construction



Shown with universal voltage driver.



IC22LEDG3 Series

Dedicated 6" LED new construction housing with integral light engine and choice of dimmable drivers: 10.5W nominal dedicated 120 volt driver with forward phase and ELV dimming or 12W nominal universal 120V-277V driver with 0-10V dimming. Shallow housing allows for fit in 2 x 6 construction. Air-Loc fully sealed housing does not require separate gasket. IC housing designed for use in IC or non-IC construction. 15 3/4" L x 9 1/8" W x 5 1/8" H Ceiling Cutout: 6 7/8"

Housing	Color Temp.	Input Voltage
IC22LEDG3	27K 2700K	1 Dedicated 120V Only,
	3K 3000K	(forward phase and ELV dimming)
	35K 3500K	U Universal Voltage 120-277V,
	41K 4100K	(0-10V dimming)

Example: IC22LEDG3-27K-1

6" Remodel



Shown with dedicated 120 volt driver.



IC22RLEDG3 Series

Dedicated 6" LED remodel housing with integral light engine and choice of 10.5W nominal dedicated 120 volt driver with forward phase and ELV dimming or 12W nominal universal 120V-277V driver with 0-10V dimming. Shallow housing allows for fit in 2 x 6 construction. Air-Loc gasket kit supplied with housing. IC housing designed for use in IC or non-IC construction. 14 1/2" L x 7 1/4" W x 5 1/8" H Ceiling Cutout: 6 3/4"

Housing	Color Temp.	Input Voltage
IC22RLEDG3	27K 2700K	1 Dedicated 120V Only,
	3K 3000K	(forward phase and ELV dimming)
	35K 3500K	U Universal Voltage 120-277V,
	41K 4100K	(0-10V dimming)

Example: IC22RLEDG3-27K-1

6" WarmDim™*



Optional 14W WarmDim new construction or remodel housing. Dedicated 120V driver with forward and reverse phase dimming.

Housing	Color Temp.	Input Voltage
IC22LWDG3 IC22RLWDG3	3K 3000K	1 Dedicated 120V Only, (forward phase and ELV dimming)

*Patent pending

Example: IC22RLWDG3-3K-1

6" LED Downlight Trims

Downlights



Downlight Baffle
24W-WH White
24B-WH Black
24B-SC Black
24B-ABZ Black
24B-BL Black



Downlight Cone
27C-WH Clear Alzak®
27G-WH Gold Alzak®
27B-WH Black Alzak®
27PT-SC Pewter Alzak®
27W-WH Gloss White
27HZ-WH Haze
27WHZ-WH Wheat Haze
27WHZ-ABZ Wheat Haze

Decorative



Octagonal
9024W-WH



Luminous Disc (Frosted)
9324-SC

Decorative, continued



Metal Band
9524-SC



Luminous Collar (Frosted)
9702

Wall Wash



Wall Wash
262G3W-WH White Baffle
262G3B-WH Black Baffle

Lensed



Albalite
20-PW Shower/Closet Light
20-WH



Drop Opal
21-PW Shower/Closet Light
21-WH



Fresnel
22-WH

Lensed, continued



Frosted Lens*
239-WH



Frosted Lens with Clear Center
242-ABZ
242-SC
242-WH



Decorative Swirled Etched Opal Glass
243-WH



White Baffle, Regressed Frosted Dome Lens*
2330W-WH
2330B-WH



Beveled Frame, Frosted Dome Lens*
6101-ABZ
6101-SC
6101-WH

ENERGY STAR® qualification and T24 certification is dependant on trim finish and LED color temperature. See housing spec sheet on junolightinggroup.com for specific information for each trim.

* Do not use reflector shipped with trim when used with LED housing. Discard or recycle reflector.

Regulatory Listings & Standards

- UL and C-UL Listed for Damp Location and Wet Location when used with lensed trims
- Listed for Direct Contact with Insulation
- UL and C-UL Listed for Feed-Thru Wiring
- ENERGY STAR® Qualified to luminaires V1.1 requirements when used with select baffle and cone trims
- Juno's sealed recessed IC LED housings meet IECC AirLoc® Code requirements per ASTM E283 for minimum leakage with IC housing
- RoHS Compliant
- Juno LED Downlights are certified to meet the high efficacy requirements of California Title 24-2008.



Trim Finishes

ABZ Classic Aged Bronze SC Satin Chrome WH White
PW Plastic White (Polycarbonate material shower trim) BL Black

Qualified Dimmers

Dedicated 120-volt fixtures (-1) are compatible with incandescent, magnetic low voltage or electronic low voltage wall box dimmers. Universal voltage fixtures (-U) are compatible with 0-10V wall box dimmers.

Refer to www.junolightinggroup.com for specific list of Juno Lighting Group recommended dimmer model numbers.

Accessories



Catalog Number
LEDOPTICG3-M
LEDOPTICG3-N
LEDOPTICG3-S

Description
Medium Flood Optic (50° beam)
Narrow Flood Optic (37° beam)
Spot Optic (10° beam)

3 of 4
3 of 4

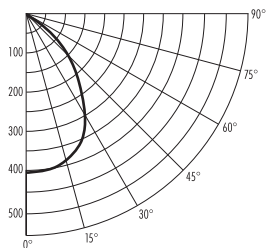
6" IC-Rated 600 Lumen Generation LED Downlight Photometric Information

White Baffle

IC22LEDG3-35K and IC22RLEDG3-35K with 24W-WH

Photometric Report

Test Report #: LTL25974R
 Catalog No: IC22LEDG3-35K
 with 24W-WH Trim and
 standard wide flood optic
 Luminaire Spacing Criterion: 1.16
 Luminaire LPW: 64



Candlepower Distribution

Degrees Vertical	0°
0	404
5	401
15	379
25	337
35	261
45	139
55	61
65	28
75	16
85	4
90	0

Multiplier: 27K - 0.90
 3K - 0.97
 41K - 1.04

Average Initial Footcandles

Multiple Units (Square Array, 60' x 60' room)
 Ceiling 80% Wall 50% Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	46	39	33
5.0'	30	25	21
6.0'	21	17	15
7.0'	17	14	12
8.0'	13	11	9
9.0'	10	8	7
10.0'	7	6	5

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0 - 30°	300	N/A	44.4
0 - 40°	461	N/A	68.2
0 - 60°	625	N/A	92.5
0 - 90°	675	N/A	100.0

Initial Footcandles

(One Unit, 10.6W , 79.8° Beam)

Distance to Footcandles Illuminated Plane (Ft.)	Beam Center	Beam Diameter
4	25.3	6.7'
6	11.2	10.0'
8	6.3	13.4'
10	4.0	16.7'

Luminance (Average cd/m²)

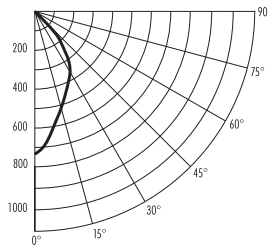
Degrees	Average Luminance
45	11731
55	6304
65	4019
75	3756
85	2961

Clear Cone

IC22LEDG3-35K and IC22RLEDG3-35K with 27C-WH

Photometric Report

Test Report #: LTL25975R
 Catalog No: IC22LEDG3-35K
 with 27C-WH Trim and
 standard wide flood optic
 Luminaire Spacing Criterion: 0.78
 Luminaire LPW: 69



Candlepower Distribution

Degrees Vertical	0°
0	718
5	674
15	512
25	401
35	286
45	137
55	43
65	9
75	0
85	0
90	0

Multiplier: 27K - 0.90
 3K - 0.97
 41K - 1.04

Average Initial Footcandles

Multiple Units (Square Array, 60' x 60' room)
 Ceiling 80% Wall 50% Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	50	42	36
5.0'	32	27	23
6.0'	22	18	16
7.0'	18	15	13
8.0'	14	12	10
9.0'	11	9	8
10.0'	8	7	6

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0 - 30°	390	N/A	53.9
0 - 40°	566	N/A	78.3
0 - 60°	713	N/A	98.7
0 - 90°	723	N/A	100.0

Initial Footcandles

(One Unit, 10.6W , 58.1° Beam)

Distance to Footcandles Illuminated Plane (Ft.)	Beam Center	Beam Diameter
4	44.9	4.4'
6	19.9	6.7'
8	11.2	8.9'
10	7.2	11.1'

Luminance (Average cd/m²)

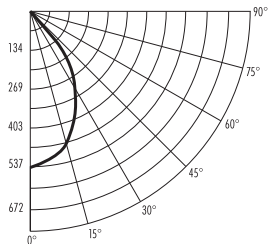
Degrees	Average Luminance
45	11550
55	4510
65	1250
75	0
85	0

Haze Cone

IC22LEDG3-35K and IC22RLEDG3-35K with 27HZ-WH

Photometric Report

Test Report #: LTL25976R
 Catalog No: IC22LEDG3-35K
 with 27HZ-WH Trim and
 standard wide flood optic
 Luminaire Spacing Criterion: 1.02
 Luminaire LPW: 66



Candlepower Distribution

Degrees Vertical	0°
0	537
5	525
15	462
25	389
35	288
45	144
55	47
65	10
75	0
85	0
90	0

Multiplier: 27K - 0.90
 3K - 0.97
 41K - 1.04

Average Initial Footcandles

Multiple Units (Square Array, 60' x 60' room)
 Ceiling 80% Wall 50% Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	48	40	35
5.0'	31	26	22
6.0'	21	18	15
7.0'	17	15	12
8.0'	14	11	10
9.0'	10	9	8
10.0'	8	6	6

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixture
0 - 30°	357	N/A	51.0
0 - 40°	535	N/A	76.3
0 - 60°	691	N/A	98.5
0 - 90°	701	N/A	100.0

Initial Footcandles

(One Unit, 10.6W , 72.9° Beam)

Distance to Footcandles Illuminated Plane (Ft.)	Beam Center	Beam Diameter
4	33.6	5.9'
6	14.9	8.9'
8	8.4	11.8'
10	5.4	14.8'

Luminance (Average cd/m²)

Degrees	Average Luminance
45	12141
55	4897
65	1366
75	0
85	0

Fixtures tested to IES recommended standard for solid state lighting per LM-79-08. Photometric performance on a single unit represents a baseline of performance for the fixture. Results may vary in the field.

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data for each luminaire, including lamps.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fixtures, Emergency Lighting Units, Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where luminaire efficacy rating (LER) is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. High-Intensity Discharge (HID) Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Exterior luminaires: Comply with UL 1598, and listed and labeled for installation in wet locations by a Nationally Recognized Testing Laboratory acceptable to authorities having jurisdiction.
- F. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2.3 BALLASTS

- A. Ballasts for Linear Fluorescent Lamps:
 - 1. Electronic: Comply with ANSI C82.11; instant-start type.

- a. Sound Rating: A, except B for T12/HO and T12/Slimline lamp ballasts.
 - b. Ballast Factor (BF): 0.85 or higher.
 - c. Power Factor: 0.95 or higher.
2. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
 3. Electromagnetic: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 4. For Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.
 5. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures zero deg F and higher.
 6. Dimmer Controlled: Electronic type.
 - a. Dimming Range: 100 to 10 percent of rated lamp lumens.
 - b. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
- B. Ballasts for Compact Fluorescent Lamps: Electronic programmed rapid-start type, complying with ANSI C 82.11.
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: A.
 4. BF: 0.95 or higher unless otherwise indicated.
 5. Power Factor: 0.95 or higher.
- C. Internal-Type Emergency Fluorescent Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.4 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 4. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 LAMPS

- A. Compact Fluorescent Lamps: Four-pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 - 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).
- B. LED Lamps: 94/93 CRI, 3000K – 4000K color temperature average rated life of 50,000 hours.
 - 1. 14.3 Watts Title 24 high efficacy 970 actual Lumens.
 - 2. 10.5 Watts Title 24 high efficacy 612 actual Lumens.

2.6 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Fixture <Insert drawing designation>:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Nora Lighting or comparable product by one of the following:
 - a. Nora Lighting.
 - 2. Voltage: 120 V ac.
 - 3. Mounting: Recessed ceiling.
 - 4. Nominal Dimensions: 4 5/8" diameter.
 - 5. Lamps: 3 recessed cans.
 - 6. External Finish: White reflector flange.
 - 7. Trim and Hardware: Friction blade mounting of trim to housing.
 - 8. Minimum CU for typical RCR shall be as follows (typical cavity reflectances are ceiling = 80 percent, wall = 50 percent, and floor = 20 percent): RCR 5 CU.
 - 9. Other Requirements: Use of self powered deck lighting for walkway lighting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-prevention features mounted in ceiling space and on ceiling.
- B. Lighting Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- C. Comply with NFPA 70 for minimum fixture supports.

- D. Seismic Protection: Luminaire attachments to building walls and ceilings shall comply with seismic criteria in Section 26 05 00 "Common Work Results for Electrical."
- E. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- F. Air-Handling Fixtures: Install with dampers closed and ready for adjustment.
- G. Adjust aimable lighting fixtures to provide required light intensities.

END

OF

SECTION

26 50 00

26 51 13 INTERIOR LIGHTING FIXTURES, LAMPS, & BALLASTS (BATHROOM VANITY SCONCE)

Access Lighting 31002-BS Vail 1-Light Vanity and Wall Fixture, Brushed Steel with Opal Glass

by [Access Lighting](#)



Access Lighting Vail 1 Light Vanity in Brushed Steel 31002-BS/OPL

Vanity & Wall Fixture



Brand Information

- Brand: Access
- Collection: Vail
- SKU: 31002-BS/OPL
- UPC: 641594076035

Dimensions and Weight

- Length: 30.25 in.
- Height: 4.25 in.
- Extension/Depth: 3.25 in.
- Backplate/Canopy Width: 3.00 in.
- Backplate/Canopy Length: 25.60 in.
- Backplate/Canopy Thickness: 1.25 in.
- Install Position: Wall

Other Specifications

- Ships Via: Freight
- System: Standard
- Warranty: 1 Year Warranty

Additional Details

- Supplied with Floating Canopy
- **Energy Efficient: Yes**

Design Information

- Category: [Bathroom Vanity Lights](#)
- Finish: [Brushed Steel](#)
- Glass: [Opal Glass](#)
- Material: [Metal](#)

Bulb Information

- Bulbs Included: Yes
- Primary Bulb(s): 1 x 24 watts T-5 HO Fluorescent (Bi-Pin Base)
- Color Temperature: 3000k

Product Rating

- Voltage: 120v
- Safety Rating: CETL Damp
- ADA Approved

Brand	Access Lighting
Part Number	31002-BS/OPL
Item Weight	5 pounds
Product Dimensions	3.2 x 30.2 x 4.2 inches
Item model number	31002-BS/OPL
Assembled Height	4.25 inches
Assembled Length	3.25 inches
Assembled Width	30.25 inches
Item Package Quantity	1
Style	Transitional
Collection	Vail
Color	Steel
Material	Steel
Finish	Brushed Steel
Number of Lights	1
Maximum Compatible Wattage	24 watts
Voltage	120 volts
Specific Uses	Damp
Fixture Features	Dimmable
Shade Color	White
Shade Material	Glass
Power Source	corded-electric
Certification	ADA Certified, ETL Listed
Type of Bulb	Fluorescent
Base Type	Fluorescent Pin, Specialty
Wattage	24 watts

TASKWORK DIRECT WIRE – 12V XENON

TaskWork Direct Wire 12V Xenon offers you a simple installation solution for illuminating a task area or adding ambient lighting.



10584 BZ
30" Fixture shown in Bronze

Select Appropriate Light Fixture Size & Finish

10579 BZ, SS, WH 7"

- 7" L x 5" W x 1" H
- 1 light
- 12V, 18 Watt Xenon bulb included

10580 BZ, SS, WH 12-1/4"

- 12-1/4" L x 5" W x 1" H
- 2 light
- 12V, 18 Watt Xenon bulbs included

10581 BZ, SS, WH 21-1/2"

- 21-1/2" L x 5" W x 1" H
- 3 light
- 12V, 18 Watt Xenon bulbs included

10584 BZ, SS, WH 30"

- 30" L x 5" W x 1" H
- 4 light
- 12V, 18 Watt Xenon bulbs included

10595 BZ, SS, WH 40"

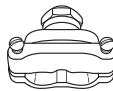
- 40" L x 5" W x 1" H
- 5 light
- 12V, 18 Watt Xenon bulbs included

Replacement Bulb

10574 CLR

- 12V, 18 Watt Xenon, clear

Accessories

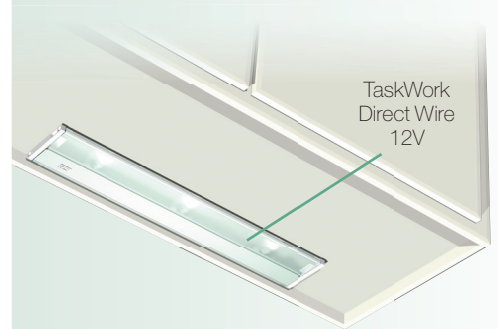


10588 SI - Duplex BX cable connector



10589 SI - Connector for NM & BX cable

BACK MOUNT DESIGN

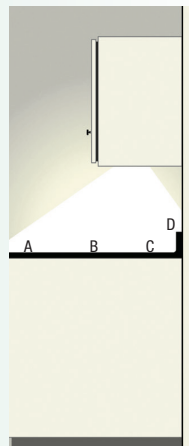


FEATURES

- Low 1" profile x 5" wide
- Fastener-free hinge assembly
- Keyhole mounting
- NM & BX single cable connector included
- High/Low/On-Off switch

PERFORMANCE DATA (10580)

Lumens/Watt	6.1
Light Output FC	
A – Counter Front	14.1
B – Counter Middle	31.2
C – Counter Back	47.3
D – Counter Wall	17.8
.....	
CRI (color rendering)	min 100
CCT (color temperature)	2700K
Light Source Life	10,000 hrs.



AVAILABLE FINISHES

Bronze (BRZ), Brushed Stainless Steel (SS) and White (WH)



BZ Bronze



SS Brushed Stainless Steel



WH White

TASKWORK DIRECT WIRE – 120V XENON

TaskWork Direct Wire 120V Xenon design features large wiring compartments and multiple 1/2" trade-size knockouts for fast and easy installation.



12013 BZ
22" Fixture shown in Bronze

Select Appropriate Light Fixture Size & Finish

- 12011 BZ, SI, WH** 7"
- 7" L x 5" W x 1-1/4" H
 - 1 light
 - 120V, 20 Watt Xenon bulb included

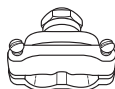
- 12012 BZ, SI, WH** 12"
- 12" L x 5" W x 1-1/4" H
 - 2 light
 - 120V, 20 Watt Xenon bulbs included

- 12013 BZ, SI, WH** 21"
- 21" L x 5" W x 1-1/4" H
 - 3 light
 - 120V, 20 Watt Xenon bulbs included

- 12014 BZ, SI, WH** 30"
- 30" L x 5" W x 1-1/4" H
 - 4 light
 - 120V, 20 Watt Xenon bulbs included

- Replacement Bulb**
12090 CLR
- 120V, 20 Watt Xenon, clear

Accessories



- 10588 SI** - Duplex BX cable connector



- 10589 SI** - Connector for NM & BX cable

AVAILABLE FINISHES

Bronze (BRZ), Silver (SI) and White (WH)



BZ Bronze

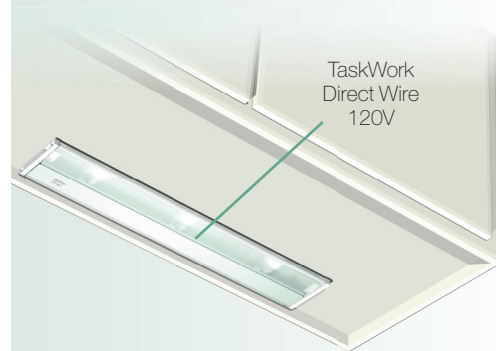


SI Silver



WH White

BACK MOUNT DESIGN

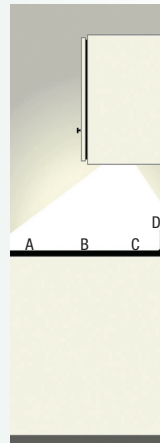


FEATURES

- 1-1/4" profile x 5" wide
- 120V, 20 Watt Xenon bulb(s)
- High/Low/On-Off switch
- cUL Listed

PERFORMANCE DATA (12012)

Lumens/Watt	5
Light Output FC	
A – Counter Front	8.6
B – Counter Middle	21.1
C – Counter Back	38.2
D – Counter Wall	13.2
CRI (color rendering)	min 100
CCT (color temperature)	2620K
Light Source Life	2,500 hrs.





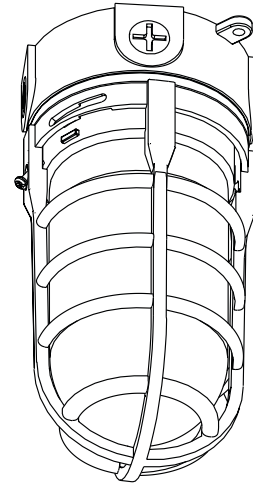
Catalog Number	
Notes	Type

Indoor General Purpose

Vapor Tight

Harsh Environment Utility

Incandescent



FEATURES & SPECIFICATIONS

INTENDED USE

Provides general illumination in residential and light commercial applications. Ideal for use where dust, dirt, humidity, and moisture are present.

ATTRIBUTES

Rugged die cast aluminum housing with moisture seal gasket for a vapor-tight seal, keeping out moisture, dust and humidity. Glass globe protects bulb from the elements. Openings on top and sides with removeable screw-plugs provide easy access for installation and maintenance.

Utilizes maximum (1) 150W incandescent lamps for energy efficiency, superior color rendering and long life (not included).

LISTING

CUL listed to US and Canadian safety standards and rated for wet locations. Can be ceiling or wall mounted.

WARRANTY

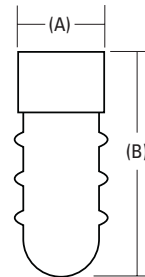
Guaranteed for two years against mechanical defects in manufacture.

DIMENSIONS

Lamp Configuration	Model Number	Number of Lamps	(A) Width inches (cm)	(B) Height inches (cm)
	OVT 150I	(1) 150W incandescent lamp	4-3/16" (10.6)	9-1/8" (23.3)

* Extension from ceiling

All dimensions are in inches (centimeters)



ORDERING INFORMATION

Example: **OVT 150I 120**

Choose the boldface catalog nomenclature that best suits your needs and write it on the appropriate line. Order accessories as separate catalog numbers.

OVT 150I	120
Model Number ¹	Voltage
OVT 150 (1) Maximum 150W incandescent lamp required	120 120 volt (standard)

Notes:
1. **REQUIRES** - (1)150w incandescent lamp - not included.

PHOTOMETRICS

Full photometric data report available within 2 weeks from request. Consult factory.

DIVISION 28 ELECTRONIC SAFETY AND COMMUNICATION

28 31 46

Smoke Detector



120V AC Wire-In Smoke Alarm

Slide Load Front Battery Door

Model i4618

- Ionization Sensing Technology
- Battery Backup (batteries included)
- Hush® Button
- Alarm Memory Indicator
- New 360° Mounting Plate with Tamper Resistance
- Front Load Battery Door



Description

The Kidde i4618 is an AC/DC powered, ionization smoke alarm that operates on a 120V power source with 9V battery backup.

This alarm uses ionization sensing technology. Ionization sensing alarms may detect invisible fire particles (associated with flaming fires) sooner than photoelectric alarms. Photoelectric sensing alarms may detect visible particles (associated with smoldering fires) sooner than ionization alarms.

Kidde strongly recommends that both ionization and photoelectric smoke alarms be installed to help insure maximum detection of the various types of fire that can occur within the home.

The front-loading battery door allows user to change the battery without removing the alarm from the mounting bracket making battery replacement easy and convenient. This smoke alarm is available in a 6-piece cut case with tray for easy display as well as a 6-piece bulk pack for contractors and property owners. This unit is a UL Listed product with a 5-year limited warranty.

Install Confidence:

Easy Installation

- Front battery pull tab allows battery activation without removing alarm from mounting bracket.
- Large mounting base makes mounting easier, protects surface paint from dirt and covers imperfections.
- Pre-stripped wiring harness with easy off cap does not require stripper tool. Tinned strands increase conductivity and wire nut grip.

Fewer Callbacks

- Large centrally located Test/Hush® alarm control button.
- Dust cover protects sensor from contaminants during construction reducing nuisance alarms.

User-Friendly Features

- Easy access front loading battery door.
- Battery backup provides protection in case of power failure.
- Interconnectable with up to 24 devices (of which 18 can be initiating) including smoke, CO and heat alarms. See user's guide for complete instructions.



Architectural and Engineering Specifications

The smoke alarm shall be Kidde Model i4618 or approved equal. It shall be powered by a 120VAC, 60Hz source along with a 9V battery backup. The unit shall incorporate an ionization sensor with nominal sensitivity of 0.50 to .92%/ft. The temperature operating range shall be between 40°F and 100°F (4°C and 38°C) and the humidity operating range shall be up to 85% relative humidity.

The smoke alarm can be installed on any standard single gang electrical box, up to a 4" octagon junction box. The electrical connection (to the alarm) shall be made with a plug-in connector. A maximum of 24 Kidde devices can be interconnected in a multiple station arrangement. The interconnect system must not exceed the NFPA (National Fire Protection Association) limit of 18 initiating devices, of which 12 can be smoke alarms. With 18 initiating devices (Smoke, heat, CO, etc), interconnected, it is still possible to interconnect 6 strobe lights and/or relay modules. The alarm shall provide optional tamper resistance that deters removal of the unit from the wall or ceiling. No additional pieces shall be required to activate this feature.

The alarm shall include an easy access battery compartment that is opened and closed by sliding the battery door. The 9V battery carrier will ensure proper battery backup protection by not allowing the battery door to close if the battery is placed in the unit incorrectly or if a battery is not present.

The unit shall include a piezoelectric horn that is rated at 85 decibels at 10 feet. The unit shall include the Smart Hush™ feature that silences the unit for approximately 8 minutes if a nuisance condition occurs.

The unit shall incorporate red and green LED indicators. The green LED (when illuminated) indicates the presence of AC power. The red LED (located under the TEST/Hush button) has four modes of operation:

Standby Condition: The red LED will flash every 30-40 seconds to indicate that the smoke alarm is operating properly. **Alarm Condition:** When the alarm senses products of combustion and goes into alarm the red LED will flash one flash per second. The flashing LED and pulsating alarm will continue until the air is cleared. When units are interconnected, only the red LED of the alarm that senses the smoke or is being tested (the originating unit) will flash. All other units in the interconnected system will sound an alarm but their red LED's will NOT flash. **Alarm Memory:** This smoke alarm is equipped with an alarm memory, which provides a visual indication when an alarm has been activated. The red LED will illuminate for about 1.5 seconds every 16 seconds to indicate the memory condition. **Smart Hush™ Mode:** The red LED will illuminate for 1.5 seconds every 8 seconds, indicating the smoke alarm is in the Smart Hush™ Mode.

The unit shall at a minimum meet the requirements of UL217, NFPA72, and (chapter 11), The State of California Fire Marshall, NFPA101 (One and two family dwellings), Federal Housing Authority (FHA), Housing and Urban Development (HUD).

Ordering Information

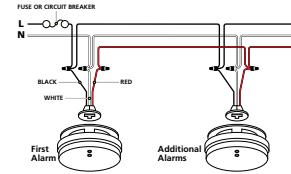
Model i4618

Ordering Number	UPC	I2F5	Pack Quantity	Dimensions (w x d x h inches)	Weight	Skid
21007581	0-47871-07581-2	100-47871-07581-9	Cut Case (6 units)	6.63 x 13.25 x 6.25	3 lbs	1008
21007584	0-47871-07584-3	100-47871-07584-0	Bulk Pack (36 units)	13.25 x 19.5 x 19.5	18 lbs	1296
21007585	0-47871-07585-0	100-47871-07585-7	Cut Case (4 units)	7.94 x 13.38 x 11.75	2 lbs	390
21007588	0-47871-07588-1	100-47871-07588-8	Bulk Pack (4 units)	6.5 x 9 x 6.5	2 lbs	720
21007583*	0-47871-07583-6	100-47871-07583-3	Cut Case (6 units)	6.63 x 13.25 x 6.25	3 lbs	1008

*Comes with alkaline battery

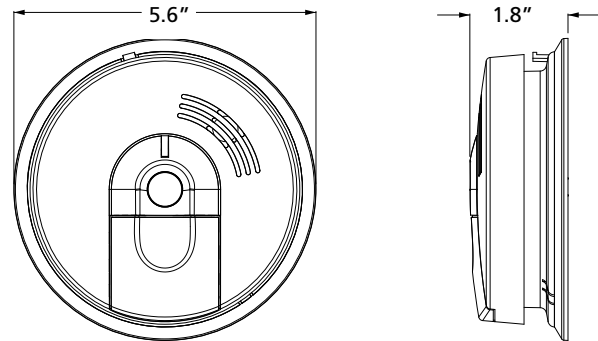
Installation of Smoke Alarm

The smoke 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 as required by code.



Technical Specifications

Model:	i4618
UPC:	0-47871-07581-2
Power Source:	120VAC (80mA Max)
Sensor:	Ionization
Audio Alarm:	85dB at 10ft
Temperature Range:	40°F (4.4°C) to 100°F (37.8°C)
Humidity Range:	Up to 85% relative humidity (RH)
Size:	5.6" in diameter x 1.8" depth
Weight:	.5lbs
Interconnects:	Up to 24 Kidde devices
LED:	Green, receiving ac power Red, 4 modes of operation
Warranty:	5 year limited



1016 Corporate Park Drive
 Mebane NC 27302
 1-800-880-6788
 www.Kidde.com



Distributed by:

DIVISION 32 EXTERIOR IMPROVEMENTS

32 82 00	Irrigation Pump (Night Sky Pump)
32 84 00	Planting Irrigation (Globe Values)
32 84 00	Planting Irrigation (Night Sky Sprinklers)

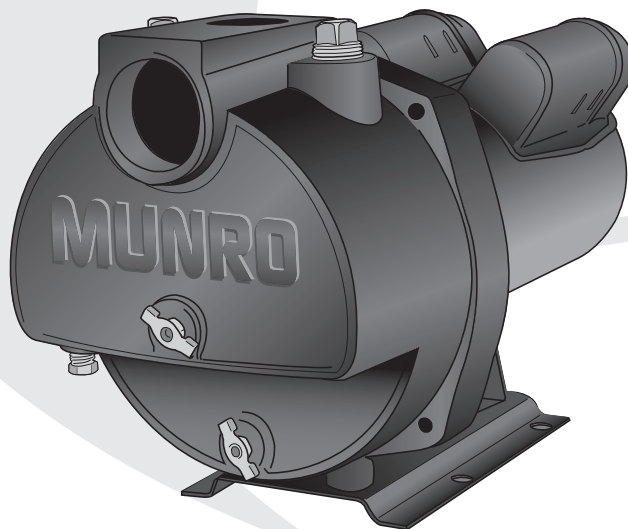
Unique Solutions For Unique Situations



Installation Manual

Operation Manual

LP SERIES Self-Priming Centrifugal Pumps



READ ALL INSTRUCTIONS CAREFULLY

Read these installation instructions in detail before installing your pump. As pump performance depends largely on installation be sure to check the following:

1. Be certain the motor is connected for the correct line voltage being

used (*check motor nameplate*).

2. Be certain the pump is completely primed before starting or damage may occur to the seal.

MUNRO LP SERIES CENTRIFUGAL IRRIGATION PUMP

GENERAL SAFETY INFORMATION

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA)
2. Replace damaged or worn wiring cord immediately.
3. Do not kink power cable or allow the cable to come in contact with oil, grease, hot surfaces, or chemicals.
4. Protect the power cable from coming in contact with sharp objects.
5. Be careful when touching the exterior of an operating motor - it may be hot enough to be painful or cause injury.
6. Make certain the power source conforms to the requirements of your equipment.
7. **Always disconnect power source before performing any work on or near the motor or its connected load.** If the power disconnect point is out-of-sight, lock it in the open position and tag it to prevent unexpected application of power. Failure to do so could result in fatal electrical shock.
8. Do not handle the pump with wet hands or when standing in water as fatal electrical shock could occur. Disconnect main power before handling unit for **ANY REASON!**
9. Unit must be securely and adequately electrically grounded. This can be



accomplished by wiring the unit to a ground metal-clad raceway system or by using a separate ground wire connected to the bare metal of the motor frame or other suitable means.

LOCATION OF PUMP

1. Pump can be located at the water source or can be offset some distance away. For best performance, it should be located as close to the water source as is practical.
2. Location can be in the basement, a pit below ground, or in a pump house above ground.

TABLE 2 - SPECIFICATIONS

HP	Type	Volts/Amps	Hz	RPM	Motor Voltage (Factory) Connected	Service Factor Motor Amps						Max Liquid Temp	Max▲ Suction Lift
						Single Phase			Three Phase				
						115V	208V	230V	208V	230V	460V		
3/4	Single Ph	115/208-230 230	60	3450	230V	10	5	5	—	—	—	180°F	15 Ft.
1						15.6	8.8	7.8					
1-1/2						13.4	7.4	6.7					
2						—	—	12.9					
3						—	—	19.6					
3/4	Three Ph	208-230/460	60	3450	230V	—	—	—	†	1.6	†	180°F	15 Ft.
1						—	—	—	†	2.5	†		
1-1/2						—	—	—	†	2.5	†		
2						—	—	—	†	4.1	†		
3						—	—	—	†	7.0	†		

▲ Suction lift varies, depending upon elevation (*altitude*) and water temperatures. † For amperage ratings consult motor nameplate.

We will use the
3/4 HP

TABLE 1 - PUMP PERFORMANCE

Model Number	Phase	HP	Suction Lift Feet	Capacity - U.S. Gallons Per Minute Discharge Pressure (PSI)									Shut Off Pressure PSI	Suction Pipe Tap	Discharge Pipe Tap
				10	15	20	25	30	35	40	45				
MULP075B	1	3/4	5	56	48	42	37	29	21	-	-	41	2"	1-1/2"	
MULP100B	1	1	5	58	53	48	43	38	32	23	11	48	2"	1-1/2"	
MULP150B	1	1-1/2	5	78	77	71	70	62	53	43	30	47	2"	1-1/2"	
MULP200B	1	2	5	86	84	81	77	71	62	52	40	50	2"	1-1/2"	
MULP300B	1	3	5	102	101	101	97	91	85	76	68	63	2"	1-1/2"	
MULP075B3	3	3/4	5	56	48	42	37	29	21	-	-	41	2"	1-1/2"	
MULP100B3	3	1	5	58	53	48	43	38	32	23	11	48	2"	1-1/2"	
MULP150B3	3	1-1/2	5	78	77	71	70	62	53	43	30	47	2"	1-1/2"	
MULP200B3	3	2	5	86	84	81	77	71	62	52	40	50	2"	1-1/2"	
MULP300B3	3	3	5	102	101	101	97	91	85	76	68	63	2"	1-1/2"	

MOTOR VOLTAGE — Single Phase: 3/4 through 1-1/2HP - 115V/208V-230V - 60Hz • 2HP & 3HP - 230V - 60Hz

Three Phase: 3/4 through 3HP - 208V-230V/460V - 60Hz

MAXIMUM CASE PRESSURE — 100 PSI

(LOCATION OF PUMP CONTINUED)

- To prevent motor damage, due to moisture, ventilation and drainage must be provided.
- The pump and all piping must be protected from freezing.
- Pump and pipe line must be drained when not in use or if there is any danger of freezing.

WELL CONDITIONS

- Wells should be pumped clean of all sand and foreign matter before installing the pump or damage may result to the operating parts.
- The well must be capable of supplying enough water to satisfy the capacity of the pump and water needs. The water level must not draw down below the maximum rated suction lift of the pump or loss of capacity and prime will result.

SUCTION LIMITATIONS

- Shallow well installation is satisfactory where the suction lift is less than 15 feet. Suction lift is the vertical lift plus losses due to friction loss.
- Suction lift varies depending upon elevation (*altitude*) and water temperature.

PIPING

- Plastic pipe, plastic hose or galvanized steel pipe may be used in the installation. Plastic pipe or hose must have a minimum pressure rating of 160 P.S.I. if used on the discharge side of the pump. Galvanized steel pipe must be in good condition — free of rust and scale. Threads should be sharp and cleanly cut.
- Both the suction and discharge pipe should be no smaller than the corresponding tapings of the pump (*see Table 1*). If long runs are encountered, larger pipes should be used. Smaller pipe will reduce the capacity of the pump.
- All joints and connections should have pipe sealing compound (*male*

threads only) applied and drawn up tightly.

NOTE: The entire system must be air and water tight for efficient operation.

PUMP INSTALLATION

- Refer to Diagram A, for typical installations. If galvanized pipe is used, both the suction and discharge pipe should be supported at a point near the pump to avoid strains being placed on the pump.
- The suction pipe or hose should slope upwards from the water source to the pump. Locate the pump as close to the water as possible keeping the suction pipe as short as conditions permit.
- Avoid dips or pockets in offset piping or air will accumulate at high points which will make priming difficult.
- A foot valve located in the water or a check valve located as close to the water as possible will reduce priming time of the pump and help maintain prime. A strainer must be used on the suction line to filter out dirt and debris.
- Install a gate valve and union in the discharge line. For removal of the pump for service, close the gate valve and disconnect the union.

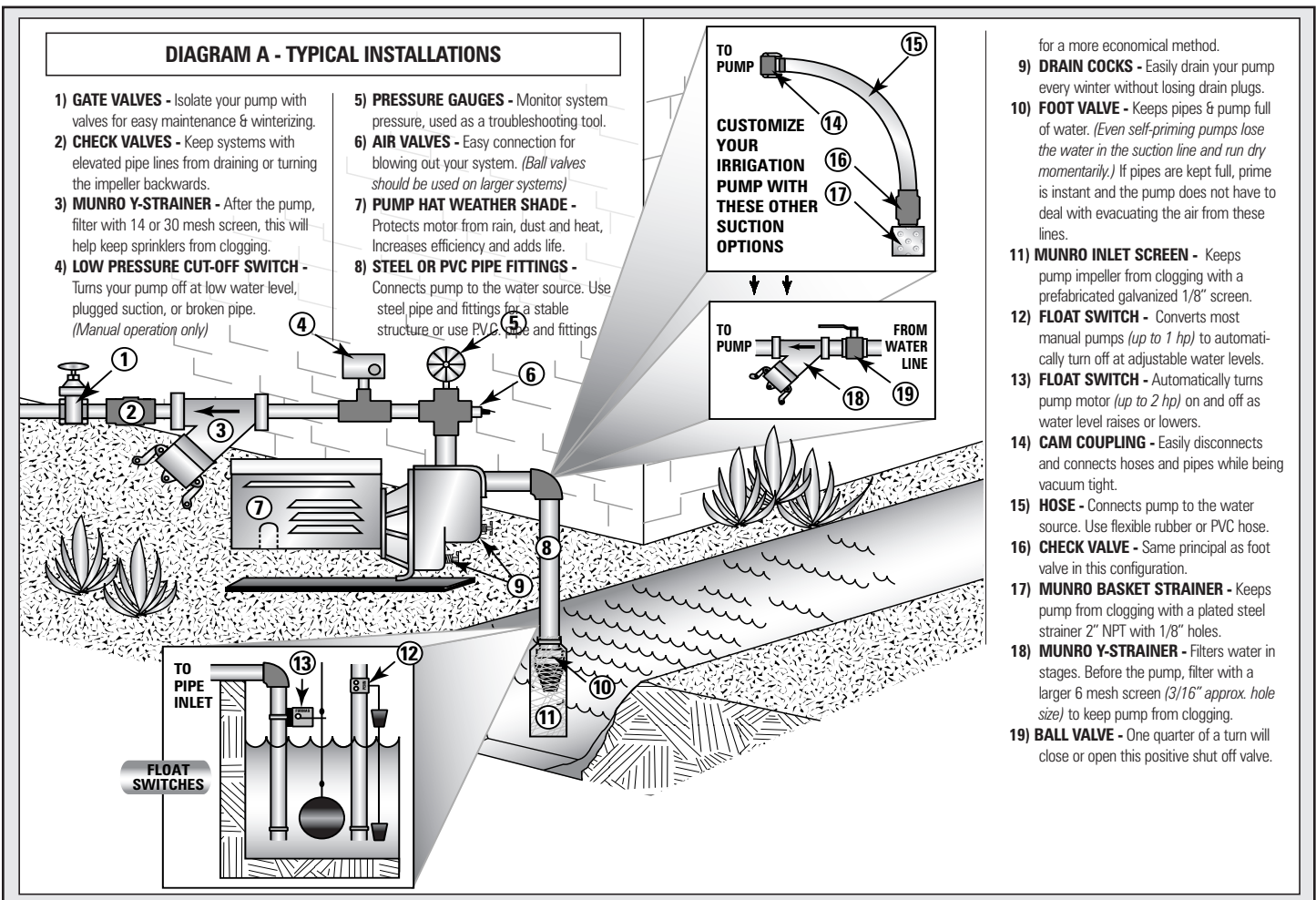
CAUTION: Do not use a globe valve or other restricting type of valve at the discharge. This will seriously restrict the capacity of the pump.

GROUNDING

CAUTION: To reduce the risk of electric shock the motor must be securely and adequately grounded to a grounded metal raceway system, or by using a separate grounding wire connected to bare metal on the motor frame, or to the grounding screw located inside motor terminal box, or other suitable means. Refer to National Electric Code (NEC Article 250 - Grounding) for additional information.

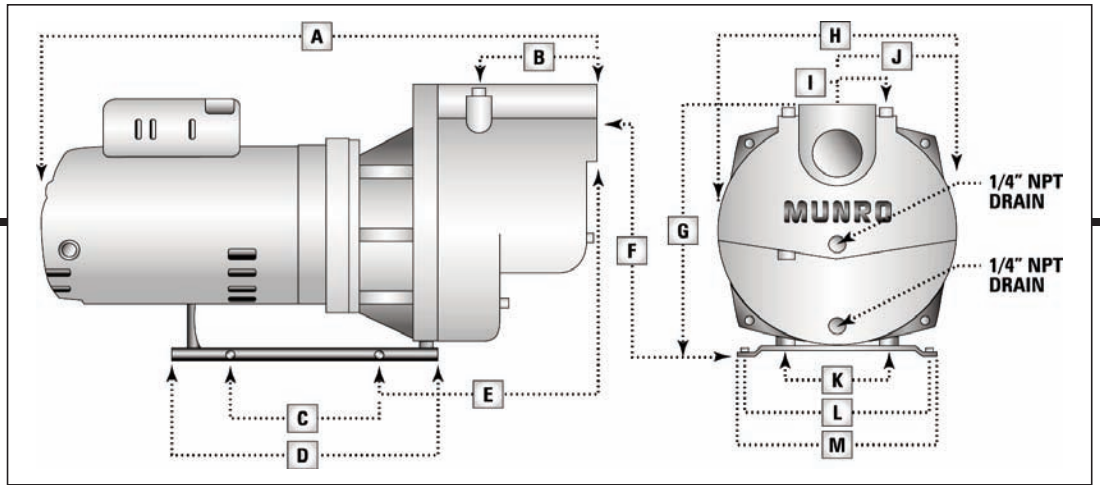
CAUTION: All wiring should be performed by a qualified electrician and in accordance with the national electric code and local electric codes.

WARNING: Failure to connect the motor frame to equipment grounding conductor by using green screw may result in serious electrical shock.



MUNRO LP SERIES DIMENSIONS

Dimensions are for estimating purposes only.



HP	DISCHARGE	SUCTION	A	B	C	D	E	F	G	H	I	J	K	L	M
3/4	1 1/2"	2"	17 3/4"	3 5/8"	4 1/4"	8 1/2"	7 1/2"	9 1/2"	10 7/8"	9 1/2"	2 3/8"	4 3/4"	2 5/8"	5 1/4"	6"
1	1 1/2"	2"	17 3/4"	3 5/8"	4 1/4"	8 1/2"	7 1/2"	9 1/2"	10 7/8"	9 1/2"	2 3/8"	4 3/4"	2 5/8"	5 1/4"	6"
1 1/2	1 1/2"	2"	17 3/4"	3 5/8"	4 1/4"	8 1/2"	7 1/2"	9 1/2"	10 7/8"	9 1/2"	2 3/8"	4 3/4"	2 5/8"	5 1/4"	6"
2	1 1/2"	2"	18"	3 5/8"	4 1/4"	8 1/2"	7 1/2"	9 1/2"	10 7/8"	9 1/2"	2 3/8"	4 3/4"	2 5/8"	5 1/4"	6"
3	1 1/2"	2"	18"	3 5/8"	4 1/4"	8 1/2"	7 1/2"	9 1/2"	10 7/8"	9 1/2"	2 3/8"	4 3/4"	2 5/8"	5 1/4"	6"

ELECTRICAL CONNECTIONS

WIRING CONNECTIONS

- The unit is not waterproof and is not intended to be used in showers, saunas, or other potentially wet locations. The motor is designed to be used in a clean dry location with access to an adequate supply of dry cool air. Ambient temperature around the motor should not exceed 104°F or 40°C. For outdoor installations, motor is designed for rain — up to a 15° angle of impact. If conditions require increased protection, the pump must be protected by a cover that does not block air flow to, and around the motor. This unit is not weatherproof nor is it able to be submersed in water, or any other liquid.
- Single phase motors, 3/4 to 1-1/2 HP, are tri-voltage (115/208-230) and can be connected for 115V or 230V service. The 2 & 3 HP single phase motors are 208-230V only. Single phase motors are factory connected for 230V at the motor.
- All three phase motors are 208-230/460 volts and are factory connected at the motor for 230 volts.
- If the motor wiring must be changed to conform to your specific voltage requirements then the motor should be rewired. For proper electrical connections, refer to the connection diagram located on the nameplate of the motor or one of the following diagrams. Make sure connections are correct for the voltage being supplied to the motor.

WARNING: Always disconnect power source before performing any work on or near the motor or its power source. Failure to do so could result in personal injury or fatal electrical shock.

DIAGRAM B-1
WIRING DIAGRAM FOR SINGLE PHASE 2 & 3 HP
CHECK VOLTAGE OF POWER SOURCE BEFORE CONNECTING.
DO NOT CONNECT ANY GROUND WIRE TO THESE LEADS.

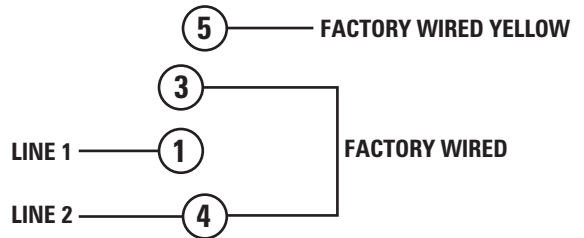


DIAGRAM B
WIRING DIAGRAM FOR SINGLE PHASE 3/4 to 1-1/2 HP
CHECK VOLTAGE OF POWER SOURCE BEFORE CONNECTING.
DO NOT CONNECT ANY GROUND WIRE TO THESE LEADS.

ROTATION CW - OPE

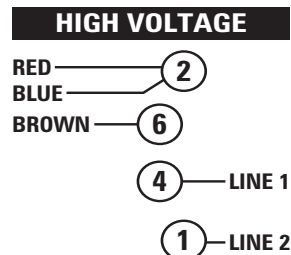
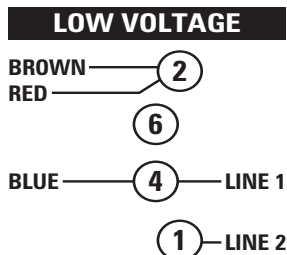
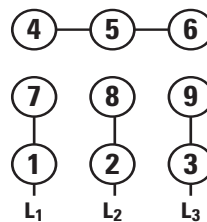
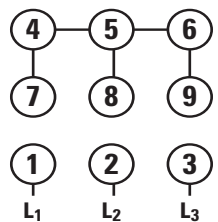


DIAGRAM B-2
WIRING DIAGRAM FOR THREE PHASE
CHECK VOLTAGE OF POWER SOURCE BEFORE CONNECTING.
DO NOT CONNECT ANY GROUND WIRE TO THESE LEADS.

LOW VOLTAGE
230V



HIGH VOLTAGE
460V



NOTE: To reverse rotation, interchange any two incoming line (power) leads.

MOTOR PROTECTION

1. All single-phase motors through 2 HP, and some 3 HP, have built-in thermal overload protection. All single-phase motors without thermal protection, must be wired externally. The overload protects the motor against burnout from overload of low voltage, high voltage and other causes. The device is automatic and resets itself once the temperature has dropped to a safe point. Frequent tripping of the device indicates trouble in the motor or power lines and immediate attention is needed. The device should never be tampered with unless the trouble is located and corrected.

WARNING: Never examine, make wiring changes, or touch the motor before disconnecting the main electrical supply switch. The thermal device may have opened the electrical circuit.

2. Three-phase motors do not have built-in thermal protection. It is recommended that a properly sized magnetic or manual starter (both with properly sized heaters) be used with all three-phase motors. Install starters following instructions of the starter manufacturer. See Diagram C for magnetic starter wiring program.
3. All motors (single and three phase) should be equipped with a correctly fused disconnect switch to provide protection. Consult local or national electric codes for proper fuse protection based on the motor data, located on the motor nameplate.
4. Undersize wiring can cause motor failure (low voltage), frequent cut-out of motor overload protector, television interference and even fire. Make certain wiring is adequately sized (See Diagram D), well insulated, and connected to a separate circuit outside the house in case of fire.

OPERATION

1. When installation has been completed, remove the priming plug from the pump housing and fill the pump body and suction pipe completely with water. No additional water will be needed for subsequent start-ups unless the pump body is drained.
2. After the pump is turned on, it will require 2-5 minutes before all the air is evacuated from the suction line and water begins to flow. If there is not water after 10 minutes, turn the pump off and verify the following:
 - a) Any air leaks on the suction line are eliminated.
 - b) Total suction lift is not greater than 25 feet at sea level.
 - c) Any restrictions in the discharge line such as a closed valve, must be remedied.

NOTE: Unit must be full of liquid before operating. Never run dry or against a closed discharge. Dry running or running unit against a closed discharge will cause damage to the shaft seal. Do not pump dirty water or abrasive liquids, or the same damage may occur as if running dry.

MOTOR ROTATION

1. Single phase models are one rotation only (counterclockwise when facing the pump suction tapping) and cannot be reversed.

2. Proper rotation of pump impeller is critical for three-phase pumps. Pump motor should turn counterclockwise (CCW) when facing pump suction tapping. Momentarily "bump" (apply power for less than a second) the motor to check for proper rotation. To change rotation on three-phase units, interchange any two incoming line (power) leads.

MAINTENANCE

Lubrication

1. The pumps and motors require no lubrication. The ball bearings of the motor have been greased and sealed at the factory. Under normal operating conditions they should require no further greasing.

Freezing

1. Drain the entire system if there is danger of freezing. Two drain valves are provided in the pump case for this purpose.

ROTARY SEAL ASSEMBLY REPLACEMENT

CAUTION: Make certain the power supply is disconnected before attempting to service the unit! The rotary seal assembly must be handled carefully to avoid damaging the precision lapped faces of the sealing components.

1. Disengage pump body (Ref. No. 8) from motor and mounting ring (Ref. No. 7) by removing bolts.
- (See parts list for reference numbers)
2. Remove diffuser bolts and remove diffuser (Ref. No. 6).
3. Unthread impeller (Ref. No. 5) from motor shaft.

NOTE: To remove the impeller use a 9/16" open end wrench to hold the motor shaft. The shaft flat area is located in the middle of the mounting ring.

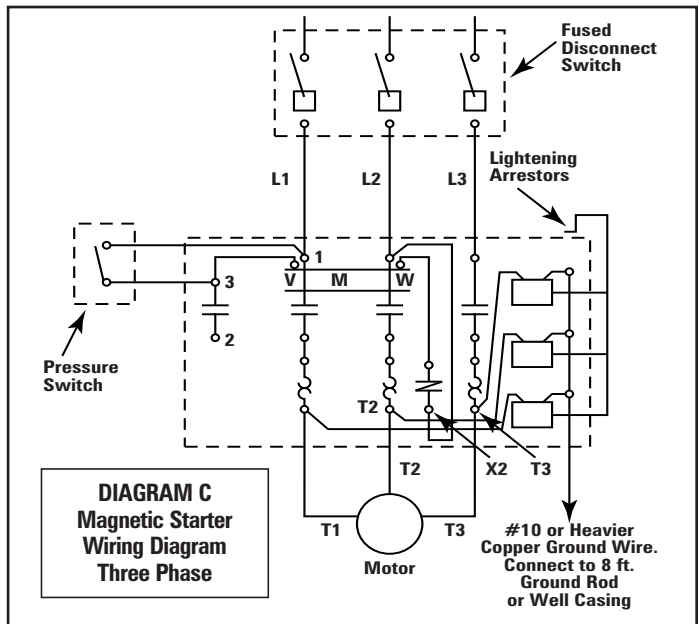


DIAGRAM C
Magnetic Starter
Wiring Diagram
Three Phase

WIRING SIZE CHART - DIAGRAM E

Distance From Motor Fuse Box Meter or Electrical Outlet	Minimum Copper Wire Size Chart (Gauge)																	
	Single Phase Motors									Three Phase Motors								
	3/4 HP		1 HP		1-1/2 HP		2 HP	3 HP	3/4 HP		1 HP		1-1/2 HP		2 HP	3 HP		
	115 Volt	230 Volt	115 Volt	230 Volt	115 Volt	230 Volt	230 Volt	230 Volt	230 Volt	460 Volt	230 Volt	460 Volt	230 Volt	460 Volt	230 Volt	460 Volt	230 Volt	460 Volt
0-50 Feet	12	14	10	14	10	12	12	10	14	14	14	14	14	14	14	14	14	14
50-100 Feet	12	14	10	14	8	12	12	10	14	14	14	14	14	14	14	14	14	14
100-150 Feet	10	14	10	12	6	12	12	10	14	14	14	14	14	14	14	14	14	14
150-200 Feet	10	12	8	12	•	10	10	10	14	14	14	14	12	14	12	14	12	14
200-300 Feet	8	12	6	10	•	10	10	8	14	14	12	14	12	14	10	12	10	12
Full Size (Amps)	20	15	30	15	30	20	20	30	15	15	15	15	15	15	15	15	15	15

• NOT ECONOMICAL TO RUN IN 115VOLT, USE 230 VOLT

- The rotary Seal (Ref. No. 4) will come loose at this time. Use a screwdriver (or similar instrument) to pry the ceramic seal and the rubber gasket from the recess of the mounting bracket.

CAUTION: Be careful not to damage the motor shaft or recess surface.

NOTE: Because damage to the shaft seal is most likely to occur in disassembly, a new seal will be necessary.

- Clean the recess and motor shaft thoroughly.
- Install the new rotary seal assembly:
 - Insert the ceramic seal and the rubber gasket into the recess.

NOTE: To help facilitate installation, apply a light coating of oil to the outside diameter of the rubber gasket. Make certain the ceramic seal is kept clean and free of dirt and/or oil.

- Slip the remaining parts of the rotary seal assembly onto the motor shaft.
- Replace the impeller and diffuser removed in Steps 2 and 3.
 - Insert rubber diffuser into pump body cavity.

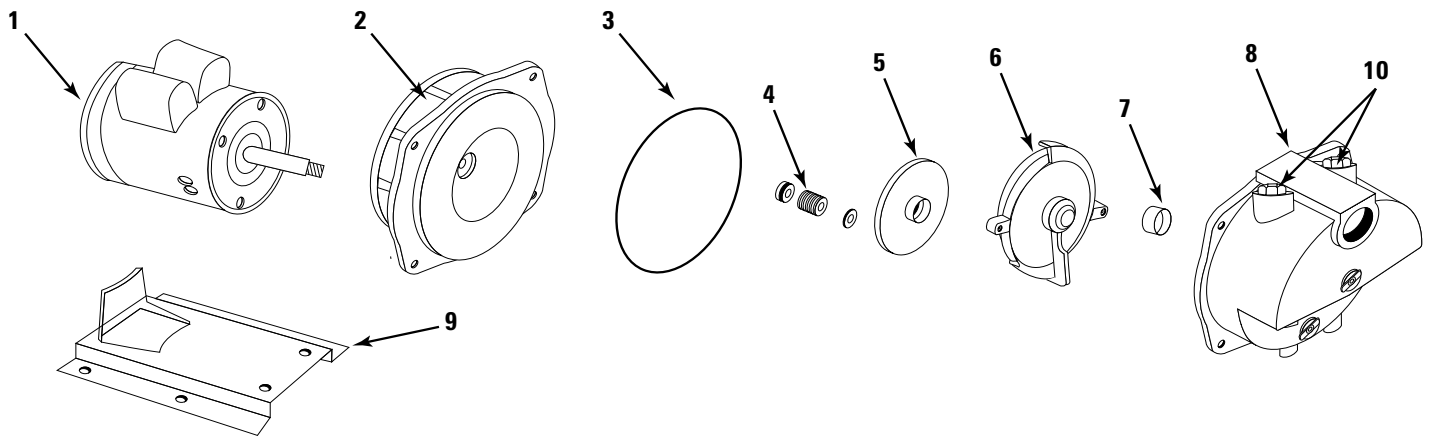
- Reassemble the pump body to the motor and mounting bracket.

MOTOR REPLACEMENT

- NEMA J motors can be replaced in the field with any standard NEMA J jet pump motor by referring to the following instructions and the attached parts list.
- Follow Steps 1 through 4 as outlined under rotary seal replacement to remove the pump body, diffuser, impeller and rotary seal.
- Remove bolts that connect the motor (Ref. No. 1) and pull motor away.
- Replace motor with standard NEMA J jet pump motor by positioning motor against the mounting frame and assembling with four 3/8" x 3/4" cap screws. The mounting base is connected at the bottom of the mounting frame with two 3/8" x 1/2" cap screws.
- Follow Steps 5, 6, 7 and 8 of Rotary Seal Assembly to reassemble the remainder of the pump.

NOTE: Because damage to the shaft seal is most likely to occur in disassembly, a new seal will be necessary.

LP SERIES — SELF-PRIMER PUMP REPAIR PARTS



ITEM	SINGLE PHASE DESCRIPTION	HORSEPOWER MODEL NO, PART NO.	3/4	1	1-1/2	2	3
			MULP075B	MULP100B	MULP150B	MULP200B	MULP300B
1	MOTOR, NEMA J - 1 PHASE ▲ MOTOR ACCESS COVER SCREW, ACCESS COVER		MLP07B1	MLP10B1	MLP15B1	MLP20B1	MLP30B1
▲	SLINGER, WASHER	MLP5030	1	1	1	1	1
2	MOUNTING RING	MLP3010	1	1	1	1	1
▲	HEX HD. CAP SCREWS 3/8 x 3/4"	MLP9010	1	1	1	1	1
3	RING, SQUARE CUT	MLP5010	4	4	4	4	4
4	SEAL, ROTARY W/SPRING	MLP6200	1	1	1	1	1
5	IMPELLER, BRASS "B" MODELS		MLP407B	MLP410B	MLP415B	MLP420B	MLP430B
6	DIFFUSER	MLP2010	1	1	1	1	MLP2011
▲	HEX HD. CAP SCREWS 1/4 x 1"	MLP9020	2	2	2	2	2
7	RUBBER DIFFUSER	MLP5020	1	1	1	1	1
8	PUMP BODY	MLP1010	1	1	1	1	1
▲	HEX HD. CAP SCREWS 7/16 x 1"	MLP9030	4	4	4	4	4
9	BASE - 48 Y-FRAME MOTOR	MLP801048	1	1	1	—	—
▲	BASE - 56 J-FRAME MOTOR	MLP801056	—	—	—	1	1
▲	HEX HD. CAP SCREWS 3/8 x 1/2"	MLP9040	2	2	2	2	1
▲	PET COCK	•					
10	3/4" PRIMING PLUG	•					

(•) Standard Hardware Item

(▲) Not Shown

TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
<i>Little or no discharge</i>	<ol style="list-style-type: none"> 1. Casing not initially filled with water to prime pump 2. Total head too high 3. Suction lift too high, or too long 4. Impeller plugged 5. Hole or air leak in suction line 6. Foot valve too small 7. Impeller damaged 8. Foot valve or suction line not submerged deep enough in water 9. Insufficient inlet pressure or suction head 10. Suction piping too small 11. Motor wired incorrectly 12. Casing gasket leaking 13. Suction or discharge line valves closed 	<ol style="list-style-type: none"> 1. Fill pump casing 2. Shorten suction lift and/or change head 3. Lower suction lift, install foot valve and prime, or shorten length of suction line. 4. Clean impeller 5. Repair or replace suction line; do not use Teflon tape; use pipe sealing compound 6. Match foot valve to piping or install one size larger foot valve 7. Replace impeller 8. Submerge lower in water 9. Increase inlet pressure by adding more water to tank or increasing back pressure 10. Increase to pump inlet size or one size larger 11. Check wiring diagram for correct wiring 12. Replace gasket 13. Open suction and/or discharge lines
<i>Pump will not deliver water or develop pressure</i>	<ol style="list-style-type: none"> 1. No priming water in casing 2. Mechanical seal is leaking 3. Leak in suction line 4. Discharge line is closed and priming air has nowhere to go 5. Suction line (<i>or valve</i>) is closed 6. Poor pump performance 7. Foot valve is leaking 8. Suction screen is clogged 	<ol style="list-style-type: none"> 1. Fill pump casing 2. Replace seal (<i>See Rotary Seal Replacement</i>) 3. Repair or replace 4. Open discharge line 5. Open suction line or valve 6. Replace worn parts 7. Replace foot valve 8. Clean or replace screen
<i>Loss of suction</i>	<ol style="list-style-type: none"> 1. Air leak in suction line 2. Suction lift is too high 3. Insufficient inlet pressure or suction head 4. Clogged foot valve or strainer 	<ol style="list-style-type: none"> 1. Repair or replace suction line 2. Lower suction lift, install foot valve and prime 3. Increase inlet pressure by adding more water to tank or increasing back pressure 4. Unclog
<i>Pump vibrates and/or makes excessive noise</i>	<ol style="list-style-type: none"> 1. Mounting plate or foundation not rigid enough 2. Foreign material in pump 3. Impeller damaged 4. Worn motor bearings 5. Suction lift too high 	<ol style="list-style-type: none"> 1. Reinforce 2. Disassemble pump and clean 3. Replace impeller 4. Replace bearings 5. Lower suction lift, install foot valve and prime
<i>Pump will not start or run</i>	<ol style="list-style-type: none"> 1. Improper wiring 2. Blown fuse or open circuit breaker 3. Loose or broken wiring 4. Stone or foreign object lodged in impeller 5. Motor shorted out 6. Thermal overload has opened circuit 	<ol style="list-style-type: none"> 1. Check wiring diagram on motor 2. Replace fuse or close circuit breaker 3. Tighten connections, replace broken wiring 4. Disassemble pump and remove foreign object 5. Replace 6. Allow unit to cool, restart after reason for overload has been determined
<i>Pump leaks at shaft</i>	<ol style="list-style-type: none"> 1. Worn mechanical seal 	<ol style="list-style-type: none"> 1. Replace (<i>see Rotary Seal Replacement</i>)

Unique Solutions For Unique Situations



Installation Manual

Operation Manual

*For more information or details
on this or any other product, contact your
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OR VISIT US ON THE WORLD WIDE WEB:



175 PSI WWP Bronze Globe Valves

Fire Protection Valve • threaded ends • rubber disc • Screw Over Bonnet



175 PSI/12.1 Bar Non-Shock Cold Water

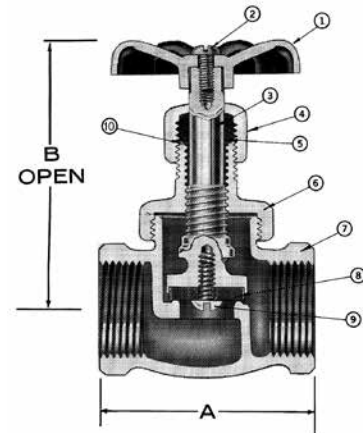
ULLISTED*

MATERIA L I S T

PART	SPeCIFICATION
1. Handwheel	Aluminum
2. Handwheel Screw Stainless Steel (1")	Carbon Steel
3. Stem or ASTM B505 Alloy C84400	Bronze ASTM B584 Alloy C84400
4. Packing Nut	Bronze ASTM B584 Alloy C83600 or ASTM B16
5. Packing	Graphite Impregnated (Non Asbestos)
6. Bonnet	Bronze ASTM B584 Alloy C84400
7. Body	Bronze ASTM B584 Alloy C84400
8. Seat Disc	EPDM Rubber (1/4" - 3/8") Nitrile (1/2" - 1")
9. Seat Screw	Stainless Steel
10. Pack Washer	Sheet Brass



KT-65-UL
Threaded



KT-65-UL
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size	Dimensions				Weight		Box Qty.	Master Ctn. Qty.
	A		B		Lbs.	Kg.		
In. mm.	In.	mm.	In.	mm.				
+1/4 8	2.00	50	2.75	70	.48	.22	10	100
+3/8 10	2.00	50	2.75	70	.45	.20	10	100
1/2 15	2.28	58	3.12	79	.68	.31	10	60
3/4 20	2.28	58	3.12	79	.74	.34	10	60
1 25	3.12	79	4.50	114	1.68	.76	5	25

* UL Listed for Trim and Drain use (Subject 258) — sizes 1/2", 3/4", 1".
Size 1/4" and 3/8" supplied as KT-65 (Not UL Listed). Subject to AHJ Approval.
† NOTE: See KT-211-W-UL for 1 1/4" - 2" sizes.

We will use 1/2" for night sky



MPR Plus Spray Nozzles

- Radius: 5'-15' (1,5-4,6m)
- Operating Pressure Range: 20-75 psi (1,4-5,2 Bar)
- Matched Precipitation

MPR Nozzles make design and installation easier than ever. Just pick your spacing and choose your arc - the nozzle does everything else.

We will be using the following sprinkler models (all 8' Flat Spray Black)

- Seven 8Q (90 degree arc)
- Five 8H (180 degree arc)
- Two 8TQ (270 degree arc)



- Side & Corner Specialty Patterns
- Arc Options: 90°, 120°, 180°, 240°, 270°, 360°
- Fit Toro® Spray Bodies

Features & Benefits

Matched Precipitation Rates

Ensure all nozzles (every arc within a family) apply water at approximately the same rate.

Low Flow Rates

Allow for more sprinklers to be placed on the same zone.

Pre-installed Pressure Compensation Device (PCD)

Eliminate fogging, conserve water and provide precise flow rates (also available without PC Devices).

Complete Selection Of Arcs

Arcs for all radius options – full, 3/4, 2/3, 1/2, 1/3 and 1/4.

Specifications

Operating Specifications

- Operating pressure range: 20-75 psi (1,4-5,2 Bar)
- Recommended pressure: 30 psi (2,1 Bar)
- Flow Rate: 0.05 – 4.58 GPM (0,2-17,3 LPM)
- Nozzle trajectory:
 - 5': 5° - 8': 10° - 10': 17° - 12': 24° - 15': 28°
 - Corner and Side Strips: 17°
 - 8' Flat Spray: 0°

Additional Features

- Standard and special spray patterns
- Customized screens for each nozzle
- Patterns for small areas: full set of arcs for 10', 8' and 5' (3,0m, 2,4m, and 1,5m) radius nozzles
- 4' x 18' (1,2-5,2m) side strip ideal for medians
- 2' x 6' (0,6-1,8m) for small planter beds and other narrow areas
- Fine-mesh snap-in filter screens for lower flow nozzles
- Five levels of trajectory
- Convenient nozzle packaging – nozzles and screens packed separately
- Adjustment screw allows up to 25% reduction in radius and complete shutoff

Warranty

- Two years

Specifying Information—MPR Plus

XX-XXX-PC			
Radius	Arc		Optional
XX	XXX		PC
5—5' (1,5m)	Q—90°	T—120°	PC—Pressure Compensation
8—8' (2,4m)	TT—240°	H—180°	
10—10' (3,0m)	EST—End Strip		
12—12' (3,7m)	CST—Center Strip		
15—15' (4,6m)	SST—Side Strip		
	F—360°		
Example: A 570 MPR Plus Nozzle with a spray of 10' (3,0m), 180° arc and pressure compensation, would be specified as: 10-H-PC			

Note: To specify a MPR Plus nozzle with a 570Z sprinkler body, attach the body specification before the above nozzle specification.

Note: Do not use PCDs with 570Z PR & 570Z PRX models

MPR Plus Spray Nozzle Series Model List

Model	Description	Model	Description
5' (1,5m) MPR Plus Nozzle Red		8' (2,4m) MPR Plus Nozzle Green	
5Q	90° Arc	8Q	90° Arc
5T	120° Arc	8T	120° Arc
5H	180° Arc	8H	180° Arc
5TT	240° Arc	8TT	240° Arc
5TQ	270° Arc	8TQ	270° Arc
5F	360° Arc	8F	360° Arc
8' (2,4m) Flat Spray Black		10' (3,0m) MPR Plus Nozzle Blue	
FSQ	90° Arc	10Q	90° Arc
FSH	180° Arc	10T	120° Arc
FSF	360° Arc	10H	180° Arc
FSQ-LG	90° Arc, Low GPM	10TT	240° Arc
FSH-LG	180° Arc, Low GPM	10TQ	270° Arc
FSF-LG	360° Arc, Low GPM	10F	360° Arc
12' (3,7m) MPR Plus Nozzle Brown		Special Patterns Orange	
12Q	90° Arc	4SSST	Side Strip 4'x30' (1,2-9,1m)
12T	120° Arc	4EST	End Strip 4'x15' (1,2-4,3m)
12H	180° Arc	4CST	Center Strip 4'x30' (1,2-6,1m)
12TT	240° Arc	9SSST	Side Strip 9'x18' (2,7-5,2m)
12TQ	270° Arc	4SSST	Side Strip 4'x18' (1,2-5,2m)
12F	360° Arc	2SSST	Side Strip 2' x 6' (0,6-1,8m)
15' (4,6m) MPR Plus Nozzle Black			
15Q	90° Arc		
15T	120° Arc		
15H	180° Arc		
15TT	240° Arc		
15TQ	270° Arc		
15F	360° Arc		

(Note: All above also available in Pressure Compensating (PC) Models)

Performance Data-MPR Plus Spray Nozzles—US

5' Series with 5° Trajectory—Red

Arc	Desc.	psi	GPM	Radius	Prec. Rate	
					▲	☒
90°	5-Q	20	0.05	4	1.40	1.21
		30	0.09	5	1.61	1.40
		40	0.12	6	1.78	1.54
	5-Q-PC	50	0.15	6	1.86	1.62
		30-40	0.09	5	1.61	1.40
		40-75	0.10	5	1.79	1.55
120°	5-T	20	0.07	4	1.47	1.27
		30	0.12	5	1.61	1.40
		40	0.16	6	1.78	1.54
	5-T-PC	50	0.20	6	1.86	1.62
		30-40	0.12	5	1.61	1.40
		40-75	0.13	5	1.79	1.55
180°	5-H	20	0.10	4	1.40	1.21
		30	0.19	5	1.70	1.47
		40	0.23	6	1.70	1.47
	5-H-PC	50	0.27	6	1.68	1.45
		30-40	0.18	5	1.61	1.40
		40-75	0.20	5	1.79	1.55
240°	5-TT	20	0.15	4	1.57	1.36
		30	0.25	5	1.68	1.45
		40	0.30	6	1.66	1.44
	5-TT-PC	50	0.35	6	1.63	1.41
		30-40	0.23	5	1.54	1.34
		40-75	0.27	5	1.81	1.57
270°	5-TQ	20	0.20	4	1.86	1.61
		30	0.29	5	1.73	1.50
		40	0.34	6	1.68	1.45
	5-TQ-PC	50	0.40	6	1.66	1.44
		30-40	0.26	5	1.55	1.34
		40-75	0.29	5	1.73	1.50
360°	5-F	20	0.25	4	1.75	1.51
		30	0.38	5	1.70	1.47
		40	0.45	6	1.66	1.44
	5-F-PC	50	0.53	6	1.65	1.43
		30-40	0.35	5	1.57	1.36
		40-75	0.39	5	1.75	1.51

8' Series with 10° Trajectory—Green

Arc	Desc.	psi	GPM	Radius	Prec. Rate	
					▲	☒
90°	8-Q	20	0.17	7	1.55	1.34
		30	0.24	8	1.68	1.45
		40	0.26	9	1.61	1.39
	8-Q-PC	50	0.29	9	1.60	1.39
		30-40	0.22	8	1.54	1.33
		40-75	0.25	8	1.75	1.51
120°	8-T	20	0.23	7	1.58	1.36
		30	0.30	8	1.57	1.36
		40	0.36	9	1.67	1.45
	8-T-PC	50	0.40	9	1.66	1.44
		30-40	0.29	8	1.52	1.32
		40-75	0.35	8	1.84	1.59
180°	8-H	20	0.37	8	1.47	1.27
		30	0.50	8	1.75	1.51
		40	0.58	9	1.80	1.56
	8-H-PC	50	0.65	9	1.80	1.56
		30-40	0.44	8	1.54	1.33
		40-75	0.50	8	1.75	1.51
240°	8-TT	20	0.56	7	1.92	1.66
		30	0.70	8	1.84	1.59
		40	0.80	9	1.86	1.61
	8-TT-PC	50	0.88	9	1.82	1.58
		30-40	0.59	8	1.55	1.34
		40-75	0.70	8	1.84	1.59
270°	8-TQ	20	0.63	7	1.92	1.66
		30	0.76	8	1.77	1.53
		40	0.86	9	1.78	1.54
	8-TQ-PC	50	0.93	9	1.71	1.48
		30-40	0.64	8	1.49	1.29
		40-75	0.70	8	1.63	1.41
360°	8-F	20	0.74	7	1.69	1.46
		30	1.00	8	1.75	1.51
		40	1.16	9	1.80	1.56
	8-F-PC	50	1.30	9	1.80	1.56
		30-40	0.85	8	1.49	1.29
		40-75	1.00	8	1.75	1.51

10' Series with 17° Trajectory—Blue

Arc	Desc.	psi	GPM	Radius	Prec. Rate	
					▲	☒
90°	10-Q	20	0.30	9	1.66	1.44
		30	0.40	10	1.79	1.55
		40	0.50	11	1.85	1.60
	10-Q-PC	50	0.60	12	1.86	1.62
		30-40	0.33	10	1.48	1.28
		40-75	0.37	10	1.66	1.43
120°	10-T	20	0.42	9	1.74	1.51
		30	0.52	10	1.75	1.51
		40	0.65	11	1.80	1.56
	10-T-PC	50	0.75	12	1.75	1.51
		30-40	0.44	10	1.48	1.28
		40-75	0.50	10	1.68	1.45
180°	10-H	20	0.60	9	1.66	1.44
		30	0.71	10	1.59	1.38
		40	0.85	11	1.57	1.36
	10-H-PC	50	0.99	12	1.65	1.43
		30-40	0.66	10	1.48	1.28
		40-75	0.75	10	1.68	1.45
240°	10-TT	20	0.71	9	1.47	1.27
		30	0.97	10	1.63	1.41
		40	1.10	11	1.67	1.45
	10-TT-PC	50	1.19	11	1.65	1.43
		30-40	0.89	10	1.49	1.29
		40-75	1.00	10	1.68	1.45
270°	10-TQ	20	0.82	9	1.51	1.31
		30	1.04	10	1.55	1.34
		40	1.20	11	1.62	1.41
	10-TQ-PC	50	1.35	11	1.66	1.44
		30-40	0.99	10	1.48	1.28
		40-75	1.09	10	1.63	1.41
360°	10-F	20	1.11	9	1.72	1.49
		30	1.49	10	1.67	1.44
		40	1.61	11	1.63	1.42
	10-F-PC	50	1.85	11	1.71	1.48
		30-40	1.33	10	1.49	1.29
		40-75	1.51	10	1.69	1.46

12' Series with 24° Trajectory—Brown

Arc	Desc.	psi	GPM	Radius	Prec. Rate	
					▲	☒
90°	12-Q	20	0.40	11	1.48	1.28
		30	0.50	12	1.55	1.35
		40	0.60	13	1.64	1.42
	12-Q-PC	50	0.63	13	1.67	1.44
		30-40	0.48	12	1.49	1.29
		40-75	0.53	12	1.65	1.43
120°	12-T	20	0.57	11	1.58	1.37
		30	0.72	12	1.68	1.45
		40	0.87	13	1.87	1.62
	12-T-PC	50	0.97	13	1.93	1.67
		30-40	0.64	12	1.49	1.29
		40-75	0.70	12	1.63	1.41
180°	12-H	20	0.95	11	1.76	1.52
		30	1.09	12	1.69	1.47
		40	1.30	13	1.72	1.49
	12-H-PC	50	1.55	14	1.77	1.53
		30-40	0.96	12	1.49	1.29
		40-75	1.05	12	1.63	1.41
240°	12-TT	20	1.12	11	1.55	1.35
		30	1.45	12	1.69	1.46
		40	1.63	13	1.75	1.52
	12-TT-PC	50	1.80	13	1.79	1.55
		30-40	1.28	12	1.49	1.29
		40-75	1.40	12	1.63	1.41
270°	12-TQ	20	1.05	11	1.42	1.23
		30	1.55	12	1.61	1.39
		40	1.65	13	1.58	1.36
	12-TQ-PC	50	1.80	13	1.59	1.38
		30-40	1.44	12	1.49	1.29
		40-75	1.60	12	1.66	1.44
360°	12-F	20	1.67	11	1.54	1.34
		30	2.19	12	1.70	1.47
		40	2.35	13	1.68	1.46
	12-F-PC	50	2.70	13	1.79	1.55
		30-40	1.92	12	1.49	1.29
		40-75	2.10	12	1.63	1.41

15' Series with 28° Trajectory—Black

Arc	Desc.	psi	GPM	Radius	Prec. Rate	
					▲	☒
90°	15-Q	20	0.68	14	1.55	1.34
		30	0.85	15	1.69	1.46
		40	1.04	16	1.82	1.57
	15-Q-PC	50	1.23	16	2.15	1.86
		30-40	0.75	15	1.49	1.29
		40-75	0.81	15	1.61	1.40
120°	15-T	20	0.95	14	1.75	1.52
		30	1.10	15	1.64	1.42
		40	1.30	16	1.82	1.57
	15-T-PC	50	1.45	16	2.03	1.75
		30-40	1.00	15	1.49	1.29
		40-75	1.10	15	1.64	1.42
180°	15-H	20	1.37	13	1.79	1.55
		30	1.65	15	1.66	1.44
		40	2.02	16	1.77	1.53
	15-H-PC	50	2.14	16	1.87	1.62
		30-40	1.50	15	1.49	1.29
		40-75	1.65	15	1.64	1.42
240°	15-TT	20	1.78	14	1.59	1.38
		30	2.20	15	1.64	1.42
		40	2.66	16	1.74	1.51
	15-TT-PC	50	2.84	16	1.86	1.61
		30-40	2.00	15	1.49	1.29
		40-75	2.20	15	1.64	1.42
270°	15-TQ	20	2.10	13	1.85	1.61
		30	2.60	15	1.72	1.49
		40	3.00	16	1.86	1.61
	15-TQ-PC	50	3.40	16	1.98	1.72
		30-40	2.30	15	1.53	1.32
		40-75	2.50	15	1.66	1.44
360°	15-F	20	2.85	13	1.89	1.63
		30	3.60	15	1.79	1.55
		40	4.20	16	1.84	1.59
	15-F-PC	50	4.58	16	2.00	1.73
		30-40	3.00	15	1.49	1.29
		40-75	3.30	15	1.64	1.42

Special Patterns—Orange

Pattern	Desc.	psi	GPM	Special Patterns		Prec. Rate*
				Width	Length	
4-EST	4-EST	20	0.38	3'	x 12'	2.03
		30	0.45	4'	x 15'	1.44
		40	0.53	5'	x 18'	1.13
		50	0.60	6'	x 20'	0.96
4-EST-PC	4-EST-PC	30-40	0.43	4'	x 15'	1.38
		40-75	0.50	4'	x 15'	1.61

DIVISION 46 INDUSTRY-SPECIFIC MANUFACTURING EQUIPMENT

46 61 53

Cartridge Filters



Star-Clear™

CARTRIDGE FILTERS



Hayward Star-Clear cartridge filters provide sparkling pure water for a wide range of pool sizes and types. From spas and hot tubs to above- and in-ground pools, they deliver full-sized filter system performance in an easy-to-afford package. Star-Clear filters feature a heavy duty cartridge element engineered from high quality reinforced polyester, for maximum efficiency, easier cleaning and longer life. A single locking knob provides easy access to the cartridge element and securely fastens the filter head to the filter tank — eliminating clamps or bolts. An attractive injection molded, corrosion-proof filter body sets the standard for value and convenience.

FILTERS



Filter Head
provides easy access to cartridge element. Attractive and durable, the head may be rotated to conveniently position pressure gauge and manual air relief valve

Single Locking Knob
securely fastens filter head to filter tank, eliminating clamps or bolts

Heavy-Duty Filter Tank
is injection-molded for dependable, corrosion-free performance

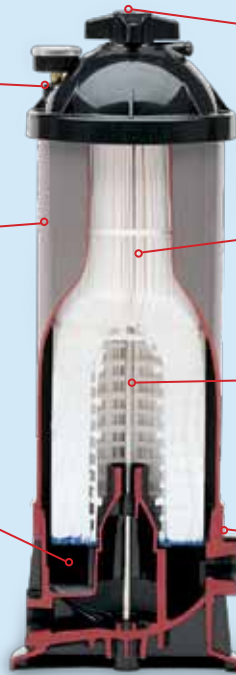
Single Element Cartridge
is engineered of high-quality reinforced polyester with gasketed molded end caps for maximum efficiency, easier cleaning and longer life

Elevated Filtered Water Collector and Debris Sump
prevents accidental by-pass of heavy debris to pool or spa when cartridge is removed for cleaning

Molded Center Core
incorporating unique "Waffle-Pattern Design" allows for maximum flow and provides extra strength

½" FIP Filter Drain Valve
provides fast draining for elevated spas and tubs. Also accepts standard spigot valve

Integral Mounting Base
provides stable, corrosion-free support and allows filter to be used separately or mounted as a complete filter, pump and platform base system



SPECIFICATIONS – STAR-CLEAR CARTRIDGE FILTERS

FILTER TYPE	Cartridge element: 25 and 50 ft. ² . (2.3 and 4.7 m ²)
FILTER TANK	Injection-molded
FILTER ELEMENTS	Reinforced Polyester
PERFORMANCE RANGE	½ to 2 HP (25 to 50 GPM/95 LPM to 189 LPM)
DIMENSIONS	C250 – 19 ½" H x 10 ½" W (495 mm x 267 mm)
	C500 – 29 ½" H x 10 ½" W (749 mm x 267 mm)



EASY TO CLEAN CARTRIDGE ELEMENTS
Hayward cartridges have extra dirt-holding capacity and are engineered from durable, high-quality materials to last for years with only minimal care. Simply remove the cartridge element and hose off with Hayward's EC2024 Jet-Action Cleaning Wand to restore to clean operating condition.

PERFORMANCE DATA

MODEL NUMBER	EFFECTIVE FILTRATION AREA		DESIGN FLOW RATE		TURNOVER (GALS.)			
	ft. ²	m ²	GPM	LPM	8 hr		10 hr	
					Gallons	Liters	Gallons	Liters
C250	25	2.3	25	95	12,000	45,420	15,000	56,775
C500	50	4.7	50	189	24,000	90,840	30,000	113,550

We will be using the C500 model.

To take a closer look at Hayward Filters or other Hayward products, go to www.hayward.com or call 1-888-HAYWARD.



DIVISION 48 ELECTRICAL POWER GENERATION

48 19 16

Electric Power Generation Inverters

SUNPOWER®

SPR-3000p-TL-1, SPR-3600p-TL-1, SPR-4200p-TL-1, SPR-5000p-TL-1 & SPR-6000p-TL-1

We will be using the
SPR-6000p-TL-1 model

BENEFITS

The World's Standard for Solar

High performance and high reliability inverters for use with SunPower photovoltaic panels - the most efficient and reliable panels on earth.

High Efficiency

Transformerless inverter technology enables maximum inverter efficiency of up to 97.1% and CEC efficiency of up to 96.5%.

Design Flexibility and Yield Maximization

Two maximum power point trackers expand deployment options and maximize energy harvest when irradiance varies across the array.

Guaranteed Performance

Reliable and robust design has a proven record for durability and longevity.



SPR-3000p-TL-1, SPR-3600p-TL-1,
SPR-4200p-TL-1, SPR-5000p-TL-1
& SPR-6000p-TL-1



SPR-3000p-TL-1
SPR-3600p-TL-1
SPR-4200p-TL-1



SPR-5000p-TL-1
SPR-6000p-TL-1

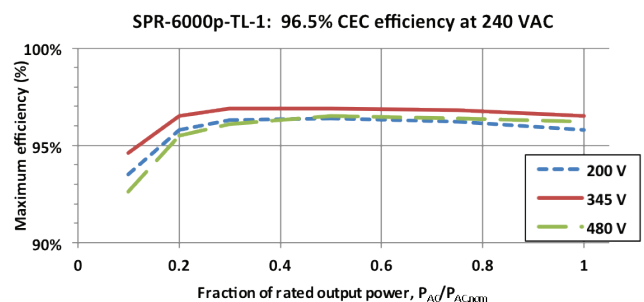
The SunPower SPR-3000p-TL-1, SPR-3600p-TL-1, SPR-4200p-TL-1, SPR-5000p-TL-1 & SPR-6000p-TL-1 offer proven reliability and superior performance. Their robust and precision designed electronics housing offers UV-resistance and corrosion protection and is suited for both indoor and outdoor (NEMA 4X) applications. All models come with a standard 10 year warranty.

Electrical Data	SPR-3000p-TL-1	SPR-3600p-TL-1	SPR-4200p-TL-1	SPR-5000p-TL-1	SPR-6000p-TL-1																		
Input Variables (DC)																							
Max. usable power per MPPT	2000 W	3000 W	3000 W	4000 W	4000 W																		
Number of MPPTs	2																						
MPPT range	160 V ... 530 V	120 V ... 530 V	140 V ... 530 V	200 V ... 530 V	200 V ... 530 V																		
Start-up voltage	200 V (adjustable 120 V ... 350 V)																						
Open circuit voltage	600 V																						
Max. input current for both MPPTs in parallel	20.0 A	32.0 A	32.0 A	36.0 A	36.0 A																		
Max. usable current per MPPT	10.0 A	16.0 A	16.0 A	18.0 A	18.0 A																		
Number of string inputs per MPPT	1	1	1	2	2																		
Output Variables (AC)																							
Nominal power	3000 W	3600 W	4200 W	5000 W	6000 W																		
Max. AC output current at:	<table border="1"> <tr><td>208 V</td><td>14.5 A</td></tr> <tr><td>240 V</td><td>14.5 A</td></tr> <tr><td>277 V</td><td>12.0 A</td></tr> </table>	208 V	14.5 A	240 V	14.5 A	277 V	12.0 A	<table border="1"> <tr><td>17.2 A</td></tr> <tr><td>16.0 A</td></tr> <tr><td>16.0 A</td></tr> </table>	17.2 A	16.0 A	16.0 A	<table border="1"> <tr><td>20.0 A</td></tr> <tr><td>20.0 A</td></tr> <tr><td>20.0 A</td></tr> </table>	20.0 A	20.0 A	20.0 A	<table border="1"> <tr><td>27.0 A</td></tr> <tr><td>23.0 A</td></tr> <tr><td>20.0 A</td></tr> </table>	27.0 A	23.0 A	20.0 A	<table border="1"> <tr><td>30.0 A</td></tr> <tr><td>28.0 A</td></tr> <tr><td>24.0 A</td></tr> </table>	30.0 A	28.0 A	24.0 A
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240 V	14.5 A																						
277 V	12.0 A																						
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30.0 A																							
28.0 A																							
24.0 A																							
Rated frequency	60 Hz																						
cos phi	> 0.995																						
Number of grid phases	1																						
General Electrical Data																							
Max. efficiency	96.9%	97.0%	97.0%	97.1%	97.1%																		
CEC efficiency at:	<table border="1"> <tr><td>208 V</td><td>96.0%</td></tr> <tr><td>240 V</td><td>96.0%</td></tr> <tr><td>277 V</td><td>96.0%</td></tr> </table>	208 V	96.0%	240 V	96.0%	277 V	96.0%	<table border="1"> <tr><td>96.0%</td></tr> <tr><td>96.0%</td></tr> <tr><td>96.0%</td></tr> </table>	96.0%	96.0%	96.0%	<table border="1"> <tr><td>96.0%</td></tr> <tr><td>96.0%</td></tr> <tr><td>96.0%</td></tr> </table>	96.0%	96.0%	96.0%	<table border="1"> <tr><td>96.0%</td></tr> <tr><td>96.5%</td></tr> <tr><td>96.5%</td></tr> </table>	96.0%	96.5%	96.5%	<table border="1"> <tr><td>96.0%</td></tr> <tr><td>96.5%</td></tr> <tr><td>96.5%</td></tr> </table>	96.0%	96.5%	96.5%
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Stand-by consumption	< 8 W																						
Switching plan	transformerless																						

Mechanical Data	SPR-3000p-TL-1 SPR-3600p-TL-1 SPR-4200p-TL-1	SPR-5000p-TL-1 SPR-6000p-TL-1
Display	16 characters x 2 lines LCD display	
Ambient temperature	-25 °C ... +60 °C * (-13 °F ... +140 °F)	
PV array isolation control	GFDI	
Connections	DC & AC: screw terminal block	
Cooling	convective cooling, no fan	
Protection class	NEMA 4X	
Noise emission	< 50 dB at 1 meter	
DC-switch	integrated	
H x W x D	859mm x 325mm x 222mm (33.8" x 12.8" x 8.7")	1052mm x 325mm x 222mm (41.4" x 12.8" x 8.7")
Weight	21.3 kg (47.3 lbs)	27.0 kg (59.5 lbs)

*Power derating above 55 °C (131 °F) for SPR-3000p-TL-1, SPR-3600p-TL-1 and SPR-4200p-TL-1 and above 50 °C (122 °F) for SPR-5000p-TL-1 and SPR-6000p-TL-1

Features	SPR-3000p-TL-1 SPR-3600p-TL-1 SPR-4200p-TL-1	SPR-5000p-TL-1 SPR-6000p-TL-1
Warranty	10 years	
Conformity to standards	UL 1741, CSA-C22.2 N. 107.1-01, IEEE 1547, cCSA US Additional certifications are available upon request	
Interface	RS485	



About SunPower

SunPower designs, manufactures, and delivers high-performance solar electric technology worldwide. Our high-efficiency solar cells generate up to 50 percent more power than conventional solar cells. Our high-performance solar panels and trackers deliver significantly more energy than competing systems.