

enable

Your home for today,
and tomorrow

Project Manual D8 Submission

August 10, 2017

HOUSE

by Northwestern

Northwestern University

U.S. Department of Energy
Solar Decathlon 2017



enable

Your home for today,
and tomorrow

HOUSE
by Northwestern

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Enable by House by Northwestern is Northwestern University's first entry in the DOE Solar Decathlon. Designed for active Baby Boomers living in Chicago's North Shore who are looking to downsize and buy their home for life, *Enable* delivers an **EN**ergized (energy-efficient and active lifestyle) and Adapt**ABLE** (the house meets residents' changing needs) experience for its target users. *Enable* is more than a house. It's a home for today, and tomorrow.

AGING-IN-PLACE & UNMET HOUSING NEEDS FOR BABY BOOMERS

Baby Boomers, born between 1946 and 1964, are important to the U.S. housing industry given their sheer numbers. From 2016 to 2060, the population of individuals 65 and older is projected to more than double — from 46 to more than 98 million — which represents an increase from 15 to nearly 24 percent of the total population¹.

In the city of Evanston, IL, home to Northwestern University and part of Chicago's North Shore, 20% of the population is projected to be 65 and older by 2020². A community that takes pride in its age-friendliness, Evanston is one of 284 cities in the world and 45 cities in the United States approved to enter the World Health Organization (WHO) Network of Age-Friendly Cities³. Being a part of this network requires that a city adapt its structure and services — including housing — “to be accessible to and inclusive of older people with varying needs and capacities”⁴.

Recent Boomer homebuyers aged between 52–61 project they will live in their homes for at least 20 years⁵ and approximately 90 percent of those over age 65 report wanting to stay in their homes as long as possible⁶. This desire to **age-in-place** means that Boomers' houses will become important places for long-term care as residents deal with disabilities and other aging-related health challenges. However, the Joint Center for Housing

Studies of Harvard University estimates that only 1 percent of the current housing stock contains the key features required to support aging-in-place, such as zero-step entrances, single-floor living, wide hallways and doorways, wheelchair-accessible light switches, and lever-style door handles and faucets⁷.

It is with this housing shortage and Evanston's interest in improving its current structures and services to create a culture of age-friendliness in mind that the Solar Decathlon team at Northwestern University set about designing a highly energy-efficient, yet fully-accessible home for a rapidly aging Baby Boomer demographic.

ENABLE: A USER-CENTRIC DESIGN APPROACH

The House by Northwestern (HBN) team took a user-centric approach to the design of *Enable*. In other words, community members weighed in at every step of the design process about how *Enable* could best meet their needs. The buyer personas of “Michael and Lisa”, which are referenced frequently in our materials, encompass HBN market research data and represent that common voice of the active Baby Boomer living in Chicago's North Shore.

Based on primary research from HBN User and Market Research Teams⁸, our target market ranked the following housing features in order of importance to them: **comfort and livability, high-performance with functionality, easy home maintenance, sustainability, and affordability**. The crux of HBN's design efforts was to create a home that balances the needs of the market with our team's desire to create a sustainable, environmentally-friendly home. By packaging energy efficient and sustainable features into a comfortable, beautiful, accessible, and easy-to-maintain home, *Enable* offers sustainability without compromise.

Construction Specifications & Product Data Sheets

- 10 Project Overview 5**
- A10 Foundations 7**
- B10 Superstructure 32**
- B20 Exterior Vertical Construction 97**
- B30 Exterior Horizontal Construction 103**
- C10 Interior Construction 105**
- C20 Interior Finishes 141**
- D20 Plumbing 147**
- D30 HVAC 177**
- D40 Fire Protection 270**
- D50 Electrical 328**
- D60 Communications 470**
- E20 Furnishings 471**
- G20 Landscape Site Development 524**

10 PROJECT OVERVIEW

1010 SUMMARY OF WORK

A. GENERAL

1. This project is a temporary exhibit of a single family home located in Chicago's North Shore. The project is adaptable to installation in the target market and designed with aging in place methodology for an older couple looking to downsize. For a full description of the target market and design goals, see the Project Overview section of the Project Manual.

B. COMPETITION SITE

1. The competition site is a currently undeveloped site located in Peña Station in Denver, CO.

1020 PROJECT PROGRAM

A. RESIDENTIAL PROGRAM

1. Master Bedroom – 184 sf
2. Living/Kitchen/Dining Room – 455 sf
3. Convertible Room – 154 sf
4. Master Bathroom – 97 sf
5. Guest Bathroom – 59 sf
6. Mechanical Closet – 23 sf

B. SITE PROGRAM

1. Garage – 280 sf
2. South Deck – 500 sf
 - a. Entry Deck – 150 sf
 - b. Sunroom – 346 sf
4. North Deck – 200 sf
5. Mechanical Shed – 61 sf

1030 SUMMARY OF RULES, CODES, STANDARDS, CRITERIA, AND LOADS

A. RULES

1. U.S Department of Energy Solar Decathlon Draft Rules, last updated; July 26, 2017.

B. CODES

1. U.S. Department of Energy Solar Decathlon Building Code; released November 2, 2016
2. 2015 International Residential Code (IRC) with International Building Code (IBC) amendments, published by the International Code Council (ICC)
3. 2014 National Electric Code (NEC) published by the National Fire Protection Agency (NFPA)

C. STANDARDS

1. 2010 ADA Standards for Accessible Design; published by the Department of Justice
 - a. Applicability; for all spaces accessible to the public as part of the required tour.
2. 2009 ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities, published by ICC, and 2015 IBC Chapter 11 Accessibility.
 - a. Applicability; for voluntary accessibility provided outside of areas accessible to the required tour for the level of accessibility desired.
3. 2003 ANSI Z765-2003 Square Footage-Method for Calculating.
 - a. Applicability; for determining the finished square footage of the house.

D. CRITERIA

1. Building Classification: Temporary exhibit of a single family, single story residence.
2. Fire Protection: Sprinkler system, refer to the Solar Decathlon Building Code for additional requirements.
3. Climate Zone: 5
4. Soil Site Class: D. (ASCE 7-10)
5. Seismic: Seismic Design Category B.
6. Sunroom Category: III (IRC)
7. Solar Envelope Surface; 2,500 psf maximum load-bearing pressure.

E. LOADS

1. Railings; 200lb concentrated load applied in any direction at any point at the top of the rail
2. Interior floor decks, ramps: 50psf live load
3. Exterior floor, decks, ramps used for tour staging and egress purposes: 100psf live load
4. Roof: 30psf live load
5. Snow: Ground snow load; 35 psf (ASCE 7-10)
6. Wind: 115 mph (3 second gust), exposure category C

A 10**FOUNDATIONS****A 1010****STANDARD FOUNDATIONS****A. SYSTEM DESCRIPTION**

1. Timber sill plate
 - a. Dimensional lumber stacked to achieve a level surface as required.
2. Standard Foundation Pier

B. FUNCTIONAL REQUIREMENTS

1. Gravity System Support
 - a. Provide structural footing assemblies that are constructed and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
 - b. Transfer vertical loads to soil from floor joists and walls above.

C. COMPONENTS

1. Boards, 2"x nominal lumber, variable widths depending on application.
 - a. Treated per AWPA Standard U1, UC2 requirements.
2. Standard Foundation Pier
 - a. See structural calculations Appendix D for specifications.

A 1020**SPECIAL FOUNDATIONS****A. SYSTEM DESCRIPTION**

1. Seismic Pier
 - a. Structural steel and precast concrete pad anchored to the ground.

B. FUNCTIONAL REQUIREMENTS

1. Lateral Force Resisting System
 - a. Provide structural footing assemblies that are constructed and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
 - b. Anchor the structure to the ground to resist sliding and overturning forces due to wind and seismic lateral loads.
 - c. Manufactured product for use with homes constructed above ground.

C. COMPONENTS

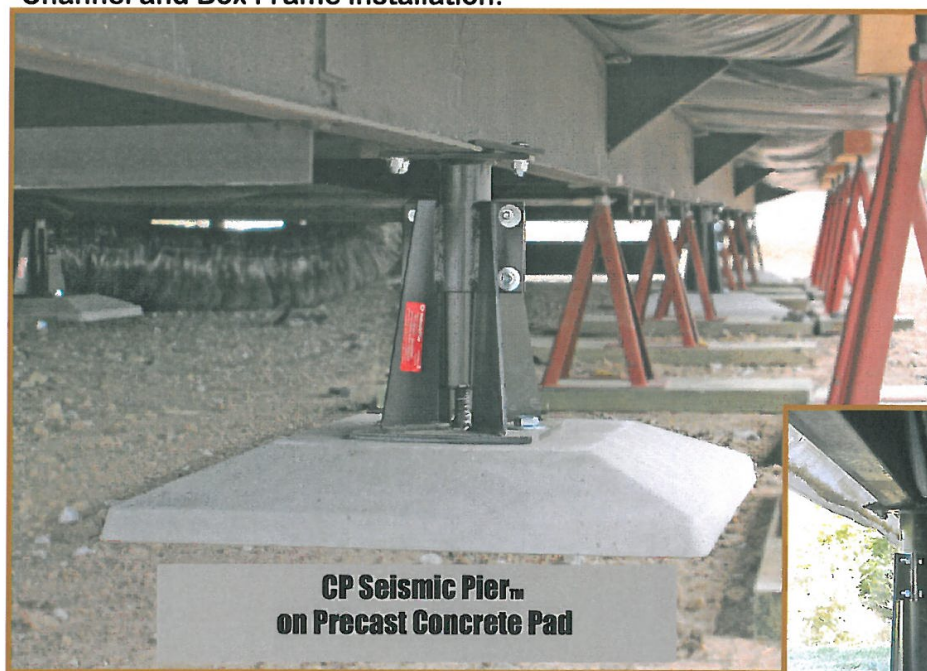
1. Central Piers Inc. product SPA 30-5F, seismic pier with tie downs as required, or equivalent.
2. See structural calculations Appendix C for specifications.



Central Piers Inc.
PO Box 11333
Fresno CA 93772
800-653-0387
centralpiers.com

CP-Seismic Pier™




The Patented CP-Seismic Pier™ with its versatility, strength, and ease of installation makes it a popular choice with contractors and homeowners. Our CP-Seismic Pier™ is designed for Foundation, Tiedown and E.R.B.S. Systems, designed for ease of installation thus saving valuable labor costs. We offer the CP-Seismic Pier™ with either a Reinforced Concrete Pad, Pressure Treated 3/4" Plywood Pad or Anchor Bolts or for wet or dry concrete installations. Frame attachments available for I-beam, C-Channel, J-Channel and Box Frame installation.









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Complete CP Seismic Pier™ with all Components

 <p>CP-Seismic Pier On Concrete Pad 112 - 7" Pier 89 - 11"Pier 96 - 18" Pier 104 - 19" Pier</p>	 <p>CP-Seismic Pier On Plywood Pad 113- 7" Pier 91- 11"Pier 98 - 18" Pier 105 - 19" Pier</p>	 <table border="1"> <tr> <td> <p>CP-Seismic Perimeter Pier On Concrete Pad 1981- 7" Pier 90- 11"Pier 97 - 18" Pier 109 - 19" Pier</p> </td> <td> <p>CP-Seismic Perimeter Pier On Plywood Pad 116- 7" Pier 94- 11"Pier 101 - 18" Pier 106 - 19" Pier</p> </td> </tr> </table>	<p>CP-Seismic Perimeter Pier On Concrete Pad 1981- 7" Pier 90- 11"Pier 97 - 18" Pier 109 - 19" Pier</p>	<p>CP-Seismic Perimeter Pier On Plywood Pad 116- 7" Pier 94- 11"Pier 101 - 18" Pier 106 - 19" Pier</p>
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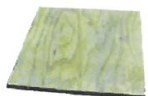




Each Complete CP-Seismic Pier™ comes with:

<p>Pre-drilled Pressure Treated Plywood Pad or Pre-cast Concrete</p> 	
<p>CP-Seismic Pier™ Base and Pipe</p> 	
<p>3 X 3 Plates</p> 	<p>Hard Ware Kit</p> 



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Individual Components

 CP-Seismic Pier Only 110 - 7" 88 - 11" 95 - 18"	 CP-Seismic Base Only 117 - 7" 86 - 11" or 18"	 Concrete CP-Pro Pad 218- 24 x 24 x 3-1/2"	 3/4" Plywood Pad 222- 24 x 24 x 3/4"	 CP-Seismic 19" Pier Only 103 - 19"	 CP-Seismic 19" Base Only 102 - 19"
 CP-Seismic Pipe 115 - 7" 93 - 11" 100 - 18"	 CP-Seismic Pipe 108 - 19"	 CP-Seismic Perimeter Pier Only 114 - 7" 92 - 11" 99 - 18"	 CP-Seismic Perimeter Base Only 1993 - 7" 1992 - 11" or 18"	 CP-Seismic 19" Perimeter Pier Only 107 - 19"	 CP-Seismic Perimeter Base Only 1994 - 19"
 Concrete CP- Seismic Perimeter Pad 85- 32 x 24 x 3- 1/2"	 CP-Seismic 3/4" Plywood Perimeter Pad 1991- 24 x 24 x 3/4"	 1/4" "J" Channel Kit 1990	 CP Seismic Wide Top Kit 256	 Wet Concrete L Bolt 1995	 5/8" Concrete Anchor Bolt 234 - 5/8"
 Hardware Kit for 1 Pier w/3x3"s 246 - Concrete 1985 - Plywood 1987 - Pier Only	 Hardware Kit for 4 Piers w/3x3"s 1984 - Concrete 1986 - Plywood 1988 - Pier Only	 1/4" 3x3" 33	 1/4" L Bracket 2134		



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Height Adjustment Charts

Concrete Pad (*Beam to Ground*)

7" Pier Adjusts	10 1/2"	to	13 1/2"
11" Pier Adjusts	14 1/2"	to	21 1/2"
18" Pier Adjusts	19 1/2"	to	26 1/2"
19" Pier Adjusts	22 1/2"	to	36"(max height)

Plywood Pad (*Beam to Ground*)

7" Pier Adjusts	7 3/4"	to	10 3/4"
11" Pier Adjusts	11 3/4"	to	18 3/4"
18" Pier Adjusts	16 3/4"	to	23 3/4"
19" Pier Adjusts	19 3/4"	to	33 3/4"

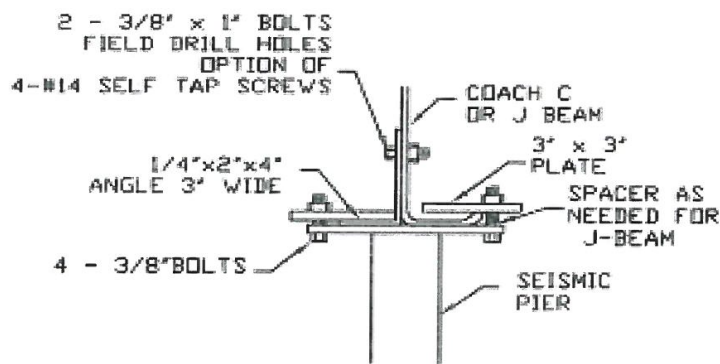
In-Ground System (*Beam to Ground*)

7" Pier Adjusts	7"	to	10"
11" Pier Adjusts	11"	to	18"
18" Pier Adjusts	16"	to	23"
19" Pier Adjusts	19"	to	33"



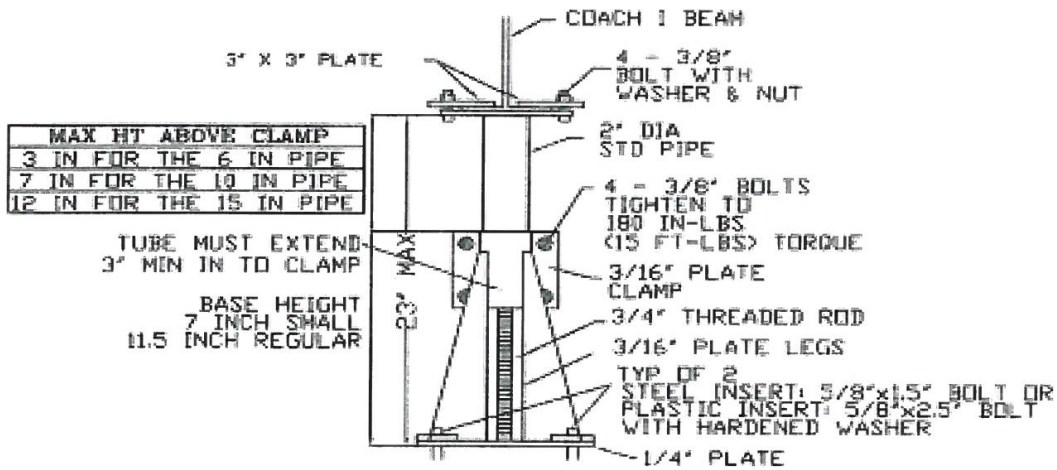
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Technical Drawing



TYP BEAM CONNECTION

Not to Scale



SEISMIC PIER

Not to Scale

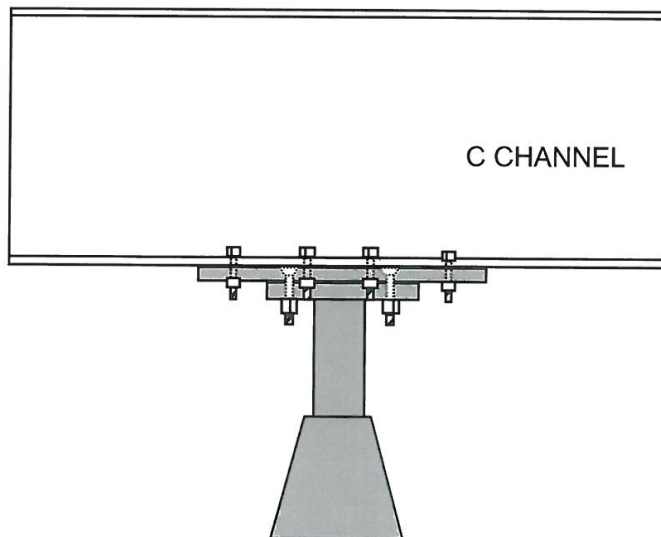
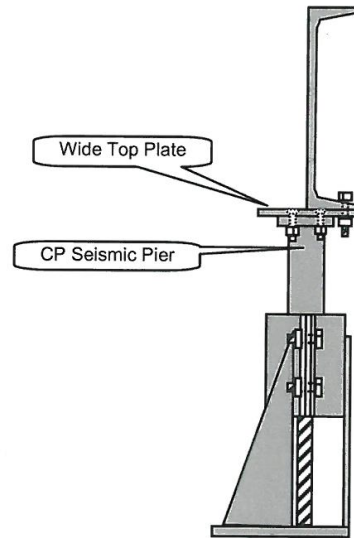
C.P. SEISMIC PIER#1-PATENT #5595366
 LISTING #C03-044-60F BY BSK



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We can accommodate all types of beam connections and alternative frame attachments.

Sample Illustrations.



ENGINEERED FOUNDATION PLAN
 C.P. SEISMIC PIER™ 
 SPA 30-5F

FOR: CENTRAL PIERS, INC.
 284 N. THORNE AVE.
 FRESNO, CA 93706
 559-268-0828

BY: ROCK SOLID ENGINEERING, INC.
 1100 MAIN STREET, SUITE A
 WATSONVILLE, CA 95076
 831-724-5868




Signed: 9/13/16

STATE APPROVAL





**MANUFACTURED HOME/MOBILE HOME
 FOUNDATION SYSTEM
 HEALTH AND SAFETY CODE, SECTION 18891
 APPROVED**

**APPROVAL DOES NOT AUTHORIZE OR APPROVE ANY
 OMISSIONS OR DEVIATION FROM REQUIREMENTS OF
 APPLICABLE STATE LAWS AND REGULATIONS**
 State of California
 Department of Housing and Community Development

DIVISION OF CODES AND STANDARDS

BY  DATE 9/19/16
(signature)

SPA NO. 30-5F
 This Plan Approval Expires 10/24/18

REV.	DATE	BY	COMMENTS
			
	09/13/16	YW	MINOR TEXT EDITS
	06/17/14	YW	ADD 130 MPH WIND LOAD
	02/14/14	YW	UPDATE TO 2013 CBC/CRC

ROCK SOLID ENGINEERING, INC.

ENGINEERED FOUNDATION PLAN
 CENTRAL PIERS - SPA 30-5F

SHEET
 F1 OF 6

GENERAL NOTES:

REFERENCE: CALIFORNIA CODE OF REGULATIONS, TITLE 25 AND 2013 C.R.C./C.B.C. THESE PLANS MEET THE INTENT OF 2013 C.R.C. 301.1.3.


1. DESIGN LOADS SHALL BE CONSISTENT WITH LOCAL REQUIREMENTS WHERE INSTALLED. THE FOLLOWING DESIGN LOADS ARE INCORPORATED HEREIN:
 FLOOR LIVE LOAD: 40 PSF ROOF LIVE LOAD: 30PSF - 100 PSF
 BASIC WIND SPEED & EXPOSURE: 110-130 MPH AS LISTED IN TABLE
 SEISMIC DESIGN CATEGORY: E
 SITE CLASS D $S_s=1.5$ $S_{ds}=1.4$ $F_a=1.4$ $V=0.215W$ (SIMPLIFIED METHOD, ASCE 7-10 SECTION 12.14)
 THIS DESIGN IS NOT INTENDED FOR USE IN FLOOD HAZARD AREAS.
2. FOOTINGS ARE TO BE SUPPORTED BY EITHER FIRM, UNSATURATED, UNDISTURBED SOIL OR COMPACTED FILL, ASPHALT OR CONCRETE. FOOTINGS ARE DESIGNED FOR 1500 PSF BEARING CAPACITY AND SHALL BE COMPATIBLE WITH LOCAL SOIL CONDITIONS. ALL FOOTINGS SHALL BE FOUNDED IN ACCORDANCE WITH H.C.D. GUIDLINES AND TITLE 25 OR PREPARE SUBGRADE PER SOIL REPORT, WHEN AVAILABLE.
3. STRUCTURAL STEEL:
 - a. SHALL CONFORM TO ASTM A36 $F_y = 36$ KSI MINIMUM.
 - b. SHALL BE FABRICATED ACCORDING TO AISC SPECIFICATIONS.
 - c. SHALL BE WELDED ACCORDING TO AWS SPECIFICATIONS:
 - i. ELECTRODES: E70
 - ii. PLATES: ASTM A36
 - iii. BOLTS: STANDARD ASTM A307
 - iv. THREADED ROD: COLD DRAWN LOW CARBON WELDABLE
 - d. ALL METAL COMPONENTS INCLUDING NAILS & SCREWS ETC. ARE TO BE PROTECTIVE COATED.
4. THE C.P. SEISMIC PIER SHALL BE LISTED & LABELED BY BSK ASSOCIATES FOR THESE ULTIMATE LOADS:
 7" THRU 18 INCH PIERS: 3203 LBS. (STRONG DIR), 2273 (WEAK DIR), 16,000 VERTICAL
5. THIS FOUNDATION SYSTEM IS FOR PLACING MANUFACTURED HOMES CONSTRUCTED WITH LONGITUDINAL OR CROSS JOISTS.
6. THIS FOUNDATION SYSTEM IS DESIGNED TO BE CONSTRUCTED ON A FAIRLY LEVEL SITE WITH NO EXISTING SOIL PROBLEMS. SEE NOTE 2 AND TITLE 25, SECTION 1334(b).
7. THE SIZE, TYPE & LOCATION OF STANDARD VERTICAL SUPPORT PIERS & FOOTINGS MUST BE INSTALLED PER THE HOME MANUFACTURER'S INSTALLATION MANUAL. WITHOUT MANUAL, SPACING OF STANDARD PIERS TO BE DETERMINED BY TITLE 25, SECTION 1335.5.

FOUNDATION PAD NOTES:

1. TWO FOUNDATION PADS ARE AVAILABLE FOR USE WITH THIS SYSTEM. THE CUSTOMER MAY CHOOSE ONE OF THE PADS FOR THEIR HOME. SEE SHEET F6, FOUNDATION PADS.
2. FOUNDATION PADS SHALL BE PLACED ON FIRM, LEVEL UNDISTURBED SOIL (SEE GEN. NOTE 2)
3. THE FOUNDATION PADS SHALL BE ORIENTED AS SHOWN ON THE PLAN VIEW DRAWING WITH THE BOLT HOLES PERPENDICULAR TO THE CHASSIS BEAM. SEE PLAN VIEWS, SHEETS F3 AND F4.

4. **CONCRETE FOUNDATION PADS**
 2500 PSI AT 28 DAYS AS TESTED AND MANUFACTURED BY STARLITE WEIGHT CONCRETE.
5. **PRESSURE TREATED FOUNDATION PAD**
 3/4 INCH A.P.A. 48/24 EXTERIOR P.S.I.-83 CC. PLUGGED, NER-QA397,PRP-108.
6. **ATTACHMENT TO EXISTING CONCRETE SLAB**
 THE C.P. SEISMIC PIER MAY BE ATTACHED TO AN EXISTING COMPETENT CONCRETE SLAB OR CONCRETE FOOTING ACCORDING TO THE FOLLOWING CRITERIA:
 1. ATTACH WITH TWO 5/8" DIAM. REDHEAD WEDGE ANCHORS
 2. MINIMUM EMBEDMENT = 2.5"
 3. MINIMUM CONCRETE THICKNESS = 3 3/4"
 4. MINIMUM EDGE DISTANCE = 2"

COACH SIZE NOTES:

1. UNLESS APPROVED BY ROCK SOLID ENGINEERING, INC., THE ROOF PITCH SHOULD NOT EXCEED:
 - A. SINGLE WIDES: 4:12
 - B. DOUBLE AND TRIPLE WIDES: 3:12 or 4:12
 AS LISTED IN TABLE 
2. FOR ANY HOME SIZE OTHER THAN AS SHOWN ON THIS PLAN OR REFERENCED IN THE TABLE, THE LAYOUT SHALL BE REVIEWED & APPROVED BY ROCK SOLID ENGINEERING, INC.

INSPECTION REQUIREMENTS:

1. THE DESIGN OF THIS SYSTEM IS BASED ON STANDARD MANUFACTURED HOMES AS BUILT BY THE MANUFACTURER. SITE BUILT ADDITIONS SUCH AS GARAGES AND SECONDARY ROOFS HAVE NOT BEEN INCLUDED IN THIS DESIGN.
2. ALL DIMENSIONS INCLUDED ON THIS PLAN, INCLUDING COACH SIZE, ROOF HEIGHT AND PIER HEIGHT, SHOULD BE FIELD VERIFIED BY THE LOCAL BUILDING OFFICIAL. ANY DISCREPENCIES SHOULD BE IMMEDIATELY BROUGHT TO THE ENGINEER'S ATTENTION.
3. THE BUILDING PAD SHOULD BE INSPECTED TO ENSURE THAT PROPER SOIL CONDITIONS AND DRAINAGE PATTERNS HAVE BEEN ESTABLISHED IN ACCORDANCE WITH TITLE 25 & THE HOME INSTALLATION MANUAL.



Exp
10/24/18
gac



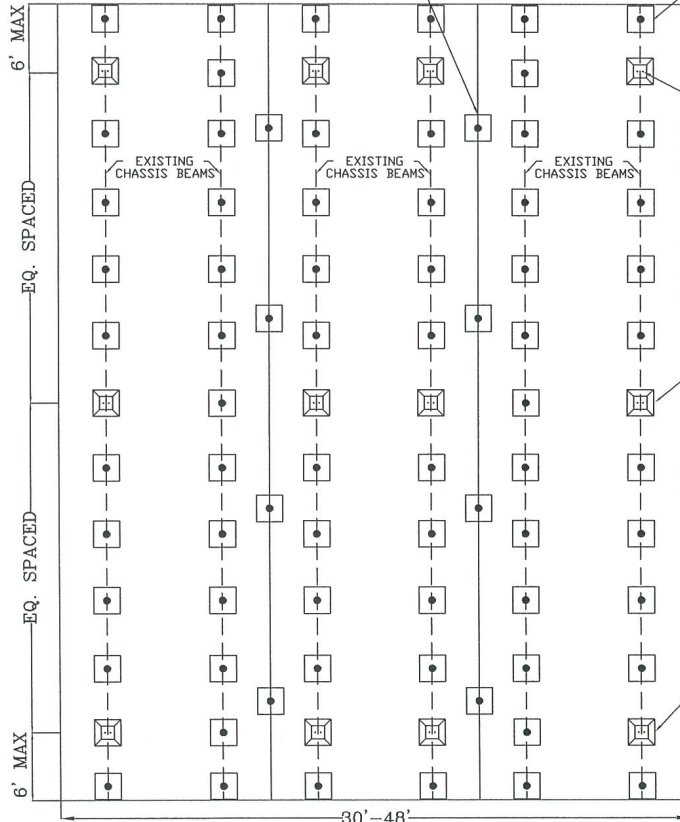
ROCK SOLID ENGINEERING, INC.

ENGINEERED FOUNDATION PLAN
CENTRAL PIERS - SPA 30-5F

SHEET
F2 OF 6

SIZE TYPE & LOCATION OF MARRIAGE LINE SUPPORTS MUST BE INSTALLED AS SPECIFIED IN THE HOME'S INSTALLATION MANUAL.

STANDARD CHASSIS PIER SUPPORT. TYPE, SIZE & LOCATION MUST BE INSTALLED AS SPECIFIED IN HOME'S INSTALLATION MANUAL



PAD ORIENTATION. PAD MUST BE PLACED AS SHOWN WITH BOLT HOLES PERPENDICULAR TO CHASSIS BEAM

PLACE C.P. SEISMIC PIERS IN ROWS OF 4 # PER TABLE, SHEET F5 # OF ROWS PER TABLE EACH SEISMIC PIER MAY REPLACE 1 STANDARD PIER

WHEN TIDOWNS ARE REQUIRED: PLACE C.P. ANCHOR PIER ON OUTER CHASSIS BEAM IN PLACE OF SEISMIC PIER. # TIEDOWNS PER TABLE, SHEET F5 (Ult. Capacity=2840 Lat & 3170 Uplift)

OUTLINE OF HOME



Exp 10/24/18 gm



PLAN Not to Scale
TRIPLE WIDE HOME

ROCK SOLID ENGINEERING, INC.

ENGINEERED FOUNDATION PLAN
CENTRAL PIERS - SPA 30-5F

SHEET
F3 OF 6

STANDARD CHASSIS PIER SUPPORT.
TYPE, SIZE & LOCATION MUST BE
INSTALLED AS SPECIFIED IN HOME'S
INSTALLATION MANUAL

PAD ORIENTATION
PAD MUST BE
PLACED AS SHOWN
WITH BOLT HOLES
PERPENDICULAR TO
CHASSIS BEAM

PLACE C.P. SEISMIC PIERS
IN ROWS OF 4
PER PIERS PER TABLE,
SHEET F5
OF ROWS PER TABLE
EACH SEISMIC PIER MAY
REPLACE 1 STANDARD PIER

WHEN TIEDOWNS ARE
REQUIRED: PLACE C.P.
ANCHOR PIER ON
OUTER CHASSIS BEAM
IN PLACE OF SEISMIC
PIER. # TIEDOWNS PER
TABLE, SHEET F5
(Ult. Capacity=2840 Lat
& 3170 Uplift)

OUTLINE OF
HOME

INSTALL HOME PRIDE EARTH ANCHORS
2900 lbs CAPACITY. NUMBER PER TABLE.
SPACE 1ST ROW 2 FT FROM END THEN SPACE EVENLY.
INSTALL END WALL TIEDOWNS, WHERE REQUIRED. SEE TABLE.

PAD ORIENTATION
PAD MUST BE
PLACED AS SHOWN
WITH BOLT HOLES
PERPENDICULAR TO
CHASSIS BEAM

C.P. SEISMIC PIER &
FOUNDATION PAD
PER TABLE,
SHEET F5
EACH SEISMIC PIER
MAY REPLACE 1
STANDARD PIER

OUTLINE OF
HOME



9-13-10

PLAN Not to Scale
DOUBLE WIDE HOME

PLAN Not to Scale
SINGLE WIDE HOME

ROCK SOLID ENGINEERING, INC.

ENGINEERED FOUNDATION PLAN
CENTRAL PIERS - SPA 30-5F

SHEET
F4 OF 6

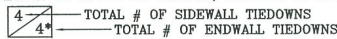
			MAX. ROOF LIVE LOAD (PSF)	30 PSF			40 PSF			40 PSF			100 PSF			100 PSF					
			MAX. WIND LOAD(MPH,EXP)	110B & 110C			110C			120B			120C			130C Δ					
HOME SIZE			# OF SEISMIC PIERS	# OF ROWS	# OF TIE DOWNS	# OF SEISMIC PIERS	# OF ROWS	# OF TIE DOWNS	# OF SEISMIC PIERS	# OF ROWS	# OF TIE DOWNS	# OF SEISMIC PIERS	# OF ROWS	# OF TIE DOWNS	# OF SEISMIC PIERS	# OF ROWS	# OF TIE DOWNS				
ROOF PITCH	WIDTH	LENGTH																			
SINGLES	4:12	10'-16'	UP TO 48'	4	2 ROWS	4	4	2 ROWS	4	4*	4	2 ROWS	4	4*	4	2 ROWS	4	4*			
			48.5'-60'	6	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6	4*	6	3 ROWS	6	4*	
			60.5'-78'	8	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8	4 ROWS	8	4*
DOUBLE WIDES	3:12	20'-28'	UP TO 56'	8	2 ROWS	0	4	2 ROWS	4	4	2 ROWS	4	8	3 ROWS	4	8	3 ROWS	4	6	3 ROWS	6
			56.5'-66'	8	2 ROWS	0	4	2 ROWS	4	8	3 ROWS	4	8	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6
			66.5'-78'	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8
	4:12	28.5'-32'	UP TO 56'	8	2 ROWS	0	4	2 ROWS	4	4	2 ROWS	4	8	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6
			56.5'-66'	8	2 ROWS	0	12	3 ROWS	0	12	3 ROWS	0	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8
			66.5'-78'	12	3 ROWS	0	12	3 ROWS	0	12	3 ROWS	0	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8
TRIPLES WIDES	4:12	20'-30'	UP TO 60'	8	2 ROWS	0	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6
			60.5'-66'	8	2 ROWS	0	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6
			66.5'-78'	12	3 ROWS	0	12	3 ROWS	0	8	3 ROWS	4	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8
	4:12	30.5'-32'	UP TO 56'	8	2 ROWS	0	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6
			56.5'-66'	8	2 ROWS	0	12	3 ROWS	0	8	3 ROWS	4	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8
			66.5'-78'	12	3 ROWS	0	12	3 ROWS	0	8	3 ROWS	4	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8
4:12	30'-43'	UP TO 48'	8	2 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	8	3 ROWS	4	6	3 ROWS	4	6	3 ROWS	6	
		48.5'-60'	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8	
		60.5'-66'	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	16	5 ROWS	4	8	5 ROWS	4	8	5 ROWS	8	
	43.5'-48'	UP TO 48'	12	3 ROWS	0	8	3 ROWS	4	8	3 ROWS	4	14	5 ROWS	6	10	5 ROWS	6	10	5 ROWS	10	
		48.5'-56'	12	3 ROWS	0	8	4 ROWS	4	8	3 ROWS	4	12	4 ROWS	4	8	4 ROWS	4	8	4 ROWS	8	
		56.5'-68'	12	3 ROWS	0	8	5 ROWS	4	12	4 ROWS	4	14	5 ROWS	6	10	5 ROWS	6	10	5 ROWS	10	
			68.5'-78'	16	4 ROWS	0	12	4 ROWS	4	12	4 ROWS	4	14	5 ROWS	6	10	5 ROWS	6	10	5 ROWS	10

TABLE NOTES

TO USE TABLE, FIND HOME SIZE (SINGLE, DOUBLE OR TRIPLE), THEN FIND ROOF PITCH, WIDTH AND LENGTH. FOLLOW ROW ACROSS TO DESIGN SNOW LOAD THEN DESIGN WIND LOAD. READ TOTAL NUMBER OF C.P. SEISMIC PIERS, # OF ROWS & TIEDOWNS REQUIRED. SEE PLAN, SHEETS F3 & F4, FOR PLACEMENT OF C.P. SEISMIC PIERS AND TIEDOWN SPECIFICATIONS.

FOR EXAMPLE, FOR A 24'x70' HOME WITH A 3:12 ROOF PITCH, DESIGN SNOW LOAD OF 30 PSF & 110 MPH, EXPOSURE C WIND LOAD, READ 12 C.P. SEISMIC PIERS, PLACED IN 3 ROWS, WITH 0 C.P. ANCHOR PIER TIEDOWNS. LAYOUT SHOWN IN DOUBLE WIDE PLAN VIEW, SHEET F4

*FOR SINGLE WIDES, WHERE TIEDOWN COLUMN IS SPLIT AS SHOWN, INSTALL 2 EARTH ANCHOR TIEDOWNS AT EACH ENDWALL, TOTAL # OF ENDWALL TIEDOWNS PER HOME IS INDICATED IN TABLE BY *.



HOME SIZES REFER TO NOMINAL SIZES THAT ARE COMMONLY MANUFACTURED. IF THE EXACT SIZE OF THE HOME IS NOT LISTED, CHECK THE NEXT HIGHER OR LOWER SIZE AND USE THE ONE THAT REQUIRED MORE PIERS.

THE TIEDOWNS SHALL BE LISTED & INSTALLATION INSTRUCTIONS SHALL BE ON SITE AT TIME OF INSPECTION.

THIS PLAN MAY BE USED WITH C.P. SEISMIC PIERS UP TO THE 16 INCH PIER SIZE. THE MAXIMUM HEIGHT OF THE C.P. SEISMIC AND C.P. ANCHOR PIERS IS 23' MEASURED FROM THE BASE PLATE TO THE TOP PLATE.

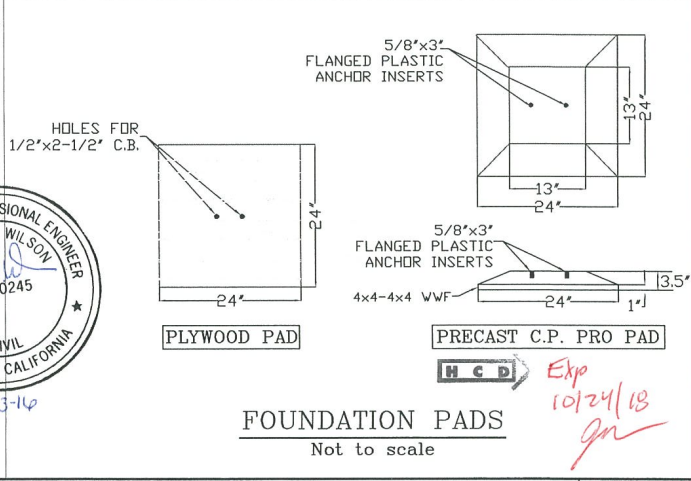
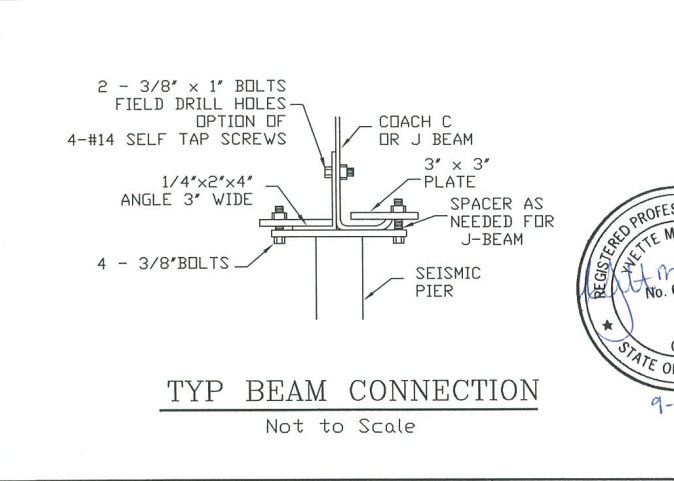
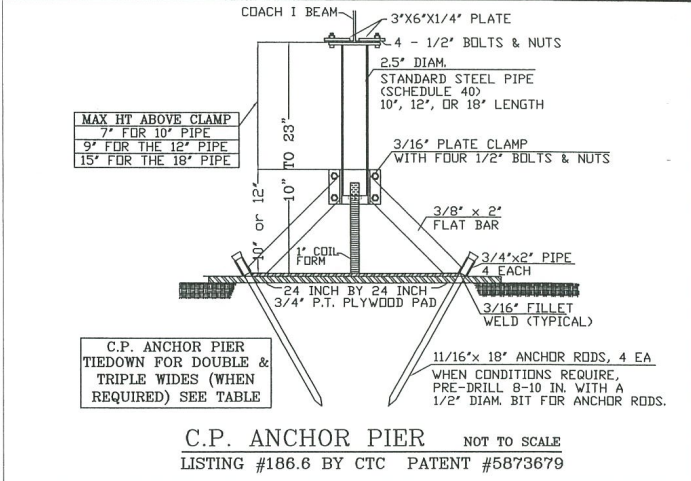
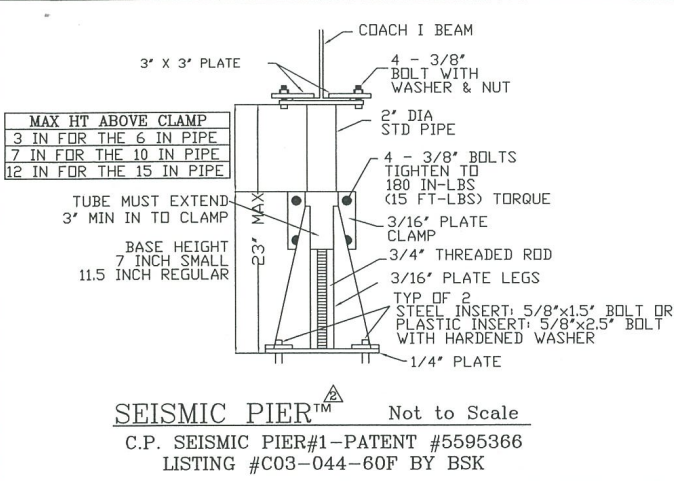
HCD Exp 10/24/18 gm



ROCK SOLID ENGINEERING, INC.

ENGINEERED FOUNDATION PLAN
CENTRAL PIERS - SPA 30-5F

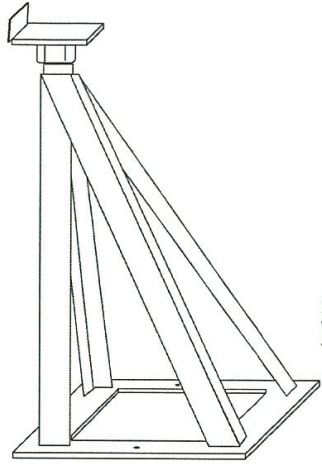
SHEET
F5 OF 6



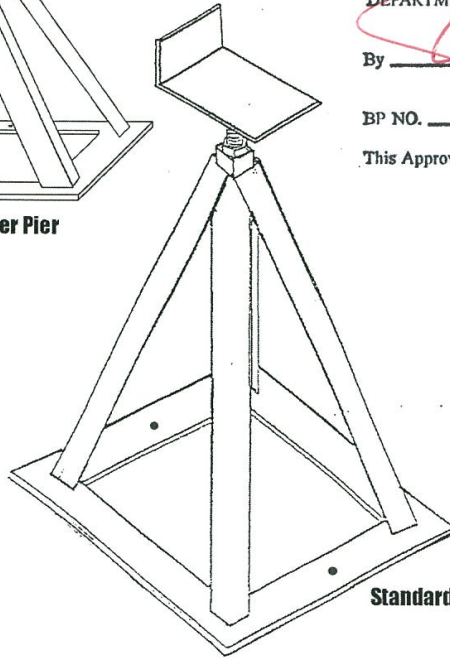
ROCK SOLID ENGINEERING, INC.

ENGINEERED FOUNDATION PLAN
 CENTRAL PIERS - SPA 30-5F
 SHEET 6 OF 6

APPENDIX D: FOUNDATION STANDARD PIER



Standard Perimeter Pier



Standard Pier

Standard Pier and Standard Perimeter Pier
Listing Agency: Technicon Engineering Services, Inc.
Listing #: 21033.001-QG0

MOBILEHOME & ACCESSORY STRUCTURE BUILDING COMPONENT
HEALTH AND SAFETY CODE, DIVISION 13, PART 2
APPROVED

SUBJECT TO CORRECTIONS NOTED
Approval does not authorize or approve any omission or deviation
from requirements of applicable State laws and regulations.

STATE OF CALIFORNIA
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
DIVISION OF CODES AND STANDARDS

By [Signature] Date 6/22/15
(signature)

BP NO. 17-01

This Approval Expires 7/14/17



Signed 5/11/15

Central Piers Inc.

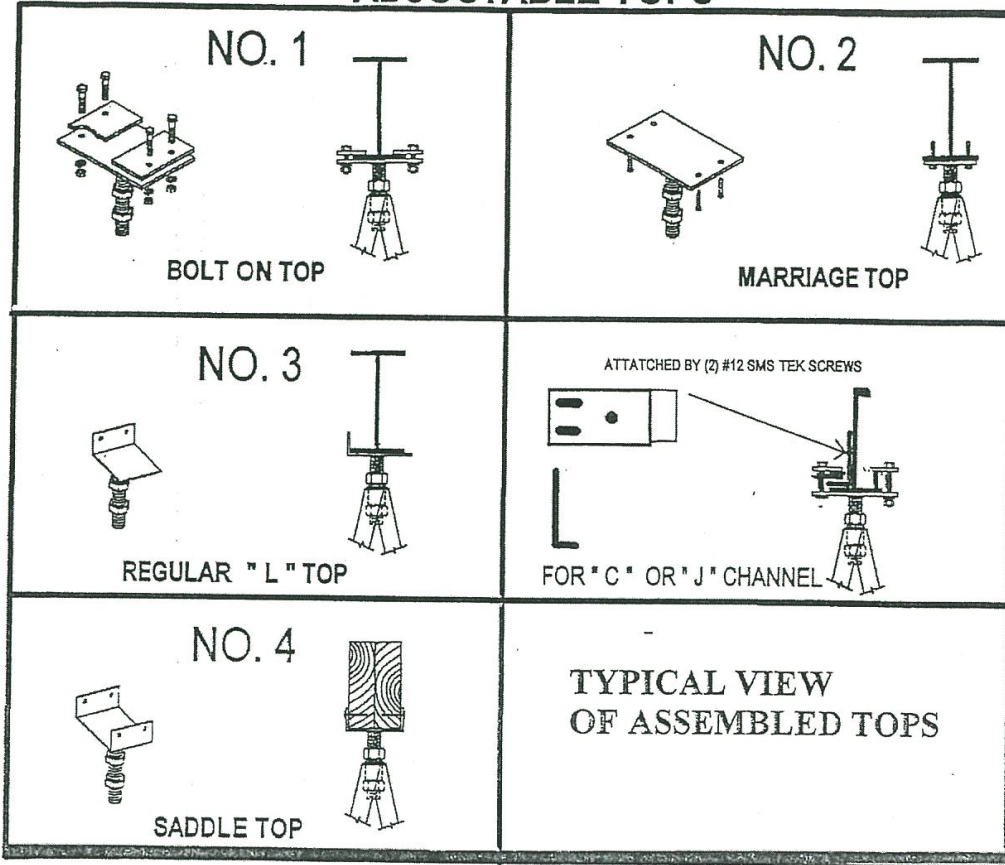
Standard Pier Heights From 4" to 36" in 2" Increments

Standard Pier 6000 lb. Rating
Standard Perimeter Pier 3000 lb. Rating

Central Piers Inc. 284 N Thorne Ave. Fresno California 93706 Office 559-268-0828 Fax 559-268-1439 centralpiers.com

①

ADJUSTABLE TOPS



INSTALLATION INSTRUCTIONS

- NO.1 ATTATCH BOLT ON TOP TO "I" BEAM WITH (4) 3/8" BOLTS AND NUTS-- WITH 2 nd 3/4" NUT , ATTATCH BOLT ON TOP TO PIER-- MAXIMUM HEIGHT ADJUSTMENT IS 2 inches
- NO. 2 ATTATCH MARRIAGE TOP TO RIDGE BEAMS THAT JOIN THE TWO HALVES OF THE MOBILE HOME TOGETHER OR THE (MARRIAGE LINE) WITH (4) LAG SCREWS. MAXIMUM HEIGHT ADJUSTMENT IS 2 inches.
- NO. 3 ATTATCH "L" TOP FLUSH AGAINST MAIN BEAM -- ALTERNATE "L" DIRECTION EVERY OTHER PIER-- MAXIMUM HEIGHT ADJUSTMENT IS 2 inches.
- NO. 4 ATTATCH SADDLE TOP FLUSH AGAINST MAIN CHASSIS BEAM AND OR RIDGE BEAM MAXIMUM HEIGHT ADJUSTMENT IS 2 inches.

CENTRAL PIERS INC.

SPA BP 17-01
 6/22/15-7/14/17
 HCD
 (2)

Central Piers Inc.
559-268-0828

New Standard Pier Labels:

Standard Steel Pier



Standard Perimeter Pier



BP 17-01 ← HCD
6/22/15 - 7/14/19

3



GEOTECHNICAL & ENVIRONMENTAL ENGINEERING ◀ CONSTRUCTION TESTING & INSPECTION

TEST REPORT

VERTICAL LOAD TESTS OF
STANDARD PIER AND STANDARD PERIMETER PIER

FOR:
CENTRAL PIERS, INC.
284 N. Thorne Avenue
Fresno, California 93706

[Handwritten signature]
6/22/15

Technicon Engineering Services, Inc.
May 4, 2015

CORPORATE OFFICE ▶ 4539 N. Brawley Avenue #108, Fresno, CA 93722 ▶ P 559.276.9311 ▶ F 559.276.9344
VISALIA OFFICE ▶ 151 S. Dunworth Avenue, Visalia, CA 93292 ▶ P 559.732.0200 ▶ F 559.732.0830
MERCED OFFICE ▶ 2345 Jetway Drive, Atwater, CA 95301 ▶ P 209.384.9300 ▶ F 209.384.0891
www.technicon.net

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3. Test Arrangements1

4. Test Procedure1

5. Test Results and Conclusions2

Appendix A: Test Data Sheets



GEOTECHNICAL & ENVIRONMENTAL ENGINEERING ◀ CONSTRUCTION TESTING & INSPECTION

May 4, 2015

Central Piers, Inc.
284 N. Thorne Avenue
Fresno, California 93706

ATTN: Mr. Andy Naze

SUBJECT: **TEST REPORT**
Standard Pier and Standard Perimeter Pier
Listing Agency: Technicon Engineering Services, Inc.
Listing #: Technicon 21033.001-Q GO

REFERENCE: California Code of Regulations, Title 25, Housing and Community Development, Division 1, Chapter 2, Section 1334, Updated April 1, 2013.

Dear Mr. Naze:

1. Introduction

The following report presents the results of the vertical load capacity testing program for the Standard Pier and Standard Perimeter Pier manufactured by Central Piers, Inc.

2. Purpose

The purpose of this testing program was to verify the design allowable vertical capacity for each pier.

3. Test Arrangements

The testing was conducted on the premises of Technicon Engineering Services, Inc. in Fresno, California on April 20, 2015. The piers tested were received on April 13, 2015. Complete test data sheets are included in Appendix A.

4. Test Procedure

a. Vertical Load

a. The purpose of the vertical load test was to verify the capacity of the Standard Pier and Standard Perimeter Pier in accordance with Title 25, Section 1334.

b. The piers were tested at varying heights. Three tests were completed at each height and the test result averaged over the three tests.

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- c. The testing apparatus consisted of an APG load cell (Serial No. Y0208 with a verified range of 50,000 lbs.) The load was read by means of a digital readout with a 10 pound capacity. The standard piers were centered underneath the loading head of the ram and the load was applied until failure. For the standard perimeter piers, the load was also applied until failure. The test was repeated for each of the pier sizes ranging from 6 inches to 36 inches, taking an average of three piers for each size.

5. Test Results and Conclusions

- b. In accordance with Title 25, Section 1334, the average load for each pier height was divided by 3 to determine the safe operating load.
- c. For the Standard Pier, the safe operating load **exceeded the rating of 6000 pounds**. Therefore all of the Standard Piers have been assigned a pass.
- d. For the Perimeter Pier, the safe operating load **exceeded the rating of 3000 pounds**. Therefore all of the Perimeter Piers have been assigned a pass.
- e. Complete load test results are presented Appendix A.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office.

Sincerely,

TECHNICON ENGINEERING SERVICES, INC.,



Darren G. Williams, PE, RCE
Principal



Attachments: Appendix A - Test Data Sheets

Appendix A
TEST DATA SHEETS



GEOTECHNICAL & ENVIRONMENTAL ENGINEERING — CONSTRUCTION TESTING & INSPECTION

April 20, 2015

TES No. 150301.001
Invoice No. 5368

For: Mr. Andrew Naze
Central Piers, Inc.
284 N Thorne Ave
Fresno, CA 93706

Project: Compression Load Testing of Steel Piers

Subject: Compression Load Testing of Steel Piers

Dear Mr. Naze:

In accordance with your request and authorization, our firm performed laboratory tests on April 20, 2015.

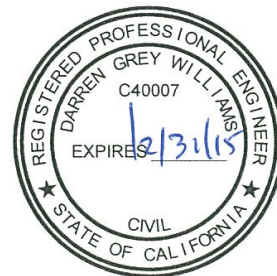
Technicon Engineering Services received samples on April 13, 2015 for Compression Load Testing of Steel Piers.

The purpose of our service is to assist in quality control to achieve conformance with the approved project plans and specifications and generally accepted practices in the industry. Our services do not guarantee the performance of the design, materials, or workmanship.

Thank you for your valued business. If you have any questions concerning this report, please call the undersigned.

Sincerely,
TECHNICON Engineering Services, Inc.

Darren G. Williams, RCE, REA II
Principal Engineer



CORPORATE OFFICE — 4539 N. Brawley Avenue #108, Fresno, CA 93722 — P 559.276.9311 — F 559.276.9344
VISALIA OFFICE — 151 S. Dunworth Avenue, Visalia, CA 93292 — P 559.732.0200 — F 559.732.0830
MERCED OFFICE — 2345 Jetway Drive, Atwater, CA 95301 — P 209.384.9300 — F 209.384.0891
www.technicon.net

Technicon Engineering Services, Inc.

Project: Compression Load Testing of Steel Piers
Central Piers, Inc.

TES No. 150301.001
Invoice No. 5368

Standard Pier Load Testing

Test Date:	4/20/2015
Test Type:	Vertical
Dead Load:	N/a

Test #1			Test #2			Test #3			Average Load (Lbs)	Load Rating
Pier Size (inches)	Load (Pounds)	Remarks	Pier Size (inches)	Load (Pounds)	Remarks	Pier Size (inches)	Load (Pounds)	Remarks		
6	22,400	1	6	20,800	1	6	22,550	1	21917	6000
8	25,400	1	8	23,500	1	8	23,550	1	24150	6000
10	23,400	1	10	22,150	1	10	24,400	1	23317	6000
12	23,500	1	12	21,600	1	12	22,400	1	22500	6000
14	23,000	1	14	24,000	1	14	23,000	1	23333	6000
16	19,500	1	16	19,500	1	16	21,250	1	20083	6000
18	20,900	1	18	19,000	1	18	19,000	1	19633	6000
20	19,700	1	20	19,600	1	20	18,000	1	19100	6000
22	21,000	1	22	19,500	1	22	23,000	1	21167	6000
24	18,900	1	24	18,500	1	24	19,500	1	18967	6000
26	18,400	1	26	18,100	1	26	18,000	1	18167	6000
28	18,150	1	28	18,900	1	28	19,000	1	18683	6000
30*	22,950	1	30*	25,400	1	30*	22,300	1	23550	6000
32*	23,400	1	32*	24,600	1	32*	23,650	1	23883	6000
34*	21,500	1	34*	22,600	1	34*	19,600	1	21233	6000
36*	19,900	1	36*	22,500	1	36*	23,400	1	21933	6000

*Test specimen contained horizontal ties welded to each face @ the vertical midpoint of the pier

Remarks:

1. Test taken to maximum load capacity of pier
2. Maximum Load Rating = 6000 pounds per pier

Technicon Engineering Services, Inc.

Project: Compression Load Testing of Steel Piers
Central Piers, Inc.

TES No. 150301.001
Invoice No. 5368

Perimeter Pier Load Testing

Test Date:	4/20/2015
Test Type:	Vertical
Dead Load:	N/a

Pier Size (inches)	Test #1		Test #2		Test #3		Average Load (Lbs)	Load Rating
	Load (Pounds)	Remarks	Pier Size (inches)	Load (Pounds)	Pier Size (inches)	Load (Pounds)		
6	18,450	1	6	19,600	6	19,350	1	3000
8	18,400	1	8	19,400	8	18,500	1	3000
10	16,500	1	10	16,500	10	18,400	1	3000
12	12,300	1	12	13,300	12	14,400	1	3000
14	13,600	1	14	12,400	14	12,300	1	3000
16	12,400	1	16	13,300	16	13,350	1	3000
18	11,200	1	18	10,100	18	11,200	1	3000
20	9,700	1	20	11,400	20	10,500	1	3000
22	12,800	1	22	12,200	22	11,200	1	3000
24	14,300	1	24	12,400	24	11,100	1	3000
26	10,400	1	26	11,800	26	11,300	1	3000
28	10,100	1	28	9,800	28	10,900	1	3000
30	11,800	1	30	10,100	30	10,100	1	3000
32*	11,100	1	32*	11,400	32*	11,300	1	3000
34*	10,100	1	34*	10,600	34*	12,100	1	3000
36*	10,400	1	36*	11,400	36*	10,150	1	3000

*Test specimen contained horizontal ties welded to each face @ the vertical midpoint of the pier

Remarks:

1. Test taken to maximum load capacity of pier
2. Maximum Load Rating = 3000 pounds per pier

B 10 SUPERSTRUCTURE

B 1010 LATERAL SYSTEM

A. SYSTEM DESCRIPTION

1. The lateral system of the house consists of structurally insulated panels (SIP) for the roof diaphragm and exterior shear walls.

B. FUNCTIONAL REQUIREMENTS

1. The SIP roof system distributes in-plane lateral forces to the exterior shear walls. These shear walls are also constructed with a SIP system that will provide the required lateral resistance of the home. Seismic piers are located under the shear wall panels to distribute the lateral forces to the ground.

C. COMPONENTS

1. Eco-Panel Structurally Insulated Panel system. Refer to sections B 1030 and B 1040 for roof construction and wall construction, respectively.

B 1020 FLOOR CONSTRUCTION

A. SYSTEM DESCRIPTION

1. The floor system is composed of structural wood I-joists (TJI), plywood sheathing, and mineral wool batt insulation. See structural drawings for additional details.

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Refer to Manufacturer's Product Data sheets provided at the end of this section where indicated.
3. TJI Engineered Wood Joists
 - a. See product specifications in Structural Calculations Set, Appendix G and J.
4. Plywood Subfloor
 - a. The subfloor construction shall be made of $\frac{3}{4}$ " APA rated plywood rated to span 24" O.C. joists.

5. Mineral Wool Insulation
 - a. 7.25" of mineral wool insulation between the joists. See attached manufacturer product data sheet CSI# 07 21 16.

B 1030

ROOF CONSTRUCTION

A. SYSTEM DESCRIPTION

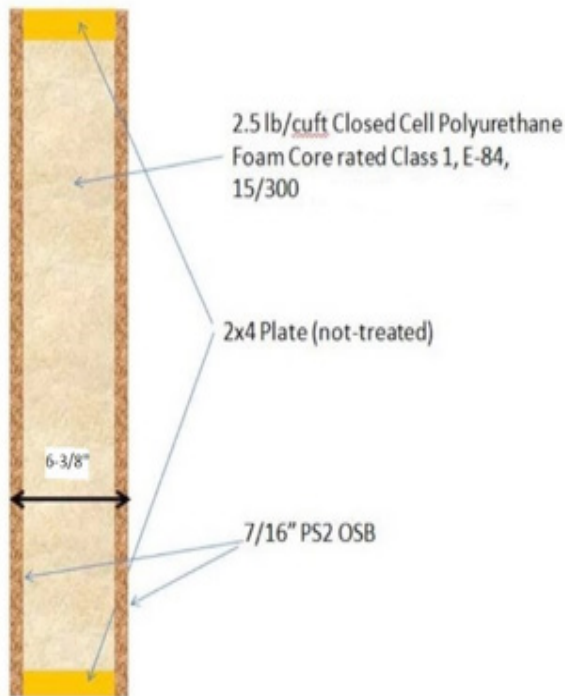
1. Structural timber roof framing system that provides the support for the SIP panels.

B. FUNCTIONAL REQUIREMENTS

1. Provide roof construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. Thermal Performance:
 - a. SIP Panels: R-Value of R-40 (ft²-F-h/Btu)
 - b. Mineral Wool Batt Insulation: 5.5" R-23 (ft²-F-h/Btu)

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Refer to manufacturer's product data sheets provided at the end of this section where indicated.
3. PSL Engineered Timber Beams
 - a. See product specifications in Structural Calculations Set, Appendix E and I.
4. Dimensional Wood Columns
5. Ceiling Cavity:
 - a. All ceilings will have a 5 ½" minimum clear space from the bottom of the finish ceiling to the bottom of the roof SIP panels. To be provided by ceiling framing members in accordance with IRC requirements. Framing cavity to be filled with Mineral Wool batt insulation.
5. SIP Panels
 - a. 6-3/8" SIP panels provided by Eco-Panels. Assembly construction indicated in image below:



- b. See attached SIP Code approval documents following this section. This system is being submitted under IRC Section 104.11 as an alternate building material for roof construction.

B 1040 WALL CONSTRUCTION

A. SYSTEM DESCRIPTION

- 1. Bearing walls constructed from structurally insulated panel system supporting the roof framing.

B. FUNCTIONAL REQUIREMENTS

- 1. Provide wall construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
- 2. SIP system provides structural support of the roof gravity system and select shear wall panels to participate in the lateral force resisting system of the house.

C. COMPONENTS

- 1. SIP panels
 - a. 6-3/8" SIP panels provided by Eco-Panels, R-value of R-40 (ft²-F-h/Btu)

General Product Information:

ROXUL[®] products are mineral wool fibre insulations made from basalt rock and slag. This combination results in a non-combustible product with a melting point of approximately 2150°F (1177°C), which gives it excellent fire resistance properties. ROXUL mineral wool is a water repellent yet vapour permeable material.

Description & Common Applications:

ROXUL AFB[®] (Acoustical Fire Batt) is a batt insulation product designed specifically for application in wall/floor systems where acoustical performance and fire resistance are the primary concerns. This noncombustible lightweight product has excellent acoustical dampening properties and is dimensionally stable which makes it ideal for friction fit into wall partitions and system applications from party walls to plant/manufacturing walls. The product is chemically inert which means that it will not promote corrosion. The AFB product comes in a number of thicknesses to meet the requirements of both retrofit and new construction applications.

Compliance and Performance:

CAN/ULC-S702-09	Mineral Fibre Thermal Insulation for Buildings	Type 1, Complies
ASTM C 665	Mineral-Fiber Blanket Thermal Insulation	Type 1, Complies
ASTM C 553	Mineral Fiber Blanket Thermal Insulation	Complies
MEA Approval	New York City Approval	338-97-M
City Of Los Angeles approval		RR 25444
ULC Design Nos.	U311, W406, W408, W419, W423, W440, W441, W442, W508, W600, Z500	
UL Design Nos.	U305, U311, U317, U411, U412, U448, U465, V417, V418, V419	

Fire Performance:

CAN/ULC-S114	Test for Non-Combustibility	Non-Combustible
ASTM E 136	Behaviour of Materials at 750°C (1382°F)	Non-Combustible
CAN/ULC-S102	Surface Burning Characteristics	Flame Spread = 0
		Smoke Developed = 0
ASTM E 84 (UL 723)	Surface Burning Characteristics	Flame Spread = 0
		Smoke Developed = 0
CAN/ULC-S129	Smoulder Resistance	0.09%

Acoustical Performance:

ASTM E 90	Airborne Sound Transmission Loss	Tested
ASTM E 413	Rating Sound Insulation	Tested
ASTM C 423	Sound Absorption Coefficients	Tested
ASTM E 1050	Impedance and Absorption of Acoustical Materials (Please contact ROXUL for Rated Wall System Designs)	Tested

Air Erosion:

UL 181	Maximum Air Velocity	1000 fpm (5.08 m/s)
--------	----------------------	---------------------

Corrosive Resistance:

ASTM C 665	Corrosiveness to Steel	Pass
ASTM C 795 ****	Stainless Steel Stress Corrosion Specification as per Test Methods C871 and C692: U.S. Nuclear Regulatory Commission, Reg. Guide #1.36: U.S. Military Specifications MIL-I-24244 (all versions including B and C)	Conforms

*MASTER FORMAT 1995 EDITION **MASTER FORMAT 2004 EDITION
*** at the time of manufacturing

ROXUL AFB

Acoustical Performance:

ASTM C 423 CO-EFFICIENTS AT FREQUENCIES							
Thickness	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
1.0"	0.14	0.25	0.65	0.90	1.01	1.01	0.70
1.5"	0.18	0.44	0.94	1.04	1.02	1.03	0.85
2.0"	0.28	0.60	1.09	1.09	1.05	1.07	0.95
3.0"	0.52	0.96	1.18	1.07	1.05	1.05	1.05
4.0"	0.86	1.11	1.20	1.07	1.08	1.07	1.10

Density:

2.8 lb/ft³ 45 kg/m³

Dimensions:

16.25" (width) x 48" (length)
413 mm (width) x 1219 mm (length)

24.25" (width) x 48" (length)
616 mm (width) x 1219 mm (length)

Thickness:

Product thickness is available in 1" to 3.5" with 1/2" increments as well as 4", 5" and 6" offerings.

For additional sizes, please contact ROXUL by phone at 1-800-265-6878.

Key Application Qualifiers:

- Easily cut
- Non-combustible
- Excellent sound absorbency
- Chemically inert
- Does not rot or sustain vermin
- Does not promote growth of fungi or mildew
- Low moisture sorption
- Water resistant
- CFC and HCFC free product and process
- Made from natural & recycled materials

Other ROXUL Products:

Please consult ROXUL for all your insulation needs. We have an extensive range of products for all applications from pipe insulation to commercial products to residential batts. ROXUL invites all inquiries and will act promptly to service all of your requirements.



**** "Provisions for lot testing may be required, consult manufacturer."

Note:

As ROXUL Inc. has no control over installation design and workmanship, accessory materials or application conditions, ROXUL Inc. does not warranty the performance or results of any installation containing ROXUL Inc's. products. ROXUL Inc's. overall liability and the remedies available are limited by the general terms and conditions of sale. This warranty is in lieu of all other warranties and conditions expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

ROXUL INC.
www.roxul.com

Milton, Ontario Tel: 905-878-8474
Tel: 1-800-265-6878

Fax: 905-878-8077
Fax: 1-800-991-0110

Revised: July 06, 2013
Supersedes: August 2, 2011

To: Solar Decathlon Code Official
Northwestern University Team
SIP Panel Approval Packet
2/23/2017

The following information is being submitted to gain approval of Eco-Panels SIP panels for roof applications, as an alternate building material under IRC 2015 Section 104.11.

Included are the following documents:

1. Durability Letter from Eco-Panels
2. Product Change Letter specifying Exact Foam Used
3. Technical Data summary on SIP Foam characteristics
4. ASTM E-84 Test report for 6" of PU Foam
5. ASTM C-518 Procedure Affirmation for Thermal Properties Testing
6. Updated Transverse Testing Report
7. Historical ASTM E72-98 test results for transverse, racking, and compression.
 - a. While these tests are for the 4.5" panels, we plan to use 6.5" (actual 6-3/8") panels. The difference between the two is the addition of 2" of additional insulating foam in the center, and a slightly different foam formulation; all other components remain the same. These are provided for historical reference. Updated racking and compression tests will be performed in the near future as part of the current battery of tests.

In addition to the documentation provided, we will require Eco-Panels to provide shop drawings stamped by a registered structural engineer once the drawings are complete. We will provide this final stamped submission to the DOE organizers and the City of Evanston once available. Eco-Panels' engineer will design and stamp all SIP walls, roof panels, columns within the SIP panels, and connections.

We have had parallel discussions with the City of Evanston regarding approval of this SIP product. Upon providing them the updated transverse reports, they also will approve our product for use.



February 10, 2017

Attn: William Bach
Project Manager
House by Northwestern | A U.S. D.O.E. Solar Decathlon 2017 team
Northwestern University

RE: Structural Failure Statement

Eco-Panels LLC, operating as a manufacturer of structural insulated panels since 2007, has never experienced a structural failure for any of its panels – whether wall, roof or floor panel, - in the history of our company.

If you have any questions or concerns regarding this correspondence, please do not hesitate to reach out to us.

Regards,

Charles H. Leahy
President, Eco-Panels LLC

www.eco-panels.com
info@eco-panels.com

263 Industrial Blvd.
Mocksville, NC 27028

336-936-0148
828-713-2357



PO Box 1528 • Mount Airy, NC 27030-1528
336-789-9161 • Fax: 336-719-0072 • www.NCFI.com

Dalton, GA

Hickory, NC

Mount Airy, NC

Salt Lake City, UT

December 8, 2016

Mr. Charles Leahy
Eco-Panels
265 Industrial Blvd.
Mocksville, NC 27028

Dear Charles,

NCFI Polyurethanes developed the product 23-015 for you because you needed a product that was able to pass the ASTM E-84 burn test when the foam panel thickness was 6-inches. Our previous product 23-002 was not able to meet that requirement. NCFI 23-002 certainly fulfilled product requirements when the typical panel in production was only 4-inches thick, but when the demand for higher insulation values created the need for a 6-inch panel, we needed to adjust the capability of the product.

The remaining physical properties of the foam beyond the flammability requirements were comparable as well. Whether we consider strength properties or dimensional stability or insulation values, the 23-015 product performs to the same quality as found in the original 23-002 product.

If there is need for further elaboration, please feel free to let us know how we may be of service.

Sincerely,

A handwritten signature in black ink that reads 'Richard Stoehr'.

Richard Stoehr
Director of R&D, Specialty Products Division
NCFI Polyurethanes

Technical Data

Foam Characteristics

Compressive Strength	ASTM D-1624-00	35 psi
Compressive Modulus	ASTM D-1624-00	790 psi
Density	ASTM D-1622-98	2.4-2.5 pcf
Dimensional Stability	ASTM D-2126-99	Excellent
Flammability – Smoke Generation	ASTM E-84-01	<400
Flammability – Flame Spread	ASTM E-84-01	<25
Foam Core Fire Rating	*** Integrity	Class 1
Linear Coefficient of Thermal Expansion	ASTM D696-98	-40°F to +240°F
Closed Cell Content by Air Pycnometer	ASTM D-2856-87	>96%
Shear Strength	ASTM C-273-61 (1988)	28 psi
Shear Modulus	ASTM C-273-61 (1988)	325 psi
Resistance to Solvent	ASTM D-543-95 (2001)	Excellent
Resistance to Mold/Mildew	ASTM D-543-95 (2001)	Excellent
Thermal Conductivity	ASTM C-518-91	K Factor 0.14 (BTU-in/ft ² hr°F)
Thermal Conductivity (aged @ temp)	ASTM C-518-91	R value 7 per inch @ 55°F
Tensile Strength	ASTM D-1623-78 (1995)	58 psi
Tensile Modulus	ASTM D-1623-78 (1995)	325 psi
Water Absorption	ASTM D-2842-01	2.4%
Vapor Permeability	ASTM D-2842-01	2 perm/in

*** Polyurethane foam is a “thermo-set” plastic. Melting does NOT occur.

January 31, 2017

Charles Leahy
Eco-Panels
265 Industrial Blvd.
Mocksville, NC 27028

Dear Charles:

This letter is to inform you that all thermal conductivity testing performed by NCFI Polyurethanes and reported on our technical data sheets is performed in accordance to ASTM C518 (Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus). NCFI uses a temperature differential of 50 degrees, with 50°F on the upper plate and 100°F on the lower plate, for a mean temperature of 75°F.

Please contact me or your account manager for further inquiries.

Sincerely,



Steven T. Farmer
R&D Supervisor

12/19/2016

A Division of BMC, Inc.
NCFI since 1964
BARNHARDT MFG. CO. since 1900

February 21, 2017

Attn: William Bach
Project Manager
House by Northwestern | A U.S. D.O.E. Solar Decathlon 2017 team
Northwestern University

RE: Eco-Panels 6.5" Panel Testing – Transverse Loading

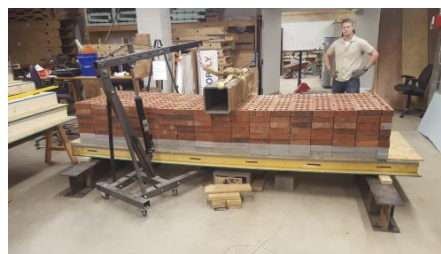
On February 20, 2017, Eco-Panels LLC, in cooperation with the Construction Management Department at Western Carolina University, and under the supervision of licensed Professional Engineer Dr. Robert Steffen, conducted transverse load testing of our 6.5" structural insulated panel having a 10' span (total panel length was 12'). This testing would simulate either roof loading (as with a snow load) or wind loading if the panel was used as a wall panel. While a much larger report is in the process of being written up by the academic team at Western Carolina University, this letter is meant to convey a summary of the results for the Solar Decathlon team at Northwestern University to share with interested parties.

SUMMARY RESULTS: A 6.5" thick panel was laid across a 10' open span and was monitored with sensitive measuring equipment to measure the panel deflection as successive weight loads were placed evenly across the entire top of the panel. After each layer of weight was placed, at least 2 minutes and often longer was allowed to elapse to observe possible subsequent deflection. No subsequent deflection was ever observed after initial loading deflection with each level, and the deflection seen after each course was very consistent with the weight load applied. After an ultimate loading of more than 5,500 lbs, the panel could not be made to fail, and in fact **after unloading returned to original starting origin.**

This picture shows a loading of eight levels of bricks, having a total weight of 4,896 lbs, or 163 psf, with a total deflection at the center of approximately 1".



Later, a large steel tube weighing 289 lbs was placed across the center, and then still later two grown persons of total weight 342 lbs stood in the center of the panel adjacent to the large steel tube – still no failure could be induced and no cracking sound was heard, and after removal panel returned to original planar position.



I have copied Dr. Robert Steffen on this document and he can also attest to these summary results and can answer any further questions you may have.

Regards,

Charles H. Leahy
President, Eco-Panels LLC

www.eco-panels.com
info@eco-panels.com

263 Industrial Blvd.
Mocksville, NC 27028

336-936-0148
828-713-2357

PART II – COMPRESSIVE LOADING

Test Procedure

A uniform loading method as described in Section 9.3.1 of ASTM E 72-98 (see Figure II-1) was used to conduct compression loading tests. A hydraulic load cell was used to load a longitudinal steel beam placed at the top of each panel. The loading piston was centered on a line parallel to the panel skins and at one-third the panel thickness from the inside face. Each panel was preloaded by the weight of the top beam 74.6 lbs. Each panel was evaluated for one test, until panel failure occurred.

Four displacement transducers (DT's) were used to measure panel shortening. Wire cables were supported by brackets attached near the top and bottom corners of each panel, and the transducer cable was attached to the wire cables. The transducer gage length as 88" for the 8' panels. Two additional displacement transducers were used to measure lateral deflections at mid-height of the two longitudinal panel edges (in lieu of the deflectometer and mirror indicated in Figure No. II-1). These transducers were unattached to opposite faces of each panel. (See attached Figure No. II-1 and Photo No. II-1 for the test setup).

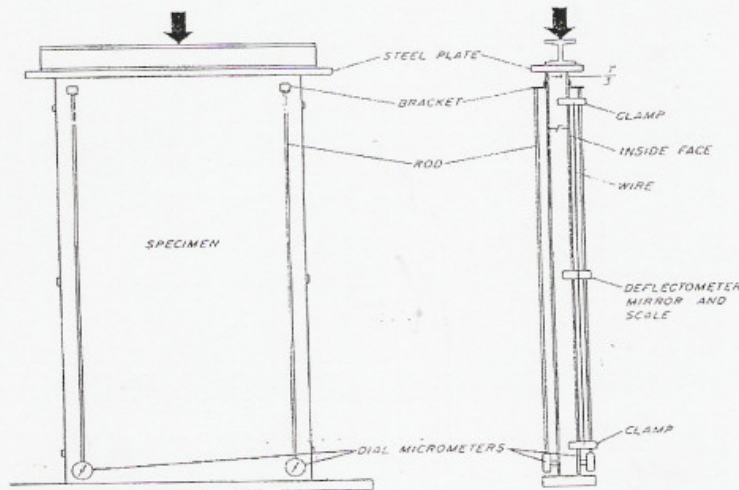


Figure No. II-1: Test Setup for Compressive (Axial) Loading (from "ASTM E72-98, Fig. 2")

Transverse load testing was performed on the following panels:

Panel Skins	Skin Orientation	Panel Size	No. of Samples	Sample Designations
OSB-OSB	OSB both faces	4' x 8'	3	OO1A, OO2A, OO3A
GGG-GGS	GGG both faces	4' x 8'	3	GG1A, GG2A, GG3A

Test Results for 8' OSB and 8' Galvanized Steel Panels

Test results for 8' panels are presented as described below:

OSB-OSB Tables No. II-1, II-3, and II-5 Figures No. II-2, II-3, II-4, II-5
 GGS-GGS Tables No. II-2, II-4, and II-5 Figures No. II-6, II-7, II-8, II-9

The results include individual panel results indicated above as well as “average” results in Table No. II-5 and Figures No. II-3, II-5, II-7, and II-9. Maximum load and displacement values and descriptions of panels and failure modes are provided in Tables No. II-3 and II-4.

Table No. II-1: Results for Compressive Load vs. Deflections for Individual 8' OSB-OSB Panels

Panel OO1A 8'-0"			Panel OO2A 8'-0"			Panel OO3A 8'-0"		
Compr. Load (lbs)	Vert. Displ. Ends (in.)	Lat. Displ. Mid-Ht. (in.)	Compr. Load (lbs)	Vert. Displ. Ends (in.)	Lat. Displ. Mid-Ht. (in.)	Compr. Load (lbs)	Vert. Displ. Ends (in.)	Lat. Displ. Mid-Ht. (in.)
8	0.0000	-0.0003	2	0.0002	-0.0003	18	0.0438	0.0000
1142	0.0021	-0.0015	675	0.0009	-0.0033	600	0.0450	0.0005
2797	0.0062	-0.0169	1676	0.0042	-0.0133	1594	0.0468	-0.0086
3985	0.0091	-0.0259	3021	0.0083	-0.0247	3492	0.0517	-0.0179
6324	0.0167	-0.0417	4701	0.0141	-0.0340	3760	0.0531	-0.0187
9372	0.0254	-0.0426	7613	0.0233	-0.0332	3949	0.0545	-0.0190
10073	0.0281	-0.0415	10968	0.0334	-0.0325	4746	0.0569	-0.0228
11297	0.0321	-0.0416	14877	0.0455	-0.0295	5825	0.0599	-0.0269
14080	0.0406	-0.0396	18214	0.0549	-0.0246	7582	0.0631	-0.0333
16998	0.0497	-0.0370	21214	0.0638	-0.0179	9566	0.0723	-0.0341
21420	0.0633	-0.0343	24287	0.0726	-0.0104	12262	0.0817	-0.0381
25662	0.0761	-0.0276	27512	0.0824	-0.0008	15115	0.0898	-0.0341
29994	0.0897	-0.0171	30827	0.0910	0.0109	18427	0.1012	-0.0301
34315	0.1045	-0.0068	34220	0.1020	0.0262	22020	0.0858	-0.0223
38470	0.1176	0.0093	37685	0.1151	0.0431	25920	0.0923	-0.0119
42330	0.1271	0.0226	41077	0.1279	0.0634	29749	0.1041	0.0020
46063	0.1399	0.0446	44412	0.1395	0.0902	33597	0.1227	0.0244
49525	0.1577	0.0709	47572	0.1529	0.1202	37547	0.1387	0.0508
52446	0.1788	0.1097	50421	0.1681	0.1563	41709	0.1605	0.0879
53891	0.2040	0.1623	52977	0.2030	0.2388	45004	0.2051	0.1291
53237	0.2171	0.1962	52743	0.2086	0.2585	44745	0.2024	0.1311

Note: Compressive load does not include the weight of the load beam or the panels

Table No. II-2: Results for Compressive Load vs. Deflections for Individual 8' GGS-GGS Panels

Panel GG1A 8'-0"		
Compr. Load (lbs)	Vert. Displ. Ends (in.)	Lat. Displ. Mid-Ht. (in.)
1	0.0002	0.0019
3	0.0001	-0.0017
37	0.0004	-0.0005
40	0.0004	0.0004
108	0.0004	0.0005
272	0.0008	0.0012
645	0.0010	0.0029
1696	0.0019	0.0029
3425	0.0038	0.0124
6101	0.0071	0.0300
7237	0.0079	0.0327
7400	0.0079	0.0332
7589	0.0078	0.0342
7782	0.0081	0.0347
7946	0.0092	0.0427
8568	0.0098	0.0442
9376	0.1530	0.0598
7140	0.0738	0.1319
7752	0.1034	0.1632
7608	0.1631	0.2054
5266	0.2941	0.4117

Panel GG2A 8'-0"		
Compr. Load (lbs)	Vert. Displ. Ends (in.)	Lat. Displ. Mid-Ht. (in.)
0	0.0000	0.0003
38	0.0002	-0.0007
631	-0.0006	-0.0003
2302	-0.0023	0.0030
3819	-0.0033	0.0089
5698	-0.0053	0.0148
7198	-0.0045	0.0210
7537	-0.0011	0.0242
7646	0.0024	0.0256
7782	0.0020	0.0260
8681	0.0033	0.0265
9444	0.0051	0.0294
10152	0.0046	0.0315
11047	0.0102	0.0346
11942	0.0155	0.0359
12769	0.0272	0.0322
13380	0.0431	0.0280
12595	0.0726	0.0227
11496	0.1581	0.0099
10285	0.2097	0.0075
10215	0.2114	0.0091

Panel GG3A 8'-0"		
Compr. Load (lbs)	Vert. Displ. Ends (in.)	Lat. Displ. Mid-Ht. (in.)
3	-0.0001	-0.0001
1427	-0.0025	0.0008
2375	-0.0059	-0.0002
3196	-0.0074	0.0047
3309	-0.0076	0.0048
3441	-0.0075	0.0058
4427	-0.0082	0.0082
5552	-0.0085	0.0102
6846	-0.0093	0.0131
7396	-0.0089	0.0131
7646	-0.0090	0.0137
8168	-0.0089	0.0130
9238	-0.0063	0.0126
9979	0.0017	0.0063
9815	0.0365	0.0054
10929	0.0502	0.0052
12662	0.0626	0.0090
14511	0.0757	0.0106
16346	0.0849	0.0108
17343	0.0904	0.0074
16589	0.0732	-0.0066

Note: Compressive load does not include the weight of the load beam or the panels

TABLE No. II-3: COMPRESSION TEST RESULTS FOR 8' OSB-OSB PANELS
 (does not include the weight of the load beam or the self-weight of the panels)

SAMPLE NO.	PANEL SIZE	GAUGE LN (IN.)	MAX LD. (LBS.)	DEFL. AT MAX. LOAD.		FAILURE CHARACTERISTICS
				VERT (IN.)	HORZ (IN.)	
OO1A	48" x 96"	88	53891	0.2040	0.1623	Panels failed by some combination of OSB buckling, galvanized steel spine buckling, and/or foam crushing near top of panel.
OO2A	48" x 96"	88	52977	0.2030	0.2388	
OO3A	48" x 96"	88	45004	0.2051	0.1291	
AVERAGE			50624	0.2040	0.1767	Load Beam Wt. = 119.8 lbs. Avg. Panel Wt. = 135.1 lbs. (range = 134.5 to 135.7 lbs.)

TABLE No. II-4: COMPRESSION TEST RESULTS FOR 8' GGS-GGS PANELS
 (does not include the weight of the load beam or the self-weight of the panels)

SAMPLE NO.	PANEL SIZE	GAUGE LN (IN.)	MAX LD. (LBS.)	DEFL. AT MAX. LOAD.		FAILURE CHARACTERISTICS
				VERT (IN.)	HORZ (IN.)	
GG1A	48" x 96"	88	9376	0.1530	0.0598	Panels failed by some combination of FCB buckling, OSB cracking, skins pulling away from foam, galvanized steel spine buckling, and/or foam crushing near top of panel.
GG2A	48" x 96"	88	13380	0.0431	0.0280	
GG3A	48" x 96"	88	17343	0.0904	0.0074	
AVERAGE			13366	0.0956	0.0317	Load Beam Wt. = 119.8 lbs. Avg. Panel Wt. = 114.8 lbs. (range = 114.5 to 115.1 lbs.)

Table No. II-5: Average Results for Compressive Load vs. Deflections for 8' Panel

8' OSB-OSB Panels OO1A, OO2A, OO3A			8' GGS-GGS Panels GG1A, GG2A, GG3A		
Avg. Compr. Load (lbs.)	Avg Vert. Displ. Ends (in.)	Avg. Lat. Displ. Mid-Ht. (in.)	Avg. Compr. Load (lbs.)	Avg Vert. Displ. Ends (in.)	Avg. Lat. Displ. Mid-Ht. (in.)
10	0.0146	-0.0002	1	0.0000	0.0007
806	0.0160	-0.0014	489	-0.0007	-0.0005
2022	0.0191	-0.0129	1014	-0.0021	-0.0004
3499	0.0230	-0.0228	1846	-0.0031	0.0027
4928	0.0280	-0.0314	2412	-0.0035	0.0047
6978	0.0344	-0.0316	3137	-0.0040	0.0072
8596	0.0395	-0.0323	4090	-0.0039	0.0107
10666	0.0458	-0.0327	4928	-0.0026	0.0125
13292	0.0529	-0.0325	5972	-0.0010	0.0170
15926	0.0619	-0.0297	7093	0.0000	0.0230
19323	0.0725	-0.0276	7855	0.0007	0.0243
22763	0.0828	-0.0208	8337	0.0013	0.0252
26416	0.0940	-0.0121	8993	0.0020	0.0261
30185	0.0974	-0.0010	9603	0.0067	0.0252
34025	0.1083	0.0135	9901	0.0204	0.0280
37718	0.1197	0.0293	10755	0.0290	0.0272
41358	0.1340	0.0531	11061	0.0598	0.0563
44881	0.1497	0.0806	11619	0.0839	0.0655
48192	0.1691	0.1180	11817	0.1354	0.0754
50242	0.2094	0.1952	10690	0.1929	0.1381

Note: Compressive load does not include the weight of the load beam or the panels

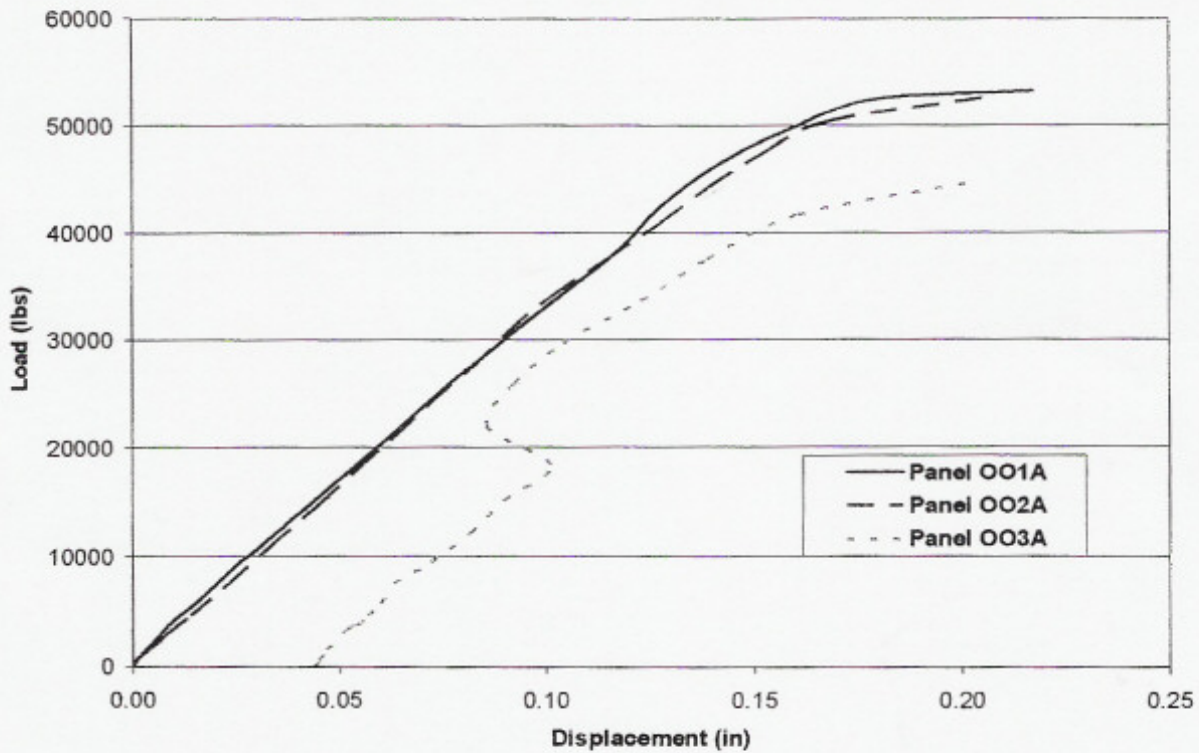


Figure No. II-2: Results for Compressive Load vs. End Deflection for 8' OSB-OSB Panels

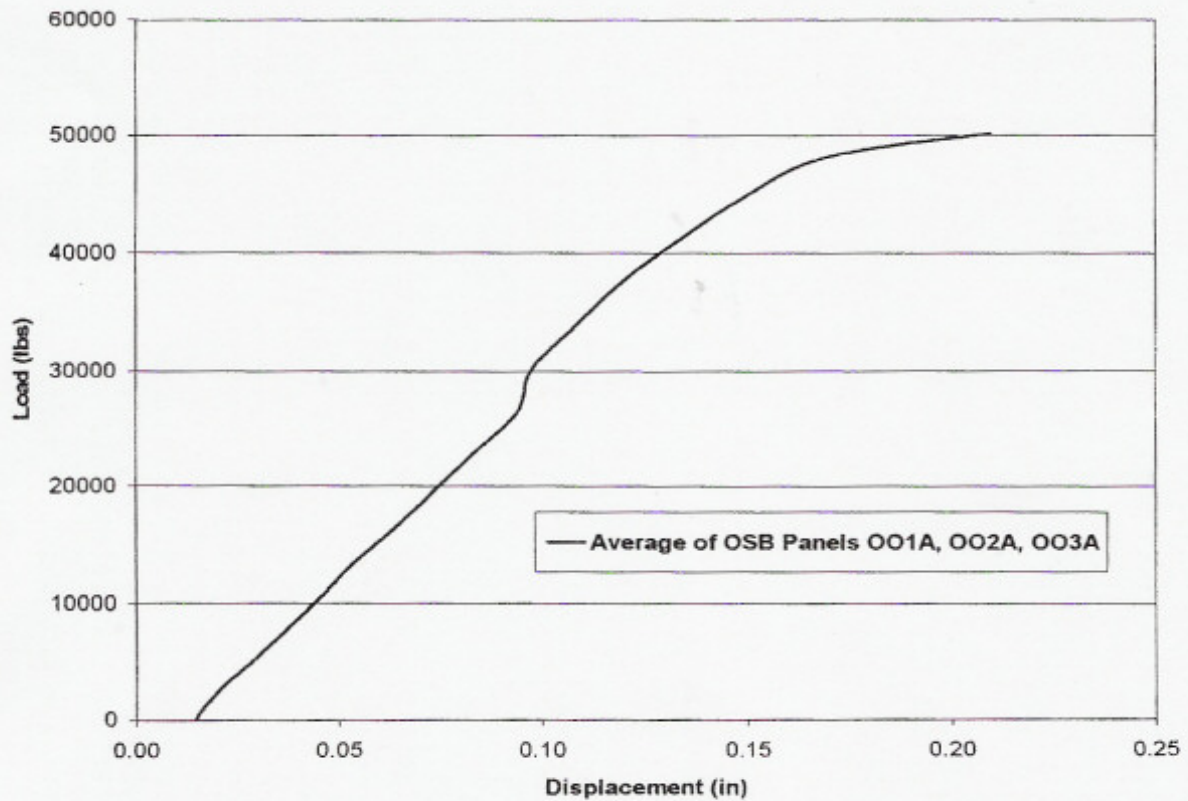


Figure No. II-3: Average Results for Compressive Load vs. End Deflection. 8' OSB-OSB Pan

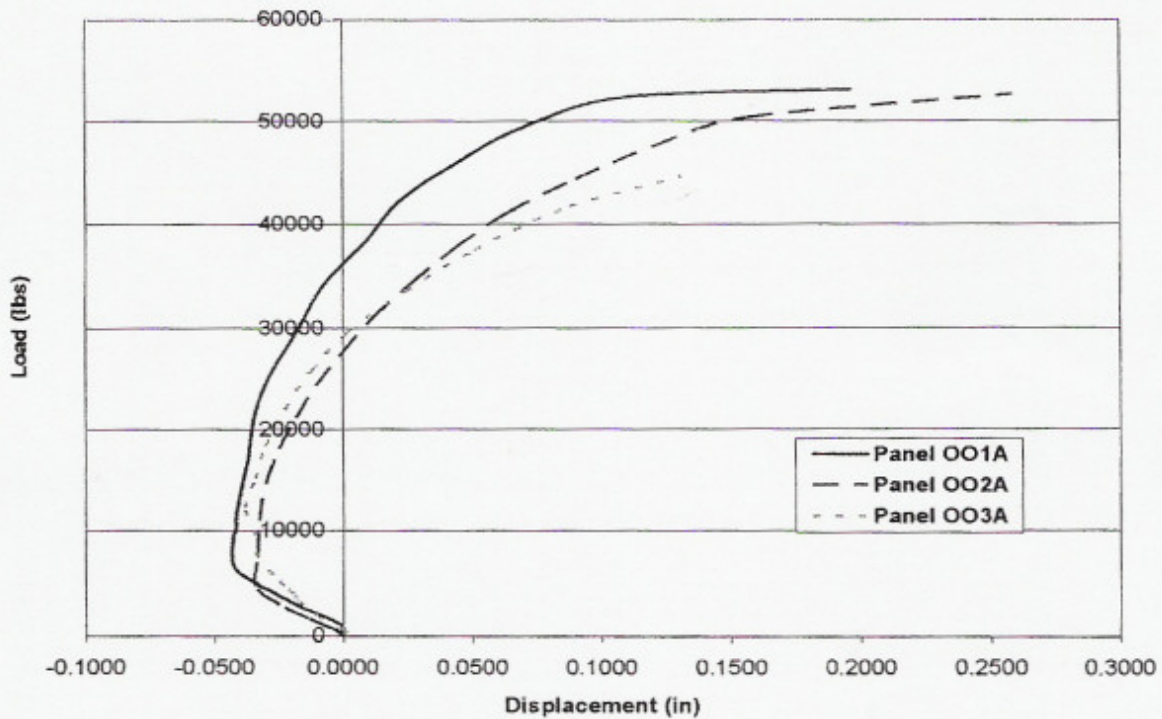


Figure No. II-4: Results for Compressive Load vs. Mid-Ht. Deflection for 8' OSB-OSB Panels

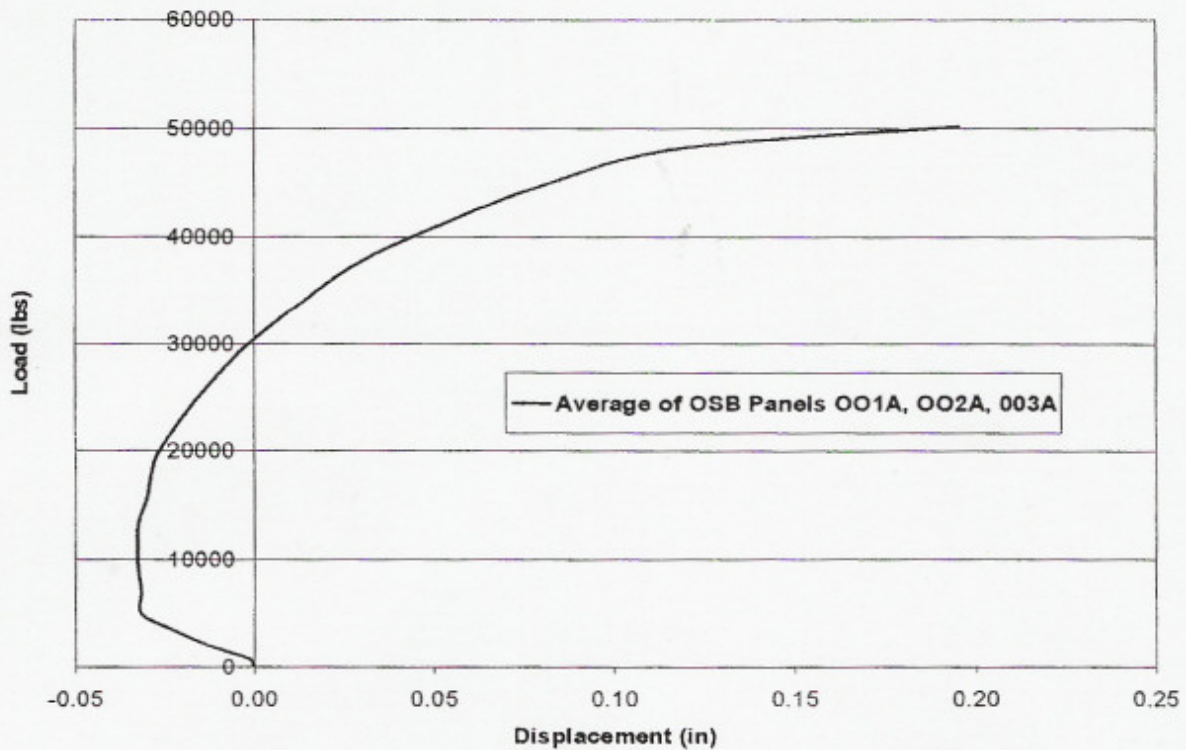


Figure No. II-5: Average Results, Compressive Load vs. Mid-Ht. Deflection, 8' OSB-OSB Panel

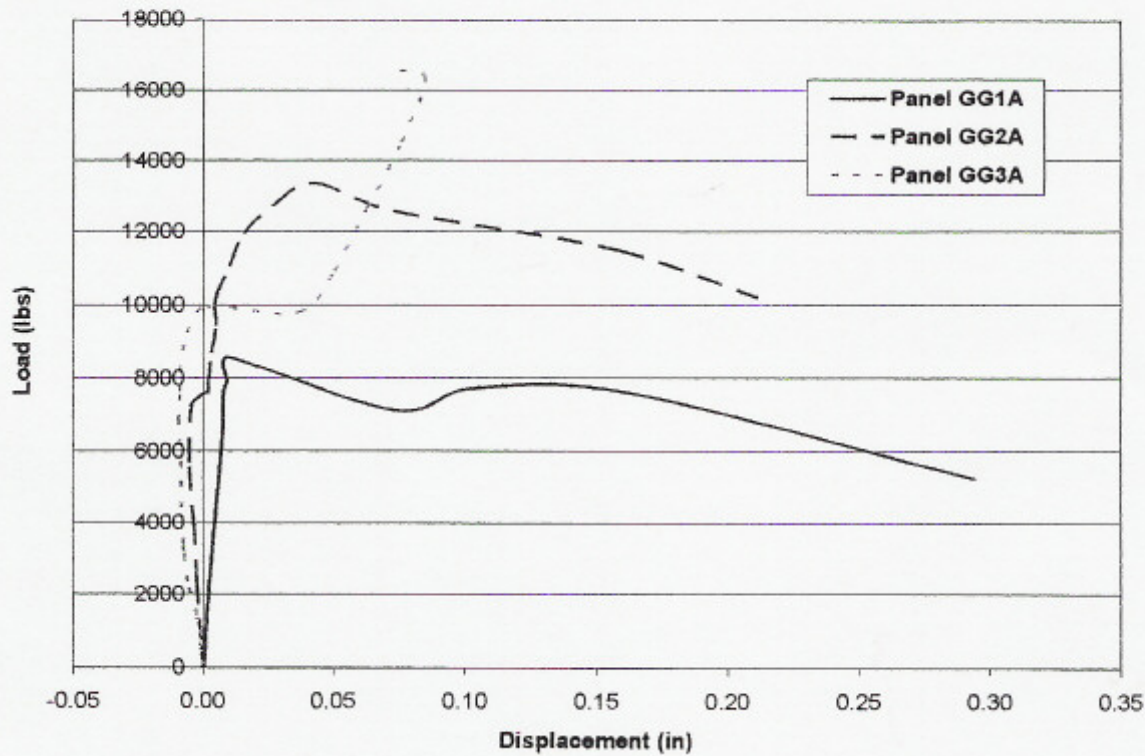


Figure No. II-6: Results for Compressive Load vs. End Deflection for 8' GGS-GGS Panels

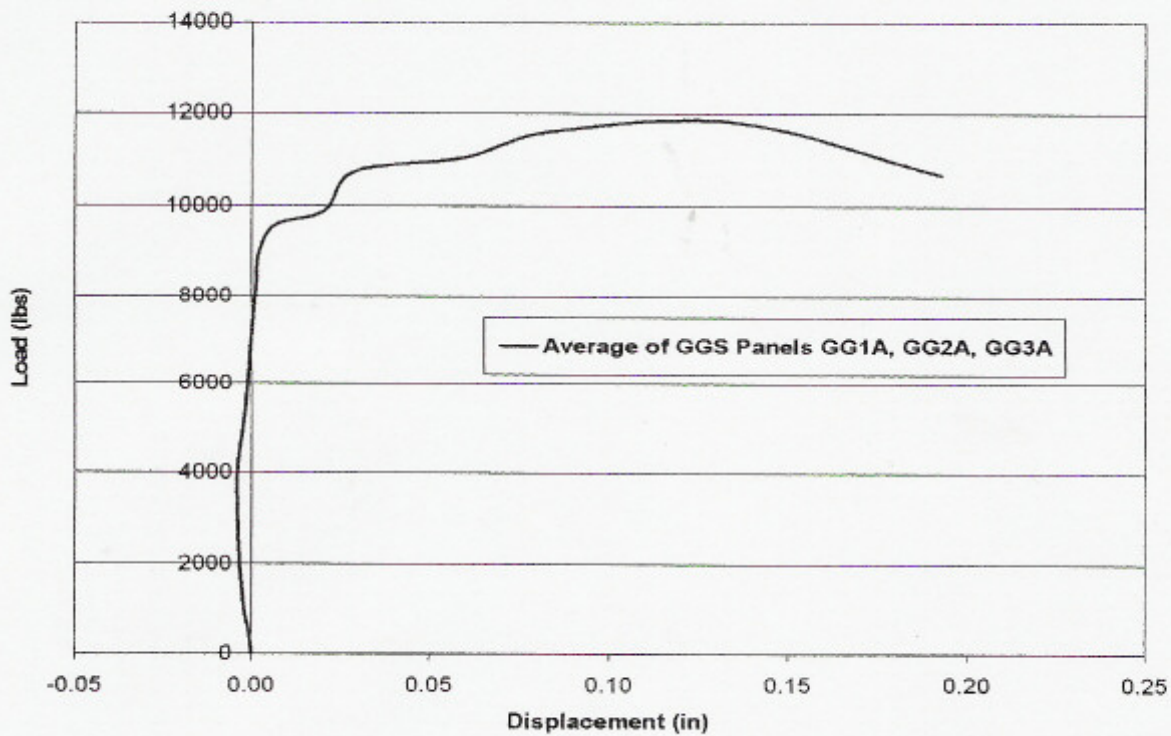


Figure No. II-7: Average Results for Compressive Load vs. End Deflection, 8' GGS-GGS Panels

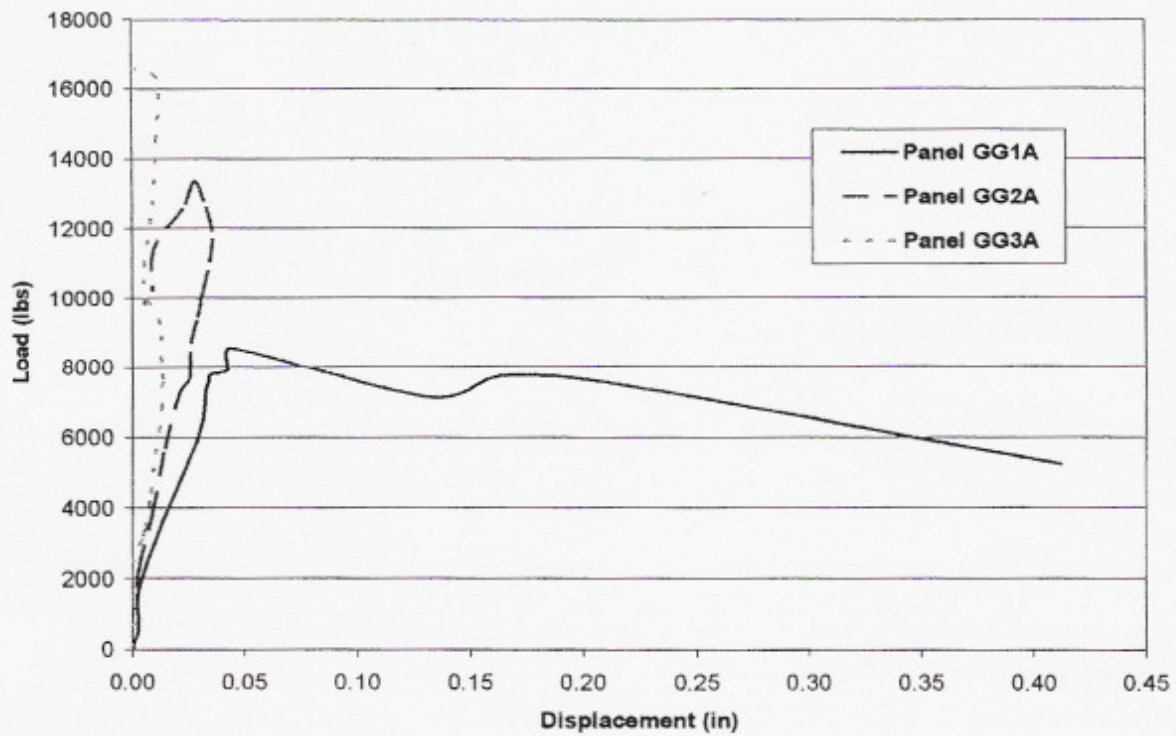


Figure No. II-8: Results for Compressive Load vs. Mid-Ht. Deflection for 8' GGS-GGS Panels\

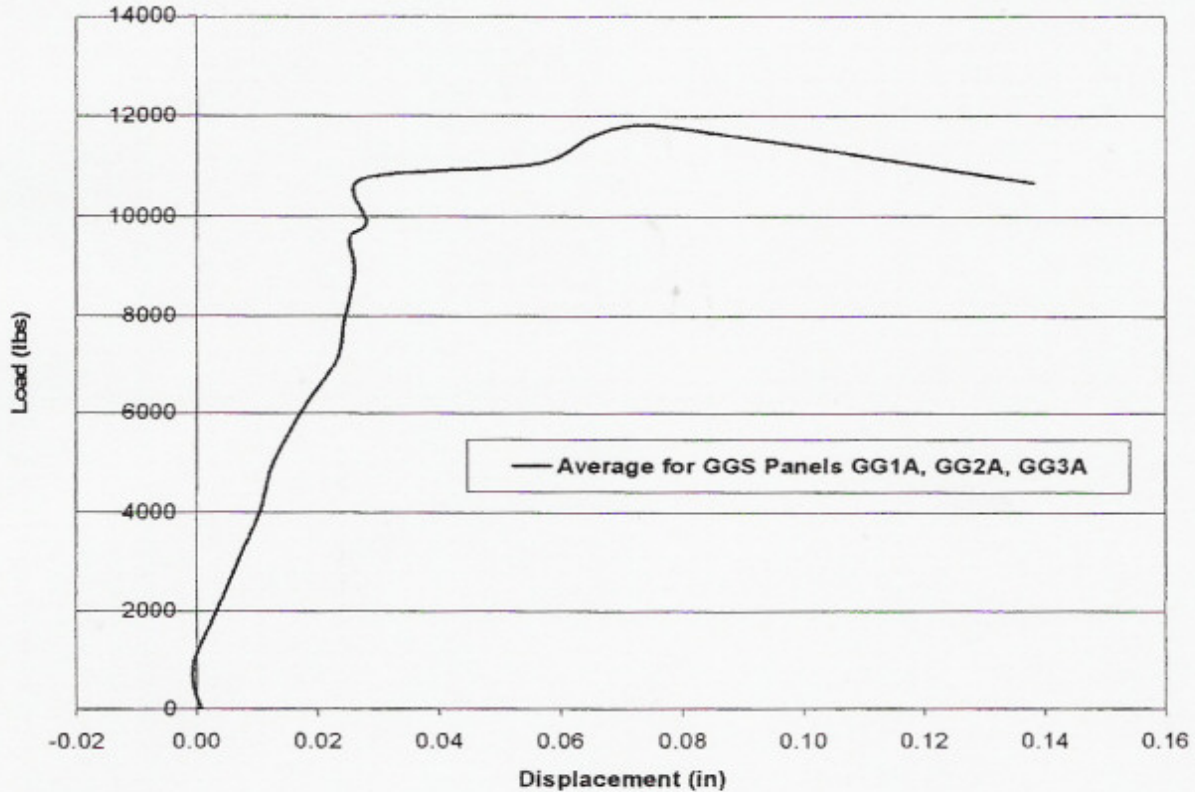


Figure No. II-9: Average Results, Compressive Load vs. Mid-Ht. Deflection, 8' GGS-GGS Panel

Discussion of Results

Representative results for individual panels and for averages for skin sets subjected to compressive loading are given in tables and figures referenced earlier. Of particular interest are the compressive "stiffness" values (load/vertical deflection). For example, for OSB-OSB panels #1A and #2A, stiffness values are in the vicinity of 300,000 lb./in., as shown in Table No. II-5. In Figure No. II-2, OSB-OSB panel #3A has a sudden change in the load-deflection curve around 20,000 lbs. that could be the result of the panel "seating" under load. Outside of this abnormal portion of the curve, the slope (stiffness) is similar to panels #1A and #2A.

GGS panels #2 and #3 exhibit zero or slightly negative vertical displacements under low loading. Thus, using only GGS panel #1A, stiffness can be calculated as shown in Table No. II-5 to be ~ 900,000 lb./in. or three times that of the OSB panels. This result is not surprising due to the stiffer steel skins on the GGS panels.

Ultimate compressive strains are in the range of 0.001 to 0.002 for these panels. Calculations for these strains are presented below based on the ultimate (failure) deflections given in Table Nos. II-3 and II-4 and gauge lengths of 88" for these 8' panels. Once again, the OSB panels are not as stiff as panels containing GGS skins, and, thus, they exhibit more strain.

Lateral "stiffness" values for these panels are more difficult to determine because of the load-deflection curves possess a high degree of non-linearity. However, selecting values at similar load points offers an indication of lateral stiffness. Stiffness terms calculated near the 6000 lb. load point are shown in Table No. II-6. The OSB-panels are once again weaker, this time in terms of lateral stiffness. These stiffness-type numbers represent the average load required to generate 1" of deflection and also represent the slopes of the load-deflection curves.

Table No. II-5: Average Compressive "Stiffness" and Strain Values for Panel Sets

Panel Type	Skin Orientation	Load, P (lbs.)	Vertical Defl., d (in)	"Stiffness" $k=P/d$ (lb/in)	Ultimate Normal Strain (in/in)
8' OSB-OSB	OSB both faces	26,587	0.0793	335,271	0.0023
8' GGS-GGS	GGS both faces	3425	0.0038	901,316	0.0011

Table No. II-6: Average Lateral "Stiffness" for Panel Sets

Panel Type	Skin Orientation	Load P (lbs.)	Lateral Defl. d(in)	"Stiffness" $k=P/d$ (lb/in)
8' OSB-OSB	OSB both faces	6978	0.0316	220,823
8' GGS-GGS	GGS both faces	7093	0.0230	308,391

Panel Type	Skin Orientation	Load, P _u (lbs.)
8' OSB-OSB	OSB both faces	50,624
8' GGS-GGS	GGS both faces	13,366

Although the panels having galvanized skins were stiffer than those having OSB skins, the OSB skin panels carried more load to failure. That is, more axial load was required to cause a certain amount of vertical and lateral deflection in the steel panels, but, even though they deflected more, the OSB panels carried more load before failing. For all panels, failure occurred most often because of crushing of the foam, buckling of the compression (“e” side) skin, pulling away of the skins from the foam, and/or buckling of the aluminum spline along the panel edge.

It is unclear why panel #GG1A produced a failure load significantly less than the other two galvanized steel panels. Nevertheless, until other GGS panels are tested in compression, the results of this panel must be included in the averaging of results.

Conclusions

Table No. II-8 below summarizes load, deflection, and strain results at calculated maximum allowable loads. Calculating the maximum axial load for each panel using a safety factor (failure load/allowable load) of 4.0, both the OSB panels and the GGS panels are able to safely carry typical axial loads resulting from roof gravity loads. For example, a 40’ wide, roof-trussed building carrying a total roof load of 30 psf would apply 600 plf axial load to the wall panels. This value is less than the calculated maximum allowable values of 3164 plf for OSB panels and 836 plf for GGS (galvanized steel) panels. Also, lateral deflections in the panels (due to the load eccentricity) of L/2945 for OSB panels and L/12200 for GGS panels at allowable loads are well within recommended deflection limits (L/360, for example).

Allowable Line Load, P _a (plf)	OSB-OSB Panels			GGS-GGS Panels		
	Vertical Deflection (in.) and [Strain] (in./in.)	Lateral Defl. (in.)	Lat. Defl. as L/xxx	Line Load (plf = P/4’)	Lateral Defl. (in.)	Lat. Defl. as L/xxx
3164	0.0512 [0.058%]	0.0326	L/2945	N/A	N/A	N/A
836	N/A	N/A	N/A	0.0040 [0.004%]	0.0079	L/12200
Average Loads (S.F. = 4.0)	Failure Load, P _f (plf)	Allowable Load, P _a = P _f /4 (plf)		Failure Load (plf)	Allowable Load (plf)	
	12,656	3164		3342	836	

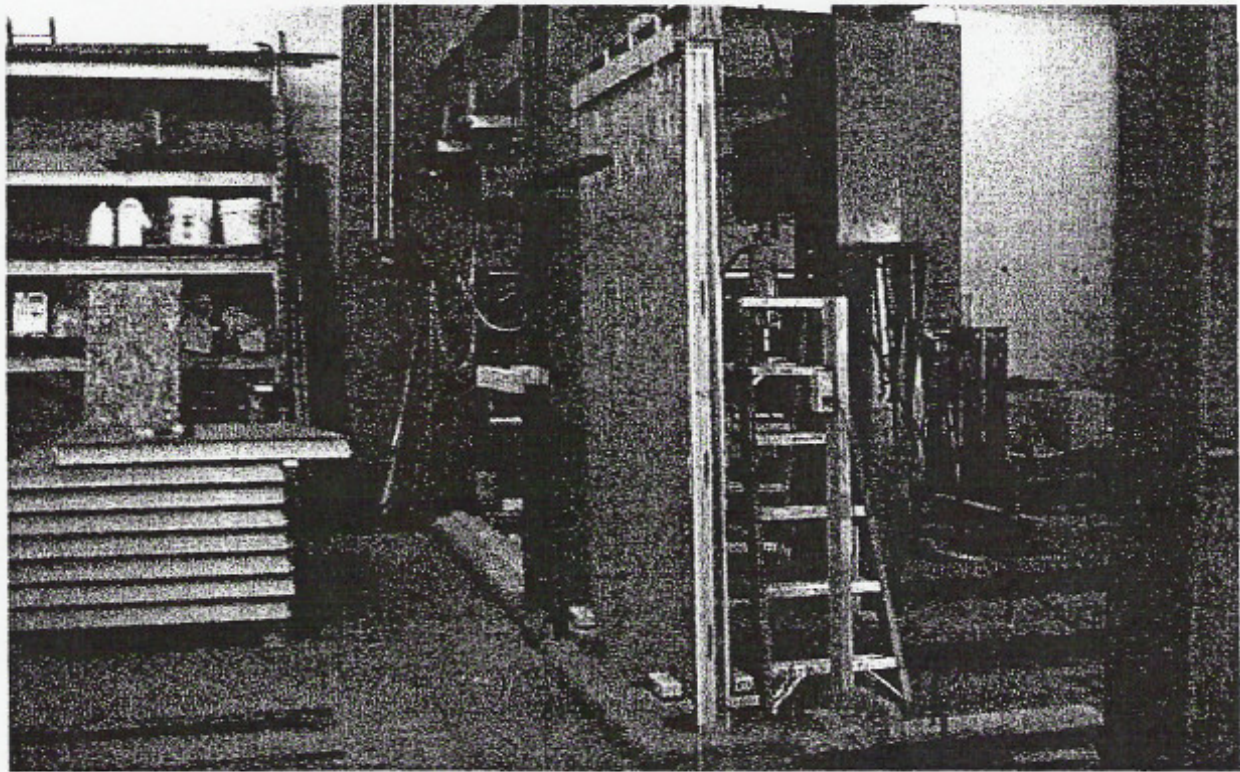


Photo No. I-1: Test Setup for Compressive Loading on 8' OSB-OSB Panel

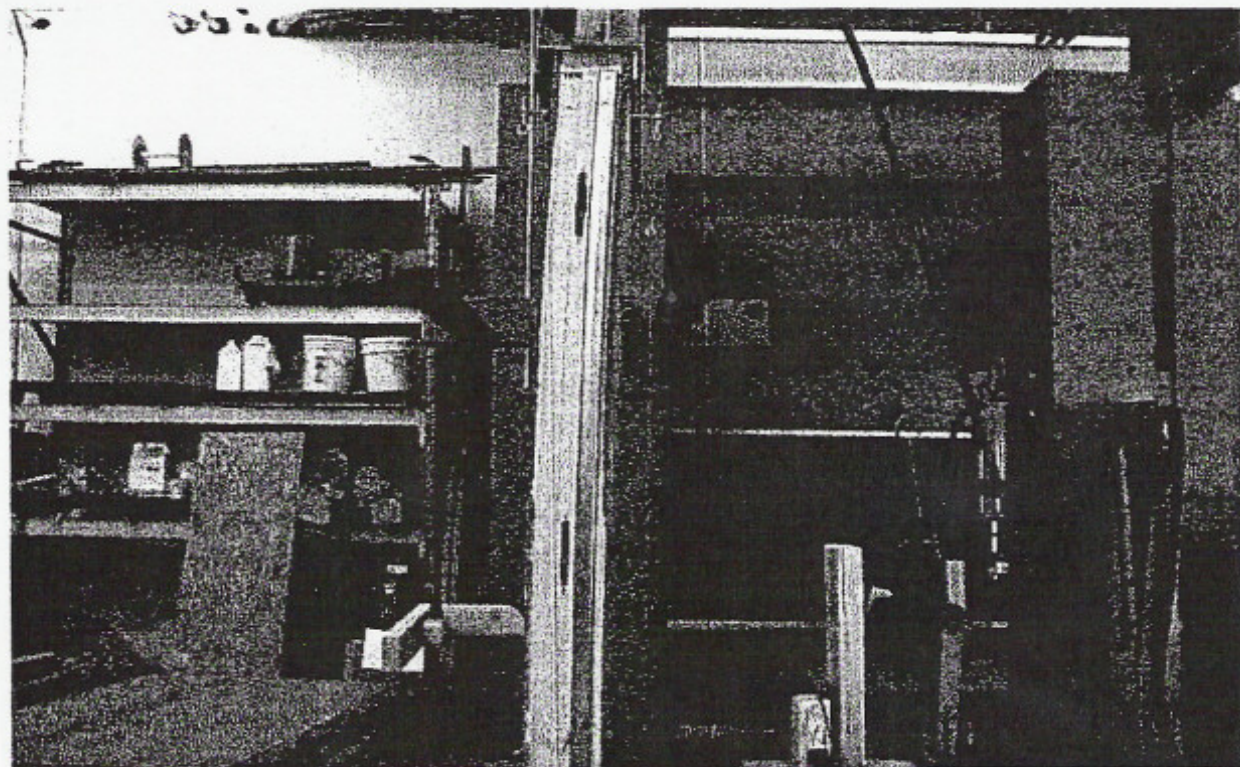


Photo No. I-2: Response of 8' OSB-OSB Panel to Compressive Loading

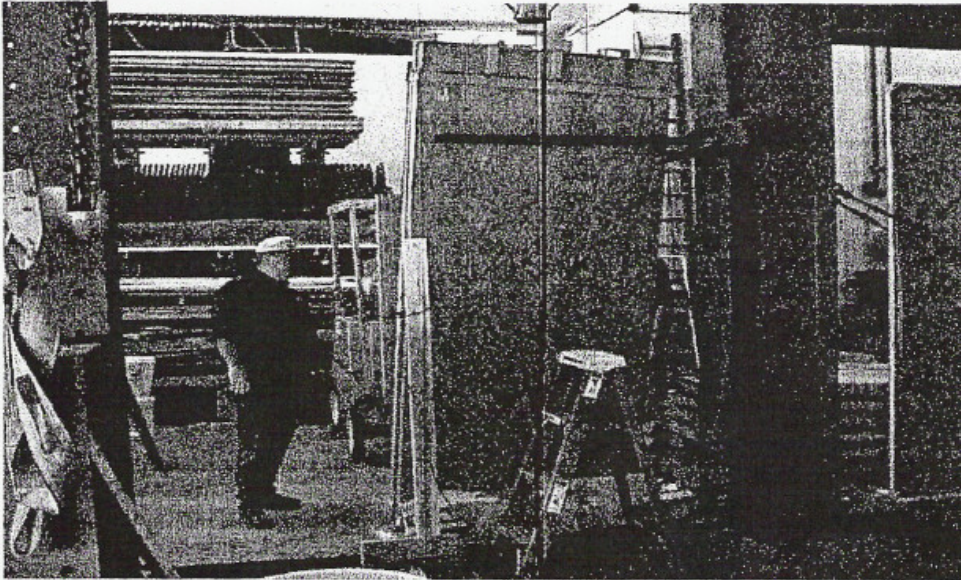


Photo No. I-3: Failure of 8' OSB-OSB Panel Under Compressive Loading



Photo No. I-4: Closeup of Failure of 8' OSB-OSB Panel Under Compressive Loading

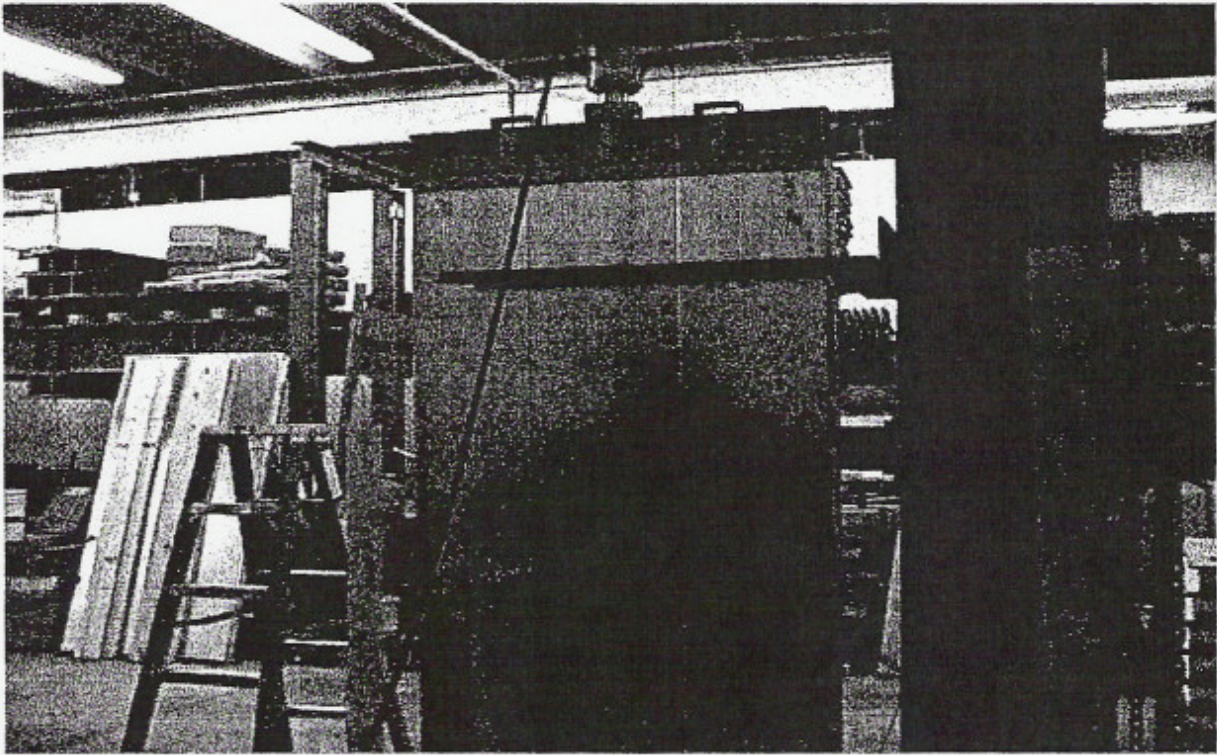


Photo No. I-5: Test Setup for Compressive Loading 8' Galv.-Galv. Panel

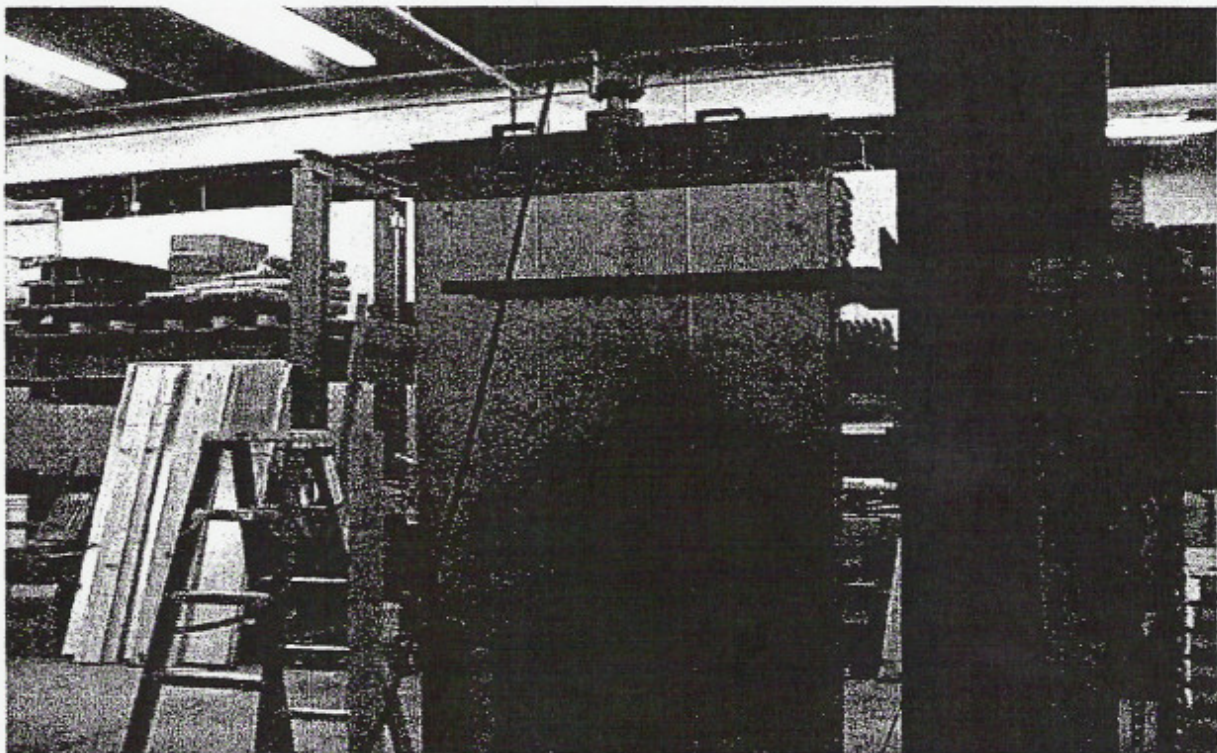


Photo No. I-6: Response of 8' Galv.-Galv. Panel Under Compressive Loading

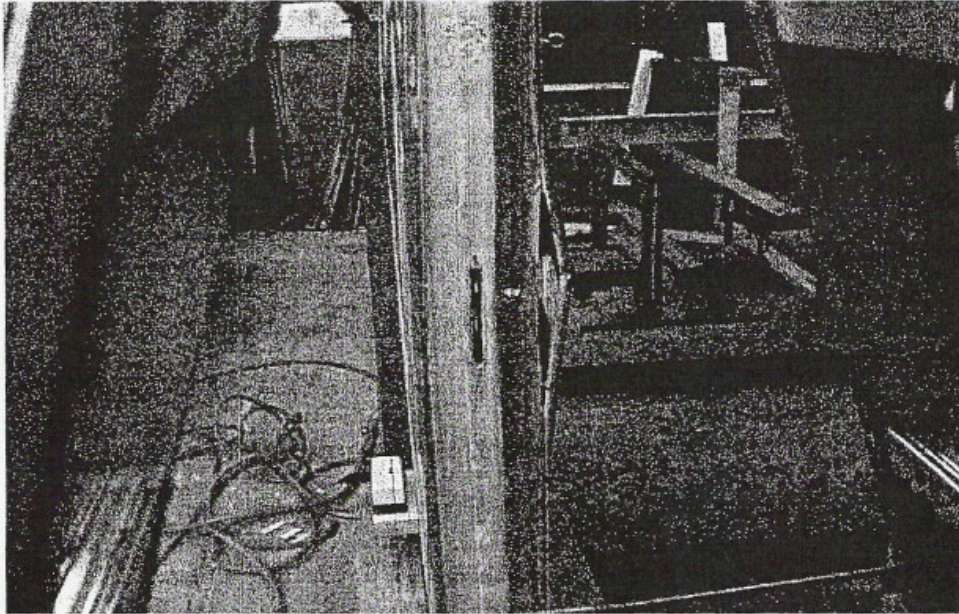


Photo No. I-7: Failure of 8' Galv.-Galv. Panel Under Compressive Loading



Photo No. I-8: Closeup of Failure of 8' Galv.-Galv. Panel Under Compressive Loading

PART III – RACKING LOAD TESTING

Test Procedure

Each test consisted of two panels, connected together along their common vertical joint, and standing (96" dimension of each panel was vertical) in the load frame. Thus, the dimensions of each test sample were 96" x 96". To prevent panel rotation (uplift), hold down rods were installed at the edge of the panel to be loaded. One rod was placed on each face of the panel, and each rod was preloaded with a tension force of 20 pounds. Non-binding lateral guides were used along the top edge of each test sample to prevent movement perpendicular to the plane of the panels during loading. OSB panel skins were nailed with 8d nails at 6" o/c into a 2" x 4" sill and cap plates. The cap plate was then bolted to the load beam. GGS panel skins were screwed to a galvanized steel channel sill with sheet metal screws at 6" o/c. The sill channel was bolted to the load frame. See Figure III-1 and Photo III-1 for details of the test setup.

An in-plane concentric load was applied at the top corner of the panel as described in Section 14.3.3 of ASTM E 72-98 and as shown in Figure III-1. A hydraulic jack was used to load a steel plate bearing on a 4" x 6" timber cap plate at the top of the sample. The applied load was transferred from the 4" x 6" cap through lag bolts into the 2" x 4" cap plate embedded in the top of each panel. A pressure transducer was used to record the magnitude of the in-plane load applied to the top corner of each sample. Each sample was loaded as follows:

- loaded to 790 lb. and then load removed
- loaded to 1570 lb. and then load removed
- loaded to 2360 lb. and then load removed
- loaded to failure

During each half-cycle of loading, applied loads and deflections were recorded at approximately 1 second intervals. Each panel was evaluated for one test, until panel failure occurred. On all samples, four displacement transducers (DT) were used to measure three separate displacements (see Figure III-1 for details):

- D1) uplift was measured by 2 DT's placed on opposite faces along the vertical edge where the load was applied;
- D2) slippage was measured by 1 DT placed on the panel centerline at the lower right corner of the sample; and
- D3) total movement was measured by 1 DT placed on the panel centerline at the upper right corner of the sample.

Net panel displacement (deformation) was then calculated to be:

$$D_{net} = D3 - D1 - D2$$

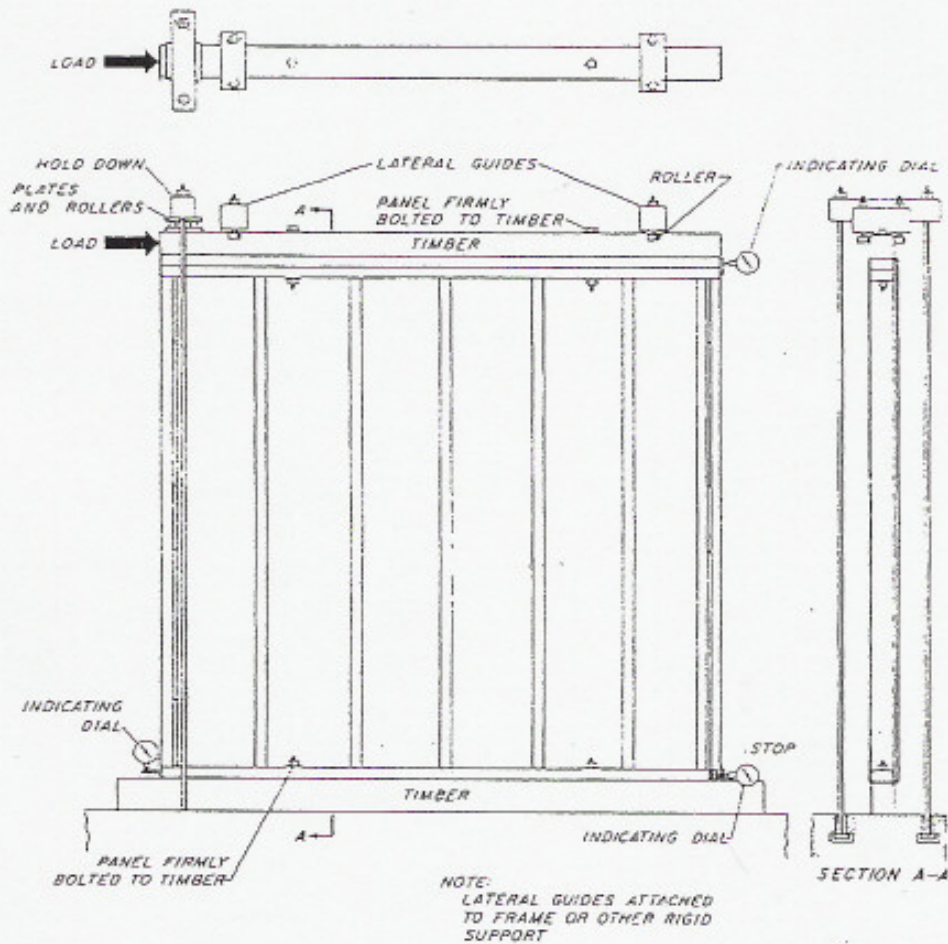


Figure No. III-1: Test Setup for Racking (in-Plane) Loading

Test Results for 8' OSB Panels and 8' Galvanized Steel Panels

Test results for 8' panels are presented as described below:

OSB-OSB	Tables No. III-1, III-3, and III-5	Figures No. III-2 and III-3
GGS-GGS	Tables No. III-2, III-4, and III-5	Figures No. III-4 and III-5

The results include individual panel results indicated above as well as “average” results (Table No. III-4 and Figures No. III-3 and III-5). Maximum load and displacement values and descriptions of panels and failure modes are provided in Tables No. III-3 and III-4. Three OSB-OSB panels and five GGS-GGS panels were tested.

Table No. III-1: Results for Racking Load vs. Net Deflections for 8' OSB-OSB Panels

8' OSB-OSB Panel OO1R			
Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)	Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)
1	-0.0018	218	0.0237
16	-0.0015	391	0.0344
23	-0.0033	634	0.0533
26	-0.0047	1002	0.0908
45	-0.0051	1529	0.1260
87	-0.0045	1913	0.1712
136	-0.0003	2369	0.5171
246	0.0056	388	0.4434
447	0.0161	-123	0.0458
814	0.1131	-44	0.0405
-38	0.0842	-18	0.0408
-99	0.0031	0	0.1272
-33	0.0019	2	0.1273
0	0.0321	76	0.0430
1	0.0321	273	0.0524
16	0.0033	698	0.0915
53	0.0049	1496	0.1621
117	0.0066	2555	0.2595
174	0.0107	3064	0.3639
276	0.0150	4001	0.4684
458	0.0231	4736	0.5703
762	0.0447	4660	0.7434
1172	0.0853	4595	0.9308
1605	0.2978	4834	1.0950
151	0.2468	5040	1.2543
-81	0.0179	5223	1.4027
-33	0.0019	5387	1.5458
-1	0.0687	5593	1.9117
3	0.0688	4732	2.0559
49	0.0158	4836	2.2395
125	0.0197	4399	2.4254

8' OSB-OSB Panel OO2R			
Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)	Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)
12	-0.0041	916	0.1358
35	-0.0041	1284	0.1628
69	-0.0034	1736	0.2001
100	-0.0023	2076	0.2511
156	0.0013	2041	0.3015
228	0.0055	2375	0.6553
338	0.0117	2226	0.6703
470	0.0195	-39	0.1623
636	0.0319	-10	0.3406
814	0.0942	0	0.3402
-24	0.0803	21	0.1714
-92	0.0103	57	0.1709
-45	0.0100	290	0.1799
0	0.0295	1021	0.2268
1	0.0293	2108	0.3397
7	0.0097	2899	0.4989
19	0.0096	3132	0.6994
53	0.0097	3417	0.9064
126	0.0124	3580	1.0890
252	0.0188	3789	1.2605
453	0.0269	4027	1.4341
828	0.0488	3944	1.6190
1142	0.0913	4297	1.8101
1697	0.3365	4489	1.9978
1597	0.3486	4501	2.1740
-52	0.0682	4804	2.3482
-25	0.1754	4959	2.5206
198	0.1756	5089	2.6479
35	0.0652	4716	2.7300
314	0.1088	4439	2.7999
524	0.1175		

8' OSB-OSB Panel OO3R			
Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)	Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)
2	0.0001	619	0.0563
39	0.0005	1232	0.1073
59	0.0005	1616	0.1870
96	0.0017	1964	0.2790
114	0.0026	2403	0.7080
167	0.0051	2247	0.7164
245	0.0089	-93	0.1697
353	0.0131	-17	0.1676
498	0.0190	-3	0.3524
830	0.0748	1	0.3521
-26	0.0600	36	0.1625
-35	0.0084	117	0.1624
0	0.0191	331	0.1747
1	0.0190	837	0.2160
28	0.0089	1692	0.3095
53	0.0090	2343	0.4250
100	0.0113	2667	0.5697
166	0.0127	2592	0.7439
279	0.0171	3020	0.9128
462	0.0242	3395	1.0739
781	0.0384	3780	1.2434
1119	0.0715	3809	1.4206
1570	0.2759	3798	1.5994
71	0.2173	3769	1.7755
-36	0.0371	3805	1.9524
-1	0.0980	4010	2.0453
5	0.0980	3809	2.1312
18	0.0373	3860	2.2896
46	0.0365	3884	2.4675
112	0.0374	3112	2.6533
267	0.0394		

Note: racking loads does not include weight of top beam and panel self weight

Table No. III-2: Representative Results, Racking Load vs. Net Deflections, 8' GGS-GGS Panels (GG1R and GG5R are not shown)

8' GGS-GGS Panel GG4R			
Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)	Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)
7	0.0002	792	0.1544
34	0.0024	1271	0.2008
126	0.0114	1704	0.2613
200	0.0209	2216	0.3247
298	0.0322	2752	0.3985
431	0.0466	2601	0.4082
596	0.0672	-150	0.1644
802	0.0959	-5	0.1595
-4	0.0805	1	0.1592
-19	0.0374	169	0.1721
2	0.0364	921	0.2701
37	0.0368	2740	0.4392
94	0.0414	3927	0.6357
285	0.0558	4952	0.8412
422	0.0662	5118	1.0694
928	0.1077	5931	1.3075
1083	0.1460	6246	1.5258
1626	0.2166	6770	1.7625
225	0.1951	7062	1.9999
-154	0.0895	7353	2.2336
4	0.0885	6659	2.4805
30	0.0876	6875	2.9816
97	0.0924	6634	3.2183
222	0.1026	6456	3.4597
448	0.1204	6254	3.7109
		6358	3.9648
		6082	4.2935

8' GGS-GGS Panel GG2R			
Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)	Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)
1	-0.0017	539	0.0605
17	-0.0017	981	0.0988
214	0.0135	2497	0.2308
266	0.0140	-82	0.1258
563	0.0323	-54	0.0591
842	0.0552	-52	0.0594
-56	0.0401	65	0.0591
-107	0.0113	319	0.0773
-125	0.0040	610	0.0965
-125	0.0042	1043	0.1467
-123	0.0047	1878	0.2026
99	0.0135	3395	0.3717
153	0.0154	3941	0.4718
325	0.0243	4522	0.5666
702	0.0421	5085	0.6684
973	0.0628	5450	0.7838
1321	0.0920	5813	0.8978
1555	0.1363	5945	1.0153
516	0.1377	5672	1.1496
-108	0.0364	5617	1.2610
-115	0.0341	5877	1.3766
66	0.0342	5939	1.5111
78	0.0358	6372	1.8247
170	0.0413	4910	1.8995
273	0.0509		

8' GGS-GGS Panel GG3R			
Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)	Avg. Racking Load (lbs.)	Avg. Net Displ. (in.)
0	-0.0003	541	0.0497
13	0.0018	986	0.0846
78	-0.0023	2494	0.2005
171	0.0021	15	0.1109
460	0.0137	-13	0.0412
828	0.0435	-4	0.0405
111	0.0367	0	0.0405
-11	0.0095	45	0.0411
-13	0.0051	108	0.0416
-14	0.0025	197	0.0442
0	0.0081	386	0.0600
27	0.0064	1915	0.1816
59	0.0066	3227	0.2838
157	0.0057	3479	0.4280
356	0.0162	4068	0.5747
592	0.0330	4545	0.7286
998	0.0592	5260	0.8753
1591	0.1224	5305	1.0502
265	0.1012	5571	1.2266
-3	0.0322	5764	1.4001
-2	0.0285	6000	1.5885
2	0.0277	6172	1.7823
79	0.0283	6465	2.0824
174	0.0304	4520	2.2580
302	0.0320		

Note: racking loads does not include weight of top beam and panel self weight

TABLE No. III-3: RACKING TEST RESULTS FOR 8' OSB-OSB PANELS

SAMPLE NO.	MAX. LD. (LBS)	DEFL. (IN) AT MAX. LOAD				FAILURE CHARACTERISTICS
		UPLIFT D1	SLIDE D2	DRIFT D3	NET D3-D1-D2	
OO1R	5593	0.20	0.22	2.33	1.91	Panels failed by some combination of tearing of the OSB around the nails at the sill and top plates and bending and shearing of the nails; crushing of the foam; lifting/tearing of the sill plate; and separation of the skins from the foam.
OO2R	5089	0.19	0.24	2.90	2.47	
OO3R	4010	0.16	0.16	2.36	2.04	
AVERAGE	4897	0.18	0.19	2.53	2.14	Avg. Panel Wt. = 135.9 lbs. (range = 133.4 to 138.9 lbs.)

TABLE No. III-4: RACKING TEST RESULTS FOR 8' GGS-GGS PANELS

SAMPLE NO.	MAX. LD. (LBS)	DEFL. (IN) AT MAX. LOAD				FAILURE CHARACTERISTICS
		UPLIFT D1	SLIDE D2	DRIFT D3	NET D3-D1-D2	
GG1R	Omitted due to premature lifting of sill channel				-----	Panels failed by some combination of tearing of the galvanized steel around the nails and screws at the sill and top plates and bending and shearing of the nails/screws; crushing of the foam; lifting/tearing of the sill plate; and separation of the skins from the foam.
GG2R	6372	0.12	0.05	1.99	1.82	
GG3R	6465	0.14	0.05	2.27	2.08	
GG4R	7353	0.08	0.18	2.38	2.12	
GG5R	6700	0.07	0.15	2.44	2.22	
AVERAGE	6723	0.10	0.11	2.27	2.06	Avg. Panel Wt. = 114.6 lbs. (range = 112.4 to 115.8 lbs.)

Table No. III-5: Average Results for Racking Load vs. Net Deflection for 8' Panels

8' OSB-OSB Panels OO1R, OO2R, and OO3R			
Racking Load (lbs.)	Average Displacement (in.)	Racking Load (Cont'd) (lbs.)	Average Displacement (in.)
5	-0.0019	1741	0.1880
30	-0.0017	1973	0.2506
51	-0.0021	2382	0.6268
74	-0.0018	1620	0.6100
105	-0.0004	-85	0.1259
161	0.0021	-24	0.1214
240	0.0067	-5	0.2734
356	0.0127	1	0.2732
527	0.0223	45	0.1256
819	0.0940	149	0.1285
-30	0.0748	440	0.1487
-75	0.0074	1118	0.2016
-38	0.0067	2118	0.3029
0	0.0269	2769	0.4293
1	0.0268	3266	0.5792
17	0.0073	3581	0.7402
42	0.0078	3753	0.9151
90	0.0092	3926	1.0884
155	0.0120	4214	1.2575
269	0.0170	4264	1.4313
458	0.0248	4439	1.6041
790	0.0440	4549	1.7730
1144	0.0827	4580	1.9424
1624	0.3034	4723	2.1136
606	0.2709	4517	2.2887
-58	0.0420	4479	2.4790
-9	0.1140	3983	2.6262
69	0.1141		
34	0.0395		
162	0.0550		
285	0.0595		
525	0.0699		
846	0.0908		
1323	0.1327		

8' GGS-GGS Panels GG2R, GG3R, GG4R, GG5R			
Racking Load (lbs.)	Average Displacement (in.)	Racking Load (Cont'd) (lbs.)	Average Displacement (in.)
4	-0.0004	357	0.0742
33	0.0018	603	0.0907
68	0.0038	936	0.1154
139	0.0079	1396	0.1569
199	0.0121	1984	0.2066
240	0.0168	2526	0.2717
314	0.0229	1239	0.2263
418	0.0321	-176	0.0843
576	0.0435	-138	0.0822
825	0.0665	-53	0.0795
217	0.0575	-89	0.0798
-129	0.0147	-18	0.0860
-133	0.0136	17	0.0863
-94	0.0114	402	0.1229
-72	0.0129	959	0.1663
-34	0.0172	1669	0.2391
20	0.0165	2336	0.3245
65	0.0202	3040	0.4293
128	0.0240	3594	0.5555
208	0.0288	4352	0.6906
311	0.0360	4706	0.8289
465	0.0441	5229	0.9742
658	0.0575	5587	1.1259
925	0.0783	5979	1.2759
1195	0.1082	5934	1.4342
1607	0.1572	5977	1.6028
642	0.1474	6078	1.7749
-136	0.0467	6219	1.9511
-74	0.0452	6282	2.1326
-34	0.0490	6295	2.3184
18	0.0490	6417	2.5022
55	0.0520	5490	2.6908
123	0.0574		
211	0.0641		

Note: racking loads does not include weight of top beam and panel self weight

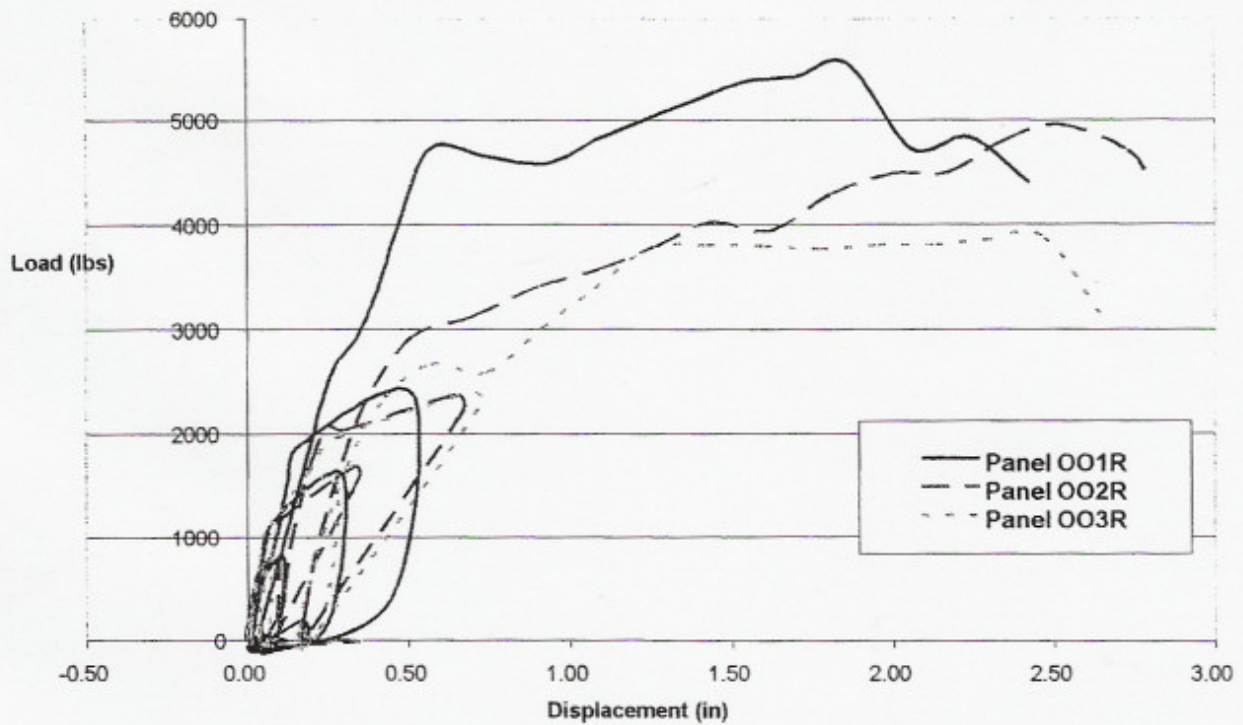


Figure No. III-2: Results for Racking Load vs. Net Deflection for 8' OSB-OSB Panels

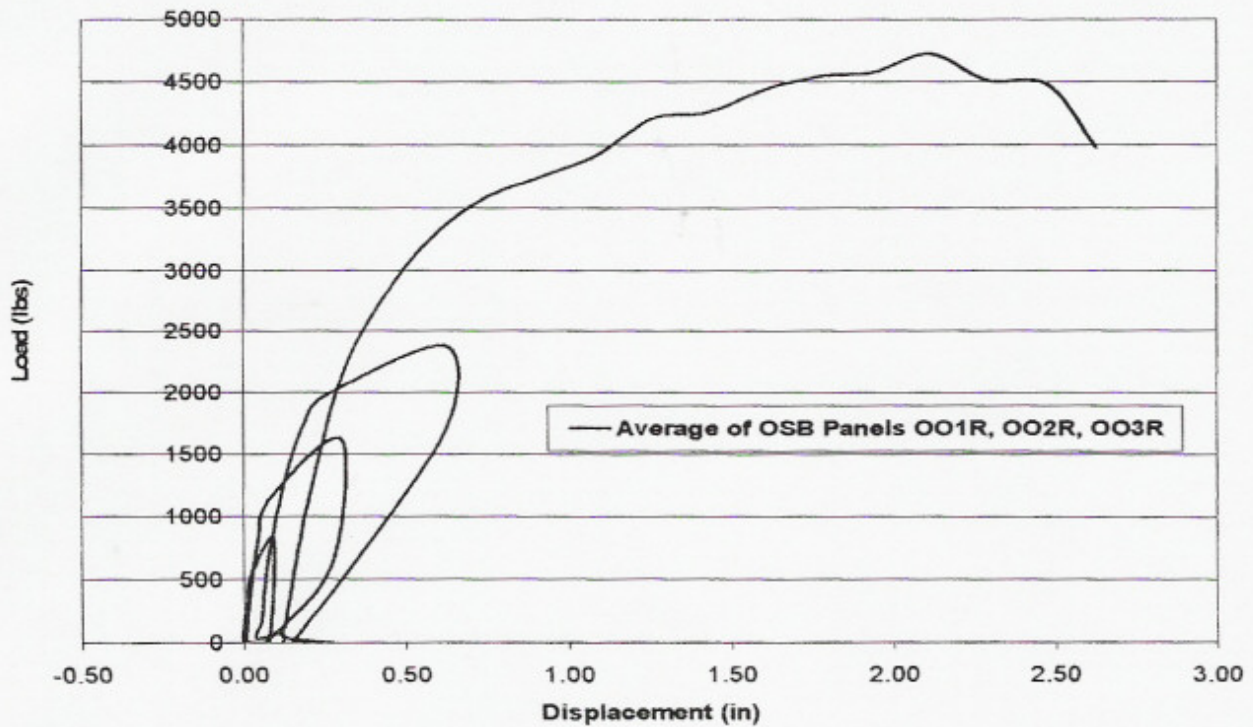


Figure No. III-3: Average Results for Racking Load vs. Net Deflection for 8' OSB-OSB Panels

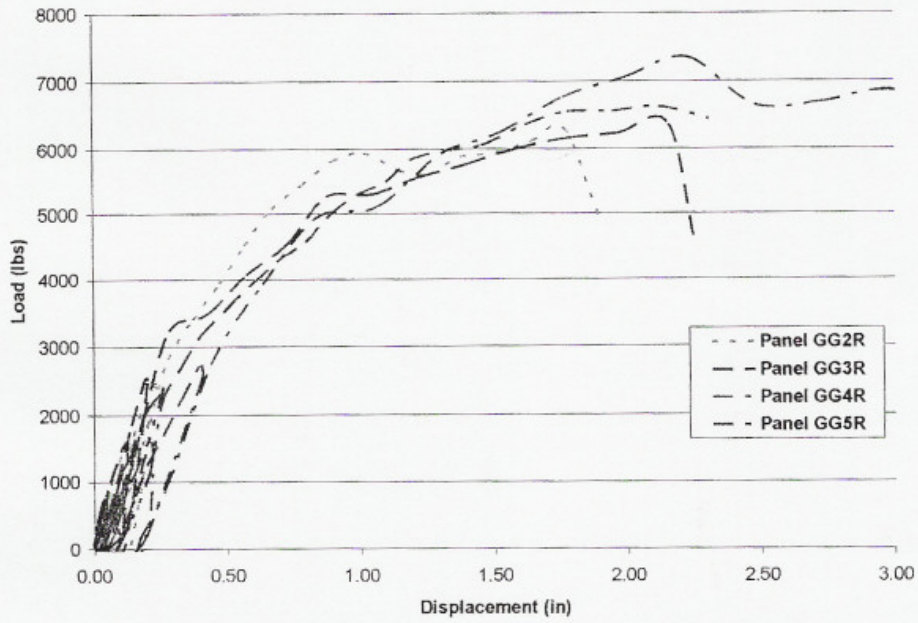


Figure No. III-4: Results for Racking Load vs. Net Deflection for 8' GGS-GGS Panels



Figure No. III-5: Average Results for Racking Load vs. Net Deflection for 8' GGS-GGS Panels

Discussion of Results

Representative results for individual panels and for averages for skin sets subjected to racking loading are given in tables and figures referenced earlier. In these tables and figures, all panels in each skin set reveal similar load-deflection characteristics. That is, the in-plane shearing "stiffness" values (load/net deflection) are in the range of 2,000-3,500 lb./in. for these 8' panels.

The OSB panels were weaker than the GGS panels in terms of in-plane shearing stiffness. Calculations for these stiffness-type terms are presented below by choosing maximum load, P, and deflection, d, values from Table No. III-3. These stiffness-type numbers represent the average load required to generate 1" of deflection and can be seen as the slopes of the load-deflection curves.

Panel Type	Skin Orientation	Max. Load, P (lbs.)	Net Defl. d(in)	"Stiffness" $k=P/d$ (lb/in)
8' OSB-OSB	OSB both faces	4897	2.14	2288
8' GGS-GGS	GGS both faces	6723	2.06	3263

Panel Type	Load = 790 lbs.			Load = 1570 lbs.		
	Avg. Max. Deflection (in.)	Avg. Set Deflection (in.)	Set Defl. as % of Max. Defl.	Avg. Max. Deflection (in.)	Avg. Set Deflection (in.)	Set Defl. as % of Max. Defl.
8' OSB-OSB	0.094	0.007	7%	0.300	0.042	14%
8' GGS-GGS	0.066	0.013	20%	0.150	0.050	33%

For the both sets, failure modes were similar. The OSB panels did not appear to tear as easily or bend the screws as easily as did the GGS panels at the nails. Thus, the OSB panels were able to carry load with slightly less deflection as compared to the GGS panels. Average set deflections after releasing 790 lbs. varied from 0.007" to 0.013". These average set deflections represent 7% to 20% of the actual deflections at 790 lbs. Average set deflections after releasing 1570 lbs. varied from 0.042" to 0.05". These average set deflections represent 14% to 33% of the actual deflections at 1570 lbs. For all panels, failure occurred most often because of tearing of the skins around the nails/screws, bending/shearing of the nails/screws, and/or crushing of the foam.

Conclusions

Considering the maximum load for the panel and a safety factor (failure load/allowable load) of 4.0, both the OSB and GGS panels can safely sustain typical in-plane shear loads applied to shear walls in low-rise buildings. As shown in Table No. III-8 below, loads causing net panel deflections of L/400, L/600, and L/800 are within the range of typical shear wall (due to wind) loads. The deflection (drift) limits shown are those commonly applied to buildings. caused by loads less than allowable racking loads for the OSB panels. GGS panels, however, must be limited to a drift of L/240.

Deflection (Drift) Limit (in.)	OSB-OSB Panels		GGS-GGS Panels	
	Load, P (lbs.)	Set Deflection (in.)	Load, P (lbs.)	Set Deflection (in.)
H/400 = 0.240"	1500	~0.04	2200	~0.08
H/600 = 0.160"	1300	~0.03	1600	~0.05
H/800 = 0.120"	1200	~0.03	1300	~0.05

Note: "H" = the panel height, which is the same as the panel length, L = 8'-0"

Panel Type	Ultimate Load, P (lbs.)	Allowable Load, P/4 (lbs)	Deflection (in.) at Allowable Load	Set Deflection (in.) After Allowable Load
8' OSB-OSB	4897	1224	0.120	~0.03
8' GGS-GGS	6723	1681	0.160	~0.05

As seen in Table Nos. III-8 and III-9, the OSB panels will limit building drift to approximately H/800 and the GGS panels will limit drift to approximately H/600 at their respective allowable loads, on an 8' high wall. For example, consider a 40'-0" square, 10'-0" high building subjected to a 20 psf wind loading. The wind load on any shear wall is 20 psf x 40'^{1/2} x 10'^{1/2} = 2000 lbs. Assuming half of any wall length (40'^{1/2} = 20') is active as a shear wall, the shear load is resisted by 20' of a wall giving a shear load (per foot of length) on the wall of 2000 lbs / 20' = 100 plf. This load equates to 800 lbs. on a double panel (2 panels = 8' wide), well below the allowable loads shown above (1224 lbs. and 1681 lbs for OSB and GGS, respectively).

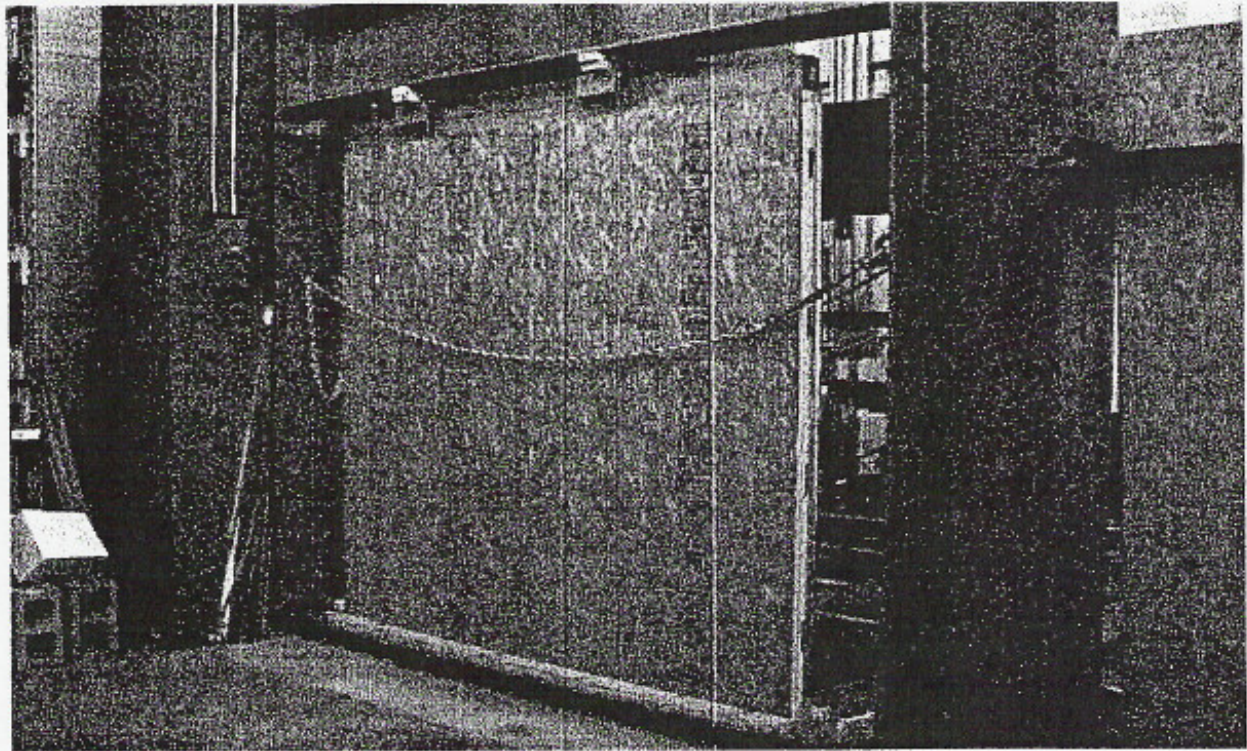


Photo No. I-1: Test Setup for Racking Loading on 8' OSB-OSB Panel

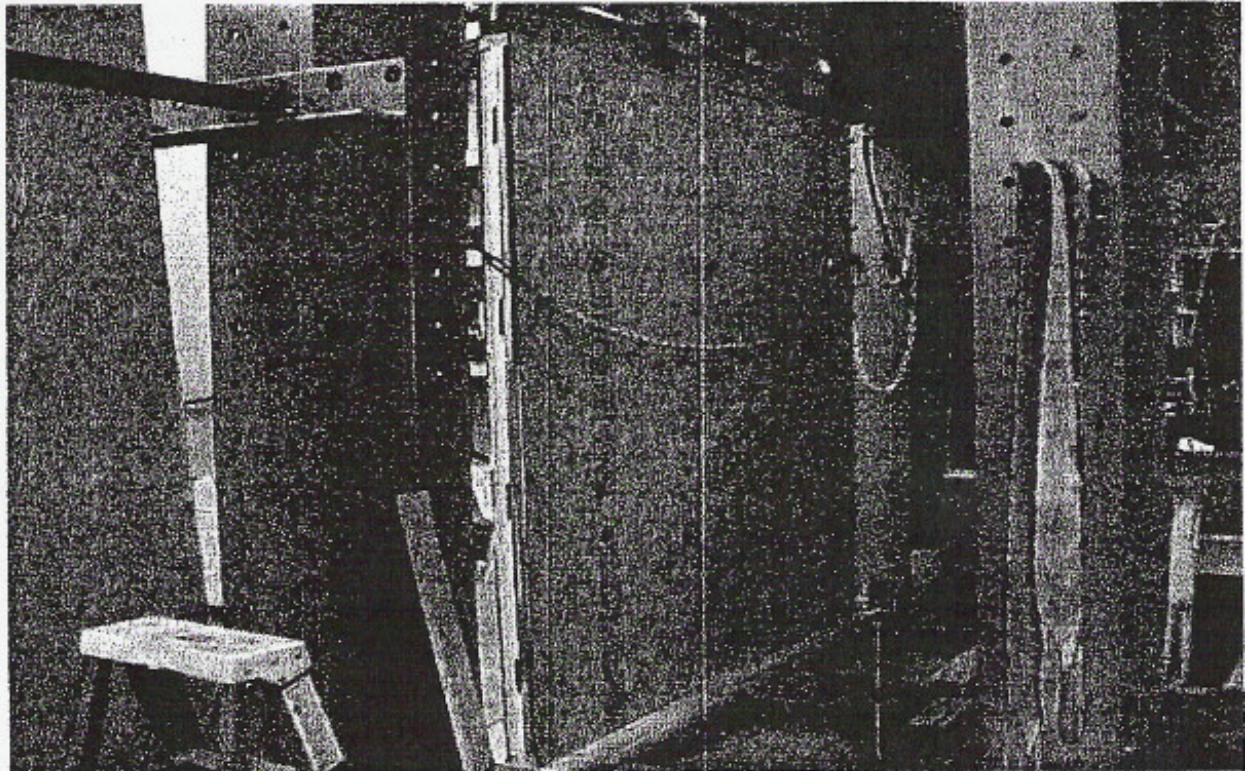


Photo No. I-2: Response of 8' OSB-OSB Panel to Racking Loading

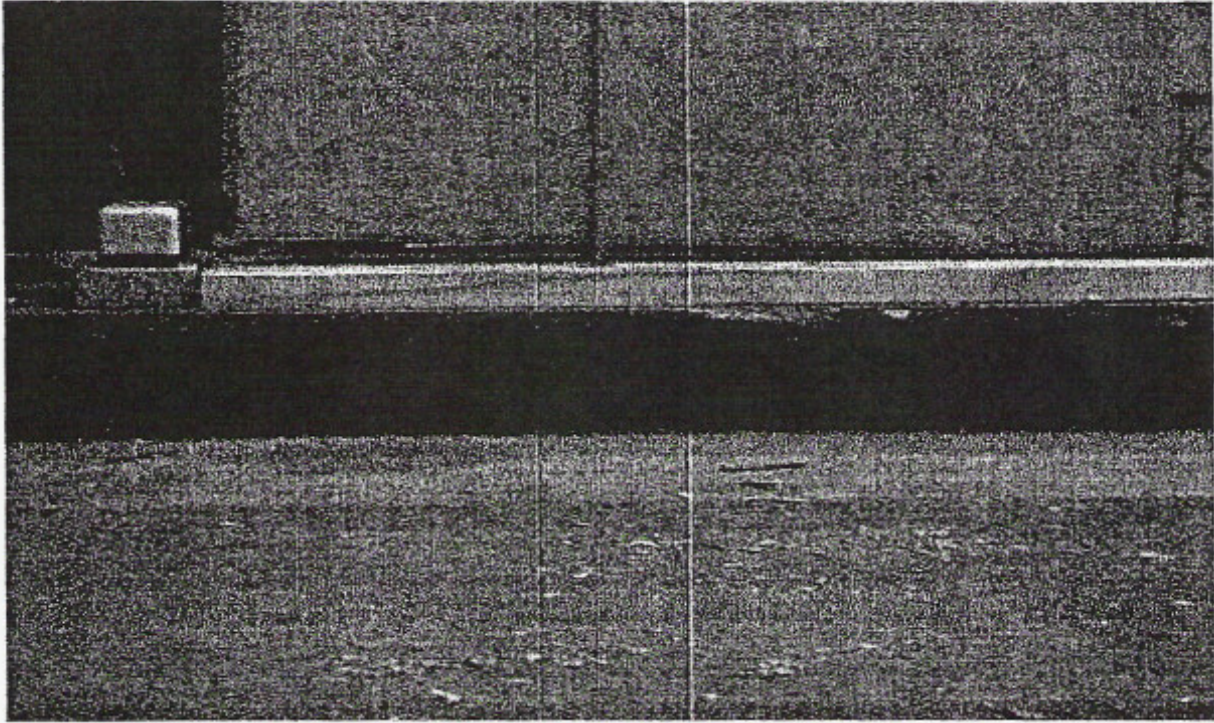


Photo No. I-3: Failure of 8' OSB-OSB Panel Under Racking Loading

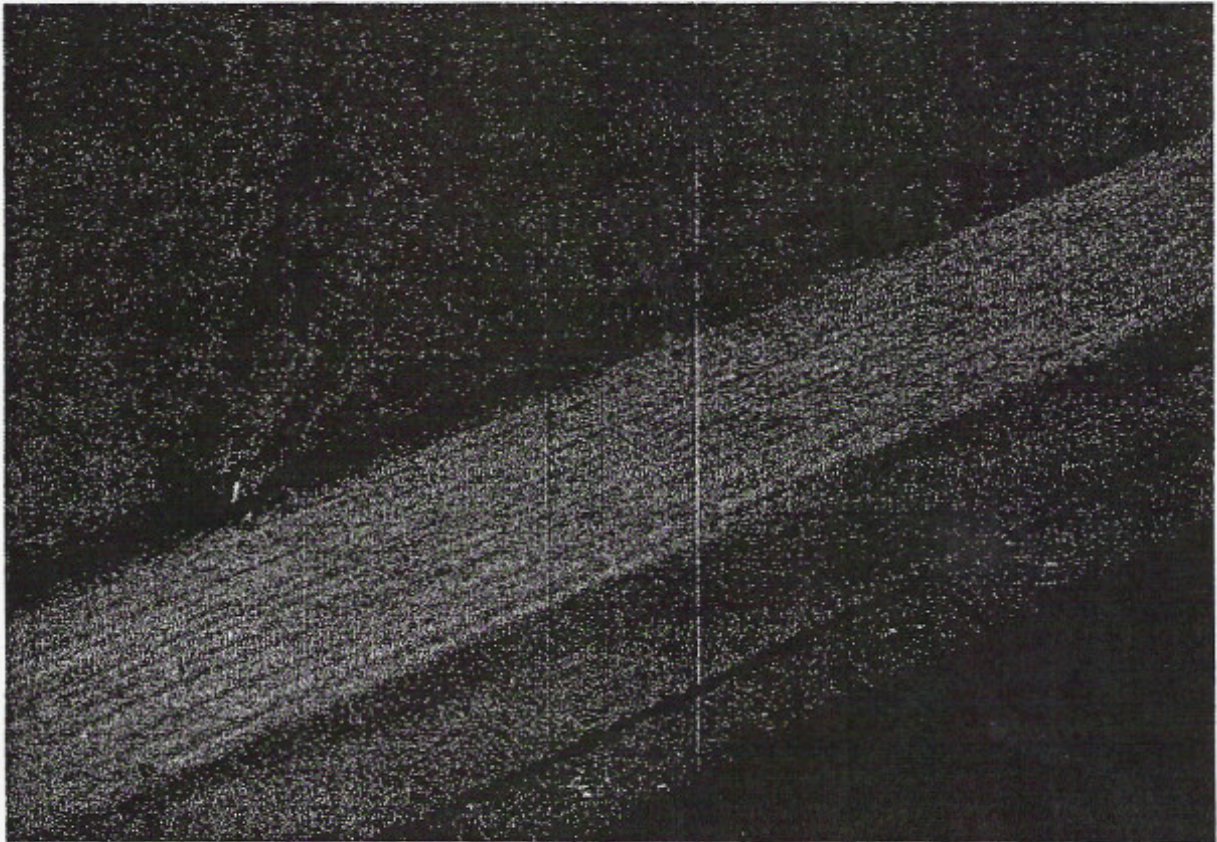


Photo No. I-4: Closeup of Failure of 8' OSB-OSB Panel Under Racking Loading

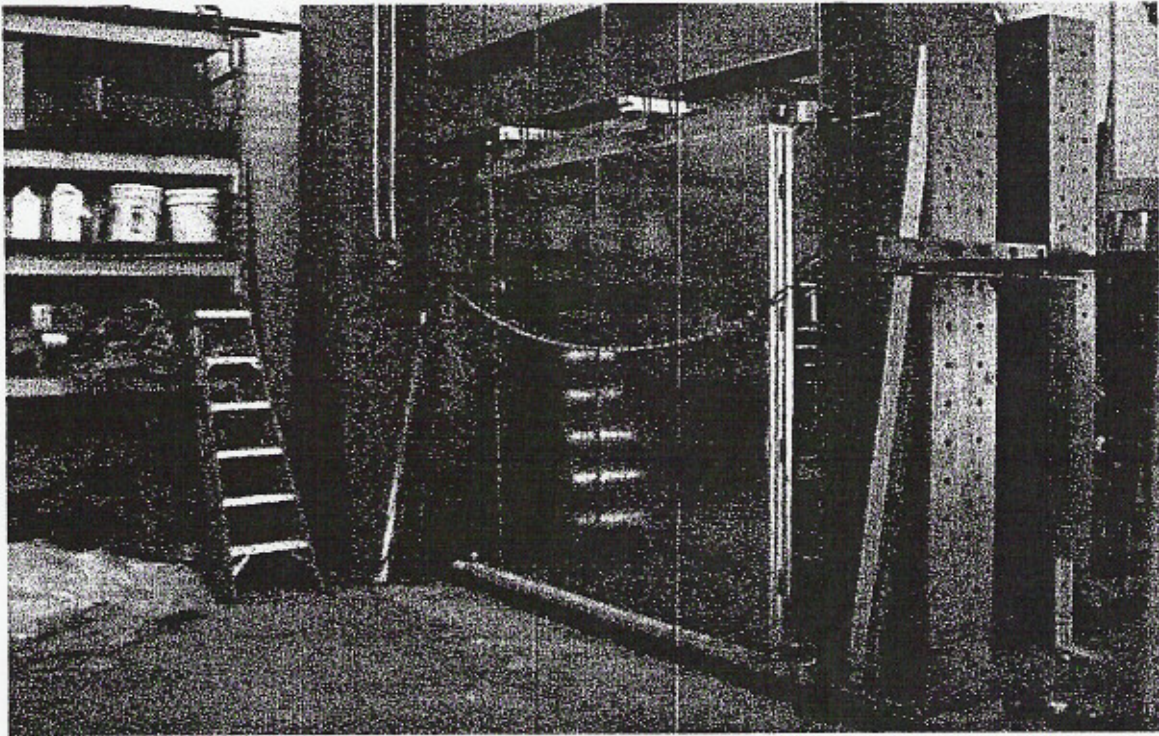


Photo No. I-5: Test Setup for Racking Loading 8' Galv.-Galv. Panel

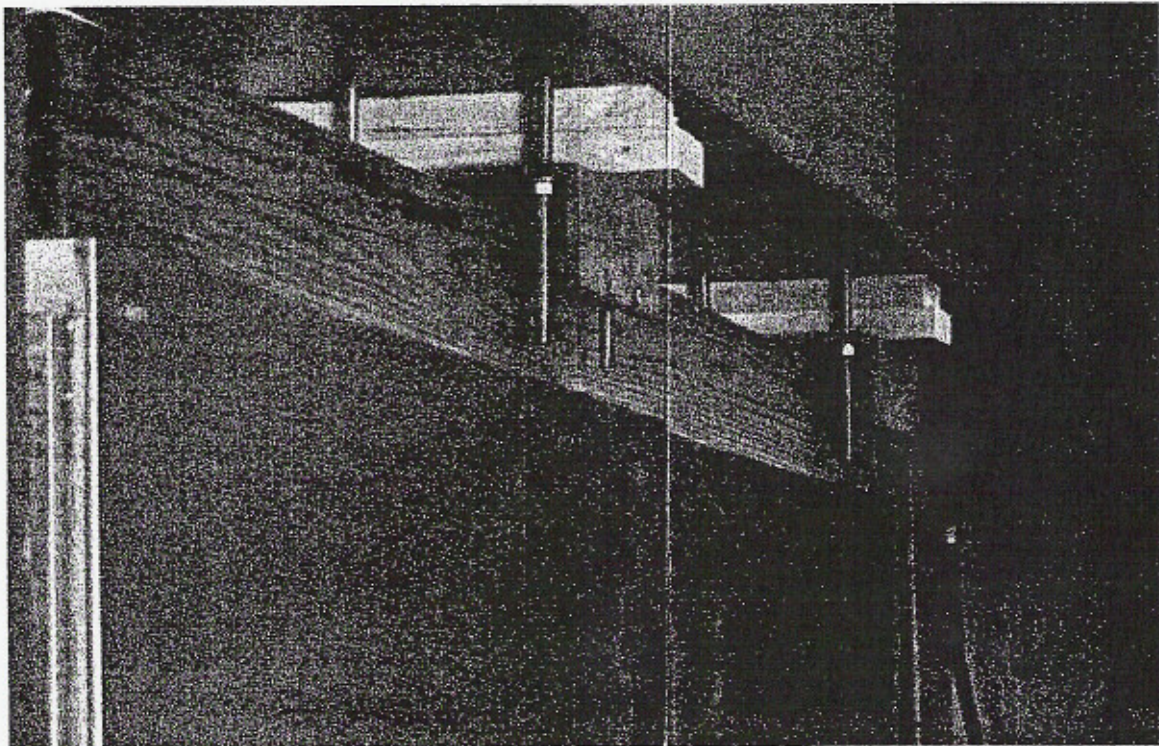


Photo No. I-6: Response of 8' Galv.-Galv. Panel Under Racking Loading

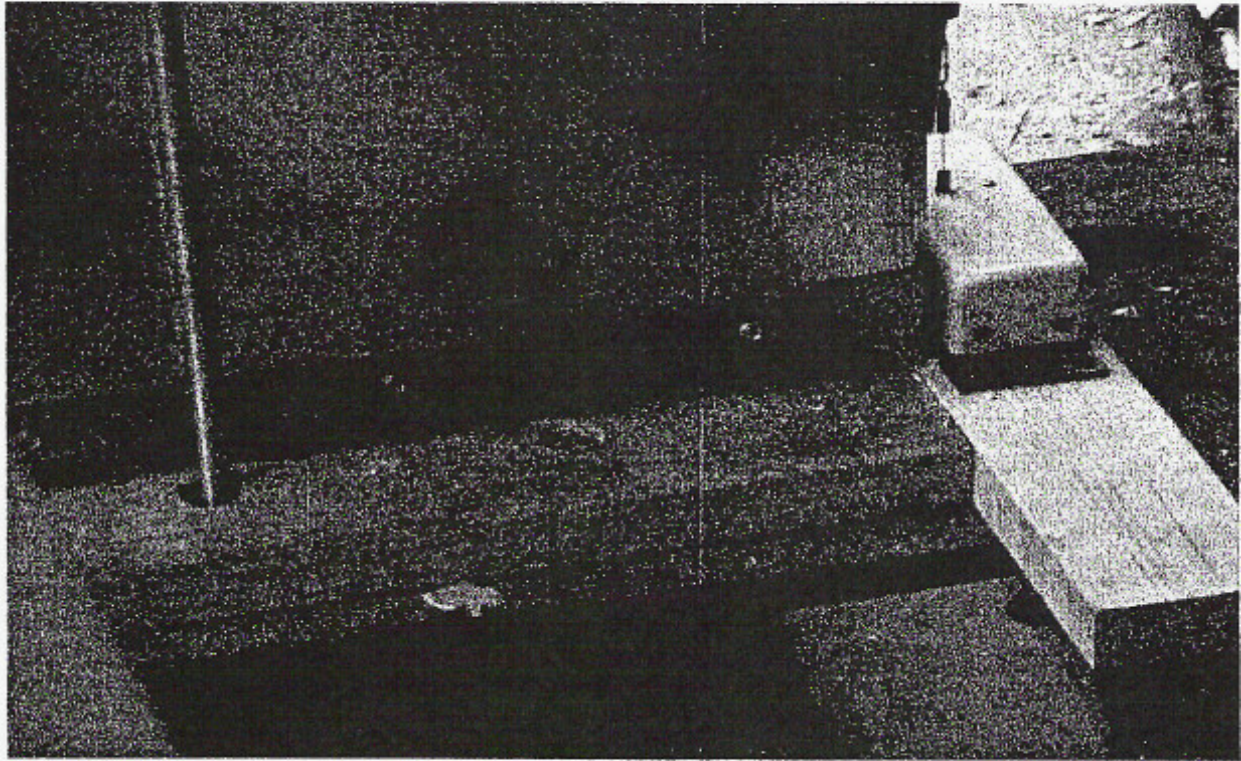


Photo No. I-7: Failure of 8' Galv.-Galv. Panel Under Racking Loading

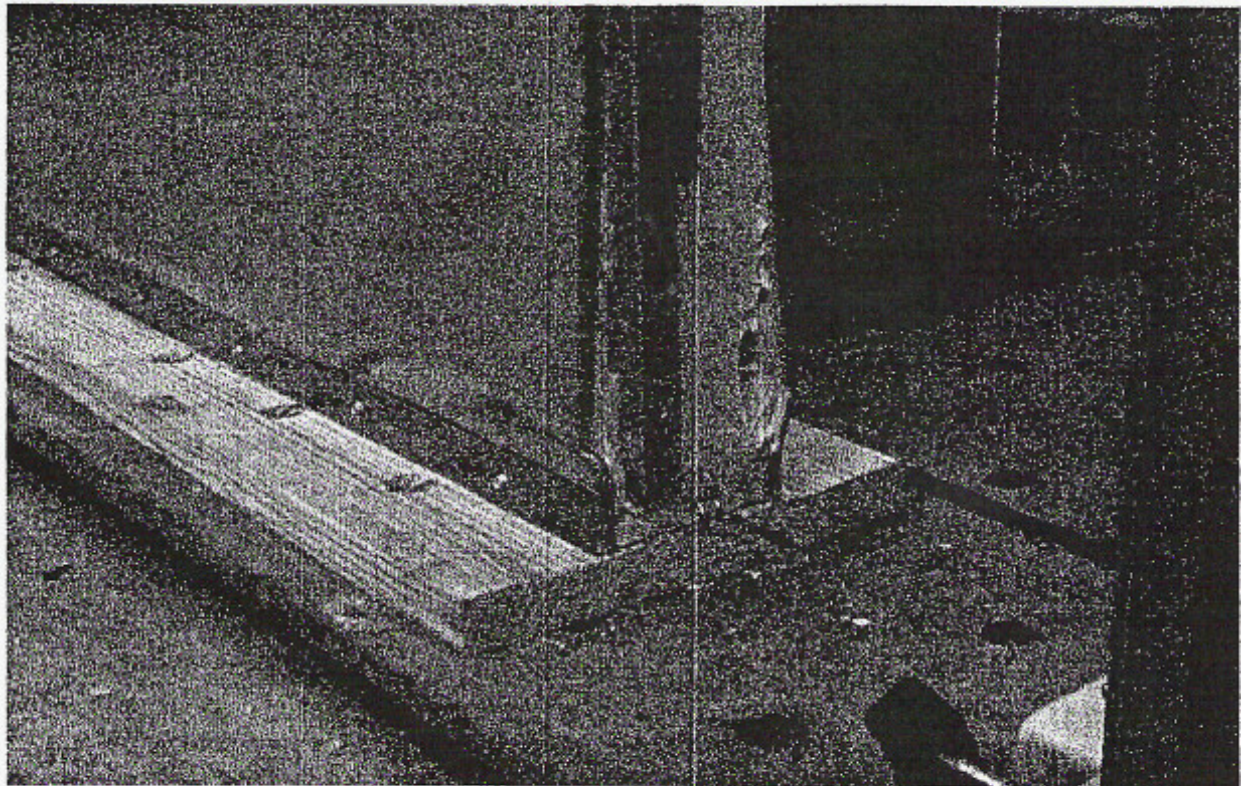


Photo No. I-8: Closeup of Failure of 8' Galv.-Galv. Panel Under Racking Loading

Young Engineering, Inc.
9928 Raddington Lane
Charlotte, NC, 28269
(704) 549-9987

Mr. Andy Hansen
Insulated Component Structures, Inc.
323 Farmington Road
Mocksville, NC 27028

July 22, 2002

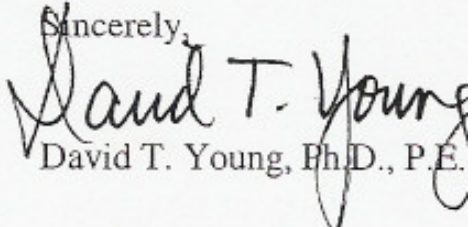
Dear Andy,

Attached is the report, "Results of Load Testing on Insulated Wall Panels Having OSB or Galvanized Steel Outer Skins." The report summarizes research and testing conducted at UNC Charlotte in March, 2002 under the supervision of Young Engineering, Inc. on insulated wall panel samples provided by Insulated Component Structures (ICS). Research and testing was conducted to evaluate panel behavior under transverse loading, compressive loading, and racking loading. This evaluation is required to satisfy requests for information from ICS clients and from building officials.

All work was performed in accordance to ASTM E72-98 "Standard Methods of Conducting Strength Tests of Panels for Building Construction." Testing was conducted on two sets of panels: one set having both skins of oriented strand board (OSB) and one set having both skins of 24 gauge galvanized steel (GGS).

I have enclosed 1 bound copy of the report for ICS and an unbound set of originals in case you want to make other copies.

It has been a pleasure working with you, and please let me know if you have questions or comments.

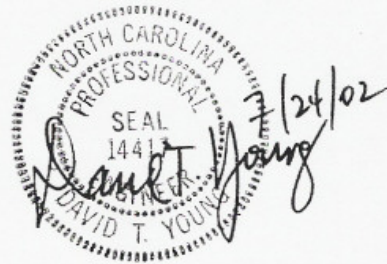
Sincerely,

David T. Young, Ph.D., P.E.

**Results of Load Testing
on
Insulated Wall Panels
Having OSB or Galvanized Steel Outer Skins**

tested for
Insulated Component Structures, Inc.
Mocksville, NC

tested at
The Structures Materials Laboratory
The William States Lee College of Engineering
The University of North Carolina at Charlotte

directed by
David T. Young, Ph.D., P.E.
Young Engineering, Inc.
Charlotte, NC



July 22, 2002

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PART I - TRANSVERSE LOAD TESTING

Test Procedure

The two-point (quarter span) loading method as described in Section 11.3.1 of ASTM E 72-98 (see Figure No. I-1) was used to conduct transverse (bending) loading tests. A 50,000 lb. hydraulic jack and 50,000 lb. load cell were used to load a longitudinal steel beam supported by two transverse beams (with rollers) placed at quarter spans of the panels. Each panel was evaluated for one test, to panel failure. On all panels, two displacement transducers (DT) were used to measure midspan panel deflections. The DT's were attached to the supporting (stationary) load frame with each DT located approximately 5" from each edge of the panel.

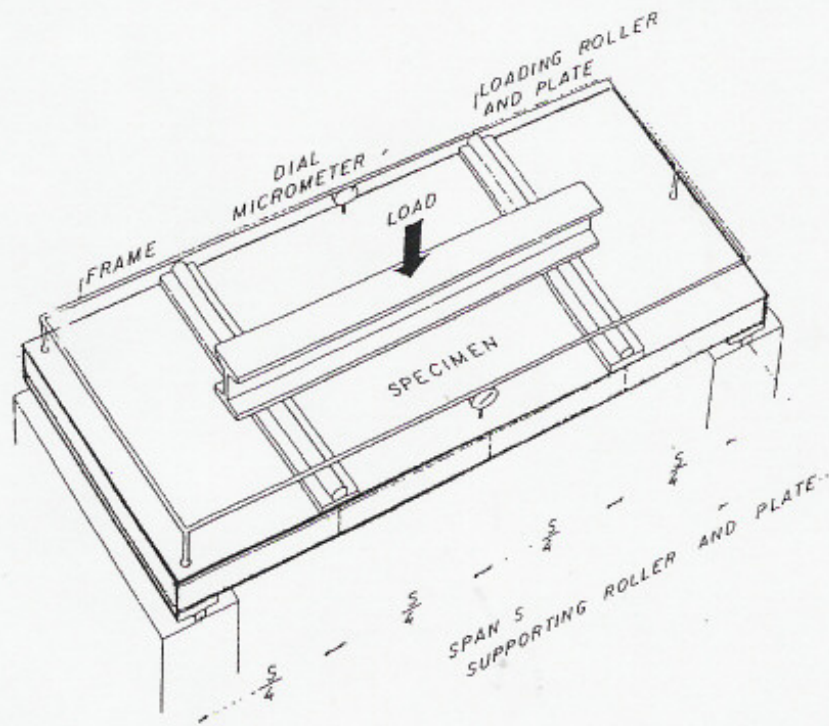


Figure No. I-1: Test Setup for Transverse (Flexural) Loading (from "ASTM E72-98, Fig. 3")

Transverse load testing was performed on the following panels:

Panel Skins		Panel Size	Number of Samples	Sample Designations
Type	Orientation			
OSB-OSB	OSB both	4' x 8'	3	OO1, OO2, OO3
GGG-GGS	GGG both	4' x 8'	3	GG1, GG2, GG3

OSB = 7/16" oriented strand board

GGG = 24 gauge galvanized steel

Test Results for 8' OSB and 8' Galvanized Steel Panels

Test results for transverse loading are presented as described below:

OSB-OSB	Tables No. I-1, I-3, and I-5	Figures No. I-2 and I-3
GGG-GGS	Tables No. I-2, I-4, and I-5	Figures No. I-4 and I-5

The results include individual panel results indicated above as well as “average” results (Table No. I-5 and Figures No. I-3 and I-5). Maximum load and displacement values and descriptions of panels and failure modes are provided in Tables No. I-3 and I-4.

Table No. I-1: Results for Load vs. Deflection for 8' OSB-OSB Panels

OSB-OSB Panel OO1 8'-0"		OSB-OSB Panel OO2 8'-0"		OSB-OSB Panel OO3 8'-0"	
Transverse Load (lbs.)	Average Displacement (in.)	Transverse Load (lbs.)	Average Displacement (in.)	Transverse Load (lbs.)	Average Displacement (in.)
10	0.0009	12	0.0026	5	0.0001
531	0.1624	505	0.1569	884	0.2506
698	0.2143	876	0.2614	1138	0.3198
895	0.2675	1646	0.4582	1177	0.3334
1410	0.4015	2605	0.7033	2384	0.6125
2711	0.7189	2556	0.7070	2793	0.7166
4512	1.2333	2539	0.7078	2846	0.7389
4457	1.2767	2653	0.7335	3798	0.9611
4382	1.2791	3166	0.8689	4070	1.0480
4334	1.2806	3613	0.9855	4129	1.0776
4581	1.3437	4131	1.1464	4499	1.1664
4912	1.4481	4253	1.2008	4792	1.2539
5091	1.5197	4312	1.2336	4926	1.3029
5193	1.5757	4334	1.2527	5499	1.4577
5269	1.6204	4688	1.3392	5722	1.5456
5565	1.7210	5705	1.6725	6840	1.8777
5811	1.8361	5904	1.8066	7257	2.2139
6131	1.9840	6067	1.9564	6714	2.3794
6314	2.1365	6610	2.1566	6835	2.6478
6336	2.2254	6174	2.3012	6800	2.9638

Note: The transverse load does not include the weight of the load beams and panels

Table No. I-2: Results for Load vs. Deflection for 8' GGS-GGS Panels

GGS-GGS Panel GG1 8'-0"	
Transverse Load (lbs.)	Average Displacement (in.)
4	0.0001
377	0.0940
892	0.2022
1297	0.2879
1381	0.3056
2508	0.5036
2393	0.5041
2622	0.5380
2768	0.5642
2794	0.5724
2801	0.5765
2833	0.5838
3533	0.6985
3788	0.7488
3901	0.7748
4068	0.8059
4528	0.8948
4709	0.9417
4799	0.9708
5048	1.0309

GGS-GGS Panel GG2 8'-0"	
Transverse Load (lbs.)	Average Displacement (in.)
7	0.0001
517	0.1161
794	0.1713
815	0.1771
808	0.1771
1886	0.3665
2086	0.4061
3060	0.5679
3448	0.6454
3506	0.6627
4658	0.8680
4901	0.9598
4869	0.9786
4850	0.9927
4834	1.0013
4793	1.0022
4760	1.0028
4732	1.0034
4710	1.0040
5340	1.1464

GGS-GGS Panel GG3 8'-0"	
Transverse Load (lbs.)	Average Displacement (in.)
9	0.0000
918	0.2053
1223	0.2727
1216	0.2740
1228	0.2777
1308	0.2929
1434	0.3157
1522	0.3322
1820	0.3846
2407	0.4940
2606	0.5343
2970	0.5992
3463	0.7022
3298	0.8499
3578	0.9584
3713	1.0145
3769	1.0502
3796	1.0749
4171	1.2039
4310	1.3331

Note: The transverse load does not include the weight of the load beams and panels

TABLE No. I-3: TRANSVERSE TEST RESULTS FOR 8' OSB-OSB PANELS

(does not include weight of load beams or panel itself)

SAMPLE NO.	MAX. LOAD (lbs.)	MAX. LOAD (psf)	MAX DEFL (in.)	PANEL SIZE (w x l)	UNSUP SPAN (in.)	FAILURE CHARACTERISTICS
OO1	6336	207	2.23	48" x 96"	92	Panels failed by some combination of foam shearing near panel ends; 24 ga. steel spline buckling near load beam; and/or OSB skin cracking near load beam.
OO2	6610	216	2.15	48" x 96"	92	
OO3	7257	237	2.21	48" x 96"	92	
Average	6734	220	2.20	Load Beams Weight = 157.7 lbs. (or 5.14 psf)		
defl of L/180 occurs at ~61 psf defl of L/240 occurs at ~44 psf defl of L/360 occurs at ~29 psf				Average Panel Weight = 113.6 lbs. (range = 112.4 to 114.7 lbs.) Average Panel Weight = 3.55 psf		

TABLE No. I-4: TRANSVERSE TEST RESULTS FOR 8' GGS-GGS PANELS

(does not include weight of load beams or panel itself)

SAMPLE NO.	MAX. LOAD (lbs.)	MAX. LOAD (psf)	MAX. DEFL (in.)	PANEL SIZE (w x l)	UNSUP SPAN (in.)	FAILURE CHARACTERISTICS
GG1	5048	165	1.03	48" x 96"	92	Panels failed by some combination of foam shearing near panel ends and 24 ga. steel spline buckling and/or pulling from foam near the ends.
GG2	5340	174	1.15	48" x 96"	92	
GG3	4310	141	1.33	48" x 96"	92	
Average (- GG3)	4900	160	1.17	Load Beams Weight = 157.7 lbs. (5.14 psf)		
defl of L/180 occurs at ~78 psf defl of L/240 occurs at ~59 psf defl of L/360 occurs at ~35 psf				Average Panel Weight = 113.6 lbs. (range = 112.4 to 114.7 lbs.) Average Panel Weight = 3.71 psf		

Note: Effective load carrying area of each panel = 48" x 92" = 30.67 sf

Table No. I-5: Average Results for Transverse Load vs. Deflection for 8' Panels

OSB-OSB Panels OO1, OO2, and OO3	
Transverse Load (lbs.)	Average Displacement (in.)
9	0.0012
885	0.2598
1138	0.3198
1411	0.3977
2495	0.6579
2687	0.7142
2692	0.7233
3705	0.9733
4226	1.1635
4198	1.1682
4404	1.2188
4653	1.3009
4902	1.3873
5346	1.5167
5495	1.5830
6037	1.7571
6312	1.9283
6263	2.0809
6405	2.2469
6433	2.4968

GGS-GGS Panels GG1, GG2, and GG3	
Transverse Load (lbs.)	Average Displacement (in.)
7	0.0000
604	0.1385
969	0.2154
1110	0.2463
1139	0.2534
1901	0.3877
1971	0.4086
2401	0.4794
2679	0.5314
2902	0.5764
3355	0.6596
3568	0.7143
3955	0.7931
3979	0.8638
4104	0.9115
4191	0.9408
4352	0.9826
4412	1.0067
4560	1.0596
4900	1.1701

Note: The transverse load does not include the weight of the load cell, load beams, and panel

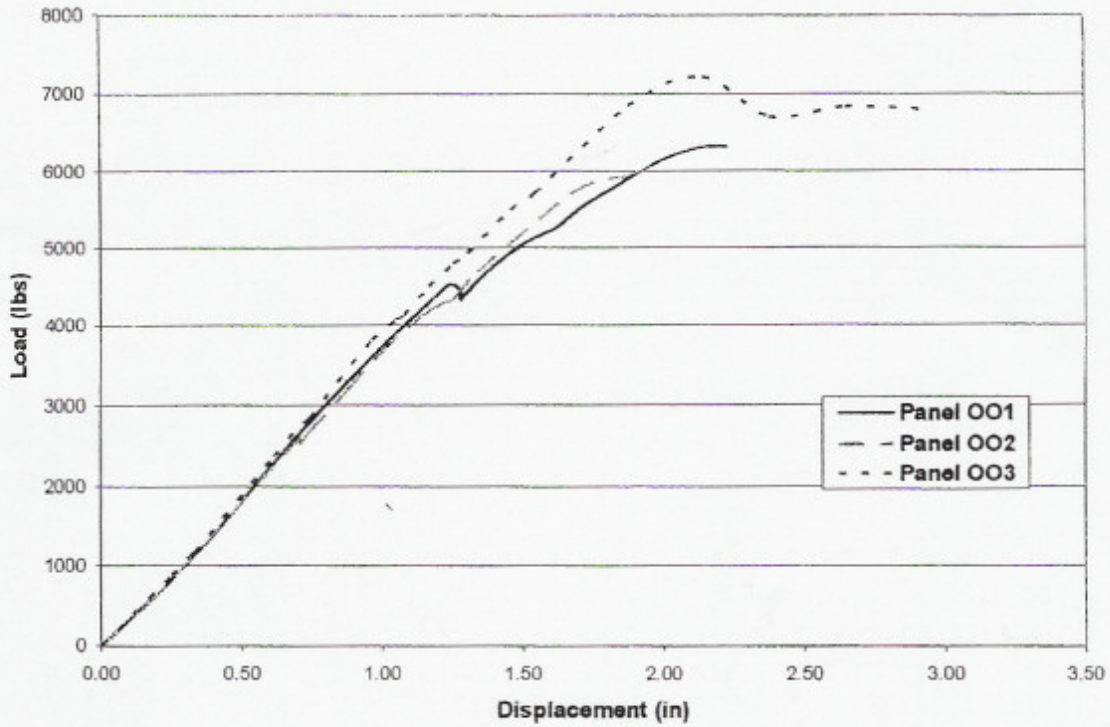


Figure No. I-2: Results for Transverse Load vs. Deflection for 8' OSB-OSB Panels

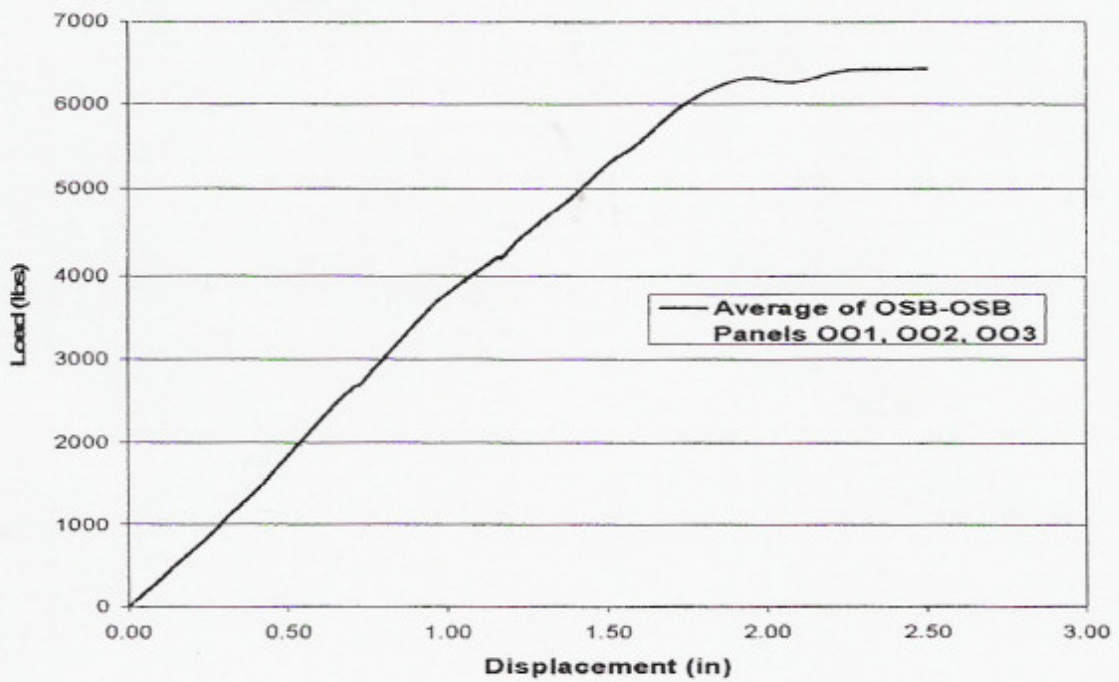


Figure No. I-3: Average Results for Transverse Load vs. Deflection, 8' OSB-OSB Panel

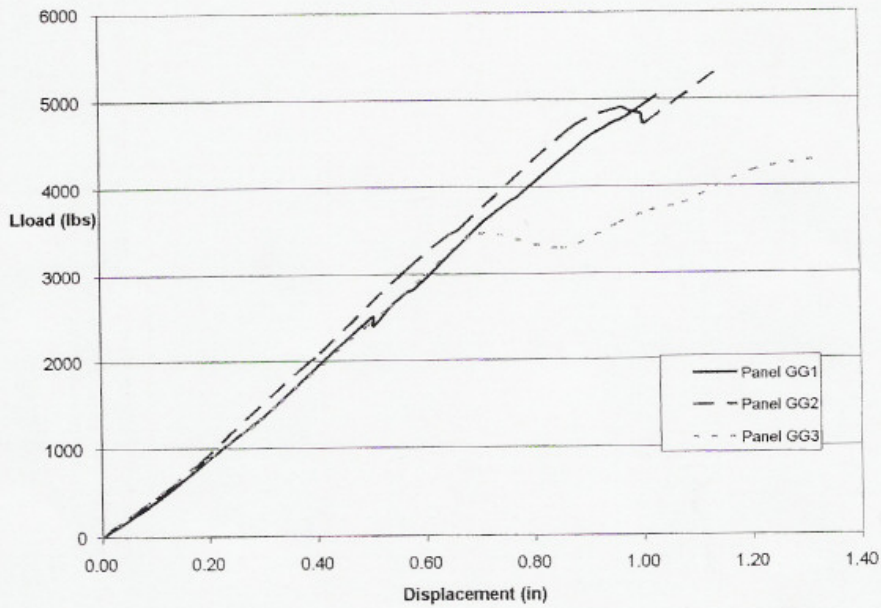


Figure No. I-4 Results for Transverse Load vs. Deflection for 8' GGS-GGS Panels

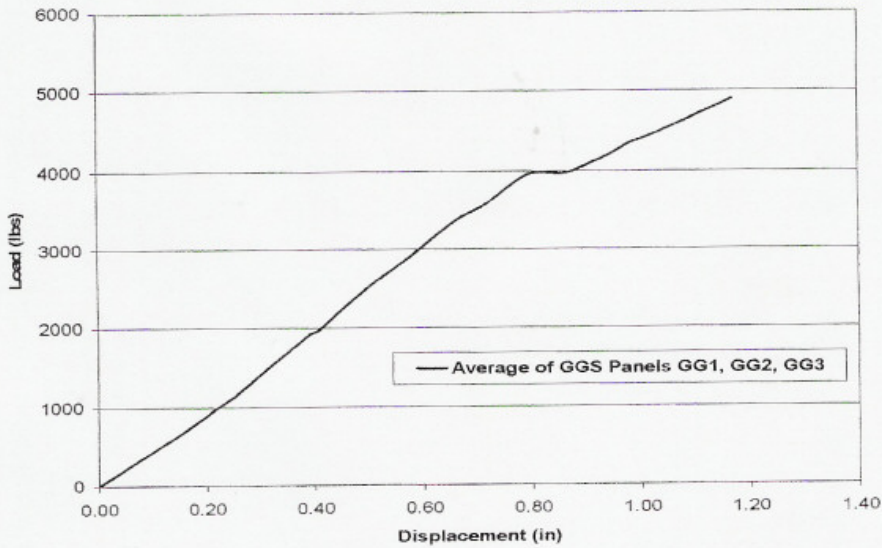


Figure No. I-5: Average Results for Transverse Load vs. Deflection for 8' GGS-GGS Panels

Discussion of Results

Representative results for individual panels and for averages for skin sets subjected to transverse loading are given in tables and figures referenced earlier. In these tables and figures, all panels in each skin set reveal similar load-deflection characteristics. That is, the flexural “stiffness” values (load/deflection) are in the range of 3500 to 4800 lb./in. for these 8’ panels. Calculations for these stiffness-type terms are presented below by choosing average load, P, and deflection, d, values from Table No. I-5 approximately half-way to the ultimate load value. These values are presented below in Table No. I-6.

Panel Type	Skin Orientation	Load, P (lbs.)	Deflection, d (in.)	“Stiffness”, $k=P/d$ (lb/in)
8’ OSB-OSB	OSB both faces	3705	0.9733	3807
8’ GGS-GGS	GGS both faces	2415	0.5221	4626

For each length panel, the “k” values for the GGS panels are greater than those of the OSB panels. These terms represent the average load required to generate 1” of deflection and can be seen as the slopes of the load-deflection curves. The greater flexural stiffness in the GGS panels is the result of the stiffer GGS skins being on of the panels. This greater stiffness is the result of a much higher modulus of elasticity for the steel (GGS) skins than for the OSB skins.

As shown below in Table No. I-7, the OSB panels failed at higher ultimate loads than did the GGS panels. The lower ultimate (failure) loads in the GGS panels often resulted from the sudden failure (buckling) of the aluminum spline along the panel edge. Generally, failure of all panels occurred from a combination of events but often occurred from crushing of the top skin in flexural compression, buckling of the aluminum spline, or tearing in the foam core. .

Panel Type	Skin Orientation	Load, P (lbs.)
8’ OSB-OSB	OSB both faces	6734
8’ GGS-GGS	GGS both faces	4900

Conclusions

Considering the maximum uniform load for each panel and a safety factor (failure load/allowable load) of 4.0, both the OSB panels and the GGS panels are able to safely sustain typical transverse wind loads. As shown in Table No. I-8 below, restricting deflections to L/360 permits a transverse wind load of 29 psf for the OSB panels and a wind load of 35 psf for the GGS panels. Both loadings exceed typical wind loads on low-rise structures.

Table No. I-8: Results at Key Deflection Limits

Initial Deflection (in.)	OSB-OSB Panels				GGS-GGS Panels			
	Load (psf)		Deflection (in.)		Load (psf)		Deflection (in.)	
L/180	61		0.51		78		0.51	
L/240	44		0.38		59		0.38	
L/360	29		0.26		35		0.26	
Loads (S.F. = 4.0)	Failure Load		Allowable Load		Failure Load		Allowable Load	
	(lbs.)	(psf)	(lbs.)	(psf)	(lbs.)	(psf)	(lbs.)	(psf)
	6734	220	6734	220	4900	160	1225	40

Based on the results presented in Table No. I-8 above, a deflection of L/180 would not be permitted for either panel because the load causing the deflection exceeds the allowable load for each panel. For the same reason, a deflection of L/240 would not be permitted for the GGS panels. To maintain a safety factor of 4.0 against failure load, deflections should be restricted to L/200 for OSB panels and L/315 for GGS panels.

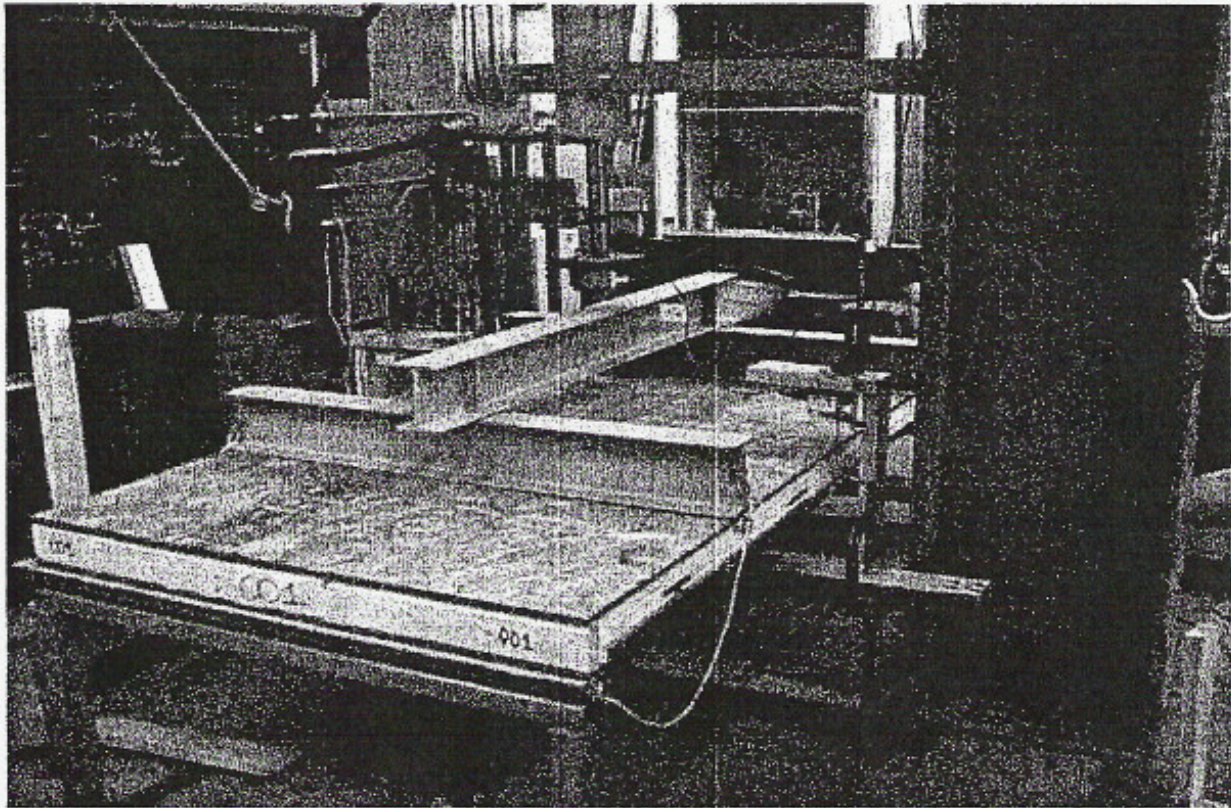


Photo No. I-1: Test Setup for Transverse Loading on 8' OSB-OSB Panel

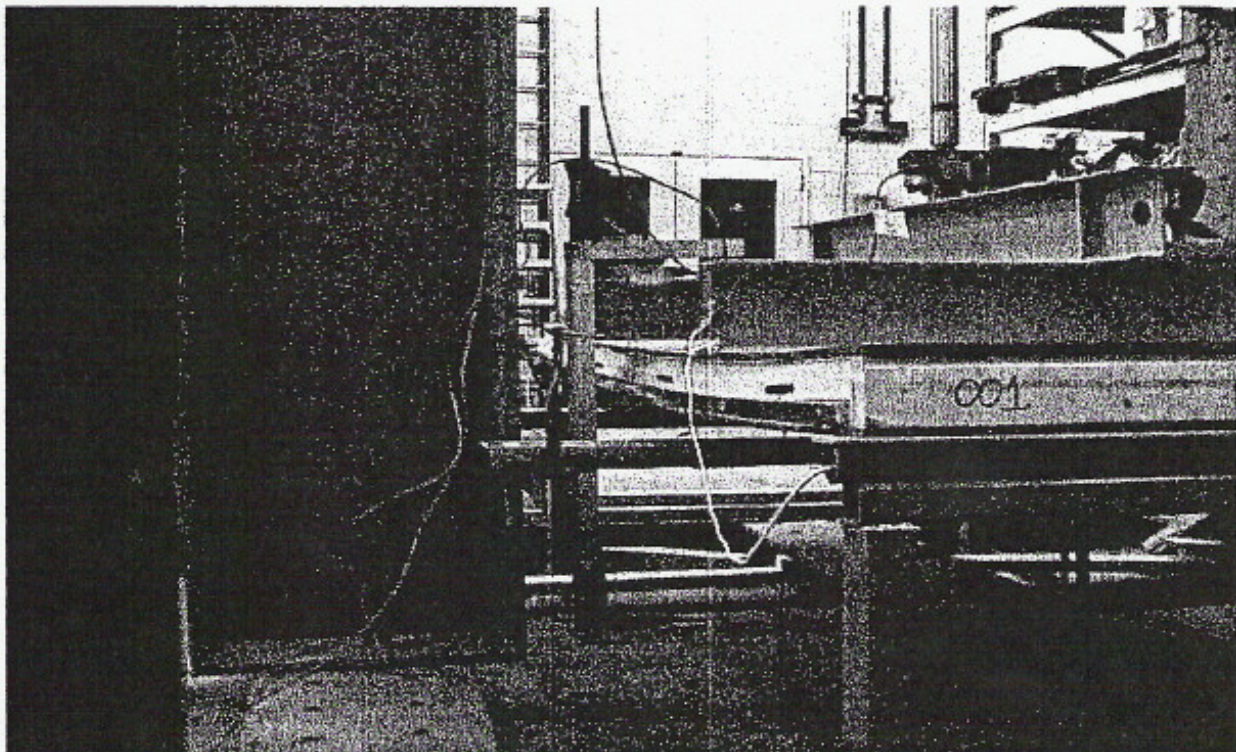


Photo No. I-2: Response of 8' OSB-OSB Panel to Transverse Loading

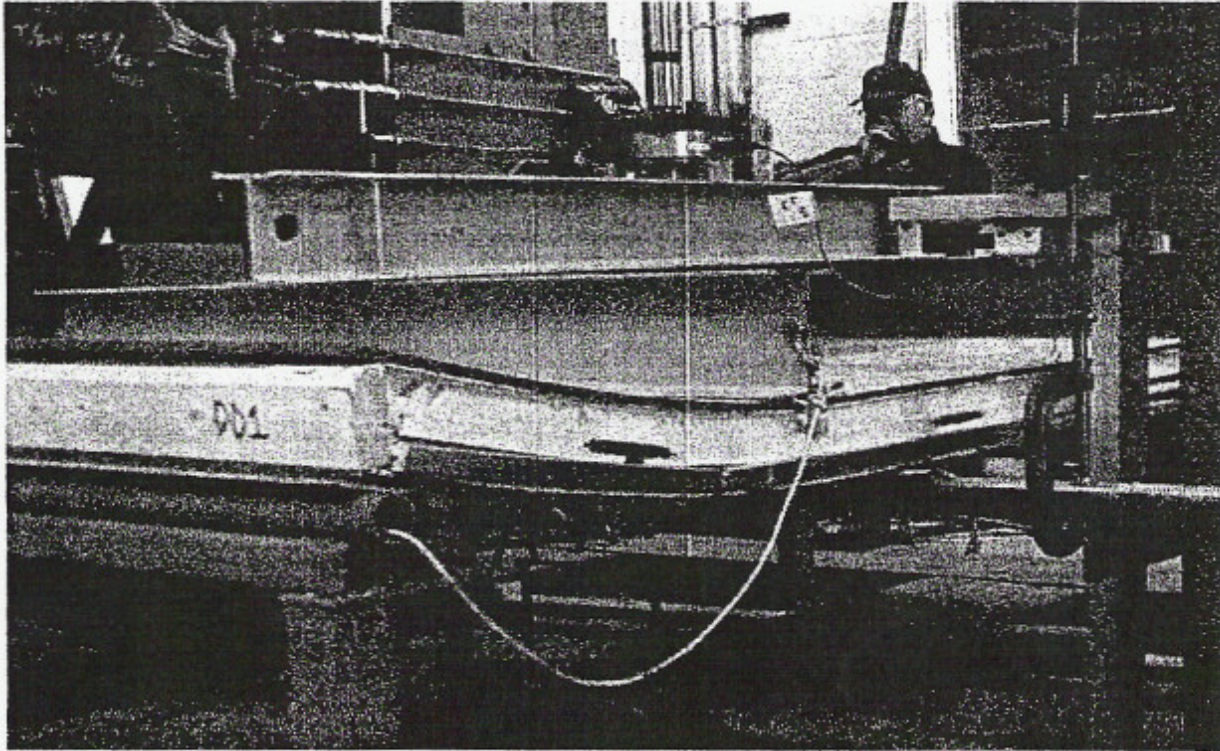


Photo No. I-3: Failure of 8' OSB-OSB Panel Under Transverse Loading

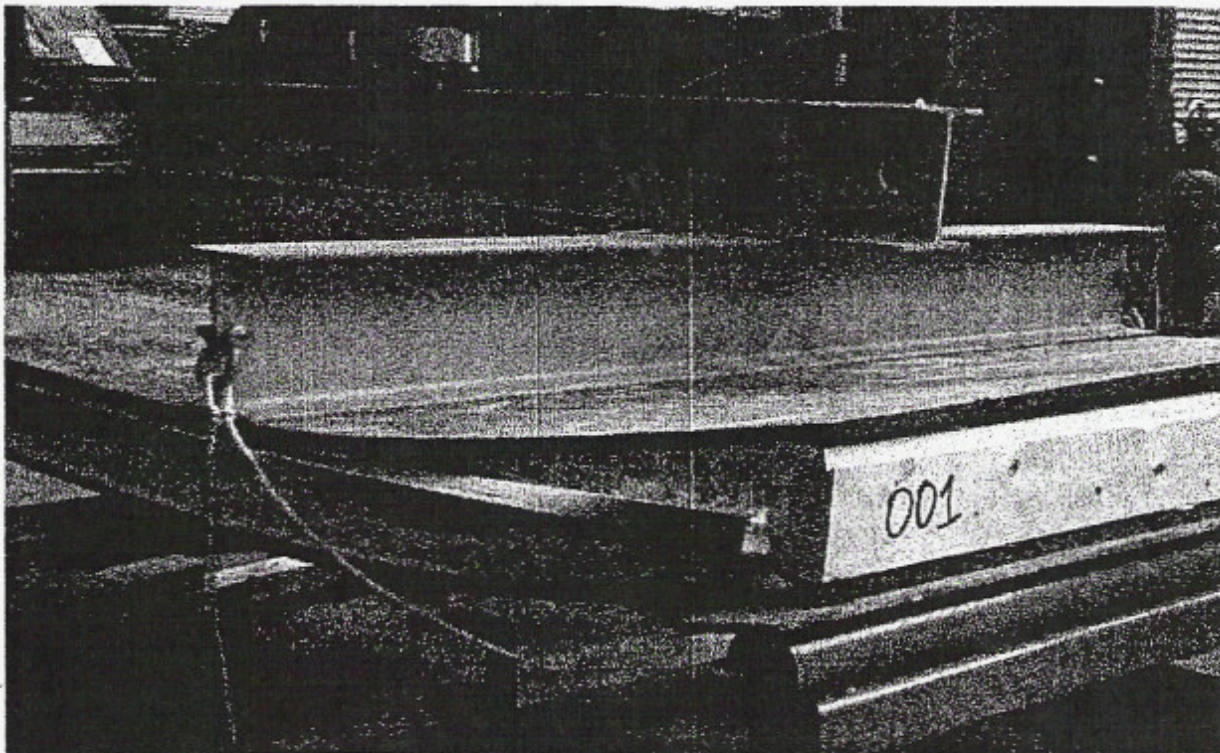


Photo No. I-4: Closeup of Failure of 8' OSB-OSB Panel Under Transverse Loading

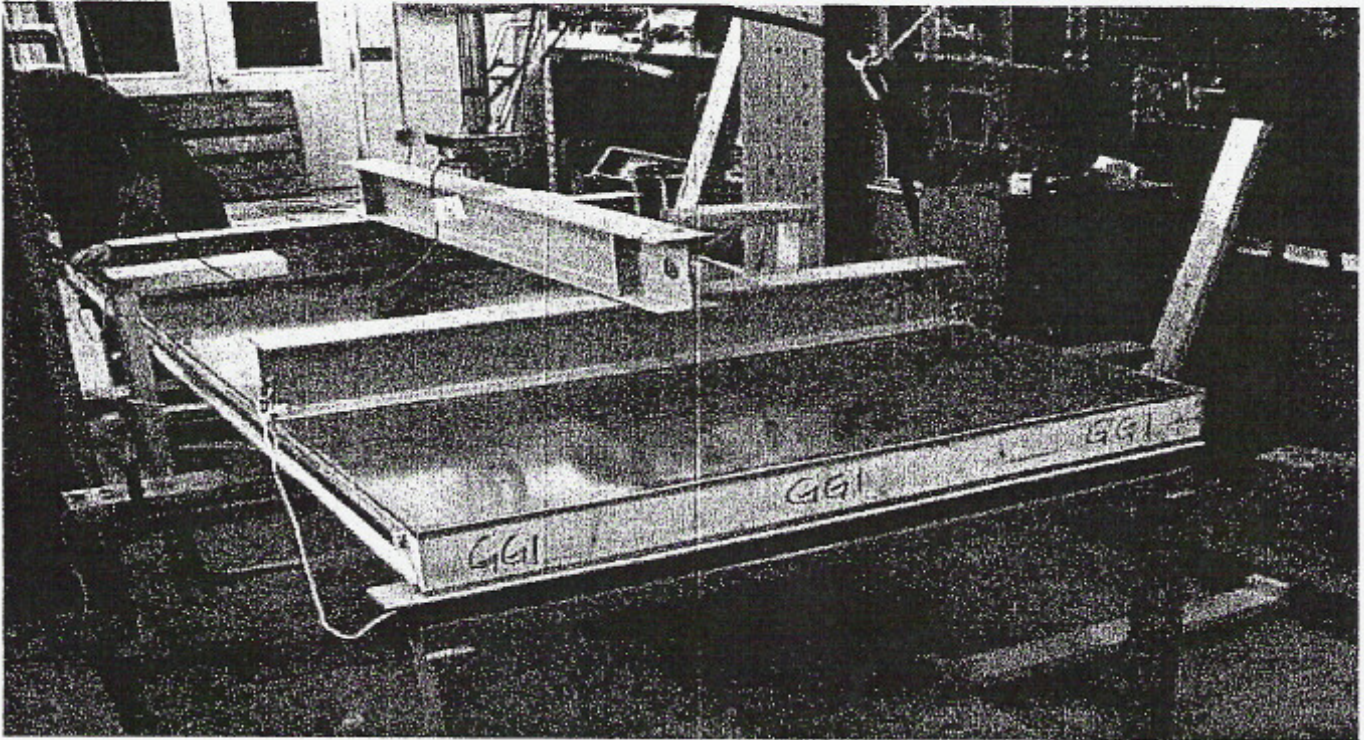


Photo No. I-5: Test Setup for Transverse Loading 8' Galv.-Galv. Panel

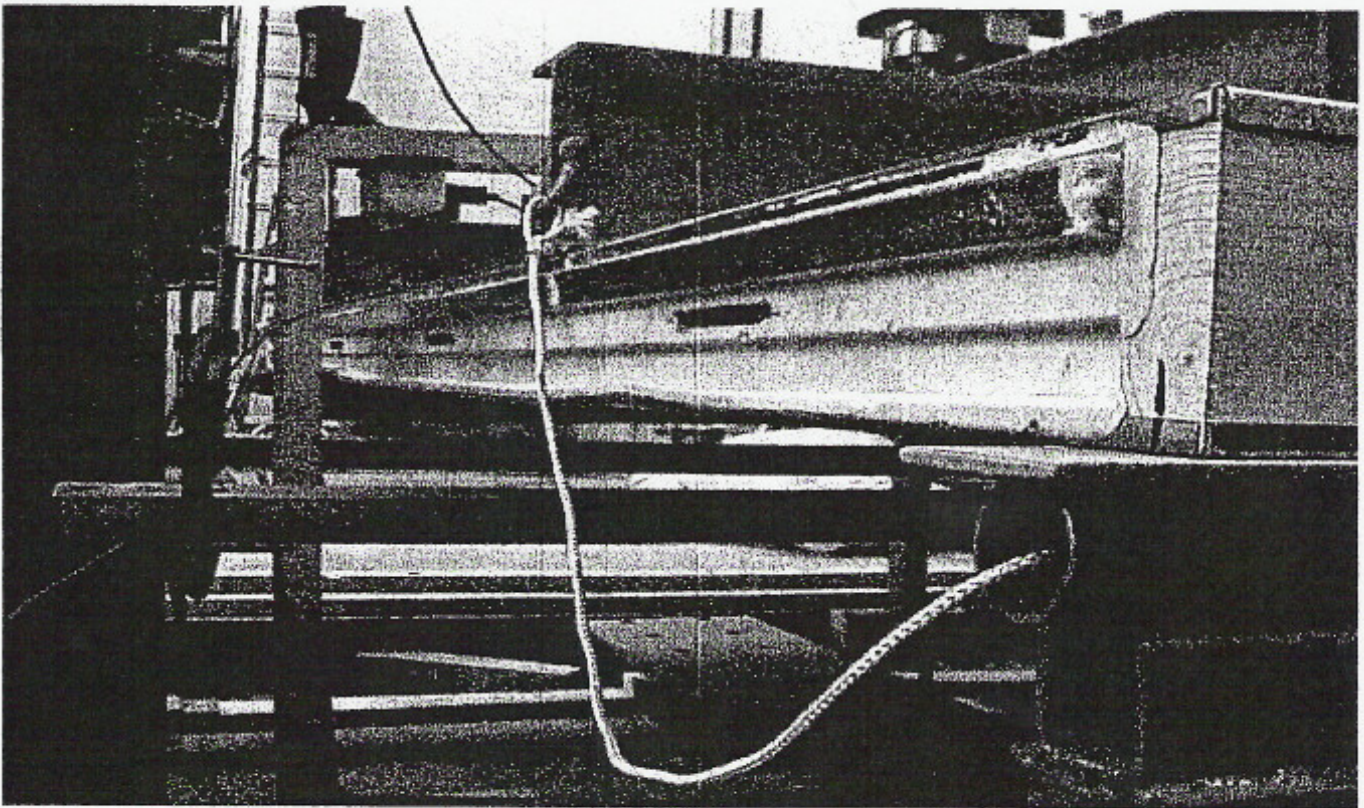


Photo No. I-6: Response of 8' Galv.-Galv. Panel Under Transverse Loading

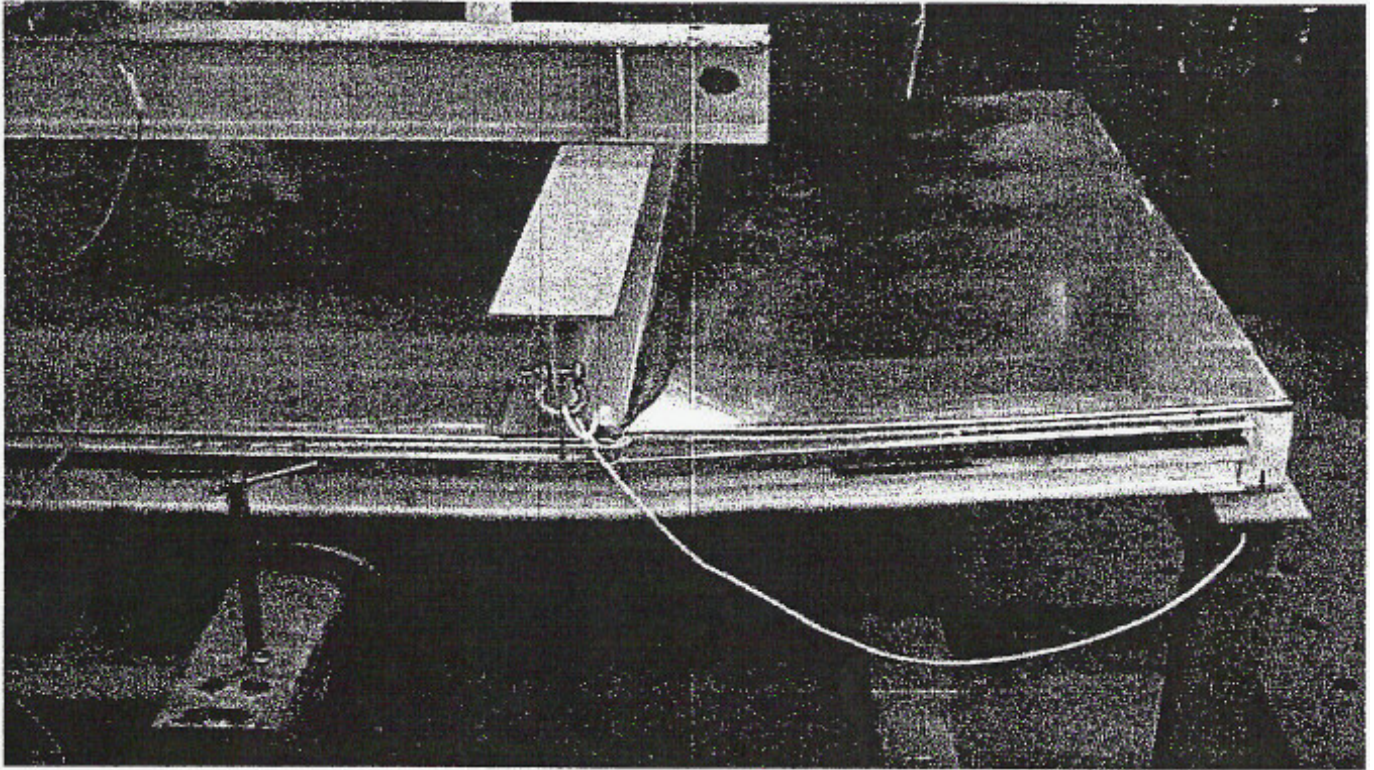


Photo No. I-7: Failure of 8' Galv.-Galv. Panel Under Transverse Loading

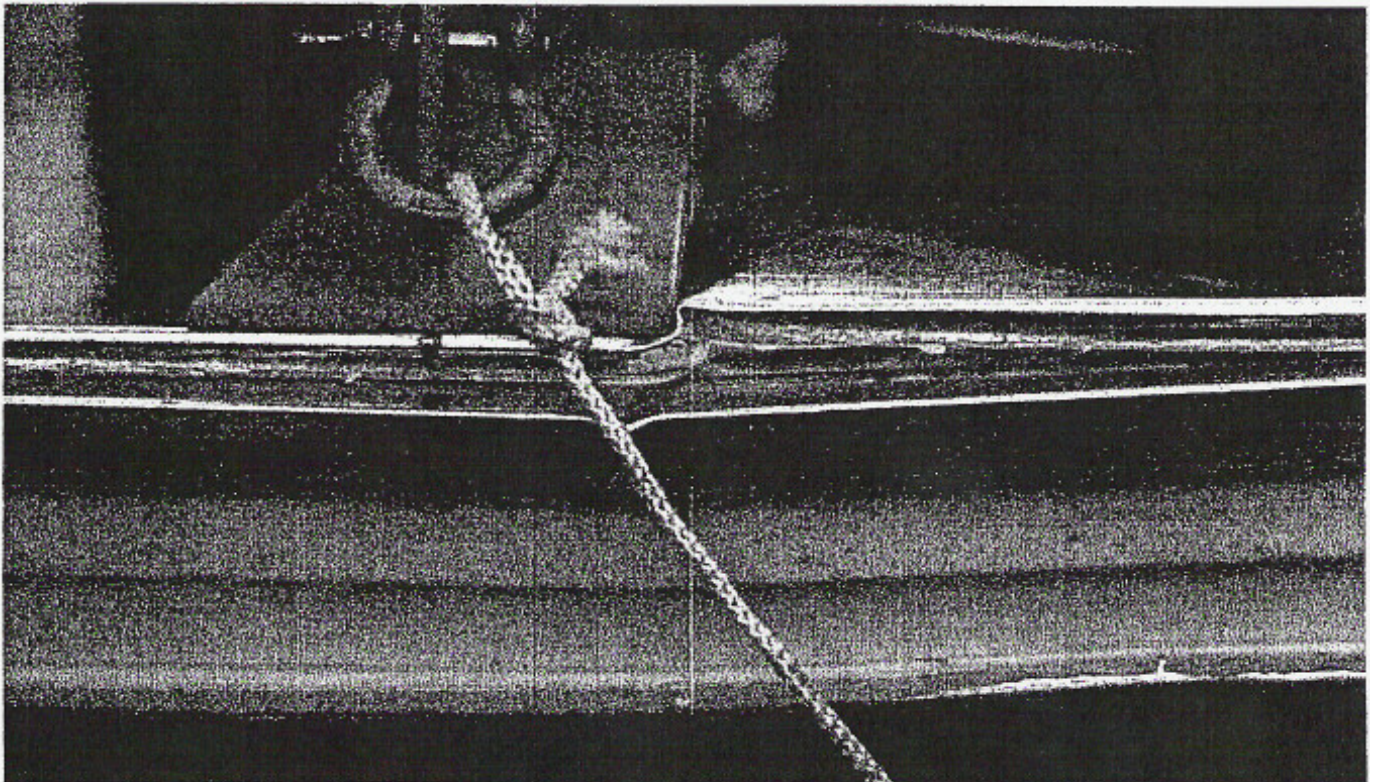


Photo No. I-8: Closeup of Failure of 8' Galv.-Galv. Panel Under Transverse Loading



REPORT NUMBER: 101098277SAT-001W
ORIGINAL ISSUE DATE: June 25, 2013
REVISED DATE:

EVALUATION CENTER
Intertek Testing Services NA Inc.
16015 Shady Falls Road
Elmendorf, TX 78112

RENDERED TO

NCFI Polyurethanes
1552 Woltz St.
Mt. Airy, NC 27030

TEST REPORT

Report of Testing "NCFI 23-119130" for compliance with the applicable requirements of the following criteria: ASTM E84-12c TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS (UL 723, UBC 8-1, NFPA 255)

ABSTRACT

Specimen I. D.	"NCFI 23-119130"	
Test Standard:	ASTM E84-12c TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS (UL 723, UBC 8-1, NFPA 255)	
Test Date:	June 21, 2013	
Client:	NCFI Polyurethanes	
Test Results:	FLAME SPREAD INDEX	15
	SMOKE DEVELOPED INDEX	300

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Darrell Gonzales

Darrell Gonzales
Technician II

June 25, 2013

Reviewed and approved:

Servando Romo

Servando Romo
Project Manager

June 26, 2013

Intertek

I. INTRODUCTION

This report describes the results of the ASTM E84-12c TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS a method for determining the comparative surface burning behavior of building materials. This test is applicable to exposed surfaces, such as ceilings or walls, provided that the material or assembly of materials, by its own structural quality or the manner in which it is tested and intended for use, is capable of supporting itself in position or being supported during the test period.

The purpose of the method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke density developed are reported, however, there is not necessarily a relationship between these two measurements.

“The use of supporting materials on the underside of the test specimen may lower the flame spread index from that which might be obtained if the specimen could be tested without such support... This method may not be appropriate for obtaining comparative surface burning behavior of some cellular plastic materials... Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed, results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place.”

This test method is also published under the following designations:

NFPA 255

UL 723

UBC 8-1

This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

Intertek

II. PURPOSE

The ASTM E84 (25 foot tunnel) test method is intended to compare the surface flame spread and smoke developed measurements to those obtained from tests of mineral fiber cement board and select grade red oak flooring. The test specimen surface (18 inches wide and 24 feet long) is exposed to a flaming fire exposure during the 10 minute test duration, while flame spread over its surface and density of the resulting smoke are measured and recorded. Test results are presented as the computed comparisons to the standard calibration materials.

The furnace is considered under calibration when a 10 minute test of red oak decking will pass flame out the end of the tunnel in five minutes, 30 seconds, plus or minus 15 seconds. The fiber cement board which complies with Annex A3 of the ASTM E 84 standard forms the zero point for both flame spread and smoke developed indexes, while the red oak flooring smoke developed index is set as 100.

III. TEST PROCEDURE

The tests were conducted in accordance with the procedures outlined in the ASTM E84. The specimens are placed directly on the tunnel ledges. As required by the standard, one or more layers of 0.25 inch thick reinforced concrete board are placed on top of the test sample between the sample and the tunnel lid. After the test, the samples are removed from the tunnel, examined and disposed of.

IV. REVISION SUMMARY

DATE	SUMMARY
June 25, 2013	Original



V. DESCRIPTION OF TEST SPECIMENS

Date Received:	6/10/2013
Date placed in the conditioning room:	6/10/2013
Conditioning (73°F & 50% R.H.):	11 days
Specimen Width (in):	24
Specimen Length (ft):	24
Specimen Thickness (in):	6.00
Total Specimen Weight (lbs):	60

Specimen Description:

The specimen was described by the client as “Polyurethane foam”.

The 24-ft. long test specimen consisted of three 8-ft. long foam panels. A picture of the sample is provided below.

The product was received by our personnel in good condition and given an identification number of SAT1306130902-004.

Mounting Method:

The specimen was self-supporting. The sample was the same on both sides.



Intertek

VI. TEST RESULTS & OBSERVATIONS

The test results, computed on the basis of observed flame front advance and electronic smoke density measurements are presented in the following table.

Test Specimen	Flame Spread Index	Smoke Developed Index
"NCFI 23-119130"	15	300

The data sheets are included in Appendix A. These sheets are actual print-outs of the computerized data system which monitors the tunnel furnace, and contain all calibration and specimen data needed to calculate the test results.

VII. OBSERVATIONS

During the test, the specimen was observed to behave in the following manner.

Time (min:sec)	Observations
0:00	The test burners were turned on.
0:03	Steady ignition was observed.
1:36	Cracking was observed.
4:40	Sagging was observed.
10:00	The test burners were shut off.

After the burners were shut off a 60+ after flame was observed.

After the test, the specimen was observed to be damaged as follows:

Distance (FEET)	Damage Descriptions
0 - 10	The specimen was heavily charred.
10 - 15	The specimen charred.
15 - 19	The specimen surface was charred.
19 - 24	The specimen surface was lightly charred.



APPENDIX A

ASTM E84 DATA SHEETS



TEST RESULTS

FLAMESPREAD INDEX: 15
SMOKE DEVELOPED INDEX: 300

SPECIMEN DATA . . .

Time to Ignition (sec): 3
Time to Max FS (sec): 403
Maximum FS (feet): 3.4
Time to 980 F (sec): Never Reached
Time to End of Tunnel (sec): Never Reached
Max Temperature (F): 659
Time to Max Temperature (sec): 582
Total Fuel Burned (cubic feet): 48.39

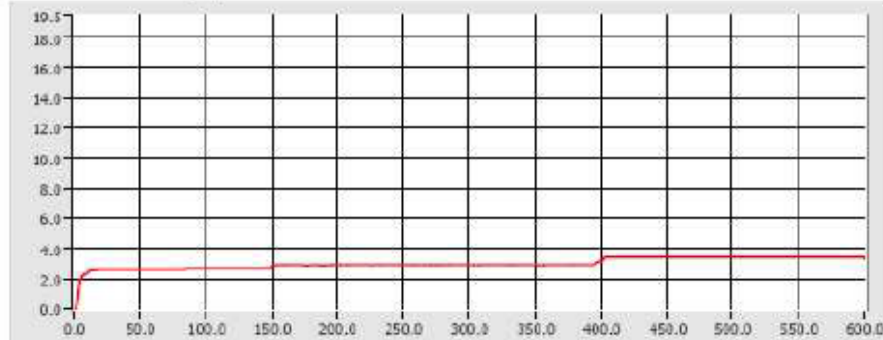
FS*Time Area (ft*min): 29.9
Smoke Area (%A*min): 274.3
Unrounded FSI: 15.4

CALIBRATION DATA . . .

Time to Ignition of Last Red Oak (Sec): 42.0
Red Oak Smoke Area (%A*min): 85.1



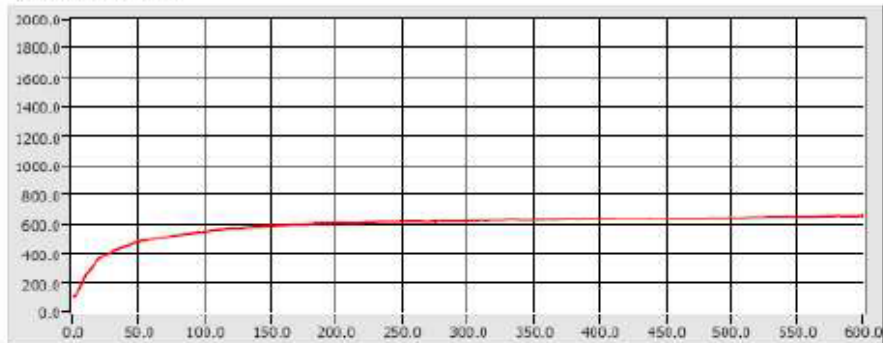
FLAME SPREAD (ft)



Smoke (%A)



Temperature (°F)



Time (sec)

600



A. SYSTEM DESCRIPTION

1. Wall Type 1A
 - a. Load bearing polyurethane Structural Insulated Panels (SIPs) with ½" GWB on the interior, tongue & groove wood siding for the exterior finish. SIP sheathing will be ZIP-system sheathing with integrated weather barrier.
2. Wall Type 1B
 - a. Load bearing polyurethane Structural Insulated Panels (SIPs) with ½" GWB on the interior, LP SmartSide siding for the exterior finish. SIP sheathing will be ZIP-system sheathing with integrated weather barrier.
3. Wall Type 2A
 - a. Load bearing 2x6 conventionally framed walls with ½" GWB on the interior, LP SmartSide siding for the exterior finish. Sheathing will be ZIP-system sheathing with integrated weather barrier.
4. Wall Type 2B
 - a. Load bearing 2x6 conventionally framed walls with ½" GWB on the interior, tongue & groove wood siding for the exterior finish. Sheathing will be ZIP-system sheathing with integrated weather barrier.
5. Wall Type 3A
 - a. Load bearing 2x6 conventionally framed walls with ½" GWB on the interior, LP SmartSide siding for the exterior finish. Sheathing will be ZIP-system sheathing with integrated weather barrier.
6. Wall Type 4A
 - a. Sunroom. Glass walls, aluminum frame, polycarbonate roof.

B. FUNCTIONAL REQUIREMENTS

1. Provide Exterior Wall assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. Maximum Air Infiltration Rate
 - a. The wall system shall be sealed to allow at most 0.05 CFM@ 50Pa/sf.
3. Heat Transfer – design R- values for walls facing the conditioned space of the home:
 - a. R-40 (ft²-F-h/Btu)

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Refer to Manufacturer's Product Data sheets provided at the end of this section where indicated.
 - a. Horizontal tongue & groove wood siding for wall type 1A
 - b. LP SmartSide siding for wall type 1B
3. Furring Strips
 - a. Common 1x dimensional lumber furring strips placed vertically as needed along the wall.
4. Weather Barrier
 - a. Integrated weather barrier in 7/16" ZIP System sheathing
5. SIP Panels
 - a. Eco-Panel Structurally Insulated Panel system. Refer to section B 1040 for wall construction.
6. Standard GWB
 - a. ½" GWB to meet the thermal barrier requirements of IRC R316.

B 2020

EXTERIOR WINDOWS

A. SYSTEM DESCRIPTION

1. Window Type 1
 - a. Triple pane windows with a thermally broken frame meeting all functional requirements below. A window shall be deemed Type 1 if it is between the finished square footage, as determined by the U.S. Department of Energy Solar Decathlon 2017 rules, and the exterior of the building.
2. Window Type 2
 - a. Glazing not meeting functional requirements 2 and 3 below. All windows not deemed Type 1 shall be deemed type 2.

B. FUNCTIONAL REQUIREMENTS

1. Provide Exterior window assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. Maximum U-Value for Type 1:
 - a. 0.3 (Btu/ft²-F-h)
3. SHGC Coefficient = ~0.35
4. Provide safety glazing at all hazardous locations as required by code (IRC R308).

C. COMPONENTS

1. Exterior windows shall consist of components meeting the functional requirements for Type 1 and Type 2 windows and approved by the Architect in the quantities and sizes outlined in the Window Schedule on Sheet A-601 in the construction drawings.
2. Exterior Sunroom enclosure to be provided by Pool & Spa Enclosures, LLC or equivalent product as the Corso Glass patio enclosure.

B 2050

EXTERIOR DOORS

A. SYSTEM DESCRIPTION

1. Exterior Door Type 1A
 - a. An insulated swing door between the finished square footage, as determined by the U.S. Department of Energy Solar Decathlon 2017 rules, and the exterior.
2. Exterior Door Type 1B
 - a. An exterior swing door that meets all code requirements for IRC R302.5.
3. Exterior Door Type 2
 - a. A multi-pane sliding glass door.
4. Exterior Door Type 2B
 - a. An exterior sliding glass door.

B. FUNCTIONAL REQUIREMENTS

1. Provide Exterior door assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. Provide safety glazing at all hazardous locations as required by code (IRC R308).

C. COMPONENTS

1. Exterior doors shall consist of components meeting or exceeding the functional requirements for each type of door and approved by the Architect in the quantities and sizes outlined in the Window Schedule on Sheet A-601 in the construction drawings.



ZIP SYSTEM® SHEATHING

MANUFACTURER

Huber Engineered Woods LLC
10925 David Taylor Drive, Suite 300, Charlotte, NC 28262
800.933.9220 • Technical Service: 800.933.9220 x2716
ZIPSystem.com • HuberArchitectLibrary.com

BASIC USE AND APPLICATIONS

ZIP System Roof and Wall sheathing panels are oriented strand board (OSB), wood structural panels with built-in protective overlays that eliminate the need for building wrap or roofing felt. Install the panels, tape the seams with Huber's ZIP System tape, and the building is rough dried-in. A wide range of roof coverings and wall claddings can be installed directly over ZIP System sheathing.

When used on a wall, ZIP System sheathing functions as a combination wall sheathing, code-recognized water-resistive, and air barrier. The sheathing panel seams are sealed with ZIP System tape, protecting the wall from water intrusion.

When Huber's ZIP System sheathing is utilized for roof applications, felt underlayment is not required. In wall and roof coverings system requiring multiple layers of water-resistive barriers or underlayment, ZIP System is intended to replace on the first layer.

ZIP System sheathing uses a tough, phenolic resin-impregnated overlay to provide permanent weather resistance, in contact with a proprietary seam tape that has been extensively tested for long-term adhesion and flexibility. This combination meets performance requirements for Grade D weather-resistive barriers in accordance with ICC Acceptance Criteria AC38.

ZIP System sheathing may be used for roofs and walls in Type V construction, in Type III construction as roof sheathing only, and other construction permitted under the International Residential Code.

AVAILABLE SIZES

ZIP System Roof and Wall sheathing panels are available in 4' x 8' sheets with self-spacing edge profiles and tongue and groove edge profile (5/8 only). ZIP System panels are Exposure 1 rated and are available in the following span ratings and performance categories.

- 24/16, Structural 1, 7/16 PERF CAT (4' x 8, 9 and 10')*
- 32/16, Structural 1, 1/2 PERF CAT
- 40/20, Structural 1, 5/8 PERF CAT

Longer length panels are available for wall applications. Third party independent testing for ZIP System Roof and Wall sheathing is conducted by Timberco, Inc. (TECO).



ZIP System Benefits

Superior Moisture Resistance	Continuous vapor permeable moisture barrier that blocks out liquid water but still allows walls to dry out
Ease of Installation	No more delays because of felt or building wraps blowing off
Energy Efficient	Code-recognized built in weather and air barrier

LIMITATIONS

When used as roof sheathing, ZIP System sheathing is limited to roofs with slopes of 2:12 (16.67 percent) or greater. Felt underlayment is not required on the roof. In roof covering systems requiring multiple layers of underlayment, ZIP System sheathing is intended to replace only the first layer. In wall covering systems requiring multiple layers of water-resistive barriers, ZIP System sheathing is intended to replace only the first layer.

ZIP System sheathing should not be used with adhesively-attached EIFS, but can be used with mechanically attached EIFS. Avoid exposing ZIP System sheathing for more than 180 days.

SUSTAINABLE DESIGN CONTRIBUTIONS

- Low-Emitting Material: No added urea formaldehyde
- Sustainable Forestry Initiative Certified Wood: Harvested, transported, manufactured, and distributed utilizing sustainable practices
- Renewable Forest Resources: Composed of primarily young growth bio-based resources
- Regional Materials: Made in the United States at one of our 4 regional manufacturing facilities: Broken Bow, OK; Commerce, GA; Crystal Hill, VA; and Easton, ME

POTENTIAL LEED CREDIT CONTRIBUTIONS

- Credit IEQ 4.4 Low-Emitting Materials, Composite Wood and Agrifiber: AdvanTech contains no added urea formaldehyde
- Credit MR 5.1 or 5.2 Regional Materials: Materials harvested, processed, and manufactured within 500 miles of project site.
- Credit MR 2.2 Environmentally Preferable Products – Local Production (LEED for Homes)
- EA 3 Air Infiltration – Meet air leakage requirements

SUBSTRATE

Before beginning installation, verify wood wall framing is properly spaced and aligned to continuously support panel edges.

PANEL INSTALLATION

Install ZIP System sheathing in accordance with:

- ZIP System Sheathing Installation Manual
- ICC-ES ESR-1473
- ICC-ES ESR-1474
- Requirements of authorities having jurisdiction

When used as roof sheathing, install panels with moisture barrier surface facing out, with long edge perpendicular to framing members, and with short edges fully supported. Stagger short edge seams. Long edges are self-spacing; 4-foot panel edges should be spaced manually approximately 1/8-inch (3 mm) apart.

When used as wall sheathing, install panels positioned with the water-resistive barrier facing out. The panels may be installed with the long side of the panel oriented either horizontally or vertically to the framing members. Walls that are designed to resist lateral shear forces and sheathed with wood structural panels typically require solid framing or blocking behind all panel edges. Long edges are self-spacing; 4-foot panel edges should be manually spaced approximately 1/8-in (3 mm) apart.

Fasteners:

Install fasteners approved by applicable building codes. Install fasteners 3/8-inch (9.5 mm) from panel edges. Space fasteners 6-inches (152 mm) on centers on supported panel ends and 12-inches (305 mm) on center at intermediate supports unless otherwise specified. ZIP System panels have a printed fastening guide for 16-inch (406 mm) and 24-inch (610 mm) on center fasteners locations.

Tape Installation:

Install ZIP System tape in accordance with manufacturer's written instructions as seams, openings, and penetrations. Install windows and window flashing in accordance with window manufacturer's written instructions. Details of installation recommendations are available in AutoCAD and PDF formats at ZIPSystem.com or HuberArchitectLibrary.com.

STORAGE AND HANDLING

Store and handle products according to manufacturer's written recommendations. Support panel bundles off the ground. Cover stored panels with weatherproof protective material; allow sides of protective material to remain loose to ensure adequate air circulation. In high-moisture conditions, cut bundle banding to prevent edge damage to panels. Factory applied packaging is intended only for protection during transit.

AVAILABILITY

Huber Engineered Wood's ZIP System Roof and Wall sheathing panels are manufactured at multiple locations in the U.S. They are available through distributors nationwide. Visit ZIPSystem.com or contact Huber Engineered Woods for a retailer near you.

WARRANTY

ZIP System Roof and Wall sheathing is furnished with a 30-year system warranty as well as a 30-year warranty against manufacturing defects. Visit ZIPSystem.com for limitations and restrictions.

NOTES AND LIMITATIONS

- Do not use on roof with slopes less than 2:12
- Do not install ZIP System tape in temperatures less than 20° F
- Roof panels edge clips are only required with 7/16 inch thick ZIP System sheathing on supports spaced greater than 16-inches oc. Panel edge clips approved to be used with ZIP System Sheathing are: Simpson Strong-Tie®, PSCA, PSCL and Tamlyn™ PCS models

TECHNICAL SERVICE

Detailed information including specifications, product literature, test reports, installation instructions, and special applications is available through Huber Engineered Woods. Please visit ZIPSystem.com or call 800.933.9220 EXT 2716 to speak to a technical representative.

AVAILABLE RESOURCES

Section 06 16 13 SHEATHING guide specifications ZIP System Roof and Wall Sheathing products in CSI 3-part format is available in MasterSpec®, ARCAT.com, BSD SpecLink®, at ZIPSystem.com, and HuberArchitectLibrary.com.

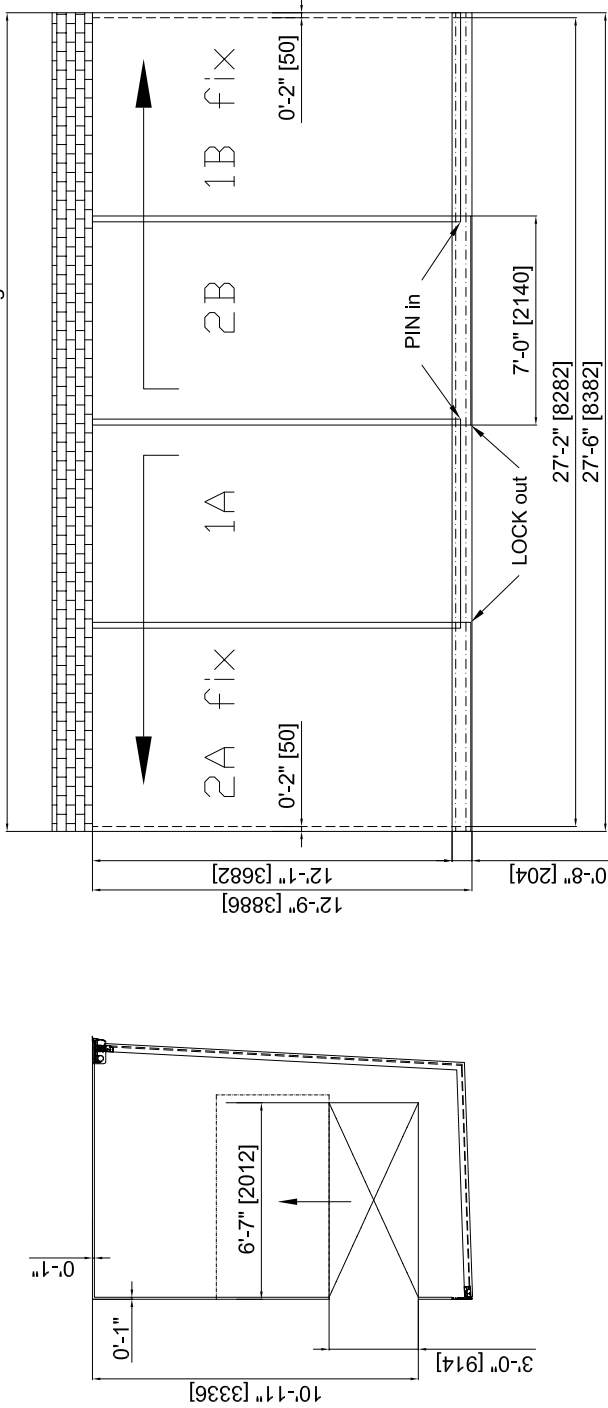
ZIP System Sheathing Performance Properties		
Exposure Durability Classification	DOC PS 2	Exposure 1
Panel Grade	DOC PS 2	Structural 1*
Moisture Barrier	AC38	Grade D WRB
Water Penetration	ASTM E331	Passed
Vapor Transmission	ASTM E96-B (panel overlay)	12-16 perms
Air Barrier Assembly	ASTM E2357	0.037 L/(s*m2)
Air Barrier Material	ASTM E2178	0.0016 L/(s*m2) @300 Pa
Wind Driven Rain	TAS 100 (at 100 mph)	Passed

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*Note: 4' x 8' 7/16" ZIP System "Structural 1" panels are not available in all areas of the country. Please check with your local supplier for availability in your area.

800.933.9220 | ZIPsystem.com

27'-6" [8382] mm
Rail STYLE with roof + without gutter



POOL & SPA USA - HOUSE BY NORTHWESTERN model CORSO ULTIMA (modif.1)

PROFILE: 2x GLASS, antique brown
RAILS - ground: PROGRES, Bronze anodized
RAILS - wall: STYLE (roof + without gutter), Silver anodized

PC: roof: compact PC 6 mm clear
faces+sides PANORAMA: safety glass 33.1

FACE No.1A: 1 pce inner fixed face with single shifting door, without doorsill, doublesides lock + inner sliding mesh screen with inner lock
FACE No.1B: 1 pce inner fixed face with single shifting door, without doorsill, doublesides lock + inner sliding mesh screen with inner lock
LATERAL DOOR: none

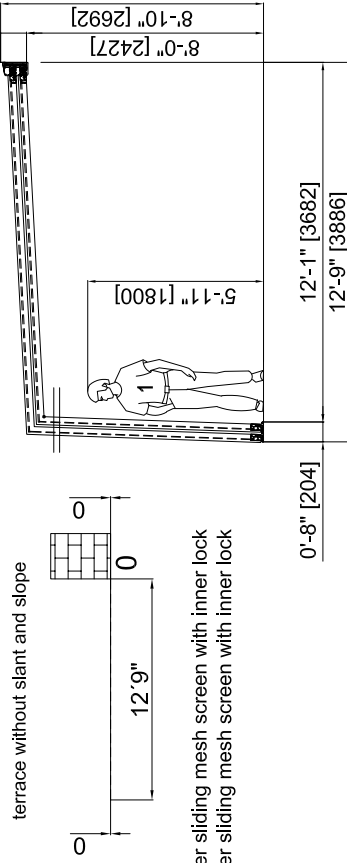
FOIL EPDM (black): none - profile U
ARRESTMENT: FORTIS (see in drawing)

! BASEMENT TYPE - GROUND: - Wood (thickness 64 mm / 2 1/2'')

! BASEMENT TYPE - WALL: - Wood SIP Panels (thickness 162 mm / 6 3/8'')

ACCESS ROAD FOR TRUCK WITH A TRAILER - YES / NO

SAVE PATH: P:_zakazky 2017\Pool & Spa (USA)_nabidky\CRS\Ult_3886x8382x2692_House by Northwestern\CRS\Ult_3886x8382x2692_House by Northwestern.dwg



B30
B 3010

EXTERIOR HORIZONTAL CONSTRUCTION
ROOFING

A. SYSTEM DESCRIPTION

1. The roofing system shall consist of a water resistive barrier and exterior roof finish applied to the exterior of the roof structure components, as specified in section B1030.

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Water resistive barrier
 - a. A membrane such as Ice and Water Shield, or equivalent approved by the Architect.
3. Roofing Finish
 - a. Composed of a membrane roof system and tapered insulation for drainage on the flat portion of the roof, with a thermoplastic single-ply membrane with protective walking surface on the flat portion. The sloped portion of the roof be comprised of asphalt shingles and GAF Decotech solar panel finish. Roof materials and assemblies must comply with IRC Chapters 8 and 9. Watertight joint assemblies will be used where the modules come together for the vertical wall and horizontal roof joints.
4. Roof Drain Assembly
 - a. A roof drain assembly that meets the functional requirements for roofing, approved by the Architect. Drainage will be off of the South face of the building.

B 3040

TRAFFIC BEARING HORIZONTAL SURFACES

A. SYSTEM DESCRIPTION

1. Wood exterior decking attached to the house.
2. Wood ramps for access to the entry level of the home.

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products

that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Dimensional Lumber

- a. Standard dimensional lumber shall be the primary component for decking and ramps. The sizing and spacing of shall be as shown in the structural drawings.

C10 INTERIOR CONSTRUCTION

C 1010 INTERIOR PARTITIONS

A. SYSTEM DESCRIPTION

1. This system consists of a modular interior partition system. It is a mix of face tiled wall and glass interior wall partitions
 - a. Standard Wall Thickness of 4"
 - b. Module Width of 48"
2. Some partitions are made of 3-5/8" metal framing with gypsum wall board or Tile Backer covering.

B. FUNCTIONAL REQUIREMENTS

1. Provide interior partition products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Aluminum Frame Interior Partitions
 - a. See product data sheet CSI# 10 22 00.
2. Interior Partition Tiles
 - a. See product data sheet CSI# 10 22 23.

C 1030 INTERIOR DOORS

A. SYSTEM DESCRIPTION

1. Interior doors that integrate with the modular interior partition system. These consist of both sliding and swing interior doors.

B. FUNCTIONAL REQUIREMENTS

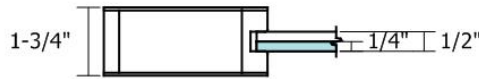
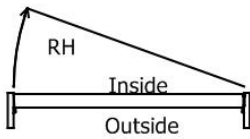
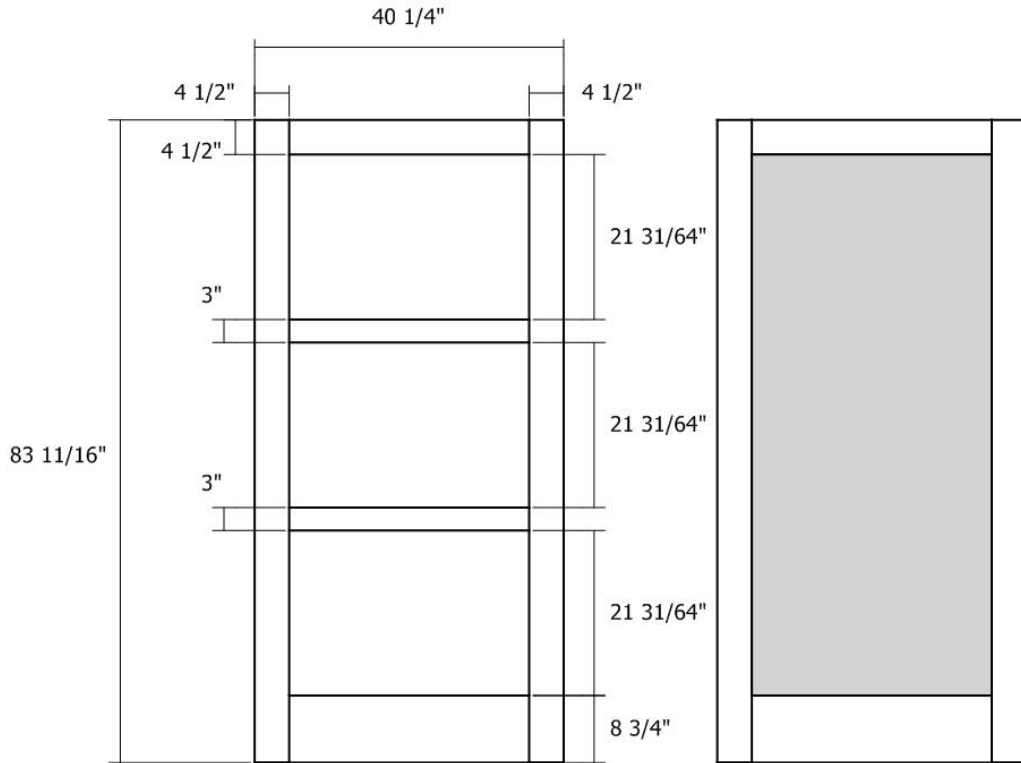
1. Provide interior doors that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Sliding Doors
 - a. See product data sheet CSI# 08 13 16.
2. Pivot Doors
 - a. See product data sheet CSI# 08 13 16.

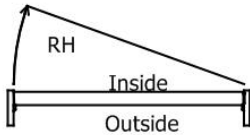
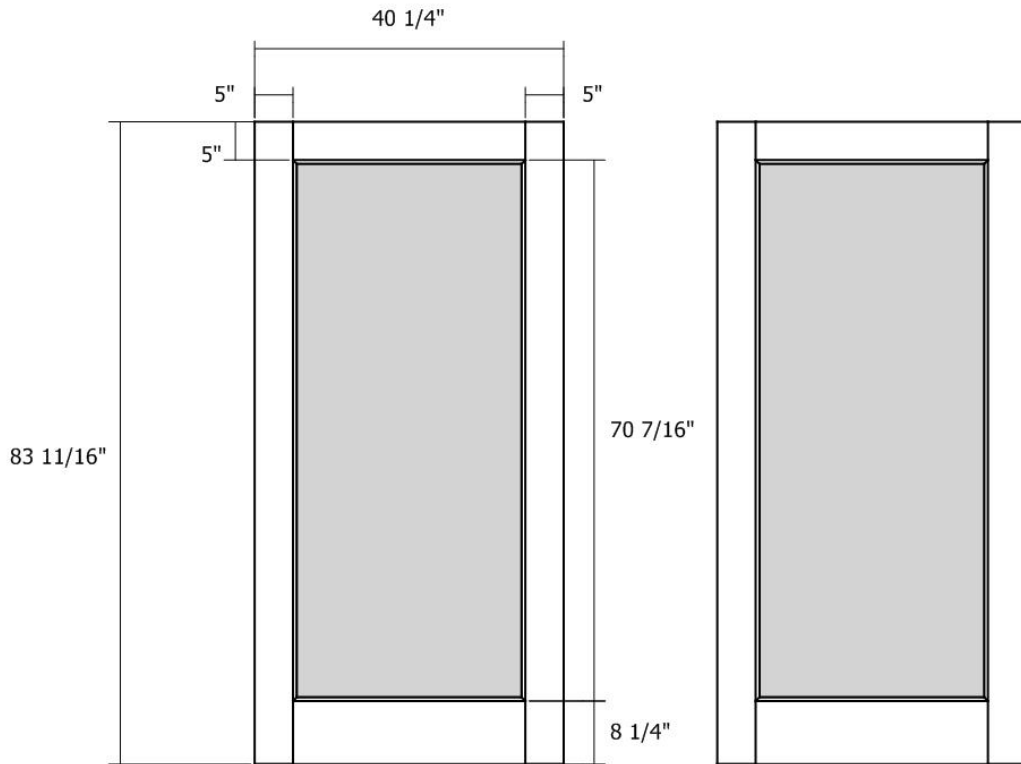


Door Style	Sticking	Panel	Material	Glass	Fire Rating	Grade
None	SS	C	White Maple	N/A	Non-Rated	Interior
Quote #: SQEFV000890-1				Line #: 1 - Dining to Second Bedroom		
TruStile - Marketing				Entered By: Alex Dennis		
Approval (sign here):				Created On: 07/24/2017		



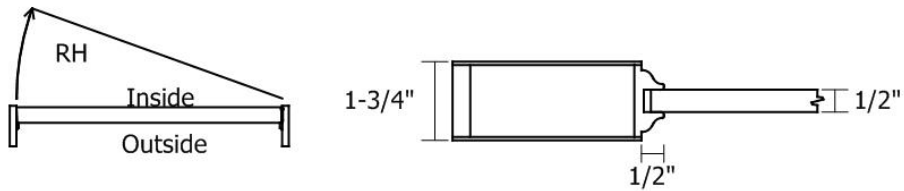
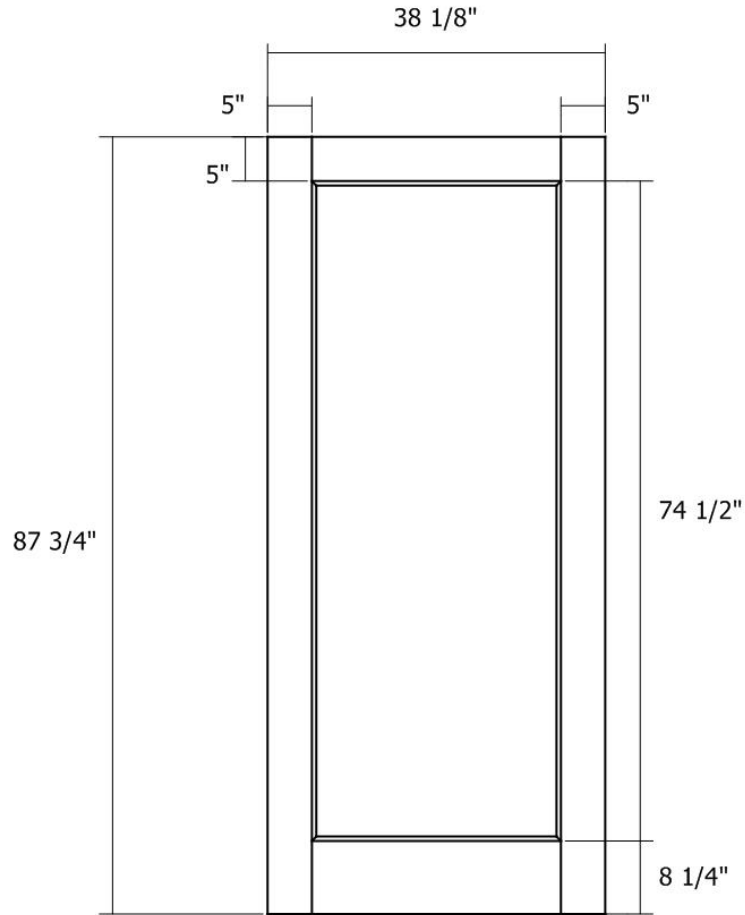
*All panels have a vertical grain orientation

Door Style	Sticking	Panel	Material	Glass	Fire Rating	Grade
TS3000	SS	C	White Maple	1/4" Safety Backed Mirror	Non-Rated	Interior
Quote #: SQEFV000890-1				Line #: 2 - Second bedroom to guest bedroom		
TruStile - Marketing				Entered By: Alex Dennis		
Approval (sign here):				Created On: 07/24/2017		

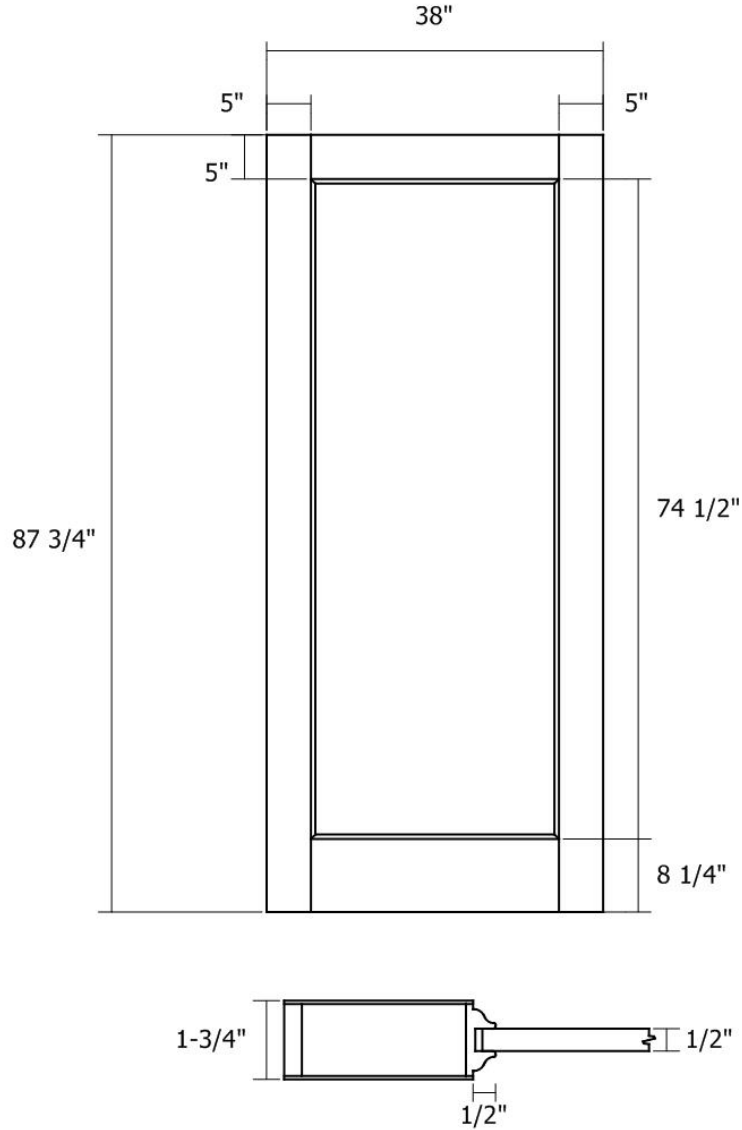


Cross Section Not Available

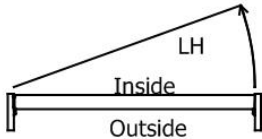
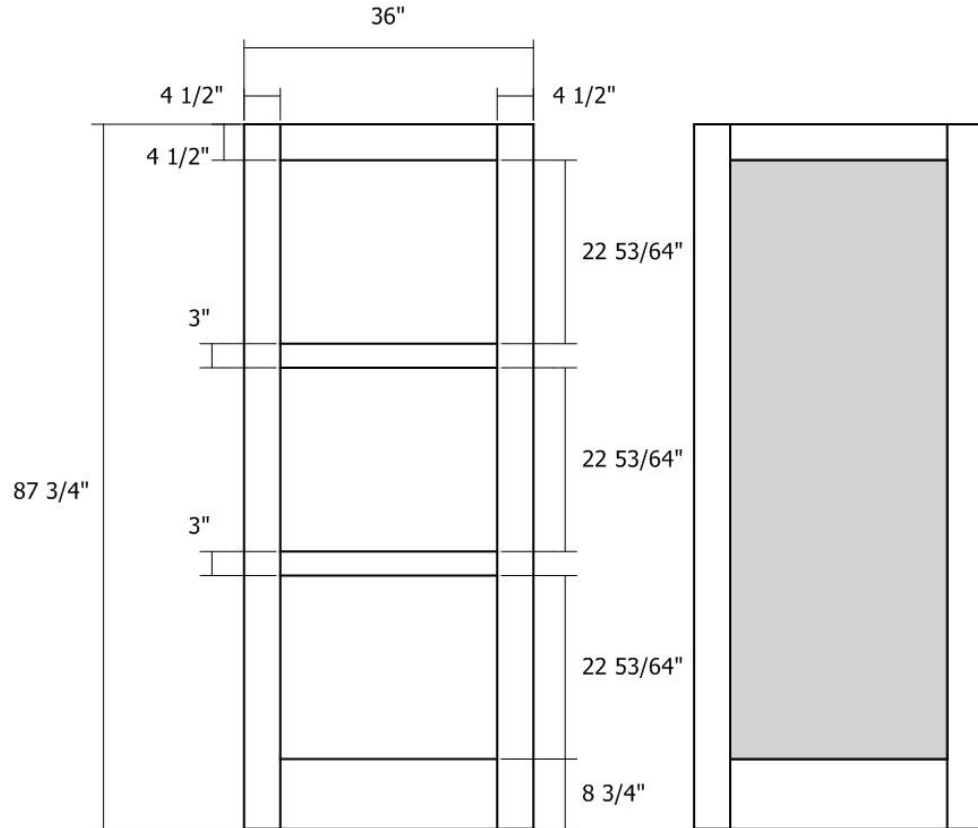
Door Style	Sticking	Panel	Material	Glass	Fire Rating	Grade
TS1000	OG	NA	White Maple	5/16 Double Sided Mirror	Non-Rated	Interior
Quote #: SQEFV000890-1				Line #: 3 - Master bedroom to Master bathroom		
TruStile - Marketing				Entered By: Alex Dennis		
Approval (sign here):				Created On: 07/24/2017		



Door Style	Sticking	Panel	Material	Glass	Fire Rating	Grade
TS1000	OG	C	White Maple	N/A	Non-Rated	Interior
Quote #: SQEFV000890-1				Line #: 4 - Living to Master Bedroom		
TruStile - Marketing				Entered By: Alex Dennis		
Approval (sign here):				Created On: 07/24/2017		



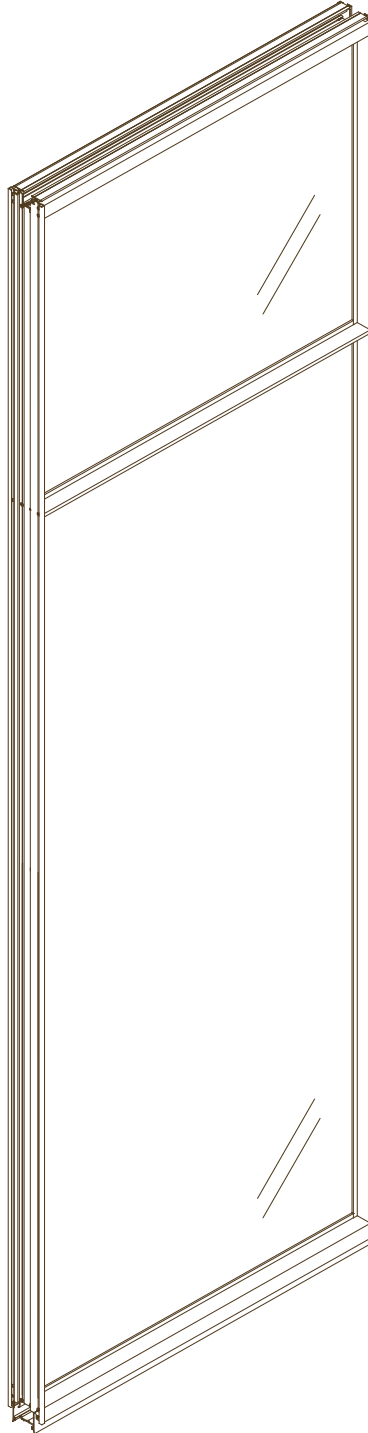
Door Style	Sticking	Panel	Material	Glass	Fire Rating	Grade
TS1000	OG	C	White Maple	N/A	Non-Rated	Interior
Quote #: SQEFV000890-1				Line #: 5 - Master bedroom closet doors		
TruStile - Marketing				Entered By: Alex Dennis		
Approval (sign here):				Created On: 07/24/2017		



*All panels have a vertical grain orientation

Door Style	Sticking	Panel	Material	Glass	Fire Rating	Grade
TS3000	SS	C	White Maple	1/4" Safety Backed Mirror	Non-Rated	Interior
Quote #: SQEFV000890-1				Line #: 6 - Guest closet door		
TruStile - Marketing				Entered By: Alex Dennis		
Approval (sign here):				Created On: 07/24/2017		

OVERVIEW - TECH SHEET
CENTER MOUNT GLASS WALL
V2 LOW PROFILE BASE



COMPONENTS & MATERIALS

Aluminum Extrusions

- Architectural Grade and Structural Aluminum Alloys
 - Vertical & Horizontal Extrusions, Base Track
- Standard Frame Profiles
 - Rectilinear Profile
 - Curvilinear Profile
 - Blade Profile
 - Double Glass Profile
- Custom Frame Profiles
- Frame Finish Options
 - Clear Anodized (5 micron standard)
 - Powder Coated
 - Veneer Wrapped (Curvilinear and Rectilinear profiles only)
 - Custom as required

Horizontal Sections

- Exposed Horizontal Members in Blade and Curvilinear profiles for dividing and supporting Center Mount Glass or Tiles.
- Center Mount Glass and Tiles are received in PVC Glass Wipes fitted in center groove of horizontal sections.
- Horizontal Member heights are user defined.

Base Track

- Aluminum Base Track
- Steel Leveler Assembly with vertical adjustment
- Carpet Grippers
- Two sided tape for hard flooring
- Optional Seismic Base track
- Optional Low Profile Base

Base Trim

- Santoprene Base Trim

Center Mount Tile Options

- Glass in $\frac{1}{4}$ " (6mm) and $\frac{3}{8}$ " (10mm) thickness
 - Clear Tempered Glass
 - Architectural Glass
 - Back Painted Glass
 - Laminated Glass
 - Center Painted Laminated Glass
 - $\frac{1}{4}$ " (6mm) = $\frac{1}{8}$ " (3mm) glass + paint + $\frac{1}{8}$ " (3mm) glass
 - $\frac{3}{8}$ " (10mm) = $\frac{3}{16}$ " (5mm) glass + paint + $\frac{3}{16}$ " (5mm) glass)
- Chroma-coat (painted) Tiles
- Veneer Tiles
- Dry Erase Film on MDF Tiles
- Fabric Tiles

DIRTT Approved Custom Finishes (COM)

**Selected finish options must meet performance requirements for intended application including Flame Spread/Core Materials.*

Colors and Patterns

See the Finishes Collection on www.dirtt.net for standard [Glass Color and Pattern](#) options.

PVC Components

- Frame Connections Rigid/Flex Co-extrusion
- Ceiling Trim/Wall Start Rigid/Flex Co-extrusion
- Glass Retainer Rigid/Flex Co-extrusion
- Color Options Black, Charcoal, Silver, Custom as required

DIMENSIONS & DETAILS

Frame

- Standard Wall Thickness 4" (102mm)
- Minimum Module Width 6" (152mm)
- Maximum Module Width 60" (1524mm)
- Standard Ceiling Height Up to 144" (3658mm)
- Vertical Height Adjustment
 - $\frac{3}{8}$ " (10mm) and +1 $\frac{1}{8}$ " (29mm)
 - Extended Leveler +2 $\frac{5}{8}$ " (67mm) overall

**Frame assemblies exceeding 60" (1524mm) in width or 144" (3658mm) in height, or both must be validated by DIRTT to confirm walls do not exceed the maximum allowable deflection per IBC.*

Frame Connections

- Hidden Links Frame alignment and gap control
- Visible PVC Zipper At frame connection between frames

Trim Components

- Ceiling Trim Flexible trim from top of wall to ceiling
- Wall Trim Rigid connection from Frame to Base Building; combined with flexible Wall Trim

Other Component Connections to Glass Walls

- Glass Panels
- Door Frames
- Corner Connectors
- Various Base Building Connections

Other Options

- Combination Wall Combined Glass with Solid Wall
- Stick Built Wall Multiple Butt Joint Glass Segments within same frame; site assembled
- Cornice Height Wall
- Curved Glass tiles and extrusions
- Glass Spandrel Detail
- Mitered Corner Joint
- Glass Transom Over Door
- DIRTT Approved Custom Solutions

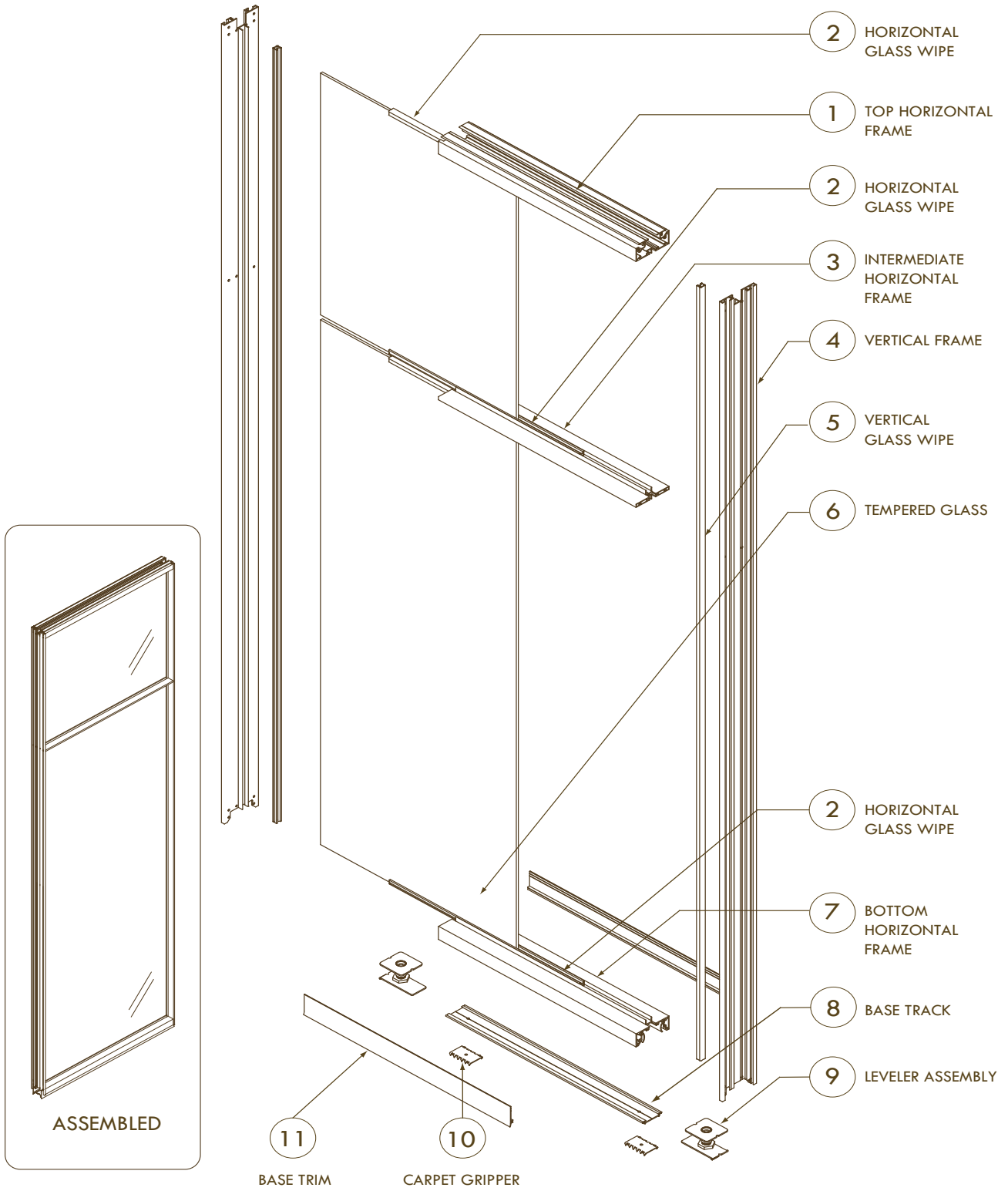
TESTING & APPROVALS

ASTM E72 "Standard Test Methods of Conducting Strength Tests of Panels for Building Construction"

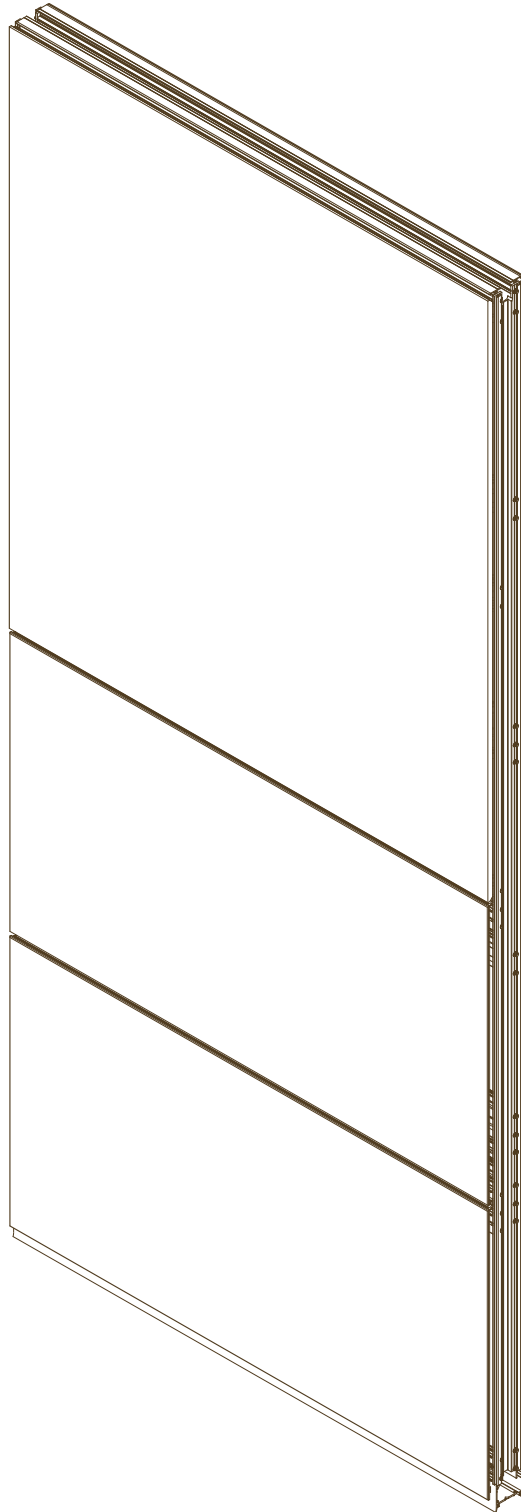
Seismic Engineering Calculations
Seismic Engineering Details

Testing Reports, Details and Approvals are available upon request.

ISOMETRIC/WALL PANEL



OVERVIEW - TECH SHEET
FACE TILED WALL (SOLID WALL)
V2 LOW PROFILE BASE



COMPONENTS & MATERIALS

Aluminum Extrusions

Architectural Grade and Structural Aluminum Alloys
Vertical & Horizontal Extrusions, Base Track

Horizontal Sections

Partially exposed Horizontal Support Member for dividing tiles and hanging components; heights user defined.

Hidden Horizontal Member for additional support of face mounted tiles; heights user defined as required.

Insulation

1" (25mm) thick Insulation, factory installed in frame. Base Insulation to be field installed in base cavity prior to base trim or scribed tiles.

Base Track

Aluminum Base Track
Steel Leveler Assembly with vertical adjustment
Carpet Grippers
Optional Two Sided Tape for smooth flooring
Optional Seismic Base Track

Base Trim

Santoprene Base Trim
Oversized Solid Tiles scribed to floor on site
Optional V1 Base with Aluminum Trim

Face Mount Tile Options

Chromacoat (painted) Tiles
Wood Veneer on MDF Tiles
Willow® Glass on MDF Tiles
Micro Perforated Wood Veneer on MDF Tiles
Magnetic Marker Board Tiles
Marker Board Tiles
Fabric Tiles; tackable and non-tackable
Frameless Back Painted Glass Tiles
Slat Wall Tiles (Accessory Rail)
DIRTT Approved Custom Finishes

PVC Components

Frame Connections	Rigid/Flex Co-extrusion
Ceiling Trim/Wall Start	Rigid/Flex Co-extrusion
PVC Color Options	Black ,Charcoal, Silver, Custom as required

DIMENSIONS & DETAILS

Frame

Standard Wall Thickness	4" (102mm) with Tiles
Minimum Module Width	6" (152mm)
Maximum Module Width	48" (1219mm)
Standard Ceiling Height	Up to 144" (3658mm)
Vertical Height Adjustment	V2 Base $-3/8"$ (-9.5mm) and $+2 5/8"$ (+67mm)

**Frame assemblies exceeding 48" (1219mm) in width or 144" (3658mm) in height, or both must be validated by DIRTT to confirm walls do not exceed the maximum allowable deflection per IBC.*

Frame Connections

Hidden Links	Frame alignment and gap control
Visible PVC Zipper	At frame connection between frames

Trim Components

Ceiling Trim	Flexible trim from top of wall to ceiling
Wall Trim	Rigid connection from Frame to Base Building; combined with flexible Wall Trim

Other Component Connections to Solid Walls

Glass Panels
Door Frames
Corner Connectors
Various Base Building Connections
Modular Electrical
Conventional Electrical

Other Options

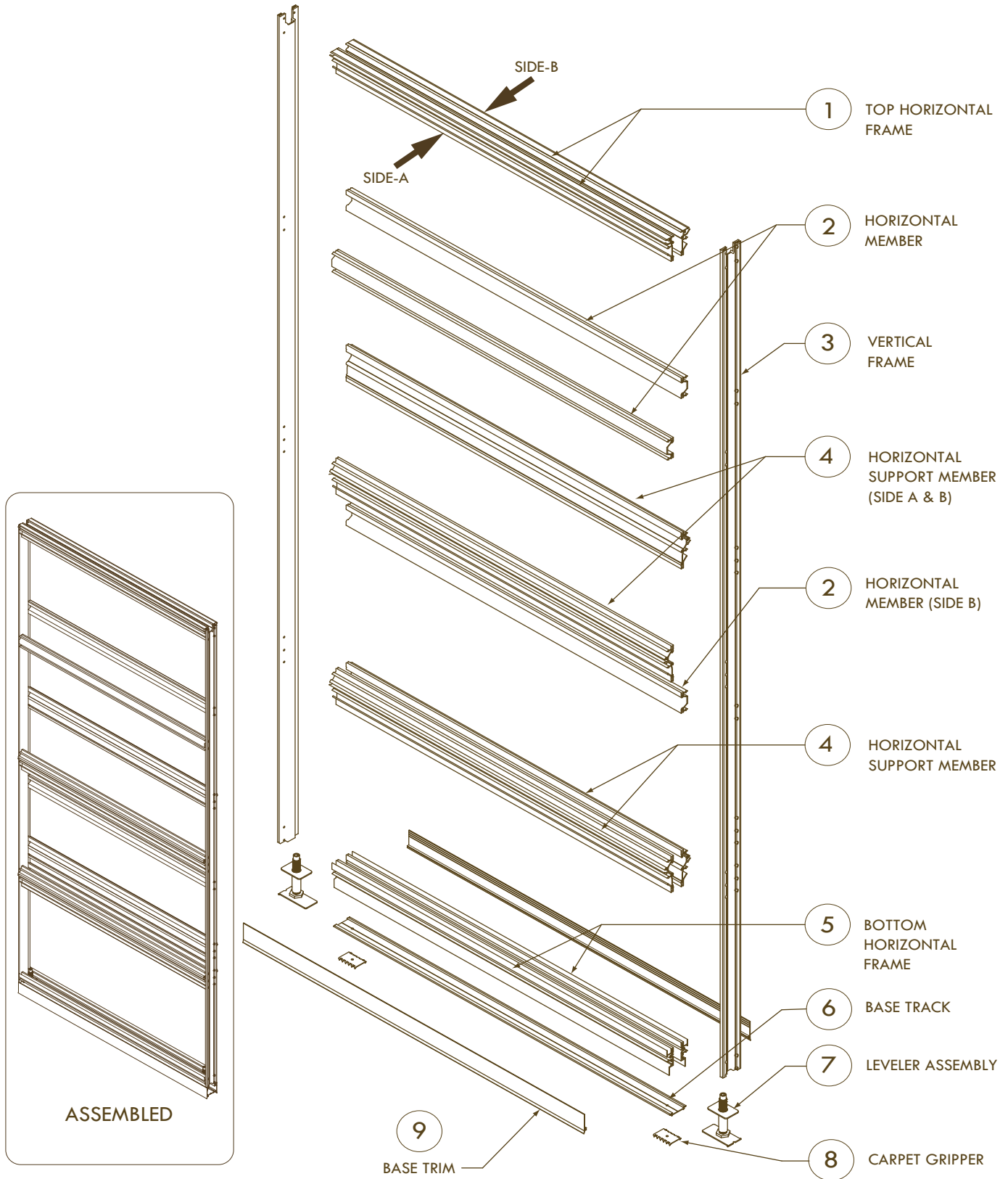
Combination Wall	Combined Face Tile Wall with Glass Wall
Curtain Wall	Installed in front of Base Building Wall Tiled one side only
Low Wall	
Cornice Height Wall	
Center Steel Septum	
Mitered Corner Joint	
Extended Levelers for additional leveling capability	
Seismic	
Enhanced STC Performance	
DIRTT Approved Custom Solutions (Bespoke)	
NAUF/NAF MDF	
Fire Retardant MDF	

TESTING & APPROVALS

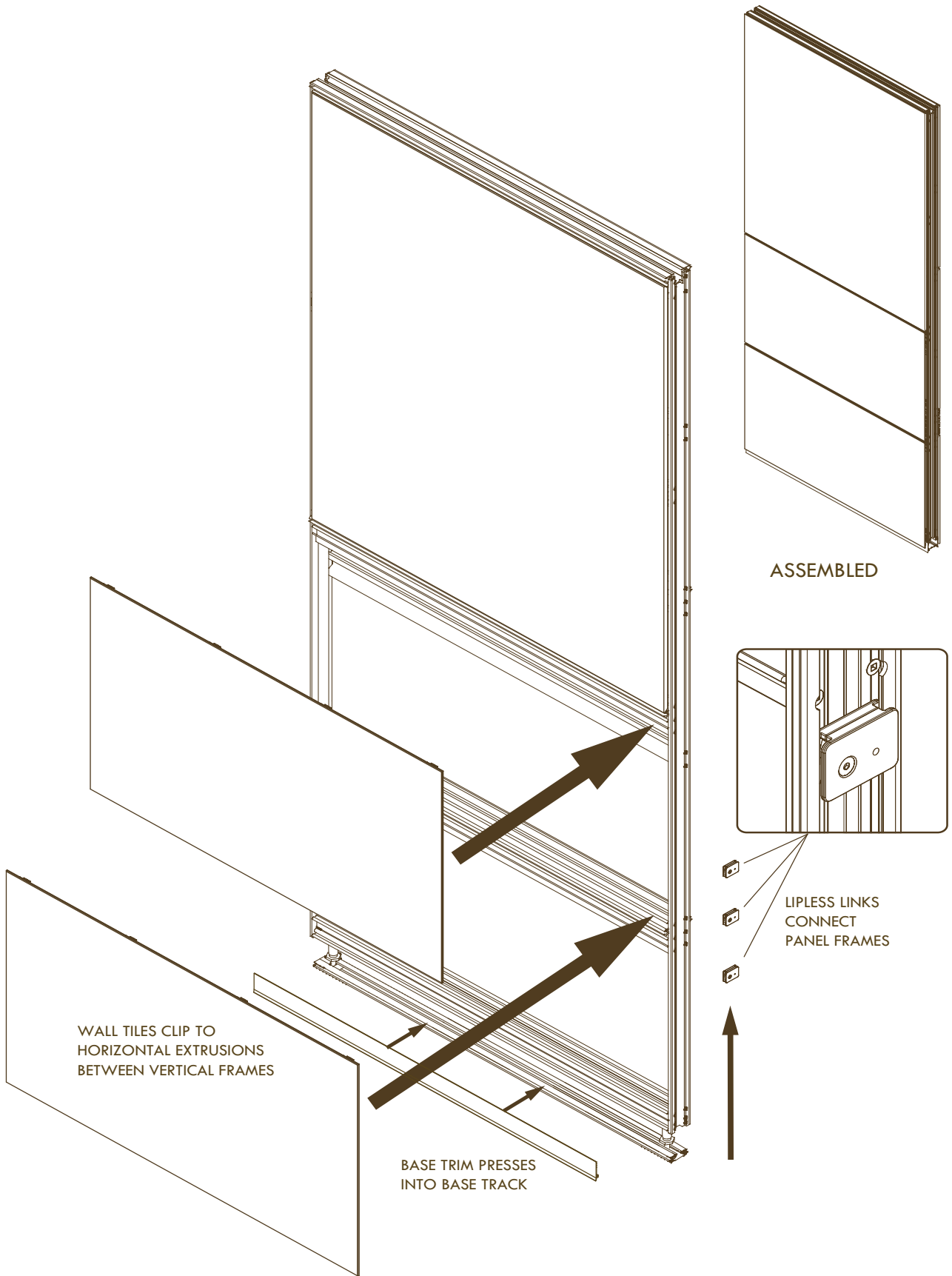
Code Compliance Research Report	CCRR-1012
Transverse Load	ASTM E72
Flame Spread	ASTM E84
STC Rating 37-50 (Dependent on wall construction)	ASTM E90
Wall Electrical	UL 468975 (Sections & Units)
OSHPD	OPM-0044-13
Seismic Engineering Calculations	
Seismic Bracing Details	

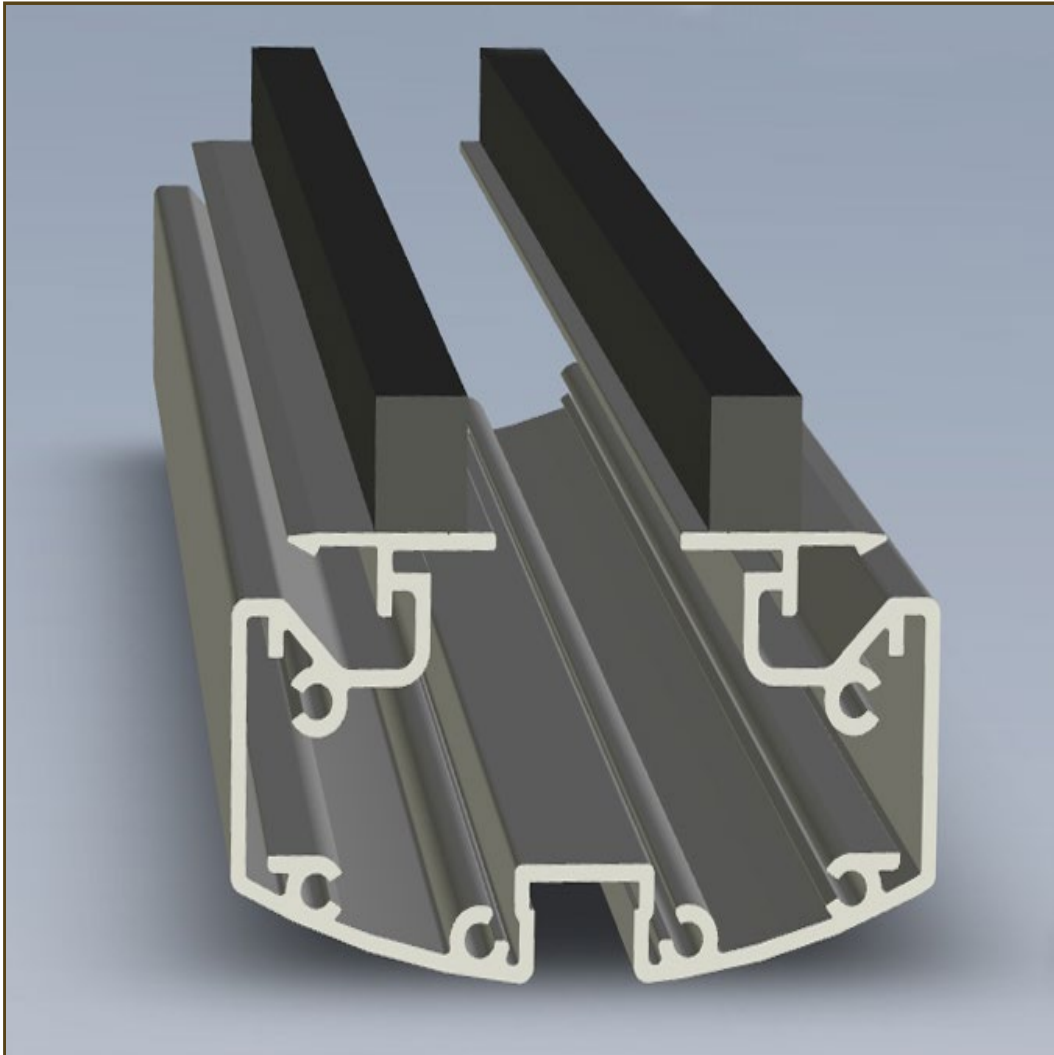
Testing Reports, Details and Approvals are available upon request.

ISOMETRIC/WALL STRUCTURE



ISOMETRIC/WALL PANEL





WALLS

STC PERFORMANCE

STC PERFORMANCE PRODUCT GUIDE_V1-6 - 18Dec2015

1 STC Overview

What is STC?

Sound Transmission Class. The Sound Transmission Class (STC) is a single-number rating of a material's or an assembly's ability to resist airborne sound transfer at predetermined frequencies. A partition is given an STC rating by measuring its *Transmission Loss* over a range of 16 different frequencies between 125-4000 Hz; this range is consistent with the frequency range of speech. In general a higher STC rating blocks more noise from transmitting through a partition.

How is DIRTT STC determined?

DIRTT STC ratings are determined by testing predefined wall "specimens" to ASTM E90 standard in a controlled laboratory environment.

The laboratory test consists of 2 Reverberation Chambers; a Transmission Chamber and a Receiving Chamber (Figure 2). Between the two Chambers is an 8'-0" high x 9'-0" wide (2438mm x 2743mm) opening (Figure 1). DIRTT walls are installed within the opening filling the void (Figure 3). Utilizing calibrated equipment in the control room, sound is then pushed through speakers in the Transmission Chamber (in 16 different frequencies) and recorded with microphones in various locations in the Receiving Chamber. By comparing the transmitted dB levels to the recorded dB levels the sound loss can be measured and an STC rating established.



Figure 1. 8'-0" high x 9'-0" wide (2438mm x 2743mm) opening between Chambers

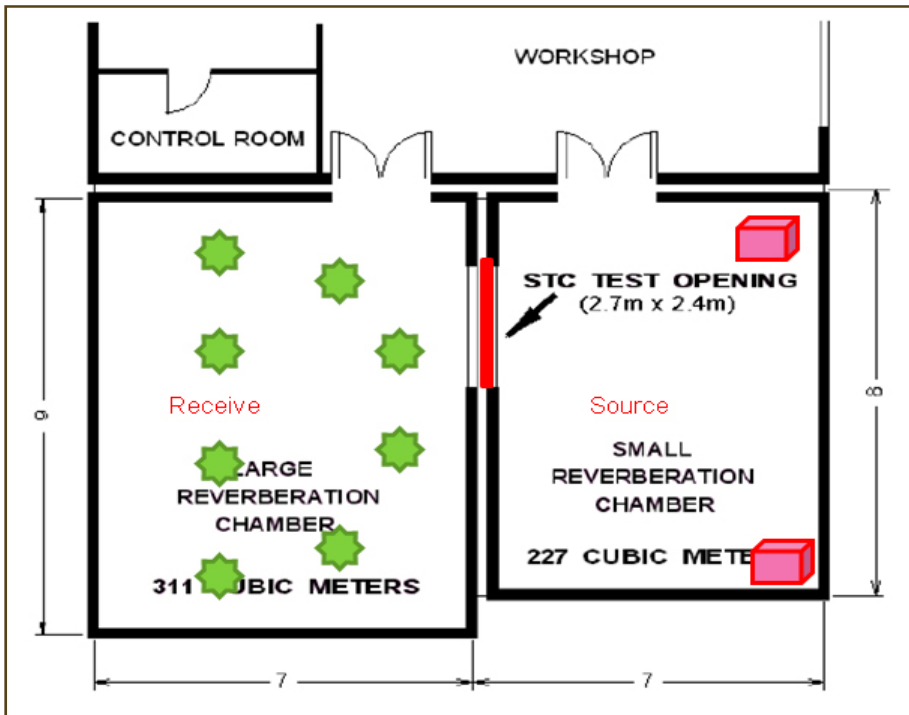


Figure 2. Receiving Chamber on left side and Transmission Chamber on right side



Figure 3. DIRTT walls installed to fill chamber to chamber opening

What does it take to increase the STC rating of a wall?

The measurement of noise is calculated in a logarithmic scale measured in decibels (dB). Sound Transmission Class (STC) is roughly the decibel (dB) reduction in noise a partition can provide.

Perceived loudness doubles for every 10 dB; therefore, 30dB is two times as loud as 20dB and 40dB is 4 times as loud as 20dB.

It is important to understand that STC performance cannot be accurately estimated or extrapolated from individual material STC values. STC ratings can only be achieved through laboratory testing to ASTM E90. It is the combination of materials, insulation and reverberation cavities within a wall that determine the acoustic performance of a wall.

Through multiple test specimens, it has been determined that STC performance of DIRTT partitions can be improved by addressing connections to base building elements (perimeter enhancements), by manipulating insulation thickness, and by adding mass to the outer tiles. See applicable test results on following pages.

What is a Field STC test?

A field STC test is conducted on-site after all walls are installed. This test will take into consideration any leaks in flanking paths such as dropped ceilings, raised floors, uninsulated connecting base building walls, doors, HVAC, lighting, etc.; if not treated these flanking paths could dramatically influence the sound performance of the environment. Field STC test results are proven to test below those determined in a controlled laboratory environment directly due to leaks in flanking paths, because these flanking paths are controlled “by others”. DIRTT will continue to promote sound masking as a solution to offset sound leaks.

OTHER TERMS

NRC - Noise Reduction Coefficient

Represents sound absorption of the surface of a specific material (not assembly) which determines the reverb or liveliness of a room.

Rw - Weighted Sound Reduction Index

Rw is a single-number rating of a material's or an assembly's ability to resist airborne sound transfer at the frequencies 100-4000 Hz. Based on feedback from our sound consultant Rw is more commonly used in Europe; it is also included in our STC reports.

What's the difference between Rw & STC?

Both are laboratory test results and directly equivalent, however:

STC = Sound transmission class that was originally intended for measuring internal sound transmission such as the human voice (high frequency).

Rw = Weighted sound reduction index that uses airborne sound and is viewed as being more appropriate for rating the attenuation of external low frequency noise, such as traffic.

Noise Criterion

Noise Criterion is a single number rating that reflects the loudness within a room or space. This would be affected by the ceiling height, material, and finish; the floor finish; the room size, and wall finishes, as well as all flanking paths. This rating can only be determined in the field, after the product is installed, similar to a field STC test.

* DIRTT provides a wall partition system that can be specified in a wide variety of sizes, heights, finishes and applications that are defined “by others” and therefore can only respond to specific sound testing at the component level. DIRTT will respond to Noise Criterion by supplying specific STC test reports for the applicable pretested assembly. The project acoustical consultant can then determine if the walls will meet the requirement. Alternatively, DIRTT can provide a mock-up reflecting actual project conditions, at the expense of the client, so the product can be evaluated locally.

2 DIRTT Performance - Solid Walls

SOLID WALL STC TEST RESULTS (APRIL 2014)

Typical Details (All Tests)

Solid Wall Frame

1/2" (12.7mm) Monolithic MDF Tiles (both sides) with Foam Strip

1" Exposed Low Profile Santoprene (TPE) Base Trim (both sides)

1" - 1.5pcf density Ultratouch Natural Cotton Fiber Insulation by Bonded Logic (varying built up layers)

Base Cavity filled with insulation (as above)

Typical wall to wall connections; Links, Zippers

Wallflower connection to opening (sides)

Ceiling Track connection at opening (top)

Typical Wallflower Trim and Ceiling Trim

Solid Wall 18 STC - Micro-Perforated Veneer on MDF (both sides) - MEANU Report #1403S1

Tile Finish Side A (Source Side): Micro-Perforated Veneer

Tile Finish Side B (Receiver Side): Micro-Perforated Veneer

Insulation Layers: One (1)

Perimeter Enhancements: No

Solid Wall 33 STC - Chromacoat on MDF (one side) Micro-Perforated Veneer on MDF (opposite side) - MEANU Report #1403S1

Tile Finish Side A (Source Side): Chromacoat

Tile Finish Side B (Receiver Side): Micro-Perforated Veneer

Insulation Layers: One (1)

Perimeter Enhancements: No

Solid Wall 39 STC - Chromacoat on MDF (one side) Micro-Perforated Veneer on MDF (opposite side) - MEANU Report #1403S1

Tile Finish Side A (Source Side): Chromacoat

Tile Finish Side B (Receiver Side): Micro-Perforated Veneer

Insulation Layers: Three (3)

Perimeter Enhancements: Yes (see Section 4 of this report - no Antler treatment applied)

Solid Wall 38 STC - Chromacoat on MDF (both sides) - MEANU Report #1403S2

Tile Finish Side A (Source Side): Chromacoat

Tile Finish Side B (Receiver Side): Chromacoat

Insulation Layers: One (1)

Perimeter Enhancements: No

Solid Wall 42 STC - Chromacoat on MDF (both sides) - MEANU Report #1403S3

Tile Finish Side A (Source Side): Chromacoat

Tile Finish Side B (Receiver Side): Chromacoat

Insulation Layers: One (1)

Perimeter Enhancements: Yes (see Section 4 of this report - no Antler treatment applied)

Solid Wall 43 STC - Chromacoat on MDF (both sides) - MEANU Report #1403S3

Tile Finish Side A (Source Side): Chromacoat
Tile Finish Side B (Receiver Side): Chromacoat
Insulation Layers: Two (2)
Perimeter Enhancements: Yes (see Section 4 of this report - no Antler treatment applied)

Solid Wall 39 STC - Chromacoat on MDF (both sides) - MEANU Report #1403S2

Tile Finish Side A (Source Side): Chromacoat
Tile Finish Side B (Receiver Side): Chromacoat
Insulation Layers: Three (3)
Perimeter Enhancements: No

Solid Wall 45 STC - Chromacoat on MDF (both sides) - MEANU Report #1403S3

Tile Finish Side A (Source Side): Chromacoat
Tile Finish Side B (Receiver Side): Chromacoat
Insulation Layers: Three (3)
Perimeter Enhancements: Yes (see Section 4 of this report - no Antler treatment applied)

Solid Wall 45 STC - Magnetic Markerboard on MDF (both sides) - MEANU Report #1403S4

Tile Finish Side A (Source Side): Chromacoat
Tile Finish Side B (Receiver Side): Chromacoat
Insulation Layers: Three (3)
Perimeter Enhancements: Yes (see Section 4 of this report - no Antler treatment applied)

NOTES:

1. Testing results indicated above show a 4-6 STC point gain when perimeter enhancements are used to inhibit gaps at base building connections.
2. Test results show equal or improved STC performance by modifying one layer of 1" (25mm) thick insulation **FROM:** Johns Mannville 1" (25mm) thick .75 - 1 pcf density glass fiber batt insulation **TO:** 1" (25mm) thick 1.5 pcf Ultratouch Natural Cotton Fiber Insulation by Bonded Logic in combination with the switch to the Santoprene (TPE) flexible base trim.
3. Each additional layer of 1" insulation increases performance by 1 STC point per layer
4. Magnetic Markerboard Tiles performed the same as Chromacoat Tiles (any finish on MDF of equal thickness would perform similarly)

Solid Wall STC TESTING (NOVEMBER 2009) CONTINUE ON NEXT PAGE

SOLID WALL STC TEST RESULTS (NOVEMBER 2009)

Typical Details (All Tests)

Solid Wall Frame

1 inch thick - .75 - 1 pcf density Johns Mansville Glass Fiber Batt Insulation (varying built up layers)

Base Cavity filled with insulation (as above)

Typical wall to wall connections; Links, Zippers

Wallflower connection to opening (sides)

Ceiling Track connection at opening (top)

Typical Wallflower Trim and Ceiling Trim

Perimeter Enhancements (See Section 4 of this report)

Solid Wall 45 STC - MEANU Report 09-05

Tile Style: Monolithic - 1/2" (12.7mm) MDF Tiles (both sides) - Chromacoat Finish

Base style: Tile Scribed to Floor (1/8" Closed Cell Foam Tape applied to cut tile edge - creating seal to floor)

Insulation Layers: One (1)

Solid Wall 50 STC - MEANU Report 09-05B

Tile Style: Monolithic - 3/8" (9.5 mm) MDF Tiles with 1/8" (both sides) with 1/8" (3.2mm) Mass Loaded Vinyl adhered to full tile backside of tile (full coverage) - Chromacoat Finish

Base style: Tile Scribed to Floor (1/8" Closed Cell Foam Tape applied to cut tile edge - creating seal to floor)

Insulation Layers: Three (3)

Solid Wall 39 STC - MEANU Report 09-05E (Config #6)

Tile Style: Monolithic - 1/2" (12.7mm) MDF Tiles (both sides) - Chromacoat Finish

Base style: Standard Base Trim (1" exposed PVC Base Trim)

Insulation Layers: Two (2)

Solid Wall 44 STC - MEANU Report 09-05E (Config #7)

Tile Style: Monolithic - 1/2" (12.7mm) MDF Tiles (both sides) -Chromacoat Finish with added 3/8" thick x 1/2" wide (10mm x 13mm) CSF tape strip continuous across Tile bottom (backside) to seal Tile to Base Trim / frame

Base style: Standard Base Trim (1" exposed PVC Base Trim)

Insulation Layers: Two (2)

Solid Wall 40 STC - MEANU Report 09-05E (Config #8)

Tile Style: Monolithic - 1/2" (12.7mm) MDF Tiles (both sides) -Chromacoat Finish with added 3/8" thick x 1/2" wide (10mm x 13mm) CSF tape strip continuous across Tile bottom (backside) to seal Tile to Base Trim / frame

Base style: Standard Base Trim (1" exposed PVC Base Trim)

Insulation Layers: One (1)

NOTES:

Monolithic Tiles vs Segmented Tiles: DIRTT tested 2 identical specimens with the only variation being the addition of Antlers - 3/8" (9mm)Tile gaps at 30" (762mm) AFF to reflect a typical desk top height, and at 68" (1727mm) AFF to reflect a typical overhead cabinet height at its top. These Antlers were introduced on both sides of the wall (back-to-back) creating a segmented tile elevation. The Antlers were also treated with 1/16" (2mm) thick continuous closed cell foam tape to ensure the Tiles sealed against the frame horizontals. The results showed an overall STC reduction 3 STC points where the tiles were segmented or 1.5 STC Points per back-to-back Antler condition. Using standard frame-to-frame connections we achieved a 50STC rating; this proves that PVC Zippers can perform to at least this level.

3 DIRTT Performance - Glass Walls

Single Pane Glass Wall

When addressing STC ratings of single pane glass walls it is largely recognized that the best the wall can perform acoustically will be limited by the properties of the materials being used. Hence, the independent STC rating of the specified finish material must be considered to “estimate” best wall performance. See table below (Figure 4) for assigned STC ratings for varying glass thicknesses and types.

Glass Product	Nominal Thickness mm	Construction Detail mm	STC Ratings
Single pane	3		24
	4		29
	5		29
	6		30
	8		30
	10		31
	12		32
Laminated	6.4	3-.4-3	33
	8.4	4-.4-4	35
	10.4	5-.4-5	36
Insulated Glass Units	13	3-6-4	27
	15	3-8-4	28
Double Windows	110 (4.3")	6-100-4	46
	160 (6.3")	6-150-4	47
	214 (8.4")	10-200-4	49
Glass Blocks	80	190x190x80	40

Figure 4. Glass STC ratings.

Double Glass Wall

When 2 panes of glass are separated by an air space, the STC rating can vary based on the material, and material thickness specified, as well as the dimensional gap between the panes. For this reason two different Double Glass (Evil Twin) configurations were tested to determine how they would perform. See below for results.

Double Glass Wall 37 STC - MEANU Report 09-05C

Standard Double Glass (Evil Twin) Extrusions with monolithic ¼" (6mm) clear tempered glass both sides, standard exposed PVC Base.

Double Glass Wall 39 STC - MEANU Report 09-05C

Standard Double Glass (Evil Twin) Extrusions with monolithic ¼" (6mm) laminate glass on one side and ⅜" (10mm) on the other side, standard exposed PVC Base.

4 Perimeter Enhancements

1. Wallflower with Closed Cell Foam (CSF) tape applied to full height of Extrusion. One (1) layer of 1/4" thick x 1/2" wide (6mm x 13mm) CSF tape on either side of Wallflower back (broken at centerline) + one (1) layer of 1/2" thick x 1/2" wide (13mm x 13mm) CSF tape on either side of the first Wallflower Extrusion drop. See Figure 5 below.

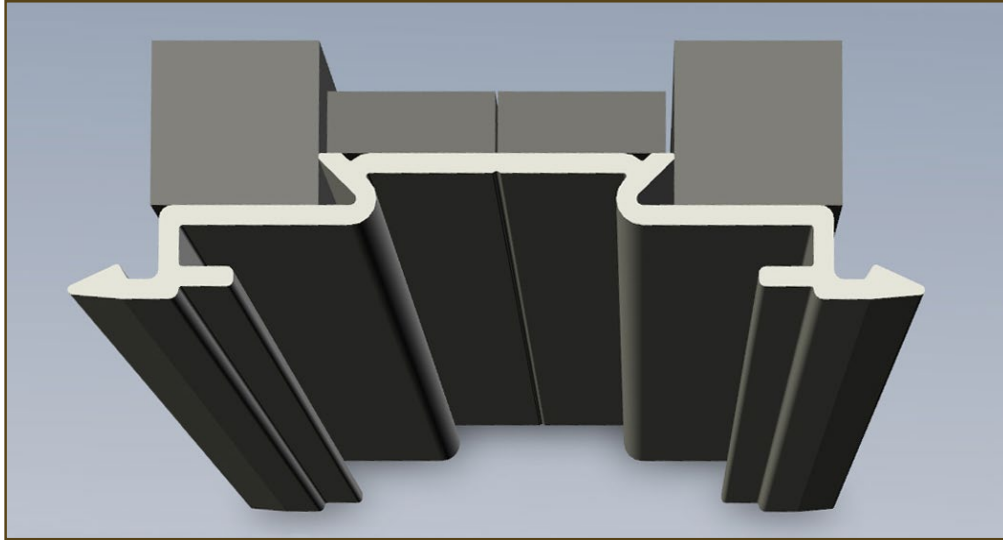


Figure 5. Wallflower with CSF tape applied to full height of Extrusion

2. Wallflower with CSF tape applied to full height of Extrusion. See Figure 6 below. One (1) layer of 1/4" thick x 1/2" wide (6mm x 13mm) CSF tape on either side of Wallflower back (broken at centerline) + one (1) layer of 1/2" (13mm) diameter closed cell backer rod on either side of first Wallflower Extrusion drop (option to Figure 5).

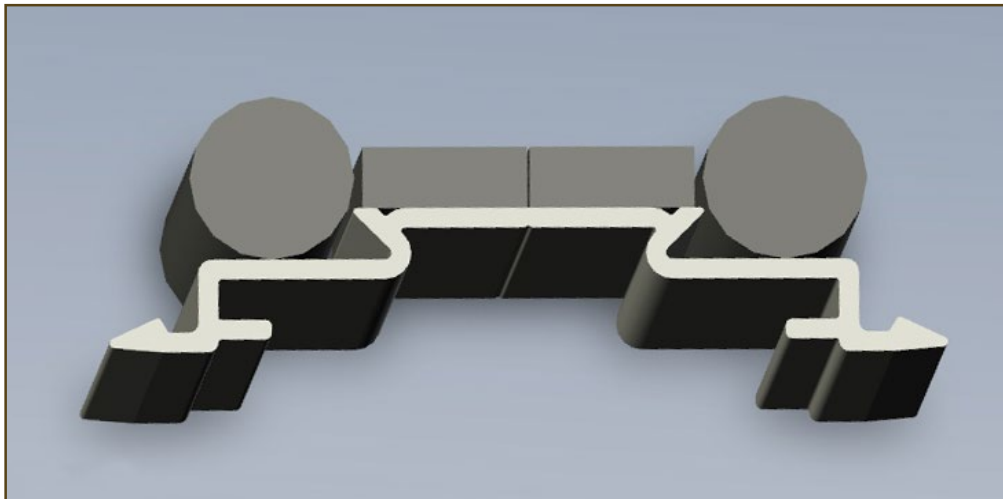


Figure 6. Wallflower with CSF tape applied to full height of Extrusion. Option to Figure 1

3. One (1) layer of $\frac{1}{8}$ " thick x $\frac{1}{2}$ " wide (3mm x 13mm) CSF tape applied continuously to top of Ceiling Track on both sides of track centerline. See Figure 7 below. Fill Ceiling Track void with batt insulation.

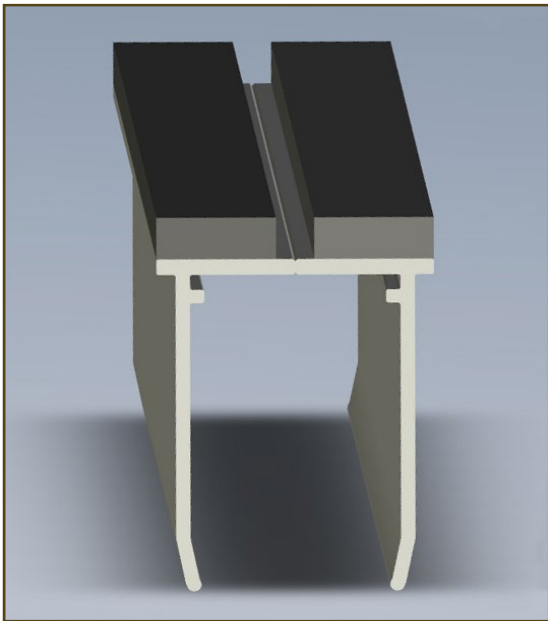


Figure 7. Ceiling Track enhancement

4. Apply one (1) layer of $\frac{5}{8}$ " thick x $\frac{1}{2}$ " wide (16mm x 13mm) CSF tape continuously to top of Glass Wall Horizontal Extrusion on either side of Ceiling Track gap. CSF tape should be positioned on top Flanges so top Horizontal is capable of engaging Ceiling Track as well as to allow for Ceiling Trim engagement. See Figure 8 below.

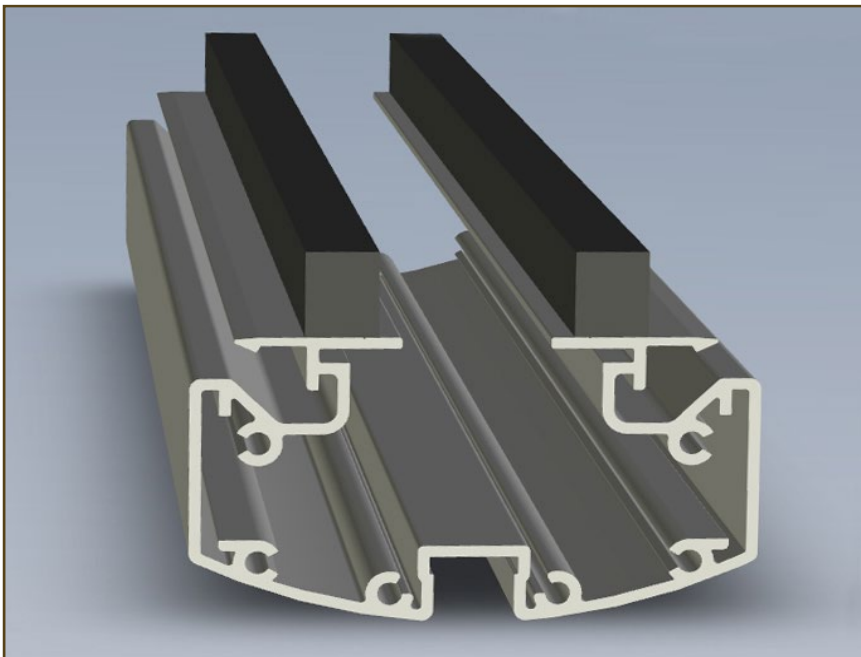


Figure 8. Glass Wall enhancement

5. Apply one (1) layer of $\frac{5}{8}$ " thick x $\frac{1}{2}$ " wide (16mm x 13mm) CSF tape continuously to top of Solid Wall Horizontal Extrusion on either side of Ceiling Track gap. CSF tape should be positioned on top Flanges so top Horizontal is capable of engaging Ceiling Track as well as to allow for Ceiling Trim engagement. See Figure 9 below.

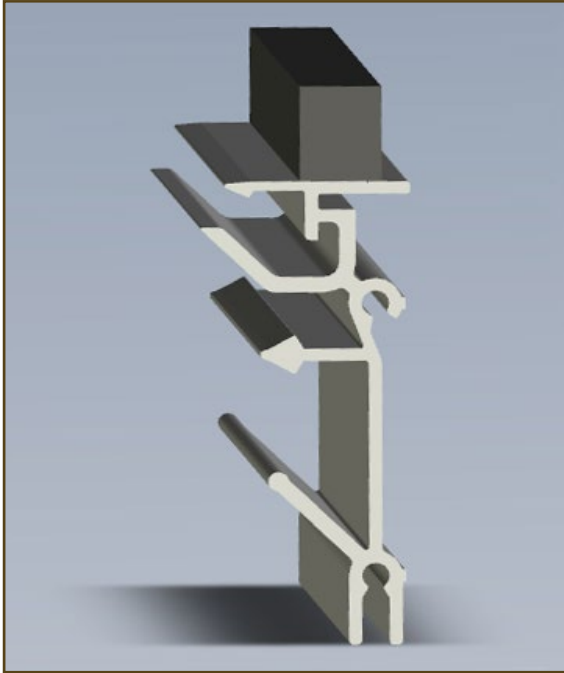


Figure 9. Solid Wall enhancement

6. Apply $\frac{1}{16}$ " (2mm) CSF tape to Horizontal Extrusions behind Tiles; Tiles press fit over CSF tape for seal. This is at Antler and Thief Extrusions. See Figure 10 below.

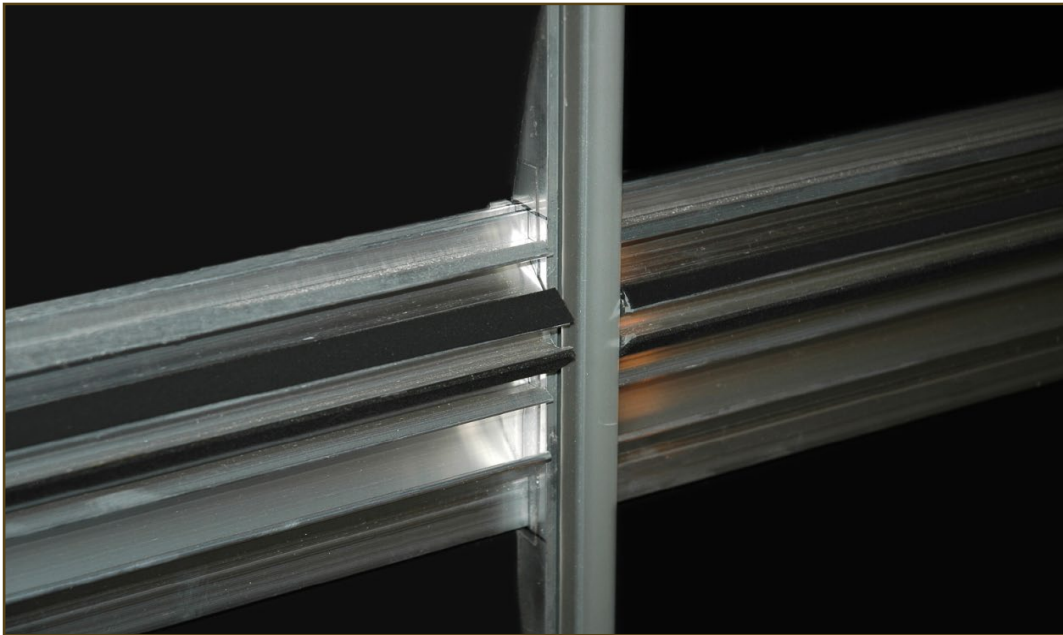


Figure 10. CSF tape applied to Horizontal Extrusions behind Tiles

7. Apply 1/4" thick x 1" wide (6mm x 25mm) CSF tape applied continuously to underside of base track (Figure 11).

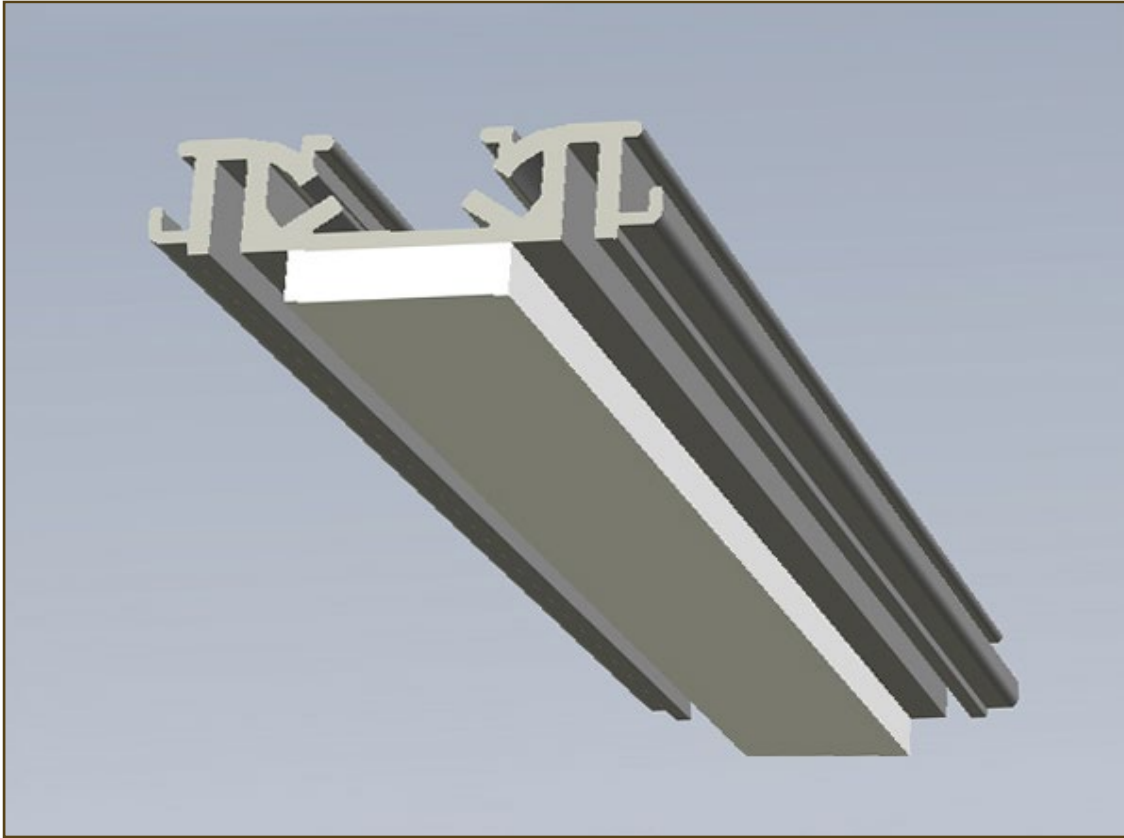
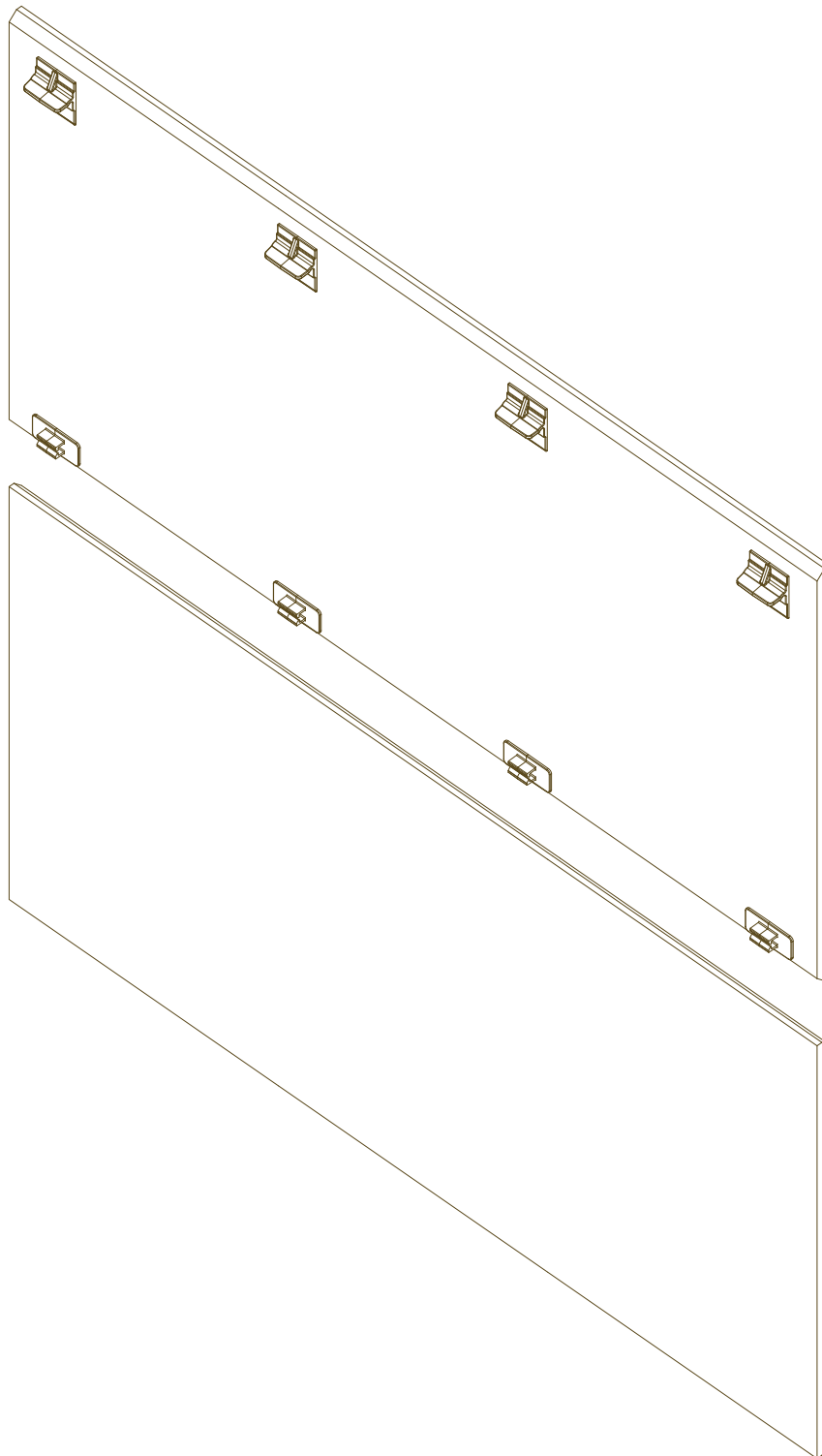


Figure 11. Base Track enhancement

CSF tape inserts are required at all frame to frame, and frame to base building connections above and below Zipper ends, or where light gaps appear. Where there's light penetration, there's sound loss.



COMPONENTS & MATERIALS

Tile Substrate

1/2" (12.7mm) MDF (Medium Density Fiberboard)

Mounting Components

Hanger Clips (Panel Hooks) Nylon
3/4 Bats Clips Nylon

Chromacoat Finish

DIRTT Chromacoat is a waterborne painted finish resulting in fewer VOC's than low VOC latex paint

Standard Colors

See www.dirtt.net for standard DIRTT color options

Finish Options

Custom Chromacoat match available upon request

DIMENSIONS & DETAILS

Minimum Tile Width	5 5/8" (143mm)
Maximum Tile Width*	60" (1524mm)
Maximum Tile Height*	120" (3048mm)

*Tiles can be oriented vertically in a monolithic application or horizontally to span multiple frames; overall size cannot exceed 60" (1524mm) in 2 directions.

Tile Connections to Solid Frame

Hanger Clips located at top of tiles
3/4 Bats Clips located on bottom edges
3/4 Bats Clips located intermediately between clip lines greater than 1008mm (39 1/4")

Testing and Approval

ASTM E84-05 "Standard Test Methods for Surface Burning Characteristics of Building Materials"

Standard MDF Finish Substrate

Flame Spread/Smoke Developed	115/120
Finish Classification	Class C

FR MDF Finish Substrate

Flame Spread/Smoke Developed	5/10
Finish Classification	Class A

MDF with MLV Backer

Flame Spread/Smoke Developed	75/85
Finish Classification	Class B

FR MDF with MLV Backer

Flame Spread/Smoke Developed	5/20
Finish Classification	Class A

CAN/ULC S102 "Standard Test Methods for Surface Burning Characteristics of Building Materials and Assemblies"

Standard MDF Finish Substrate

Flame Spread/Smoke Developed	150/100 ¹
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FR MDF Finish Substrate

Flame Spread/Smoke Developed	45/75
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1. Assigned flame spread rating for thin surface coatings found in table D-3.1.1.A per item D-1.3.4 of the National Building Code of Canada

*Please note testing reports, details and approvals are available upon request.

Electrical and Communications Option

Cutout ports for Electrical and Communication boxes
See Electrical Information Tech Sheets for electrical options

Substrate Options

Urea Formaldehyde Free MDF
NAUF (No Added Urea Formaldehyde) MDF
FSC (Forest Stewardship Council) Certified MDF
FSC + NAUF MDF
FR MDF
MLV (Mass Loaded Vinyl)

Tile Configuration Options

Tiles oversized to be scribed to the floor
Tiles can be applied over multiple frames

Finish Classifications have been established for the **DIRTT standard finishes** listed below in accordance with the **ASTM E84** test as required by **Section 803.1** the **International Building Code** (2012 edition). Flame Spread testing must be conducted on all interior finishes to establish a *Finish Classification* which corresponds with **Table 803.9** in the **IBC** that limits finish use in buildings based on *Occupancy Type, Location in the Building, and Sprinkler inclusion / exclusion*. This **does not** imply DIRTT walls are fire-rated; our walls **cannot** be specified where fire-resistance ratings are required.

DIRTT Tile Flame Spread Ratings / Finish Classification (Standard MDF Core/Glass)

Finish Assembly / Material	Flame Spread Index	Smoke Development Index	Finish Classification
Chromacoat on MDF	115	120	C
Chromacoat on MDF w/ MLV Backer	75	85	B
Veneer on MDF	150	35	C
Veneer on MDF w/ MLV Backer	180	105	C
Thermofoil on MDF	90	400	C
Writeaway Film on MDF	110	300	C
Magnetic Markerboard on MDF	0	60	A
Class A Fabric on MA Board (V2- Tackable)	5	25	A
Class A Fabric on MA Board w/MDF Backer (V3 -Tackable)	25	45	A
Class A Fabric on MDF (Non-Tackable)	85	350	C
Back Painted Frameless Glass	0	0	A
Back Painted Magnetic Frameless Glass	10	45	A
Wrapture Film on MDF	65	400	B
MicroPerforated Veneer on MDF	105	400	C
MicroPerforated Thermofoil on MDF	55	300	B
Willow Glass on MDF	140	300	C
Magnetic Willow Glass on MDF	10/15	50/90	A

ASTM E84 Flame Spread / Smoke Development Finish Classifications:

- Class A: Flame spread index 0-25; smoke-developed index 0-450.
- Class B: Flame spread index 26-75; smoke-developed index 0-450.
- Class C: Flame spread index 76-200; smoke-developed index 0-450.

DIRTT Finish Classifications

Testing in accordance with **ASTM E84**
By Intertek Testing Services NA Inc.
Updated: June 2016

DIRTT Tile Flame Spread Ratings / Finish Classification (Flame-Retardant MDF Core):

<u>Finish Assembly / Material</u>	<u>Flame Spread Index</u>	<u>Smoke Development Index</u>	<u>Finish Classification</u>
Chromacoat on FR MDF	5	10	A
Chromacoat on FR MDF w/ MLV Backer	5	20	A
Veneer on FR MDF	15	25	A
Veneer on FR MDF w/ MLV Backer	15	15	A
Thermofoil on FR MDF	25	400	A
Writeaway Film on FR MDF	35	250	B
Magnetic Markerboard on FR LPL	0	90	A
Class A Fabric on MA Board w/FR MDF Backer (V3-Tackable)	25	40	A
Class A Fabric on FR MDF (Non-Tackable)	20	250	A
Wrapture Film on FR MDF	15	95	A
Micro Perforated Veneer on FR MDF	55	90	B
Micro Perforated Thermofoil on FR MDF	10	45	A
Willow Glass on FR MDF	120	110	C
Magnetic Willow Glass on FR MDF	10/10	50/55	A

ASTM E84 Flame Spread / Smoke Development Finish Classifications:

- Class A: Flame spread index 0-25; smoke-developed index 0-450.
- Class B: Flame spread index 26-75; smoke-developed index 0-450.
- Class C: Flame spread index 76-200; smoke-developed index 0-450.

Applicability

DIRTT has tested all finishes to ASTM E84 to confirm finish classification; however, how the finishes are applied is up to the local *Distribution Partner* in concert with the design team / *Professional of Record*. Please refer to **Table 803.9** in the **International Building Code** for a guideline to applicability of finishes. Other sections of the code, or variations adopted at the state level may apply; therefore, finishes applications should be validated with the *Professional of Record* to confirm compliance with the presiding *Authority Having Jurisdiction* for each install location.

International Building Code (2012) Reference

803.9 Interior finish requirements based on group.

Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.9 for the group and location designated. *Interior wall and ceiling finish materials* tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.2.1, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 or UL 723 is required.

TABLE 803.9 INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY^k

GROUP	SPRINKLERED ^d			NONSPRINKLERED		
	Interior exit stairways, interior exit ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces ^c	Interior exit stairways, interior exit ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces ^c
A-1 & A-2	B	B	C	A	A ^d	B ^e
A-3 ^f , A-4, A-5	B	B	C	A	A ^d	C
B, E, M, R-1	B	C	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C ^g	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B ^{h, i}	A	A	B
I-3	A	A ^j	C	A	A	B
I-4	B	B	B ^{h, i}	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929m².

- a. Class C interior finish materials shall be permitted for wainscoting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.11.1.
- b. In other than Group I-2 occupancies in buildings less than three stories above grade plane of other than Group I-3, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.
- c. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and the rooms or spaces on both sides shall be considered one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.
- d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall not be less than Class B materials.
- e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.
- f. For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.
- g. Class B material is required where the building exceeds two stories.
- h. Class C interior finish materials shall be permitted in administrative spaces.
- i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.
- j. Class B materials shall be permitted as wainscoting extending not more than 48 inches above the finished floor in corridors and exit access stairways and ramps.
- k. Finish materials as provided for in other sections of this code.
- l. Applies when protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

MDF Substrates

Standard MDF:

DIRTT uses ½" (13mm) thick Flakeboard Superior MDF as the default substrate for all tile finishes that utilize a wood substrate. This raw material offers a flame spread/smoke developed performance of 110/180 when tested in accordance with ASTM E84 which is representative of a Class C material. Per the American Wood Council (AWC); *"if the material is homogeneous, flame spread may be considered nearly independent of material thickness greater than ¼" (6.4mm)."*

FR (Fire Retardant) MDF (NAF):

DIRTT uses ½" (13mm) thick Sierra Pine Medite FR as the substrate when a **Fire Retardant Treated Wood** is required to provide an enhanced finish classification. This raw material offers a flame spread/smoke developed performance of 15/95 when tested in accordance with ASTM E2768-2011 which is representative of a Class A material. ASTM E2768-2011 is a Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test) which is a requirement of **Section 2303.2** qualifying **Fire Retardant Treated Wood**.

International Building Code (2012) Reference

2303.2 Fire-retardant-treated wood.

Fire-retardant-treated wood is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84 or UL 723, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.

NAF (No Added Formaldehyde) MDF:

DIRTT uses ½" (13mm) thick Sierra Pine ARREIS® sustainable design fiberboard as the substrate when a NAF / NAUF **material** is required to gain LEEDS points or to meet local code or standards requirements. This raw material is classified as Class C material per the AWC.

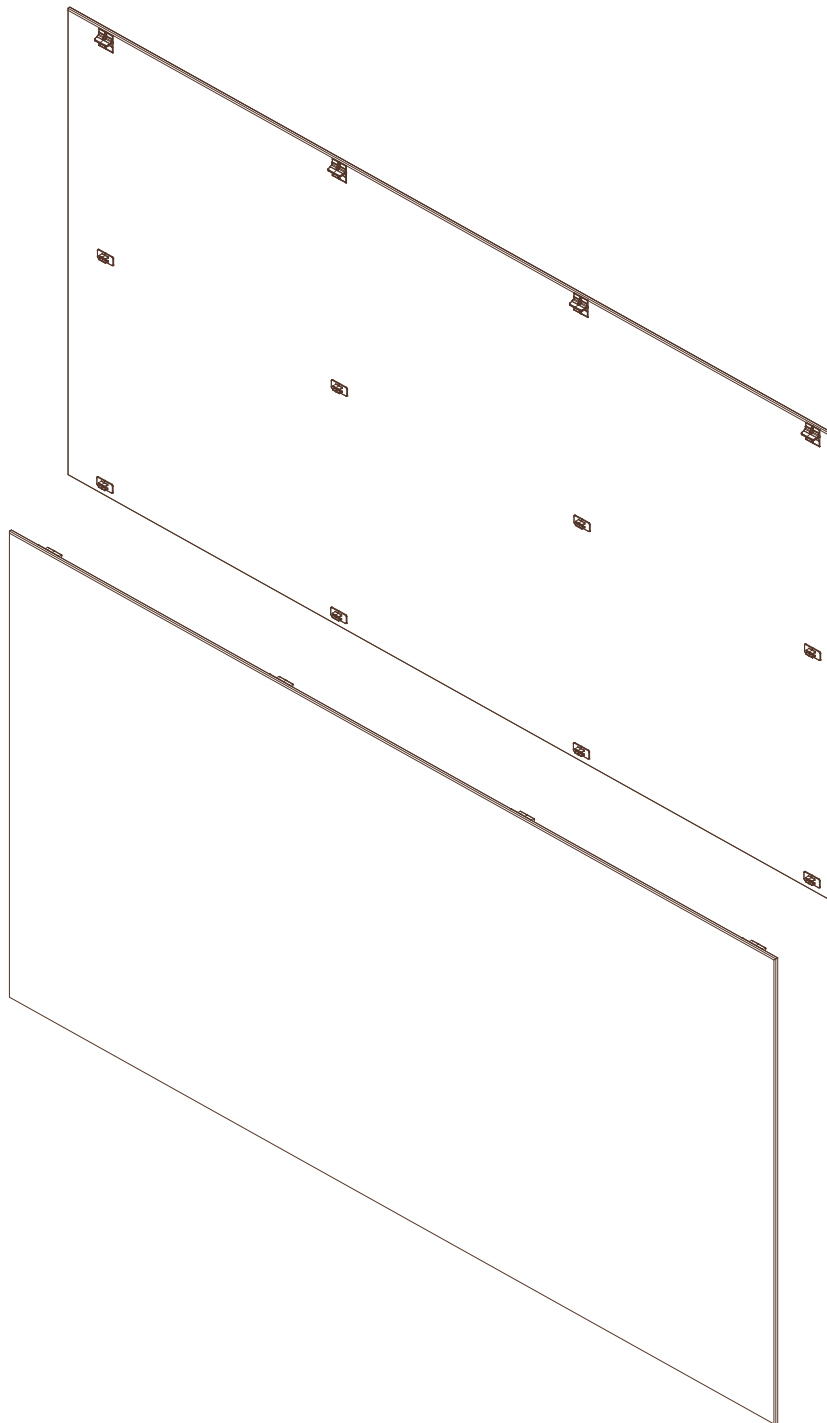
FSC (Forest Stewardship Council) MDF / wood products:

DIRTT is Chain of Custody certified to sell products as "FSC Pure and FSC Mixed" by Scientific Certification Systems (SCS) in accordance with the rules of FSC to the FSC Standard: FSC-STD-40-004 V2-0. DIRTT's Certification Code is SCS-COC-000848. All MDF substrates can be ordered as FSC but must be addressed prior to order placement with info@dirtt.net to confirm pricing and any manufacturing lead-time concerns.

Mass Loaded Vinyl (Acoustic Enhancement)

Finished tiles utilizing a 1/8" (3mm) thick Mass Loaded Vinyl (MLV) backing material for enhanced STC performance will utilize an MDF or FR MDF that is 3/8" (10mm) thick. This will result in an overall finished tile thickness of ½" (13mm).

DIRTT Environmental Solutions manufactures a wide variety of solutions and options. It is the responsibility of the Professional of Record in conjunction with the Distribution Partner to ensure product applications meet the intent of the governing code and is adequately justified to the satisfaction of the Authority Having Jurisdiction.



COMPONENTS & MATERIALS

Tile Substrate

1/2" (12.7mm) MDF (Medium Density Fiberboard)

Tile Backer

3A Gator-Ply

Mounting Components

Hanger Clips (Panel Hooks) Nylon
3/4 Bats Clips Nylon

Veneer Finish

Water Based Stain with UV Cured Waterborne Lacquer finish coat

Veneer Species and Colors

DIRTT standard Architectural Grade Wood Veneer
Cherry
Oak
Walnut
Machine Figured Anigre
Anigre
Beech*
Fir*
Maple*

See www.dirtt.net for standard DIRTT stain options.

**Clear coat Finish on Natural Veneer Only. No Color Stain Available*

Finish Options

Custom Stain match upon request
Custom Veneer upon request
FSC (Forest Stewardship Council) Veneer

**DIRTT does not permit the use of Customers Own Material (COM – Veneer)*

DIMENSIONS & DETAILS

Minimum Tile Width	5 5/8" (143mm)
Maximum Tile Width*	60" (1524mm)
Maximum Tile Height*	120" (3048mm)

**Tiles can be oriented vertically in a monolithic application or horizontally to span multiple frames; overall size cannot exceed 60" (1524mm) in 2 directions.*

Tile Connections to Solid Frame

Hanger Clips located at top of tiles
3/4 Bats Clips located on bottom edges
3/4 Bats Clips located intermediately between clip lines greater than 1008mm (39 1/16")

Testing and Approval

ASTM E84-05 "Standard Test Methods for Surface Burning Characteristics of Building Materials"

Standard MDF Finish Substrate	
Flame Spread/Smoke Developed	150/35
Finish Classification	Class C

FR MDF Finish Substrate	
Flame Spread/Smoke Developed	15/25
Finish Classification	Class A

MDF Finish Substrate w/ MLV Backer	
Flame Spread/Smoke Developed	180/105
Finish Classification	Class C

FR MDF Finish Substrate w/ MLV Backer	
Flame Spread/Smoke Developed	15/15
Finish Classification	Class A

CAN/ULC S102 "Standard Test Methods for Surface Burning Characteristics of Building Materials and Assemblies"

Standard MDF Substrate	
Flame Spread/Smoke Developed	150/100 ¹

FR MDF Substrate	
Flame Spread/Smoke Developed	55/90

1. Assigned flame spread rating for thin surface coatings found in table D-3.1.1.A per item D-1.3.4 of the National Building Code of Canada

**Please note testing reports, details and approvals are available upon request*

Electrical and Communications Option

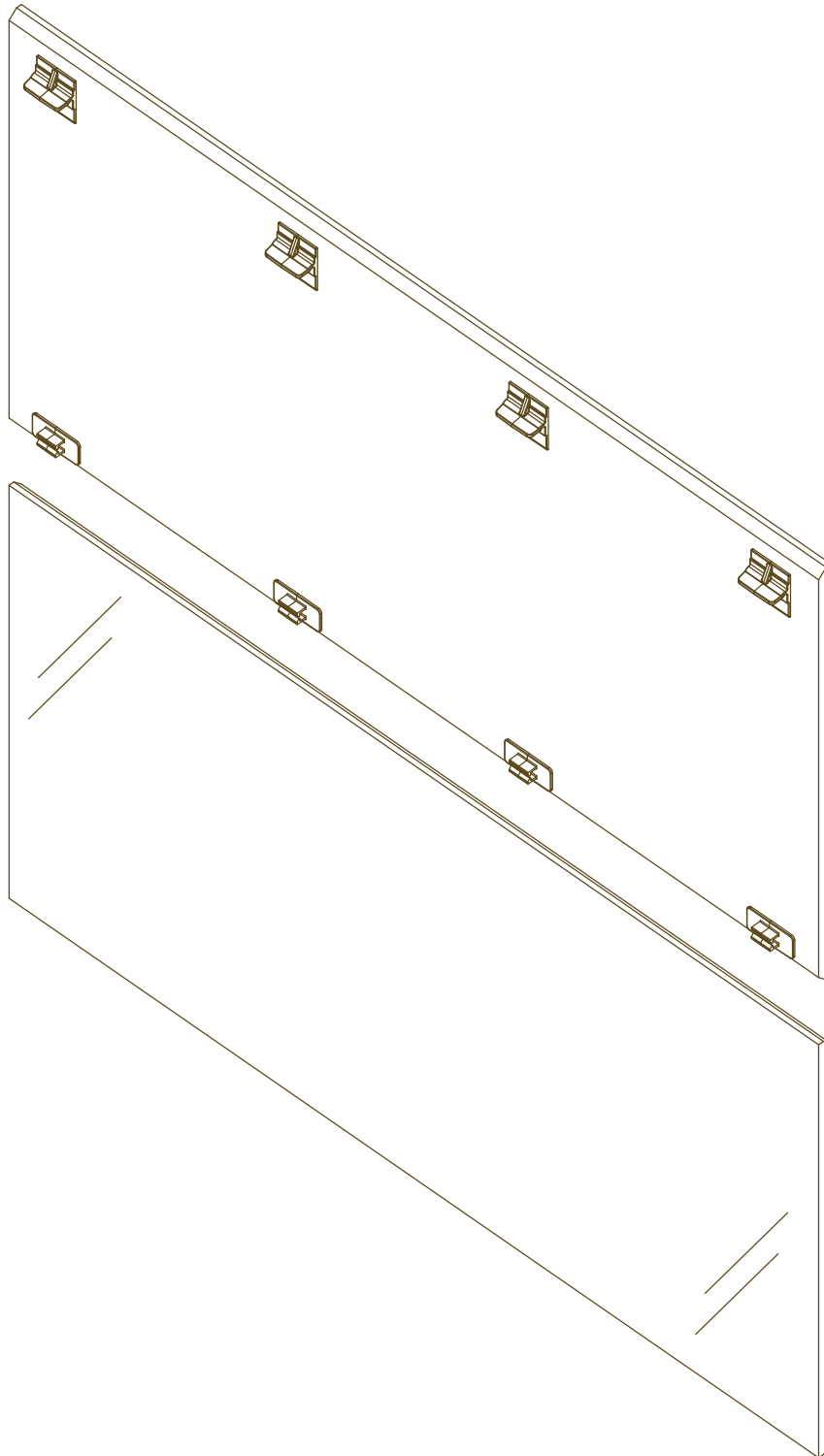
Cutout ports for Electrical and Communication boxes
See Electrical Information Tech Sheets for electrical options

Substrate Options

Urea Formaldehyde Free MDF
FSC Certified MDF
FSC + NAF MDF
FR (Fire Retardant) MDF (NAF)
MLV (Mass Loaded Vinyl)

Tile Configuration Options

Tiles oversized to be scribed to the floor
Tiles can be applied over multiple frames



COMPONENTS & MATERIALS

Tile Substrate

1/2" (12.7mm) MDF (Medium Density Fiberboard)

Willow Glass

Willow® Glass by Corning® is a thin, light glass (200 micron thick) laminated over a waterborne painted finish on MDF. This provides the ability to print on the underside of the Willow Glass while retaining standard MDF tile mounting components and finish options.

Chromacoat Finish

DIRTT Chromacoat is a water-borne painted finish

Mounting Components

Hanger Clips (Panel Hooks) Nylon
3/4 Bats Clips Nylon

Standard Colors

See www.dirtt.net for standard DIRTT options, selected in ICE

Finish Options

Standard Solid Color Chromacoat
Printed Graphics or Patterns
Custom Solid Color Chromacoat*
Custom Printed Graphic

* Custom Chromacoat match available upon request

DIMENSIONS & DETAILS

Minimum Tile Width	5 5/8" (143mm)
Maximum Tile Width*	46" (1168mm)
Maximum Tile Height*	120" (3048mm)

* Tiles can be oriented vertically in a monolithic application or horizontally to span multiple frames; overall size cannot exceed 46" (1168mm) in 2 directions.

Tile Connections to Solid Frame

Hanger Clips located at top of tiles
3/4 Bats Clips located on bottom edges
3/4 Bats Clips located intermediately between clip lines greater than 39 1/4" (1008mm)

Testing and Approval

ASTM E84-05 "Standard Test Methods for Surface Burning Characteristics of Building Materials"

Willow Glass on MDF Substrate
Flame Spread/Smoke Developed (test pending)
Finish Classification (test pending)

CAN/ULC S102 "Standard Test Methods for Surface Burning Characteristics of Building Materials and Assemblies"

Willow Glass on MDF Substrate
Flame Spread/Smoke Developed (test pending)

* Testing reports, details and approvals will be available upon request.

Electrical and Communications Option

Cutout ports for Electrical and Communication boxes
See Electrical Information Tech Sheets for electrical options

Tile Configuration Options

Tiles can be applied over multiple frames
Tiles oversized to be scribed to the floor*

* Tiles scribed to the floor on-site require special equipment and specific procedures must be followed.

C20
C 2010

INTERIOR FINISHES
WALL FINISHES

A. SYSTEM DESCRIPTION

1. The selected interior wall finishes provide a consistent and aesthetically pleasing design appearance.

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect.
2. DIRT T Tile Finish Classifications
 - a. ASTM E84 test results on DIRT T standard finishes. See attached product data sheet CSI# 10 22 23.
3. GWB on SIP Walls
 - a. Interior faces of all SIP walls to be covered with ½" GWB as an approved thermal barrier per code requirements.

C 2030

FLOORING

A. SYSTEM DESCRIPTION

1. Hardwood flooring in primary living and traffic areas.
2. Tile flooring in bathroom areas.

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Specific components will be determined by the Architect in accordance with the functional requirements. This will include the following flooring types:
 2. ¾" Hardwood Flooring
 3. Tile Flooring

C 2050

CEILING

A. SYSTEM DESCRIPTION

1. 5/8" GWB on metal stud in all ceiling spaces

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Specific components will be determined by the Architect in accordance with the functional requirements. This will include the following flooring types:
 2. Standard GWB
 3. Metal Studs
 - a. Type and spacing determined using IRC 804.3.1

Finish Classifications have been established for the **DIRTT standard finishes** listed below in accordance with the **ASTM E84** test as required by **Section 803.1** the **International Building Code** (2012 edition). Flame Spread testing must be conducted on all interior finishes to establish a *Finish Classification* which corresponds with **Table 803.9** in the **IBC** that limits finish use in buildings based on *Occupancy Type, Location in the Building, and Sprinkler inclusion / exclusion*. This **does not** imply DIRTT walls are fire-rated; our walls **cannot** be specified where fire-resistance ratings are required.

DIRTT Tile Flame Spread Ratings / Finish Classification (Standard MDF Core/Glass)

Finish Assembly / Material	Flame Spread Index	Smoke Development Index	Finish Classification
Chromacoat on MDF	115	120	C
Chromacoat on MDF w/ MLV Backer	75	85	B
Veneer on MDF	150	35	C
Veneer on MDF w/ MLV Backer	180	105	C
Thermofoil on MDF	90	400	C
Writeaway Film on MDF	110	300	C
Magnetic Markerboard on MDF	0	60	A
Class A Fabric on MA Board (V2- Tackable)	5	25	A
Class A Fabric on MA Board w/MDF Backer (V3 -Tackable)	25	45	A
Class A Fabric on MDF (Non-Tackable)	85	350	C
Back Painted Frameless Glass	0	0	A
Back Painted Magnetic Frameless Glass	10	45	A
Wrapture Film on MDF	65	400	B
MicroPerforated Veneer on MDF	105	400	C
MicroPerforated Thermofoil on MDF	55	300	B
Willow Glass on MDF	140	300	C
Magnetic Willow Glass on MDF	10/15	50/90	A

ASTM E84 Flame Spread / Smoke Development Finish Classifications:

- Class A: Flame spread index 0-25; smoke-developed index 0-450.
- Class B: Flame spread index 26-75; smoke-developed index 0-450.
- Class C: Flame spread index 76-200; smoke-developed index 0-450.

DIRTT Finish Classifications

Testing in accordance with **ASTM E84**
By Intertek Testing Services NA Inc.
Updated: June 2016

DIRTT Tile Flame Spread Ratings / Finish Classification (Flame-Retardant MDF Core):

<u>Finish Assembly / Material</u>	<u>Flame Spread Index</u>	<u>Smoke Development Index</u>	<u>Finish Classification</u>
Chromacoat on FR MDF	5	10	A
Chromacoat on FR MDF w/ MLV Backer	5	20	A
Veneer on FR MDF	15	25	A
Veneer on FR MDF w/ MLV Backer	15	15	A
Thermofoil on FR MDF	25	400	A
Writeaway Film on FR MDF	35	250	B
Magnetic Markerboard on FR LPL	0	90	A
Class A Fabric on MA Board w/FR MDF Backer (V3-Tackable)	25	40	A
Class A Fabric on FR MDF (Non-Tackable)	20	250	A
Wrapture Film on FR MDF	15	95	A
Micro Perforated Veneer on FR MDF	55	90	B
Micro Perforated Thermofoil on FR MDF	10	45	A
Willow Glass on FR MDF	120	110	C
Magnetic Willow Glass on FR MDF	10/10	50/55	A

ASTM E84 Flame Spread / Smoke Development Finish Classifications:

- Class A: Flame spread index 0-25; smoke-developed index 0-450.
- Class B: Flame spread index 26-75; smoke-developed index 0-450.
- Class C: Flame spread index 76-200; smoke-developed index 0-450.

Applicability

DIRTT has tested all finishes to ASTM E84 to confirm finish classification; however, how the finishes are applied is up to the local *Distribution Partner* in concert with the design team / *Professional of Record*. Please refer to **Table 803.9** in the **International Building Code** for a guideline to applicability of finishes. Other sections of the code, or variations adopted at the state level may apply; therefore, finishes applications should be validated with the *Professional of Record* to confirm compliance with the presiding *Authority Having Jurisdiction* for each install location.

International Building Code (2012) Reference

803.9 Interior finish requirements based on group.

Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.9 for the group and location designated. *Interior wall and ceiling finish materials* tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.2.1, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 or UL 723 is required.

TABLE 803.9 INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY^k

GROUP	SPRINKLERED ^d			NONSPRINKLERED		
	Interior exit stairways, interior exit ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces ^c	Interior exit stairways, interior exit ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and exit access ramps	Rooms and enclosed spaces ^c
A-1 & A-2	B	B	C	A	A ^d	B ^e
A-3 ^f , A-4, A-5	B	B	C	A	A ^d	C
B, E, M, R-1	B	C	C	A	B	C
R-4	B	C	C	A	B	B
F	C	C	C	B	C	C
H	B	B	C ^g	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B ^{h, i}	A	A	B
I-3	A	A ^j	C	A	A	B
I-4	B	B	B ^{h, i}	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929m².

- a. Class C interior finish materials shall be permitted for wainscoting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.11.1.
- b. In other than Group I-2 occupancies in buildings less than three stories above grade plane of other than Group I-3, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.
- c. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and the rooms or spaces on both sides shall be considered one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.
- d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall not be less than Class B materials.
- e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.
- f. For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.
- g. Class B material is required where the building exceeds two stories.
- h. Class C interior finish materials shall be permitted in administrative spaces.
- i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.
- j. Class B materials shall be permitted as wainscoting extending not more than 48 inches above the finished floor in corridors and exit access stairways and ramps.
- k. Finish materials as provided for in other sections of this code.
- l. Applies when protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

MDF Substrates

Standard MDF:

DIRTT uses ½" (13mm) thick Flakeboard Superior MDF as the default substrate for all tile finishes that utilize a wood substrate. This raw material offers a flame spread/smoke developed performance of 110/180 when tested in accordance with ASTM E84 which is representative of a Class C material. Per the American Wood Council (AWC); *"if the material is homogeneous, flame spread may be considered nearly independent of material thickness greater than ¼" (6.4mm)."*

FR (Fire Retardant) MDF (NAF):

DIRTT uses ½" (13mm) thick Sierra Pine Medite FR as the substrate when a **Fire Retardant Treated Wood** is required to provide an enhanced finish classification. This raw material offers a flame spread/smoke developed performance of 15/95 when tested in accordance with ASTM E2768-2011 which is representative of a Class A material. ASTM E2768-2011 is a Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test) which is a requirement of **Section 2303.2** qualifying **Fire Retardant Treated Wood**.

International Building Code (2012) Reference

2303.2 Fire-retardant-treated wood.

Fire-retardant-treated wood is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84 or UL 723, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.

NAF (No Added Formaldehyde) MDF:

DIRTT uses ½" (13mm) thick Sierra Pine ARREIS® sustainable design fiberboard as the substrate when a NAF / NAUF **material** is required to gain LEEDS points or to meet local code or standards requirements. This raw material is classified as Class C material per the AWC.

FSC (Forest Stewardship Council) MDF / wood products:

DIRTT is Chain of Custody certified to sell products as "FSC Pure and FSC Mixed" by Scientific Certification Systems (SCS) in accordance with the rules of FSC to the FSC Standard: FSC-STD-40-004 V2-0. DIRTT's Certification Code is SCS-COC-000848. All MDF substrates can be ordered as FSC but must be addressed prior to order placement with info@dirtt.net to confirm pricing and any manufacturing lead-time concerns.

Mass Loaded Vinyl (Acoustic Enhancement)

Finished tiles utilizing a 1/8" (3mm) thick Mass Loaded Vinyl (MLV) backing material for enhanced STC performance will utilize an MDF or FR MDF that is 3/8" (10mm) thick. This will result in an overall finished tile thickness of ½" (13mm).

DIRTT Environmental Solutions manufactures a wide variety of solutions and options. It is the responsibility of the Professional of Record in conjunction with the Distribution Partner to ensure product applications meet the intent of the governing code and is adequately justified to the satisfaction of the Authority Having Jurisdiction.

D 20 PLUMBING**D 2010 DOMESTIC WATER DISTRIBUTION****A. SYSTEM DESCRIPTION**

1. Water is pumped from the supply tank and distributed through a branch and tee distribution system to supply different branches of the home.

B. FUNCTIONAL REQUIREMENTS

1. Provide hot and cold water to necessary fixtures and appliances. All products are manufactured and installed in compliance with applicable Building Codes, Regulations, and Rules.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design of the plumbing system is based on the components indicated below. Subject to compliance with requirements, provide equal products as determined by the architect and/or engineer.
2. Rotoplas RP-550657
 - a. Supply tank for domestic water use. Product data sheet CSI 22 11 19.
3. Walrus TQ800
 - a. Provide sufficient pressure to deliver water to fixtures and appliances. Product data sheet CSI 22 11 23.
4. Copper Piping
 - a. Provides domestic water supply distribution.
5. PVC Piping
 - a. Provides domestic water return and vents.
6. Domestic Hot Water Tank
 - a. See product data sheet CSI# 22 33 30.

D 2020 SANITARY DRAINAGE**A. SYSTEM DESCRIPTION**

1. Domestic return and venting routed to underdeck waste tank.

B. FUNCTIONAL REQUIREMENTS

1. Drain house pipes as required with proper slope. All products and design in compliance with applicable Building Codes, Regulations, and Rules.

C. COMPONENTS

1. Aire Industrial 952-003006
 - a. Collect wastewater used in the home. See product data sheet CSI# 22 13 53.

2. Standard PVC 2 ½" pipe
 - a. Pipe for plumbing return.

**1/2" VOLUME CONTROL VALVE
K-2974-K**

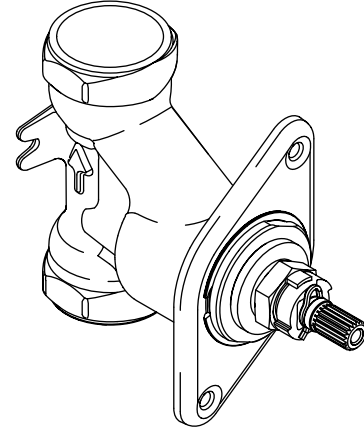
Features

- Forged brass construction
- Single-handle volume control
- 1/2" quarter-run washerless ceramic disc valves
- 1/2" NPT connections
- Intended for use with Kohler® thermostatic mixer valving

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASME A112.18.1/CSA B125.1



Colors/Finishes

- NA: None applicable

Specified Model

Model	Description	Colors/Finishes
K-2974-K	1/2" volume control valve	<input type="checkbox"/> NA

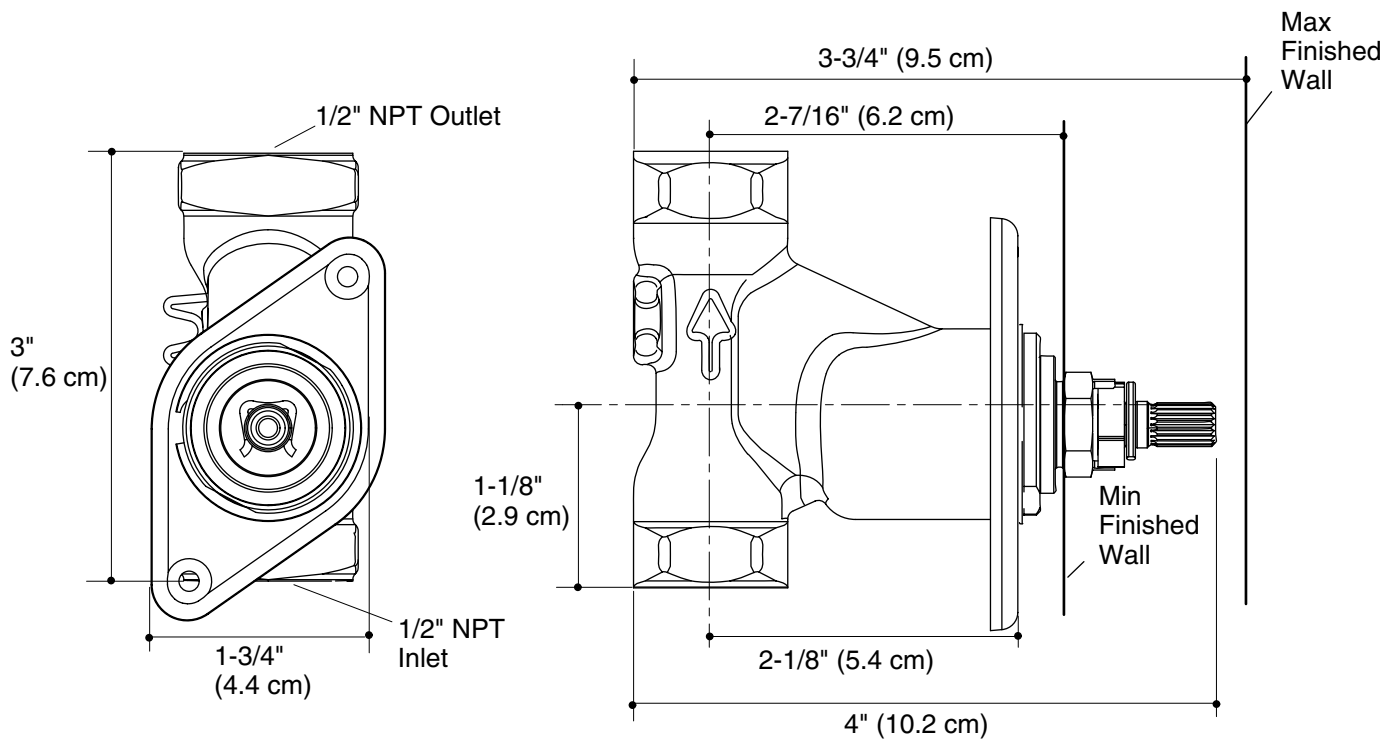
Product Specification

The volume control valve shall have a forged brass valve body. Product shall feature a 1/2" quarter-turn washerless ceramic disc valve, assuring positive handle stop positioning. Product shall have 1/2" NPT connections. Product shall feature single-handle volume control. Product is intended for use with Kohler thermostatic mixer valving. Product shall be Kohler Model K-2974-K-NA.

MASTERSHOWER®

Installation Notes

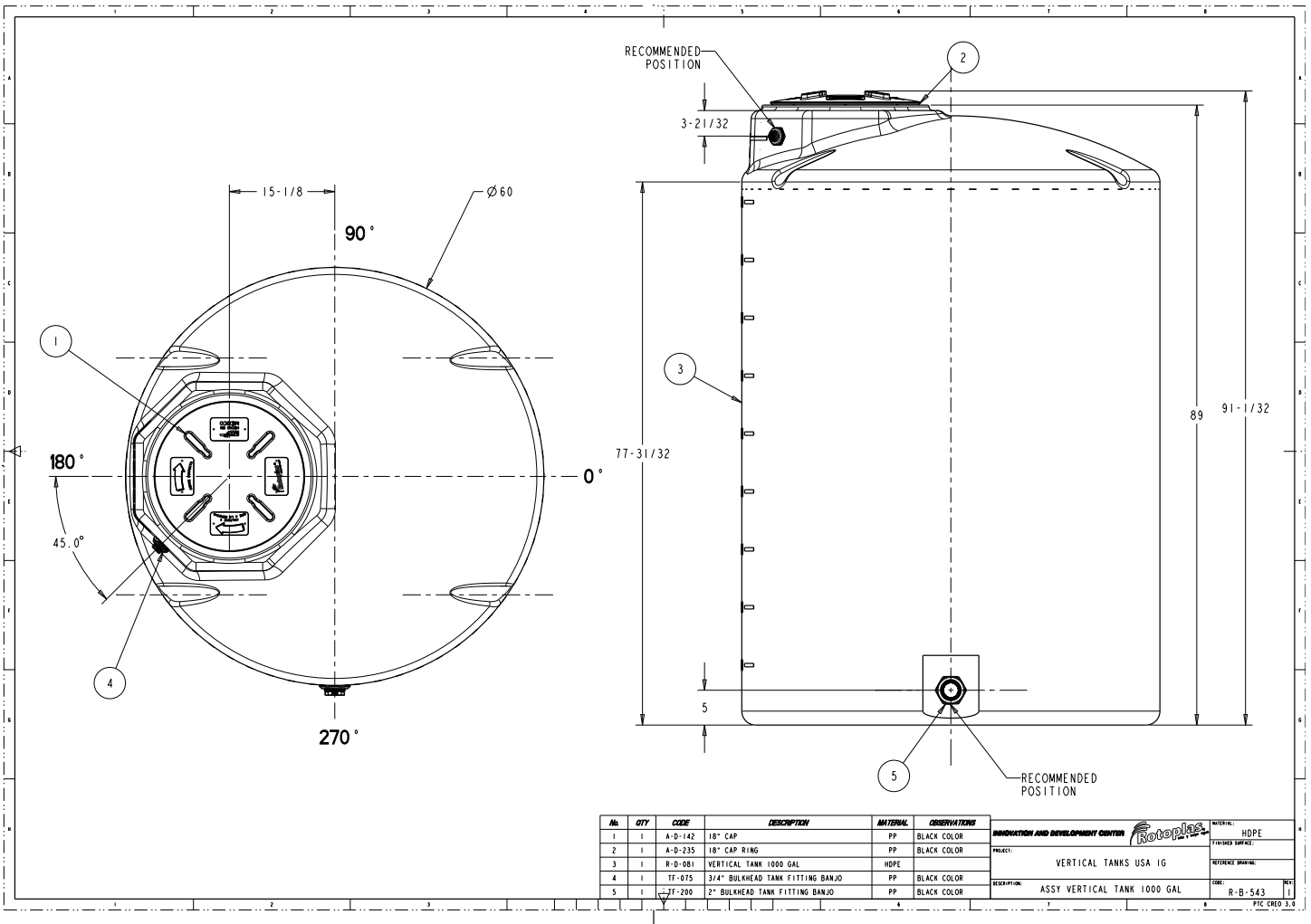
Install this product according to the installation guide.



Product Diagram

MASTERSHOWER® 1/2" VOLUME CONTROL VALVE
Page 2 of 2
1145573-4-A

THE BOLD LOOK
OF **KOHLER**®



No.	QTY	CODE	DESCRIPTION	MATERIAL	OBSERVATIONS	INNOVATION AND DEVELOPMENT CENTER	PROJECT: VERTICAL TANKS USA IG	REFERENCE DRAWING: R-B-543	MATERIAL: HDPE
1	1	A-D-142	18" CAP	PP	BLACK COLOR				
2	1	A-D-235	18" CAP RING	PP	BLACK COLOR				
3	1	R-D-081	VERTICAL TANK 1000 GAL	HDPE					
4	1	TF-075	3/4" BULKHEAD TANK FITTING BANJO	PP	BLACK COLOR				
5	1	JF-200	2" BULKHEAD TANK FITTING BANJO	PP	BLACK COLOR				

TQ Series Electronic Control Pump



50Hz

Power: 0.18 - 2.2 kW

Head: Up to 34M

Flow: Up to 250 L/min

60Hz

Power: 0.18 - 3.7 kW

Head: Up to 52M

Flow: Up to 270 L/min

Outlet: 1" - 2"

Applications

The TQ series pumps are designed for water supply and pressure boosting in residential, commercial and light industrial applications where low or inadequate water pressure exists. It is suitable for boosting pressure from underground or surface water supplies.

Operating Conditions

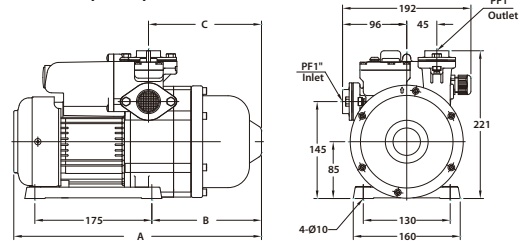
1. Ambient temperature: Max. +40°C
2. Liquid temperature: +4°C ~ +40°C
3. System Pressure : Max. 8.5 kg/cm²
4. Relative humidity: Max. 85% (RH)
5. Under normal operation, it is not necessary to adjust the pressure unless the cut in pressure is higher than preset activation point (refer to specification).

Product Features

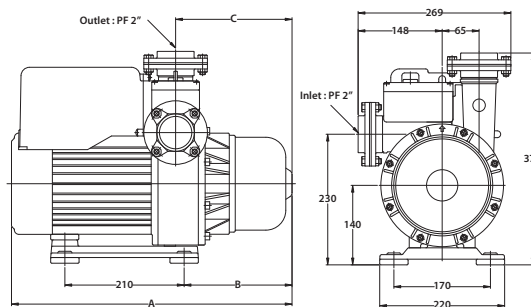
1. The TQ is a complete, all-in-one unit, consisting of pump, motor, pressure tank, and electronic controller. The built-in electronic controller provides constant pressure which ensures that the pump starts automatically when water is consumed and operates continuously until water is not required.
2. Compact design and quiet operation make the TQ series suitable for many applications.
3. The TQ is constructed from the top quality corrosion resistant materials.
4. Pump has built in dry-run shut off with automatic reset function.
5. The motor has built-in thermal overload to protect against high operating temperatures and over current. (Single phase motor only)
6. The TQ has an anti-cycling feature which prevents the pump from continuous starting and stopping when you have a dripping tap or minor leak in the system.
7. The pumps will lift water up to 7.6m. with foot valve and pump suction piping filled with water.

Dimensions

TQ200/400/800

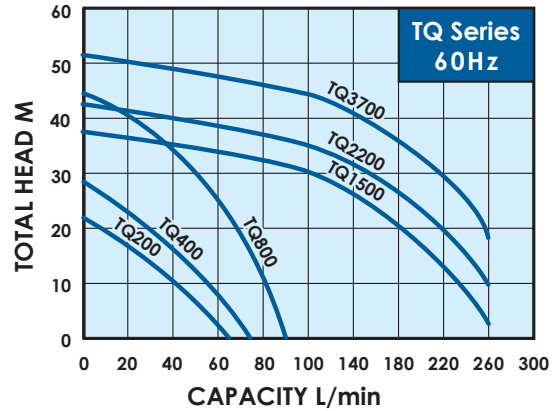
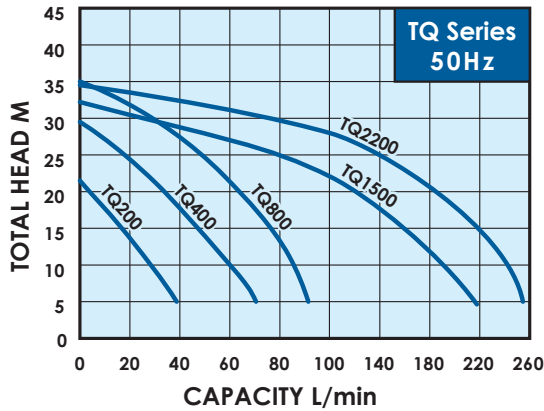


TQ1500/2200/3700




Model	Cycle (Hz)	Dimensions (mm)		
		A	B	C
TQ200	50	360	153	158
	60	336	129	134
TQ400	50	371	164	169
	60	345	138	143
TQ800	50 / 60	417	164	169
TQ1500 ~ 2200	50 / 60	501	197	212
TQ3700	60	501	197	212


Performance curve



Specification, 50Hz

Model	Power (kW)	Cycle (Hz)	Phase (Ø)	Voltage (V)	Amp's (A)	Inlet (in.)	Outlet (in.)	Preset activation point (kg/cm ²)	H max. (m)	Q max. (L/min)	N.W. kg	
TQ200	0.18	50	1	200~240	1.5	1"	1"	1.2	22	45	7.4	30
TQ400	0.37	50	1	200~240	3	1"	1"	1.8	30	75	9.4	30
TQ800	0.75	50	1	200~240	4.4	1"	1"	2.0	35	95	11	24
TQ1500	1.5	50	1	200~240	7.2	2"	2"	2.5	32	230	28	12
			3	200~240	5.8							
TQ2200	2.2	50	1	200~240	11.1	2"	2"	2.5	34	250	31	12
			3	200~240	7.2							

Specification, 60Hz

Model	Power (kW)	Cycle (Hz)	Phase (Ø)	Voltage (V)	Amp's (A)	Inlet (in.)	Outlet (in.)	Preset activation point (kg/cm ²)	H max. (m)	Q max. (L/min)	N.W. kg	
TQ200	0.18	60	1	110/220	4.0/2.0	1"	1"	1.4	22	60	7.4	30
TQ400	0.37	60	1	110/220	6.0/3.0	1"	1"	2.0	28	70	9.4	30
TQ800	0.75	60	1	110/220	11/5.5	1"	1"	2.5	44	90	11.6	24
TQ1500	1.5	60	1	220	9.5	2"	2"	3.0	37	270	28	12
			3	220	6.5							
TQ2200	2.2	60	3	220	9.5	2"	2"	3.0	42	270	31	12
TQ3700	3.7	60	3	220	13.8	2"	2"	3.0	52	270	31.5	12

300 Waste w/free ground pad



SKU: 952-003006

Downloads:
[Fitting Placement Request](#)
[Bladder Instructions](#)

\$445.00

List Price: ~~\$461.80~~

You Save: 3.64%

Qty:

[Add to Cart](#)

[View Larger](#)



[Specifications](#)

[Video](#)

[Features](#)

Specs	
Capacity	300 gal.
Length	108"
Width	60"
Loft	12"
Weight	28 lbs.

- PVC fabric for the most rugged of conditions
- All standard waste bladders are made using 30 oz fabric
- All waste bladders come standard with 2 each 2" fill / discharge female NPT flanges
- Waste water bladders come with 3/4" NPT vent
- All fitting locations are re-enforced to double thickness for bladder stability
- All seams are 1.25" in width and thermo welded seams
- Fitting locations customizable upon request
- Geotextile ground pad is included for every bladder tank
- Bladder tank material is UV resistant
- High puncture resistant fabric
- 22 to 28 mils min. fabric thickness depending on tank capacity
- Low temperature tolerance to -40 F
- Ball valves and camlocks available upon request

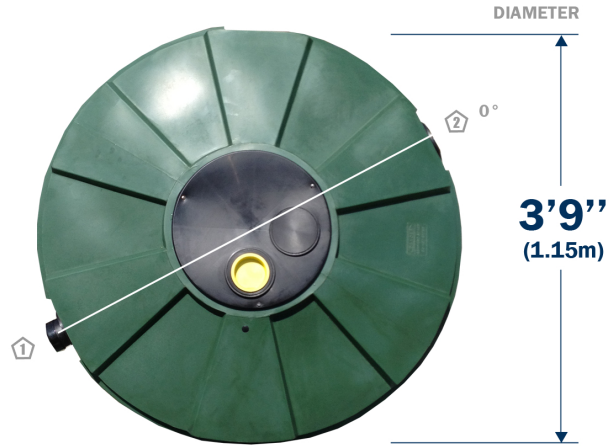
TOP VIEW

STRAINER BASKET

Material: Polypropylene
 Color: Black
 Dimension: 16" x 4"
 Mesh: 20x20 S.S.

COVER

Material: Polypropylene
 Color: Black
 Diameter: 16"
 Holes: 2 - 4" K.O.
 1 - 3" Precut



SIDE VIEW

TANK

Material: Polyethylene
 Rib: 6

OVERFLOW

Material: Polypropylene
 Diameter: 3" SDR 35

FITTINGS

Type: Bulkhead
 Height: 3.5"/180°
 3.5"/0°
 Diameter: 1" NPT



FEATURES



OVERVIEW

53' Truck Load
28 units w/o pallets



COLORS



- Actual colors may vary from the example shown above.

CONTACT

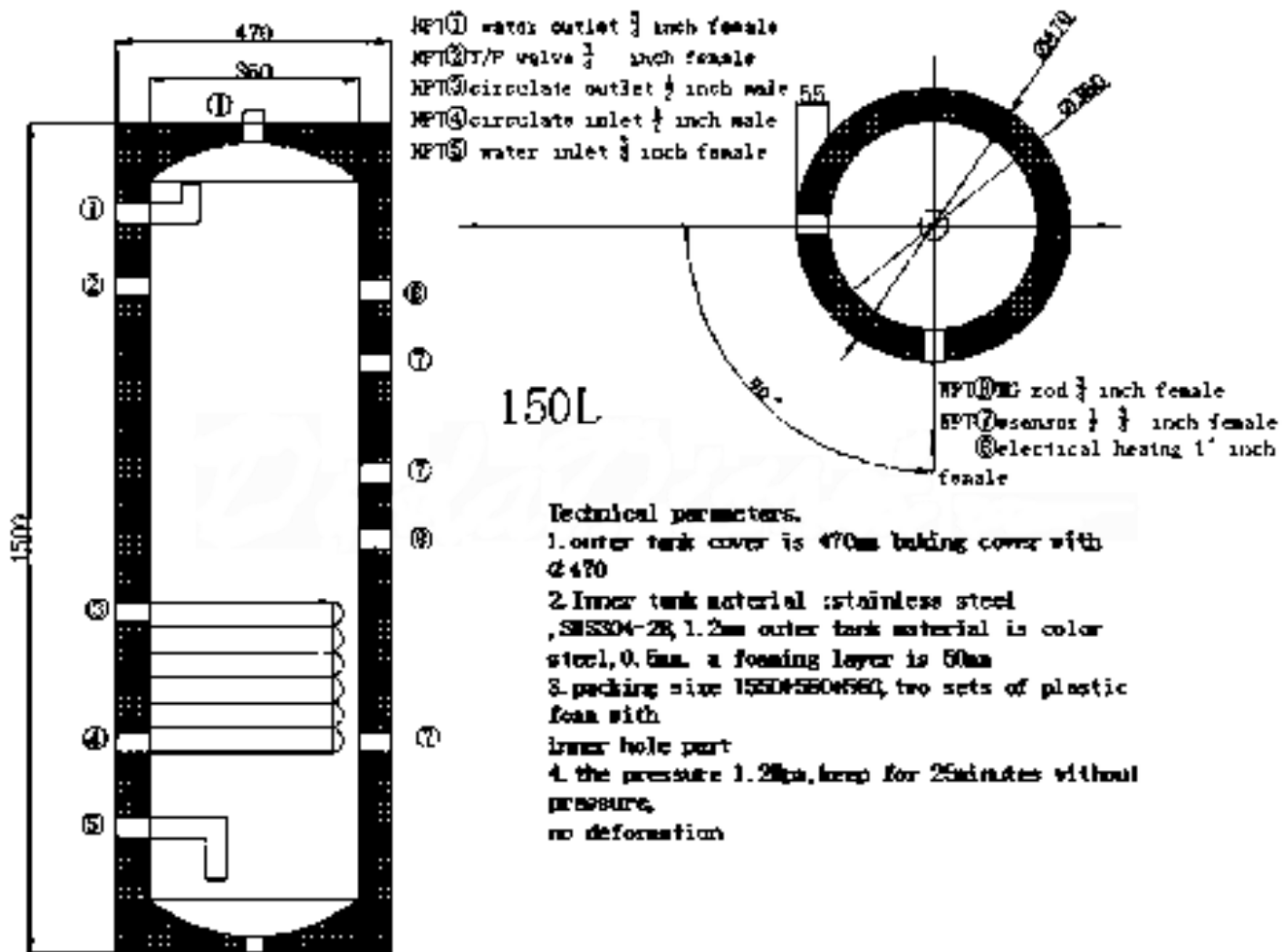
Corporate Headquarters
26040 Ynez Road, P.O. Box 893051
Temecula, California 92589-3051
866.920.8265 (p)
951.296.6123 (f)
www.bushmanusa.com

Canada
6185 Tomken Road, Unit 3-5
Mississauga, Ontario L5T1X3
800.387.8332 (p)
905.565.8282 (f)

Rev.1 31412



Solar Water Heater Tank Specifications	
Inner tank material	Food Grade SUS 304-2B
Outer tank cover material	Galvanized Steel 0.5 mm thickness.
Heat preservation layer	high pressure automatic polyurethane foaming layer, Density of 36 kg/m ³ (2.24 lb/ft ³)
In Tank heat exchanger specs	TU1 copper (Red Copper), thickness: 1mm (0.04")
Water Purification	Magnesium rod installed
Backup heating	Standard 1" port for electric backup with mechanical thermostat
Drain port	3/4" female NPT (Bottom of tank)
T/P Port (Exhaust Port)	3/4" female NPT (for T/P Valve)
Coil connections	12mm (1/2") Diameter coils have 1/2" Male NPT, 20mm (3/4") Diameter coils have 3/4" Male NPT
Accessories	tank feet, screws, T/P valve
Duda Energy Warranty	5 Years against manufacturing defects



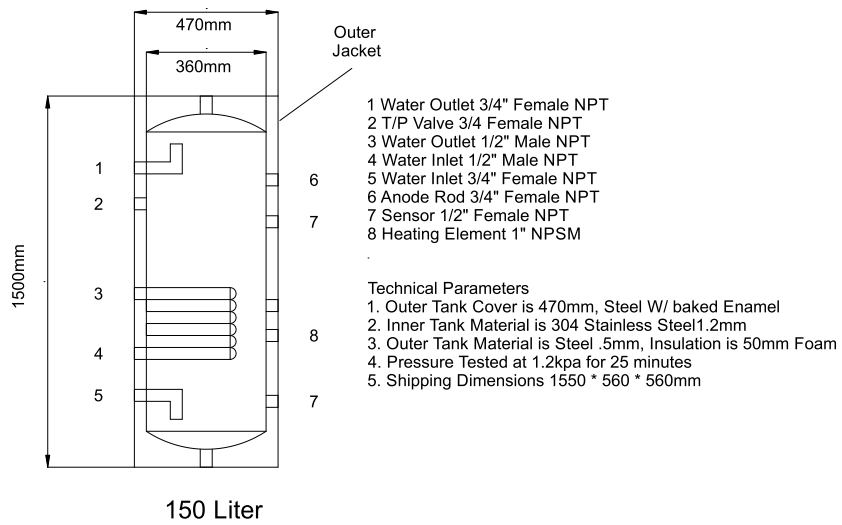
Tank Specs by Size

Capacity	Weight (Single Coil)	Diameter	Insulation Thickness	R-Value	Inner Tank Thickness	Water Ports Size	Coil Diameter	Coil Length		
								Single Coil	Dual Coil (Lower)	Dual Coil (Upper)
150 Liters (39.6 Gallons)	40 Kg (88 lb)	470mm (18.5")	50mm (1.97")	12.45 (US) 2.19 (SI)	1.2mm (0.047")	3/4" NPT	12mm (1/2")	20m (66 ft)	20m (66 ft)	10m (33 ft)

*Note: Listed tank heights do not include the mounting feet. Mounting feet add an additional 6.8cm (2.7") to total height.

Solar Panels Plus 2133 Smith Ave.
www.solarpanelsplus.com

Chesapeake, VA 23320 tel: (757) 549-1494



Features

- Reversible quarter-turn washerless ceramic disc valves.
- Ceramic disc valves exceed industry longevity standards, ensuring durable performance for life.
- High-arch swing spout offers superior clearance for filling pots and cleaning.
- Two lever handles offer separate control of hot and cold water.
- 9" (229 mm) swing spout reach.
- For 8" (203 mm) centers
- Matching finish sidespray.
- 1.8 gal/min (6.8l/min) maximum flow rate [max at 60 psi (4.14 bar)].
- Meets CalGreen requirements for kitchen faucets.

Material

- Premium metal construction.
- KOHLER finishes resist corrosion and tarnishing.

Installation

- Four-hole installation.
- Requires K-15850-4M lever handles (sold separately)
- Lower flow aerator options are available (refer to the Kohler Price Book).

Required Accessories

K-15850-4M Decorative Lever Handles

Optional Accessories

1030920 Side Spray Deep Rough-In



ADA

Codes/Standards

ASME A112.18.1/CSA B125.1

NSF 61

NSF 372

All applicable US Federal and State material regulations

DOE - Energy Policy Act 1992

California Energy Commission (CEC)

ADA

ICC/ANSI A117.1

KOHLER® Faucet Lifetime Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color Code Description

■ CP Polished Chrome

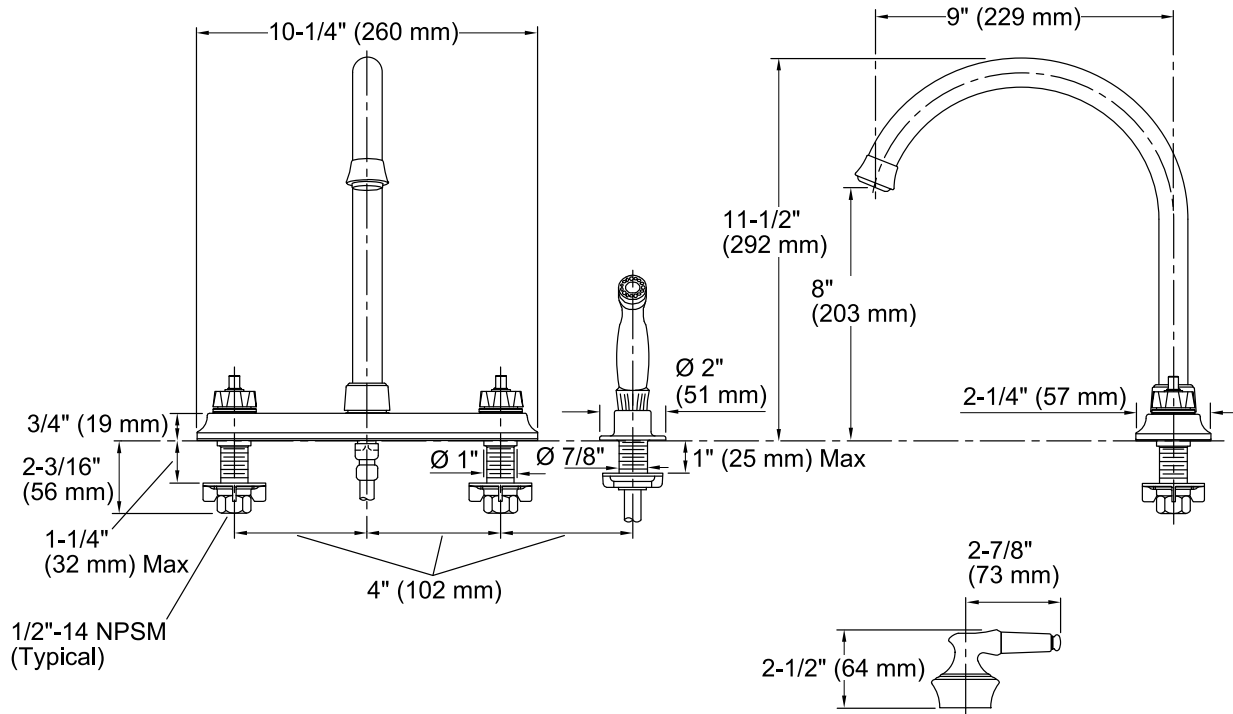
USA/Canada: 1-800-4KOHLER (1-800-456-4537)

Kohler Co. reserves the right to make revisions without notice to product specifications.

For the most current Specification Sheet, go to www.kohler.com.

12-20-2016 04:10

THE BOLD LOOK
OF **KOHLER®**



Technical Information

All product dimensions are nominal.

Spout:

Spout reach: 9" (229 mm)

Faucet:

Flow rate: 1.8 gal/min (6.8 l/min)

Pressure: 60 psi (4.1 bar)

Notes

Install this product according to the installation guide.

ADA compliant when installed to the specific requirements of these regulations.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)

Kohler Co. reserves the right to make revisions without notice to product specifications.

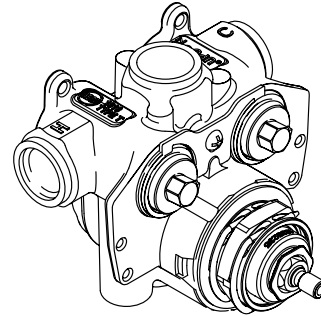
For the most current Specification Sheet, go to www.kohler.com.

12-20-2016 04:10

THE BOLD LOOK
OF **KOHLER**®

Features

- Forged brass valve body
- Single-handle temperature control
- High-temperature limit setting for added safety
- Temperature-balancing mechanism
- Scald hazard prevention
- Integral stops
- Crossflow prevention
- 1/2" NPT connections
- Filter screens
- Single outlet
- Less volume control



Codes/Standards Applicable

Specified model meets or exceeds the following:

- ASSE 1016
- ASME A112.18.1/CSA B125.1

Colors/Finishes

- NA: None applicable

Accessories

- NA: None applicable

Specified Model

Model	Description	Colors/Finishes
K-2972-KS	1/2" thermostatic mixer - less volume control	<input type="checkbox"/> NA
Required Accessories		
K-2974-K	1/2" volume control valve - for use on bath and shower outlets	<input type="checkbox"/> NA
Optional Accessories		
K-9663	Twin ell - for use with diverter bath spouts only	<input type="checkbox"/> NA

Product Specification

The thermostatic mixer less volume control shall have a forged brass valve body. Product shall feature single-handle temperature control, high-temperature limit stop for added safety, and temperature-balancing mechanism. Product shall feature integral stops, crossflow prevention, filter screens, and scald hazard prevention. Product shall have 1/2" NPT connections. The thermostatic mixer shall be Kohler Model K-2972-KS-NA and the required volume control valve shall be K-2974-K-NA.

MASTERSHOWER®

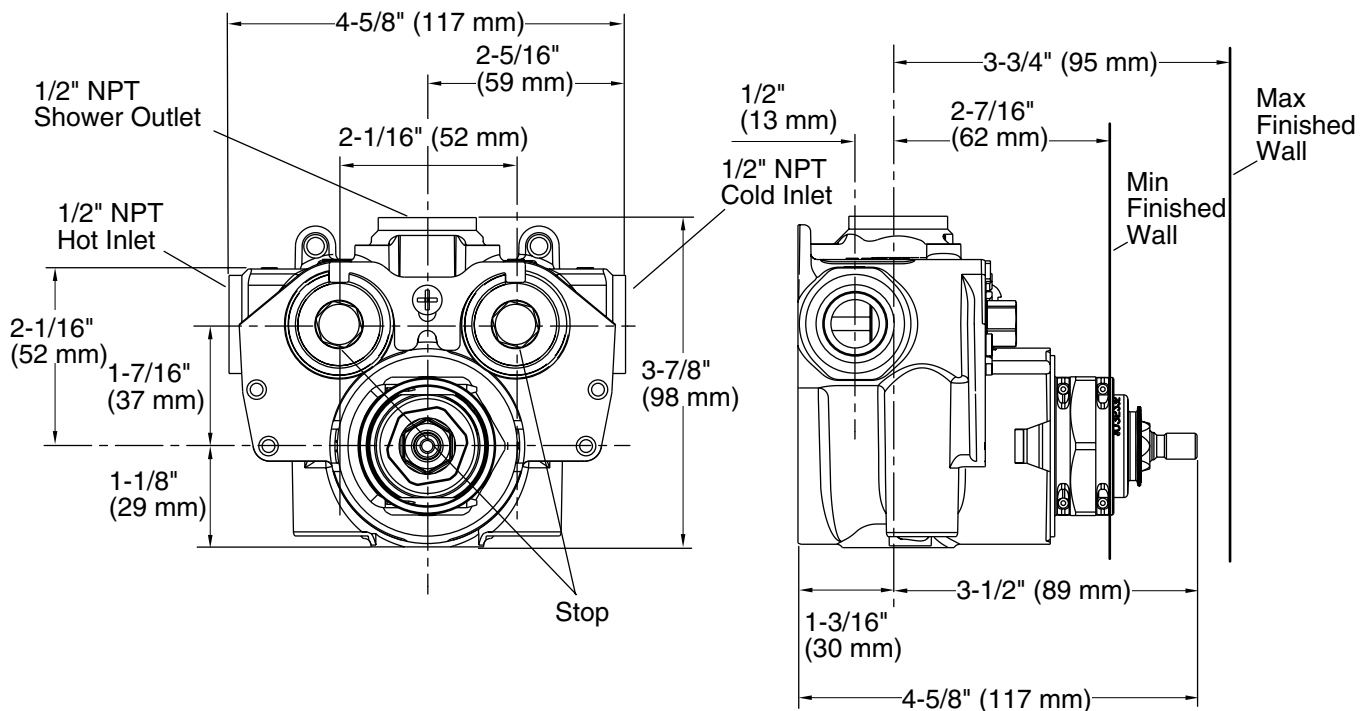
Installation Notes

Install this product according to the installation guide.

The K-2972-KS thermostatic mixer valve requires a separate volume control valve, K-2974-K, for each bath and/or shower outlet.

For bath-only installations, valve may be installed upside down.

For installations with a diverter spout, a twin ell, K-9663, is required between the valve and the spout. It is acceptable for the supply to the K-9663 twin ell to run from the top port through the volume control valve.



Product Diagram

MASTERSHOWER® 1/2" THERMOSTATIC MIXER

Page 2 of 2
1145571-4-B

THE BOLD LOOK
OF **KOHLER**®

MODEL: 200521-COLOR

UNDER COUNTER SINKS

Under counter ceramic vessel with overflow

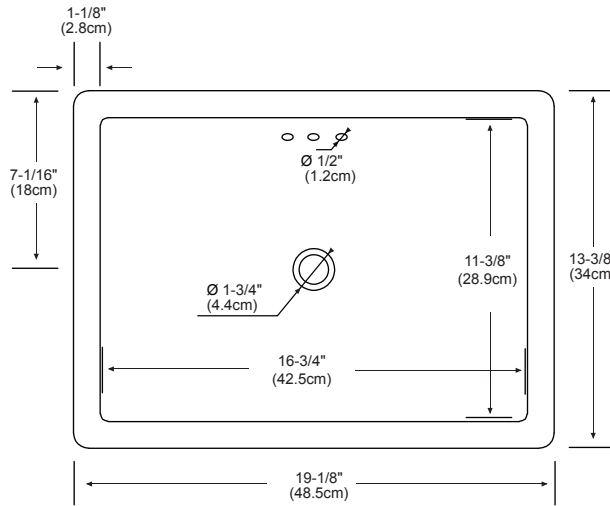
Codes/Standards Applicable

Specified model meets or exceeds the following:

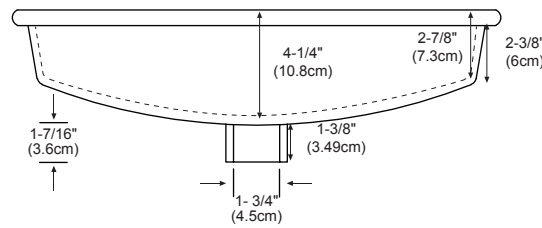
- ASME A112.19.2
- IAPMO/cUPC®
- CSA B45
- CMR 248

Available Colors:

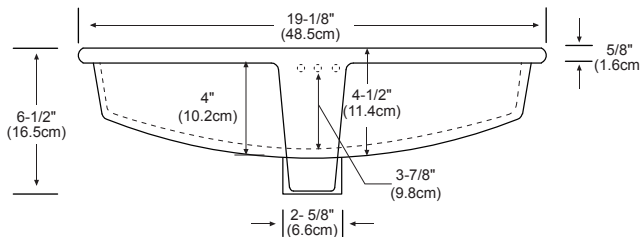
- WHITE WH
- BISCUIT BI
- BLACK BL
- COOL GRAY CG



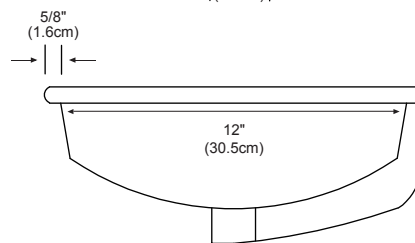
TOP



FRONT



BACK



SIDE

By IAPMO, ceramic lavatory warpage is defective only if warpage of flat slab out of horizontal plane exceeds 6.3 mm/m (0.25 in/ft) on all sizes OR warpage on back of lavatories that are attached to the wall exceeds 3 mm (0.13 in).



STEALTH®

QUIET. POWERFUL. PROVEN.™

THE WORLD'S ONLY ULTRA-HIGH-EFFICIENCY TOILETS



THE ORIGINAL 0.8 GPF SINGLE FLUSH ROUND BOWL

BOWL - N7716 | TANK - N7714 | 12" Rough-In

FEATURES

- Quiet, powerful flush delivered with a patented Stealth flush chamber and air transfer system
- Reliable standard Fluidmaster fill valve
- One flush thoroughly evacuates the bowl every time, eliminating double flushing
- Smooth, low friction ceramic surface helps achieve a clear bowl every time
- Two-piece toilet
- Stylish, inconspicuous and durable flush button
- EZ Height design makes it easier to sit and stand
- No flapper to cause leakage

SPECIFICATIONS

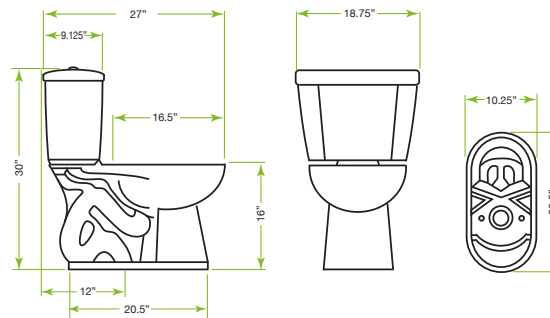
N7716 Bowl and N7714 Tank

Technology	Stealth
Flush Rate	0.8 GPF
MaP Performance Score	800g - MaP Premium
Efficiency Rating	UHET
ASME Certification	✓ A112.19.2
CSA Certification	✓ B45.1
WaterSense Labeled	✓
Materials	Vitreous China
Finish Color	White

NOTE: EZ Height is only ADA Compliant with appropriate seat configuration.

MEASUREMENTS

Bowl Dimensions:	14"W x 16"H x 26.5"D
Footprint:	20.5"L x 10.25"W
Water Spot:	8" x 6"
Assembled Dimensions:	18.75" W x 30" H x 27" D
Rough-In:	12"



*LIMITED LIFETIME WARRANTY on vitreous china products. Toilet tank trim: fill valve and flush valve assembly and plumbing fittings are warranted for a period of ten years to the purchaser from the date of purchase. Call Niagara Conservation for complete warranty details.

CORPORATE HQ 1200 Lakeside Parkway, Suite 450, Flower Mound, Texas 75028 USA
(t) 800.831.8383 (p) 817.391.0800 (f) 682.200.6962 (e) info@niagaracorp.com

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STEALTH®

THE ORIGINAL 0.8 GPF SINGLE FLUSH ROUND BOWL

RETAIL PACKAGING

77001RWHAI1 All-In-One

UPC Code 732291000420

Packaging Type High-Quality, White Corrugate With Litho Label

Dimensions 16.5" W
28.7" H
31.5" D

Weight (Pkg.) 101 lbs

BULK PACKAGING

N7716 Round

UPC Code 732291771641

Packaging Type Kraft Corrugated

Dimensions 15.5" W
16.5" H
27.5" D

Weight (Pkg.) 40 lbs

Skid Quantity 18 or 12

N7714 Tank

UPC Code 732291771429

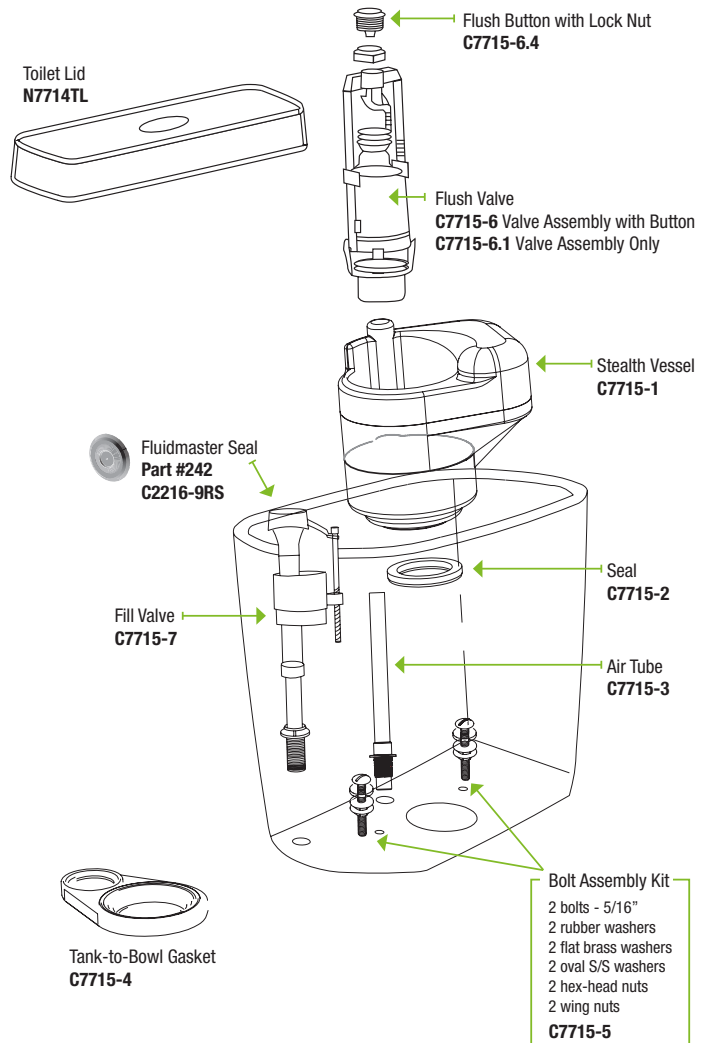
Packaging Type Kraft Corrugated

Dimensions 9.5" W
15.5" H
19" D

Weight (Pkg.) 37 lbs

Skid Quantity 30

ASSEMBLY / SPARE PARTS



INSTALLATION NOTES

Install this product according to the installation guide. For back-to-back toilet installations: Use only a 45° double wye fitting. Will comply with the Americans with Disabilities Act (ADA) when installed per the requirements of the 2010 ADA Standards of Accessible Design, Section 604 Water Closets, of the Act. The Model Plumbing Codes require the installation of elongated open-front toilet seats in public bathrooms. Will comply with CSA B651 when installed per Clause 4.3.6 of the standard. Will comply with OBC Barrier Free requirements when installed per Clause 3.8.3.8 and 3.8.3.9.

CORPORATE HQ 1200 Lakeside Parkway, Suite 450, Flower Mound, Texas 75028 USA (t) 800.831.8383 (p) 817.391.0800 (f) 682.200.6962 (e) info@niagaracorp.com

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77167714

niagaracorp.com



EARTH[®]

Handheld Showerhead

Available In **UHET[™]** WATER-SAVING KITS



FEATURES

- Three spray settings: 9-jet spray, shower and combo
- Non-removable flow compensator
- Non-aerated spray means less temperature loss with maximum energy savings
- Corrosion-resistant, high-impact ABS thermoplastic body
- Steady stream with a large spray diameter
- Patented Equiforce[™] Technology guarantees a consistent flow rate across a wide range of pressure

SPECIFICATIONS

ITEM NUMBER	FLOW RATE	FINISH	SPRAY
N2945CH	1.5 GPM	Chrome Plated	3 Function
N2935	2.0 GPM	White	3 Function
N2935CH	2.0 GPM	Chrome Plated	3 Function

Technology Pressure Compensator Flow Control

Materials Body: ABS Durable Plastic; Bracket Ball Joint: White ABS Durable Plastic or Chrome Plated ABS Thermoplastic; Internal Parts: Brass, ABS and POM Plastics, High-Heat Rubber Gaskets, and Pressure Compensator; Hose: 72" Nylon Reinforced PVC Hose with Durable BS connectors

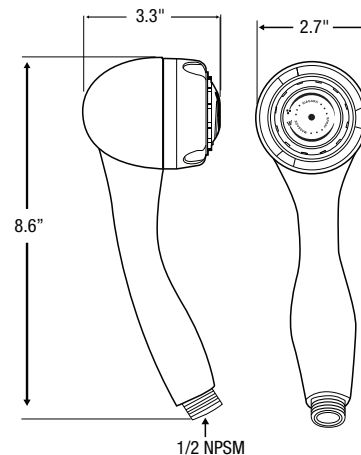
ASME Certification A112.18.1

CSA Certification B125.1

MEASUREMENTS

LENGTH: 8.504"

FACE: 2.756"



NOTE: Dimensions are subject to change.



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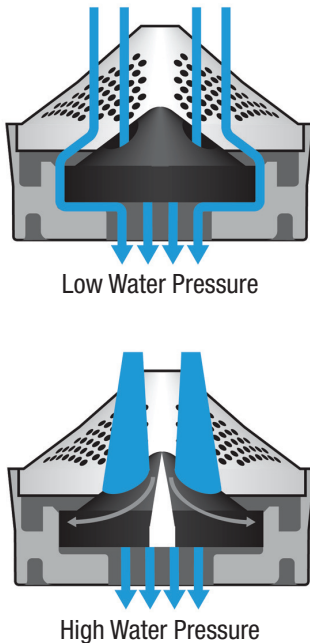
EARTH HANDHELD SHOWERHEAD



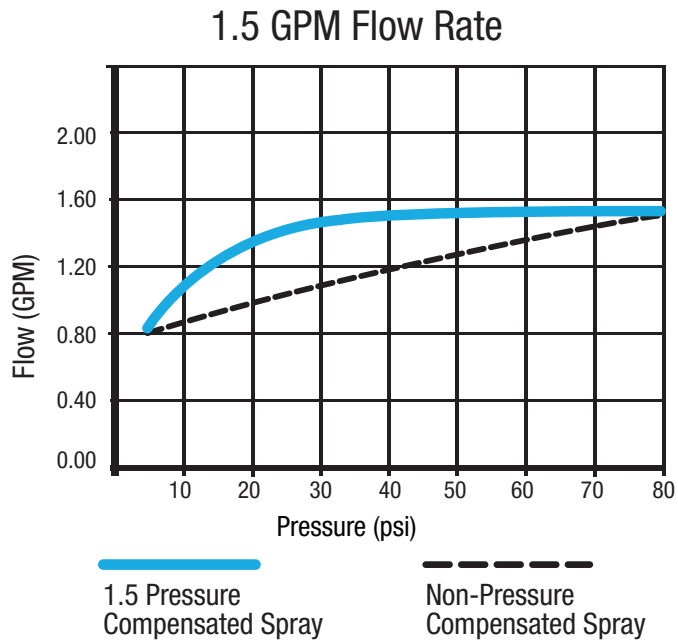
EQUIFORCE™ TECHNOLOGY

Niagara's patented pressure-compensating technology, Equiforce, revolutionizes water flow by providing constant water output regardless of water pressure. At low pressure, water is allowed to flow through three holes in the center of the compensator around the scallop cutouts on the edges. As water pressure increases, the force presses down on the compensator, causing it to flex. As it flexes, the scalloped cuts seal off, allowing water to only flow through the center holes. As water pressure increases further, the compensator continues to flex and the shape of the holes distort, reducing the size of the openings. This further controls the amount of water that flows through them. The shape and hardness of the rubber help maintain a level flow rate as the pressure increases.

Constant Output Regardless of Pressure



Constant Flow Rate Across Wide Range of Pressure



WARRANTIES

Niagara Conservation guarantees to the original purchaser or recipient of a showerhead that it is free from defects in material and workmanship for a period of 10 years. Niagara Conservation will, at our choice, replace any part of the showerhead which is in our opinion defective provided that the product has not been abused, misused, altered, or damaged after its purchase. This includes damage due to the use of tools or harsh chemicals. In the event a product has been discontinued, Niagara Conservation will replace it with what we determine to be the closest product. Niagara Conservation is not responsible for labor charges, installation, or other consequential cost. Niagara Conservation's responsibility shall not exceed the original cost of the product. For complete warranty details, contact Niagara Conservation at 800.831.0800.

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Features

- Metal construction.
- Brass valve bodies.
- Pop-up drain with lift rod and tailpiece.
- 5-1/2" (140 mm) spout reach.
- Stationary spout.
- For 8" (203 mm) or 16" (406 mm) centers.
- Quarter-turn washerless ceramic disc valves.
- Lever handles.
- Low gooseneck spout.
- 1.2 gal/min (4.5 l/min) maximum flow rate [max at 60 psi (4.14 bar)].



ADA CSA B651

Codes/Standards

ASME A112.18.1/CSA B125.1
 NSF 61
 NSF 372
 All applicable US Federal and State material regulations
 DOE - Energy Policy Act 1992
 EPA WaterSense®
 California Energy Commission (CEC)
 ADA
 ICC/ANSI A117.1
 CSA B651

KOHLER® Faucet Lifetime Limited Warranty

See website for detailed warranty information.

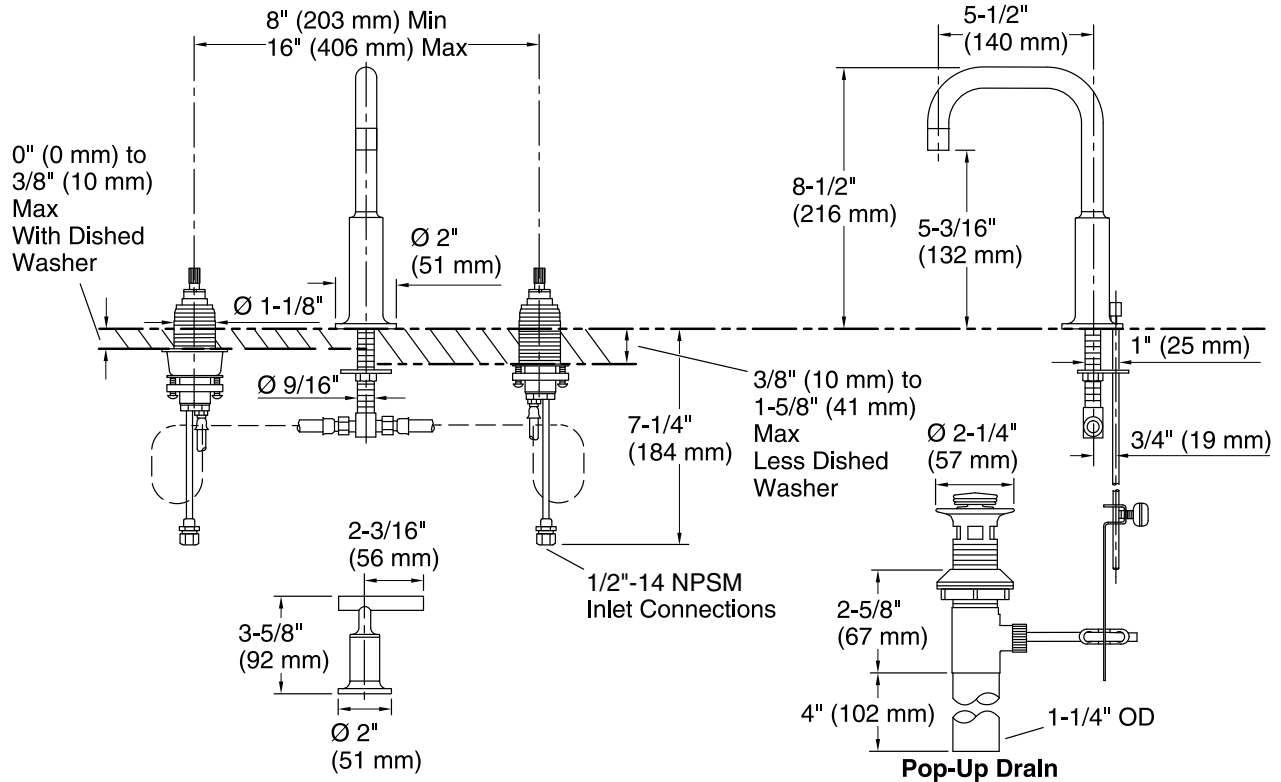
Available Color/Finishes

Color tiles intended for reference only.

Color	Code	Description
	CP	Polished Chrome
	SN	Vibrant® Polished Nickel
	BGD	Vibrant® Moderne Brushed Gold
	BN	Vibrant® Brushed Nickel
	BV	Vibrant® Brushed Bronze
	RGD	Vibrant Rose Gold

USA/Canada: 1-800-4KOHLER (1-800-456-4537)
 Kohler Co. reserves the right to make revisions without notice to product specifications.
 For the most current Specification Sheet, go to www.kohler.com.
 7-28-2017 03:29

THE BOLD LOOK
 OF **KOHLER®**



Technical Information

All product dimensions are nominal.

Drain included: YES

Drain tailpiece included: YES

Spout:

Spout reach: 5-1/2" (140 mm)

Handle clearance: 2-3/16" (56 mm)

Faucet:

Flow rate: 1.2 gal/min (4.5 l/min)

Pressure: 60 psi (4.1 bar)

Notes

Install this product according to the installation guide.

ADA, CSA B651 compliant when installed to the specific requirements of these regulations.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)

Kohler Co. reserves the right to make revisions without notice to product specifications.

For the most current Specification Sheet, go to www.kohler.com.

7-28-2017 03:29

THE BOLD LOOK
OF **KOHLER®**



STEALTH®

QUIET. POWERFUL. PROVEN.™

THE WORLD'S ONLY ULTRA-HIGH-EFFICIENCY TOILETS



THE ORIGINAL 0.5/0.95 GPF DUAL FLUSH ELONGATED BOWL
BOWL - N7717 | TANK - N7714T-DF | 12" Rough-In

FEATURES

- Quiet, powerful flush delivered with a patented Stealth flush chamber and air transfer system
- Reliable standard Fluidmaster fill valve
- One flush thoroughly evacuates the bowl every time, eliminating double flushing
- Smooth, low friction ceramic surface helps achieve a clear bowl every time
- Two-piece toilet
- Easy-to-use flush buttons
- EZ Height design makes it easier to sit and stand
- No flapper to cause leakage

SPECIFICATIONS

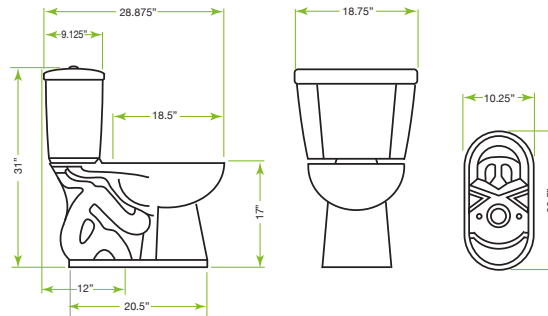
N7717 Bowl and N7714T-DF Tank

Technology	Stealth
Flush Rate	0.5/0.95 GPF
MaP Performance Score	800g - MaP Premium
Efficiency Rating	UHET
ASME Certification	✓ A112.19.2
CSA Certification	✓ B45.1
WaterSense Labeled	✓
EZ Height	✓ 17"
Materials	Vitreous China
Finish Color	White

NOTE: EZ Height is only ADA Compliant with appropriate seat configuration.

MEASUREMENTS

Bowl Dimensions:	14"W x 17"H x 28.5"D
Footprint:	20.5"L x 10.25"W
Water Spot:	8" x 6"
Assembled Dimensions:	18.75" W x 31.5" H x 28.875" D
Rough-In:	12"



*LIMITED LIFETIME WARRANTY on vitreous china products. Toilet tank trim: fill valve and flush valve assembly and plumbing fittings are warranted for a period of ten years to the purchaser from the date of purchase. Call Niagara Conservation for complete warranty details.

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STEALTH®

THE ORIGINAL 0.5/0.95 GPF DUAL FLUSH ELONGATED BOWL

BULK PACKAGING

N7717 Elongated

UPC Code 732291771733

Packaging Type Kraft Corrugated

Dimensions
16" W
17.5" H
29.5" D

Weight (Pkg.) 40 lbs

Skid Quantity 18 or 12

N7714T-DF Tank

UPC Code 732291000239

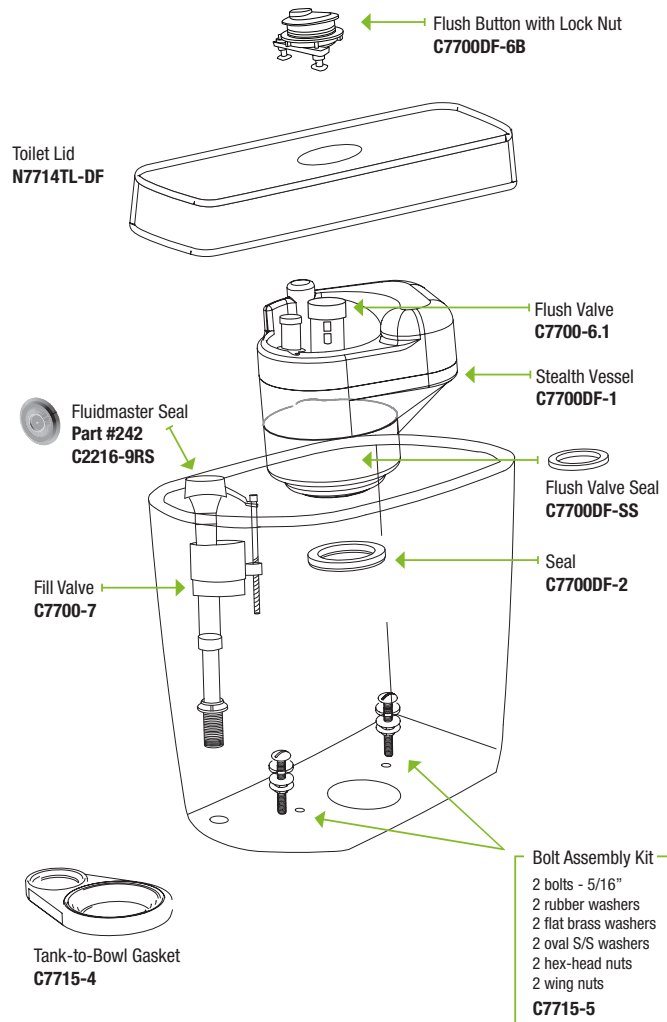
Packaging Type Kraft Corrugated

Dimensions
9.5" W
15.5" H
19" D

Weight (Pkg.) 37 lbs

Skid Quantity 30

ASSEMBLY / SPARE PARTS



INSTALLATION NOTES

Install this product according to the installation guide. For back-to-back toilet installations: Use only a 45° double wye fitting. Will comply with the Americans with Disabilities Act (ADA) when installed per the requirements of the 2010 ADA Standards of Accessible Design, Section 604 Water Closets, of the Act. The Model Plumbing Codes require the installation of elongated open-front toilet seats in public bathrooms. Will comply with CSA B651 when installed per Clause 4.3.6 of the standard. Will comply with OBC Barrier Free requirements when installed per Clause 3.8.3.8 and 3.8.3.9.

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 7717714DF



SAVA SPA™

Fixed Mount Showerhead

Available In **U-HET™** WATER-SAVING KITS



FEATURES

- Single spray function, wide spray coverage
- Saves 40% more than standard showerheads
- 360 ball joint swivel for adjustment
- Extra large spray head, 4.4" diameter
- Corrosion resistant high-impact ABS thermoplastic body
- Patented Equiforce™ Technology guarantees a consistent flow rate across a wide range of pressure

SPECIFICATIONS

ITEM NUMBER	FLOW RATE	FINISH	SPRAY
N2515	1.5 GPM	White	Single Function
N2515CH	1.5 GPM	Chrome Plated	Single Function
N2517	1.75 GPM	White	Single Function
N2517CH	1.75 GPM	Chrome Plated	Single Function

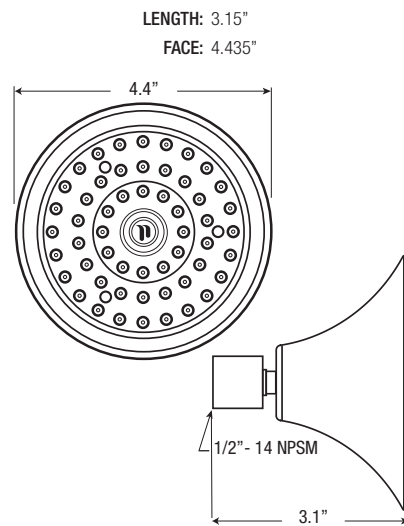
Technology Pressure Compensator Flow Control

Materials Body: ABS Durable Plastic

ASME Certification A112.18.1

CSA Certification B125.1

MEASUREMENTS



NOTE: Dimensions are subject to change.



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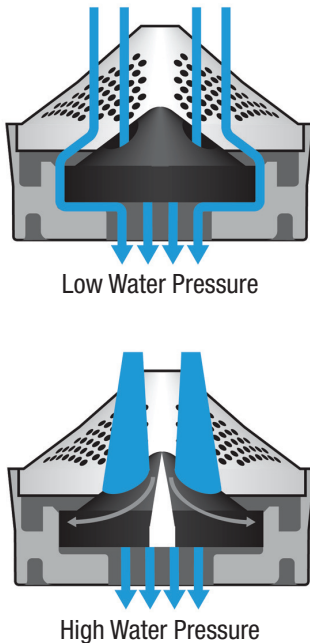
SAVA SPA FIXED MOUNT SHOWERHEAD



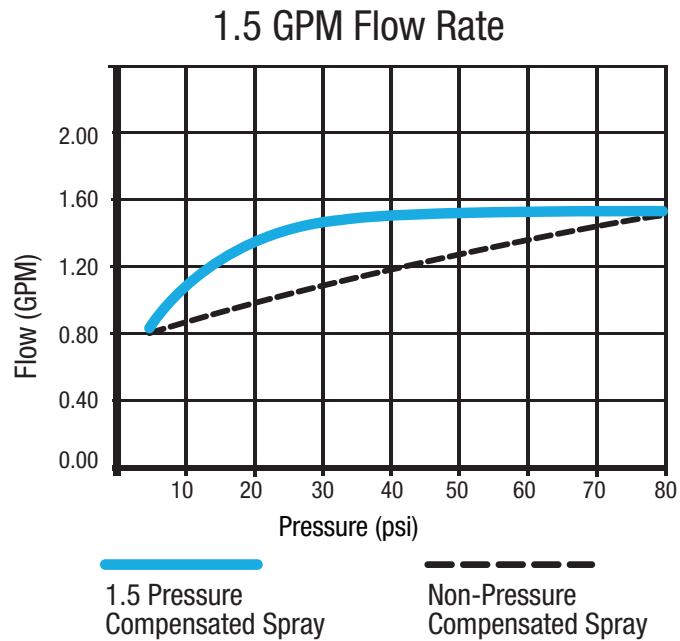
EQUIFORCE™ TECHNOLOGY

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Constant Output Regardless of Pressure



Constant Flow Rate Across Wide Range of Pressure



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Features

- 60-inch hose length.
- Swivel base helps reach target areas.
- For use with a handshower (sold separately)

Material

- Durable metal construction.
- KOHLER finishes resist corrosion and tarnishing.



Codes/Standards

None Applicable

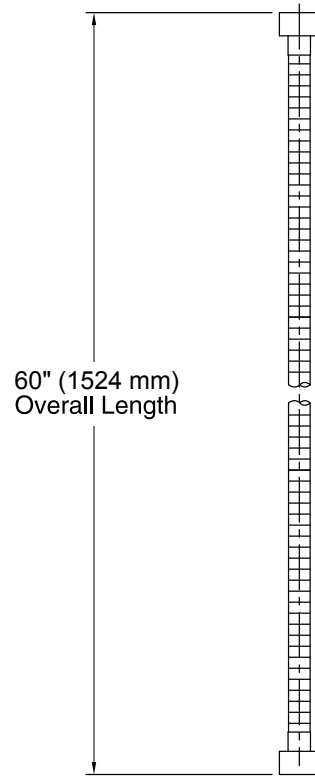
KOHLER® Faucet Lifetime Limited Warranty

See website for detailed warranty information.

Available Color/Finishes

Color tiles intended for reference only.

Color	Code	Description
	CP	Polished Chrome
	SN	Vibrant® Polished Nickel
	AF	Vibrant® French Gold
	PB	Vibrant® Polished Brass
	G	Brushed Chrome
	BN	Vibrant® Brushed Nickel
	BV	Vibrant® Brushed Bronze
	2BZ	Oil-Rubbed Bronze



Technical Information

All product dimensions are nominal.

Notes

Install this product according to the installation guide.

A. SYSTEM DESCRIPTION

1. Heating is provided by a reversible chiller/heat pump split system.

B. FUNCTIONAL REQUIREMENTS

1. Provide heating system products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Refer to Manufacturer's Product Data sheets provided at the end of this section where indicated.
3. Chiltrix CX34
 - a. Outdoor heat pump unit. Product data sheet CSI 23 81 43.
4. FirstCo 8VMB Air Handler
 - a. Variable-speed air handler. Product data sheet CSI 23 70 00.
5. Buffer Tank
 - a. A buffer tank of appropriate size in accordance with the manufacturer design guidelines and approved by the Engineer.
6. Heat Transfer Fluid
 - a. A water and glycol mix to serve as the heat transfer fluid for the heating system and provide freeze protection. To be specified by the Engineer.
7. Copper Piping
 - a. Copper piping to contain the heat transfer fluid. Configuration to be specified by the Engineer.
8. Rigid and Flexible Metal Ducting
 - a. All Rigid and flexible metal ducts to be designed by contractor to meet or exceed all applicable code requirements.

A. SYSTEM DESCRIPTION

1. Cooling is provided by the same reversible chiller/heat pump split system that provides heating.

B. FUNCTIONAL REQUIREMENTS

1. Provide cooling system products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. The components of the cooling system are identical to that of the heating system. Refer to section D3020 C for a components list.

D 3060

VENTILATION

A. SYSTEM DESCRIPTION

1. A dedicated balanced ventilation system with heat recovery.

B. FUNCTIONAL REQUIREMENTS

1. Provide heating system products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. Heat Recovery Requirements
 - a. Provide both sensible and latent heat recovery

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Refer to Manufacturer's Product Data sheets provided at the end of this section where indicated.
3. Zehnder ComfoFlex UL Approved flexible ductwork
 - a. Product data sheet CSI 23 31 16.
4. Zehnder ComfoWell 320 Silencer and Manifold
 - a. Product data sheet CSI 23 33 19.
5. Zehnder TVA 75 Diffuser box and STB cap
 - a. Product data sheet CSI 23 72 23.
6. Zehnder ComfoAir 200 packaged ERV unit
 - a. Product data sheet CSI 23 72 23.
7. Rigid and Flexible Metal Ducting
 - a. All Rigid or flexible metal ducts to be designed by contractor to meet or exceed all applicable code requirements.

Ventilation tube

Zehnder ComfoFlex

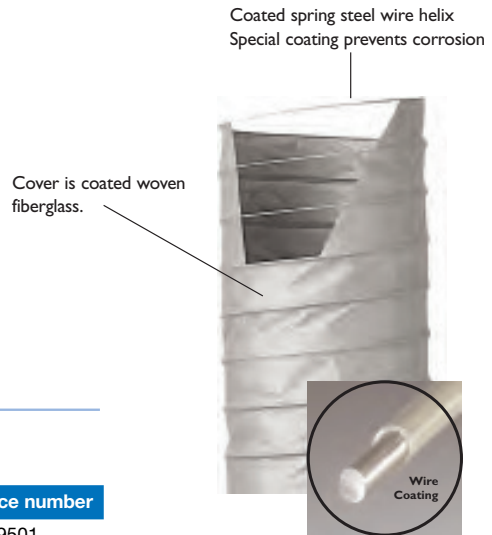
Benefits

- Reduced total installed cost—fast, economical installation.
- Material will not support mold or mildew growth.
- Long lengths help reduce waste—easily cut to exact lengths, or spliced at the job.
- Underwriters Laboratories (UL) listed as Class 1 air duct, Standard 181.
- All components are self-extinguishing and will not support flame.
- Complies with NFPA Standards 90A and 90B and most local, state and federal standards or codes.
- Maintenance free under normal conditions—highly resistant to rust and corrosion.
- Strict quality control over all raw materials and completed ducts.
- Suitable for all commercial applications where noninsulated “connector” rated products are not allowed.
- Will not collapse at recommended operating pressure.
- Assists absorbing system vibration transmitted through ductwork.
- Packaged compactly for efficient transporting, storing and handling.

Construction and Materials:

The supporting helix of coated spring steel wire is permanently bonded to a coated woven fiberglass cover.

GreenGuard Certified
for Superior Indoor
Air Quality



Article numbers

Product	Reference number
ComfoFlex 210, 3 x 70' sections	9501

ComfoFlex non-insulated flexible air duct is designed for use in all balanced ventilation Systems. It is used in either supply or return sections from the manifold plate to the diffusion valves. ComfoFlex air duct provides economical means for handling misalignment between system components and ducting around obstacles where fabricated and fitted ducts are difficult and costly to install. This duct is equally suitable for new jobs or retrofit work. Compliance with NFPA Standards lets you install lengths longer than the limitation applying to connectors. ComfoFlex air duct offers further economy of installed cost, for example, as a return duct within conditioned spaces or in any zone where the function of insulated duct is not required.

TS010 - 1

always
around you



APPLICATIONS and ENGINEERING DATA:

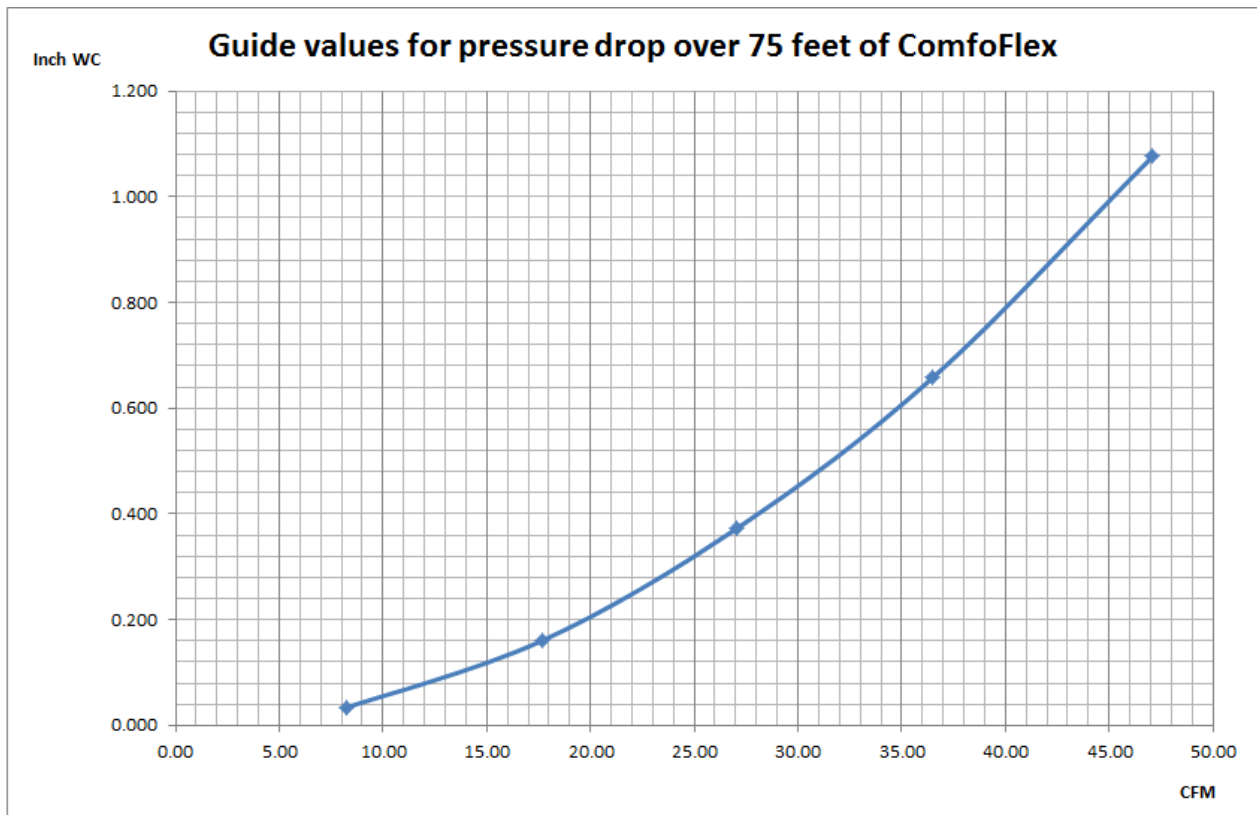
Nominal inside diameter (inches):		3
Length (feet):		70
Inside bend radius (inches):		3
Operating pressure (inches water column):	Positive = 16 inches	Negative = 1 inch
Maximum leakage (cubic ft./min./linear ft./in. diameter) At 16 inch water column:	0.015	
Internal operating temperature range (°F):	Minimum = 0	Maximum = 250
Velocity (feet per minute):	6000	
Surface burning characteristics:	Max. flame spread = 25	Max. smoke developed = 50
Oxygen index ratings:	Woven and coated glass cloth fabric = 35.60	

Technical specifications

Data	
Inside diameter ["]	3.0
Weight per running length [lb/ft]	0.17
Running length per box [ft]	210
Weight per Box [lb]	38.0
Box Dimentions length x deeph x height [Inch]	22 x 22 x 20

Ventilation tube **Zehnder ComfoFlex**

Pressure loss diagram



Note:
Each 90 deg. bend will add ~ 0.02 inch WC Pressure drop

TS010 - 3

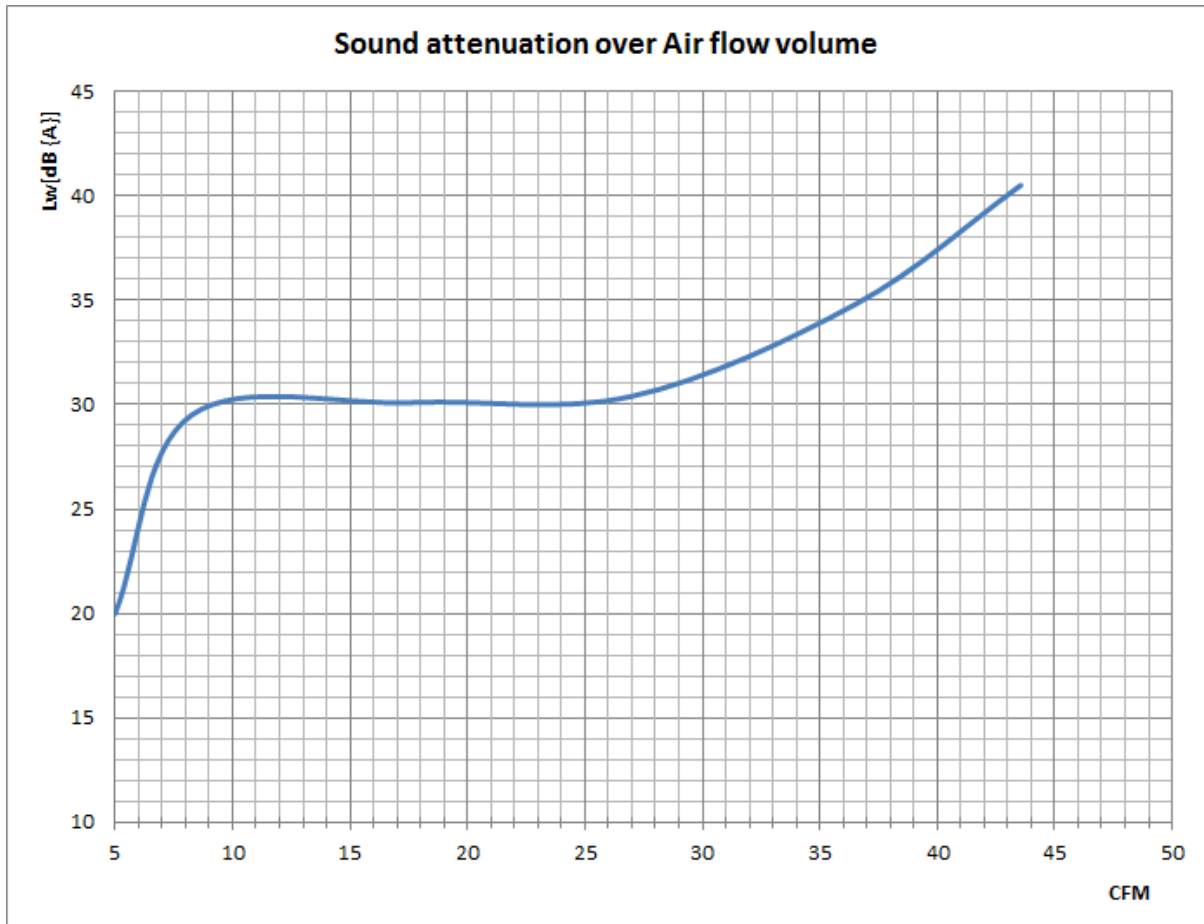
always
around you



Ventilation tube

Zehnder ComfoFlex

ComfoFlex sound attenuation



Zehnder America, Inc. · 6 Merrill Industrial Drive, Suite 7 · Hampton, NH 03842 · USA
T +1 603 601 8544 · Toll Free: 888 778 6701 · F +1 603 601 8510
info@zehnderamerica.com · www.zehnderamerica.com

TS010 - 4

Benefits

- All air treatment functions available: attenuator, fine filter, active carbon filter, manifold box
- Modular design
- Compact dimensions
- Easy to clean
- Components connected with sliding profiles for easy mounting
- Pipes connected by end pieces with sleeves
- Directly connected to all components of the ComfoWell system
- Very good sound attenuation
- Two silencers can be used in series for maximum sound reduction
- Mounting set available for vertical mounting of silencers on ComfoAir 200 and ComfoAir 350
- High-efficiency fine filters up to filter class MERV15 available
- Odor neutralisation by active carbon filter available
- Components available in width of 126" to connect 6 ComfoTubes 3" (75)

Article number

Designation	Art. no.	Reference No
Attenuator CW-S 320	990 323 501	9319
Manifold box CW-D 320	990 323 531	9331
Filter housing CW-F 320	990 323 551	9333



ComfoWell attenuator



ComfoWell manifold box



ComfoWell filter housing

Description

Attenuator

Zehnder ComfoWell Attenuator CW-S 320. Compact rectangular attenuator with high-efficiency special sound absorbing foam pack and low pressure losses. The attenuator can be used on its own or in combination with any add-on from the ComfoWell system. It is connected to all add-ons with a folded joint and clamping rail to create an airtight seal. The sound absorbing foam element can be removed for inspection and cleaning. The silencer is mounted on a wall or ceiling with height-adjustable mounting brackets. Mounting accessories are supplied with the unit.

Technical data:

Insertion loss: 12.6 dB / 250 Hz

Housing: Galvanised steel

Sound absorbing element: Special foam with hygienic coating

Dimensions:

Length: 19.7"

Depth: 12.6"

Height: 9.0"

Manifold box

Zehnder ComfoWell Manifold Box CW-D 320. Compact sound-absorbing manifold box with closed-cell, silencer inner lining, fits mounting plate for ComfoTube 6 x 3" (75) ventilation pipes. The mounting plate connection can be moved from the front to the side. The manifold box can be used on its own or in combination with any add-on. It is connected to all add-ons with a folded joint and clamping rail to create an airtight seal. The manifold box features an access panel for easy cleaning and adjustment of the ComfoTube ventilation pipes. Mounting accessories are supplied with the unit.

Material: Galvanised steel

Dimensions:

Length: 9.0"

Width: 12.6"

Height: 9.0"

Filter housing

Zehnder ComfoWell Filter Housing CW-F 320. Compact filter housing for mounting in supply line, to accommodate pollen filter MERV15 or active carbon filter element. Filter elements are not supplied with the unit. The manifold box can be used on its own or in combination with any add-on from the ComfoWell system. It is connected to all add-ons with a folded joint and clamping rail to create an airtight seal. It is mounted with adjustable mounting brackets; mounting accessories are included.

Material: Galvanised steel

Dimensions:

Length: 11.8"

Width: 12.6"

Height: 9.0"

TS222 - 2

Attenuator and Distribution System **Zehnder ComfoWell 320**

Specifications

Material:

Housing: Galvanised steel
 Inner lining: Closed-cell melamine resin foam
 Permissible operating temperature range: -13°F to 140°F
 Maximum airflow: 141 cfm at normal ventilation level

Accessories

Designation	Art. no.	Reference No
Mounting plate CW-M 320-6 x 3" (75)	990 323 522	9329
End plate CW-P 320 – 5" (125)	990 323 511	9354
End plate CW-P 320 – 6" (150)	990 323 562	9372
End plate CW-P 320 – 6.3" (160)	990 323 512	9321
End plate CW-P 320 – 7" (180)	990 323 527	9322
Mounting set CW-K 320 – CA 200	990 323 517	9325
Mounting set CW-K 320 – CA 350	990 323 526	9328
Fine dust filter CW-MERV13 320	990 323 603	9302
Fine dust filter CW-MERV15 320	990 323 604	9343
Active carbon filter CW-FC 320	990 323 605	9355

Description of accessories

Mounting plate:

Zehnder ComfoWell Mounting Plate CW-M320-6 x 3" (75) for connecting 6x Zehnder ComfoTube 3" (75) flexible ducts. Supplied with guard and clamping rails. Mounting plate can also be used for mounting in concrete.

End plate:

Zehnder ComfoWell End Plate CW-P 320 - 5" /6" / 6.3" / 7" (with central support) for connecting the ComfoWell silencer and distribution system to a 5" /6" / 6.3" / 7" round duct. Clamping rails included.

Mounting set:

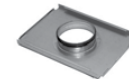
A special mounting set is available for the Zehnder ComfoWell 320 silencer and distribution system for direct mounting on the ComfoAir 200 / ComfoAir 350 ventilation unit. The set includes all the necessary accessories (screws, brackets and mounting brackets).

Filter:

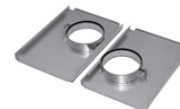
Filter for mounting in filter housing CW-F 320. Available filter classes include MERV13, MERV15 and an active carbon filter for odor neutralisation.



Mounting plate



End plate



Mounting set



Fine dust filter MERV13



Fine dust filter MERV15



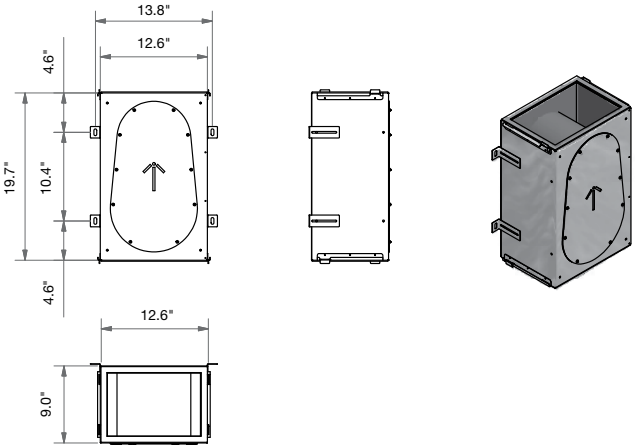
Active carbon filter FC

TS222 - 3

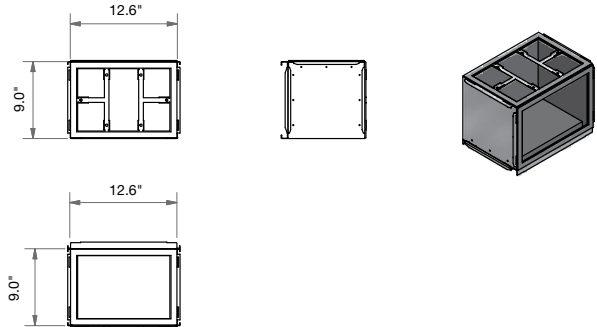
Attenuator and Distribution System **Zehnder ComfoWell 320**

Dimensional drawings

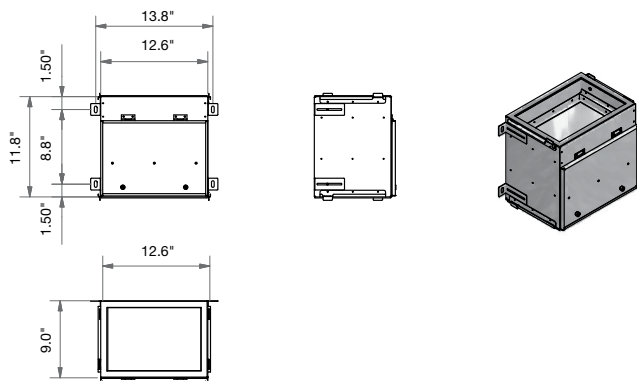
Attenuator



Manifold box



Filter housing

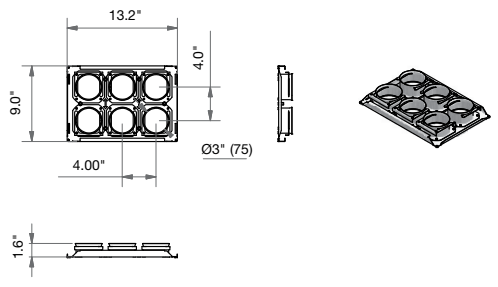


TS222 - 4

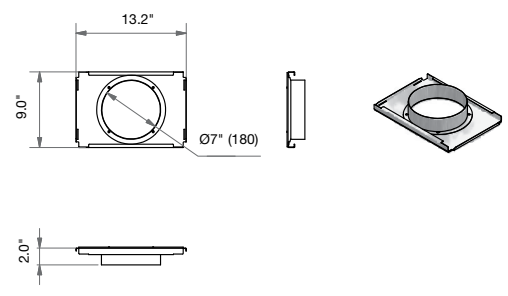
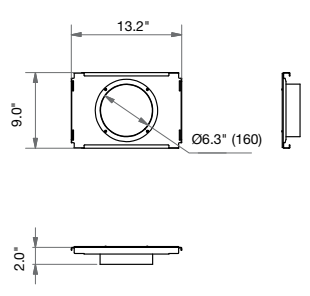
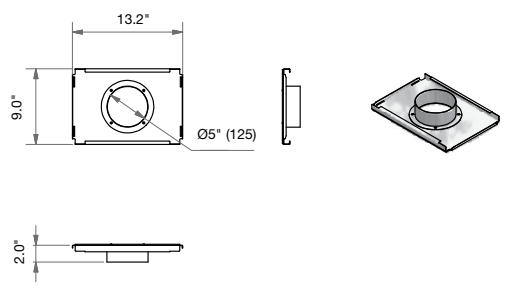
Attenuator and Distribution System

Zehnder ComfoWell 320

Mounting plate



End plate

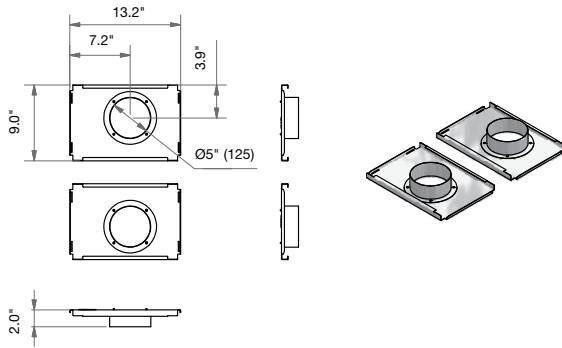


TS222 - 5

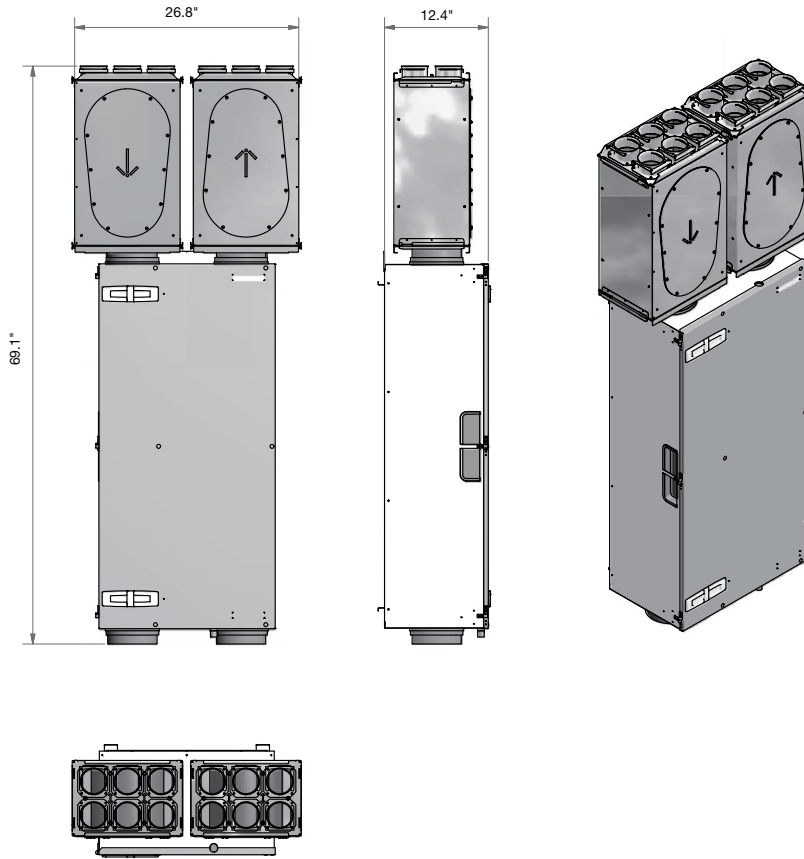
Attenuator and Distribution System

Zehnder ComfoWell 320

Mounting set CA 200



ComfoAir 200 with mounting set

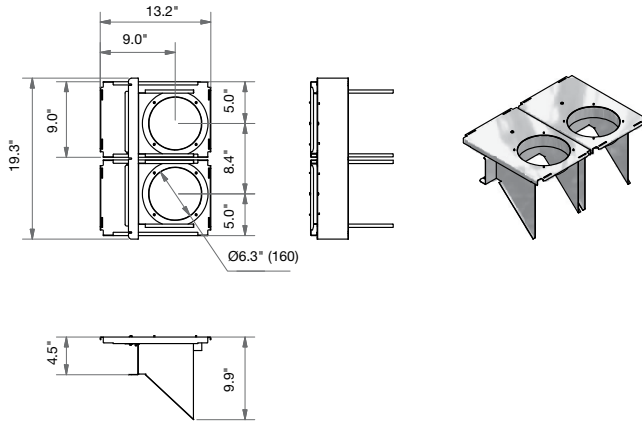


TS222 - 6

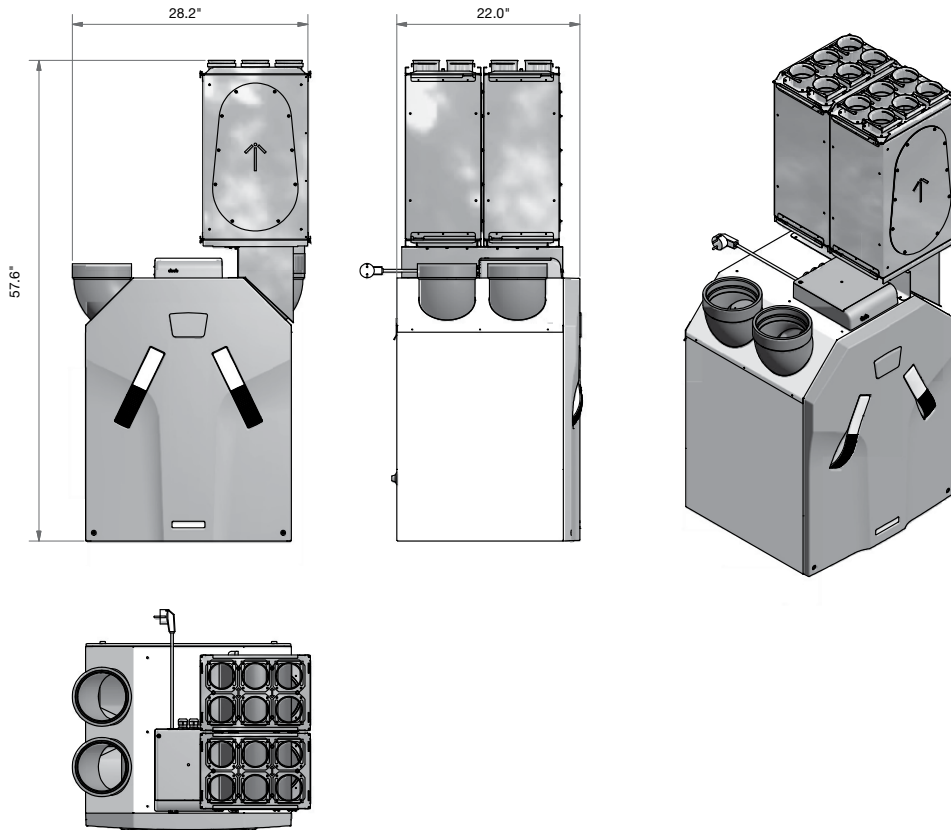
Attenuator and Distribution System

Zehnder ComfoWell 320

Mounting set CA 350



ComfoAir 350 with mounting set (Right hand configuration shown)



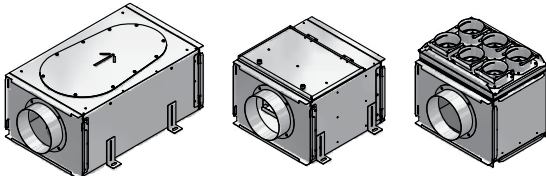
TS222 - 7

Attenuator and Distributin System

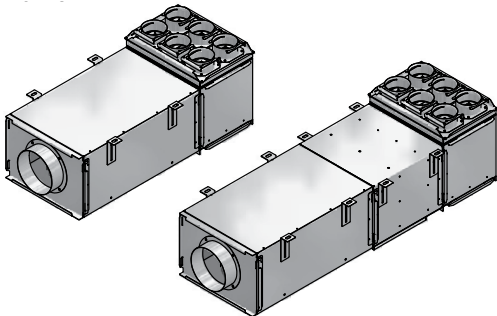
Zehnder ComfoWell 320

Usage scenarios

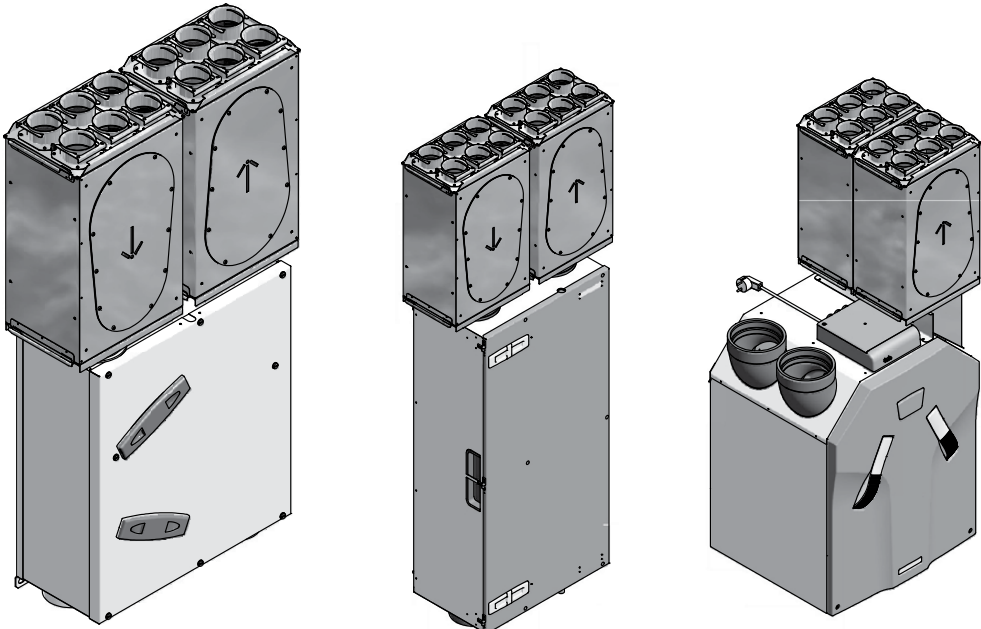
Standalone



Combined



Compact with ventilation unit



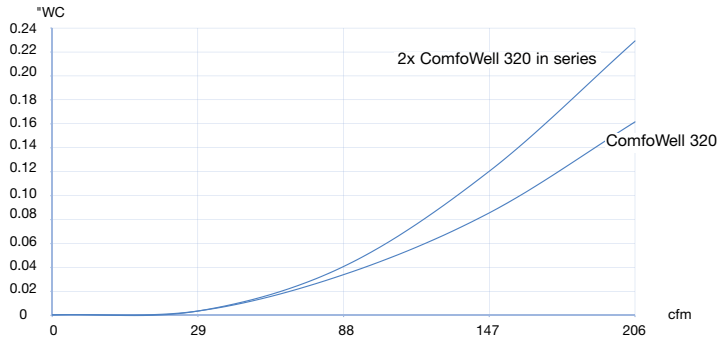
TS222 - 8

Attenuator and Distribution System

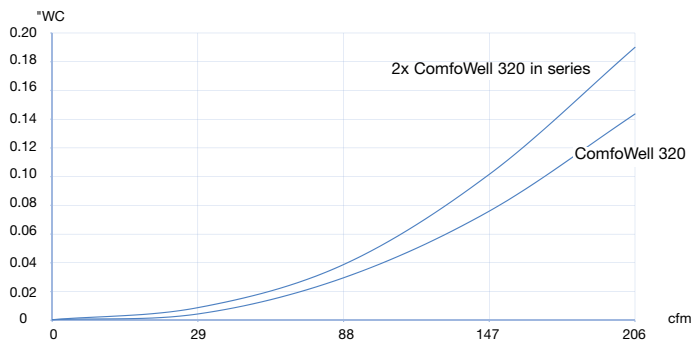
Zehnder ComfoWell 320

Pressure losses

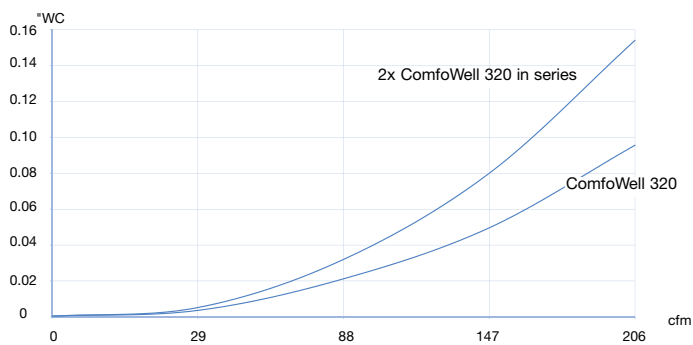
ComfoWell attenuator CW-S320 with end plate CW-P320 - 5" (125)



ComfoWell attenuator CW-S320 with end plate CW-P320 - 6.3" (160)



ComfoWell attenuator CW-S320 with end plate CW-P320 - 7" (180)



TS222 - 9

Attenuator and Distribution

Zehnder ComfoWell 320

System Insertion loss

1x end plate CW-P320 - 6"/6.3"/7" + 1x attenuator CW-S320 +
1x end plate CW-P320 - 6"/6.3"/7"

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Connection 6" (150) [dB]	8.1	11.9	14.5	14.9	19.1	35.9	28.3	29
Connection 6.3" (160) [dB]	6.9	13.1	12.6	12.7	18	34.8	27.2	28.8
Connection 7" (180) [dB]	7.5	12.4	12.9	12.6	19.7	33.5	26.3	27.5

1x end plate CW-P320 - 6"/6.3"/7" + 2x attenuators CW-S320
+ 1x end plate CW-P320 - 6"/6.3"/7"

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Connection 6" (150) [dB]	10.6	19.4	24.7	26.4	37.8	58.3	52.8	50.8
Connection 6.3" (160) [dB]	10.5	19.4	23.7	25	39.1	56.2	51.6	50
Connection 7" (180) [dB]	12.7	18.9	24.1	24.2	39	59.3	51.1	49.5

1x end plate CW-P320 - 6"/6.3"/7" + 1x attenuator CW-S320 +
1x mounting plate CW-M320-6 x 3" (75)

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Connection 6"/6.3"/7" [dB]	18.5	15.4	13	16.4	18.5	35.6	30.9	31.2

1x end plate CW-P320 - 6"/6.3"/7" + 2x attenuators CW-S320
+ 1x mounting plate CW-M320-6 x 3" (75)

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Connection 6"/6.3"/7" [dB]	20.6	22.7	22.4	31	38.6	55.8	52.7	54.7

ZA-CSY-FLYERTS222, V1211, en_us, subject to changes

Extract valve

Zehnder STB

Description

White, powder-coated metal extract valve suitable for walls and ceilings. Adjustable flow rate set using the valve's locking regulating device. STB connects to TVA box with its own rubber sealing ring, ensuring optimal airtightness.

Benefits

- With lockable, variable regulator
- Simple, fast installation with rubber installation/sealing ring
- Sound absorbing
- Easy to clean

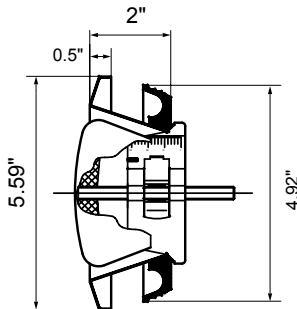


STB-1

Article Numbers

Housing	Article Number	Reference Number
Extract Valve STB-1-125	705 512 521	9310
Extract Valve STB-2-125	705 522 521	9441

Accessories	Article Number	Reference Number
Filter DN 125 (5")	990 320 032	9252



Description

Zehnder housing TVA 75 for connecting diffusers and designer grilles with connection width DN 125. Connection ports for (2) flexible ComfoTubes. The supplied mounting brackets allow the housing to be secured to wood studs, floor joists or concrete ceilings.

Benefits

- Suitable for supply and extract air
- Suitable for wall or ceiling installation
- Easy to install
- High air output
- Easy to clean
- Extract air filter optional
- Mounting bracket attached to housing
- Protective dust cover



TVA 75

Specifications

Material: Galvanized sheet steel
Nominal air volume: 24 cfm
Permissible temperature range: -13°F to 140°F

Accessories

Diffusers and grilles:

Zehnder diffusers and grilles are suitable for installation in walls and ceilings. They are connected to the housing without the use of tools, and are firmly secured in the housing by a rubber seal. Air volume can be adjusted smoothly at diffusers.

Filter:

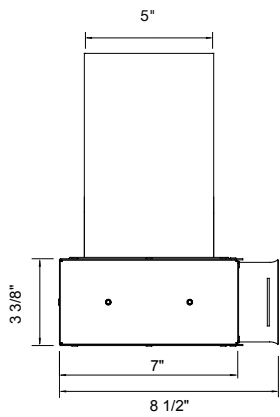
Zehnder filter set for exhaust air diffuser TVA grille housing to protect the air ducts against impurities. Filter class G4. The filter is clamped between the outlet and exhaust housing. Sold individually.

Housing	Article Number	Reference Number
TVA 75	990 320 710	9308
TVA 75 - 3 (3-port version)	528 006 630	9442

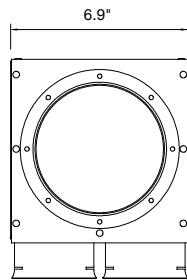
Diffusers/Grille options	Article Number	Reference Number
STB 1 Exhaust Diffuser	705 512 521	9310
STB 2 Exhaust Diffuser	705 522 521	9441
KE 125 Supply Diffuser	990 326 252	9309
Venezia Grille	705 512 521	9310

Filters	Article Number	Reference Number
Filter 125mm (1pc)	990 320 032	9352

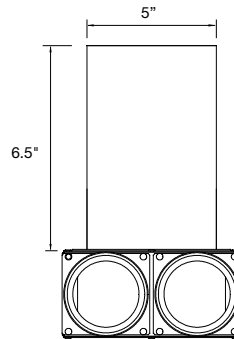
Dimensions



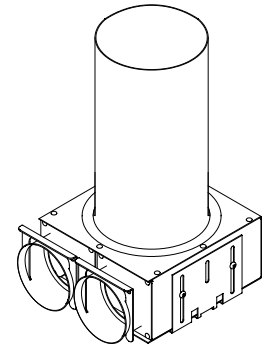
Side



Front

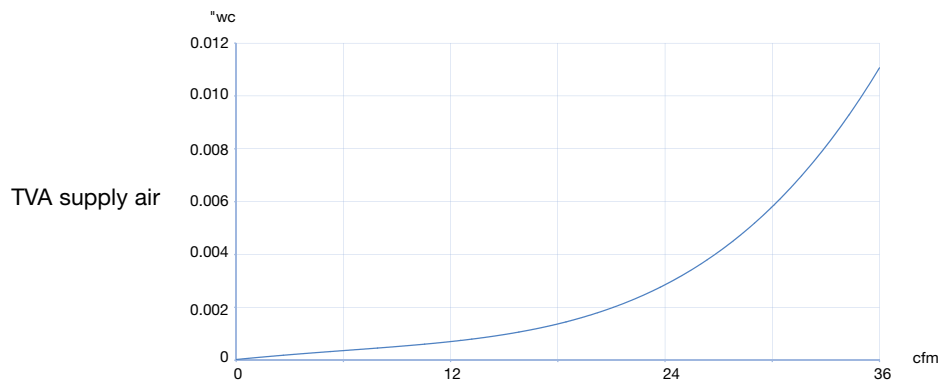
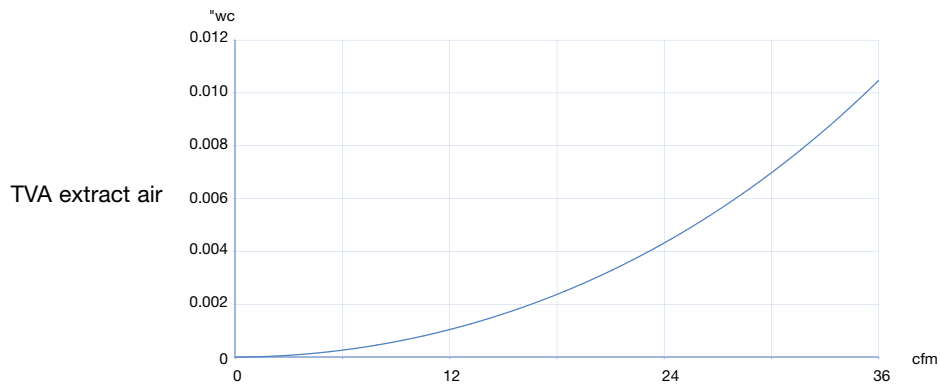


Side



Isometric

Pressure Drop



TS042 - 2

2015.02.27

**2-PIPE
VARIABLE SPEED**

Compatible with Chiltrix
Ultra-Efficient Heat Pump Chillers
www.chiltrix.com



VMB Series Variable Speed 2-Pipe Hydronic Fan Coils 1.5 - 5.0 Tons Cooling



The **VMB** Series includes a programmable, high efficiency motor that redefines comfort and energy savings. The **VMB** motor automatically adjusts its torque and speed to maintain a preprogrammed level of constant airflow over a wide range of external static pressures. This variable speed technology offers better indoor air quality, more precise humidity control, quieter operation, consistent indoor air temperature, and lower utility bills.

High Efficiency - At full load conditions the **VMB** motor is 20% more efficient than an induction motor and at constant fan speed it consumes only 60-80 watts of power compared to 400 watts for a standard induction motor.

Quiet Operation - The versatile **VMB** motor quietly "ramps up" when the unit is turned on and "ramps down" when the thermostat is satisfied, eliminating the annoying sounds of changing airflow.

Self-Regulating Constant Airflow - The **VMB** motor is factory programmed to maintain a predetermined level of airflow over a wide range of external static pressures, ensuring optimum system performance and whole-house comfort. The benefits of constant fan operation are:

- **Consistent air distribution** (and temperature) throughout the home
- **Better indoor air quality** (further improved with the addition of high efficiency filter) - This allows the air to be filtered without excessive drafts and without sacrificing efficiency.
- **Better humidity control** - The **VMB** is designed to extract much more moisture from the air than a conventional system by slowing the airflow over the cooling coil. The result is an improved summer comfort level at higher indoor temperatures.



Variable Speed ECM Motor

Additional Standard Features:

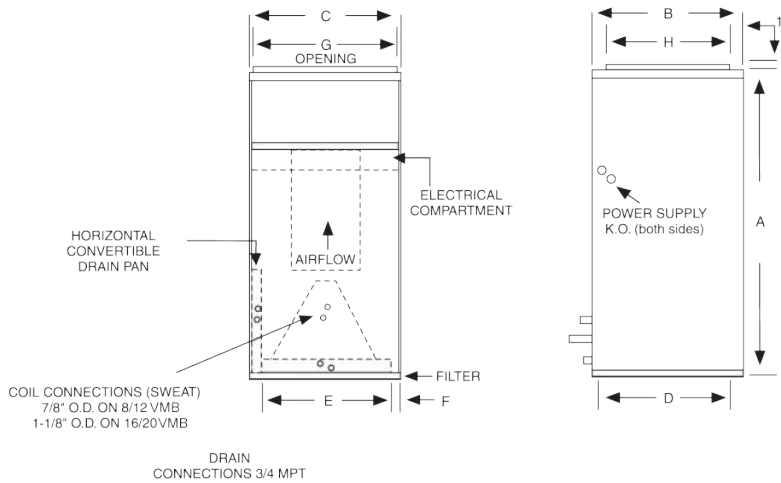
- Vertical/horizontal drain pans
- Attractive baked-on powder coat finish
- Fully insulated cabinet
- Primary and secondary drain connections on cooling coil
- 120V motor, 24V control
- Compatible with most properly sized and installed zone control systems.
Contact the zone control manufacturer.
- High efficiency pleated filter(s)

VMB Series

Cooling / Heating

(2-pipe)

Compatible with Chiltrix
Ultra-Efficient Heat Pump Chillers
www.chiltrix.com



Features:

1. Variable speed motor
2. Vertical / Horizontal drain pan (right-to-left and left-to-right airflow)
3. Manual air vent
4. Pleated filter(s)

ELECTRICAL DATA				
UNIT MODEL	MOTOR HP (120V)	MOTOR AMPS	MIN. CIR. AMPACITY	MAX. HACR BREAKER
8VMB	1/3	4.8	6.0	15
12VMB	1/2	7.3	10	15
16VMB	3/4	10.5	14	15
20VMB	1	11.5	15	15

PHYSICAL DIMENSIONS										
UNIT MODEL	A	B	C	D	E	F	G	H	COIL CONNECTIONS	FILTER SIZE
8VMB	40	20	20	18-1/2	16	2	18	16	7/8 SWEAT	18 X 20 X 1
12VMB	42	23	20	21-1/2	16	2	18	17	7/8 SWEAT	20 X 22 X 1
16/20VMB	48	28	21-1/4	26-1/4	17-1/4	2	19-1/4	18	1-1/8 SWEAT	20 X 25 X 1

AIR FLOW DATA									
MODEL	OPERATING MODE	CONTROL BOARD SELECTION TAPS							
		COOL (CFM) (2)				HEAT (CFM) (1)			
		A	B	C	D	A	B	C	D
8VMB	COOLING or HEATING THERMOSTAT SIGNAL					800	700	600	500
	CONTINUOUS BLOWER	400	350	300	250				
12VMB	COOLING or HEATING THERMOSTAT SIGNAL					1200	1050	900	750
	CONTINUOUS BLOWER	600	525	450	375				
16VMB	COOLING or HEATING THERMOSTAT SIGNAL					1600	1400	1200	1000
	CONTINUOUS BLOWER	800	700	600	500				
20VMB	COOLING or HEATING THERMOSTAT SIGNAL					1825	1700	1600	1400
	CONTINUOUS BLOWER	900	850	800	700				

For additional sales and technical information on variable speed motors, visit www.thedealertools.com

Digital thermostats for these units must have a "C" terminal.



NOTES:

1. The HEAT select tap controls the maximum CFM in both heating and cooling modes.
2. The COOL select tap only controls the CFM when fan switch on thermostat is set to "ON" (continuous blower).
3. The COOL and HEAT taps are factory set on "A"

Airflow shown are dry coil at 120 volts.

Max. ext. static pressure is 0.50" wtr

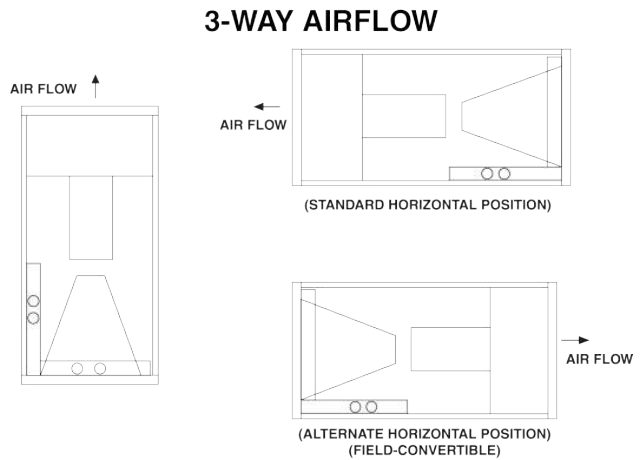
NOTES:

- The cooling and heating speed taps are factory set on "A".
- The delay profile is factory set on "Arid" setting.
- The adjust profile is factory set on "Normal:"
- Adjust profile (+) will increase airflow by 10%, while tap (-) will decrease airflow by 10%

In keeping with its policy of continuous progress and product improvement, First Operations reserves the right to make changes without notice. Maintenance for all First Co. products is available under "Product Maintenance" at www.firstco.com.

COOLING PERFORMANCE DATA															
UNIT MODEL	NOM. CFM	GPM	P.D. (FT. WTR.)	45°F ENTERING WATER						42°F ENTERING WATER					
				80°F DB/67°F WB ENT. AIR			75°F DB/63°F WB ENT. AIR			80°F DB/67°F WB ENT. AIR			75°F DB/63°F WB ENT. AIR		
				TOTAL MBH	SENS. MBH	TEMP. RISE	TOTAL MBH	SENS. MBH	TEMP. RISE	TOTAL MBH	SENS. MBH	TEMP. RISE	TOTAL MBH	SENS. MBH	TEMP. RISE
8VMB	600	3.0	2.5	19.0	13.8	12.7	14.5	12.1	9.7	20.7	14.4	13.8	15.8	12.6	10.5
		4.5	5.5	22.4	15.1	9.9	17.1	13.1	7.6	24.4	15.9	10.8	18.6	13.7	8.3
		6.0	9.5	24.4	15.9	8.2	18.7	13.7	6.2	26.6	16.8	8.9	20.3	14.4	6.8
	800	3.5	3.4	23.1	17.3	13.2	17.6	15.2	10.1	25.2	18.1	14.4	19.2	15.8	11.0
		5.0	6.7	26.9	18.7	10.7	20.5	16.3	8.2	29.3	19.6	11.7	22.4	17.1	8.9
		6.5	11.0	29.2	19.6	9.0	22.3	17.0	6.9	31.8	20.6	9.8	24.3	17.8	7.5
12VMB	1000	4.0	2.4	28.3	21.6	14.1	21.6	19.0	10.8	30.8	22.5	15.4	23.6	19.7	11.8
		6.0	4.8	33.9	23.7	11.3	25.9	20.6	8.6	36.9	24.8	12.3	28.2	21.6	9.4
		8.0	7.9	37.3	25.0	9.3	28.5	21.7	7.1	40.6	26.3	10.2	31.0	22.7	7.8
	1200	5.0	3.5	33.7	25.5	13.5	25.8	22.4	10.3	36.8	26.6	14.7	28.1	23.3	11.3
		6.5	5.5	38.0	27.1	11.7	29.1	23.7	8.9	41.5	28.4	12.8	31.7	24.7	9.7
		8.0	7.9	41.0	28.2	10.3	31.3	24.6	7.8	44.7	29.6	11.2	34.1	25.7	8.5
16VMB	1400	4.5	2.0	36.2	29.2	16.1	27.7	25.8	12.3	39.5	30.3	17.6	30.1	26.7	13.4
		6.0	3.3	42.4	31.4	14.1	32.4	27.6	10.8	46.2	32.8	15.4	35.3	28.7	11.8
		7.5	4.8	46.9	33.1	12.5	35.8	28.9	9.6	51.1	34.7	13.6	39.0	30.2	10.4
	1600	6.0	3.3	44.2	34.1	14.7	33.8	30.0	11.3	48.2	35.5	16.1	36.8	31.2	12.3
		8.0	5.4	51.0	36.6	12.7	38.9	32.0	9.7	55.5	38.3	13.9	42.4	33.4	10.6
		10.0	7.9	55.7	38.4	11.1	42.5	33.4	8.5	60.7	40.3	12.1	46.3	34.9	9.3
20VMB	1600	6.5	3.8	46.1	34.8	14.2	35.2	30.6	10.8	50.3	36.3	15.5	38.4	31.8	11.8
		8.5	6.0	52.3	37.1	12.3	39.9	32.4	9.4	57.0	38.8	13.4	43.5	33.8	10.2
		10.5	8.6	56.6	38.7	10.8	43.2	33.7	8.2	61.7	40.7	11.8	47.1	35.2	9.0
	2000	7.0	4.3	52.4	40.9	15.0	40.0	36.1	11.4	57.1	42.6	16.3	43.6	37.4	12.5
		10.0	7.9	61.7	44.3	12.3	47.1	38.8	9.4	67.3	46.4	13.5	51.4	40.5	10.3
		13.0	12.5	67.5	46.5	10.4	51.6	40.5	7.9	73.6	48.8	11.3	56.2	42.4	8.6

HEATING PERFORMANCE DATA							
UNIT MODEL	NOM. COOLING BTUH	NOM. CFM	GPM (HTG)	P.D. (FT. WATER)	BTUH (1000) AT ENTERING WATER TEMPERATURE		
					140°F	160°F	180°F
8VMB	18,000/24,000	800	6.0	9.5	45.5	58.5	*
			4.5	5.5	43.5	56.0	68.4
			3.0	2.5	40.4	52.0	63.5
		700	6.0	9.5	41.4	53.3	*
			4.5	5.5	39.7	51.1	*
			3.0	2.5	37.0	47.6	58.2
		600	4.0	4.4	35.1	45.1	*
			3.0	2.5	33.5	43.0	*
			2.0	1.2	31.0	39.8	48.7
		500	4.0	4.4	30.9	39.8	*
			3.0	2.5	29.6	38.0	*
			2.0	1.2	27.6	35.5	43.4
12VMB	30,000/36,000	1200	8.0	7.9	66.6	85.7	104.7
			6.5	5.5	66.4	85.3	104.3
			5.0	3.6	61.5	79.0	96.6
		1050	8.0	7.9	60.7	78.1	*
			6.5	5.5	58.9	75.7	*
			5.0	3.6	56.3	72.4	88.5
		900	6.0	4.8	52.3	67.3	*
			4.5	3.0	49.8	64.1	78.3
			3.0	1.5	48.0	61.8	75.5
		750	6.0	4.8	46.1	59.2	*
			4.5	3.0	44.1	56.7	*
			3.0	1.5	41.1	52.9	64.6
16VMB	42,000/48,000	1600	10.0	8.0	90.6	116.5	*
			8.0	5.4	87.3	112.3	137.2
			6.0	3.3	82.7	106.3	129.9
		1400	10.0	8.0	82.7	106.3	*
			8.0	5.4	79.8	102.6	*
			6.0	3.3	75.8	97.4	119.1
		1200	6.0	3.3	68.5	88.0	*
			5.0	2.4	66.2	85.2	104.1
			4.0	1.6	63.4	81.6	99.7
		1000	6.0	3.3	60.7	78.1	*
			5.0	2.4	58.9	75.8	*
			4.0	1.6	56.6	72.8	*
20VMB	48,000/60,000	2000	13.0	12.5	110.2	141.7	173.2
			10.0	8.0	105.9	136.1	166.4
			7.0	4.3	99.1	127.4	155.7
		1800	13.0	12.5	102.2	131.4	*
			10.0	8.0	98.3	126.3	154.4
			7.0	4.3	92.0	118.2	144.5
		1600	9.0	6.6	89.1	114.5	*
			7.0	4.3	85.2	109.6	133.9
			5.0	2.4	79.6	102.3	125.0
		1400	9.0	6.6	81.3	104.6	*
			7.0	4.3	78.0	100.2	*
			5.0	2.4	73.1	94.0	114.9



Chiltrix Compatibility Note*
 Please Use The Chiltrix VMB Sizing Guide
 For Accurate Performance & Sizing Information
 When Used With Chiltrix Ultra-Efficient
 Heat Pump Chillers

www.chiltrix.com/documents/

NOTES:

- (1) Heat BTU is at 70° Entering Air Temperature.
- (2) * Capacity exceeds the leaving air temperature maximum

2-PIPE
VARIABLE SPEED



VMB Series

Variable Speed
2-Pipe Hydronic Fan Coils
1.5 - 5.0 Tons Cooling



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- **Consistent air distribution** (and temperature) throughout the home
- **Better indoor air quality** (further improved with the addition of high efficiency filter) - This allows the air to be filtered without excessive drafts and without sacrificing efficiency.
- **Better humidity control** - The **VMB** is designed to extract much more moisture from the air than a conventional system by slowing the airflow over the cooling coil. The result is an improved summer comfort level at higher indoor temperatures.

Additional Standard Features:

- Vertical/horizontal drain pans
- Attractive baked-on powder coat finish
- Fully insulated cabinet
- Primary and secondary drain connections on cooling coil
- 120V motor, 24V control
- Compatible with most properly sized and installed zone control systems.
Contact the zone control manufacturer.
- High efficiency pleated filter(s)



Variable Speed ECM Motor

Ventilation Unit

Zehnder ComfoAir 200

Use

The ComfoAir 200 ventilation unit was developed for residential and small commercial buildings. It combines maximum comfort, simple operation and very high efficiency. The CA200 moves up to 116 cfm of air at 0.80" wc

Efficiency

The integrated cross-counterflow heat exchanger achieves efficiencies of up to 92% (according to testing by the Passive House Institute). For user comfort this means no unpleasant cold drafts, because the supply air is heated nearly to room temperature, even when external temperatures are very low.

Fans

The supply fan and extract fan are driven by efficient DC motors. Differential pressures in the supply and extract air distribution systems can be adjusted thanks to individual control. The especially quiet fans can be adjusted to the required volumetric flow in 1% increments. The air volumes of the selectable stages can be set to between 29 cfm and 116 cfm.

Filters

The CA200 is equipped with two class G4 filters (MERV 7/8). An optional class F7 pollen filter (MERV 13) is available for fresh air intake.

Installation

The CA200 can be wall-mounted (vertically) or ceiling-mounted (horizontally). Connections for air and wiring are on the top of the unit. The insulated, sound-absorbing pipe connections can be rotated to optimize the location of the ventilation tubes while acoustically decoupling the CA200 from the air distribution system. The condensate drain is located on the bottom of the unit.

Operation

The CA200 is controlled by the ComfoSense control unit, typically installed in the living area. Optional, wireless remote control units are installed in bathrooms for timed boost mode.

Maintenance

Maintenance of the CA200 is limited to periodic cleaning or replacement of the filters accessible from the front of the unit. The exchanger core should be inspected and cleaned annually (depending on outside air quality). Please see the unit manual for additional servicing tasks.

Frost protection

If the ventilation unit is operated without an optional geothermal heat exchanger, condensate in the extract air may freeze. The frost protection setting prevents this by variably reducing the supply air volume. An optional, integrated electric preheater warms incoming fresh air to prevent the heat exchanger from freezing even at very low temperatures.



Filter G4



Filter F7



ComfoSense controller



Remote Control Timer

Bypass

During summer nights and in the “shoulder” seasons of spring and fall with strong sunshine, the house can become too warm, while the outside temperature remains pleasantly cool. In such cases, heat removal by what is known as “free cooling” helps: The CA200 is equipped with a standard automatic bypass for just this purpose, and diverts 100% of the relatively warm extract air from the heat exchanger, introducing cool supply air to the space.

Options

- **Humidity recovery with the Zehnder enthalpy exchanger**

When the CA200 is fitted with an enthalpy exchanger core, the humidity from the extracted air is partly transferred to the fresh supply air. In this case, the process of drying out the house in dry winter months is delayed. Additionally, there is no condensate that must be drained from the ComfoAir. Therefore a condensation drain is not necessary with an enthalpy exchanger.

The Zehnder enthalpy exchanger provides the ideal hygienic solution. Supply and extract air flows are kept completely separate so there is no transfer of odors or bacteria.

- **Pollen filter (F7/MERV 13)**

A pollen filter installed in the intake air line (upstream of the heat exchanger) keeps the inside of the house pollen-free and reduces particulates, spores and germs so occupants can breathe freely in times of increasing allergies.

- **Wireless remote control**

With the Zehnder wireless remote control, the CA200 can be controlled from locations throughout the house, apartment, classroom, etc. Typically, one is installed in each bathroom to provide a boost function.

- **Open fire program**

The ventilation system can be installed in a home with a fireplace, wood stove, etc. but must be accounted for in the control unit. By indicating in the ComfoSense control unit the presence of a fireplace, negative pressure and possible back-drafting of unpleasant fumes and/or harmful gases can be avoided.

Benefits

- Comfort ventilation up to 116 cfm
- Heat recovery with an efficiency of 92% (according to PHI)
- Moisture recovery with optional Zehnder enthalpy exchanger
- Low power consumption DC motors
- Automatic summer bypass
- Frost protection function
- Quick, safe installation, maintenance and servicing
- Simple operation
- Optional, integrated electric pre-heater
- Wireless remote control/boost switch
- Filter replacement indicator
- Electric and hydronic post-heater integration possible
- CO2 control (optional)
- Relative humidity control (optional)

Article Numbers

L = supply air left

R= supply air right

VV = integrated electric pre-heater

Product	Article Number	Reference Number
CA200 HRV-L	471 236 710	9280
CA200 HRV-R	471 236 715	9276
CA200 HRV-VV-L	471 236 730	9281
CA200 HRV-VV-R	471 236 735	9338
CA200 ERV-L	471 236 840	9357
CA200 ERV-R	471 236 845	9364
CA200 ERV-VV-L	471 238 540	9422
CA200 ERV-VV-R	471 238 545	9423

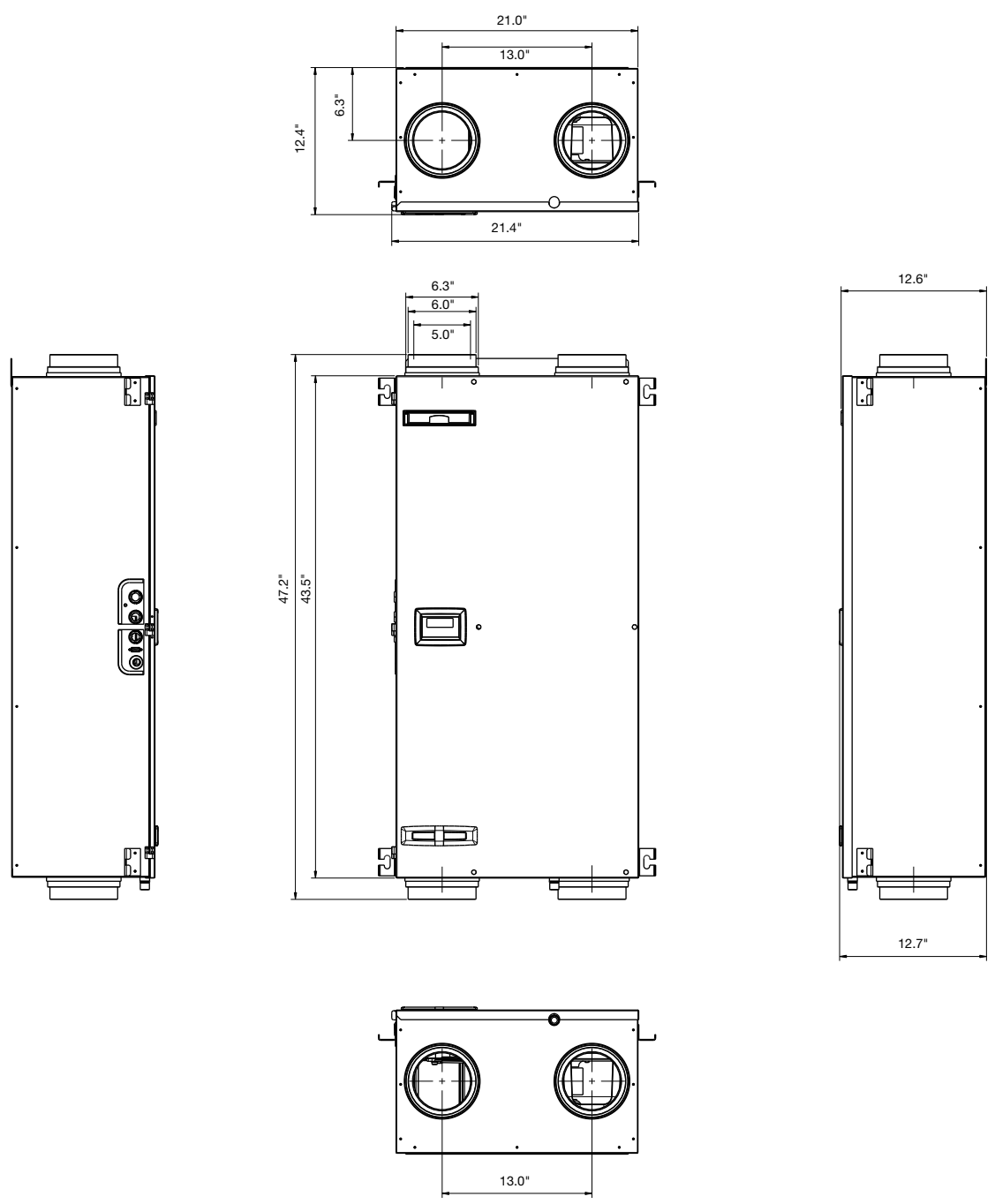
Accessories	Article Number	Reference Number
ComfoSense control unit	655 010 215	9257
Wireless remote control	655 000 755	9238
Waterless P-Trap	990 201 330	9362

Filters	Article Number	Reference Number
G4 (MERV 7/8) 1pc	400 100 014	9282
F7 (MERV 13) 1pc	400 100 013	9283

Technical Specifications

Heat Exchanger:	Polystyrene
Fans:	ECM direct current, radial fans
Filters:	(2) Class G4 (MERV 7/8), F7 (MERV 13) optional
Condensate Connection:	20mm
Air Duct Connections:	5" ID (nominal), 6" OD (nominal); (2) top; (2) bottom.
Electrical Connection:	230v, 50-60Hz
Temperature Range:	44.6°F - 104°F (7°C - 40°C)
Acoustic Performance:	Extract air (min – max): 30 - 57 dB(A) Supply air (min – max): 36 - 73 dB(A)
Heat Recovery:	92% (according to PHI)
Volumetric Flow:	29cfm - 118cfm
Power Consumption:	9W – 143W
Dimensions:	Height: 47.2" Width: 21" Depth: 12.6"
Weight:	66.2 pounds (30kg)
Versions:	ComfoAir 200 HRV L ComfoAir 200 HRV R ComfoAir 200 HRV VV L ComfoAir 200 HRV VV R ComfoAir 200 ERV L ComfoAir 200 ERV R ComfoAir 200 ERV VV L ComfoAir 200 ERV VV R
Manufacturer:	Zehnder Group Nederland B.V. Lingenstraat 2 8028 PM Zwolle NETHERLANDS

Ventilation Unit **Zehnder ComfoAir 200**

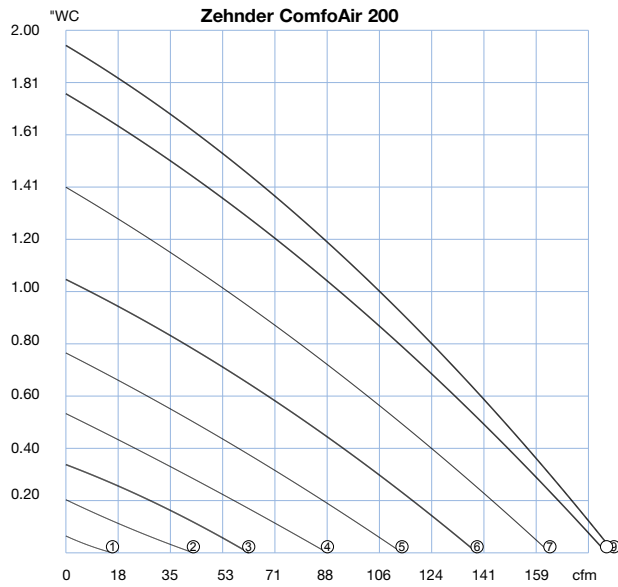


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2015.03.23

Ventilation Unit Zehnder ComfoAir 200

Stage	Setting	Capacity	Pressure	Power consumption	Current consumption	COS ϕ (-)	Installed noise level		Weight lb
	Percent	Qv cfm	ΔP_{st} "WC	W	A		Extract air dB(A)	Supply air dB(A)	
Zehnder ComfoAir 200									
(1)	15%	12	0.012	9	0.08	0.48	30	36	66.2
(2)	30%	35	0.028	14	0.11	0.54	35	46	
(3) Low	40%	53	0.060	20	0.16	0.55	37	53	
(4)	50%	71	0.120	30	0.25	0.52	43	59	
(5)	60%	91	0.180	46	0.37	0.55	47	63	
(6) Medium	70%	109	0.281	68	0.55	0.54	51	66	
(7)	80%	127	0.402	98	0.77	0.55	54	69	
(8) High	90%	144	0.482	128	0.99	0.56	56	72	
(9) Maximum	100%	150	0.502	143	1.1	0.57	57	73	



Sound, supply air

Ventilation unit	Speed	Acoustic performance						
Type		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
ComfoAir 200	1	41.1	39.6	35.2	30	20.8	12.9	8.7
ComfoAir 200	2	50.3	48.8	44.4	39.2	30	22.1	17.9
ComfoAir 200	3	56	54.8	50.7	48.3	39.4	33.7	24.6
ComfoAir 200	4	61.3	60.4	54.7	54.9	46.1	42.2	35.7
ComfoAir 200	5	66.5	65.4	58.1	58.6	51.8	48.1	43.5
ComfoAir 200	6	69.4	69.3	61.1	61.1	56.5	52.5	49
ComfoAir 200	7	73.2	72.2	63.8	63.4	60.9	56.4	53.6
ComfoAir 200	8	74.9	75.2	66.2	64.9	64	59.1	57
ComfoAir 200	9	75.9	75.9	67.5	65.7	64.8	60.1	58.1

Sound, extract air

Ventilation unit	Speed	Acoustic performance						
Type		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
ComfoAir 200	1	43.4	35.2	18.4	12.8	3.2	7.3	14.9
ComfoAir 200	2	47.6	39.4	22.6	17	7.4	11.5	19.1
ComfoAir 200	3	47.5	43.6	28.2	24.7	11.5	11.5	19
ComfoAir 200	4	52	50.1	33.1	31.2	17.4	12.4	18.7
ComfoAir 200	5	57	53.4	39.9	34.4	22.8	14.5	18.8
ComfoAir 200	6	60.1	58	40.6	37	27.3	18.4	19.2
ComfoAir 200	7	63.1	60.8	41.7	38.5	30.5	22.2	19.6
ComfoAir 200	8	65.1	62.8	44.9	40.4	33.3	25.9	20.3
ComfoAir 200	9	65.2	63.9	46.3	41.3	34.3	27.3	21

Sound, unit emission

Ventilation unit	Speed	Acoustic performance						
Type		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	db(A)	
ComfoAir 200	2	28.5	35.2	23.1	14.5	10.5	23.9	
ComfoAir 200	3	34.6	39.4	27.3	19.8	11.8	29.1	
ComfoAir 200	4	40.3	43.6	32.4	24.9	18.9	34.6	
ComfoAir 200	5	45.3	50.1	35.6	28.7	24.5	39	
ComfoAir 200	6	46.8	53.4	43.5	31.9	28.5	43.3	
ComfoAir 200	7	49.7	58	41.4	34.1	31.9	44.3	
ComfoAir 200	8	52.3	60.8	43.6	36	34.6	46.7	
ComfoAir 200	9	53.8	62.8	44.7	36.7	35.5	47.9	

Certificate

Certified Passive House Component

For cool, temperate climates, valid until 31 December 2014

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY



Category: **Heat recovery unit**
 Manufacturer: **Zehnder Group Nederland B.V.**
8028 PM Zwolle, NETHERLANDS
 Product name: **ComfoAir 200, ComfoD250, WHR920**

This certificate was awarded based on the following criteria:

Thermal comfort	$\theta_{\text{supply air}} \geq 16.5 \text{ }^\circ\text{C}$ at $\theta_{\text{outdoor air}} = -10 \text{ }^\circ\text{C}$
Effective heat recovery rate	$\eta_{\text{HR,eff}} \geq 75 \%$
Electric power consumption	$P_{\text{el}} \leq 0.45 \text{ Wh/m}^3$
Airtightness	Interior and exterior air leakage rates less than 3 % of nominal air flow rate
Balancing and adjustability	Air flow balancing possible: yes Automated air flow balancing: no
Sound insulation	Sound level $L_w \leq 35 \text{ dB(A)}$ not met Here $L_w = 49.0 \text{ dB(A)}$ Unit should be installed so that it is acoustically separated from living areas
Indoor air quality	Outdoor air filter F7 Extract air filter G4
Frostprotection	Frost protection for the heat exchanger with continuous fresh air supply down to $\theta_{\text{outdoor air}} = -15 \text{ }^\circ\text{C}$

Further information can be found in the appendix of this certificate.

www.passivehouse.com

0327vs03

Certified for air flow rates of

60 – 150 m³/h

$\eta_{\text{HR,eff}}$

92 %

Electric power consumption

0.42 Wh/m³





The World's Most Efficient Chiller Heat Pump

Ultra-Efficient

CX34 Chiller Heat Pump

2 Tons Cooling / 3 Tons heating
 IPLV Cooling 24,000 BTU COP 6.15 EER 21
 NPLV Cooling 29,000 BTU COP 9 EER 30
 Heating 34,000 BTU COP 3.92

Multiple IDUs - Up to 8 Indoor Units Per CX34



Ultra High Efficiency Heat Pump Chiller

The CX34 obtains its ultra high efficiency using existing technologies in a new way. For example, we use a DC Inverter compressor and a DC Inverter water pump (both are variable speed) controlled together with a DC inverter fan motor to achieve the best possible balance of water flow rate, compressor speed, and energy use.

A special control algorithm looks at the temperature delta between the entering and exiting water temperatures of the chiller, and also compares the exiting water temperature to the system settings. The controller constantly adjusts the pump and compressor speeds independently of each other to maintain the needed capacity at the lowest possible power draw, usually avoiding the need for a buffer tank. There is not a more efficient air source heat pump chiller made anywhere by anyone.

Dynamic Humidity Control (DHC)

The Chiltrix Psychrologix™ controller offers DHC (Dynamic Humidity Control) to maximize comfort and performance and allow the unit to operate well above its published ratings at times when humidity allows. The controller provides dynamic loop/coil temperature adjustment among other features.

The CX34 system capacity is fully dynamic and can operate between 25% and 100% of its rated capacity, as needed, and matches its actual capacity to the instantaneous heating or cooling load in real time. This means the system is always the right size for changing conditions and is never oversized and avoids the on/off cycling of traditional systems.

Save More w/ DC Inverter Fan Motors

All of the thin-line (5.1" thin) wall, floor and ceiling fan coil units use high efficiency and nearly silent DC Inverter fan motors, designed for 115v 50/60Hz power. 220v 50/60Hz standard FCUs are available for export customers.

Geothermal Performance

There is no Energy Star program for air-cooled chillers. However, the Chiltrix air-cooled chiller exceeds the Energy Star EER requirements for geothermal water-to-water systems.

Server Room Cooling

Chiltrix offers an optional Free Cooling add-on which allows up to EER 141+ & COP 41+ cooling performance during winter at low ambient temperatures. Chiltrix chillers are also available in a N+1 redundant configuration.

Solar Ready

Perfect for solar PV operation with super low power draw and a 2 amp soft start that's easy on inverters and batteries. Also integrates directly with solar thermal hydronic heating & solar water heating systems.

Boiler & Hydronic Integration

Can serve as low-cost primary heat when used with an existing boiler heating system. Dramatically reduces heating costs for users of propane or oil fired boiler systems.

Modular – Stackable

The CX34 can be configured with up to 3 outdoor units to create systems up to 6 Tons Cooling/8.5 Tons Heating

Heating Performance

The CX34 provides heating down to outdoor temperatures as low as -4F (-20C).

* Cooling IPLV EER per AHRI 550/590, IPLV capacity at A95 44 LWT /24,002 BTU, NPLV A95 54L LWT 29,537 BTU. Heating A47/43wB at 95LWT /33,813 BTU.

UL 60335-2-40 / CSA 22.2 / SGS



www.chiltrix.com

All Specifications Subject To Change





The World's Most Efficient Chiller Heat Pump

Ultra-Efficient

CX34 Chiller Heat Pump

2 Tons Cooling / 3 Tons heating
 IPLV Cooling 26,615 BTU COP 6.75 EER 23.02
 NPLV Cooling 30,049 BTU COP 9.0 EER 30.72
 Heating 33,813 BTU COP 3.92



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UL 60335-2-40 / CSA 22.2 / SGS

All Specifications Subject To Change



www.chiltrix.com





The World's Most Efficient Chiller Heat Pump

Ultra-Efficient CX34 Chiller Heat Pump

2 Tons Cooling / 3 Tons heating
IPLV Cooling 26,150 BTU COP 6.75 EER 23.02
NPLV Cooling 30,049 BTU COP 9.0 EER 30.7
Heating 33,813 BTU COP 3.92

The CX34 is Stackable up to 3 Systems
Use up to 8 Indoor Units per Outdoor Unit.

UL 6035-2-40 / CSA C22.2 / SGS

Best of Breed Components

At Chiltrix we used every trick in the book and then some to deliver the highest electrical efficiency possible. And we didn't stop there. The components we use to build our chillers are sourced from the world's top manufacturers and include heat exchangers from Sweden, German pumps, American valves, electronics from Japan, controls from USA, and a compressor from Mitsubishi.

No corner has been cut when it comes to making sure that the parts and materials used to manufacture the CX34 are the best available. Our chiller is designed for performance - to deliver the lowest kW usage per BTU of any chiller heat pump available, and to perform this task for a 20-year service life.

Anti-Corrosion Technology to protect against salt air or air pollution is incorporated into all Chiltrix outdoor units. Includes special coil, sealed compressor and fan motor.

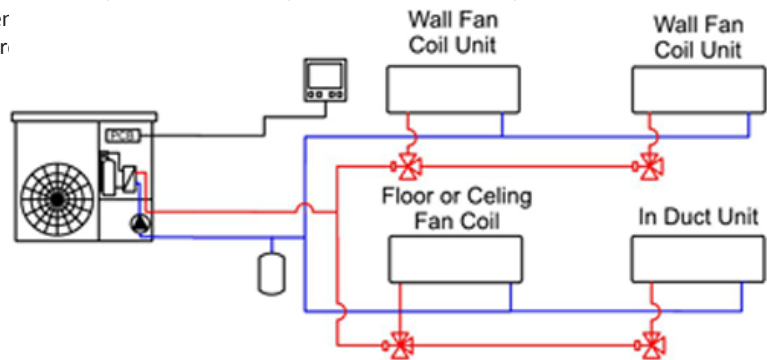
There is no other chiller like the CX34 available on the market at any price. Contact us to learn more about designing a chiller system for your home, commercial location, or server room. We can also help you integrate our system with an existing system, retrofit replacemer or integration with solar or to an existing boiler or hydr heating system.

Up to 8 Indoor Units

You can use up to 8 indoor fan coil units of any type including high-wall (mini-split type), low wall, ceiling, floor standing, etc. You can also use in-duct fan coil units for creating a small central heating & air conditioning system.

The system is also compatible with radiant hydronic heating, or can be connected to a boiler system to provide a low cost primary heating source.

Model CX34 Per AHRI 550/590	Ambient / LWT (°F)	Capacity / Input BTU/kW
Heating	at A43/W95	33,813/2.53
	at A17/W95	22,237/2.32
Cooling	Efficiency A95/W44	IPLV EER 23.02
	Efficiency A95/W54	NPLV EER 30.7
Cooling Capacity/Max Power Input(kW)	at A95/W44	26,150 / 2.36
	at A95/W54	30,049 / 2.36
Input Power	Variable (kW)	.364 - 2.36
Max.Current/ Min. Circuit (A)		15/20
Electric supply		208-240V / 50~60HZ
Max.Water Temperature (°C)		55 (131F)
Operating Temperature Range (°C)		-20 ~ 50 (-4F ~ 122F)
Refrigerant Circuit	Refrigerant	R410a
	DC Inverter Compressor(s)	Mitsubishi Scroll - DC Inverter
	Heat Exchanger	Cu/Al Hydrophilic w/ Anti-Corrosion
	Electronic Expansion Valve	Saginomiya Japan
	Condenser Fan Motor	Panasonic DC Fan
	Max Air flow (CFM)	1700
Water Circuit	Heat exchanger	Multistack BPHE
	Inlet / Outlet	1" NPT
	Water Flow - Max	7.6 GPM
	Pump	Wilco DC Variable Speed
	Max/Std. Pressure	115/25 PSI
Unit Dimensions WxHxD (Inch)		43.9 x 38.15 x 16.74
Package Dimensions WxHxD (Inch)		46 x 49.25 x 18.5
Net Weight (Lbs.)		232
Gross weight (Lbs.)		254
Noise level dB(a)		49



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Chesapeake VA 23323
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info@hotspotenergy.com

1-757-410-8640



www.chiltrix.com

All Specifications Subject To Change



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Safety Precautions

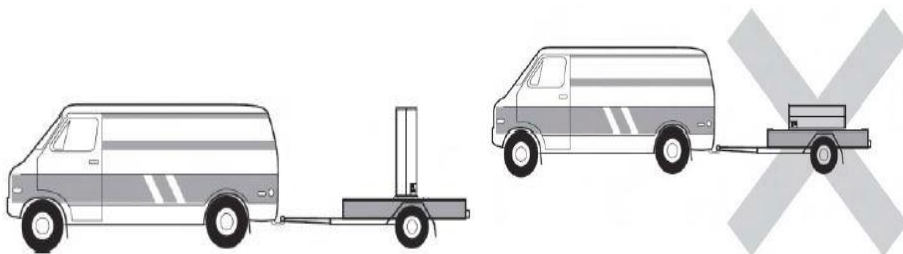
NOTE: It is required to read the Safety precautions in detail before operation. The precautions listed below are very important for safety, please follow all safety precautions.

General

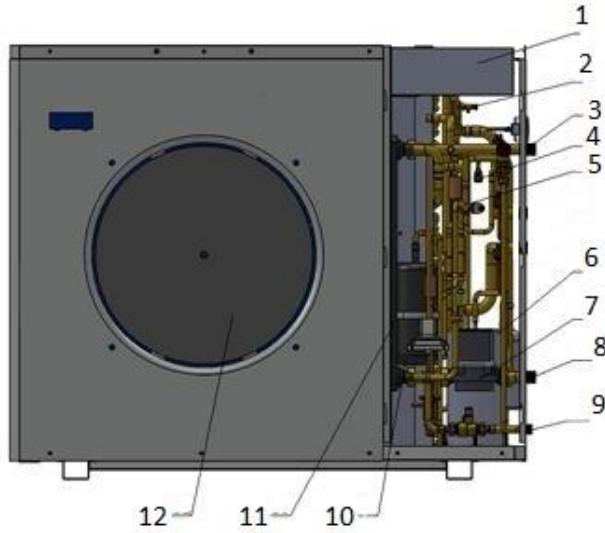
- Make sure that the ground wire in the building is securely connected to earth. Wiring tasks should be carried out by qualified electricians only, in addition, they should check the safety conditions of power utilization, for example, verify that the line capacity is adequate, and the power cable isn't damaged.
- Users must not install, repair or relocate the unit. Improper procedures might lead to accidents e.g. personal injury caused by fire, electrical shock or unit's falling off its base, and water leaking into the machine. Please contact a professional service department if problems arise.
- The unit shall not be installed at a spot with the potential hazard of leaking flammable gas. If gas is leaking near the machine, there might be the risk of explosion.
- Make sure that the foundation of the unit is stable. If the foundation is unstable, the outdoor unit may come loose from its base and cause injury.
- Make sure that the GFCI installed at the service panel is working properly to avoid shock or fires.
- If any abnormality occurs in the unit (such as a burning smell is noticed inside the unit), cut off the power supply immediately, and contact a professional service department.
- Please observe the follow items when cleaning the unit. Before cleaning, shut off the electric supply of the unit first to avoid injuries caused by the fan operation.
- Do not rinse the unit with water because the rinsed unit may cause electric shock.
- Make sure to shut off the electric supply before maintaining the unit.
- Please do not insert fingers or sticks into air outlet or air inlet.

Transporting and storage

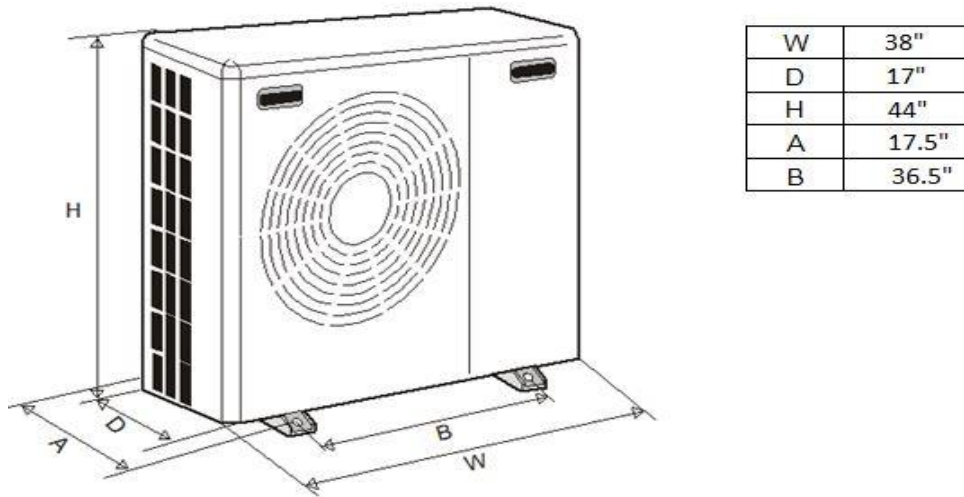
- The machine must be transported and stored vertically.



CX34 Components



Position	Component	Position	Component
1	Electronics Box	7	Water Pump
2	Air Discharge Valve	8	Heat Pump Inlet
3	Heat Pump Outlet	9	Plate H.E. Drain
4	Needle Valve	10	Accumulator
5	4 Way Valve	11	Plate Heat exchanger
6	Compressor	12	Fan

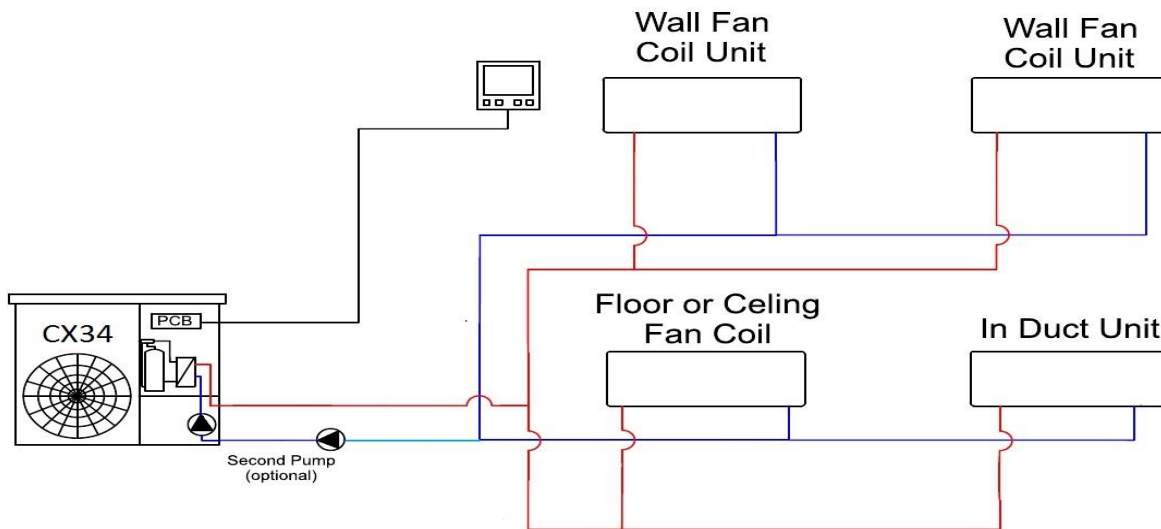


Hydronic Piping and Design Guide

Installation Methods Heating and Cooling (Heating Shown)

Note: Primary Secondary Piping is NOT supported on this chiller.

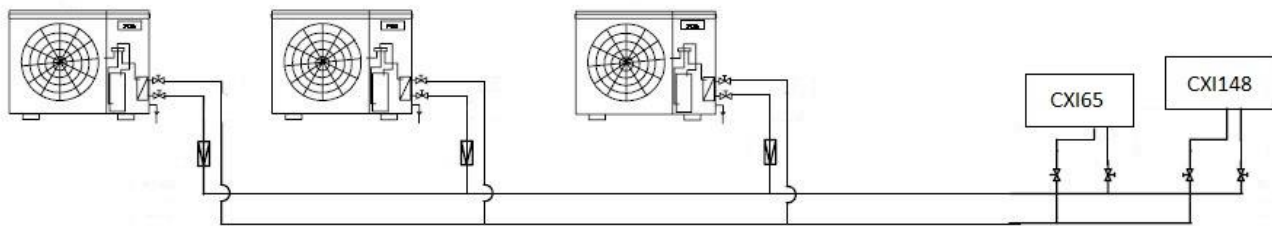
A buffer tank must be used for floor heating.

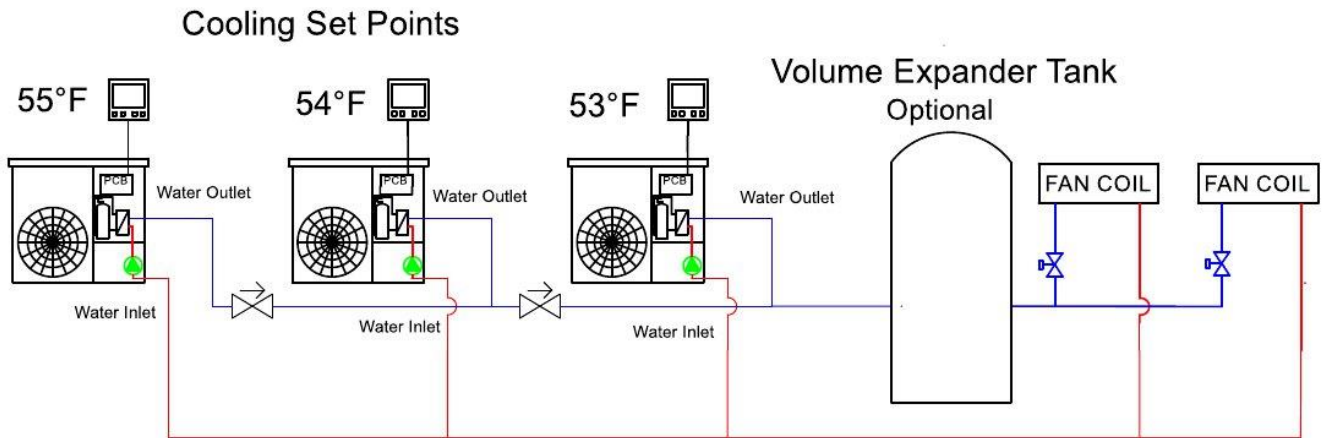


1. Minimum pipe size should be no less than 1", CPVC or Oxygen Barrier PEX, reverse return piping is preferable to eliminate balancing valves or pressure regulators. The installer should calculate the pipe and fitting resistance to determine the head pressure. See the examples on the following pages, maximum water flow for the CX34 is 6 gpm, design flow is 4.8 gpm. If necessary, a second PWM pump may be added to the loop and controlled by the CX34. The second water pump connections can be found in the wiring diagram starting on page 19.
2. The loop example above is designed with wild coils. Water flows through the coil at all times, if there is a call for heating or cooling the FCU controls will turn the fan on. Optionally, a 2 way valve may be installed at the input tee to prevent any flow through the coil and the FCU will control it.
3. An air discharge valve should be installed at the top of the circulation system if possible for easy air discharge. As an alternative an automatic/manual air vent can be used inline before the pumps.
4. Flow meters with restrictor valves, Watts Flow Guard for example, may be used when reverse return piping is not an option.
5. Always install a water filter or wye strainer on the supply pipe to the chiller to prevent blockage of the heat exchanger.

Piping Examples: Stacked Chillers

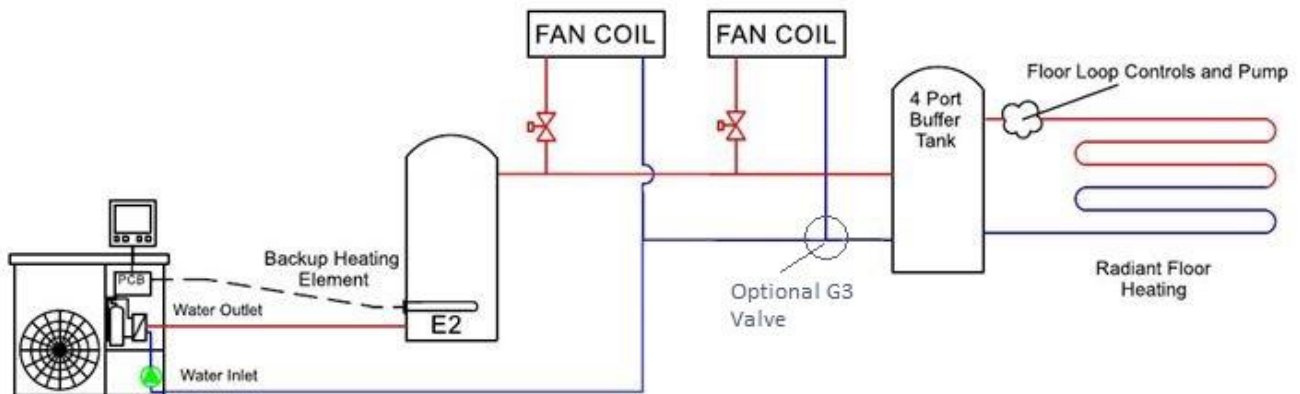
Without Buffer Tank





A volume expander tank should be used when the loop volume is less than 20 gallons to keep the compressor from cycling.

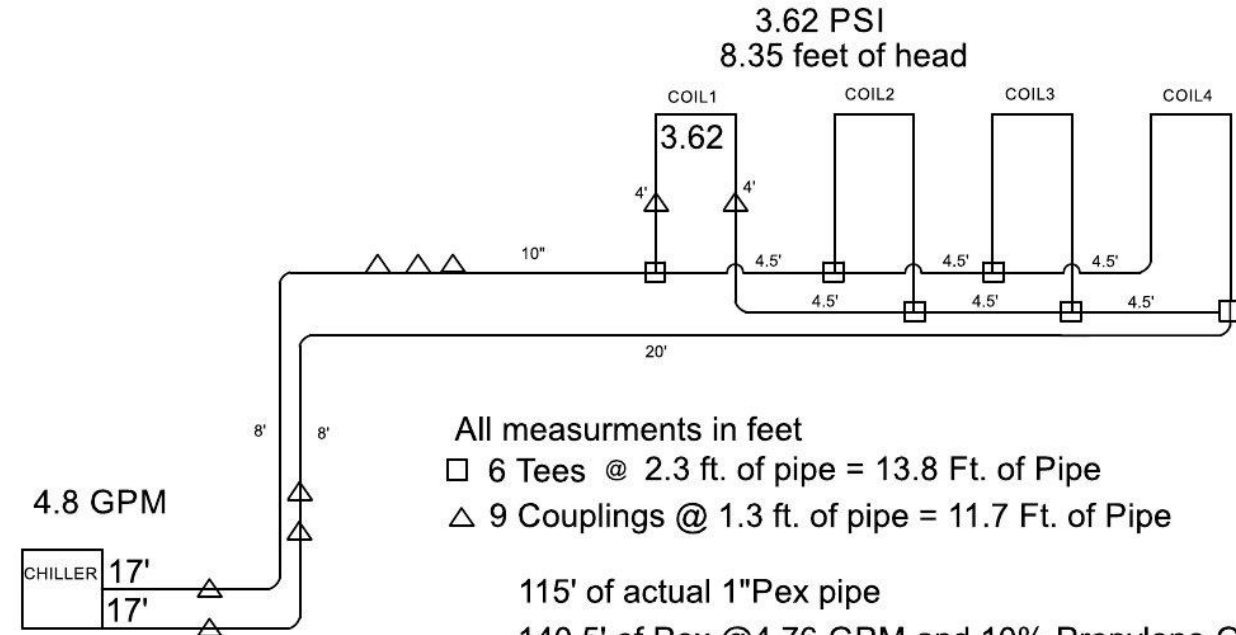
Using a Buffer Tank



Primary / secondary piping is not supported, when connecting to a floor heating loop always use a buffer tank. Buffer tanks are generally used only with floor heating.

The pump in the buffer tank drawing is controlled by the customer’s floor loop controls. A 20-50 gallon buffer tank is used generally for best performance. A G3 seasonal valve may be used to isolate the tank in cooling mode.

Head Calculation Example:



All measurements in feet
 □ 6 Tees @ 2.3 ft. of pipe = 13.8 Ft. of Pipe
 △ 9 Couplings @ 1.3 ft. of pipe = 11.7 Ft. of Pipe

115' of actual 1" Pex pipe
 140.5' of Pex @ 4.76 GPM and 10% Propylene Glycol
 140.5' x .05 = 7.02 Ft Hd. per chart
 Fan coils = 8.35 ft of head
 Chiller = 8.3 ft of head

Total Feet of Head = 23.67

To calculate the head pressure for the correct water flow, the pipe length must be measured and all fittings counted. It is advisable to use flexible red oxygen barrier PEX piping to avoid as many elbows as possible. All fittings have an equivalent length of pipe already calculated, available on the next page under PEX Fittings Pressure Drops. Add up the equivalent length of pipe for the fittings, 13.8' + 11.7' = 25.5'. Then, add this to the actual pipe, 25.5' + 115' = 140.5' of 1" pipe. Once you know the total length of pipe, use a (1" PEX 10% Glycol, feet of head per 100 feet of tubing chart), to get the head for 1' of pipe, at 40°F and 4.76 GPM. This comes to (.0500) feet of head per foot. 140.5 x .0500 = 7.02 ft. of head. Add up all head calculations, 7.02 + 2.3 + 8.35 + 8.3 = 23.67 ft. of head. Next we will look at the Wilo Pump curve on page 13. Maximum head at 4.76 GPM is 25 ft.

If using the CX30SE (Free Cooling option) the CX30SE's pressure drop is 4.5 PSI when active.

Notes:

The example loop above has a volume of 4.5 gallons. The internal thermal expansion tank is 2 liters or .52 Gallons. An additional thermal expansion tank may be required for larger loops. There are many thermal expansion calculators on the internet, the following is an example. <http://westank.com/calculator/> Minimum loop pressure is 14.5 psi, maximum pressure is 43.5 psi, and ideal pressure is 29 psi. The Lowest temperature is 44°F, the highest temperature is 131°F, the Initial pressure is 14.5 psi, and the final pressure is 29 psi.

An air scoop should be installed above the expansion tank to remove any air in the circulation loop. Always install a water filter or wye strainer on the supply pipe to the chiller to prevent blockage of the heat exchanger.

Nominal size	OD	Wall thickness	ID	Volume gal/100'
3/8"	0.500	0.070	0.350	0.50
1/2"	0.625	0.070	0.475	0.92
5/8"	0.750	0.083	0.574	1.34
3/4"	0.875	0.097	0.677	1.83
1"	1.125	0.125	0.863	3.03



WYE STRAINER

PEX PIPE VOLUME



PEX Fittings Pressure Drops

PEX Brass Crimp Fittings
Friction Loss - Equivalent Feet of PEX Tubing

Size	Coupling	Elbow	Tee Run	Tee Branch
3/8"	2.9	9.2	2.9	9.4
1/2"	2.0	9.4	2.2	10.4
3/4"	0.6	9.4	1.9	8.9
1"	1.3	10.0	2.3	11.0

Freeze protection

Vol% Propylene Glycol	Wt% Propylene Glycol	Freezing Point		Burst Point	
		°F	°C	°F	°C
0	0	32	0.0	32	0.0
5	5.2	29	-1.7	27	-2.7
10	10.5	26	-3.3	22	-5.6
15	15.6	23	-5.0	18	-7.5
20	20.8	19	-7.2	11	-11.8
21	21.8	17	-8.3	9	-12.9
22	22.9	17	-8.3	7	-14.2
23	23.9	16	-8.9	4	-15.5
24	24.9	15	-9.4	2	-16.9
25	25.9	14	-10.1	-1	-18.4
26	27.0	13	-10.6	-4	-20.1
27	28.0	12	-11.1	-7	-21.8
28	29.0	10	-12.2	-10	-23.6
29	30.1	9	-12.8	-14	-25.5
30	31.1	8	-13.3	-18	-27.5
31	32.1	7	-13.9	-21	-29.6
32	33.1	5	-15.0	-24	-31.1
33	34.1	4	-15.6	-30	-34.4
34	35.1	2	-16.7	-38	-38.9
35	36.1	1	-17.2	-46	-43.3
36	37.2	-1	-18.3	-53	-47.2
37	38.2	-3	-19.4	-60	-51.1
38	39.2	-4	-20.0	-60	-51.1
39	40.2	-6	-21.1	-60	-51.1
40	41.2	-8	-22.2	-60	-51.1
41	42.2	-10	-23.3	-60	-51.1

	Vol%	Wt%	Freezing Point		Burst Point	
	Propylene Glycol	Propylene Glycol	°F	°C	°F	°C
42		43.2	-12	-24.4	-60	-51.1
43		44.2	-14	-25.5	-60	-51.1
44		45.2	-16	-26.7	-60	-51.1
45		46.2	-18	-27.8	-60	-51.1
46		47.2	-21	-29.4	-60	-51.1
47		48.2	-23	-30.6	-60	-51.1
48		49.2	-26	-32.2	-60	-51.1
49		50.2	-28	-33.3	-60	-51.1
50		51.2	-31	-35.0	-60	-51.1

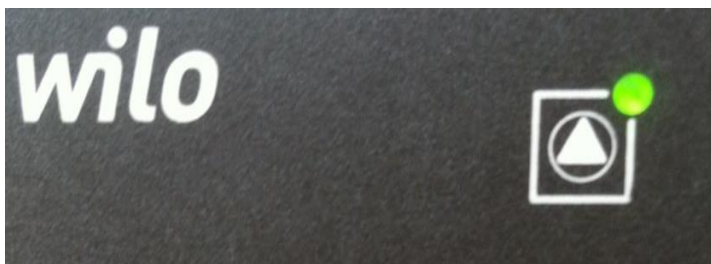
NOTE:

When using **CPVC piping** it is highly recommended that you do not exceed a 25% glycol to water ratio. Environmental Stress Cracking, also referred to as ESC, is a mechanism by which an organic chemical (possibly a weak solvent or even a non-solvent) achieves an extremely localized weakening at the surface of the material which permits propagation of a crack. Environmental stress cracking generally presents itself as a crack with glossy fracture surfaces that occur in regions of high mechanical stresses. ESC is dependent on both the presence of the chemical and a significant level of mechanical stress.

Therefore, it may occur in some installations or certain parts of a system, while the system performs well in other areas. Many problems can, as a result, be avoided by proper design and installation. Potential ESC agents for CPVC include natural or synthetic ester oils, nonionic surfactants, alcohols and glycols.

Internal CX34 WILO Pump

LED	Meaning	Diagnostic	Cause	Remedy
On-Green	Pump in Operation	Pump is Running	Normal Operation	
Green Flashing	PWM Model	Pump in Standby	Normal Operation	
Blinks Red/Green	Pump is Functional but has stopped	Pump will restart after fault is cleared	Under Voltage < 160 vac Pump Over heating	Check Power supply 195 vac – 253 vac
Blinks Red	Pump is not Functional	Pump Stopped	Pump will not start due to a permanent failure	Replace Pump
LED Off	No Power	No Voltage to Electronics	Pump Has no Power	Check Cable Connections
			Led is Damaged	Check if the Pump is Running
			Electronics are damaged	Replace Pump



PWM pcb LED Error Codes (3 digit display)

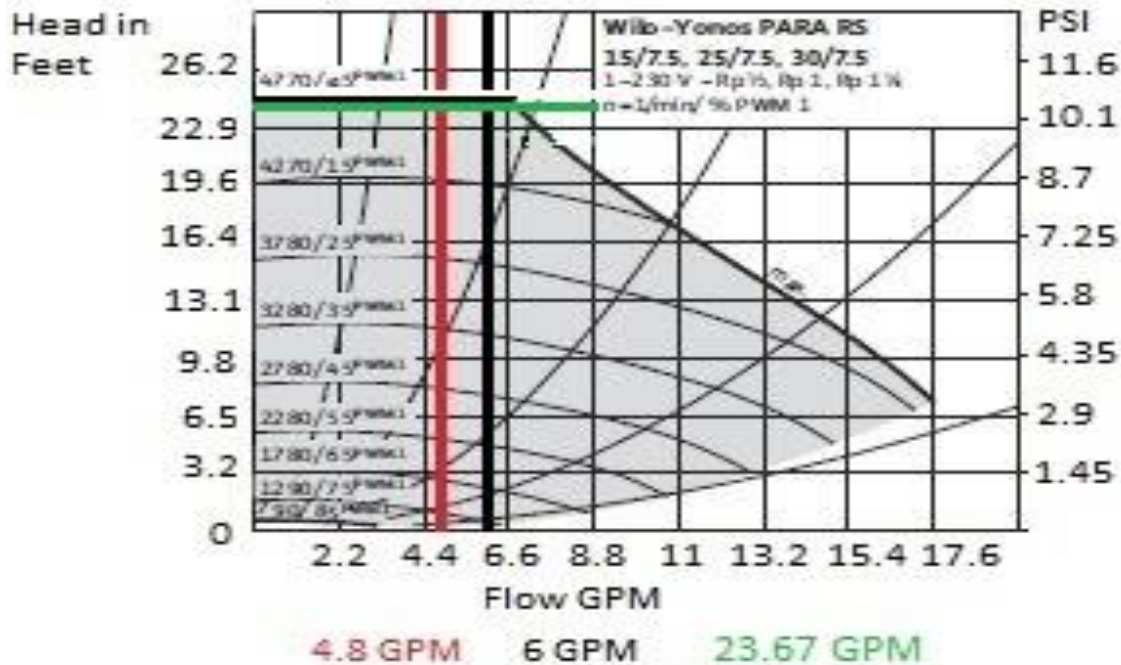
Normally the 3 digit display shows the pump speed percentage in addition to temperatures and sensor errors.

E1 is a Th1 sensor error, it is open or shorted.

E2 is a Th2 sensor error, it is open or shorted.

Wilco-Yonos PARA RS 15/7.5, 25/7.5, 30/7.5

External control via PWM 1



Pump Specifications

- Voltage AC 1-230, 50-60 Hz
- Power consumption 4-75 Watts
- Speed 800-4770 RPM
- Max Head 25 ft
- Max Flow 15 GPM

Pipe Insulation

All loop piping must be insulated per local and national mechanical codes.

For design tips and a thickness calculator please visit <http://www.armacell.us/knowledge-center/>

Heat Pump Installation

Installation position

Note: *Installation must be carried out by professional personnel.*

1. The recommended mounting pad should be 1" to 1 ½" above ground level.
2. Proper drainage is required at each outdoor unit to avoid flooding the outdoor unit.
3. To install the unit on a balcony or on top of a building, the installation site must meet the allowable bearing capacity of the building structure without affecting the structural safety.
4. Ensure the unit is well ventilated; the direction of air exhaust should be kept away from the windows of neighboring buildings. Adequate service clearance should be kept around the unit.
5. The unit should not be installed in places accompanied with oil, inflammable gases; corrosive components e.g. sulfur compound, or high-frequency equipment.
6. The unit must be installed upon a reliable machine base or framework. Weight capacity of framework should be 3 times of the outdoor unit's body weight, and safeguard measures should be taken to avoid a malfunction of the fasteners.
7. The unit must have extra precautions taken when it is installed at sites with hurricane/ earthquake hazards. Consult the appropriate professional to determine the needed requirements
8. Midair or suspended installation should be avoided as much as possible, falling machines may result in personal injury and property damage.

Internal pump installation (Remove Top, Front, and Right Side Covers)



Removing the shipping spacer

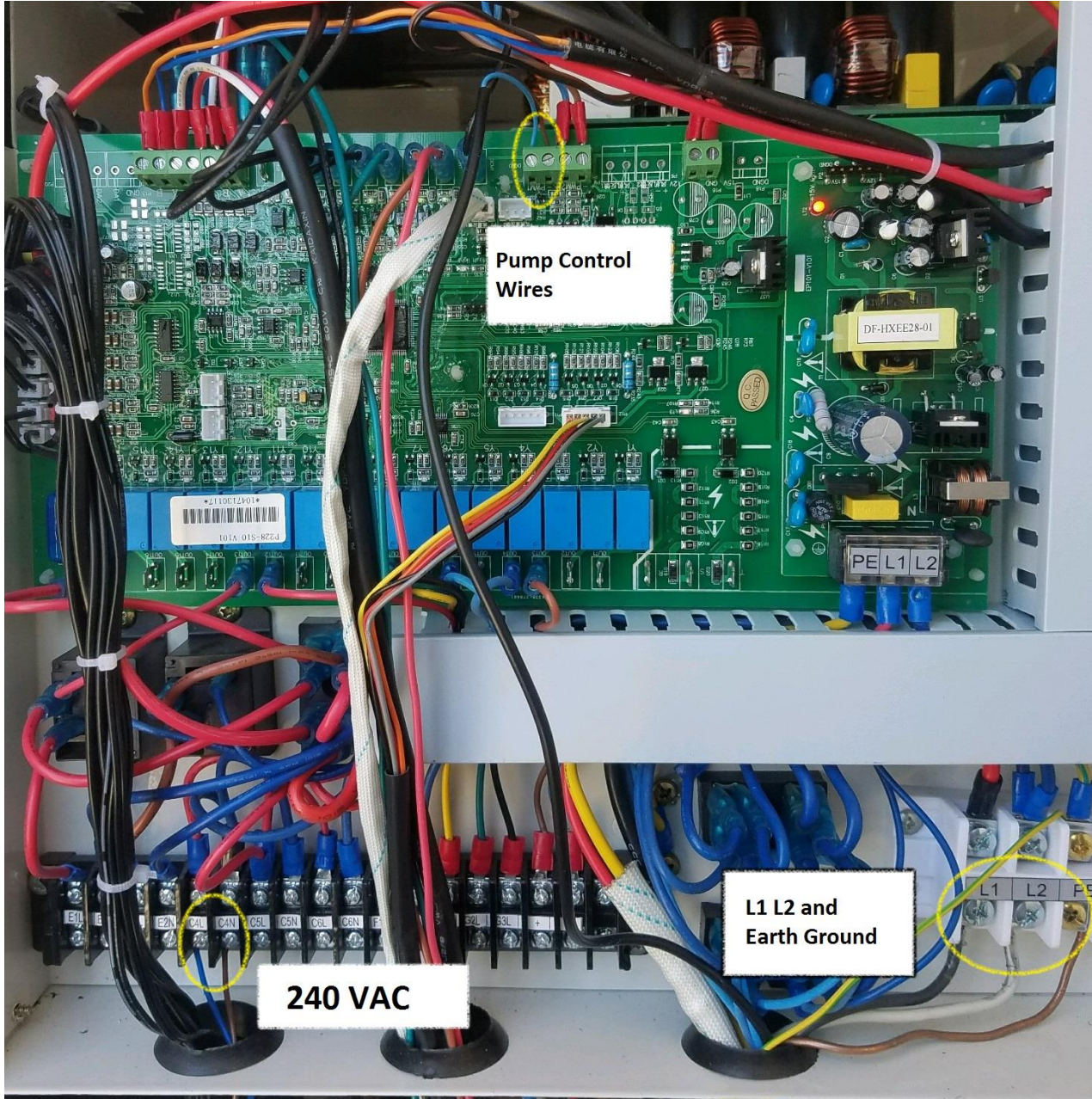


Verify flow direction (UP)

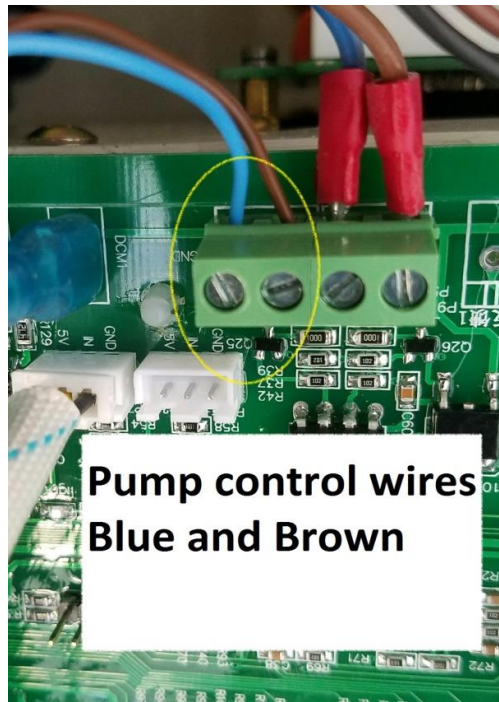
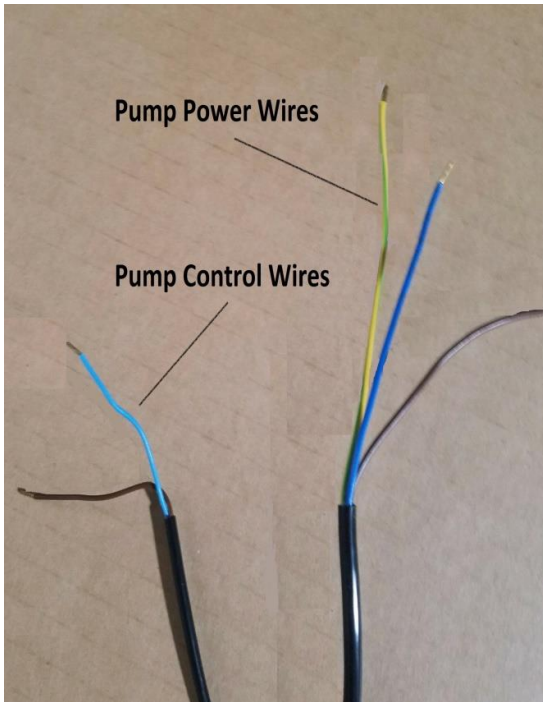


Installed properly

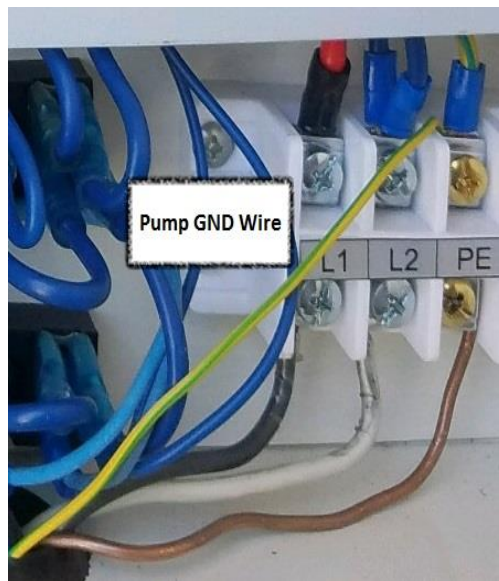
Internal Pump Wiring



Electronics cabinet



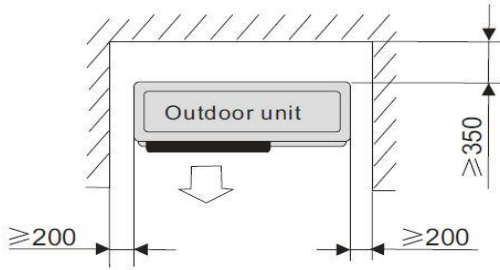
Pump power wires.



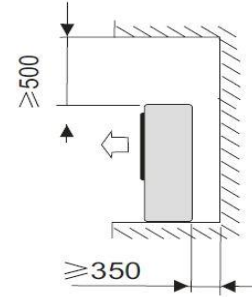
Pump ground wire.

Clearances (unit: mm) 200mm = 8" , 350mm =14 " , 400=16" , 500=20" ,1000=40"

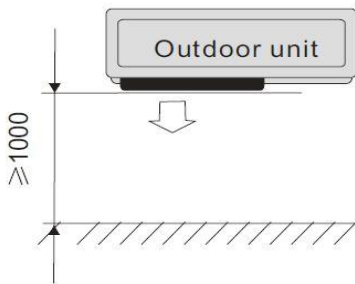
No obstacle in front of the unit



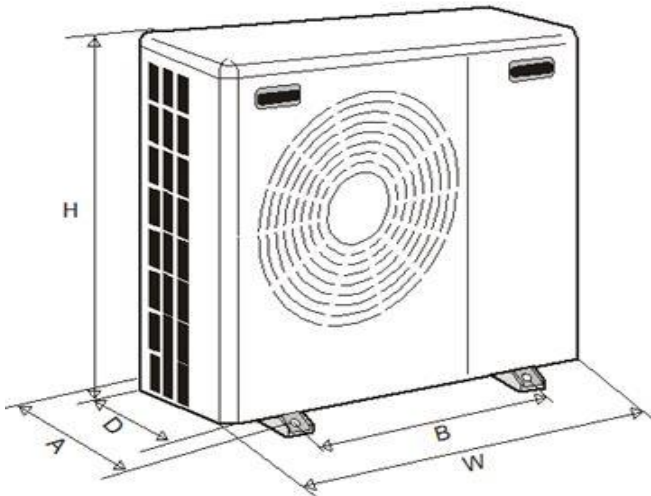
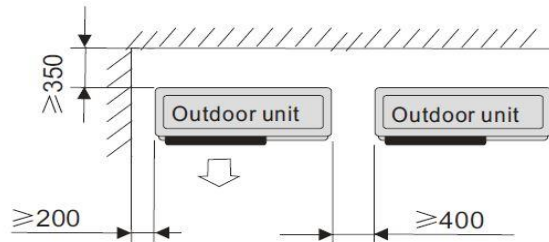
Obstacle above the unit



Obstacle in front of the unit



Several units in a row



W	38"
D	17"
H	44"
A	17.5"
B	36.5"

Electric connection

General

Note!

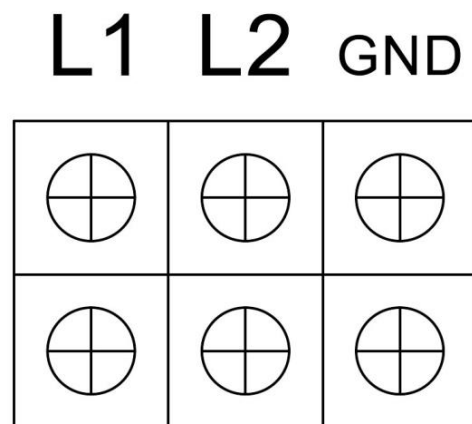
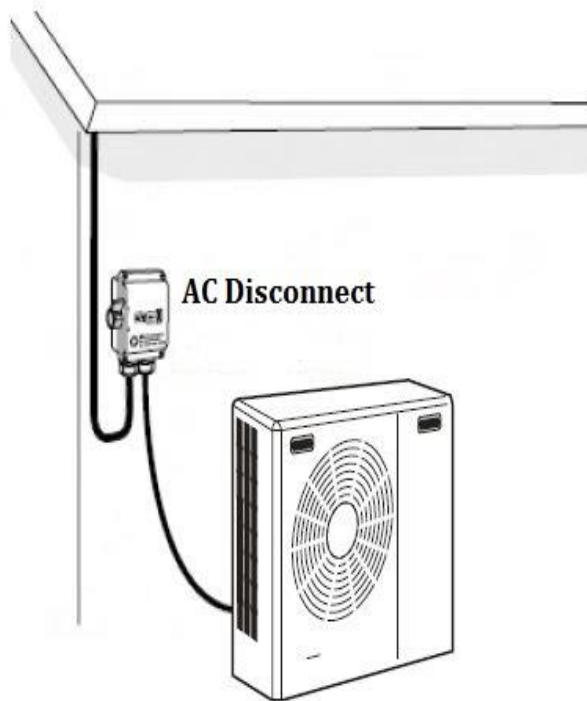
Electrical installation and service must be carried out under the supervision of a qualified electrician. Electrical installation and wiring must be carried out in accordance with the NEC.

The heat pump must not be connected without the permission of the electricity supplier and must be connected under the supervision of a qualified electrician. Wires, spare parts and materials etc. must satisfy the relevant standards issued by the host country or region.

The heat pump does not include an AC disconnect or switch on the incoming electrical supply. The power supply cable must be connected to a circuit-breaker with at least a 3 mm breaking gap. Incoming supply must comply with the technical requirements, with a frame ground wire (neutral is not used), via a distribution box with breakers.

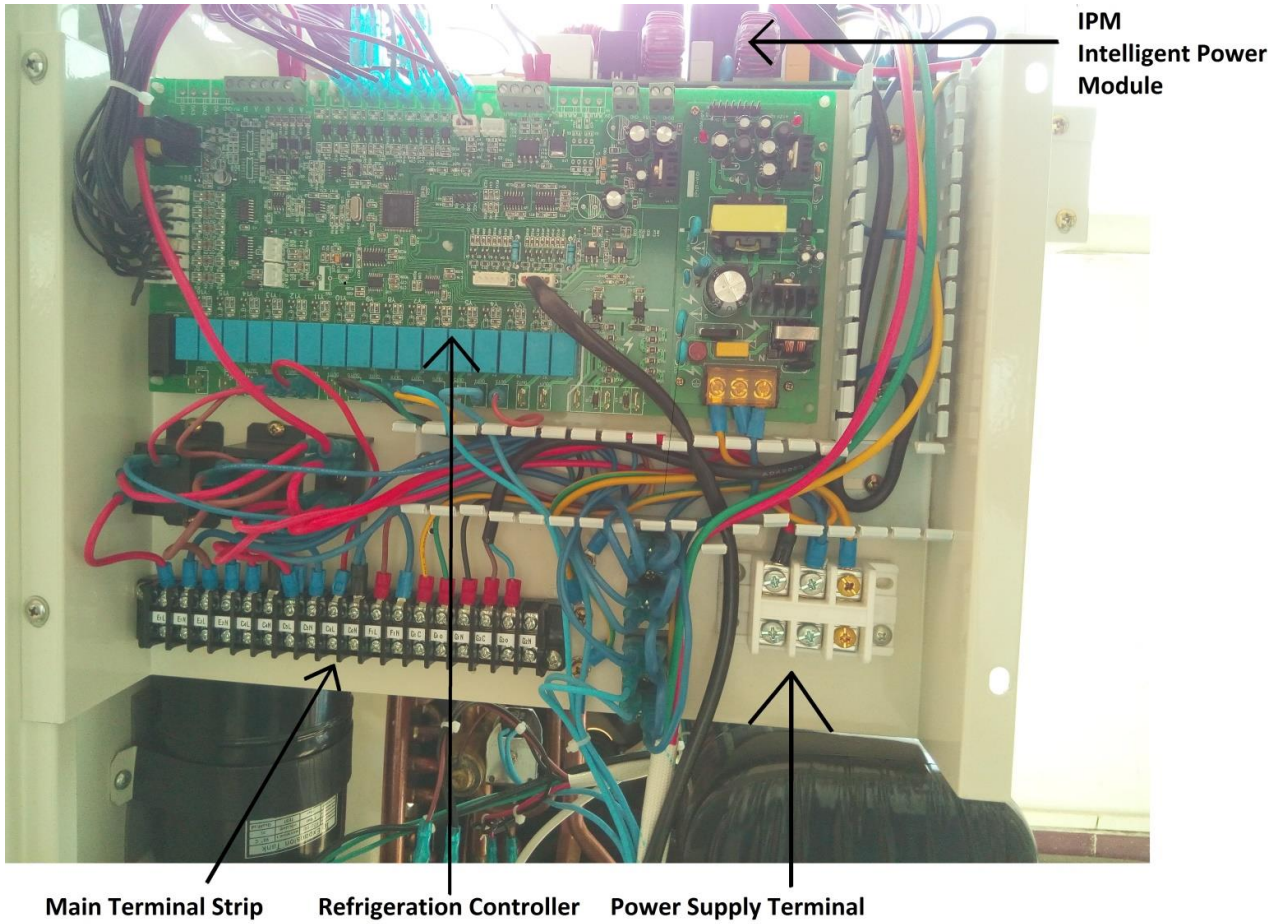
Voltage range is 208-240vac

Maximum current draw is 13 amps, minimum wire size is 12 AWG, minimum breaker size is 20 AMP.

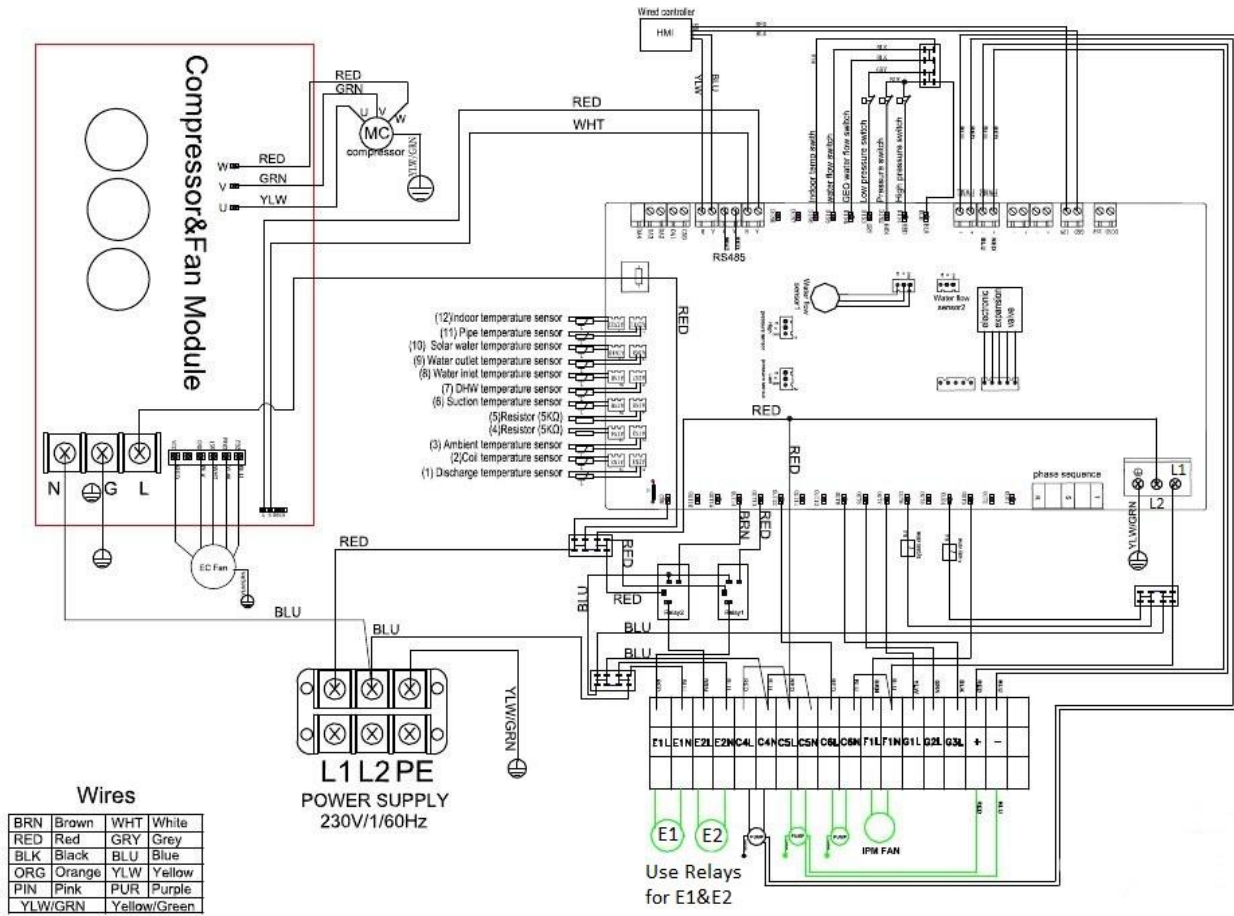


Main terminal block inside electronics box

Electric Connections and Component Locator

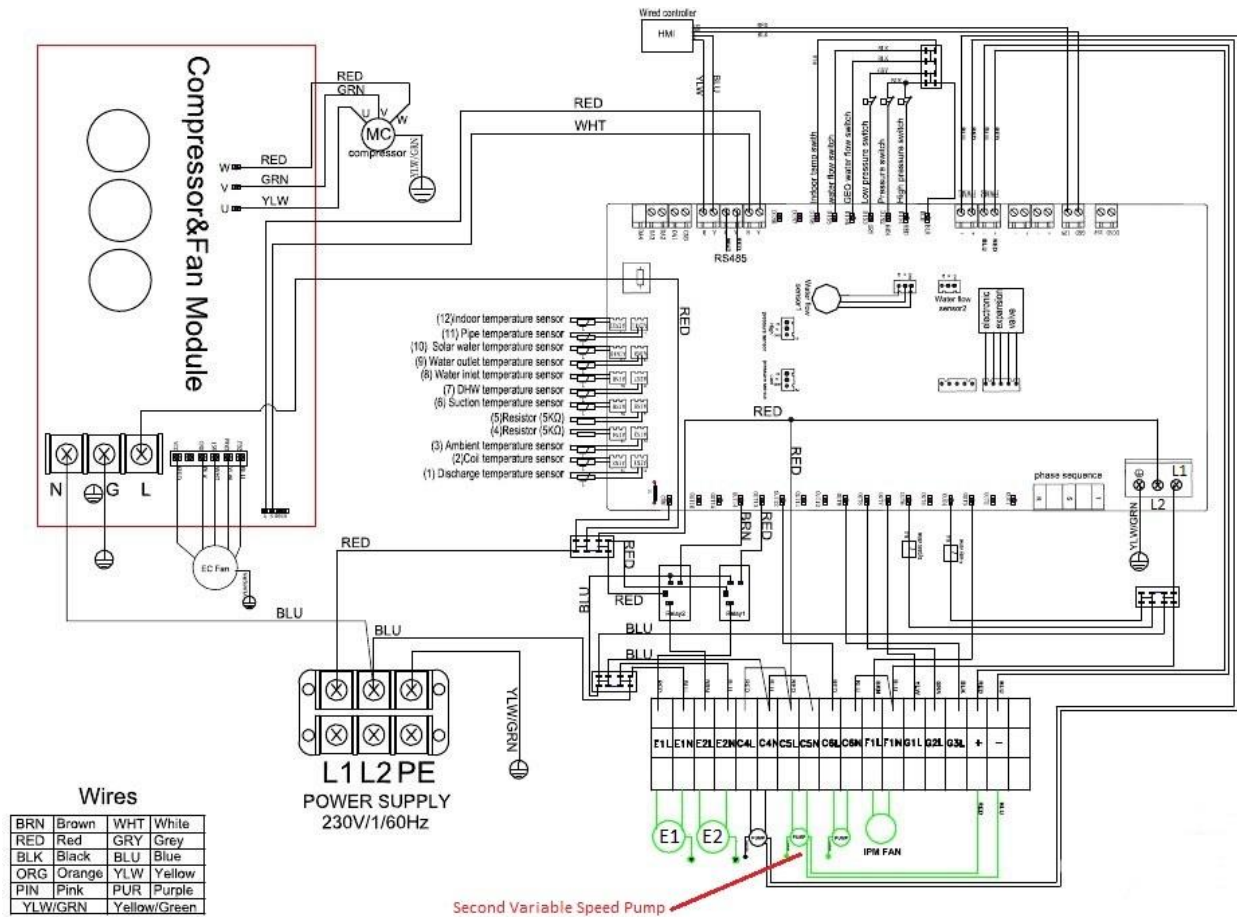


Using Internal PWM Pump



System Layout with internal flow switch and MODBUS

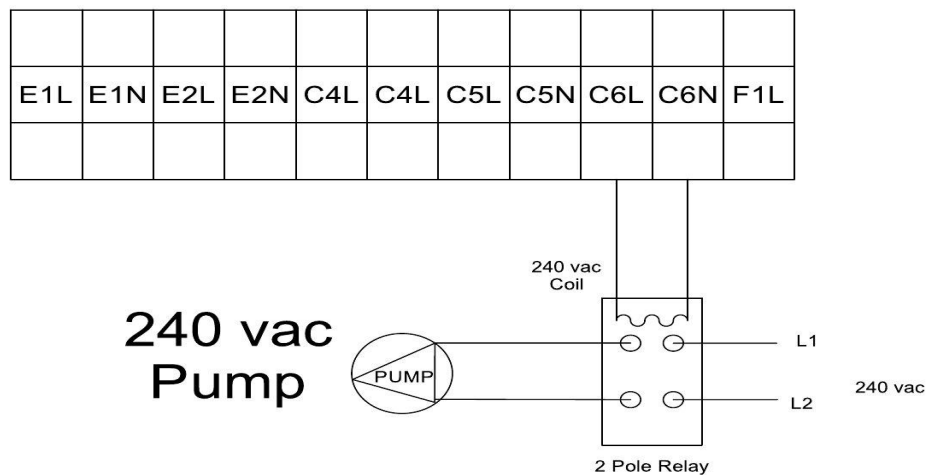
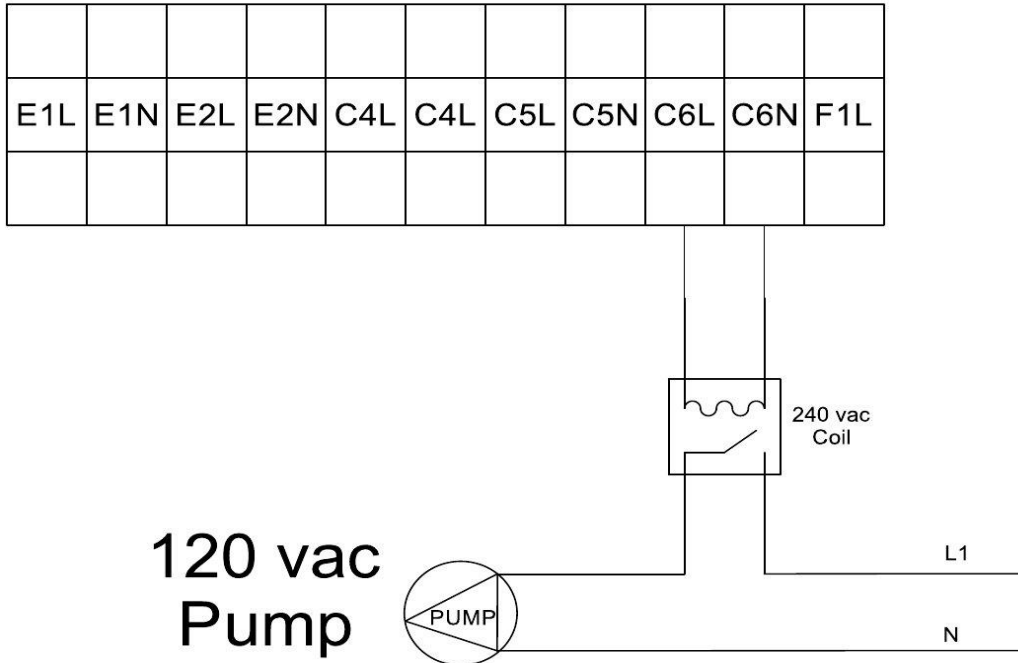
Second PWM Pump Wiring



If the Wilo RS 25/7.5 PWM pump does not have the required pressure at the targeted flow rate, a second Wilo RS 25/7.5 may be added to increase the total pump pressure. This will double the head pressure at the targeted flow rate. Connect to C5L and C5N for 240 vac, + and – for controls.

Contact us for more information on booster pumps.

When using a second NON-PWM water pump



When using a second NON-PWM water pump, use terminals C6L and C6N for relay coil power only. Do not connect a pump directly to C6L and C6N, always use a relay with a 240 vac coil. This pump will only run when the PWM pump is running.

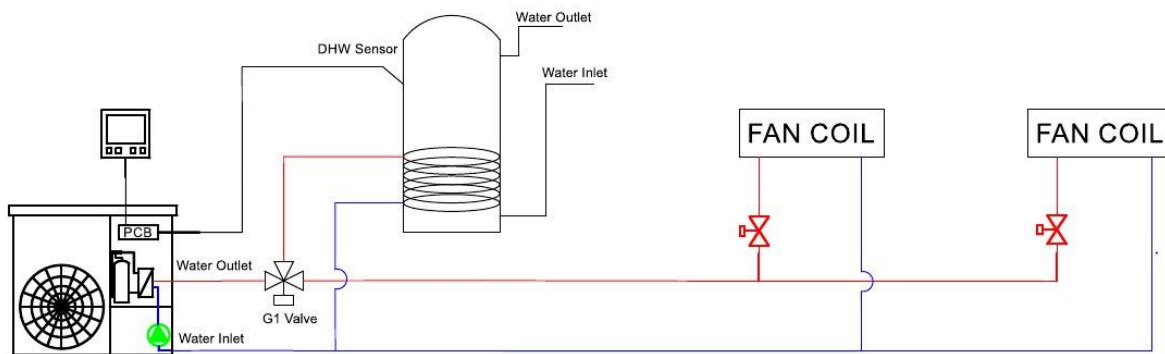
G1 Valve

DHW and AC / Heating

G1: DHW/AC / Heating Valve

In DHW mode, the G1 valve is powered off. In AC mode, G1 is powered on.

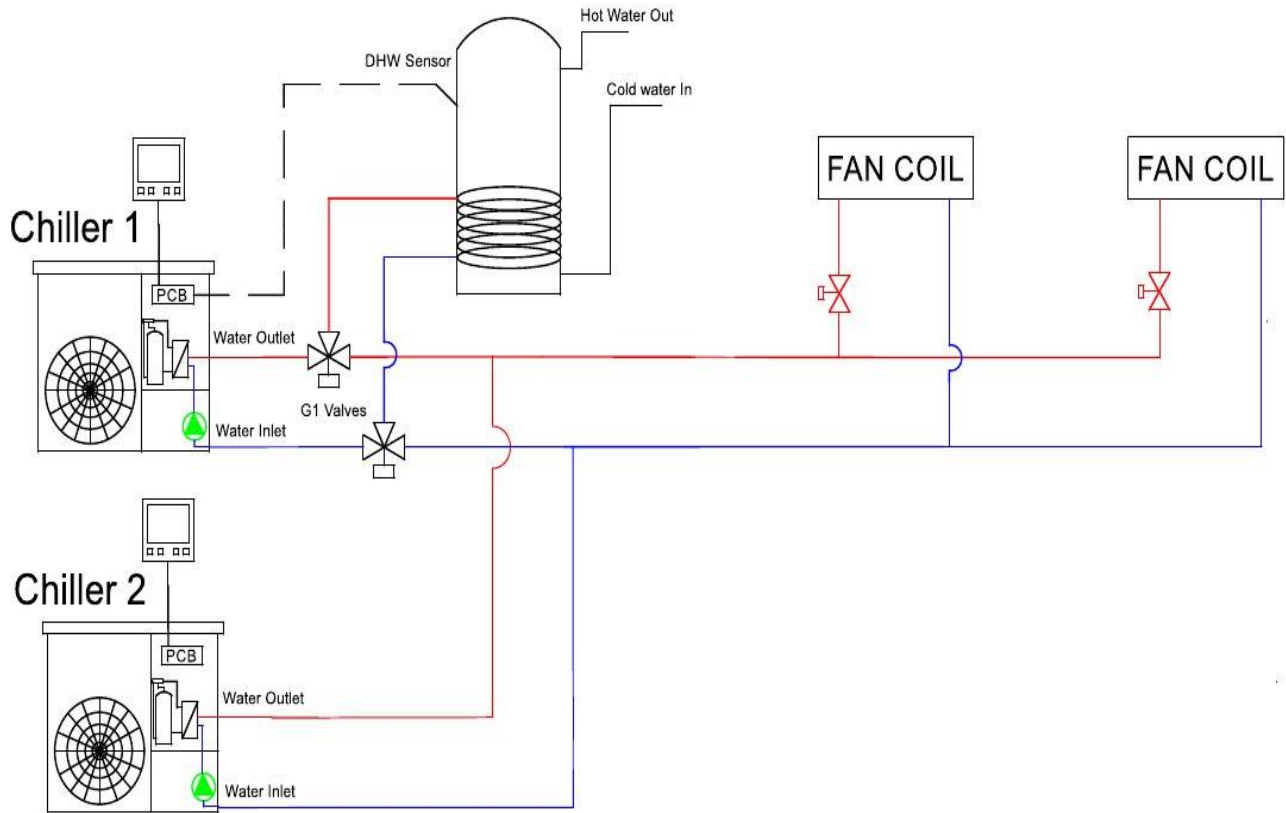
Parameter P08 must be "0" to enable DHW, C19 will show the switch status.



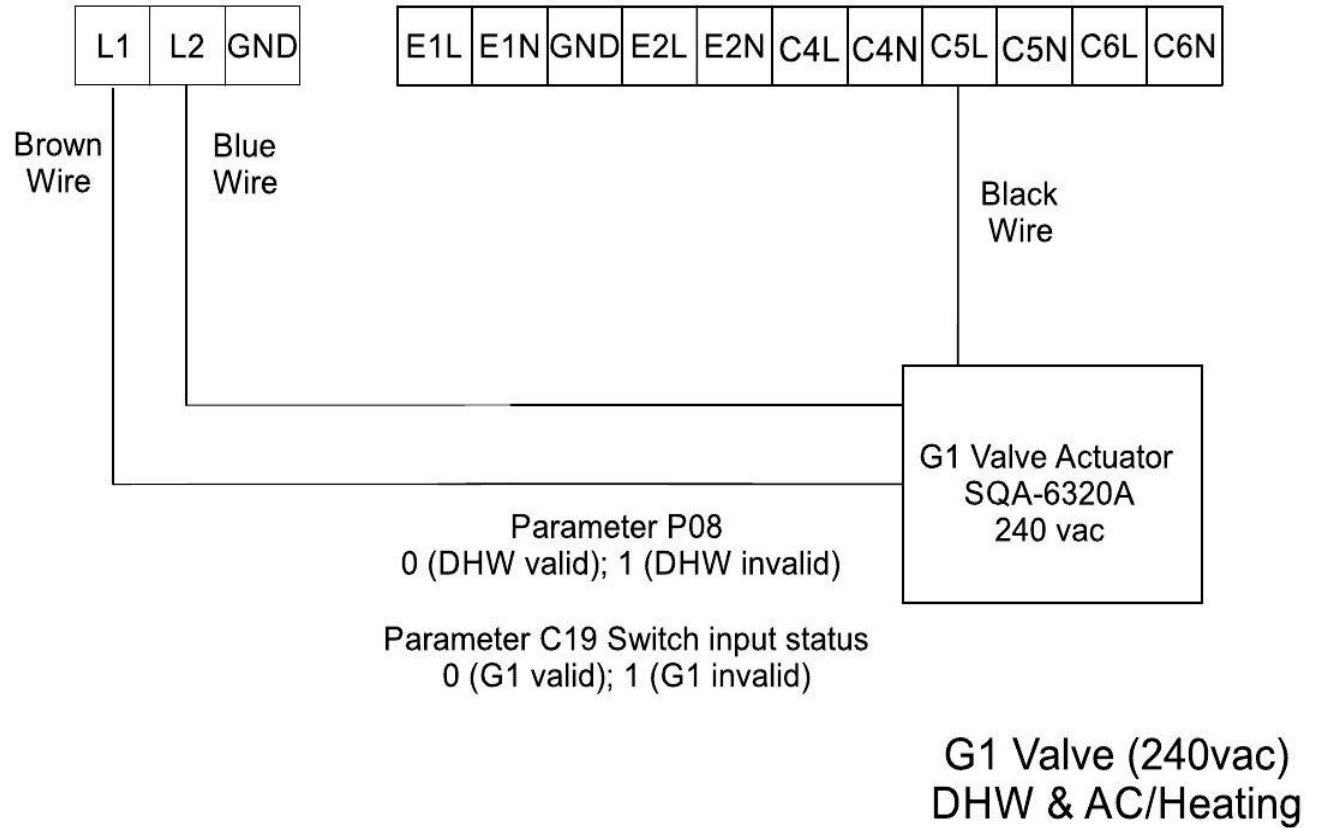
DHW target setting temperature is the tank water temperature measured with the DHW sensor, not the inlet water temperature. If the target temperature is 122°F, refer to page 31 to set the DHW temp, and the differential is 2°C, it means, when the DHW tank reaches 122°F, the compressor will stop. When the DHW tank temperature is lower than 119°F, the compressor will start.

G1 Valve

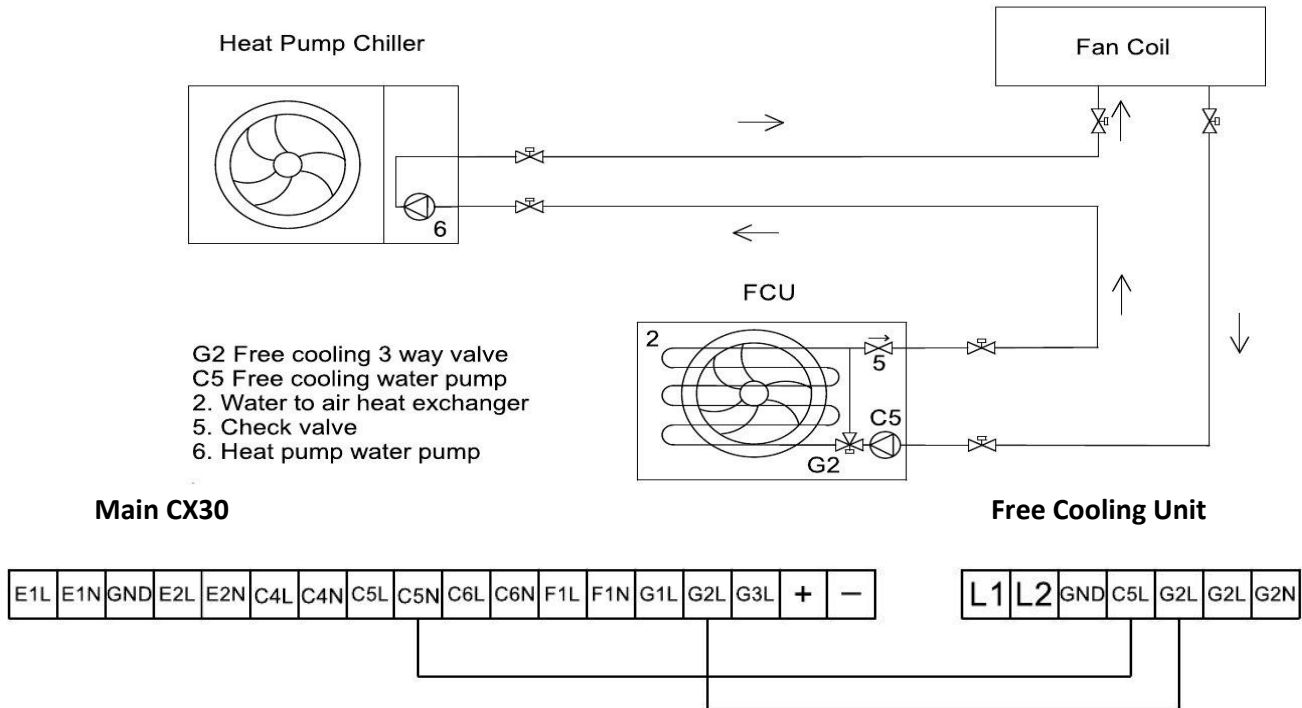
DHW and AC / Heating with two chillers in Parallel



G1 Valve Wiring and Parameters

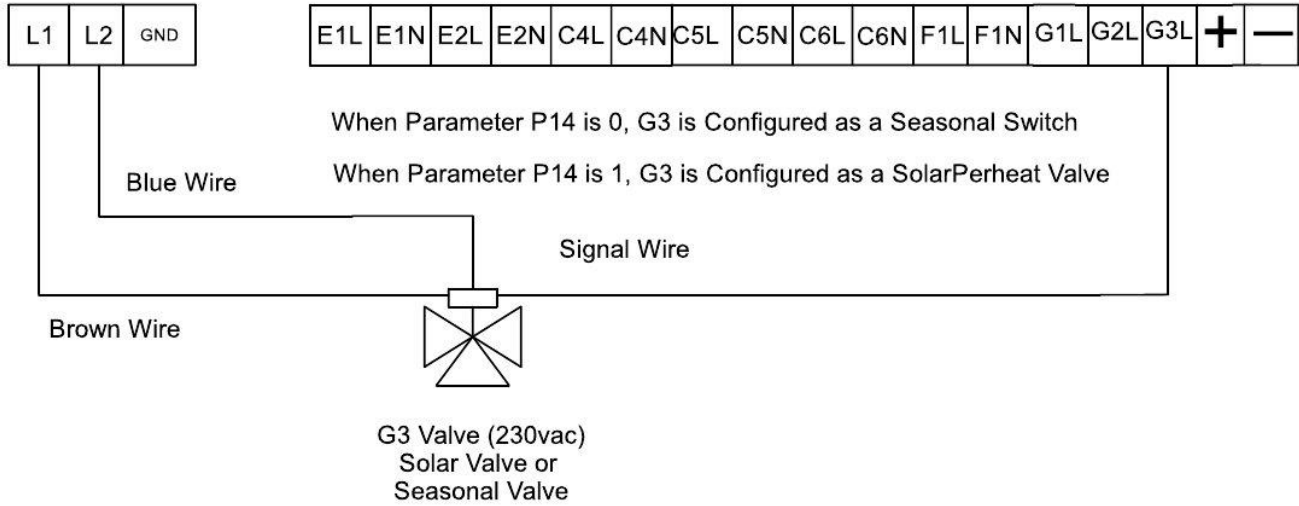


G2 Valve Wiring “Free Cooling “ CX30SE Model



G2 Valve and C5 cooling water pump are preinstalled in the CX30SE. To enable the free cooling function P06 must be set to “0”, C17 will show the status. The main CX34 C5N port is connected to the Free Cooling Units C5N port, the CX34 G2L is connected to the FCU 3-way valve G2L port. With parameter P06 a “0”, the unit will operate as follows: When outdoor temperatures drop below 38F, the CX30SE glycol-water loop is automatically extended through the water-to-air heat exchanger to harvest outdoor cold ambient conditions to pre-cool the glycol-water loop so that the CX34 variable speed compressor can drop to a very slow speed and consume less power. At and below 28F, the CX30SE server room chiller will turn off the CX34 compressor entirely and still be able to maintain its rated cooling capacity using only the variable speed pump and fan motors.

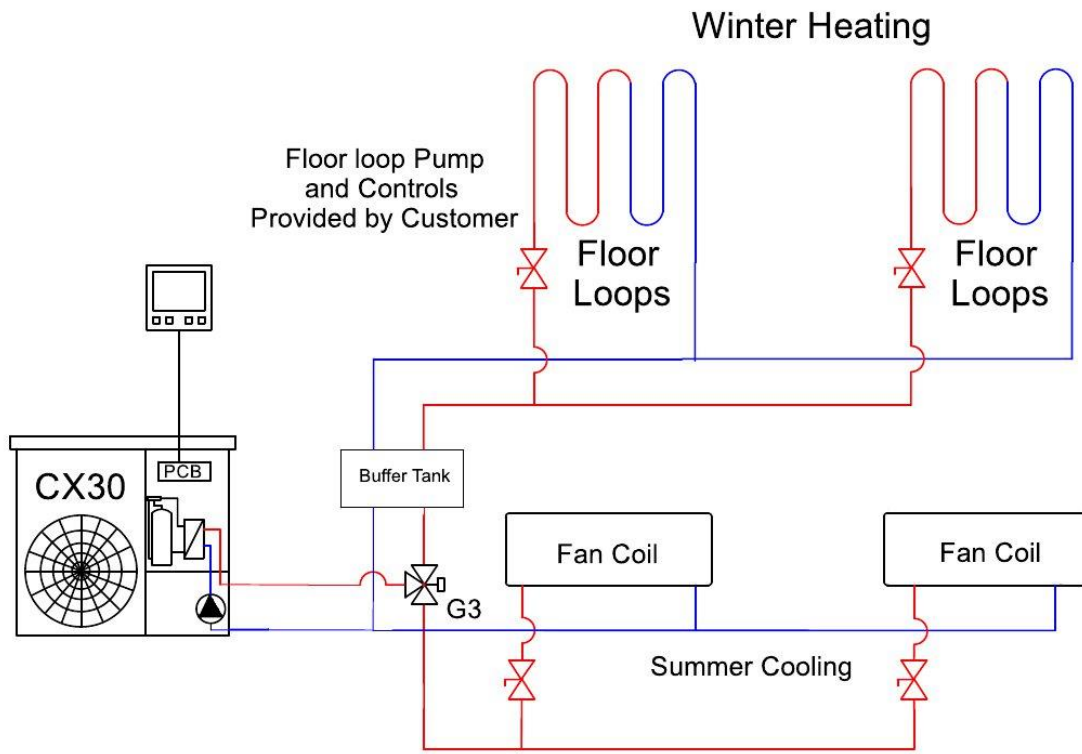
G3 Valve: Seasonal Switch Valve or Solar Preheat Valve



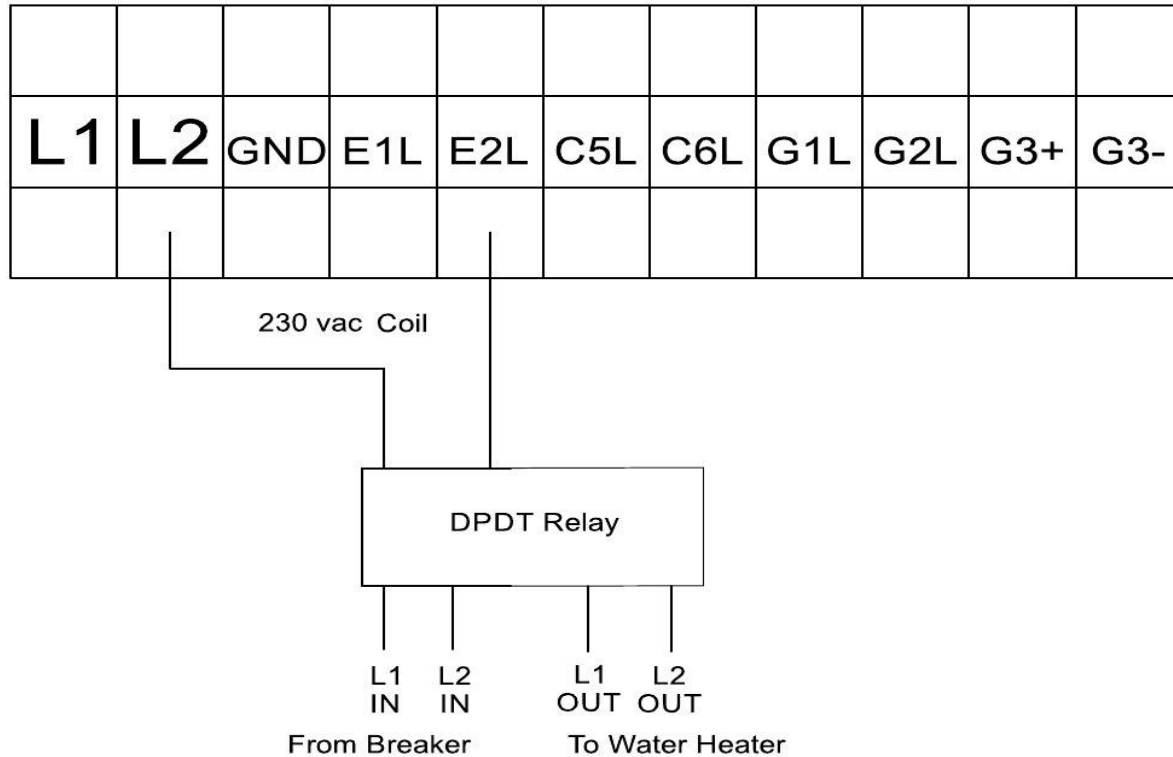
The G3 port can be used to control a seasonal switch valve. The seasonal switch valve is used to isolate the floor coils from the fan coils when switching over from heating to cooling. The seasonal switch valve is controlled by parameter P50. When parameter P50 is 0, the valve is configured as a seasonal Switch.

When parameter P50 is 1, the valve is configured as a solar pre-heat valve. The CX34 compares the solar tank temp and AC returned temp. When the solar tank temp – AC returned temp is $\geq 5\text{ }^{\circ}\text{C}$, the 3-way valve G3 will be on; when solar water tank temperature minus the air conditioning returned temperature is less than $2\text{ }^{\circ}\text{C}$, G3 will be off.

G3 VALVE Seasonal Switch Valve



Second Heat Source or Assistant Electric Heater



Parameter 27, 28 usage If you set parameter P56 to "0", E2 is the assistant electric heater control port, if you set parameter P56 to 1, E2 will be 2nd heat source control port. If the E2 port is the assistant electric heater control port, it is controlled by parameter P57. If air temp < Parameter P57, E2 will be active. But it will not start at once, if the compressor cannot reach target temp within 15 minutes, it will energize the relay coil at L2 & E2. The compressor will work together with E2.

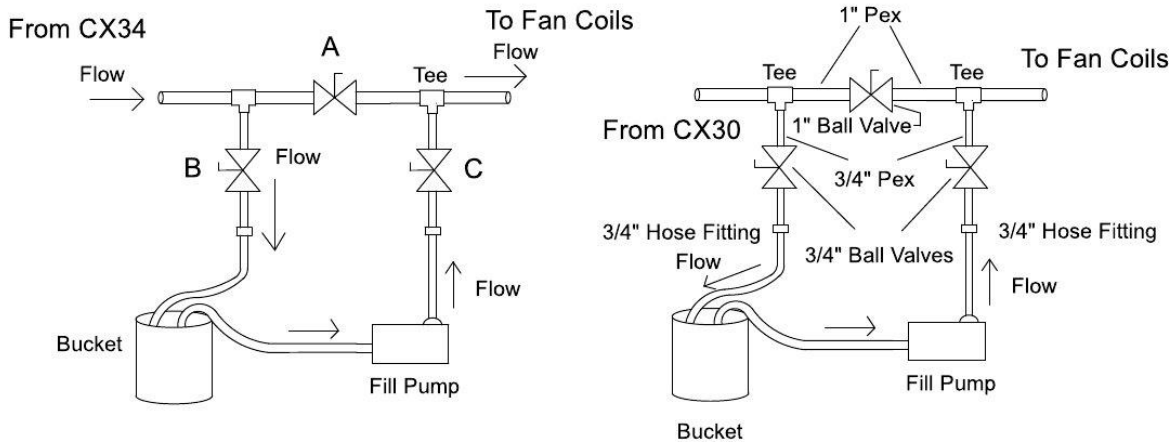
If E2 is 2nd heat source control port, it is controlled by parameter P56. When air temp is lower than parameter P58 (default -15c), E2 will be energized and the compressor will stop. Only the 2nd heat source is working with E2. You can connect the electric boiler on/off signal to E2. E2 only provides an "on/off" signal. You can connect your own controls, its max current is 1 amp. You must add a relay to protect the heat pump PCB, so if there are any problems from the electric boiler, it will not damage the heat pump PCB. If your winter is not too cold (above -15c), you can use E2 as an assistant electric heater. If your winter is too cold, (lower than -18c~-20c), the compressor will work too hard, so you should set E2 as 2nd heat source port to protect the heat pump.

System filling with Propylene Glycol and water

At or near the chiller a flush/fill valve assembly must be installed. This can be made with three ball valves and a couple hose fittings. See example below.

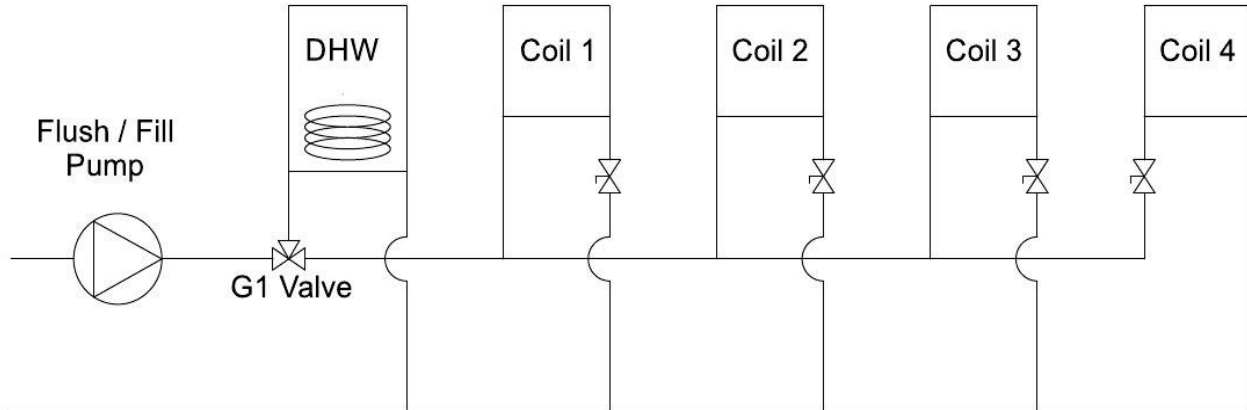
Bill Of Materials

- 2 ea. 1" x 3/4" tee
- 1 ea. 1" Ball Valve
- 2 ea. 3/4" Ball Valve
- 2 ea. 3/4" Hose Fittings
- 10' of Garden Hose
- 5 Gallon Bucket
- High Head Fill Pump



Pre-mix the propylene glycol in a container large enough to hold the loop volume plus a few gallons. Using a filling pump and 3 hoses, place one hose in the glycol container and connect it to the suction side of the pump. Connect the second hose to the pump discharge and the other end to valve "C" that is closest to the fan coils. Using a third hose, connect it to valve "B", closest to the chiller and leave the open end in the glycol bucket. Close the middle ball valve "A". The pump should be pumping away from the CX34 chiller. Run the pump until there are no more air bubbles coming out of the loop. After all air is expelled from the loop, close valve "B" and then open valve "A" with the pump running. When the pressure gage on the CX34 shows at least 30 psi close valve "C" and turn off the pump. Minimum loop pressure is 14.5 psi, maximum pressure is 43.5 psi, and ideal pressure is 30 psi.

Purging Air from the Fan Coils



If a DHW tank is installed, it should be the first device on the loop as shown. To purge the air from its coil, remove the actuator from the valve body and rotate the valve stub 90° clockwise to force the water through the coil. Return the valve stub back to its original position when all of the air is purged. Close the input valve to each fan coil except the first coil (1). Turn the pump on and run it, when the bubbles stop coming out of the discharge hose turn on the ball valve on coil (2), wait for the bubbles to stop, then do the same for coil number (3), then (4). All CX Chillers have a flow switch installed in the loop. Air in the system may cause a flow switch alarm; the controller will display a P5 or P6 error code.

All CXI fan coils have an air purge screw near the water inlet port, always purge the fan coils before starting the chiller.

The CX34 chiller also has a bleeder valve with a ¼" clear tube attached to it located near the brazed plate heat exchanger.

Proper and even flow through each fan coil is critical for both heating and cooling. This can be done with balance valves or ball valves installed at each fan coil supply or return pipe. Set each fan coil to the same temperature and fan speed. Using an accurate digital thermometer adjust each ball valve until the coil return temperatures are even. This must be done in heating mode so proper flow can be verified to protect the heat exchanger from freezing up in cooling mode. If a fan coil is powered on but the fan isn't running, there is a good possibility that there is air trapped in that particular part of the loop.

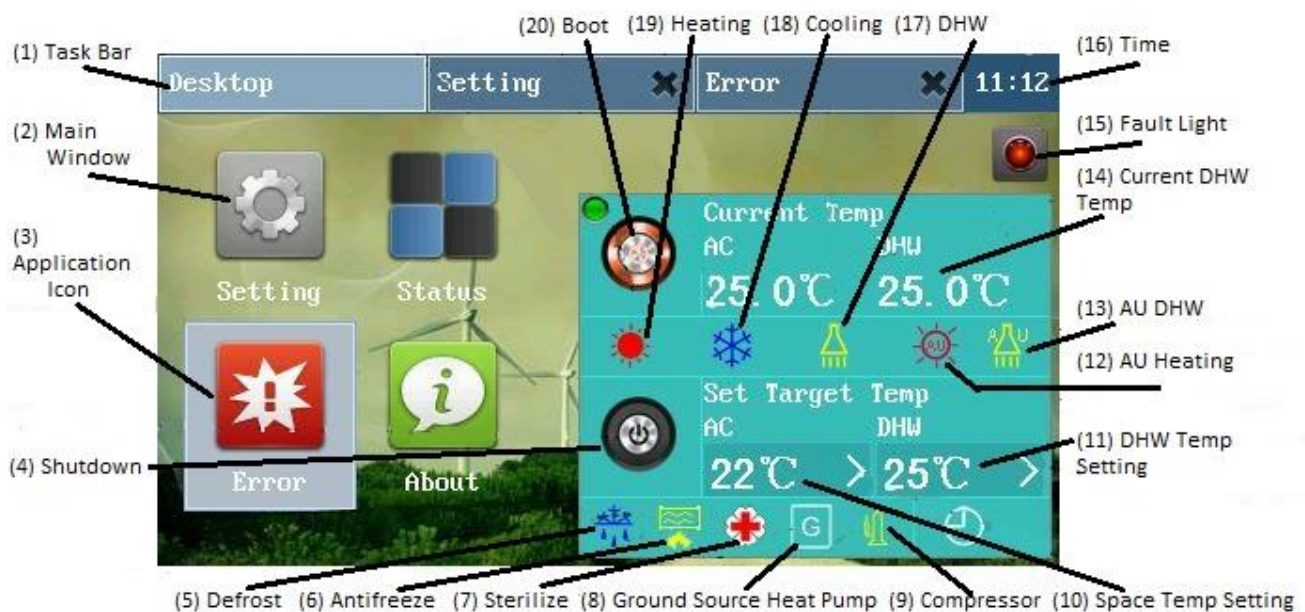
Wired Controller

1. Functions and features

Cooling, Heating, DHW, cooling + DHW, heating + DHW mode of operation options, automatic fault detection, alarm processing, and energy control.

Following characteristics:

1. The controller handles all input and output signals, and system status to ensure that the unit is stable and reliable.
2. Full-touch color LCD display.
3. Modes and other factory parameter settings are entered directly on the LCD screen.
4. 100 fault records can be stored and retrieved to show the details of each fault that may occur.
5. All of the switch input / outputs can be directly observed on the LCD control panel making commissioning convenient.
6. The LCD display is wall-mountable.



- (1) **Taskbar:** shows the current running applications, and the time. Clicking on the different application boxes will switch to different applications.
- (2) **Main window:** Displays the main window of the application that is currently running.
- (3) **Application icon:** A desktop application that first highlights the icon when it is first clicked, and then clicked again to launch the application.

- (4) **Shutdown button:** Used to execute the **shutdown command**, when clicked it will pop up a confirmation window, click "OK" to execute the boot command, or click "Cancel" for no action. The shutdown command is used to take the chiller out of heating or cooling mode.
- (5) **Defrost:** Is illuminated when system is in the Defrost State.
- (6) **Antifreeze:** Is illuminated when system is in the antifreeze mode.
- (7) **Sterilization:** Is illuminated when system is in the sterilization mode.
- (8) **Ground source heat pump:** N/A
- (9) **Compressor:** Illuminated when the compressor is on.



Figure 1-2

- (10) **AC temp setting:** Temperature setting in the air conditioning mode (cooling or heating), touch the "SET TARGET TEMP" icon and the keyboard window will pop up, as shown in Figure 1-2, then, enter the required temperature. Use the ENT" key will confirm the input. Use the "DEL" key to delete the input, and the "ESC" to cancel the input and exit.
- (11) **DHW temperature setting:** Sets the temperature in the (DHW) mode.
- (12) **AU heat:** AU enable is used to see whether it is in the AU heating mode. **Not Used**
- (13) **AU DHW:** When DHW is enabled, it is illuminated when it is in AU DHW mode.
- (14) **Current DHW temperature:** This is used to check the current DHW mode temperature.
- (15) **Fault light:** Illuminated if there is a fault.

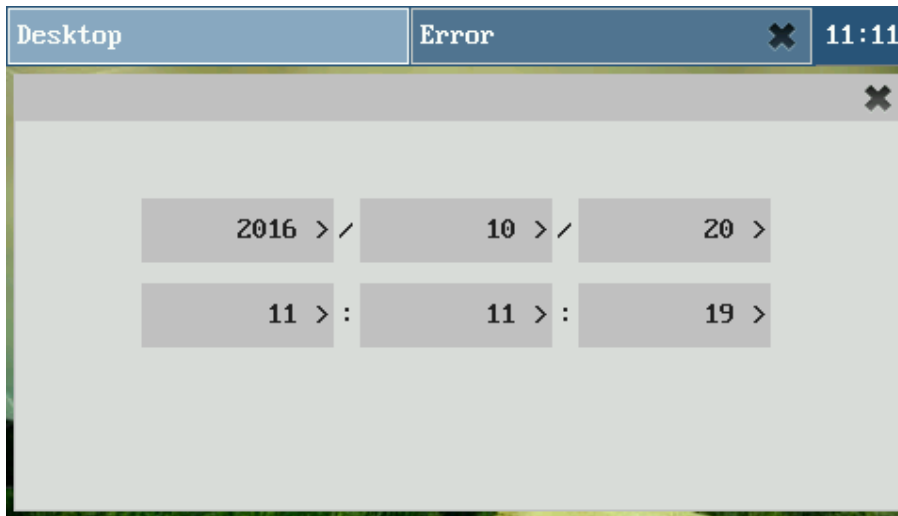


Figure 1-3

- (16) **Time:** Used to display and set the current time. When clicked, a pop-up showing the date and time is displayed, Figure 1-3. From left to right, and from top to bottom is the year, month, day, hour, minute, and second. Clicking on each box will allow you to set its value.
- (17) **DHW:** If the hot water mode is enabled, this icon will be lit.
- (18) **Cooling:** If the cooling mode is on in the user setting, this icon will be lit.
- (19) **Heating:** If the heating model is on in the user setting, this icon will be lit.

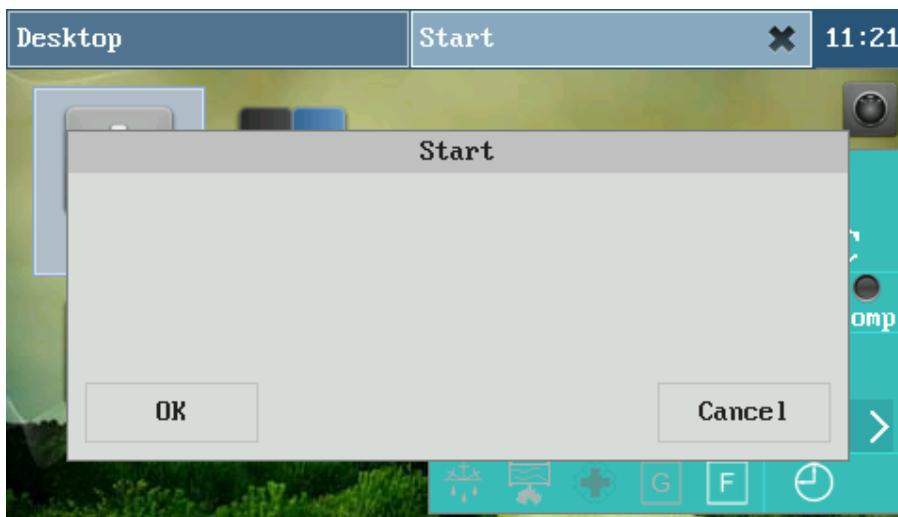


Figure 1-4

- (20) **Boot button:** Used to execute the boot command operating mode.

1.1 SETTING PASSWORDS

The application is used to set the user parameters, and set a password, as shown in Figure 1-5, minimum of 6 characters, maximum of 127.

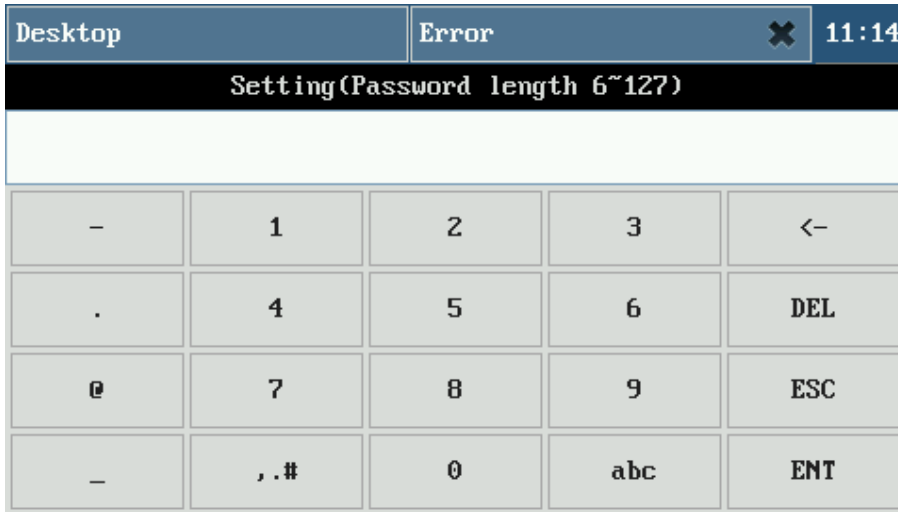


Figure 1-5

Description of the keypad function keys:

- “<-” : Backspace key, used to delete a character.
- “DEL” : Delete key, used to delete all characters.
- “ESC” : Exit key, used to exit the input state.
- “ENT” : ENTER key to confirm an input.
- “abc” : Toggles key for switching to lowercase alphabetic keyboards.
- “ABC” : Toggle key for switching to uppercase alphabetic keyboards.
- “123” : Numeric keypad toggle key for switching to the numeric keyboard.
- “,.#” : Symbol Keyboard toggle key for switching to the symbol keyboard.

Note: The password can be composed of numbers, letters, symbols, etc., the factory default password is empty, and any 6 characters can be used.

Write the password on the back of the controller.

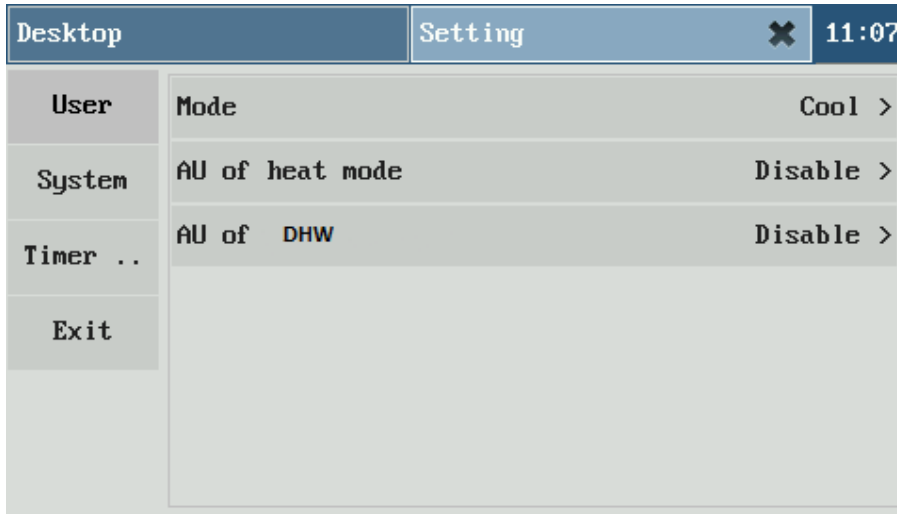


Figure 1-6

After the password is entered correctly, as shown in Figure 1-6, click "Exit" in the main menu or "X" in the task bar to exit the application.

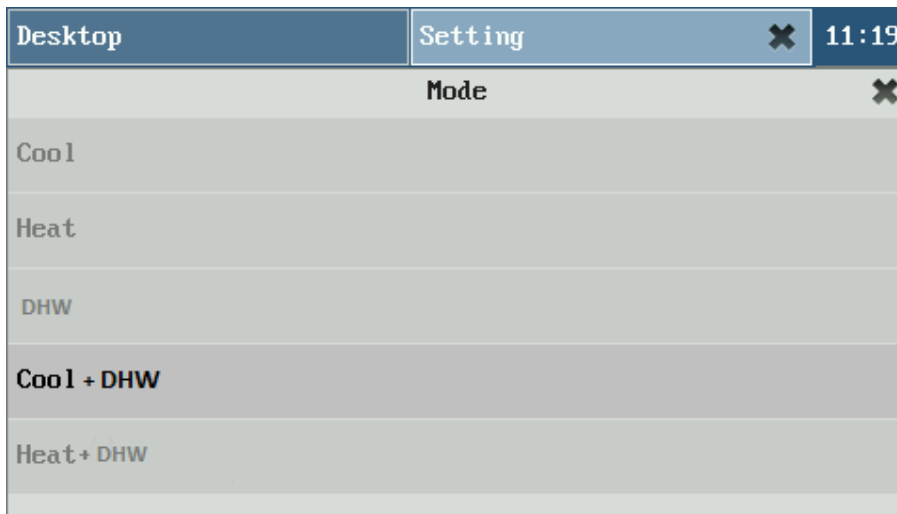


Figure 1-7

1.2 USER PARAMETERS (Figure 1-7)

- Operation mode: Set the units' operation mode.
- Five optional modes: cooling、heating、DHW、cooling + DHW、heating + DHW

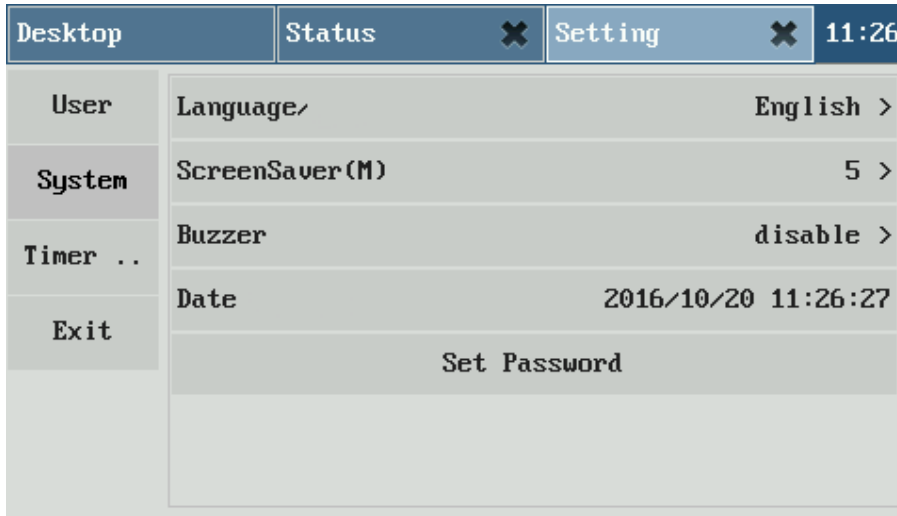


Figure 1-8

1.3 SYSTEM

- Language: Default is English.
- Screensaver: Sets the screen saver pop-up time.
- Buzzer: Disables or uses the buzzer sound when the unit has an alarm.
- Date & Time: you can set the machine date and time.
- Password setting: Set the password to enter this application

1.4 Machine Timing Switch

- Boot Timing (1 ~ 3): 3 segment Boot timing setting.
- Timing shutdown (1~3) : 3 segment "Off" timing setting.

Figure 1-8 shows the setting window of each machine timer switch. After setting the time to turn the machine on and off, click the small circle at the bottom to select the time to execute the switch during the week. Use small circles of blue to select the day, gray means disabled. See next page, Figure 1-9.

Desktop	Statu: ✕	Setti ✕	Manuf: ✕	Error ✕	17:54
User	Timer 1 On				00:00:00
System	Timer 1 Off				00:00:00
Timer On/Off	Timer 2 On				00:00:00
Exit	Timer 2 Off				00:00:00
	Timer 3 On				00:00:00

Figure 1-9

Desktop Setting ✕ 08:46

Timer 1 On ✕

09 > : 00 > : 00 >

SU MO TU WE TH FR SA

Weekly Setting

2 STATUS

The status application is used to check the detailed status of the unit operation, such as compressor speed, fan speed, G1, G2, G3, G4 valves and so on.

2.1 State preview display interface

- Compressor:** Displays the current working status of the compressor.
- Compressor Heating:** Displays compressor heating status.
- Outdoor fan:** show the working status of the outdoor fan.
- Reversing valve, electronic expansion valve, electrical heating, G1 valve and other work status, query can be directly observed through this interface.

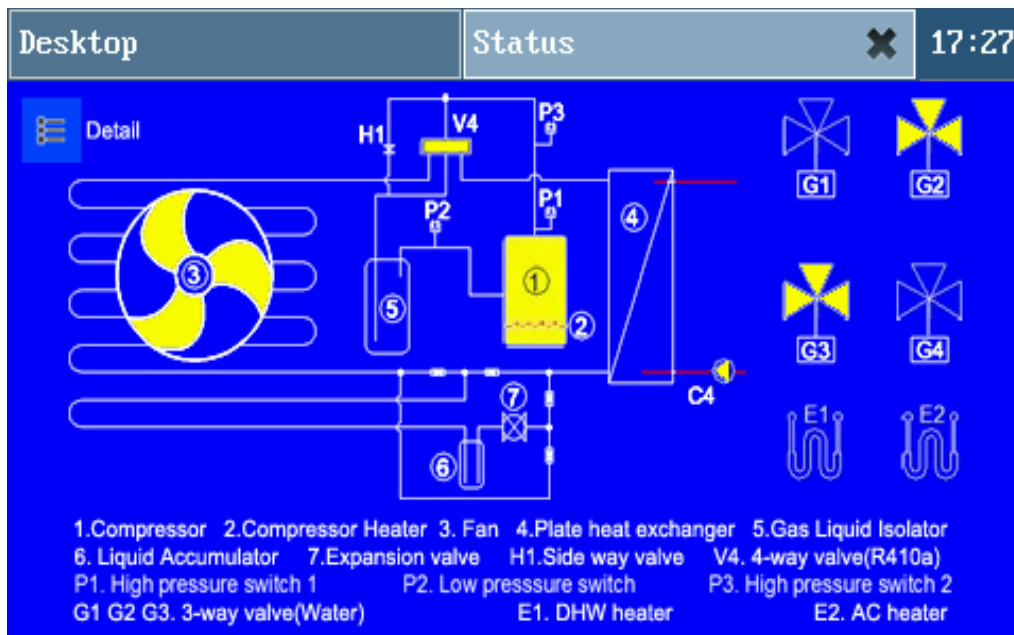


Figure 2-1

2.2 Detailed Status Interface

Click "detail" in the status query interface to enter the detailed status interface of the machine, as shown in Figure 2-1. Click the arrow “->” button to return to the previous state interface. Specific parameters can be found in Table 2-2 below.

Desktop		Status	✕	11:30
item			value	
C08	Water source outlet water temp		25.0°C	
C09	Compressor current value		0.0A	
C10	High pressure value		0.0MPa	
C11	Low pressure value		0.0MPa	
C12	Water Source side water flow volume		0.0L/m	
C13	Usage side water flow volume		0.0L/m	
C14	Functional parameter(P03)	1:Air source	Source	
C15	Functional para..	0:AC heating temp control method 1		

2/8

Figure 2-2

2.3 Manufacturing Setting

Press and hold the lower left side of the main window for more than 3 seconds to enter the factory setting confirmation window as shown in Figure 2-3, press "Confirm" Factory setting, or press "Cancel" to exit.



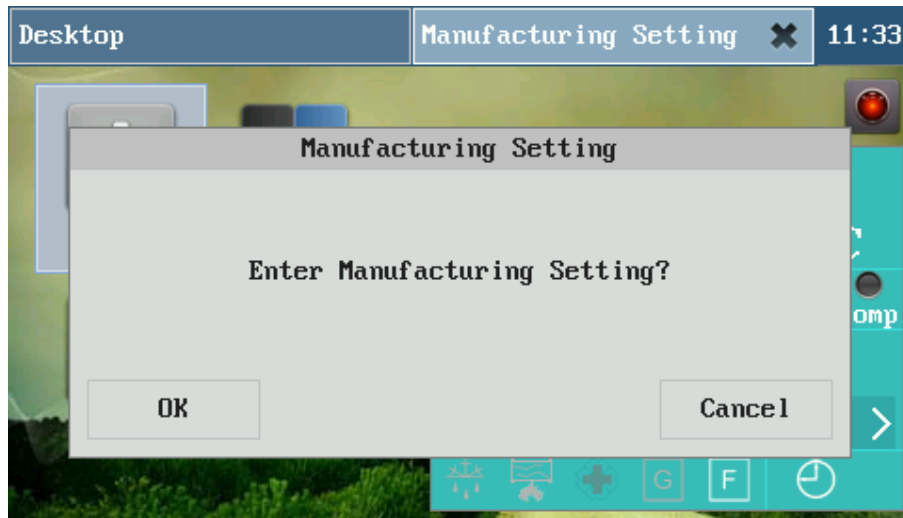


Figure 2-3

Enter the factory settings menus as shown in figure 2-4, the left is the "main menu", on the right are the "settings". For Multi-pages, click on the "main menu" arrow to display the next page.

Main menu includes:

- (1) Basic settings
- (2) Communication settings
- (3) Special functions

2.4 Basic Settings

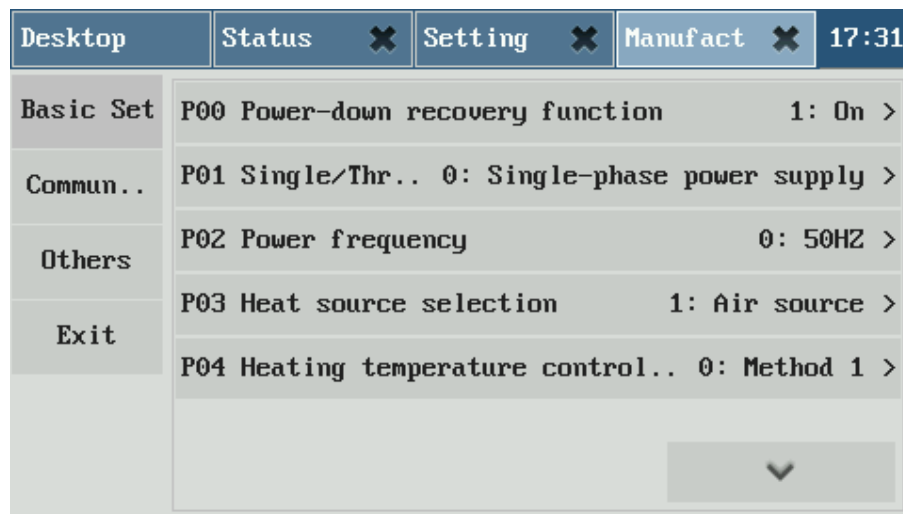


Figure 2-4

2.5 Communication Setting

Communication settings include settings for the protocol and baud rate. The interface is shown in Figure 2-5.

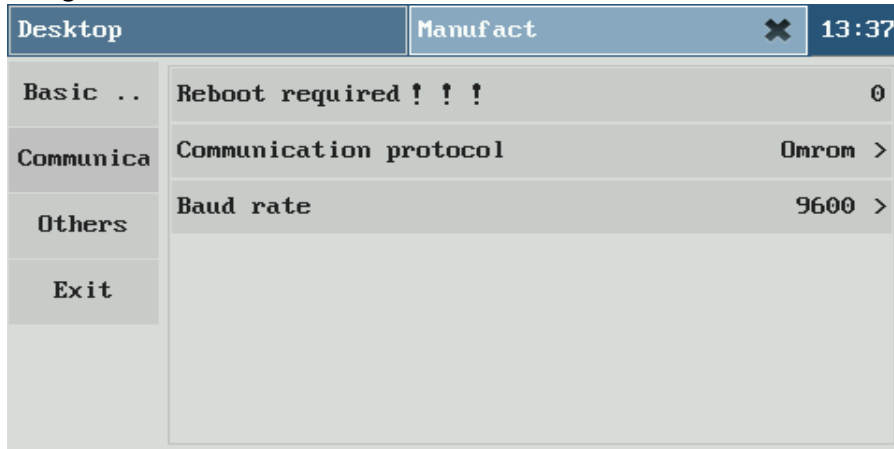


Figure 2-5

2.6 SPECIAL FUNCTIONS

- (1) **Initialize the control panel:** The initialization of the control panel function is used to initialize all parameters in the control panel.
- (2) **Delete the fault history:** Deletes all historical faults.
- (3) **Password setting:** To set the password to enter settings.

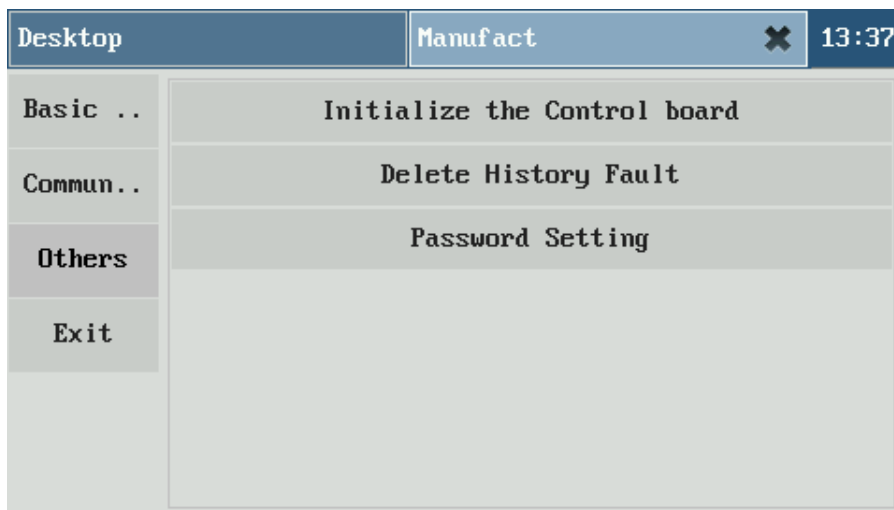
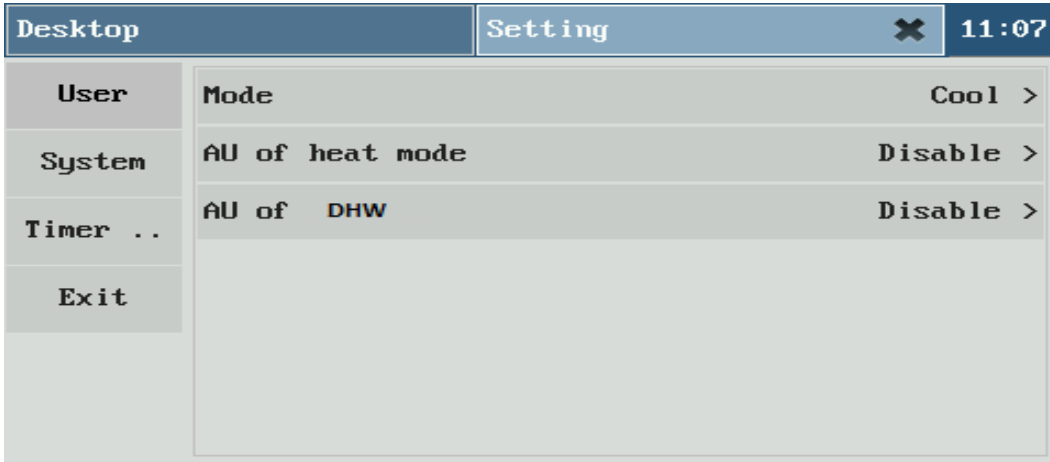


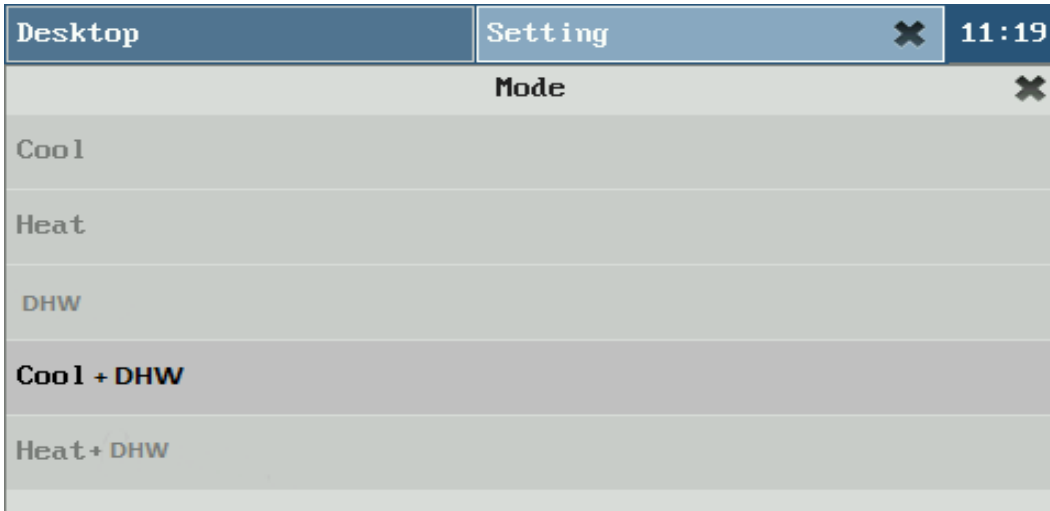
Figure 2-6

Operating the CX34

To select a mode to operate in, from the desktop, touch “settings”. The screen below will appear.



Touch the mode bar and the screen below will appear. Select the mode you want by touching the bar associated with the mode. AU Heat Mode and AU DHW Modes are not used on the CX34.



Next, to set the temperature go back to the desktop and touch the “set target AC” icon.

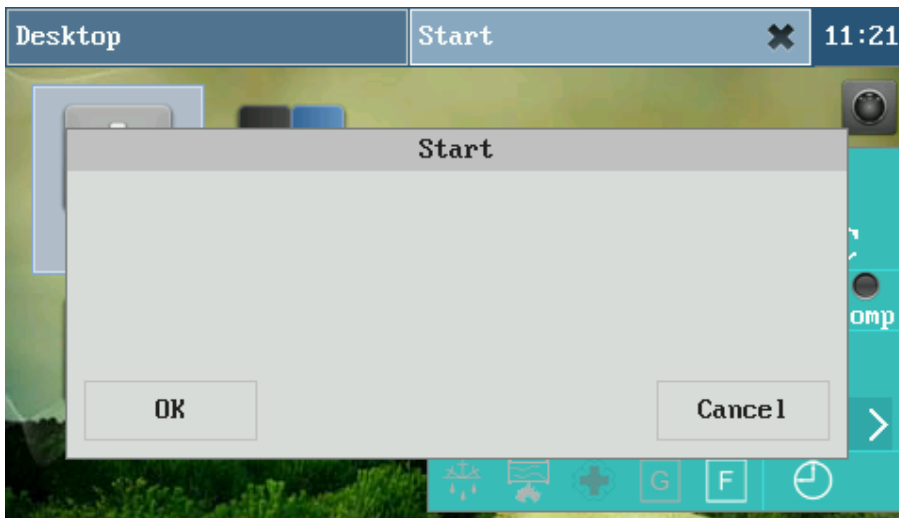




Using the keypad select the desired temperature and touch the “ENT” icon.



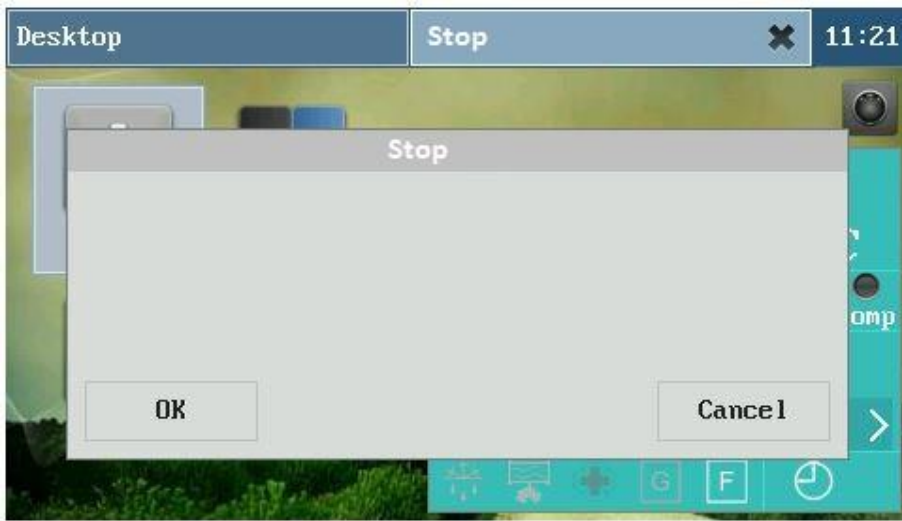
To launch the selected mode hit the Start button then “OK”



Use this same sequence for all of the modes.



To stop a mode touch the “shutdown” icon. Then touch “OK”.



3. Parameter Checking and Setting

The detailed parameters of the manufacturer settings are described in the table below.

NO	Name	scope/means	Range, Meaning	Default
P00	Power-down recovery function	0 : off ; 1 : on	0 : off ; 1 : on	1
P01	Input Power: Single / three phase selection	0 : Single-phase 1 : Three-phase	0 : Single-phase power Three-phase power	0
P02	Power frequency	0 : 50HZ ; 1 : 60HZ	5 : 50HZ ; 6 : 60HZ	5
P03	Heat source selection	0 : ground source ; 1 : air source	0 ; ground source 1 : Air source	1
P04	Heating temperature control method	0 : Method 1 ; 1 : Method 2	0 : Method 1 : 1 : Method 2	0
P05	Defrost method selection	0 : Method 1 ; 1 : Method 2	0 : Method 1 : 1 : Method 2	0
P06	FREECOOLING validation	0 : valid ; 1 : invalid	0 : valid ; 1 : invalid	1
P07	Frequency control method	0 : Method 1 ; 1 : Method 2	0 : Method 1 ; 1 : Method 2	0
P08	DHW validation G1	0 : valid ; 1 : invalid	0 : valid ; 1 : invalid	0
P09	Air conditioning and heating validation	0 : valid ; 1 : invalid	0 : valid ; 1 : invalid	0
P10	Air conditioning and Cooling validation	0 : valid ; 1 : invalid	0 : valid ; 1 : invalid	0
P11	DHW hot water temp hysteresis	2~15°C, minus hysteresis	2~15°C, minus hysteresis	2°C
P12	AC temp hysteresis	2~15°C, minus hysteresis	2~15°C, minus hysteresis	2°C
P13	Ambient temp to start heating of Heating temp control Method 2	-10~15°C (Higher than the set ambient temperature before starting)	-10~15°C (When ambient temp is higher than this temp it can start)	7°C
P14	Indoor target temperature	10~28°C	10~28°C	21°C
P15	buffer tank highest temp	35~55°C	35~55°C	45°C
P16	buffer tank lowest temp	15~30°C	15~30°C	25°C
P17	Water temperature adjustment scope	1~5°C	1~5°C	2°C
P18	water temp adjust interval time	2~300min	2~300min	120min
P19	longest counting period time	6~48H	6~48H	24H
P20	target water temp corrected Value	-2~5°C	-2~5°C	0°C
P21	ambient temp correction factor	0.1~2.0	0.1~2.0	0.75
P22	Counting starting ambient temp	-7~15°C	-7~15°C	7°C
P23	Frequency control method	0 : Method 1 ; 1 : Method 2	0 : Method 1 ; 1 : Method 2	0
P24	Low-frequency ambient temperature	30~10°C (A)	30~10°C (A)	15°C

P25	High-frequency ambient temperature	-20~8°C (B)	-20~8°C (B)	0°C
P26	The lowest operating frequency	10~50% (C)	10~50% (C)	30%
P27	The maximum operating frequency	55~100% (D)	55~100% (D)	100%
P28	Frequency limit pressure	2.00-4.50MPa	2.0-4.5MPa	3.70MPa
P29	Cancel limit frequency pressure	2.00-4.50MPa	2.0-4.5MPa	3.40MPa
P30	fan motor Category	0=AC fan, 1=EC fan1, 2=EC fan 2	0=AC Fan, 1=EC Fan1, 2= EC Fan2	1
P31	Maximum speed of the fan	10-100 (100 show 100%)	1-10 (10=100%)	100
P32	Heating fan speed control temperature difference	2~15°C	2~15°C	6°C
P33	Cooling Fan speed control Temperature difference	5~18°C	5~18°C	12°C
P34	Defrost method	0 : Method 1 ; 1 : Method 2	0 : Method 1 ; 1 : Method 2	0
P35	defrost starting temp	-5~5°C	-5~5°C	-1°C
P36	defrost interval time multiple rate	0 : Not defrost ; 1 ; 2 ; 3 ; 4 : (interval X 4)	0 : Not defrost ; 1 ; 2 ; 3 ; 4 : (interval X 4)	1
P37	The first defrost interval	15~99minu (1st interval after repower on)	15~99minute (1st interval after repower on)	35
P38	defrost exist temp	10~35°C	10~35°C	30°C
P39	Set value of Δ	3~8 (B)	3~8 (B)	5
P40	Ambient temp correction value of Δ	(5~50) /100 (C)	(5~50) /100 (C)	10/100
P41	ambient temp correction multiple rate	1~5 (D)	1~5 (D)	1
P42	water temp correction value of Δ	(5~50) /100 (E)	(5~50) /100 (E)	10/100
P43	water temp correction multiple rate	1~5 (F)	1~5 (F)	1
P44	Minimum allowed Δ	(1~100) /100 (G)	(1~100) /100 (G)	30/100
P45	Allowed defrost coil temperature	-20~0°C (H)	-20~0°C (H)	-6°C
P46	Allowed the defrost time	1~10min (I)	1~10min (I)	3min
P47	hot water frequency limitation	2~10, max frequency 20~100%	2~10= max frequency 20~100%	10
P48	AC heating AU mode highest temp	30~50°C	30~50°C	45°C
P49	AC Heating AU mode offset temperature	-10~10°C	-10~10°C	0°C
P50	solenoid valve function parameters	0=G3 seasonal valve, 1=G3 solar valve	0= G3 is seasonal valve, 1=G3 is solar valve	0

P51	C4 Water pump type selection	0=AC Water pump, 1=EC Water pump	0=AC Water pump, 1=EC Water pump	0
P52	water pump working mode	0=Not stop, 1=stop after reaching target temp) 2=start 1 minute after each stopping of 15 minutes)	0=Not stop, 1=stop after reaching target temp, 2=start 1 minute after each stopping of 15 minutes)	0
P53	EC Water pump C4 Minimum speed	20-80%	20-80%	4
P54	C5 Water pump type selection	0=AC Water pump, 1=EC Water pump	0=AC Water pump, 1=EC Water pump	0
P55	DHW e-heater activated ambient temp	-20~20°C	-20~20°C	0°C
P56	Electric heating function	0=electric heating, 1=the second heat source	0=electric heating, 1=the second heat source	0
P57	AC e-heater activated ambient temp	-20~20°C	-20~20°C	0°C
P58	2nd heat source starting air temp	-30~15°C	-30~15°C	-15°C
P59	AC anti-freezing temperature	-15~5°C	-15~5°C	3°C
P60	Virus killing interval days	7~99day	7~99 day	7
P61	Start virus killing time	1~24hour	1~24 hour	1
P62	Virus killing holding time	5~99minu	5~99 Min	10
P63	Target temperature of virus killing	55~80°C	55~80°C	65°C
P64	AC water flow switch type selection	0=Water flow switch 1=flow meter	0=Normal Water flow switch 1=Water flow meter switch	0
P65	AC minimum water flow	3-80L/m	3-80L/m	20
P66	Water source Water flow switch type selection	0=Water flow switch 1=flow meter	0=Normal Water flow switch 1=Water flow meter switch	0
P67	The lowest water flow of water source	3-80L/m	3-80L/m	20
P68	air source heat pump FREECOOLING function start ambient temp	-16~20°C	-16~20°C	5°C
P69	FREECOOLING function additional Temperature difference to start full free cooling. (compressor stops)	3~15°C	3~15°C	5°C
P70	water source side anti- freeze temp	-20~5°C	-20~5°C	2°C
P71	Cooling Maximum set temperature	15~35°C	15~35°C	25°C
P72	Heating maximum set temperature	25~55°C	25~55°C	50°C
P73	DHW The highest set temperature	25~60°C	25~60°C	50°C
P74	Debugging fixed operating frequency	10~100 HZ	10~100 HZ	50HZ

P75	run setting frequency	0= Manual frequency, 1= Auto frequency	00= Manual frequency, 1= Auto frequency	1
P76	EEV manually open degree (heating)	70~480	70~480	350
P77	EEV manually open degree (cooling)	70~480	70~480	350
P78	EEV control mode	0=No,1=table list,2=manually,3=automatically	0=No,1=table list,2=manually,3=automatically	0
P79	target overheat degree (heating)	-5~10°C	-5~10°C	0°C
P80	target overheat degree (cooling)	-5~10°C	-5~10°C	0°C
P81	night mode validation	0= no start, 1= start	0= no start, 1= start	0
P82	night mode starting point	0-23 (for relative time)	0-23 (for relative time)	22
P83	night mode ending point	0-23 (for relative time)	0-23 (for relative time)	6
P84	High-pressure protection settings	2.50~5.00MPa	2.5~5.0MPa	4.5
P85	Low-pressure protection settings	0.01~1.00MPa	0.01~1.0MPa	0.2
P86	High-pressure protection stop hysteresis	0.20~1.50MPa	0.20~1.50MPa	0.5
P87	Low-pressure protection stop hysteresis	0.01~1.00MPa	0.01~1.00MPa	0.2
P88	Model selection	0~255	0~255	0
P89	Electronic expansion valve manual opening	70~480	70~480	350
P90	Electronic expansion valve control mode	0=No, 1=table list, 2=manually 3=automatically	0=No, 1=table list, 2=manually 3=automatically	0
P91	Condensation temperature correction value	-5~10°C	-5~10°C	5°C
P92	Whether to use high and low pressure transmitter	-5~10°C	-5~10°C	5°C
P93	Target air temperature coefficient	0.75~1.15	0.75~1.15	0.95
P94	Whether to use high and low pressure transmitter	0=Disabled 1= Enable	0= N/A 1= Enable	0
P95	C4 Control the temperature difference (°C)	2~8	2~8	5

4. Parameter Checking Only

No	Name	Scope/means	Range, Meaning
C00	out pipe temp	-30~97°C	-30~97°C
C01	compressor discharge temp	-30~128°C	-30~128°C
C02	ambient temp	-30~97°C	-30~97°C
C03	Suction temperature	-30~97°C	-30~97°C
C04	Plate heat exchanger inlet temperature	-30~97°C	-30~97°C
C05	AC outlet water temp	-30~97°C	-30~97°C
C06	Solar temperature	-30~97°C	-30~97°C
C07	water source inlet water temp	-30~97°C	-30~97°C
C08	Water source outlet water temp	-30~97°C	-30~97°C
C09	Compressor current value	0.0~30.0A	0.00~30.00A
C10	High pressure value	0.00~5.50MPa	0.00~5.50MPa
C11	Low pressure value	0.00~5.50MPa	0.00~5.50MPa
C12	Water Source side water flow volume	0~100L/m	0~100L/m
C13	Usage side water flow volume	0~100L/m	0~100L/m
C14	P03 Status	0=Air source, 1= Ground source	0=Air source, 1=Ground source
C15	P04 Status	0=Heating temperature control mode one, 1= Heating temperature control mode two	AC heating temp control method
C16	P05 Status	0=Defrost mode one, 1= Defrost mode two	Defrost method
C17	P06 Status	0= Free cooling valid, 1= Free cooling invalid	Free cooling=0 valid, 1=invalid
C18	P07 Status	0=Frequency mode one, 1= Frequency mode two	Frequency method
C19	P08 Status	0= DHW valid, 1= DHW invalid	0=DHW valid, 1= DHW invalid
C20	P09 Status	0=Heating valid, 1= Heating invalid	AC heating valid= 0 valid 1= invalid
C21	P10 Status	0=cooling valid, 1=cooling invalid	0=cooling valid, 1=cooling invalid
C22	high pressure switch status	1= on, 0= off	1= on, 0= off

C23	low pressure switch status	1=on, 0= off	1=on, 0= off
C24	second high pressure switch status	1=on, 0= off	1=on, 0= off
C25	inner water flow switch	1=on, 0= off	1=on, 0= off
C26	external water flow switch	1=on, 0= off	1=on, 0= off
C27	Compressor Frequency	Displays the actual operating frequency	Show actual frequency
C28	Thermal switch status	1=on, 0= off	1=on, 0= off
C29	outdoor fan motor	1= run, 0= stop	1=on, 0= off
C30	electrical valve 1	1= run, 0= stop	1= run, 0= stop
C31	electrical valve 2	1= run, 0= stop	1= run, 0= stop
C32	electrical valve 3	1= run, 0= stop	1= run, 0= stop
C33	electrical valve 4	1= run, 0= stop	1= run, 0= stop
C34	C4water pump	1= run, 0= stop	1= run, 0= stop
C35	C5water pump	1= run, 0= stop	1= run, 0= stop
C36	C6water pump	1= run, 0= stop	1= run, 0= stop
C37	The accumulative days after last virus killing	0-99 (From the last complete sterilization to the present, cumulative number of days)	0-99 (from the last complete sterilization to the present, cumulative number of days)
C38	outdoor modular temp	-30~97°C	-30~97°C
C39	Expansion valve 1 opening degree	0~500	0~500
C40	Expansion valve 2 opening degree	0~500	0~500
C41	inner pipe temp display	-30~97°C	-30~97°C
C42	Heating Method 2 target temperature	-30~97°C	-30~97°C
C43	Indoor temperature control switch	1=on, 0= off	1=on, 0= off
C44	fan type	0= AC fan, 1= EC fan 1, 2= EC fan 2	0= AC fan, 1= EC fan 1, 2= EC fan 2
C45	EC fan motor 1 speed	0~3000	0~3000
C46	EC fan motor 2 speed	0~3000	0~3000
C47	water pump types	0= AC Water pump 1= EC Water pump	0= AC Water pump 1= EC Water pump
C48	water pump1 speed	1~10 (10 Show 100%)	1~10 (10 means 100%)
C49	water pump2 speed	1~10 (10 Show 100%)	1~10 (10 means 100%)

C50	Inductor AC Current value	0~50A	0~50A
C51	Driver working status value	Hexadecimal value	Hexadecimal values
C52	Compressor shut down Code	Hexadecimal value	Hexadecimal values
C53	Driver allowed highest frequency	30-120Hz	30-120Hz
C54	Reduce frequency temperature setting	55~200°C	55~200°C
C55	input AC Voltage value	0~550V	0~550V
C56	input AC current value	0~50A (IPM test)	0~50A (IPM Check)
C57	Compressor phase current value	0~50A (IPM test)	0~50A (IPM Check)
C58	Bus line voltage	0~750V	0~750V
C59	Fan shutdown Code	Hexadecimal value	Hexadecimal values
C60	IPM temp	55~200°C	55~200°C
C61	Compressor total running time	0~65000	0~65000 hour

5 INITIAL TEMPERATURE SETTINGS

***Note – Cooling set points refer to the CX34 outlet temperature, however, the system is managed by a ΔT controller. Default setting for cooling should be 7°C, therefore the controller returned temp would be set to 12°C. This will create a 44°F leaving water temperature which is the correct setting. The same logic applies to the heating setting. The default setting for heating should be 35°C, therefore the returned temp would be set to 30°C, this will create a 95°F leaving water temperature which is the correct setting for floor heating and when using floor heat and CCUs together. For FCU-only operation increase the temperature 2-3C as desired.**

Detailed settings as follows:

NO.	Meaning	Selected temperature range	Recommended controller temperature setting
1	Cooling returned water temp	10°C ~ 25°C	12°C
2	Heating returned water temp	10°C ~ 55°C	30-35°C
3	DHW temp	10°C ~ 50°C	50°C

7 FAULTS

Fault application is used to query the current or historical fault, after entering the fault application, click on the main window of the "current fault" or "historical failure" can be switched to the corresponding interface.

7.1 CURRENT FAULT

To enter the current fault display as shown in Figure 7-1, the left side shows the fault item, the format is "fault number". On the right side of the three buttons are "on a page", "next" page, "reset", click the reset button to reset the current fault.

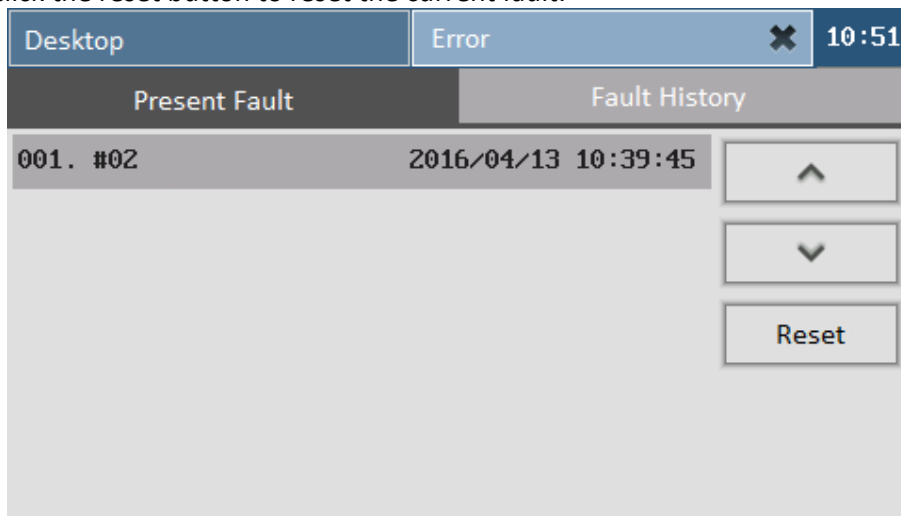


Figure 7-2

7.3 FAULT HISTORY

Enter the history fault display as shown in Figure 7-3, the left side is the fault item, the right side is the previous page, the next page and the query time of the history fault, the query time can be set by clicking the year / month / day.

Desktop	Statu: ✕	Settin ✕	Manuf: ✕	Error ✕	17:52
Present Fault		History Fault			
P9 Communication error	2016/10/18 17:11:19				▲
P9 Communication error	2016/10/18 16:52:01				
P9 Communication error	2016/10/18 16:15:34				▼
P9 Communication error	2016/10/18 16:08:37	Year	2016	>	
P9 Communication error	2016/10/18 16:07:48	Month	10	>	
				Day	18 >
1/1					

Figure 7-3

7.4 ABOUT

The interface displays the touch screen and PLC version information, as shown in Figure 7-4.

Desktop	About ✕	11:17
Main FW version: H8200-U107-10-LIB106		
Configure version: S10-U0.016		
PLC version: P228		

Figure 7-4

8 Error Codes

Fault Meaning	Name
Compressor discharge high temp protection	E1
Outdoor air temp sensor error	E2
Outer coil pipe temp sensor error	E3
Pipe returned gas sensor error	E4
indoor refrigerant pipe temp sensor error	E5
Coil high temp protection	E6
solar water temp sensor error	E7
AC inlet water temp sensor error	E8
AC outlet water temp sensor error	E9
DHW temp sensor error	E10
Indoor ambient sensor error	E11
water source inlet water temp sensor error	E12
water source outlet temp sensor	E13
system anti- freeze twice	E14
DHW anti- freeze twice	E15
discharge Probe error	E16
high pressure protection	P1
low pressure protection	P2
compressor overheat protection	P3
over current protection	P4
indoor unit water flow error	P5
outdoor water flow error	P6
miss phase	P7
wrong phase	P8
communication error	P9
water source anti- freeze	P10
Low water source water flow	P11
voltage protection	F1
IPM Fault	F2
Compressor Drive Fault	F3
Compressor over current protection 1	F4

Compressor over current protection 2	F5
IPM Overheat	F6
PFC Fault	F7
DC bus overvoltage	F8
DC bus under voltage	F9
AC input over or under voltage	F10
AC input overcurrent	F11
Temperature sensor Fault	F12
DSP and motherboard communication Fault	F13
Control board and inverter communication fault	
Control panel parameters are not initialized	
EEV inlet temp sensor fault	<i>ERR3.15</i>
EEV outlet temp sensor fault	<i>ERR4.0</i>

9 Commissioning “In Heating Mode Only”

Preparation

After finishing the installation tasks, please check the items below:

1. Check the Wired Controller settings for the standard features.
2. Check that the power cable is securely connected and the screws are tight.
3. Is the display lit on the wired controller after the power is applied?
4. Verify that all the shut off valves and manual valves are open. Insulate all water supply and return pipes. Test only in **heating mode** to verify proper water flow.

Water or Glycol Filling (See page 28) A 10% minimum glycol mixture is required to protect the unit from freezing. Refer to the chart on page 10.

1. With a hose and filling pump connected to the CX34 water system, and all air exhaust valves open in the water system, fill the water loop with water and glycol mixture. Keep the air exhaust valves open until there is a continuous flow of water and glycol mixture coming out of the air exhaust valve. Then close the air exhaust valves. See page 30 and 31 for more details.
2. Discharge the air from both domestic hot water system and air conditioning water system. CXI fan coils have a bleeder valve located near the inlet and outlet ports. The CX34 has a bleeder tube attached to the Brazed plate heat exchanger.

To avoid freezing the heat pump when the air temperature drops below 32F in winter, you must use an appropriate glycol and water mixture just in case the electricity is cut off. We recommend biodegradable non-toxic SPP Corn Glycol, any Propylene Glycol (PG) can be used.

Running a Test- Call tech support if this is your first time commissioning a CX34.

Apply power to the CX34 and select **heating mode** using the wired controller. Return and leaving water temperature should be within 6-7 degrees. If more than 6-7 degrees there is not enough flow in the system and you will get P5 and P1 errors. Call tech support if any error codes are displayed on the wired controller.

Chiltrix Tech Support hours of operation, M-F, 9 am-6 pm EST, 757-410-8640 x119

MOST IMPORTANT!

1. Always maintain an electrical connection with heat pump to enable the antifreeze function.
2. Initial test should be done in **heating mode**. Make sure it is not in cooling mode during first operation or running a test until you make sure the air conditioning circulation pump is working properly and water is flowing smoothly.

SPEC SHEET

Nest Learning Thermostat

Programs itself.
Then pays for itself.



Meet the Nest Learning Thermostat.

The third gen Nest Learning Thermostat is more beautiful than ever, with a thinner, sleeker design and bigger, crisper display. And it's proven to help save energy. In independent studies, the Nest Thermostat saved an average of 10-12% on heating bills and 15% on cooling bills.

How does it work?



Auto-Schedule
No more confusing programming. It learns the temperatures you like and programs itself.



Remote control
Connect the Nest Thermostat to Wi-Fi to change the temperature from your phone, tablet or laptop.



Nest Leaf
You'll see the Leaf when you choose a temperature that saves energy. It guides you in the right direction.



Early-on
Nest learns how your home warms up and keeps an eye on the weather to get you the temperature you want when you want it.



Auto-Away
The Nest Thermostat automatically turns itself down when you're away to avoid heating or cooling an empty home.



Energy History
See when heating and cooling were on and what affected your energy use.



Safety Alerts
Get an alert on your phone or tablet if your home gets dangerously hot or cold.



Farsight
When Nest Thermostat spots you across the room, it lights up beautifully to show you the temperature you've set or the time.



3400 Hillview Ave
Palo Alto, CA 94304

1-855-VIP-NEST
nest.com

PRINTING STATIONS

PROCESS COLORS:



CMYK
(4-COLOR PROCESS)

FONTS USED:

Akkurat Pro Bold
Akkurat Pro
Helvetica 57 Condensed
Helvetica 77 Bold
Condensed

D3		US - Spec Sheet	nest
FILE NAME: 10529_POS_D3_SpecSheet_ENUS_v9.ai		PART NUMBER:	
EXECUTIVE:	DATE APPROVED:	NOTES: Trim: 8.5 in (w) x 11 in (h) Substrate: 80 lbs McCoy Silk	
LEGAL:	DATE APPROVED:		
ART DIRECTOR: AK, JK	DATE APPROVED:		
PRODUCTION ARTIST: MV, ET	DATE APPROVED:		
PRODUCT MANAGER: TODD	DATE APPROVED:		
COPYWRITER: EP, DM, AS	DATE APPROVED:		



FEATURES

- Auto-Schedule
- Auto-Away
- Energy History
- Home Report
- Nest Leaf
- Nest app
- Farsight
- Airwave
- System Match: Early-On, Heat Pump Balance, True Radiant
- Time-to-Temperature
- Weather-aware
- Advanced Fan Control
- Sunblock
- Cool to Dry
- Thermostat Lock
- Software updates over Wi-Fi
- Safety Temperature Notification
- Furnace Heads-up
- Filter Alert
- System Test
- Stainless steel ring

SPECS

- Display**
 - 24-bit color LCD
 - 480 x 480 resolution at 229 pixels per inch (PPI)
 - 2.08 in (5.3 cm) diameter
- Sensors**
 - Temperature
 - Humidity
 - Near-field activity
 - Far-field activity
 - Ambient light
- Size and Weight**
 - Display
 - Mass: 7.25 oz (205.4 g)
 - Diameter: 3.3 in (8.4 cm)
 - Height: 1.06 in (2.69 cm)
 - Base
 - Mass: 1.35 oz (38.3 g)
 - Diameter: 3 in (7.6 cm)
 - Height: 0.42 in (1.1 cm)
- Assembled**
 - Mass: 8.6 oz (243.7 g)
 - Diameter: 3.3 in (8.4 cm)
 - Height: 1.21 in (3.08 cm)
- Connectivity requirements**
 - Wi-Fi connection with Internet access
 - Phone or tablet with iOS 8 or later, or Android 4 or later
 - Free Nest Account
- Languages**
 - English
 - French
 - Spanish
 - Dutch
- Wireless**
 - Working Wi-Fi connection: 802.11b/g/n @ 2.4GHz
 - Wireless Interconnect: 802.15.4 @ 2.4GHz
 - Bluetooth Low Energy (BLE)
- Battery**
 - Built-in rechargeable lithium-ion battery
- Power consumption**
 - Less than 1 kWh/month
- Warranty**
 - 2-year limited warranty. For support, visit nest.com/support. Our support team is also available by phone 24/7.

IN THE BOX

- Display
- Base
- Optional trim kit
- Mounting screws and labels
- Nest screwdriver
- Installation Guide
- Welcome Guide
- Nest Pro installation card

COMPATIBILITY

- The Nest Learning Thermostat works with 95% of 24V heating and cooling systems, including gas, electric, forced air, heat pump, radiant, oil, hot water, solar and geothermal.
- Heating: 1, 2, and 3 stages (W1, W2, W3)
- Cooling: 1 and 2 stages (Y1, Y2)
- Heat pump: with auxiliary and emergency heat (O/B, AUX, E)
- Humidifier or dehumidifier (HUM, DEHUM)
- Fan (G)
- Power (C, RH, RC)



3400 Hillview Ave
Palo Alto, CA 94304

1-855-VIP-NEST
nest.com

nr10529v10

D 40 FIRE PROTECTION

D 4010 FIRE PROTECTION SYSTEM

A. SYSTEM DESCRIPTION

1. Wet Pipe domestic sprinkler system.

B. FUNCTIONAL REQUIREMENTS

1. In the case of a fire, sprinklers shall operate quickly to reduce heat, flames, and smoke. All products are manufactured and installed in compliance with applicable codes.

C. COMPONENTS

1. Legend I Residential Pump
 - a. Supply sprinkler system with sufficient water at required pressure. Product data sheet CSI 23 30 00.
2. Tyco Blazemaster CPVC Pipe
 - a. For sprinkler water supply. Product data sheet CSI 21 13 13.
3. Rapid Response LFII Residential Sprinklers
 - a. Concealed pendent fire sprinklers. Product data sheet CSI 21 13 13.

D 4030 FIRE PROTECTION SPECIALTIES

A. SYSTEM DESCRIPTION

1. Interconnected smoke detector system to alert of smoke and possible fires.
2. Fire extinguisher

B. FUNCTIONAL REQUIRMENTS

1. Alert of high levels of carbon monoxide, presence of smoke, and possible fires. Products are manufactured and installed in compliance with applicable codes and manufacturer's manual.
2. Equip the home with means to extinguish small fires. Product is manufactured and installed in compliance with applicable codes and manufacturer's manual.

C. COMPONENTS

1. Nest Protect CO + Smoke Alarm
 - a. Interconnected system of wired 120V detectors with backup batteries. Product data sheet CSI 28 46 10.
2. Kidde Consumer Fire Extinguisher PRO
 - a. Rated 2-A:10-B:C for low hazard occupancies. Product data sheet CSI 10 44 16.



DETAIL

KEY FEATURES

SPECIFICATIONS

DOCUMENTS

Description

Suitable for use on Class A (trash, wood & paper), Class B (liquids & gases) and Class C fires (energized electrical equipment). The PRO 210 is fitted with a pressure gauge that provides at-a-glance status, is manufactured from lightweight aluminum cylinder with a tough aluminum valve assembly.

Features bilingual nameplate and carton.

FOR LOW HAZARDS

A 2-A:10-B:C rated extinguisher is required for protecting LOW hazard occupancies such as: living areas of the home, offices, churches, assembly halls classrooms & hotel guest areas.

Part Number(Ordering Number):21005779



DETAIL

KEY FEATURES

SPECIFICATIONS

DOCUMENTS

Description

Suitable for use on Class A (trash, wood & paper), Class B (liquids & gases) and Class C fires (energized electrical equipment). The PRO 210 is fitted with a pressure gauge that provides at-a-glance status, is manufactured from lightweight aluminum cylinder with a tough aluminum valve assembly.

Features bilingual nameplate and carton.

FOR LOW HAZARDS

A 2-A:10-B:C rated extinguisher is required for protecting LOW hazard occupancies such as: living areas of the home, offices, churches, assembly halls classrooms & hotel guest areas.

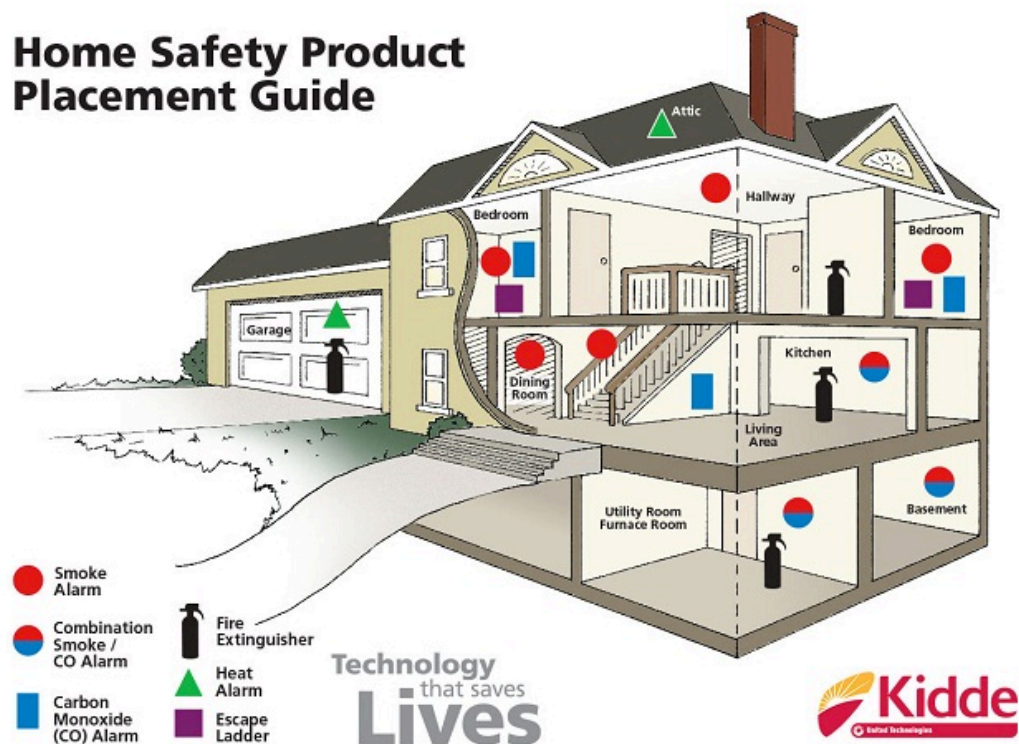
Part Number(Ordering Number):21005779

Product Overview

Protect low-hazard locations from fire with the Kidde Pro 210 2-A:10-B:C Fire Extinguisher. This fire extinguisher features a pressure gauge for quick status checking and is made of corrosion-resistant powder-coated aluminum. Recharge this fire extinguisher after discharging for a reusable fire safety device.

- Kidde pro is rated for use on household fire types with a discharge time of 13-15 seconds, and discharge range of 10-15 feet and this unit has operating pressure of 100 PSI with net agent weight of 4 lb.
- Pressure gauge allows you to check that the extinguisher is in proper working order
- Rechargeable for long life
- Powder-coated aluminum cylinder with heavy-duty chrome-plated brass valve provides corrosion resistance

Home Safety Product Placement Guide



BlazeMaster®

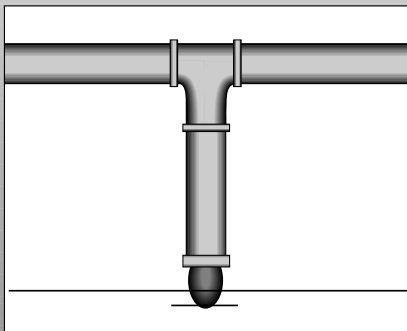
INSTALLATION INSTRUCTIONS & TECHNICAL MANUAL

TYCO FIRE PRODUCTS

451 North Cannon Avenue
Lansdale, Pennsylvania 19446
www.tyco-fire.com

TECHNICAL SERVICES

TEL: (800) 381-9312 · FAX: (800) 791-5500
E-MAIL: techserv@tycofp.com



No. 19-1.0
TD910
4-1.1.10
Rev. 8 8/2001

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This Installation and Technical Manual refers to pipe produced with either Tyco Fire Products (TFP) BlazeMaster® or BlazeMaster 2000 resin and fittings produced from BlazeMaster resin. When reference to NFPA or NFPA Standards is made in this Installation and Technical Manual, the 1999 edition of the relevant code is used. This Installation and Technical Manual contains the criteria to install a TFP BlazeMaster CPVC piping system in accordance with the UL Listing, C-UL Listing, LPCB Approval, and/or Factory Mutual Research Approval. Additionally, the manual contains recommendations for installation, general piping practices and other suggestions that may not be required to satisfy the UL Listing, C-UL Listing, LPCB Approval, and/or Factory Mutual Research Approval. To differentiate between a requirement and a suggestion, use the following definitions:

SHALL – The use of the word “shall” indicates a mandatory requirement of the Listings/Approvals.

SHOULD – The use of the word “should” indicates a recommendation which is strongly advised, but not required to meet the Listings/Approvals.

Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer’s representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCT’S LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Look for the UL, C-UL, Factory Mutual Research, MEA, NSF-pw, LPCB, Dade County, and the City of Los Angeles marks on the product.

BlazeMaster® and BlazeMaster® 2000™ are registered trademarks of the BFGoodrich Company. All TFP BlazeMaster CPVC Products are manufactured in the USA.



Introduction

Tyco Fire Products (TFP) Company using BFGoodrich resin has created a line of BlazeMaster[®] CPVC (Post Chlorinated Polyvinyl Chloride) sprinkler pipe and fittings. TFP BlazeMaster[®] products are designed specifically for fire sprinkler systems and provide the following advantages over traditional sprinkler piping systems:

- Increased hydraulic capabilities (C-Factor = 150)
- No precutting and expensive fabrication required
- NSF-pw approved for potable water
- Can be easily connected to other sprinkler piping systems
- Flexibility in the piping for greater ease of installation
- Resistant to rust, scale and foreign contaminant build up
- Inexpensive tools required for installation
- Greater resistance to seismic activity than copper or steel systems
- Easily repaired or modified on site
- Easily transported and handled at installation
- Resists sweating and condensation

Conversion Factors

- Appropriate conversion factors for values shown in this guide are as follows:

1 inch = 25.4 mm
1 foot = 0.3048 meters
1 psi = 6.895 kPa
1 psi = 0.0689 bar
1 psi = 6894.757 Pa
1000 Pa = 1 kPa

Listings and Approvals

TFP BlazeMaster[®] CPVC piping systems have been evaluated and are UL Listed in accordance with U.S. requirements and C-UL Listed in accordance with Canadian requirements by Underwriters Laboratories Inc. and are Factory Mutual Research approved for use in:

- Light Hazard occupancies as defined in the Standard for "Installation of Sprinkler Systems", NFPA 13.
- Residential occupancies as defined in the Standard for "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height", NFPA 13R.
- Residential occupancies as defined in the Standard for "Installation of Sprinkler Systems in One and Two Family Dwellings and Manufactured Homes", NFPA 13D.
- Underground fire service systems as described in the "Installation of Sprinkler Systems," NFPA 13, 1999 Edition, and where appropriate the "Standard for Installation of Private Fire Service Mains & Their Appurtenances," NFPA 24.
- TFP BlazeMaster[®] products have also been evaluated and are UL Listed in accordance with U.S. requirements by Underwriters Laboratories, Inc. for use in return air plenums as described in the "Standard for Installation of Air Conditioning and Ventilating Systems", NFPA 90A. TFP BlazeMaster[®] products are not C-UL Listed for use in return air plenums.

TFP BlazeMaster[®] CPVC sprinkler pipe and fittings are Listed by ME&A in Residential buildings as defined by NFPA 13D and 13R. The ME&A listing number is 434-88-M.

TFP BlazeMaster[®] CPVC sprinkler pipe and fittings are tested by NSF for chemical extraction to standard 61 and carry the NSF-pw Listing.

TFP BlazeMaster[®] CPVC sprinkler pipe and fittings are Approved by the Loss Prevention Certification Board for use in Residential and Light Hazard Occupancies as defined above. For "scope of use" of TFP BlazeMaster[®] CPVC products with the LPCB Approval, please refer to the Approval for the TFP CPVC Company in the most recent version of the LPCB Specifiers' Guide, List of Approvals Fire and Security Products and Services.

TFP BlazeMaster[®] CPVC sprinkler pipe and fittings are Approved by the City of Los Angeles and Metro-Dade County for use in Light Hazard and Residential occupancies as defined above.

Special Note: TFP BlazeMaster[®] CPVC pipe and fittings are UL and C-UL Listed and LPCB and Factory Mutual Research Approved for use with TFP and/or other **BlazeMaster[®] and/or BlazeMaster 2000™ CPVC pipe and/or BlazeMaster[®] CPVC fittings Listed and/or Approved in accordance with the appropriate U.S., Canadian and/or U.K. requirements.** TFP BlazeMaster[®] CPVC pipe is UL and C-UL Listed with TFP-500 Solvent/Cement for use with Grinnell Flameaway CPVC fittings listed in accordance with the appropriate US and/or Canadian requirements. Please consult the current UL Fire Protection Equipment Directory, C-UL Products Certified for Canada Directory, Factory Mutual Research Approval Guide, LPCB List of Approved Fire Security Products and Services Guide and/or contact TFP's Corporate Headquarters at 800-523-6512 for further information on Listings and Approvals.

Where and how to use a Tyco Fire Products BlazeMaster® System

1. TFP BlazeMaster® pipe and fittings shall be employed in "wet" systems only. (A wet pipe system contains water and is connected to a water supply so that the water will discharge immediately when the sprinkler is opened.) **TFP BlazeMaster® products shall not be used in a system using compressed air or other gases.**
2. National Fire Protection Association Standards 13, 13R, 13D or 24 shall be followed and when applicable, the National Building Code of Canada shall be referenced for design and installation requirements in conjunction with these instructions.

3. For a concealed installation:

A. In accordance with the UL Listing, protection shall be provided for BlazeMaster® CPVC pipe and fittings. The minimum protection shall consist of either one layer of 3/8" thick gypsum wall board, 1/2" plywood soffits, or a suspended membrane ceiling with lay-in panels or tiles having a weight of 0.35 pounds per sq. ft. when installed with metallic grids. For residential occupancies defined in NFPA 13D and 13R, the minimum protection may consist of one layer of 1/2" plywood. In these cases, any standard sprinkler head rated at 170°F or less may be used.

B. In accordance with the C-UL Listing, protection shall be provided for BlazeMaster® CPVC pipe and fittings. The minimum protection shall consist of either lath and plaster, one layer of 9mm thick gypsum wallboard, one layer of 13mm plywood, or a suspended membrane ceiling with lay-in panels or tiles classified with respect to surface burning characteristics having a mass of not less than 1.7 kg/m² when installed with metallic grids. The effectiveness of this protection can be impaired if penetrated by large openings such as ventilation grills, exhaust fans connected to metal ducts serving washrooms excepted. Where such penetration is present, individual openings exceeding 0.03m², but not exceeding 0.71 m² in area must be located such that the distance from the edge of the opening to the nearest sprinkler does not exceed 300mm. BlazeMaster® pipe and fittings shall not be used where such openings exceed 0.71m² in area. In these cases, any standard sprinkler head rated at 77°C or less may be used.

C. For a concealed installation per Factory Mutual Research Approvals, the piping shall be protected and completely separated by a permanently installed non-combustible barrier from any area protected by the system. A permanently installed barrier is one that cannot be removed without substantial cosmetic damage. Drop in ceiling tiles, as used in suspended ceilings are specifically considered not to be permanently installed for the purposes of this definition. Non-combustible is defined as having a minimum finish fire rating of 15 minutes when tested per ASTM E 119.

4. For an exposed installation:

• **In accordance with the UL and C-UL Listings,** BlazeMaster® CPVC pipe and fittings shall be installed below a smooth flat horizontal ceiling construction per its UL Listing. For C-UL Listed applications, BlazeMaster® CPVC pipe and fittings shall be installed below smooth, flat, fixed, and horizontal ceiling construction. For pendent sprinkler installations, Listed Quick Response, ordinary temperature rating, pendent sprinklers installed within 8" from the ceiling or Listed Residential sprinklers located in accordance with their Listing shall be used and the maximum distance between sprinklers **shall not exceed 15'**.

For horizontal sidewall installations, Listed Quick Response, ordinary temperature rating, horizontal sidewall sprinklers having deflectors within 6" from the ceiling and within 4" from the sidewall or Listed Residential horizontal sidewall sprinklers located in accordance with their Listing shall be used and the maximum distance between sprinklers **shall not exceed 14'**.

5. TFP BlazeMaster® CPVC pipe and fittings shall be installed in areas where the **ambient temperature does not exceed 150°F (65°C).**
6. TFP BlazeMaster® CPVC pipe and fittings **is not approved for installation** in combustible concealed spaces requiring sprinklers, as referenced in NFPA 13 **unless protected by sprinklers specifically Listed for this application.** (Please refer to page 11 of this manual for the Use of CPVC Products in Combustible Concealed Spaces with Specific Use Sprinklers.) NFPA 13R and 13D permit the omission of sprinklers from combustible concealed spaces and TFP BlazeMaster® pipe and fittings can be installed in these areas when protecting residential occupancies according to these standards with sprinklers.
7. In installations where sprinkler pipe runs through an attic space that **requires** sprinklers per NFPA, CPVC piping shall be protected in order to meet the requirements of its UL and C-UL Listings. The *Authority Having Jurisdiction* shall be consulted prior to any installation of CPVC in attic spaces requiring sprinklers. Protection methods and requirements may vary by jurisdiction and are subject to interpretation.
8. TFP BlazeMaster® CPVC pipe and fittings, when installed in accordance with its UL Listing in air plenums, may be installed in the plenum adjacent to, but not over, an opening in the ceiling such as ventilation grills. Return Air Plenum installations may only be made with UL Listed TFP BlazeMaster® CPVC pipe and fittings and require the use of Schedule 80 fittings for installation sizes 1-1/2" and larger. Grinnell Flameaway fittings may not be used with TFP BlazeMaster® pipe in return air plenum installations. The Factory Mutual Research Approval restricts the use of TFP BlazeMaster® CPVC pipe and fittings in return air plenums as referenced in NFPA 90A.
9. Before penetrating fire rated walls and partitions, consult building codes and *Authorities Having Jurisdiction* in your area. TFP BlazeMaster® systems should be designed and installed so that the piping is not exposed to excessive temperatures from specific heat producing sources, such as light fixtures, ballasts and steam lines. Pipe shall not be positioned directly over open ventilation grills.
Note: There is no exact minimum distance TFP BlazeMaster® CPVC pipe and fittings should be installed from heat sources. Minimum distances are a function of the specific heat producing source, the maximum ambient temperature, heat shielding, if any, and proximity of CPVC piping to the above. Please consult TFP's Technical Services department for answers regarding specific heat sources and recommended TFP BlazeMaster® CPVC spacing.
10. During remodeling or ceiling repair appropriate precautions must be implemented to properly shield the piping from the protected occupancy.
11. TFP BlazeMaster® CPVC pipe and fittings shall not be installed in outdoor applications.
12. The use of BlazeMaster® CPVC in ceiling spaces above non-sprinklered areas has not been investigated by UL or Factory Mutual Research.

Tyco Fire Products BlazeMaster[®] Specifications

Pipe

TFP BlazeMaster[®] CPVC sprinkler pipe conforms to the requirements of ASTM F442 and carries the markings of Underwriters Laboratories Inc. (UL & C-UL), Factory Mutual Research, ME&A, Dade County, City of Los Angeles, LPCB, and the National Sanitation Foundation (NSF-pw S.E.) for use in potable water systems.

Fittings

TFP BlazeMaster[®] CPVC sprinkler fittings conform to the requirements of ASTM F438 (Schedule 40 dimensions from 3/4" to 1 1/4") and ASTM F439 (Schedule 80 dimensions for 1 1/2" to 3"). Female threaded adapters for sprinkler head connections contain brass inserts. Fittings carry the markings of Underwriters Laboratories Inc. (UL & C-UL), Factory Mutual Research, ME&A, Dade County, City of Los Angeles, LPCB, and National Sanitation Foundation (NSF-pw S.E.) for use in potable water systems.

Solvent/Cement

BlazeMaster[®] CPVC socket connections can be joined using one of two solvent/cementing processes. Connections shall be joined with TFP BlazeMaster[®] One-Step TFP-400 or TFP-500 Solvent Cements or Two Step TFP-100 Primer and TFP-200 Solvent Cement. TFP-100, TFP-200, TFP-400 and TFP-500 Solvent/Cements meet ASTM F493 and NSF requirements. Please review solvent cementing instructions within this manual prior to installation. Other primer or cements shall not be used with TFP BlazeMaster[®] products and the use of such non-approved welding agents will void the Manufacturer's warranty and product Listings/Approvals. **Caution: Avoid applying too much cement. Do not allow the cement to drip beyond the bottom of fitting socket. Excessive cement on the pipe and/or fitting can result in decreasing the overall strength of the pipe and/or fitting and may cause cracks when pressure is applied.**

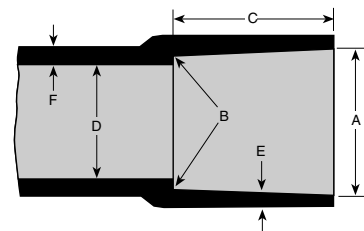
Dimensions for TFP BlazeMaster[®] CPVC Pipe

Nominal Size (see note)	Average OD		Average ID		Pounds per Foot
3/4"	1.050	(26.7)	.874	(22.2)	.168
1"	1.315	(33.4)	1.101	(28.0)	.262
1 1/4"	1.660	(42.2)	1.394	(35.6)	.418
1 1/2"	1.900	(48.3)	1.598	(40.6)	.548
2"	2.375	(60.3)	2.003	(50.9)	.859
2 1/2"	2.875	(73.0)	2.423	(61.7)	1.257
3"	3.500	(88.9)	2.952	(75.1)	1.867

Note: TFP BlazeMaster[®] pipe is produced in SDR 13.5 dimensions in accordance with ASTM442. SDR (Standard Dimension Ratio) is the ratio of the outside pipe diameter to the wall thickness of the pipe.

ASTM CPVC Fitting Socket Dimensions

Nominal Size	A	B	C	D	Minimum Wall Thickness	
	Socket Entrance Diameter Average Diameter	Socket Bottom Diameter Average Diameter	Socket Length Minimum	Inside Diameter Minimum	E	F
3/4"	1.058	1.046	0.719	0.820	0.113	0.141
1"	1.325	1.310	0.875	1.044	0.133	0.166
1 1/4"	1.670	1.655	0.938	1.375	0.140	0.175
1 1/2"	1.912	1.894	1.375	1.446	0.200	0.250
2"	2.387	2.369	1.500	1.933	0.218	0.275
2 1/2"	2.889	2.868	1.750	2.316	0.276	0.345
3"	3.516	3.492	1.875	2.892	0.300	0.375



Product Ratings and Capabilities

Pressure Rating & Pressure Listing

TFP BlazeMaster® pipe and fittings are UL and C-UL Listed and Factory Mutual Research and LPCB Approved for a rated pressure of 175 psi (1210 kPa) for sprinkler service up to 150°F (65°C).

Friction Loss

TFP BlazeMaster® CPVC pipe has a Hazen-Williams C-Value of 150. Pipe friction loss calculations shall be made according to NFPA Standards. The following table shows the allowance of friction loss for fittings, expressed in equivalent feet of pipe.

Allowance for Friction Loss in Fittings (Equivalent Feet of Pipe)							
Fitting Size (In.)	¾"	1"	1¼"	1½"	2"	2½"	3"
Tee Branch	3	5	6	8	10	12	15
Elbow 90° *	4	5	6	7	9	12	13
Elbow 45°	1	1	2	2	2	3	4
Coupling	1	1	1	1	1	2	2
Tee Run	1	1	1	1	1	2	2

*The above stated friction loss values are for TFP BlazeMaster® fittings only. When using other Listed BlazeMaster® CPVC 90° elbows with TFP BlazeMaster® products, please consult the fitting manufacturer's installation and design manuals.

Thermal Expansion

BlazeMaster® plastics, like all piping materials, expand and contract with changes in temperature. The coefficient of linear expansions is:
0.0000340 inch/inch /°F.

A 25°F change in temperature will cause an expansion of ¼ inch for a 50 foot straight length. For most operating and installation conditions, expansion and contraction can be accommodated at changes in direction of the pipe run. For additional information on Thermal Expansion please see Table C.

Where $\Delta L = 12eL (\Delta T)$
 $e = 3.4 \times 10^{-5}$ in/in/°F (Coefficient of Linear Expansion)
 L = Length of Run in Feet
 ΔT = Temperature Change in °F

An example of Thermal Expansion is shown below:

Example: How much will a 40 foot run of ¾" of BlazeMaster® CPVC pipe increase in length (or expand) if the expected ambient temperature ranges from 35°F to 85°F? Changes in length due to fittings are insignificant relative to the pipe.

$$\Delta L = 12eL (\Delta T)$$

$$\Delta L = 12 (.000034) \times 40 \times 50$$

$$\Delta L = .82 \text{ in. or } \frac{1}{8}"$$

TFP BlazeMaster® CPVC exhibits a relatively high coefficient of thermal expansion (see Table C). When designing TFP BlazeMaster® sprinkler systems, expansion of long runs must be considered if temperature variations will be encountered (ie; summer to winter extremes). Methods of compensating for thermal expansion are; expansion loops, offsets and change of direction of the pipe run. (See Figure G for examples of control methods.)

The expansion loops and offset tables are shown below. If the change in temperature and the maximum working temperature are lower than those used to derive the tables, the numbers will be conservative in nature. For example, for a temperature change from 60°F to 125°F use Table F because the maximum temperature is greater than those shown in Tables D and E.

For conditions which are not covered in the Loop Length Tables, use the formulas and examples found in Table H.

Note: Table based on Stress and Modulus of Elasticity at 100°F.
 Refer to Table H on page 5.
 $\Delta T = 70^\circ\text{F}$
 $S = 1560 \text{ psi}$
 $E = 3.85 \times 10^5 \text{ psi}$

Temp Change $\Delta T^\circ\text{F}$	Length of Run (ft.)													
	5	10	15	20	25	30	35	40	45	50	70	90	120	160
20	.04	.08	.12	.16	.20	.24	.29	.33	.37	.41	.57	.73	.98	1.31
30	.06	.12	.18	.24	.31	.37	.43	.49	.55	.61	.86	1.10	1.47	1.96
40	.08	.16	.24	.33	.41	.49	.57	.65	.73	.82	1.14	1.47	1.96	2.61
50	.10	.20	.31	.41	.51	.61	.71	.82	.92	1.02	1.43	1.84	2.45	3.26
60	.12	.24	.37	.49	.61	.73	.86	.98	1.10	1.22	1.71	2.20	2.94	3.92
70	.14	.29	.43	.57	.71	.86	1.00	1.14	1.29	1.43	2.00	2.57	3.43	4.57
80	.16	.33	.49	.65	.82	.98	1.14	1.31	1.47	1.63	2.28	2.94	3.92	5.22
90	.18	.37	.55	.73	.92	1.10	1.29	1.47	1.65	1.84	2.57	3.30	4.41	5.88
100	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.84	2.04	2.86	3.67	4.90	6.53

Nom. Pipe Size	Avg. O.D.	Length of Run (ft.)															
		10	20	30	40	50	60	70	80	90	100	120	140	160			
¾"	1.050	11	15	18	21	24	26	28	30	32	33	37	39	42			
1"	1.315	12	17	20	24	26	29	31	33	35	37	41	44	47			
1¼"	1.660	13	19	23	26	30	32	35	37	40	42	46	50	53			
1½"	1.900	14	20	25	28	32	35	38	40	43	45	49	53	57			
2"	2.375	16	22	27	32	35	39	42	45	48	50	55	59	63			
2½"	2.875	18	25	30	35	39	43	46	49	52	55	60	65	70			
3"	3.500	19	27	33	38	43	47	51	54	58	61	67	72	77			

Table E • Loop Length (60°F to 120°F) $\Delta T = 60^\circ F$

Nom. Pipe Size	Avg. O.D.	Length of Run (ft.)												
		10	20	30	40	50	60	70	80	90	100	120	140	160
		Length of Loop (in.)												
3/4"	1.050	10	15	18	21	23	25	27	29	31	33	36	39	41
1"	1.315	11	18	20	23	26	28	31	33	35	37	40	43	46
1 1/4"	1.660	13	18	22	26	29	32	34	37	39	41	45	49	52
1 1/2"	1.900	14	20	24	28	31	34	37	39	42	44	48	52	56
2"	2.375	15	22	27	31	35	38	41	44	47	49	54	58	62
2 1/2"	2.875	17	24	30	34	38	42	45	49	51	54	59	64	69
3"	3.500	19	27	33	38	42	46	50	54	57	60	66	71	76

Note: Table based on Stress and Modulus of Elasticity at 120°F
Refer to Table H.

$$\begin{aligned} \Delta T &= 60^\circ F \\ S &= 1275 \text{ psi} \\ E &= 3.55 \times 10^5 \text{ psi} \end{aligned}$$

Table F • Loop Length (70°F to 150°F) $\Delta T = 80^\circ F$

Pipe Size	Nom. Avg. O.D.	Length of Run (ft.)												
		10	20	30	40	50	60	70	80	90	100	120	140	160
		Length of Loop (in.)												
3/4"	1.050	14	19	23	27	30	33	36	38	40	43	47	50	54
1"	1.315	15	21	26	30	34	37	40	43	45	48	52	56	60
1 1/4"	1.660	17	24	29	34	38	41	45	48	51	53	59	63	68
1 1/2"	1.900	18	26	31	36	40	44	48	51	54	57	63	68	72
2"	2.375	20	29	35	41	45	50	53	57	61	64	70	76	81
2 1/2"	2.875	22	31	39	45	50	55	59	63	67	70	77	83	89
3"	3.500	25	35	43	49	55	60	65	69	74	78	85	92	98

Note: Table based on Stress and Modulus of Elasticity at 150°F
Refer to Table H.

$$\begin{aligned} \Delta T &= 80^\circ F \\ S &= 875 \text{ psi} \\ E &= 3.08 \times 10^5 \text{ psi} \end{aligned}$$

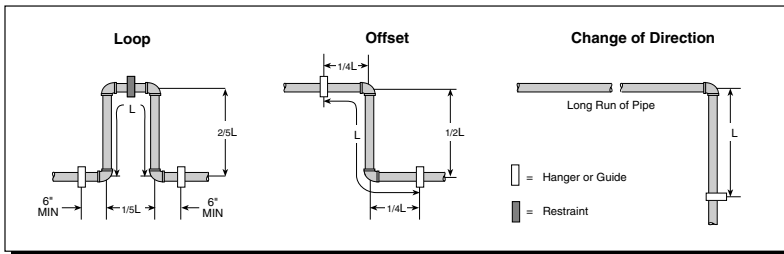


Figure G • Expansion Loop and Offset Configurations

Hangers should only be placed in the loop, offset or change of direction as indicated. Piping supports should restrict lateral movement and shall direct axial movement into the expansion loop.

The Expansion Loop Formula has the following components as shown below:

- L = Length of Expansion Loop in Inches
- E = Modulus of Elasticity at 100°F (Table H below)
- D = Average O.D. of Pipe
- ΔL = Change in Length of Pipe Due to Change in Temperature
- S = Working Stress at 100°F (Table H below)

Table H • Modulus of Elasticity & Stress vs Temperature

Temperature °F	73°	80°	90°	100°	110°	120°	140°	150°
Modulus of Elasticity "E" x 10 ⁵ (psi)	4.23	4.14	3.99	3.85	3.70	3.55	3.23	3.08
Working Stress "S" (psi)	2,000	1,875	1,715	1,560	1,415	1,275	1,000	875

The Modulus of Elasticity & Stress vs Temperature table H will need to be used to find "E" in the Expansion Loop Formula. An example is presented to demonstrate the calculation of expansion given a defined thermal change and to calculate the length of the expansion loop or offset in inches.

Example

How much expansion can be expected in a 240 foot run of 2" TFP BlazeMaster® CPVC pipe installed in 40°F given a maximum temperature change to 100°F? Additionally, how long should the expansion loop be to compensate for this expansion?

First, find the temperature change expressed as ΔT .

$$\begin{aligned} \Delta T &= 100^\circ F - 40^\circ F \\ \Delta T &= 60^\circ F \end{aligned}$$

Now use Table C to calculate the change in length expressed as ΔL . Since the run is 240 feet and the table is inclusive to only 160 feet, two calculations will need to be made.

$$\begin{aligned} \text{Length of run} &= 160 \text{ feet with } \Delta T = 60^\circ F \\ \text{From Table C, } \Delta L &= 3.92 \text{ in} \end{aligned}$$

Now we must calculate the additional 80 feet of run for ΔL . Since Table C does not include 80 feet we must interpolate 80 feet between 70 feet and 90 feet.

$$\Delta T = 60^{\circ}\text{F}$$

$$\Delta L = 1.71 \text{ in for } 70 \text{ feet}$$

$$\Delta L = 2.20 \text{ in for } 90 \text{ feet}$$

$$\Delta L = \frac{1.71 + 2.20}{2} = 1.96 \text{ inches for } 80 \text{ feet of pipe}$$

$$\text{Total } \Delta L \text{ for } 240 \text{ feet} = 3.92 + 1.96$$

$$\Delta L = 5.88 \text{ inches}$$

To find the length of the expansion loop on offset in inches

$$L = \sqrt{\frac{3ED(\Delta L)}{2S}}$$

- L = Length of Expansion Loop in inches.
- E = Modulus of Elasticity at maximum temperature from Table H.
- D = Average Outside Diameter of pipe from Table A, in inches.
- S = Working Stress at maximum temperature from Table H, psi.
- ΔL = Change in length of pipe due to a change in temperature from Table C, in inches.

$$L = \sqrt{\frac{3 \times (3.85 \times 10^5) \times (2.375) \times (5.88)}{2(1,560)}}$$

$$L = 71.90 \text{ inches}$$

For Loop Length: $\frac{1}{2} L = \frac{1}{2} \times 71.90 = 14.38 \text{ in.}$
 $\frac{3}{4} L = \frac{3}{4} \times 71.90 = 28.76 \text{ in.}$

For Offset Length: $\frac{1}{4} L = \frac{1}{4} \times 71.90 = 17.98 \text{ in} \approx 18 \text{ in.}$
 $\frac{1}{2} L = \frac{1}{2} \times 71.90 = 35.95 \text{ in} \approx 36 \text{ in.}$

Physical and Thermal Properties of TFP BlazeMaster® CPVC

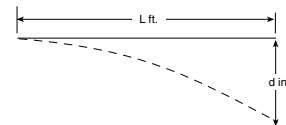
The Physical and Thermal Properties of TFP BlazeMaster® pipe can be found in Table I.

Property	CPVC	ASTM
Specific Gravity "Sp. Gr."	1.55	D792
IZOD Impact Strength (ft. lbs./inch, notched)	3.0	D256A
Modulus of Elasticity, @ 73°F, psi "E"	4.23 x 10 ⁵	D638
Ultimate Tensile Strength, psi	8,400	D638
Compressive Strength, psi "o"	9,600	D695
Poisson's Ratio "o"	.35 - .38	-
Working Stress @ 73°F, psi "S"	2,000	D1598
Hazen Williams "C" Factor "C"	150	-
Coefficient of Linear Expansion in/(in °F) "e"	3.4 x 10 ⁵	D696
Thermal Conductivity BTU/hr/ft/°F/in "k"	0.95	C177
Flash Ignition Temperature F°	900	D1929
Limiting Oxygen Index "LOI"	%60	D2863
Electrical Conductivity	Non Conductor	

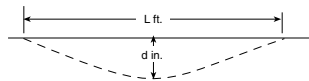
Permissible Bending Deflections

BlazeMaster® fire sprinkler piping, while classified as a rigid piping material, is inherently flexible allowing it to be deflected, within permissible limits, **around or away from objects during installation**. The maximum allowable deflections for BlazeMaster® piping can be found in Tables J and K.

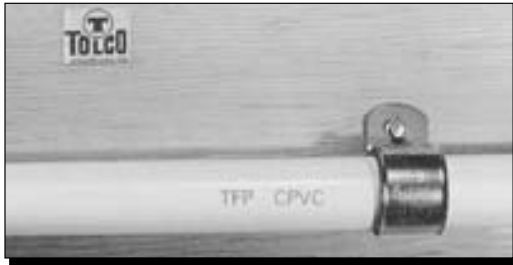
Pipe Size	Length of Run (L) in feet															
	2'	5'	7'	10'	12'	15'	17'	20'	25'	30'	35'	40'	45'	50'		
	Deflection (D) in inches															
3/4"	1.3	7.8	15.4	31.3	45.1	70.5	90.6	125.4	195.9	282.1	383.9	-	-	-		
1"	1.0	6.3	12.3	25.0	36.0	56.3	72.3	100.1	156.4	225.2	306.6	400.4	-	-		
1 1/4"	0.8	5.0	9.7	19.8	28.5	44.6	57.3	79.3	123.9	178.4	242.8	317.2	401.4	-		
1 1/2"	0.7	4.3	8.5	17.3	24.9	39.0	50.1	69.3	108.2	155.9	212.2	277.1	350.7	433.0		
2"	0.6	3.5	6.8	13.9	20.0	31.2	40.0	55.4	86.6	124.7	169.7	221.7	280.6	346.4		
2 1/2"	0.5	2.9	5.6	11.4	16.5	25.8	33.1	45.8	71.5	103.0	140.2	183.1	231.8	286.2		
3"	0.4	2.4	4.6	9.4	13.5	21.2	27.2	37.6	58.8	84.6	115.2	150.4	190.4	235.1		



Pipe Size	Length of Run (L) in feet															
	2'	5'	7'	10'	12'	15'	17'	20'	25'	30'	35'	40'	45'	50'		
	Deflection (D) in inches															
3/4"	.3	2.0	3.8	7.8	11.3	17.6	22.6	31.3	49.0	70.5	96.0	125.4	158.7	195.9		
1"	.3	1.6	3.1	6.3	9.0	14.1	18.1	25.0	39.1	56.3	76.6	100.1	126.7	156.4		
1 1/4"	.2	1.2	2.4	5.0	7.1	11.2	14.3	19.8	31.0	44.6	60.7	79.3	100.4	123.9		
1 1/2"	.2	1.1	2.1	4.3	6.2	9.7	12.5	17.3	27.1	39.0	53.0	69.3	87.7	108.2		
2"	.1	.9	1.7	3.5	5.0	7.8	10.0	13.9	21.6	31.2	42.4	55.4	70.1	86.6		
2 1/2"	.1	.7	1.4	2.9	4.1	6.4	8.3	11.4	17.9	25.8	35.1	45.8	57.9	71.5		
3"	.1	.6	1.2	2.4	3.4	5.3	6.8	9.4	14.7	21.2	28.8	37.6	47.6	58.8		



Support and Hanger Recommendations*



One Hole Strap



Two Hole Strap

Some hangers designed for metal pipe are suitable for CPVC pipe. The hanger shall not have rough or sharp edges which can come in contact with the pipe. **Do not use under sized hangers.** Hangers with sufficient sizing shall be selected based on pipe size (ie; 1½" hangers for 1½" pipe). Pipe hangers must comply with the appropriate Standard, NFPA 13, 13D, or 13R, whichever applies and should have load bearing surfaces at least ½" wide.

Some local codes may not allow plastic to metal contact. In this case, plastic sleeves or vinyl electrical tape should be used to isolate the materials.

Strapping pipe overly tight to a structural member can cause damage to the pipe when pressurized. Please ensure the pipe is held snug by the hanger, but is not pinched or crushed in any way.

PLUMBERS TAPE OR J HOOKS ARE NOT RECOMMENDED WITHOUT SHIELDING FOR ROUGH EDGES IN NFPA 13D APPLICATIONS.

Pipe Bracing with Standard Band Hanger*

Tolco, Inc. and Afcon make three hanger/restraining devices that are available for use with TFP BlazeMaster®.

A "one hole strap", shown left, can function as a hanger and as a restraining device. As a restraining device, invert the hanger so that the fastener is downward. Installation in this manner will prevent upward movement of the sprinkler head during activation.

A "two hole strap, shown left, can function as a hanger and as a restraining strap. UL Listed CPVC hangers incorporate features which protect the pipe from sharp edges and ease installation. The hex head self-threading screw (furnished with most UL Listed CPVC hangers) is easily installed using a rechargeable electric drill and a ⅝" socket attachment. No predrilling of a pilot hole is required.

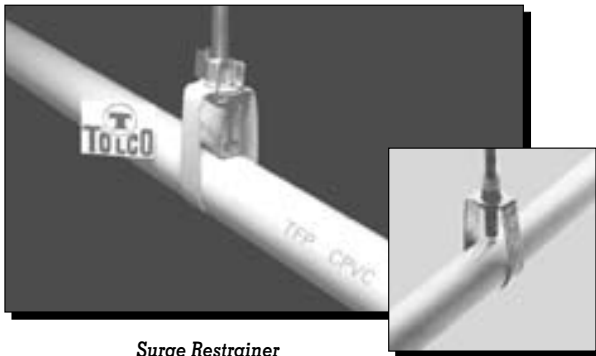
Both Tolco Models 22 and 23 and Afcon Models 513 and 510 were designed and tested for CPVC plastic pipe only and are UL Listed for this application. The Tolco Models 22 and 23, and Afcon Models 513 and 510 satisfy both support and vertical restraint criteria. For more information about Tolco or Afcon products, consult TFP.

Table L • Support Spacing "L" (ft.) CPVC SDR 13.5

Temp °F	Nominal Pipe Size						
	¾"	1"	1¼"	1½"	2"	2½"	3"
73°	5½'	6'	6½'	7'	8'	9'	10'

Hanger/Support Spacing

Because TFP BlazeMaster® pipe is more rigid than other types of plastic pipe systems, the support spacing shown in Table L shall be adhered to when installing the system. **For exposed installations, Listed support devices shall be used which mount piping directly to the ceiling or side wall, except when using upright sprinklers per the installation information on Page 11 of this manual.**



Surge Restrainer

Table M • Support Spacing Distance to an In Line Sprinkler Head Drop Tee

Nominal Pipe Size	Less than 100 psi (690 kPa)	Greater than 100 psi (690 kPa)
¾ inch	4'	3'
1 inch	5'	4'
1¼ inch	6'	5'
1½ to 3 inches	7'	7'

Vertical Restraint

When a sprinkler head activates, a significant reactive force is exerted on the pipe, especially at system pressures greater than 100 psi. The reactive force will cause the pipe to lift vertically if it is not properly secured, especially if the sprinkler drop is from a small diameter pipe.

When a sprinkler drop is from ¾", 1" or 1¼" pipe, the closest hanger should brace the pipe against vertical lift-up. A number of techniques can be used to brace the pipe such as a standard band hanger positioning the threaded support rod to ⅛ inch above the pipe or using a split ring or a wrap-around hanger for restraint.

Note: Threaded rod shall not come in contact with CPVC when installed. It is advisable to use lift restraint devices such as those produced by Tolco and Afcon which prevent the threaded rod from coming in contact with the CPVC pipe as shown to the left.

Branch lines shall be braced at a distance from a tee or elbow to prevent lift of sprinklers as shown in Tables M and N.

*Local codes have final authority on which types of hangers can be used.

Table N • Support Spacing to an End Line Sprinkler Head Drop Elbow

Nominal Pipe Size	Less than 100 psi (690 kPa)	Greater than 100 psi (690 kPa)
¾ inch	9"	6"
1 inch	1'0"	9"
1½ inch	1'4"	1'
1½ to 3 inches	2'	1'

When piping is suspended from a deck, hangers are required to suspend the pipe as well as provide vertical lift restraint. One hanger can serve as both. Drop locations between supports are acceptable in any location as long as support spacing is in compliance with Tables M and N as applicable. Examples of where this type of hanging is used include: concrete decks with rod and ring hangers, "pan decks" on I beams with beam clamps, or concrete anchors, and under wood joists with straps or rod hangers. See Figure O.

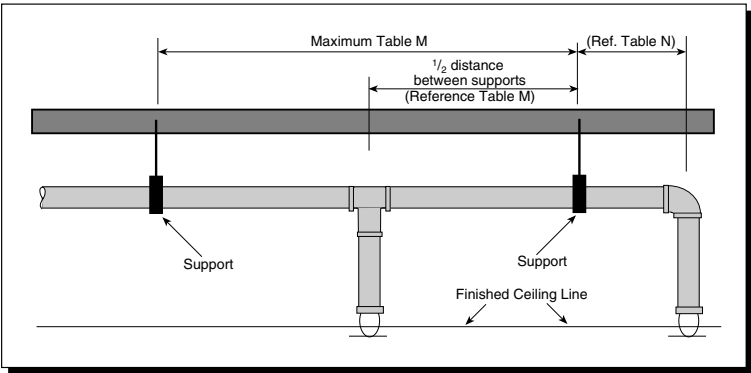


Fig. O • Drop Ceiling Installation.

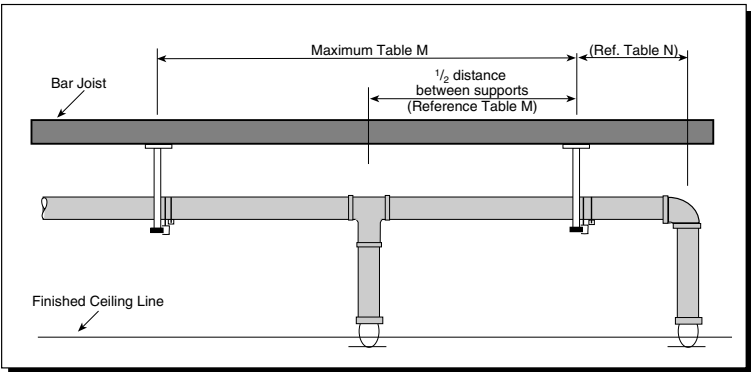
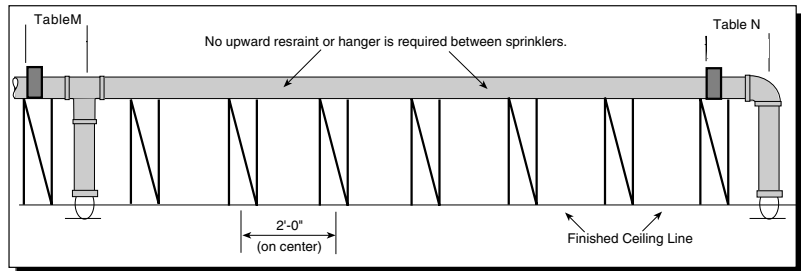


Fig. Q • Sprinkler Drop Pipe Adjacent to Truss

When the piping is supported by wood joists or trusses, the structure provides the support, especially when the joists are close together. The only requirement with this type of construction is to provide vertical restraint of the sprinkler and additional hangers on the line may not be required. When supporting CPVC piping below the deck, and when the supporting members are spaced far apart, it is important to brace for vertical restraint per Tables M and N. Drop location between supports are acceptable in any location as long as support spacing is in compliance with Tables M and N.



Wood Frame Construction

In manufactured homes, additional hangers may be required to prevent pipe movement from thermal expansion. Please consult with your Authority Having Jurisdiction and TFP's Technical Services Department for further information.

*CPVC pipe or fitting must be supported near a sprinkler head as shown in Tables M and N.

Underground Installation Specifications

Pipe

TFP BlazeMaster[®] CPVC pipe complies with the requirements of ASTM F442 and standard dimension ratio (SDR) 13.5. **TFP BlazeMaster[®] pipe is UL Listed and C-UL Listed for a rated pressure of 175 psi (1210 kPa) for underground service.**

Fittings

TFP BlazeMaster[®] CPVC fittings comply with the requirements of ASTM F438 (Schedule 40 socket) or ASTM F439 (Schedule 80 socket).

Primer/Solvent Cement

All socket type joints shall be made in accordance with TFP's Installation Instructions using the "One Step" TFP-400 or TFP-500 Solvent Cements or "Two Step" TFP-100 Primer and TFP-200 Solvent Cement. Please refer to sections of this manual for Joining TFP BlazeMaster[®] Pipe Systems which reference the application of these systems as well as page 19 for the standard practice for safe handling of Primers and Solvent/Cements.

Note: When using TFP BlazeMaster[®] pipe and fittings, pipe and fittings must be installed in accordance with ASTM D2774, the standard recommended practice for underground installation of thermoplastic pressure piping and ASTM F645, the standard guide for selection, design and installation of thermoplastic water pressure piping systems, and all TFP installation instructions contained within this document.

System Design

A TFP BlazeMaster[®] underground system shall be hydraulically calculated using a Hazen-Williams C-Factor of 150, and designed and installed in accordance with the the "Installation of Sprinkler Systems," NFPA 13, 1999 edition, and where appropriate the "Standard for Installation of Private Fire Service Mains and Their Appurtenances," NFPA 24.

Installation Procedures

The installation procedures detailed within apply to TFP BlazeMaster[®] CPVC pipe that has solvent cemented joints in size ranging from 3/4" - 3".

Inspection

Before installation, TFP BlazeMaster[®] CPVC pipe and fittings should be thoroughly inspected for cuts, scratches, gouges or split ends which may have occurred to the products during shipping and handling.

Trenching

The trench should be of adequate width to allow convenient installation, while at the same time being as narrow as possible. Minimum trench widths may be utilized by joining pipe outside of the trench and lowering it into the trench after adequate joint strength has been achieved.

Note: Please refer to TFP's instructions for recommended set and cure times for solvent cemented joints as found in Tables U through Z1 of this installation guide. Trench widths will have to be wider where pipe is joined in the trench or where thermal expansion and contraction is a factor. For additional details on expansion and contraction, please see thermal expansion characteristics on page 4 of this brochure. The following chart shows the trench width and minimum ground cover required for underground installation.

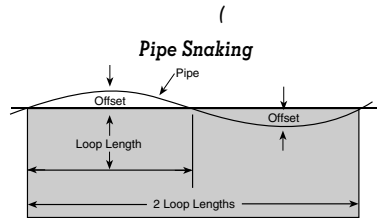
Pipe Size	Trench Width	Ground Cover Minimum	
		Light Traffic	Heavy Traffic
3" and Under	8"	12" - 18"	30" - 36"

All TFP BlazeMaster[®] CPVC pipe that is water filled should be buried at least 12" below the maximum expected frost line. It is recommended that TFP BlazeMaster[®] piping be run within a metal or concrete casing when it is installed beneath surfaces that are subject to heavy-weight or constant traffic such as roadways and railroad tracks.

The trench bottom should be continuous, relatively smooth and free of rocks. Where ledge rock, hardpan or boulders are encountered, it is necessary to pad the trench bottom using a minimum of four (4) inches of tamped earth or sand beneath the pipe as a cushion and for protection of the pipe from damage. Sufficient cover must be maintained to keep external stress levels below acceptable design stress. Reliability and safety of service is of major importance in determining minimum cover. Local, state and national codes may also govern.

Snaking of Pipe

After TFP BlazeMaster[®] CPVC pipe has been solvent cemented, it is advisable to snake the pipe according to the following recommendations beside the trench during its required drying time. **Be especially careful not to apply any stress that will disturb the undried joint.** Snaking is necessary in order to allow for any anticipated thermal contraction that will take place in the newly joined pipe line. Snaking is particularly necessary on the lengths of pipe that have been Solvent/Cement welded during the late afternoon of a hot summers day, because the drying time will extend through the cool of the night when thermal contraction of the pipe could stress the joints to the point of pull out. This snaking is also especially necessary with pipe that is laid in its trench (necessitating wider trenches than recommended) and is back-filled with cool earth before the joints are thoroughly dry. The following chart (Table R) shows the Pipe Snaking and the Loop Off Set in inches for contraction.



**Table R • Maximum Temperature Variation, °F
Between Time of Solvent Welding and Final Use**

Loop Length	10°F	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F
20 Feet	3"	4"	5"	5"	6"	6"	7"	7"	8"	8"
50 Feet	7"	9"	11"	13"	14"	16"	17"	18"	19"	20"
100 Feet	18"	18"	22"	26"	29"	32"	35"	37"	40"	42"

Back-Filling

Ideally, back-filling should only be completed early in the morning during hot weather when the line is fully contracted and there is no chance of insufficiently dried joints being subject to contraction stresses.

The pipe should be uniformly and continuously supported over its entire length with firm, stable material. Blocking should not be used to change pipe grade or to intermittently support pipe across excavated sections. Pipe is installed in a wide range of sub soils. These soils should not only be stable, but applied in such a manner so as to physically shield the pipe from damage. Attention should be given to local pipe laying experience which may indicate particular bedding problems.

Back-filled material free of rocks with a size of 1/2" or less should be used to surround the pipe with 6" - 8" of cover. The back-filled material should be placed in layers. Each soil layer should be sufficiently compacted uniformly to develop laterally passive soil forces during the back-fill operation. It may be advisable to have the pipe under water pressure, 15 - 25 psi during the back-filling.

Vibratory methods are preferred when compacting sand or gravel. Best results are obtained when the soils are in a nearly saturated condition. Where water flooding is used, the initial back-fill should be sufficient to ensure complete coverage of the pipe. Additional material should not be added until the water flooded back-fill is firm enough to walk on. Care should be taken to avoid floating the pipe.

Sand and gravel containing a significant portion of fine-grained material such as silt and clay should be compacted by hand or preferably by a mechanical tamper. The remainder of the back-fill should be placed and spread in uniform layers in such a manner to fill the trench completely so that there will be no unfilled spaces under or about rocks or lumps of earth in the back-fill. Large or sharp rocks, frozen clods and other debris greater than 3" in diameter should be removed. Rolling equipment or heavy tampers should only be used to consolidate the final back-fill.

Maintenance

Maintenance of TFP BlazeMaster® CPVC pipe and fittings for underground water service shall be in accordance with the Standard for Inspection, Testing and Maintenance of Water Based Extinguishing Systems as defined by NFPA 25.

TFP BlazeMaster® CPVC Fire Sprinkler Pipe and Fittings for use in System Risers in accordance with NFPA 13D and 13R

In accordance with the UL Listing, TFP BlazeMaster® CPVC pipe and fittings may be used as system risers in accordance with NFPA 13D and 13R when subject to the following additional limitations:

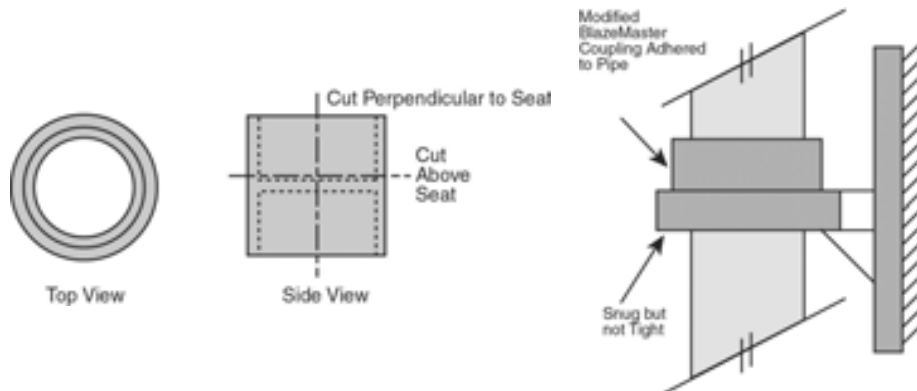
1. When installed protected (concealed), the minimum protection shall consist of either one layer of 3/8 in. (9.5 mm) thick gypsum wallboard or 1/2 in. (12.7 mm) thick plywood.
2. When installed without protection (exposed), the following limitations shall apply:
 - a) The riser shall be installed below a smooth, flat, horizontal ceiling construction. A Listed residential pendent sprinkler is to be installed with its deflector at the distance from the ceiling specified in the sprinkler Listing.

OR

The riser shall be installed below a horizontal unfinished basement ceiling (in accordance with NFPA 13D) constructed utilizing nominal 2 in. x 10 in. or nominal 2 in. x 12 in. exposed solid wood joists on 16 in. centers. A Listed residential pendent sprinkler is to be installed with its deflector a maximum of 1-3/4 in. below the bottom of the solid wood joist in anticipation of future installation of a finished ceiling.

- When installing TFP BlazeMaster® CPVC pipe and fittings in conjunction with 2 in. x 12 in. solid wood joists, the maximum system working pressure under flowing conditions shall not exceed 100 psi and the maximum system working pressure under static (non-flowing) conditions shall not exceed 175 psi.
- b) The Listed residential pendent sprinkler is to have a maximum temperature rating of 155°F and a minimum K-factor of 3.0 and is to be installed at a maximum horizontal distance of 12 inches from the center line of the riser. The system is to be designed based upon the Listed flows for the sprinkler selected except that the flow for a single sprinkler flowing is to be not less than 10 gpm and the flow for multiple sprinklers flowing is to be not less than 8 gpm per sprinkler.
 - c) The riser shall be supported vertically within 2 feet of the ceiling or bottom of the joist.
 - d) The minimum riser diameter shall be 1 in. and the maximum riser diameter shall be 2 in.
 - e) The maximum distance between the wall(s) and the outside surface of the riser pipe shall be 1-1/2 in.
 - f) All solvent cement joints shall be made with TFP-500 One Step Solvent Cement.

- g) The instructions shown here for Exposed System Risers require the use of Schedule 80 fittings for riser sizes 1- 1/2" and larger. Grinnell Flameaway fittings are not to be used with TFP BlazeMaster® CPVC Pipe for Exposed System Riser installations.
- The system shall be installed per the requirements of NFPA 13, Sections 6-2.5 (1999 Edition), Support of Risers.
 - The TFP BlazeMaster® CPVC sprinkler pipe and fittings shall be installed per the manufacturer's installation and design manual.
 - Risers shall be supported by pipe clamps or by hangers located on the horizontal connection close to the riser. Only Listed hangers and clamps shall be used.
 - Vertical lines must be supported at intervals, described in 7 & 8 below, to avoid placing excessive load on a fitting at the lower end. Do this by using riser clamps or double bolt pipe clamps Listed for this service. The clamps must not exert compressive stresses on the pipe. If possible, the clamps should be located just below a fitting so that the shoulder of the fitting rests against the clamp. If necessary, a coupling can be modified and adhered to the pipe as a bearing support such that the shoulder of the fitting rests on the clamp. Follow the manufacturer's recommended cure time.



Recommended method for securing TFP BlazeMaster® pipe vertically. Place clamp below shoulder of fitting.
WARNING: Modified riser collar shall only be used to provide support to the riser and shall not be used to join two pieces of pipe.

- Do not use riser clamps that squeeze the pipe and depend on compression of the pipe to support the weight.
- Hangers and straps shall not compress, distort, cut or abrade the piping and shall allow for free movement of the pipe to allow for thermal expansion and contraction.
- Maintain vertical piping in straight alignment with supports at each floor level, or at 10 feet (3.05 m) intervals, whichever is less.
- TFP BlazeMaster® CPVC risers in vertical shafts or in buildings with ceilings over 25 feet (7.62 m), shall be aligned straightly and supported at each floor level, or at 10 feet (3.05 m) intervals, whichever is less.

Upright Sprinkler Installation Specifications

Primer/Solvent Cement

All socket type joints shall be made in accordance with TFP's Installation and Technical Manual using TFP-400 or TFP-500 "One Step" Solvent Cements. When installing TFP BlazeMaster® CPVC products per the Specifications for Upright Sprinkler Installations, "One Step" TFP-400 or TFP-500 Solvent Cements shall only be used on all pipe sizes. Please refer to Page 14 of this manual, which reference the application of these Solvent Cement systems as well as Page 13 of the manual for the Standard Practice for Safe Handling of Primers and Solvent/Cements.

Requirements for Pipe, Fittings, Installations, System Design, and Maintenance are covered within this manual. Please read these sections carefully prior to designing or installing TFP BlazeMaster® pipe and fittings for upright sprinkler installation. **The installation of TFP BlazeMaster® pipe and fittings for use with upright sprinklers is only UL Listed and is not C-UL Listed nor Factory Mutual Research Approved.**

Installation Requirements

TFP BlazeMaster® pipe and fittings may be used with upright Quick Response sprinklers in NFPA 13, 13R and 13D installations. TFP BlazeMaster® CPVC pipe and fittings shall be installed without protection (exposed) when subject to the following limitations:

- Exposed pipe shall be installed below smooth flat horizontal ceiling construction.
- The system shall be installed with Listed Quick Response upright sprinklers having deflectors installed a maximum of 4" from the ceiling.
- The sprinkler heads shall have a temperature rating not exceeding 155°F.
- The maximum distance from the ceiling to the centerline of the main run of pipe shall be 7 1/2".
- The distance from the centerline of a sprinkler head to a hanger shall be 3".

Use of CPVC Products in Combustible Concealed Spaces with Specific Use Sprinklers

Product Description

In accordance with the UL Listing, the Central Sprinkler Corporation Model CC1 Combustible Concealed Sprinklers are specific application sprinklers designed to provide protection of specific light hazard combustible, as well as non-combustible, concealed spaces requiring sprinkler protection. The Model CC1 Sprinklers can in some cases allow for the use of BlazeMaster® CPVC pipe and fittings within concealed spaces requiring automatic sprinkler protection.

Installation Requirements

When using the Model CC1 Sprinklers, the system can be installed with BlazeMaster® CPVC pipe and fittings in wood truss construction provided the system is installed in accordance with the Technical Data Sheet for the Model CC-1 Combustible Concealed Space Sprinklers (reference Technical Data Sheet 6-3.0).

CPVC Fire Sprinkler Pipe and Fittings for use in Unfinished Basements with Exposed Solid Wood Joist Installations in accordance with NFPA 13D

In accordance with the UL Listing, TFP BlazeMaster® CPVC pipe and fittings may be installed without protection (exposed) in unfinished basements in accordance with NFPA 13D when subject to the following additional limitations:

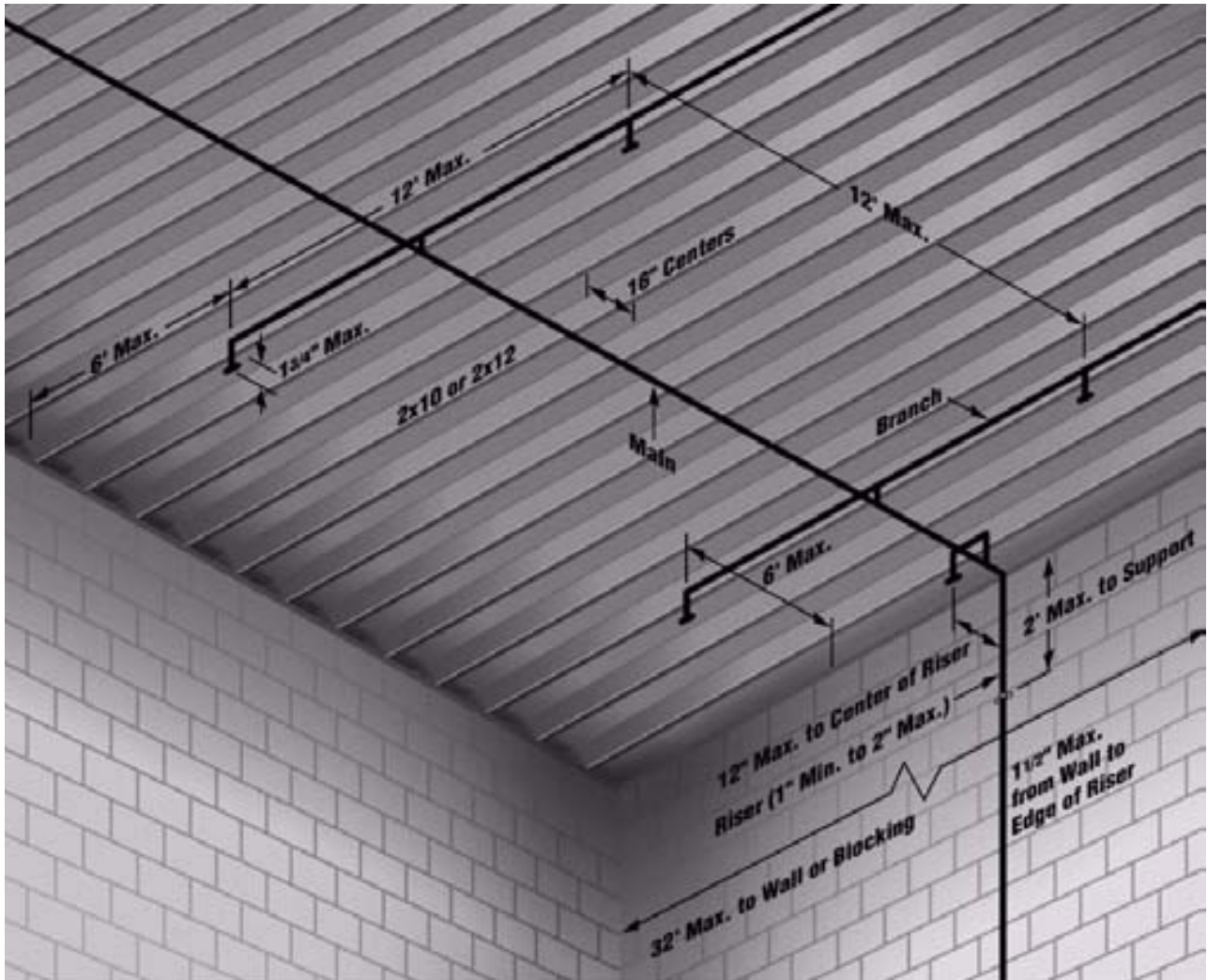
1. The ceiling shall be horizontal and constructed utilizing nominal 2 in. x 10 in. solid wood joists on 16 in. centers.

OR

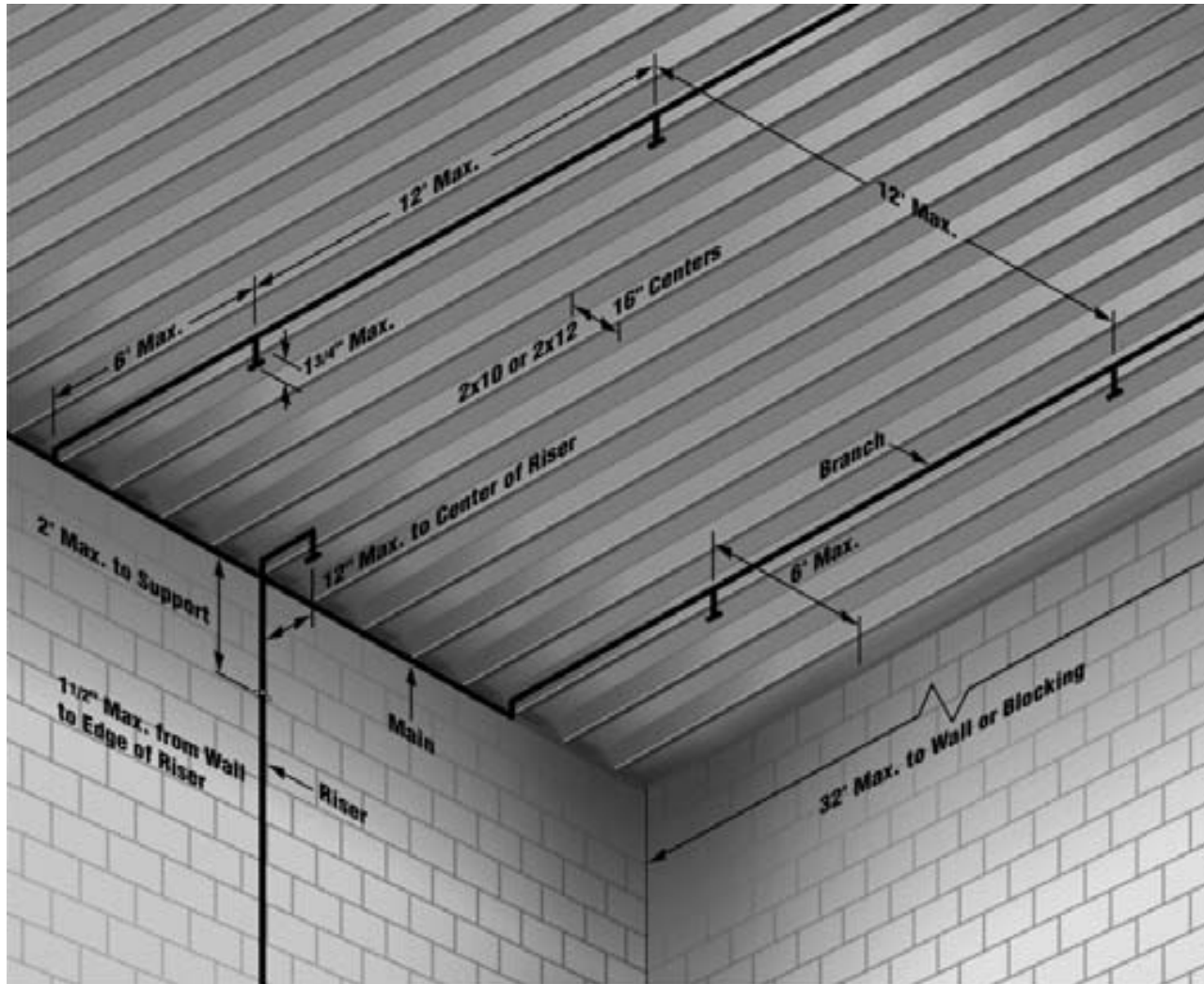
The ceiling shall be horizontal and constructed utilizing nominal 2 in. x 12 in. solid wood joists on 16 in. centers. When installing TFP BlazeMaster® CPVC pipe and fittings in conjunction with 2 in. x 12 in. solid wood joists, the maximum system working pressure under flowing conditions shall not exceed 100 psi and the maximum system working pressure under static (nonflowing) conditions shall not exceed 175 psi.

2. The distance from the floor to the bottom of the solid wood joists shall be between 7 ft and 8 ft.
3. Listed residential pendent sprinklers with a maximum temperature rating of 155°F and a minimum K-factor of 3.0 are to be used for this type of installation. The maximum sprinkler spacing shall not exceed 12 feet. The system is to be designed based upon the Listed flows for the sprinkler selected except that the flow for a single sprinkler flowing is to be not less than 10 gpm and the flow for multiple sprinklers flowing is to be not less than 8 gpm per sprinkler. The sprinklers are to be installed with their deflectors a maximum of 1-3/4 in. below the bottom of the solid wood joists in anticipation of future installation of a finished ceiling. (reference NFPA 13D, Section 4-2.4, 1999 Edition)
4. All system mains shall be run perpendicular to the joists. All branch lines shall be run parallel to the joists.

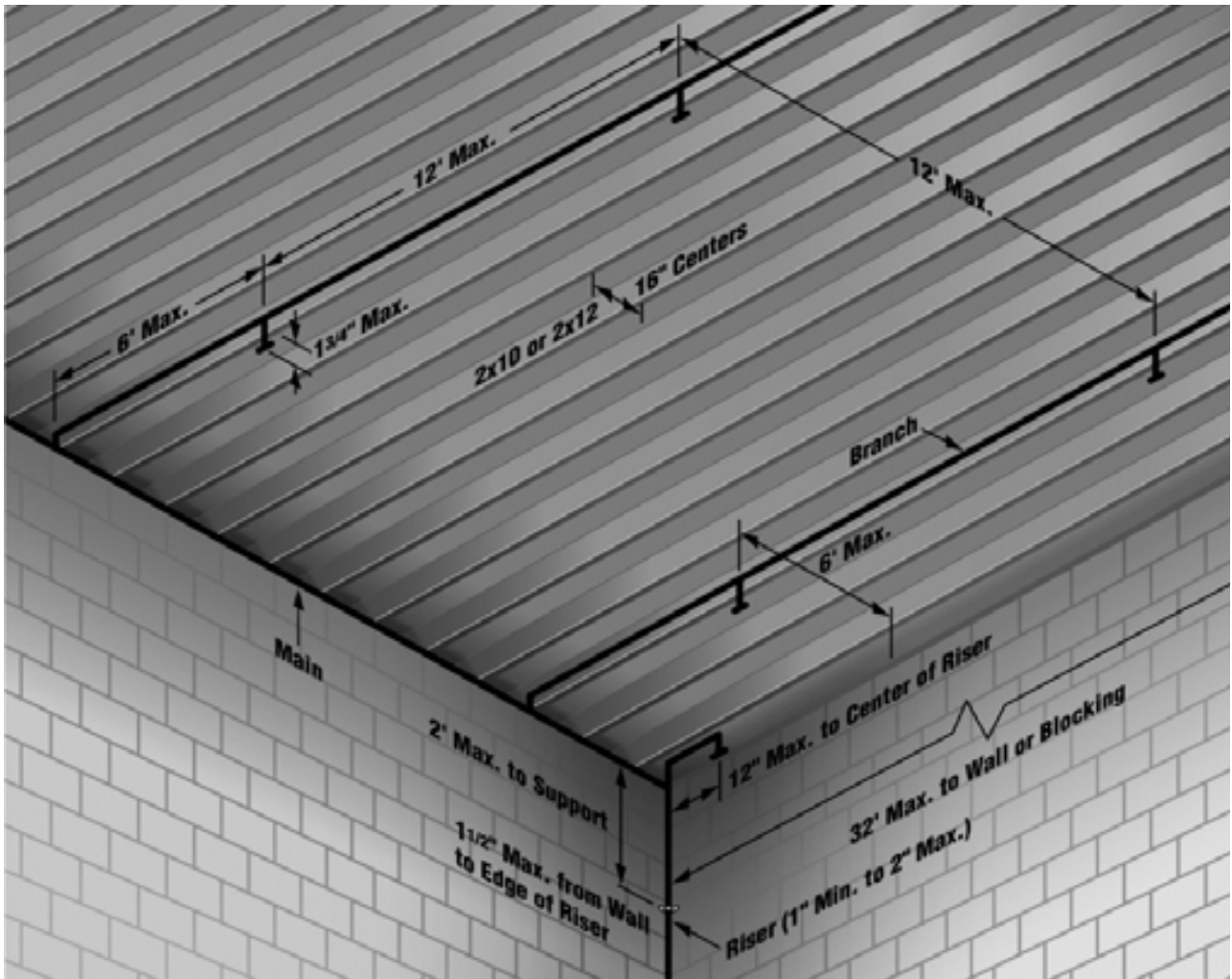
Center Wall Riser with Center Room Main



Center Wall Riser with Main at Wall



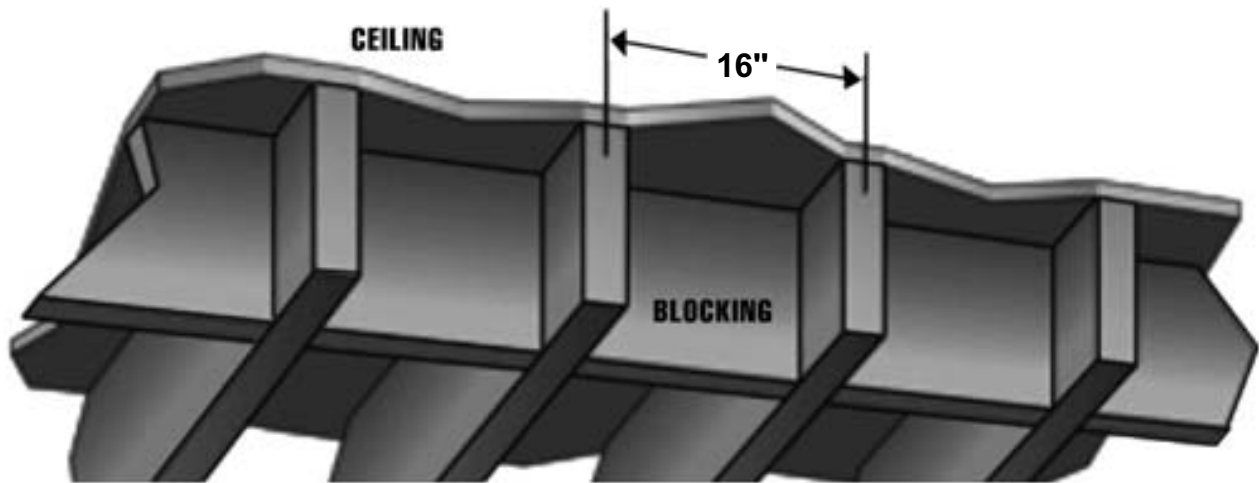
Riser in Corner



5. For installations incorporating 2 in. x 10 in. solid wood joists, all solvents cement joints should be made with TFP-400 or TFP-500 One Step Solvent Cement.

For installations incorporating 2 in. x 12 in. solid wood joists, all solvent cement joints shall be made with TFP-500 One Step Solvent Cement.

6. When the total protected area exceeds 1,000 square feet, blocking shall be utilized to divide the area into individual compartments not exceeding 1,000 square feet. The maximum length along the joist shall not exceed 32 feet. When the length exceeds 32 feet, blocking shall be utilized. The blocking shall be constructed of minimum 1/2 in. plywood and shall be the full depth of the wood joists.



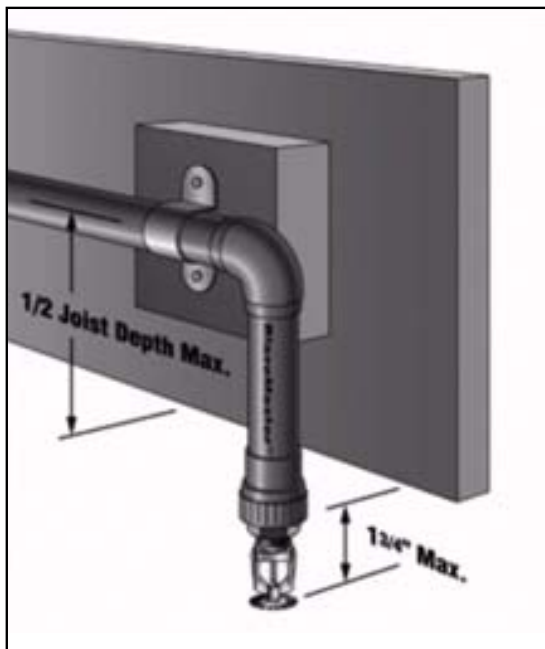
7. When installing TFP BlazeMaster® CPVC pipe and fittings perpendicular (system mains) to the solid wood joists, listed support devices for thermoplastic sprinkler piping or other listed support devices shall be used which mount the piping directly to the bottom of the solid wood joists. As an alternative to mounting the pipe and fittings below the solid wood joists, it is also acceptable to cut holes in the solid wood joists at or below the center of the depth of the solid wood joist for support – the holes should be oversized to allow for movement and located to not impair the structural integrity of the joists.

CAUTION: When drilling holes in the solid wood joists, the structural integrity must be maintained. Consult the Authority Having Jurisdiction (AHJ) or building code for requirements.

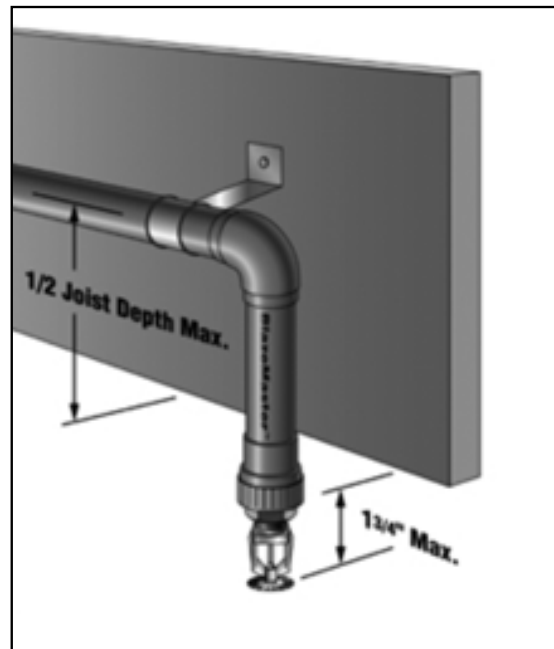
8. When installing TFP BlazeMaster® CPVC pipe and fittings parallel (branch lines) to the solid wood joists, the pipe and fittings shall be installed in the cavity below the bottom of the ceiling and above the bottom of the joist. The branch lines shall be located at or below the center of the depth of the solid wood joist. The pipe shall be installed utilizing listed support devices for thermoplastic sprinkler piping or other listed support devices which mount the piping directly to nominal 2 in. wood blocking or listed support devices for thermoplastic sprinkler piping which offset the pipe a nominal distance of 1-1/2 in. from the solid wood joists.

9. The instructions shown here for Unfinished Basements with Exposed Solid Wood Joists require the use of Schedule 80 fittings for installations of 1-1/2" sizes and larger. Grinnell Flameaway fittings may not be used with TFP BlazeMaster® CPVC pipe for Unfinished Basements with Exposed Solid Wood Joist installations.

Branches Supported with Blocking



Branches Supported with Hangers



Use of TFP BlazeMaster® CPVC pipe and fittings is limited to basements where the quantity and combustibility of contents is low and fires with relatively low rates of heat release are expected.

Use of CPVC Products in Combustible Attic Spaces with Specific Use Sprinklers

Product Description

In accordance with the UL listing, the Central Sprinkler Corporation Specific Application Attic Sprinklers are specific application sprinklers designed to provide protection of specific light hazard combustible, as well as non-combustible, attic spaces requiring sprinkler protection. The Specific Application Attic Sprinklers can allow for the use of BlazeMaster CPVC pipe and fittings within the attic space provided the attic space is protected with Specific Application Attic Sprinklers and the BlazeMaster CPVC pipe and fittings are only used to feed the wet system sprinklers below the ceiling. The Specific Application Attic Sprinklers cannot be installed with BlazeMaster CPVC pipe and fittings.

Installation Requirements

When using the Specific Application Attic Sprinklers, the system below the ceiling can be installed with BlazeMaster CPVC pipe and fittings provided both systems are installed in accordance with the Technical Data Sheet for the Specific Application Attic Sprinklers (reference Technical Data Sheet 6-1.0).

Support and Hanger Recommendations for TFP BlazeMaster[®] Fire Sprinkler Systems

Special care must be exercised when selecting the appropriate hanger or support method for TFP BlazeMaster[®] CPVC fire sprinkler systems.

TFP BlazeMaster[®] CPVC fire sprinkler systems may be supported as follows:

- Using the same hangers as metal piping systems that meet the requirements of this section.
- Using hangers specifically listed for thermoplastic sprinkler piping.
- Using any other support method acceptable to the local Authority Having Jurisdiction.

The pipe size of the hanger shall be the same size as the supported pipe, and the hanger shall be applied to the pipe (i.e., not the fittings). Horizontal runs of piping must be braced so that stress loads (caused by bending or snaking the pipe) will not be placed on a fitting or joint. In jurisdictions that do not allow plastic to metal contact, plastic sleeves or vinyl electrical tape should be used to isolate the materials. Strapping pipe overly tight to a structural member may cause damage to the pipe when pressurized. The pipe should be held snugly by the hanger, but cannot be pinched or crushed in any way. Pipe hangers must comply with the appropriate Standard, NFPA 13, NFPA 13D, or NFPA 13R, whichever applies.

Some hangers designed for metal pipe are suitable for use with TFP BlazeMaster[®] CPVC fire sprinklers systems. The hanger shall not have rough or sharp edges, which can come in contact with the pipe. Pipe hangers must have a load bearing surface at least 1/2" wide.

There are several types of hangers, which have been specifically listed as "Support Devices For Thermoplastic Piping" such as the Tolco (Fig. 22, 23, 24), Afcon (Model 510, 511, 512) or Erico (Model 7FL or 8FL). Please consult the specific manufacturer for information on the appropriateness of these devices as hangers and/or vertical restraining devices.

Two types of hangers have been specifically listed as "Support Devices For Thermoplastic Piping". For complete installation and positioning requirements for the "Headset TM" and "No-Block TM" hangers refer to their individual Technical Data Sheet. With the provided fasteners, they are designed for direct attachment to the side of a structural wood joist or structural composite wood joist (minimum 3/8 inch thick OSB web member or equivalent).

- The Model SHB1 "Head Set" sprinkler head mounting bracket is listed for use with 3/4, 1, 1-1/4, 1-1/2 and 2 in. CPVC pipe. The "Head Set" restrains against upward movement of the sprinkler head, as well as pre-positions the sprinkler for the future ceiling. By simply aligning the appropriate serration on the depth tab with the bottom of the ceiling joist, the installer is assured of the proper sprinkler to ceiling fit. Due to the unique design of the "Head Set" hanger, no additional "blocking" is required to allow for clearance of the sprinkler escutcheon from the edge of the ceiling joist.
- The Models S012, S016, S020, S024, S032 Offset strap "No Block" hangers are listed for use with 3/4, 1, 1-1/4, 1-1/2 and 2 in. CPVC pipe. The "No Block" is a simple two-hole strap for hanging CPVC pipe in joist channels. With "No Block" hangers, there is no longer the need to nail "blocking" to the beam. The offset strap positions the face of the CPVC pipe 1-1/2" off the face of the joist from which it is being hung.

PLUMBERS TAPE OR J HOOKS ARE NOT RECOMMENDED WITHOUT SHIELDING FOR ROUGH EDGES IN NFPA 13D APPLICATIONS.

Garage Installation Specifications

Scope of Use

Garage Installation Specifications shall only apply for the installation of UL Listed BlazeMaster[®] CPVC pipe and fittings in garages requiring sprinkler protection per NFPA 13D and NFPA 13R. These Standards are defined in NFPA codes entitled "One and Two Family Dwellings and Mobile Homes" and in "Residential Occupancies up to Four Stories in Height". As referenced in NFPA 13D Section 4-6, Exception Number 3, "Sprinklers are not required in garages, open attached porches, carports or similar structures." The installation of TFP BlazeMaster[®] sprinkler pipe and fittings for use in garages requiring sprinkler protection per NFPA 13R is only applicable to the UL Listing of this product.

Requirements for Pipe, Fittings, Solvent Cement Systems, System Design, Installation, Freeze Protection, and Penetrating Fire Related Walls and Partitions are covered in this installation and technical manual. Please read these sections of the manual carefully prior to designing or installing TFP BlazeMaster[®] pipe and fittings for garage installations. **The installation of TFP BlazeMaster[®] pipe and fittings in garages requiring sprinklers is only UL Listed and is not C-UL Listed or Factory Mutual Research Approved.**

Installation Requirements

Protection: TFP BlazeMaster[®] CPVC pipe and fittings shall be installed concealed behind protection consisting of a minimum of one layer of 3/8" thick gypsum wallboard or 1/2" thick plywood.

Sprinkler Requirements: UL Listed pendent or sidewall sprinklers with a maximum temperature rating of 170 degrees F shall be utilized. All sprinklers shall be installed per the manufacturer's published installation instructions.

Installation Standard: The Listing for Garage Installations shall pertain to those occupancies defined by NFPA 13R.

Handling & Storage

Handling

TFP BlazeMaster[®] CPVC pipe and fittings are boxed for ease of handling and storage, minimizing the potential damage of pipe and fittings due to transit and storage.

CPVC piping products have a lower impact strength as compared to metal piping products. Pipe fittings, cartoned or loose, should **never** be tossed or thrown to the ground. Pipe should **never** be dropped or dragged on the ground (ie; when unloaded from a truck) and should remain boxed until ready for use. Impact cracks, splits or scratches can weaken or damage the pipe and fittings. Heavy or sharp objects should not be thrown into or against CPVC pipe or fittings. When handling plastic pipe, please ensure that the pipe is well supported and sagging is minimized.

**VERY COLD WEATHER WILL MAKE PLASTIC PIPE AND FITTINGS BRITTLE.
EXTRA CARE DURING HANDLING SHOULD BE TAKEN TO PREVENT DAMAGE.**

Pipe and fittings should always be inspected for damage before actual installation. Pipe or fittings with cuts, gouges, scratches, splits or other signs of damage from improper handling or storage should not be used. Damaged sections on lengths of pipe can easily be cut out using proper techniques for cutting BlazeMaster[®] CPVC pipe.

Storage

TFP BlazeMaster[®] pipe (un-boxed) must be covered with a non-transparent material when stored out of doors for extended periods of time. Brief exposure to direct sunlight on the job site may result in color fade, but will not affect physical properties. TFP BlazeMaster[®] pipe and fittings can be stored in their original containers to keep them free from dirt and reduce the possibility of damage.

When storing inside, TFP BlazeMaster[®] pipe and fittings should be kept in a well ventilated area, away from steam-lines or other types of heat sources. TFP BlazeMaster[®] pipe and fittings should always be stored in the original packaging to eliminate color fading and possible damage until needed for use.

Pipe should be stored on a clean, flat surface that provides an even support for the entire length of the pipe. When palletized pipe is stored, insure that the wooden pallet bracings are in full contact with each other. Loose pipe should be stored in original packaging from previously used CPVC BlazeMaster[®] pipe. When storing pipe on racks, the racks should have continuous or close support arms to prevent the pipe from sagging. Plastic pipe fittings should be stored in their original cartons, on pallets. The cartons should then be wrapped with thin plastic sheeting to prevent moisture from causing the packaging to collapse. Pipe fittings should never be mixed in storage bins with metal fittings. **Special care shall be taken to avoid contamination of TFP BlazeMaster[®] pipe and fittings with petroleum based products such as cutting or packing oils that may be present on metallic system components.**

Handling of TFP BlazeMaster[®] Cements and Primers

Safety and Health Precautions: Prior to using CPVC primers and solvent cements, read the directions and take precautions found on the container labels, material safety data sheets and Standard Practice for Safe Handling, ASTM F402. Cements and primers contain volatile solvents, which evaporate rapidly. Avoid breathing the vapors and provide ventilation. If necessary, use a fan to keep the work area clear of fumes. Avoid skin or eye contact. Keep the cement can closed when not in use. If the cement thickens beyond its original consistency, discard it. Do not attempt to dilute it with primer or thinner, as this may change the character of the cement and make it ineffective.

Caution: CPVC solvent cement has a limited shelf life of approximately one to two years. Do not use the cement beyond the period recommended by the manufacturer as stated on can.

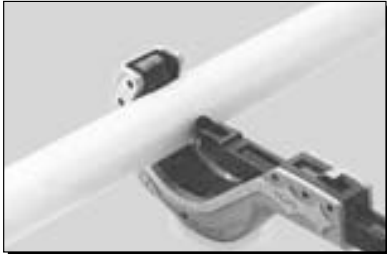
Solvent/Cementing Instructions

Solvent cementing is the only method of joining rigid CPVC pipe and fittings which provides a chemically fused joint. Solvent cementing procedures must be carefully followed. Field experience has shown that problems can occur with improperly solvent cemented joints.

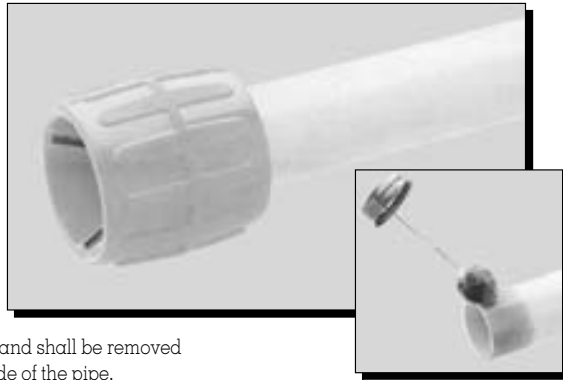
Follow the instructions presented below carefully. Do not omit any steps and ensure that all facets of installation are fully understood prior to commencing work. Please note the specific instructions and cure times for the "One-Step" TFP-400 and TFP-500 Solvent/Cements and the "Two-Step" TFP-100 Primer and TFP-200 are provided within this manual and must be followed carefully. TFP offers a demonstration program for installers which is outlined on Page 25 of this guide.

Joining TFP BlazeMaster® Pipe Systems

Cutting: BlazeMaster® pipe can be easily cut with a ratchet cutter, wheel-type plastic tubing cutter or a power or other fine toothed saw. To ensure the pipe is cut square, a miter box should be used when using a saw. Cutting the pipe as squarely as possible provides the surface of the pipe with maximum bonding area. Caution should be taken when cutting CPVC pipe in cold weather as a ratchet cutter shall not be used below 50°F (10°C) without warming the pipe.



Deburring: Burrs and filings can prevent proper contact between the pipe and fitting during assembly, and shall be removed from the outside and the inside of the pipe. A chamfering tool or file is suitable for this purpose. A slight bevel shall be placed at the end of the pipe as shown below. This will ease entry of the pipe into the socket and minimize the chance of wiping solvent cement from the fitting.



Fitting Preparation: Using a clean dry rag, wipe loose dirt and moisture from the fitting socket and pipe end. Moisture can slow the cure time, and at this stage of assembly, excessive water can reduce joint strength. Check the dry fit of the pipe and fitting. The pipe should enter the fitting socket easily ¼ to ¾ of the way. If the pipe bottoms in the fitting with little interference, use extra solvent cement in making the joint. **Before applying primer and/or solvent cement, appropriate safety precautions should be taken. Primer and cement must be stored between 40°F (4.4°C) and 100°F (38°C) and should be kept in the shade. Eliminate all ignition sources and do not smoke when using. Avoid breathing vapors. Use only with adequate ventilation; explosion-proof general mechanical ventilation or local exhaust is recommended to maintain vapor concentrations below recommended exposure limits. In confined or partially enclosed areas, a NIOSH approved organic vapor cartridge respirator with full face piece is recommended. Containers of primer and solvent cement should be closed when not in use. Avoid frequent contact with skin by wearing PVA coated protection gloves and an impervious apron are recommended. Contact with eyes can be avoided. Splash proof chemical goggles are recommended. For further information refer to Material Safety Data Sheets for TFP BlazeMaster® "Two Step" TFP-100 Primer and TFP-200 Solvent/Cement, and "One Step" TFP-400 and TFP-500 Solvent/Cements.**

Estimating Primer and Cement Requirements: The following guidelines are provided to allow estimation of TFP BlazeMaster® Primer and Cement quantities needed.

Primer and Cement Requirements

Fitting Size (in.)	One Step Solvent Cements No. of Joints per Quart	Two Step Solvent Cement No. of Joints per Quart	Two Step Primer No. of Joints per Quart
¾	260	270	810
1	170	180	540
1¼	125	130	390
1½	95	100	300
2	65	70	210
2½*	40	50	150
3*	30	40	120

Note: Use of solvent cement products other than those recommended by the TFP will void its warranty on BlazeMaster® pipe and fittings. **Caution: Avoid applying too much cement. Do not allow the cement to drip beyond the bottom of fitting socket. Excessive cement on the pipe and/or fitting can result in decreasing the overall strength of the pipe and/or fitting and may cause cracks when pressure is applied.**

"Two-Step" TFP-100 Primer Application: TFP BlazeMaster® TFP-100 primer is needed to prepare the bonding area for the addition of the TFP-200 cement and subsequent assembly. It is important to use a proper applicator - a dauber or paint brush approximately ½ the size of the pipe diameter is appropriate. A rag must not be used. Apply TFP BlazeMaster® TFP-100 primer to the outside of the pipe end and the inside of the fitting socket, re-dipping applicator as necessary to ensure entire surface is tacky. **Over application of TFP-100 primer can over-soften the pipe wall or fitting socket and can cause joint failure when pressurized. Please use extreme caution to ensure over-application of TFP-100 primer is avoided.**



“Two-Step” TFP-200 Solvent/Cement Application: TFP BlazeMaster® TFP-200 solvent/cement must be applied when the pipe surface is still tacky (not wet) from the primer. Joining surfaces should be penetrated and softened. TFP BlazeMaster® cement should be applied with a natural bristle brush ½ the size of the pipe diameter. A dauber may be used to apply cement on pipe sizes below 2 inches. For pipe sizes 2 inches and above, a roller is available to apply the cement. Apply a heavy, even coat of TFP-200 cement to the outside pipe end. Apply a medium coat to the fitting socket. If there was little interference when the dry fit was checked, a second application of cement should be made to the pipe end.

“One-Step” TFP-400 and TFP- 500 Solvent/Cement Application : Joining surfaces shall be penetrated and softened with TFP BlazeMaster® TFP-400 or TFP-500 solvent/cements. Cement must be applied to the pipe and fittings. Cement shall be applied (worked into pipe) with an applicator ½ the size of the pipe diameter. Apply a heavy, even coat of cement to the outside pipe end. Apply a medium coat to the fitting socket. Apply a second cement application on the pipe end. (Apply cement on the pipe end, in the fitting socket, and on the pipe again.) It is important to insure sufficient penetration of the solvent/cement into the pipe and fitting surface(s) by wiping the cement with the dauber until the pipe markings have been removed from the pipe surface. Usually 3-5 rotations around the pipe with the dauber are sufficient to achieve proper softening.

Assembly: Immediately insert the pipe into the fitting socket, while rotating the pipe ¼ turn. Properly align the fitting for the installation at this time. The pipe end must reach socket bottom. Hold assembly for 10 to 15 seconds to ensure initial bonding. A bead of cement should form around the outside of the pipe and the shoulder of the fitting. If this bead is not continuous around the socket shoulder, it may indicate that insufficient cement was applied. If insufficient cement is applied, cut out the joint, discard the fitting and begin once again. Cement in excess of the continuous bead should be wiped off with a rag.

Set and Cure Times: TFP BlazeMaster® solvent cement cure times are a function of pipe size, temperature, relative humidity, and tightness of fit. Drying time is faster in drier environments, smaller pipe sizes, high temperatures and tighter fits. **The assembly must be allowed to set, without any stress on the joint, for 1 to 5 minutes.** Larger sizes require longer set times. Following initial set period, the assembly can be handled carefully avoiding significant stresses to the joint. Refer to the following tables for **minimum cure times** prior to pressure testing.

TFP 100 & TFP 200 “Two Step” Solvent Cement

Pipe Size	40°F-120°F	0°F-39°F
3/4" -2"	48 hours	See Note 1
2 1/2"-3"	96 hours	See Note 1

See Note 3 for use of these products.

TFP 400 and TFP-500 “One Step” Solvent Cements

Pipe Size	Ambient Temperature During Cure Period		
	60°F-120°F	40°F-59°F	0°F-39°F
¾"	15 minutes	15 minutes	30 minutes
1"	15 minutes	30 minutes	30 minutes
1½"	15 minutes	30 minutes	2 hours

See Note 2 and 3 for use of these products.

TFP 400 and TFP-500 “One Step” Solvent Cements

Pipe Size	Ambient Temperature During Cure Period		
	60°F-120°F	40°F-59°F	0°F-39°F
¾"	45 minutes	1½ hours	24 hours
1"	45 minutes	1½ hours	24 hours
1½"	1½ hours	16 hours	120 hours
1½"	1½ hours	16 hours	120 hours
2"	6 hours	36 hours	See Note 1
2½"	8 hours	72 hours	See Note 1
3"	8 hours	72 hours	See Note 1

See Note 2 and 3 for use of these products.

TFP 400 and TFP-500 “One Step” Solvent Cement

Pipe Size	Ambient Temperature During Cure Period		
	60°F-120°F	40°F-59°F	0°F-39°F
¾"	1 hour	4 hours	48 hours
1"	1½ hour	4 hours	48 hours
1½"	3 hours	32 hours	10 days
1½"	3 hours	32 hours	10 days
2"	8hours	48 hours	See Note 1
2½"	24 hours	96 hours	See Note 1
3"	24 hours	96 hours	See Note 1

See Note 2 and 3 for use of these products.

Note 1: For this size pipe and fitting, the primer (if applicable) and solvent cement can be applied at temperatures below 40°F (4.5°C), however, the sprinkler system temperature must be raised to a temperature of 40°F (4.5°C) or above and allowed to cure per the above recommendations prior to pressure testing.

Note 2: Do not mix TFP-400 and TFP-500 “One Step” Solvent Cements with one another as each is a different formulation and has not been investigated for performance.

Note 3: LPCB Approval does not recognize nor accept the use of the TFP-100 and TFP-200 “Two Step” Solvent Cement process as only “One Step” TFP-400, and TFP-500 Solvent Cement products have been tested and approved for use.

Special Notes: The cure time can be accelerated with Solvent Cement systems by use of external heating methods to warm the surface of the pipe and fittings to temperatures of 40°F (4.5°C) or higher. Caution **shall** be used in heating surfaces of pipe and fittings due to the flammable nature of Solvent/Cement. Use of excessive heat on cold TFP BlazeMaster® pipe and fittings can cause the piping system to snake and bend, thus moving unanchored drops and pipe runs.

Extra set and cure time should be allowed in colder temperatures. In extremely hot temperatures, make sure both surfaces to be joined are still wet with cement when putting them together.

Pressure Testing the System: Once an installation is completed and cured per the recommendations, the system shall be pressure tested at 200 psi (1379 kPa) for two hours, or at 50 psi (345 Kpa) in excess of the static pressure, when the maximum water pressure to be maintained in the system is in excess of 150 psi (1,034 Kpa), in accordance with the requirements established by NFPA Standard 13, 13R, 13D or 24 as applicable. (Note: 175 psi (1210 kPa) is the maximum rated continuous working pressure.) Sprinkler systems in one and two family dwellings and mobile homes may be tested at line pressure in accordance with the requirements established by NFPA 13D, Section 1-5.4.

When pressure testing the system, the sprinkler system shall be filled with water and the air bled from the highest and farthest sprinkler heads before test pressure is applied. **Air or compressed gas should never be used for pressure testing.** If a leak is found, the fitting shall be cut out and discarded. A new section can be installed using couplings.

Warning: Sprinkler heads shall be installed only after all the CPVC pipe and fittings, including the sprinkler head adapters, are solvent welded to the piping and allowed to cure for a minimum of 30 minutes. Sprinkler head fittings should be visually inspected and probed with a wooden dowel to insure that the water way and threads are clear of any excess cement that may restrict the flow of water before installing the sprinkler head. Once the installation is complete and **cured per Tables U, V, W, or X**, the system shall be hydrostatically tested. It is an unacceptable practice to install sprinklers into the head adapter fittings and then solvent cement to the drop.

Transition to Other Materials

Female brass insert thread adapters, grooved pipe adapters or flanges shall be used when connecting a TFP BlazeMaster® system to other piping materials. Special brass threaded adapters are used for connection to sprinkler heads.

A thread sealant should be used when making a threaded connection. TFE (Teflon) thread tape is the only recommended sealant and must be used with all threaded connections. The use of other thread sealants may result in damage to the BlazeMaster® CPVC. Teflon tape should be wrapped in the direction of the threads for the entire length of the thread. Generally, 2 to 3 wraps is sufficient to obtain a leak free seal.

Cautions For Transition to Other Materials

Care must be taken when transition is made to dissimilar materials. **Brass inserts used in male and female threaded and grooved CPVC adapters may create galvanic reaction with steel and iron drop nipples, pipe, and cast fittings in certain water conditions. If you are unsure of the potential for galvanic reaction to occur, verify the water condition and conductivity of the water being used in the sprinkler system piping prior to installation. Brass threaded nipples are recommended when using brass inserted threaded BlazeMaster® CPVC fittings to reduce the potential of galvanic reaction caused by dissimilar metals.**

Care must be taken to avoid over-torquing – usually 1 to 2 turns beyond finger tight is all that is required to make up a threaded connection. TFP recommends between 14 and 21 foot pounds of torque to achieve a leak free seal. **Note: Torquing on the body of the sprinkler head adapter or female adapter without holding back on the brass threaded connector may damage the fitting and will void the published TFP warranty. When transitioning from steel piping systems to a BlazeMaster® CPVC piping system via grooved coupling adapters, female adapters, or flanges, caution must be taken to ensure that all hydrocarbons and/or cutting oils are removed from the system piping as petroleum based substances can stress fail CPVC products causing leakage and/or breakage.** The instructions for transitioning to other materials are specifically for TFP produced BlazeMaster® CPVC fittings. Should other Listed BlazeMaster® CPVC fittings be used in conjunction with TFP BlazeMaster® CPVC products, please consult the fitting manufacturer's installation and design manuals.

Flanged Connections

Piping runs joined by flanges shall be installed in a straight line position to avoid over stressing the flange due to misalignment. Piping must also be secured to prevent lateral movement which can create stress and damage the flange.

- A. With gasket in place, align the bolt holes of the mating flanges by rotating the ring into position. (Consideration should be given to alignment of a One-Piece Flange prior to joining with pipe.)
- B. Insert all bolts, washers (two standard flat washers per bolt), and nuts.
- C. Make sure the faces of the mating surfaces are flush against gasket prior to bolting down the flanges.
- D. Tighten the nuts by hand until they are snug. Establish uniform pressure over the flange face by tightening the bolts in 5 ft-lb increments according to the sequence shown in Fig. Z3 following a 180° opposing sequence.
- E. Care must be taken to avoid "bending" the flange when joining a flange to a "raised face" flange, or a wafer style valve. Do not use bolts to bring together improperly mated flanges.

Caution: Unnecessary over-torquing will damage the flange.

Flange Size (in.)	Bolt Diameter (in.)	Torque (ft. lb)
¾ - 1½	½	10 - 15
2 - 3	¾	20 - 30

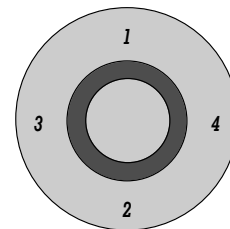


Fig. Z3

Tightening Sequence for Flange Bolt

Torque given is for dry, non lubricated bolt, standard washers, neoprene ¼" thick full face gasket. If lubricant (non-petroleum based) is used, torque levels may vary. Bolts, nuts, washers and gaskets are not furnished. Actual field conditions may require a variation in these recommendations.

Grooved Coupling Adapters

The following procedures are recommended for proper assembly of the Grooved Coupling Adapter. **READ THESE INSTRUCTIONS CAREFULLY BEFORE BEGINNING INSTALLATION.**

Inspect the fittings and pipe to insure that they are sufficiently free from indentations, projections or roll-marks on the gasket seating areas of the fitting and pipe. The pipe should be squarely cut. Any loose scale, paint and/or dirt must be removed from the groove and seating surfaces prior to assembly. **Use a standard grade EPDM-A* compound that is suitable for wet fire sprinkler service. A flexible coupling shall be used with grooved coupling adapters such as the TFP Figure 575, 705 or 707 Grooved flexible coupling. Caution: Use of rigid style couplings may damage the grooved coupling adapter. Consult the grooved coupling manufacturer for proper selection and installation instructions. Use of petroleum based lubricants will damage the gasket and may damage the adapter resulting in stress failure of the CPVC housing.**

*See manufacturer for temperature ratings.

Penetrating Fire Rated Walls & Partitions with TFP BlazeMaster® Piping

Consult the *Authority Having Jurisdiction* and building codes prior to penetrating fire rated walls and partitions. Several through-penetration firestop systems are UL Classified for use with CPVC pipe. TFP recommends the use of **BlazeMaster® Caulk and Walk®** for use with its BlazeMaster® pipe and fittings as this caulking product contains a water based intumescent which will not harm the CPVC compound as verified by BFGoodrich. For further information on Firestop systems, contact TFP or BFGoodrich.

Other Design Criteria

TFP BlazeMaster® piping systems shall be designed and installed so that the piping is not closely located to heat producing sources, such as light fixtures, ballasts and steam lines. Pipe must not be positioned directly over open ventilation grills. Finally, during periods of remodeling and renovations, appropriate steps must be taken to protect the piping from fire exposure if the ceiling is temporarily removed.

Since BlazeMaster® plastic is flexible compared to metallic sprinkler pipe, it has greater capacity to withstand earthquake damage. In areas subject to earthquakes, TFP BlazeMaster® systems should be designed and braced in accordance with local codes and NFPA Standard 13. For information regarding Bending Deflections and Snaking Deflections for given lengths of CPVC SDR 13.5 pipe, refer to Tables J & K on Page 6.

Freeze Protection

Whenever possible, TFP BlazeMaster® CPVC systems are recommended to be protected using Batt Insulation and building construction techniques which ensure adequate freeze protection and wind blocking. Batt insulation guidelines are provided by most local *Authorities Having Jurisdiction* with recommendations for NFPA 13D installations provided in the Appendix of the Standard. Local building code and *Authorities Having Jurisdiction* requirements **must** be followed carefully as misplaced or inadequate insulation and wind blocking can create localized freeze of the system piping which can result in damage to the structure and piping system. When adequate insulation and wind blocking are not available, TFP BlazeMaster® pipe and other Listed BlazeMaster® fittings can be protected with Glycerine antifreeze solutions only as outlined by NFPA 13 in areas that are subject to freezing.

The guidelines provided below should be followed when providing freeze protection for TFP BlazeMaster® CPVC pipe and fittings.

- The use of glycol based antifreeze solutions is specifically prohibited for use with BlazeMaster® CPVC systems.
- Prior to using Glycerine Antifreeze, consult the Local Authority Having Jurisdiction on the use of antifreeze solutions in fire sprinkler applications.
- Glycerin Antifreeze should only be used in TFP BlazeMaster® CPVC systems when purity levels of 96.5 USP Grade or higher are achieved. There are many manufacturers and distributors of Glycerine antifreeze, thus extreme care should be used when purchasing Glycerine antifreeze to ensure purity. Obtain material certifications and check the labeling on antifreeze solutions prior to usage in TFP Sprinkler BlazeMaster® CPVC systems.
- Glycerine antifreeze stored or mixed in contaminated barrels or containers may have serious and detrimental affects on the performance of TFP BlazeMaster® CPVC products. **Contaminated Glycerine can stress fail CPVC products causing leakage and deterioration of the piping system.**
- Glycerine and water solutions must be mixed properly and completely. If mixing an antifreeze solution for the piping system from concentrate/pure Glycerine antifreeze, you must completely agitate the antifreeze and water to ensure proper mixing. Glycerine antifreeze must not be pumped into the piping system with water without being fully mixed to ensure that the solution does not separate thus causing localized freeze of the system piping and increased chance of leakage in system components. Properly mixed Glycerine antifreeze and water solutions will not separate.
- Glycerine antifreeze should never be introduced into a piping system without mixing with water (excepting premixed solutions), since Glycerine antifreeze tends to thicken near 32 degrees Fahrenheit (0 degrees Celsius) thus increasing viscosity and reducing freeze protection.
- Do not hydro test Glycerine antifreeze designed sprinkler systems with water only prior to introducing Glycerine antifreeze as the potential for freezing in the drops is increased as the Glycerine solution will not fully mix with trapped water in sprinkler drops and sprinkler system low points.
- A Glycerine antifreeze sprinkler system is more prone to leakage than a water only sprinkler system. Glycerine antifreeze characteristics increase the capacity for leakage which can be successfully addressed by using care when making threaded connections by utilizing high quality teflon thread tape, and by ensuring sufficient torque is applied to the male and female threads being mated together. **TFP recommends between 14 and 21 foot pounds of torque to achieve a leak free seal. Do not use fittings or sprinklers with damaged threads in glycerine systems, as the damaged threads create increased leakage potential.**
- Glycerine antifreeze can be cleaned with alcohol based cleaners. Prior to using any cleaner on a surface, please ensure compatibility with the surface material to be cleaned. If compatibility with the surface to be cleaned is questionable, a small section of the surface should be spot cleaned prior to wide spread application of the cleaner.

NFPA References:

- NFPA 13 Section 4-5.2.3 indicates glycerine antifreeze solutions shall be prepared with a freezing point below the expected minimum temperature for the locality.
- NFPA 13 Section 4-5.2.3 also indicates antifreeze solutions shall be checked by hydrometer with suitable scale or refractometer having a scale calibrated for the antifreeze solution used.
- **NFPA 13 Section 4-5.3.2 requires the use of expansion chambers to accommodate for the expansion of the antifreeze solution when connection between the antifreeze system and wet pipe system incorporates the use of a backflow prevention device.**
- NFPA 13 Appendix A4-5.1 recommends the use of antifreeze in sprinkler systems **not exceeding** 40 gallons (151L).
- NFPA 13 Section 4-5.1 states "the use of antifreeze solutions shall be in conformity with state and local health regulations".

Batt Insulation Requirements and Suggestions

Many jurisdictions recommend the use of batt insulation for freeze protection in place of antifreeze solutions. These jurisdictions typically publish recommended batt insulation installation guidelines which provide the minimum thickness of insulation to be utilized. These **minimum** insulation recommendations should be followed. Insulation requirements may vary by geographic area given climate conditions. Batt insulation is used to maintain a minimum water temperature in the sprinkler piping of 40°F or 3°C. The minimum insulation recommendations pictured in the Appendix of NFPA 13D are shown primarily for piping wood frame ceilings with an unheated attic or an un-insulated roof above. Many jurisdictions do not allow the installation of water filled sprinkler piping in unheated outside walls. Consult with your local *Authority Having Jurisdiction* prior to installing batt insulation for freeze protection with TFP BlazeMaster® CPVC products.

Batt Insulation Installation Recommendations

NFPA 13D, The Standard for the Installation of Sprinkler Systems in One and Two-Family Dwellings and Manufactured Homes, Appendix A-4-3.1 recommends the following guidelines for use of batt insulation:

- "In areas subject to freezing, care should be taken to cover sprinkler piping completely in unheated attic spaces with insulation. Installation should follow the guidelines of the insulation manufacturer." (Figures A-4-3.1 (a) through (e) show several installation methods that can be considered.)
- A-4-3.1 (a) "It is important that the insulation be installed tight against the joists. In unheated areas, any spaces or voids between the insulation and the joists causes the water in the fire sprinkler piping to freeze."
- A-4-3.1 (b) "For areas having temperatures of 0°F (-18°C) or lower, an additional batt of insulation covering the joist and the fire sprinkler piping should be used. If this is not done, localized freeze-ups can occur in the sprinkler piping."
- A-4-3.1 (c) "Boring holes in the joist is one of the methods for locating the fire sprinkler piping in the ceiling. As an alternative, when temperatures are expected to be 0°F (-18°C) or lower, loose pieces of insulation should be stuffed in the bored holes around the piping."
- A-4-3.1 (d) (e) "Care should be taken to avoid compressing the insulation. This reduces its R value. To prevent potential freeze-ups of the sprinkler piping, the insulation should be tight against the joists."

Minimum insulation R value requirements are typically between R19 and R30; however, the minimum requirements **must** be verified with the *Authority Having Jurisdiction*.

TFP BlazeMaster® Systems and Penetration of Metal Studs

Please use extreme care when passing TFP BlazeMaster® pipe and fittings through metal studs as the sharp cut edges of these studs can scar or puncture thermoplastic pipe. TFP recommends the use of rubber or plastic gromets such as those commonly used in the plumbing industry for protection of the pipe when passing through such spaces. Please consult your local *Authority Having Jurisdiction* for additional information regarding the protection of thermoplastic pipe when passed through metal studs.

Solvent Cement and Primer Spills

The best protection from accidental spills of cement or primer is to protect the work area with drop cloths. If cement or primer comes in contact with fiberglass tub/shower enclosures, carpet or furniture, the excess cement or primer must be wiped up immediately before it sets. Once the cement or primer is dry, it is almost impossible to remove, especially the purple stain in the CPVC primer.

Immediate use of soap and water or a mild cleaner such as "Ajax" or "Comet" will remove the stain of the primer from a fiberglass tub/shower surface. Whatever method is used, test it on a small hidden area first to see if it removes the shine or color or softens the surface. If this happens, do not use.

The use of solvents such as alcohol, M.E.K., or acetone will usually work on tile sinks or floors but can do more damage than good on some synthetic materials. Caution should be used when trying any solvent to remove cement or primer from any surface. Always protect the work area before you start, both under and around where cement or primer spills can cause irreparable damage.

Joining TFP BlazeMaster® CPVC in Adverse Conditions

Joining TFP BlazeMaster® CPVC in Cold Weather

TFP BlazeMaster® TFP-200, TFP-400, and TFP-500 solvent cements are approved for cold weather usage down to 0°F (-17°C). The bonding of pipe and fittings is a function of temperature and time, so therefore very cold weather requires proper care and extra time be taken in joining pipe and fittings. Very cold weather will make TFP BlazeMaster® pipe and fittings brittle, extra care should be taken to prevent damage during handling.

Caution: Ratchet type cutters should never be used on pipe below 50°F (10°C) without warming the pipe first. Ratchet cutters tend to leave hair line cracks on the end of the pipe in cold weather. Additionally, dull pipe cutters should be checked as they may break the pipe prior to cutting through completely.

Follow the installation instructions when working in cold weather taking special note that solvents penetrate and soften the surfaces more slowly than in warm weather. (Assembly temperatures below 0°F (-17°C) are not in accordance with the UL and C-UL Listings.) Colder temperatures require greater cure time due to the slower evaporation of primer in solvent cements.

Cure charts are found in Tables U, V, W, and X. The following recommendations should be followed when cementing during cold weather.

1. Carefully read and follow all directions before installation.
2. Prefabricate as much of the system as possible in a heated working area.
3. Store cements and primers in a warmer area when not in use and make sure they remain fluid. Do not allow the cement to freeze or become "jelly-like". **Gelled cement shall be discarded.**
4. Take special care to remove moisture, including ice and snow.
5. Always use TFP-100 primer to soften the joining surfaces before applying TFP-200 cement if using the "Two Step" process.
6. When using TFP-400 or TFP-500 "One Step" solvent cements, Primer shall never be used.
7. Allow a longer cure period before the system is used.

Joining TFP BlazeMaster® CPVC in Hot Weather

CPVC solvent cements contain volatile solvents. Higher temperatures and/or wind accelerate evaporation. Pipe stored in direct sunlight may have surface temperatures of 20°F to 30°F above air temperatures. Solvents attack these hot surfaces deeper, therefore it is very important to **avoid puddling** the primer or cement inside the fitting socket. Always ensure that the excess cement and primer are wiped from the outside of the joint. Follow the standard installation instructions and take special note of the tips and cautions below.

1. Please refer to Table C on page 4 for the appropriate temperature related expansion and contraction information.
2. Store solvent cements and primers in a cool or shaded area prior to use.
3. If possible, store pipe and fittings, or at least the ends to be solvent welded, in a shady area before cementing.
4. Make sure that both surfaces to be joined are still wet with cement when putting them together. With larger size pipe more people may be required to complete application successfully.
5. Carefully read and follow all directions before installation.

Helpful Tips

Page No.

- Do not thread, groove, or drill into BlazeMaster® pipe. 20
- Always use tools specifically designed for plastic pipe and fittings. 20
- Refer to Tables for Thermal Expansion when large temperature changes are encountered. 20
- Always chamfer and debur CPVC pipe prior to installation. 20
- Do not use ratchet type cutters in temperatures below 50°F (10°C) without warming pipe. 20
- Air shipment of cement and primer is strictly prohibited by law (contact carriers for details). -
- When bottoming a joint, rotate ¼ turn if possible. If a particular alignment is required, dry mark your pipe and/or use the hash marks on the fittings. 21
- When solvent cementing, avoid sources of heat or open flame. 20
- PVA-coated protection gloves are recommended for use while solvent cementing. If hands come in contact with solvent cement, use a waterless abrasive soap. 20
- **DO NOT SMOKE.**
- Always hold the pipe end and fitting socket downward when applying primer and cement to prevent the solvents from running into the pipe or fitting socket. 21
- Do not bend, twist or pressure test a BlazeMaster® system until the recommended cure time has elapsed. 21
- Do not get solvent cement and primer in sprinkler heads and threads. 22
- Acetone, alcohol, or MEK (Methyl Ethyl Ketone) may be used to clean accidental spills of primer and cement from certain surfaces. 24
- Batt Insulation is the preferred method of insulation for TFP BlazeMaster® CPVC. Glycerine Antifreeze is the only approved antifreeze solution that can be used with CPVC products. 23 - 24

Material Safety Data for Primer Solvent Cements

Please review the Material Safety Data Sheets contained within this guide. As with all toxic products, extra precaution should be taken during use and all directions followed.

Training/Demonstration

TFP strongly recommends that installers receive hands on demonstration in the proper procedure(s) for installation of BlazeMaster® sprinkler systems. On-site demonstration in proper pipe preparation, solvent cementing, proper handling of CPVC and installation instruction is available from TFP at no charge. Upon completion of the BlazeMaster® demonstration program, TFP will issue a completion card to the persons successfully finishing the required subject matter. This demonstration card is to be carried when working on BlazeMaster® CPVC systems. For information about on-site demonstration, please contact your local TFP Distribution Center or your TFP sales representative.

TFP-100 PRIMER		MATERIAL SAFETY DATA SHEET		Date Revised: APR 1992 Supersedes: JUN 1990		
Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act and shall not be used for any other purpose. Tyco Fire Products Company urges the customer receiving this Material Safety Data Sheet to study it carefully to become aware of the hazards, if any, of the products involved. In the interest of safety, you should notify your employees, agents, and contractors of the information on this sheet.						
SECTION I						
MANUFACTURER'S NAME IPS Corporation for Tyco Fire Products			TRANSPORTATION EMERGENCIES: CHEMTREC: (800) 424-9300			
ADDRESS 451 North Cannon Avenue, Lansdale, PA 19446			Medical Emergencies: (213) 222-3212 (LA. Poison Center 24 Hr. No.) Business: (213) 321-6515			
CHEMICAL NAME AND FAMILY Mixture of Organic Solvents		TRADE NAME TFP-100 BLAZEMASTER PURPLE PRIMER for CPVC PLASTIC PIPE & FITTINGS				
		FORMULA Proprietary				
SECTION II - HAZARDOUS INGREDIENTS						
None of the ingredients below are listed as carcinogens by IARC, NTP or OSHA						
	CAS #	APPROX %	ACGIH-TLV	ACGIH-STEL	OSHA-PEL	OSHA-STEL
Tetrahydrofutan (THF)	109-99-9	45-55	200 PPM	250 PPM	200 PPM	250 PPM
Methyl Ethyl Ketone (MEK)	78-93-3	47*	200 PPM	300 PPM	200 PPM	300 PPM
Cyclohexanone	108-94-1	5-15	25 PPM Skin		25 PPM Skin	
*Title III Section 313 Supplier Notification: This product contains toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and of 40CFR372. This information must be included in all MSDS's that are copied and distributed for this material.						
SHIPPING INFORMATION DOT Hazard Class: Flammable Liquid DOT Shipping Name: Flammable Liquid, N.O.S. (Tetrahydrofuran, Methyl Ethyl Ketone) Identification Number: UN 1993		SPECIAL HAZARD DESIGNATIONS				
		HEALTH:	HMIS 2	NFPA 2	HAZARD RATING 0 - MINIMAL	
		FLAMMABILITY:	3	3	1 - SLIGHT	
		REACTIVITY:	0	1	2 - MODERATE	
		PROTECTIVE EQUIPMENT:	H		3 - SERIOUS	
					4 - SEVERE	
SECTION III - PHYSICAL DATA						
APPEARANCE Purple or Clear, thin liquid	ODOR Ethereal	BOILING POINT (°F/°C) 151°F based on first boiling component: THF				
SPECIFIC GRAVITY @ 73 +/-2°F Typical 0.870 +/-0.040	VAPOR PRESSURE (mm Hg.) 143 mm Hg. Based on first boiling component, THF @ 20°C	PERCENT VOLATILE BY VOLUME (%) 100%				
VAPOR DENSITY (Air = 1) 2.49	EVAPORATION RATE (BUAC = 1) > 1.0	SOLUBILITY IN WATER Completely soluble in water				
VOC STATEMENT: This cement contains 850 grams of VOC per liter as manufactured. More than 60 percent of the VOC acts as a reactive diluent and remains in the joint.						
SECTION IV - FIRE AND EXPLOSION HAZARD DATA						
FLASH POINT 6°F T.C.C. Based on THF	FLAMMABLE LIMITS (Percent by Volume)			LEL 2.0	UEL 11.8	
FIRE EXTINGUISHING MEDIA Ansul "Purple K" potassium bicarbonate dry chemical, carbon dioxide, National Aer-O-Foam universal alcohol resistant foam, water spray.						
SPECIAL FIRE FIGHTING PROCEDURES Evacuate enclosed areas, stay upwind. Close or confined quarters require self-contained breathing apparatus, positive pressure hose masks or airline masks. Use water spray to cool containers, to flush spills from source of ignition and to disperse vapors.						
UNUSUAL FIRE AND EXPLOSION HAZARDS Fire hazard because of low flash point and high volatility. Vapors are heavier than air and may travel to source of ignition.						

SECTION V - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY: x Inhalation x Skin Contact Eye Contact Ingestion

EFFECT OF OVEREXPOSURE
ACUTE: Inhalation: Severe overexposure may result in nausea, dizziness, headache. Can cause drowsiness, irritation of eyes and nasal passages.
Skin Contact: Skin irritant. Liquid contact may remove natural skin oils resulting in skin irritation. Dermatitis may occur with prolonged contact.
Skin Absorption: Prolonged or widespread exposure may result in the absorption of harmful amounts of material.
Eye Contact: Overexposure may result in severe eye injury with corneal or conjunctive inflammation on contact with the liquid. Vapors slightly uncomfortable.
Ingestion: Moderately toxic. May cause nausea, vomiting, diarrhea. May cause mental sluggishness.
CHRONIC: Symptoms of respiratory tract irritation and damage to respiratory epithelium were reported in rats exposed to 5000 ppm for 90 days. Elevation of SGPT suggests a disturbance in liver function. The NOEL was reported to be 200 ppm.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Individuals with pre-existing diseases of the eyes, skin or respiratory system may have increased susceptibility to the toxicity of excessive exposures.

EMERGENCY AND FIRST AID PROCEDURES
Inhalation: If overcome by vapors, remove to fresh air and if breathing stopped, give artificial respiration. If breathing is difficult, give oxygen. Call physician.
Eye Contact: Flush eyes with plenty of water for 15 minutes and call a physician.
Skin Contact: Remove contaminated clothing and shoes. Wash skin with plenty of soap and water for at least 15 minutes. If irritation develops, get medical attention.
Ingestion: Give 1 or 2 glasses of water or milk. Do not induce vomiting. Call physician or poison control center immediately.

SECTION VI - REACTIVITY

STABILITY	UNSTABLE		CONDITIONS TO AVOID Keep away from heat, sparks, open flame and other sources of ignition.
	STABLE	x	

INCOMPATIBILITY (MATERIALS TO AVOID) Caustics, ammonia, inorganic acids, chlorinated compounds, strong oxidizers and isocyanates.

HAZARDOUS DECOMPOSITION PRODUCTS
 When forced to burn, this product gives out carbon monoxide, carbon dioxide, hydrogen chloride and smoke.

HAZARDOUS POLYMERIZATION	MAY OCCUR	WILL NOT OCCUR	CONDITIONS TO AVOID Keep away from heat, sparks, open flame and other sources of ignition
		x	

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
 Eliminate all ignition sources. Avoid breathing of vapors. Keep liquid out of eyes. Flush with large amount of water. Contain liquid with sand or earth. Absorb with sand or nonflammable absorbent material and transfer into steel drums for recovery or disposal. Prevent liquid from entering drains.

WASTE DISPOSAL METHOD
 Follow local, State and Federal regulations. Consult disposal expert. Can be disposed of by incineration. Excessive quantities should not be permitted to enter drains. Empty containers should be air dried before disposing. Hazardous Waste Code: 214.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type)
 Atmospheric levels should be maintained below established exposure limits contained in Section II. If airborne concentrations exceed those limits, use of a NIOSH-approved organic vapor cartridge respirator with full face-piece is recommended. The effectiveness of an air purifying respirator is limited. Use it only for a single short-term exposure. For emergency and other conditions where short term exposure guidelines may be exceeded, use an approved positive pressure self-contained breathing apparatus.

VENTILATION
 Use only with adequate ventilation. Provide sufficient ventilation in volume and pattern to keep contaminants below applicable exposure limits set forth in Section II. Use only explosion proof ventilation equipment.

PROTECTIVE GLOVES PVA Coated	EYE PROTECTION Splashproof chemical goggles
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OTHER PROTECTIVE EQUIPMENT AND HYGIENIC PRACTICES
 Impervious apron and a source of running water to flush or wash the eyes and skin in case of contact.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
 Store in the shade between 40°F - 110°F. Keep away from heat, sparks, open flame and other sources of ignition. Avoid prolonged breathing of vapor. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Train employees on all special handling procedures before they work with this product.

OTHER PRECAUTIONS
 Follow all precautionary information given on container label and solvent cementing literature. Follow good industrial safety practices. All handling equipment should be electrically grounded.

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of this data or the results to be obtained from the use thereof.

TFP-200 SOLVENT/CEMENT		MATERIAL SAFETY DATA SHEET		Date Revised: APR 1992 Supersedes: JUN 1990		
Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act and shall not be used for any other purpose. Tyco Fire Products Company urges the customer receiving this Material Safety Data Sheet to study it carefully to become aware of the hazards, if any, of the products involved. In the interest of safety, you should notify your employees, agents, and contractors of the information on this sheet.						
SECTION I						
MANUFACTURER'S NAME IPS Corporation for Tyco Fire Products			TRANSPORTATION EMERGENCIES: CHEMTREC: (800) 424-9300			
ADDRESS 451 North Cannon Avenue, Lansdale, PA 19446			Medical Emergencies: (213) 222-3212 (L.A. Poison Center 24 Hr. No.) Business: (213) 321-6515			
CHEMICAL NAME AND FAMILY Mixture of CPVC Resin and Organic Solvents			TRADE NAME TFP-200 BLAZEMASTER ORANGE CEMENT for CPVC PLASTIC PIPE & FITTINGS			
			FORMULA Proprietary			
SECTION II - HAZARDOUS INGREDIENTS						
None of the ingredients below are listed as carcinogens by IARC, NTP or OSHA						
	CAS #	APPROX %	ACGIH-TLV	ACGIH-STEL	OSHA-PEL	OSHA-STEL
Chlorinated Polyvinyl Chloride Resin	NON/HAZ		N/A		N/A	
Tetrahydrofutan (THF)	109-99-9	50-70	200 PPM	250 PPM	200 PPM	250 PPM
Methyl Ethyl Ketone (MEK)	78-93-3	15*	200 PPM	300 PPM	200 PPM	300 PPM
Cyclohexanone	108-94-1	5-15	25 PPM Skin		25 PPM Skin	
*Title III Section 313 Supplier Notification: This product contains toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and of 40CFR372. This information must be included in all MSDS's that are copied and distributed for this material.						
SHIPPING INFORMATION DOT Hazard Class: Flammable Liquid DOT Shipping Name: Cement Identification Number: NA 1133			SPECIAL HAZARD DESIGNATIONS			
			HMIS	NFPA	HAZARD RATING	
			HEALTH: 2	2	0 - MINIMAL	
			FLAMMABILITY: 3	3	1 - SLIGHT	
			REACTIVITY: 0	1	2 - MODERATE	
			PROTECTIVE EQUIPMENT: H		3 - SERIOUS	
					4 - SEVERE	
SECTION III - PHYSICAL DATA						
APPEARANCE Tan or gray, medium syrupy liquid	ODOR Ethereal		BOILING POINT (°F/°C) 151°F based on first boiling component: THF			
SPECIFIC GRAVITY @ 73 +/-2°F Typical 0.968 +/-0.040	VAPOR PRESSURE (mm Hg.) 143 mm Hg. Based on first boiling component, THF @ 20°C		PERCENT VOLATILE BY VOLUME (%) Approx: 80 - 90%			
VAPOR DENSITY (Air = 1) 2.49	EVAPORATION RATE (BUAC = 1) > 1.0		SOLUBILITY IN WATER Solvent portion completely soluble in water Resin portion separates out.			
VOC STATEMENT: This cement contains 760 grams of VOC per liter as manufactured. More than 60 percent of the VOC acts as a reactive diluent and remains in the joint.						
SECTION IV - FIRE AND EXPLOSION HAZARD DATA						
FLASH POINT 6°F T.C.C. Based on THF		FLAMMABLE LIMITS (Percent by Volume)		LEL	UEL	
				2.0	11.8	
FIRE EXTINGUISHING MEDIA Ansul "Purple K" potassium bicarbonate dry chemical, carbon dioxide, National Aer-O-Foam universal alcohol resistant foam, water spray.						
SPECIAL FIRE FIGHTING PROCEDURES Evacuate enclosed areas, stay upwind. Close or confined quarters require self-contained breathing apparatus, positive pressure hose masks or airline masks. Use water spray to cool containers, to flush spills from source of ignition and to disperse vapors.						
UNUSUAL FIRE AND EXPLOSION HAZARDS Fire hazard because of low flash point and high volatility. Vapors are heavier than air and may travel to source of ignition.						

SECTION V - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY: <input checked="" type="checkbox"/> Inhalation <input checked="" type="checkbox"/> Skin Contact <input type="checkbox"/> Eye Contact <input type="checkbox"/> Ingestion			
EFFECT OF OVEREXPOSURE ACUTE: <u>Inhalation:</u> Severe overexposure may result in nausea, dizziness, headache. Can cause drowsiness, irritation of eyes and nasal passages. <u>Skin Contact:</u> Skin irritant. Liquid contact may remove natural skin oils resulting in skin irritation. Dermatitis may occur with prolonged contact. <u>Skin Absorption:</u> Prolonged or widespread exposure may result in the absorption of harmful amounts of material. <u>Eye Contact:</u> Overexposure may result in severe eye injury with corneal or conjunctive inflammation on contact with the liquid. Vapors slightly uncomfortable. <u>Ingestion:</u> Moderately toxic. May cause nausea, vomiting, diarrhea. May cause mental sluggishness. CHRONIC: Symptoms of respiratory tract irritation and damage to respiratory epithelium were reported in rats exposed to 5000 ppm for 90 days. Elevation of SGPT suggests a disturbance in liver function. The NOEL was reported to be 200 ppm.			
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Individuals with pre-existing diseases of the eyes, skin or respiratory system may have increased susceptibility to the toxicity of excessive exposures.			
EMERGENCY AND FIRST AID PROCEDURES <u>Inhalation:</u> If overcome by vapors, remove to fresh air and if breathing stopped, give artificial respiration. If breathing is difficult, give oxygen. Call physician. <u>Eye Contact:</u> Flush eyes with plenty of water for 15 minutes and call a physician. <u>Skin Contact:</u> Remove contaminated clothing and shoes. Wash skin with plenty of soap and water for at least 15 minutes. If irritation develops, get medical attention. <u>Ingestion:</u> Give 1 or 2 glasses of water or milk. Do not induce vomiting. Call physician or poison control center immediately.			

SECTION VI - REACTIVITY

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	x	Keep away from heat, sparks, open flame and other sources of ignition.
INCOMPATIBILITY (MATERIALS TO AVOID) Caustics, ammonia, inorganic acids, chlorinated compounds, strong oxidizers and isocyanates.			
HAZARDOUS DECOMPOSITION PRODUCTS When forced to burn, this product gives out carbon monoxide, carbon dioxide, hydrogen chloride and smoke.			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	x	Keep away from heat, sparks, open flame and other sources of ignition

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Eliminate all ignition sources. Avoid breathing of vapors. Keep liquid out of eyes. Flush with large amount of water. Contain liquid with sand or earth. Absorb with sand or nonflammable absorbent material and transfer into steel drums for recovery or disposal. Prevent liquid from entering drains.
WASTE DISPOSAL METHOD Follow local, State and Federal regulations. Consult disposal expert. Can be disposed of by incineration. Excessive quantities should not be permitted to enter drains. Empty containers should be air dried before disposing. Hazardous Waste Code: 214.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Atmospheric levels should be maintained below established exposure limits contained in Section II. If airborne concentrations exceed those limits, use of a NIOSH-approved organic vapor cartridge respirator with full face-piece is recommended. The effectiveness of an air purifying respirator is limited. Use it only for a single short-term exposure. For emergency and other conditions where short term exposure guidelines may be exceeded, use an approved positive pressure self-contained breathing apparatus.	
VENTILATION Use only with adequate ventilation. Provide sufficient ventilation in volume and pattern to keep contaminants below applicable exposure limits set forth in Section II. Use only explosion proof ventilation equipment.	
PROTECTIVE GLOVES PVA Coated	EYE PROTECTION Splashproof chemical goggles
OTHER PROTECTIVE EQUIPMENT AND HYGIENIC PRACTICES Impervious apron and a source of running water to flush or wash the eyes and skin in case of contact.	

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Store in the shade between 40°F - 110°F. Keep away from heat, sparks, open flame and other sources of ignition. Avoid prolonged breathing of vapor. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Train employees on all special handling procedures before they work with this product.
OTHER PRECAUTIONS Follow all precautionary information given on container label and solvent cementing literature. Follow good industrial safety practices. All handling equipment should be electrically grounded.
The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of this data or the results to be obtained from the use thereof.

TFP-400		MATERIAL SAFETY DATA SHEET		Date Revised: 03/12/96	
Solvent/Cement		Supersedes:			
Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act and shall not be used for any other purpose. Tyco Fire Products Company urges the customer receiving this Material Safety Data Sheet to study it carefully to become aware of the hazards, if any, of the products involved. In the interest of safety, you should notify your employees, agents, and contractors of the information on this sheet.					
SECTION I					
MANUFACTURER'S NAME Oatey Company for Tyco Fire Products ADDRESS 4700 West 160th Street, PO Box 35906, Cleveland, OH 44135			TRANSPORTATION EMERGENCIES ONLY: CHEMTREC: (800) 424-9300 Emergency First Aid: (303) 623-5716 COLLECT (L.A. Poison Center 24 Hour Number) Business: (216) 267-7100		
TRADENAME FORMULA	BLAZEMASTER CPVC CEMENT TFP-400 Mixture of CPVC Resin and Organic Solvents		PRODUCT NUMBERS	90397, 90398	
SECTION II - HAZARDOUS INGREDIENTS					
INGREDIENTS	%	CAS #	SEC 313		
Tetrahydrofuran	35 - 45 %	109-99-9	No		
Acetone	20 - 30 %	67-64-1	No		
Cyclohexanone	5 - 10 %	108-94-1	No		
Methyl Ethyl Ketone	< 5 %	78-93-3	Yes		
NONHAZARDOUS INGREDIENTS					
CPVC Resin	13 - 16 %	68648-82-8	No		
Amorphous Silica	.25 - 3 %	112945-52-5	No		
Proprietary	5 - 25 %		No		
SECTION III - KNOWN HAZARDS UNDER 29 CFR 1910.1200					
HAZARDS	YES	NO	HAZARDS	YES	NO
Combustible Liquid		X	Skin Hazard	X	
Flammable Liquid	X		Eye Hazard	X	
Pyrophoric Material		X	Toxic Agent	X	
Explosive Material		X	Highly Toxic Agent		X
Unstable Material		X	Sensitizer		X
Water Reactive Material		X	Kidney Toxin	X	
Oxidizer		X	Reproductive Toxin	X	
Organic Peroxide		X	Blood Toxin		X
Corrosive Material		X	Nervous System Toxin	X	
Compressed Gas		X	Lung Toxin	X	
Irritant	X		Liver Toxin	X	
Carcinogen NTP/IARC/OSHA		X			
SECTION IV - REGULATIONS					
CHEMICAL	TLV (TWA)	PEL (Transitional Limits)	STEEL	HAZARD ACTION LEVEL	
Tetrahydrofuran	200 ppm, 590 mg/cu m	200 ppm, 590 mg/cu m	250 ppm, 735 mg/cu m	N/A	
Acetone	750 ppm, 1800 mg/cu m	1000 ppm, 2400 mg/cu m	1000 ppm, 2400 mg/cu m	N/A	
Cyclohexanone	25 ppm, 100 mg/cu m (skin)	50 ppm, 200 mg/cu m	100 ppm, 400 mg/cu m	N/A	
Methyl Ethyl Ketone	200 ppm, 590 mg/cu m	200 ppm, 590 mg/cu m	300 ppm, 885 mg/cu m	N/A	
Amorphous Silica	10 mg/cu m	20 mppcf	N/A	N/A	
SECTION V - REGULATED IDENTIFICATION					
DOT PROPER SHIPPING NAME.....	CONSUMER COMMODITY ORM-D; for gallons: Adhesive (Contains Tetrahydrofuran, Acetone) 3, 1133, PG II, Cement-001				
DOT HAZARD CLASS.....	Flammable Liquid				
SHIPPING ID NUMBER.....	NA 1133 (Gallons Only)				
EPA HAZARDOUS WASTE ID NUMBER...	D-001				
EPA HAZARD WASTE CLASS.....	Ignitable Waste				

TFP-400
Solvent/Cement

MATERIAL SAFETY DATA SHEET

Date Revised: 03/12/96
Supersedes:

SECTION VI - EFFECTS OF EXPOSURE

ENTRY ROUTE.....	INHALE - YES INGEST - YES SKIN - YES EYE - YES
INHALATION.....	May cause irritation of mucous membranes, nose & throat, headache, dizziness, nausea, numbness of the extremities and narcosis in high concentrations. Has caused CNS depression & liver damage in animals, & high concentrations have caused retardation of fetal developments in rats.
SKIN.....	Chronic contact may lead to irritation & dermatitis. Chronic exposure to vapors of high concentration may cause dermatitis. May possibly be absorbed through the skin.
EYE.....	Vapors or direct contact may cause irritation.
INGESTION.....	May be aspirated into the lungs or cause systemic effects described under inhalation.
TARGET ORGANS..	Eye, Skin, Kidney, Lung, Liver, Central Nervous System

SECTION VII - EMERGENCY AND FIRST AID PROCEDURES - 303/623-5716 COLLECT

SKIN.....	If irritation arises, wash thoroughly with soap and water. Seek medical attention if irritation persists.
EYES.....	If fumes cause irritation, move to fresh air and irrigate eyes with water for 15 minutes. If irritations persists, seek medical attention. If eye is struck with wire, seek medical attention.
INHALATION.....	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Keep victim quiet and warm. Call a poison control center or physician immediately.
INGESTION.....	Drink water and call a poison control center or physician immediately. Avoid alcoholic beverages. Never give anything by mouth to an unconscious person.

SECTION VIII - PHYSICAL AND CHEMICAL PROPERTIES

NFPA HAZARD SIGNAL.....	HEALTH 1 STABILITY 0 FLAMMABILITY 3 SPECIAL NONE
BOILING POINT.....	151 Degrees F/66 Degrees Celsius
MELTING POINT.....	N/A
VAPOR PRESSURE.....	145 mmHg @ 20 Degrees psi
VAPOR DENSITY (AIR - 1)...	2.5
VOLATILE COMPONENTS....	70 - 80% WT.
SOLUBILITY IN WATER.....	Negligible
PH.....	N/A
SPECIFIC GRAVITY.....	0.91 +/- 0.02
EVAPORATION RATE.....	(BUAC = 1) = 5.5 - 8.0
APPEARANCE.....	Red Liquid
ODOR.....	Ether-Like
WILL DISSOLVE IN.....	Tetrahydrofuran
MATERIAL IS.....	Liquid

SECTION IX - FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY.....	LEL - 1.8 % Volume UEL - 11.8 % Volume
FLASHPOINT AND METHOD USED.....	5 - 8 Degrees F/PMCC
STABILITY.....	Stable Conditions to Avoid: Heat, sparks and open flame. HAZARDOUS DECOMP. P.DTS.: Carbon Monoxide/carbon dioxide/hydrogen chloride/smoke
HAZARDOUS POLYMERIZATION.....	Will not occur. Conditions to Avoid: None
INCOMPATIBILITY/MAT. TO AVOID.....	Acids, oxidizing materials, alkalis, chlorinated inorganics (potassium, calcium and sodium hypochlorite), copper and copper alloys
SPECIAL FIRE RIGHTING PROCEDURE...	FOR SMALL FIRES: Use dry chemical, CO2, water or foam extinguisher. FOR LARGE FIRES: Evacuate area and call Fire Department immediately.

SECTION X - SPILL AND DISPOSAL INFORMATION

SPILL OR LEAK PROCEDURES....	Ventilate area, stop leak if it can be done without risk. Take up with sand, earth, or other noncombustible absorbing material.
WASTE DISPOSAL.....	Dispose of according to local, state, and Federal regulations.

SECTION XI - SAFE USAGE DATA

PROTECTIVE EQUIPMENT TYPES.	NIOSH-Approved cannister respirator in absence of adequate ventilation.
VENTILATION.....	GENERAL MECHANICAL: Exhaust ventilation capable of maintaining emissions at the point of use below PEL. LOCAL EXHAUST: Open doors & windows. If used in enclosed area, use exhaust fans.
PRECAUTIONS:.....	HANDLING & STORAGE: Keep away from heat, sparks and flames; store in cool, dry place. OTHER: Containers, even empties will retain residue and vapors.

TFP-500 Solvent/Cement		MATERIAL SAFETY DATA SHEET		Date Revised: APR 1996 Supersedes:																									
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SECTION I																													
MANUFACTURER'S NAME IPS Corporation for Tyco Fire Products ADDRESS 17109 South Main Street, P.O. Box 379, Gardena, CA 90248			TRANSPORTATION EMERGENCIES ONLY: CHEMTREC: (800) 424-9300 Emergency First Aid: (231) 222-3212 (L.A. Poison Center 24 Hour Number) Business: (310) 898-3300																										
CHEMICAL NAME AND FAMILY Solvent Cement for CPVC Plastic Pipe Mixture of CPVC Resin and Organic Solvents			TRADENAME: TFP-500 BlazeMaster Red Cement for CPVC Plastic Pipe FORMULA: Proprietary																										
SECTION II - HAZARDOUS INGREDIENTS																													
None of the ingredients below are listed as carcinogens by IARC, NTP or OSHA																													
	CAS #	APPROX %	ACGIH-TLV	ACGIH-STEL	OSHA-PEL	OSHA-STEL																							
Chlorinated Polyvinyl Chloride Resin (CPVC)	NON/HAZ		N/A		N/A																								
Tetrahydrofuran (THF)	1099-99-9	50-60	200 PPM	250 PPM	200 PPM	250 PPM																							
Methyl Ethyl Ketone (MEK)	78-93-3	2-9	200 PPM	300 PPM	200 PPM	300 PPM																							
Cyclohexanone	108-94-1	2-10	25 PPM Skin		25 PPM Skin																								
Acetone	67-64-1	5-12	750 PPM	1000 PPM	750 PPM	1000 PPM																							
* Title III Section 313 Supplier Notification: This product contains toxic chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40CFR372. This information must be included in all MSDS's that are copied and distributed for this material.																													
SHIPPING INFORMATION FOR GALLON CONTAINERS OR ABOVE DOT Shipping Name: Adhesive DOT Hazard Class: 3 Identification Number: UN 1133 Packaging Group: II Label Required: Flammable Liquid			SPECIAL HAZARD DESIGNATIONS <table border="1"> <thead> <tr> <th></th> <th>HMIS</th> <th>NFPA</th> <th>HAZARD RATING</th> </tr> </thead> <tbody> <tr> <td>HEALTH:</td> <td>2</td> <td>2</td> <td>0-MINIMAL</td> </tr> <tr> <td>FLAMMABILITY:</td> <td>3</td> <td>3</td> <td>1-SLIGHT</td> </tr> <tr> <td>REACTIVITY:</td> <td>0</td> <td>1</td> <td>2-MODERATE</td> </tr> <tr> <td>PROTECTIVE EQUIPMENT:</td> <td></td> <td></td> <td>3-SERIOUS</td> </tr> <tr> <td></td> <td></td> <td></td> <td>4-SEVERE</td> </tr> </tbody> </table>				HMIS	NFPA	HAZARD RATING	HEALTH:	2	2	0-MINIMAL	FLAMMABILITY:	3	3	1-SLIGHT	REACTIVITY:	0	1	2-MODERATE	PROTECTIVE EQUIPMENT:			3-SERIOUS				4-SEVERE
	HMIS	NFPA	HAZARD RATING																										
HEALTH:	2	2	0-MINIMAL																										
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REACTIVITY:	0	1	2-MODERATE																										
PROTECTIVE EQUIPMENT:			3-SERIOUS																										
			4-SEVERE																										
SHIPPING INFORMATION FOR CONTAINERS LESS THAN ONE GALLON DOT Shipping Name: Consumer Commodity DOT Hazard Class: ORM-D																													
SECTION III - PHYSICAL DATA																													
APPEARANCE Red, medium syrupy liquid	ODOR Ethereal	BOILING POINT (°F/°C) 133°F Based on first boiling component: Acetone																											
SPECIFIC GRAVITY @ 73 +/- 2°F Typical 0.985 +/- 0.040	VAPOR PRESSURE (mmHg) 143 mmHg based on first boiling component, Acetone @ 20°C	PERCENT VOLATILE BY VOLUME (%) Approx: 70-80%																											
VAPOR DENSITY (Air = 1) 2.0	EVAPORATION RATE (BUAC = 1) >1.0	SOLUBILITY IN WATER Solvent portion completely soluble in water. Resin portion separates out.																											
VOC STATEMENT: VOC as manufactured: 760 Grams/Liter. Maximum VOC emission per SCAQMD Rule 1168, Test Method 316A: 450 Grams/Liter																													
SECTION IV - FIRE AND EXPLOSION HAZARD DATA																													
FLASH POINT O-6°F T.C.C. Based on Acetone		FLAMMABLE LIMITS (PERCENT BY VOLUME)		LEL 2.0	UEL 11.8																								
FIRE EXTINGUISHING MEDIA Ansul "Purple K" potassium bicarbonate dry chemical, carbon dioxide, National Aer-O-Foam universal alcohol resistant foam, water spray.																													
SPECIAL FIRE FIGHTING PROCEDURES Evacuate enclosed areas, stay upwind. Close or confined quarters require self-contained breathing apparatus, positive pressure hose masks or airline masks. Use water spray to cool containers, to flush spills from source of ignition and to disperse vapors.																													
UNUSUAL FIRE AND EXPLOSION HAZARDS Fire hazard because of low flash point and high volatility. Vapors are heavier than air and may travel to source of ignition.																													

TFP-500 Solvent/Cement		SECTION V - HEALTH HAZARD DATA	
PRIMARY ROUTES OF ENTRY:			
	<u> X </u>	Inhalation	<u> X </u>
		Skin Contact	<u> X </u>
		Eye Contact	<u> X </u>
		Ingestion	
EFFECT OF OVEREXPOSURE			
ACUTE:			
Inhalation:	Sever overexposure may result in nausea, dizziness, headache. Can cause drowsiness, irritation of eyes and nasal passages.		
Skin Contact:	Skin irritant. Liquid contact may remove natural skin oils resulting in skin irritation. Dermatitis may occur with prolonged contact.		
Skin Absorption:	Prolonged or widespread exposure may result in the absorption of harmful amounts of material		
Eye Contact:	Overexposure may result in sever eye injury with corneal or conjunctive inflammation on contact with the liquid. Vapors slightly uncomfortable.		
Ingestion:	Moderately toxic. May cause nausea, vomiting, diarrhea. May cause mental sluggishness.		
CHRONIC:			
Symptoms of respiratory tract irritation and damage to respiratory epithelium were reported in rats exposed to 5000 ppm THF for 90 days. Elevation of SGPT suggests a disturbance in liver function. The NOEL was reported to be 200 ppm.			
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Individuals with pre-existing diseases of the eyes, skin or respiratory system may have increased susceptibility to the toxicity of excessive exposures.			
EMERGENCY AND FIRST AID PROCEDURES			
Inhalation:	If overcome by vapors, remove to fresh air and if breathing stopped, give artificial respiration. If breathing is difficult, give oxygen. Call physician.		
Eye Contact:	Flush eyes with plenty of water for 15 minutes and call a physician.		
Skin Contact:	Remove contaminated clothing and shoes. Wash skin with plenty of sap and water for at least 15 minutes. If irritation develops, get medical attention.		
Ingestion:	Give 1 or 2 glasses of water or milk. Do not induce vomiting. Call physician or poison control center immediately.		
SECTION VI - REACTIVITY			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	
INCOMPATIBILITY (MATERIALS TO AVOID) Caustics, ammonia, inorganic acids, chlorinated compounds, strong oxidizers and isocyanates.			
HAZARDOUS DECOMPOSITION PRODUCTS			
When forced to burn, this product gives out carbon monoxide, carbon dioxide, hydrogen chloride and smoke.			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	MAY NOT OCCUR	X	
SECTION VII - SPILL OR LEAK PROCEDURES			
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASE OR SPILLED			
Eliminate all ignition sources. Avoid breathing of vapors. Keep liquid out of eyes. Flush with large amount of water. Contain liquid with sand or earth. Absorb with sand or nonflammable absorbent material and transfer into steel drums for recovery or disposal. Prevent liquid from entering drains.			
WASTE DISPOSAL METHOD			
Follow local, State and Federal regulations. Consult disposal expert. Can be disposed of by incineration. Excessive quantities should not be permitted to enter drains. Empty containers should be air dried before disposing. Hazardous Waste Code: 214.			
SECTION VIII - SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type)			
Atmospheric levels should be maintained below established exposure limits contained in Section II. If airborne concentrations exceed those limits, use of NIOSH approved organic vapor cartridge respirator with full face-piece is recommended. The effectiveness of an air purifying respirator is limited. Use it only for a single short-term exposure. For emergency and other conditions where short term exposure guidelines may be exceeded, use an approved positive pressure self-contained breathing apparatus.			
VENTILATION			
Use only with adequate ventilation. Provide sufficient ventilation in volume and pattern to keep contaminants below applicable exposure limits set forth in Section II. Use only explosion proof ventilation equipment.			
PROTECTIVE GLOVES		EYE PROTECTION	
PVA coated		Splashproof chemical goggles	
OTHER PROTECTIVE EQUIPMENT AND HYGIENIC PRACTICES			
Impervious apron and a source of running water to flush or wash the eyes and skin in case of contact.			
SECTION IX - SPECIAL PRECAUTIONS			
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING			
Store in the shade between 40°F - 110°F. Keep away from heat, sparks, open flame, and other sources of ignition. Avoid prolonged breathing of vapor. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Train employees on all special handling procedures before they work with this product.			
OTHER PRECAUTIONS			
Follow all precautionary information given on container label, product bulletins and our solvent cementing literature. All handling equipment should be electrically grounded.			
The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of this data or the results to be obtained from the us thereof.			



TYCO FIRE PRODUCTS
451 North Cannon Avenue
Lansdale, Pennsylvania 19446
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TECHNICAL SERVICES
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E-MAIL: techserv@tycofp.com

Figure 513D (13D) and 513D/R (13D/R) Riser Manifolds 1, 1-1/2, and 2 Inch (DN25, DN40, and DN50) For NFPA 13D/13R Residential Sprinkler Systems

General Description

The Riser Manifolds described in this technical data sheet provide the necessary waterflow alarm, pressure gauge, and drain equipment in a single assembly for use in NFPA 13D or 13R residential sprinkler systems as follows:

NFPA 13D

- Figure 513D (13D)
1 Inch (DN25)
Female Thread x Female Thread

NFPA 13D/13R

- Figure 513D/R (13D/R)
1-1/2 Inch (DN40)
Male Thread x Female Thread
Male Thread x Male Thread
- Figure 513D/R (13D/R)
2 Inch (DN50)
Groove x Groove
Male Thread x Groove

The variety of sizes and end connections allow cost effective and easy transition to check valves, control valves, and system piping. The Riser Manifolds may be installed in either the horizontal (flow switch on top) or vertical (flow going up).

WARNING

The Riser Manifolds described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other 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.

Technical Data

Approvals

The Figure 513D (13D) and 513D/R (13D/R) Riser Manifolds with a cover tamper switch for the waterflow alarm switch are UL Listed, ULC Listed, and FM Approved.

The Figure 513D (13D) and 513D/R (13D/R) Riser Manifolds without a cover tamper switch for the waterflow alarm switch are UL Listed and FM Approved.

Maximum Working Pressure

175 psi (12,1 bar)

Assembly

The manifold body of the Figure 513 is ductile iron, whereas the manifold body of the Figure 13 is cast iron. The two assemblies are completely interchangeable in function, application, and end-to-end laying length.

Finish

Red painted.

Installation

The Riser Manifolds may be installed in either the horizontal (flow switch on top) or vertical (flow going up). The inlet of the Riser Manifold may be directly connected to a shut-off control valve.

NOTES

(1) Where applicable pipe thread sealant is to be applied sparingly. Use of a non-hardening pipe thread sealant is recommended.

(2) Provisions for an alarm test flow must be made. The alarm test flow is to be through an orifice having a flow capacity equal to or smaller than the smallest orifice sprinkler in the system. One of two options can be considered. The first option is to temporarily install a test orifice in the outlet of the drain



line prior to performing the alarm test. The second option is to install an Inspector's Test Connection downstream of the Waterflow Alarm Switch.

(3) Never remove any piping component nor correct or modify any piping deficiencies without first depressurizing and draining the system.

Step 1. Install the manifold body with the flow arrow pointing in the downstream position using threaded connections and/or listed mechanical grooved connections, as applicable.

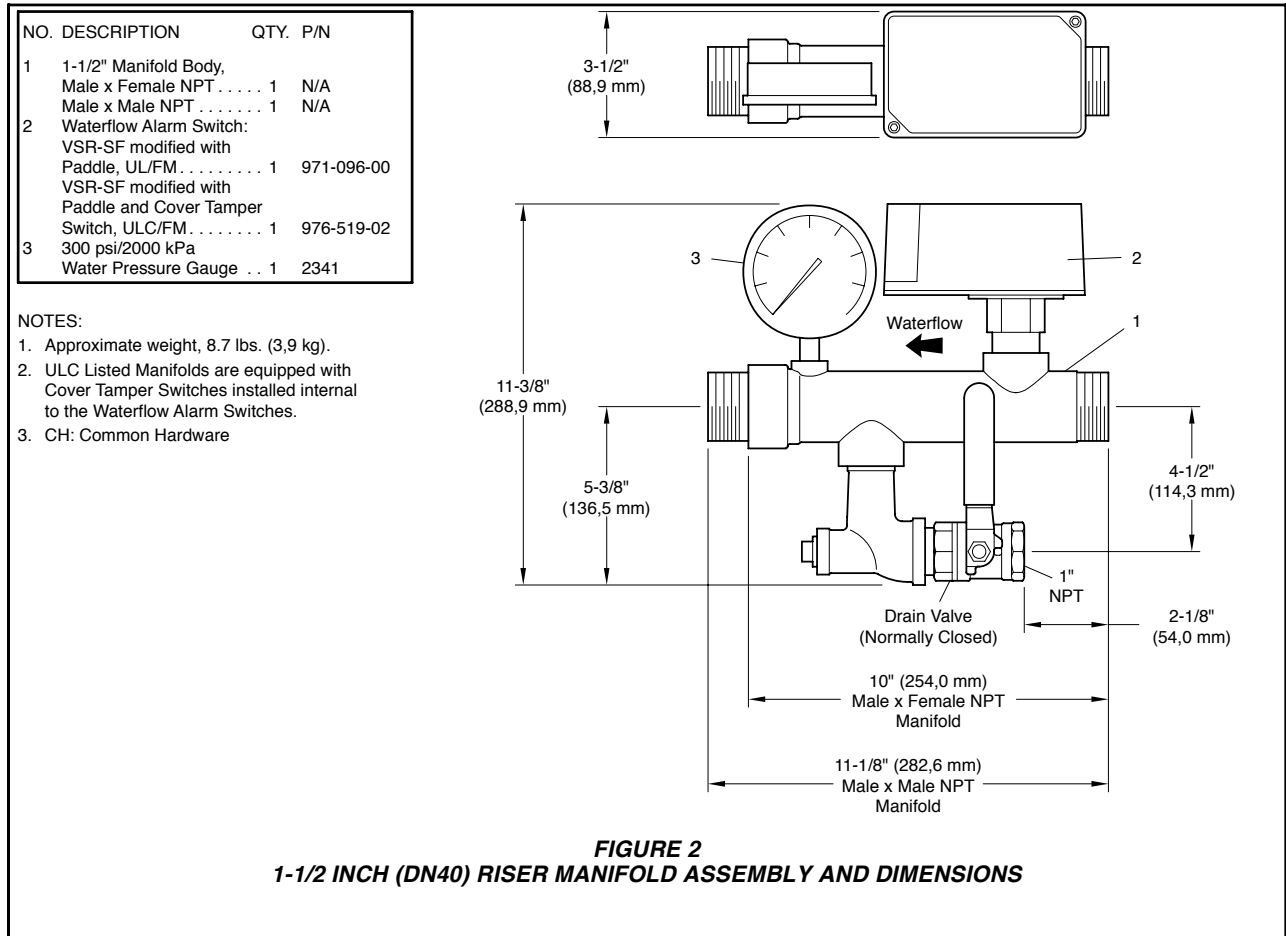
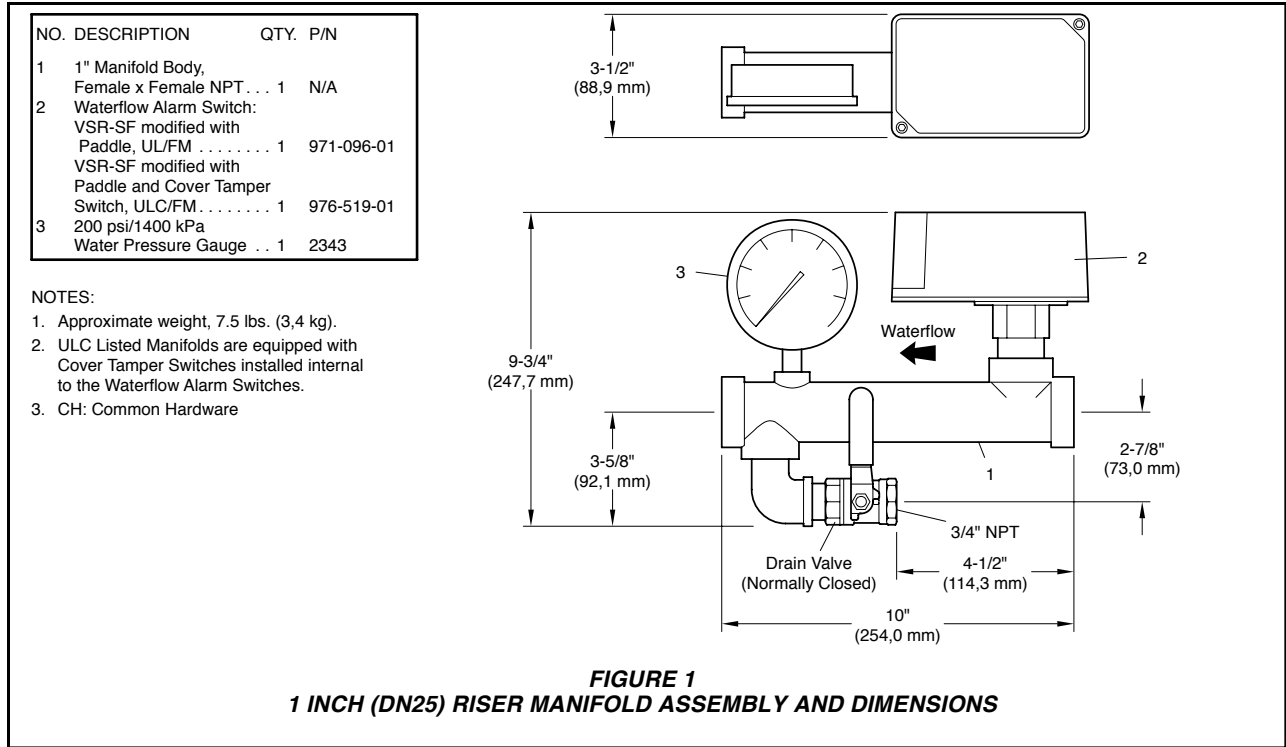
Step 2. Connect the drain line, and then close the drain valve.

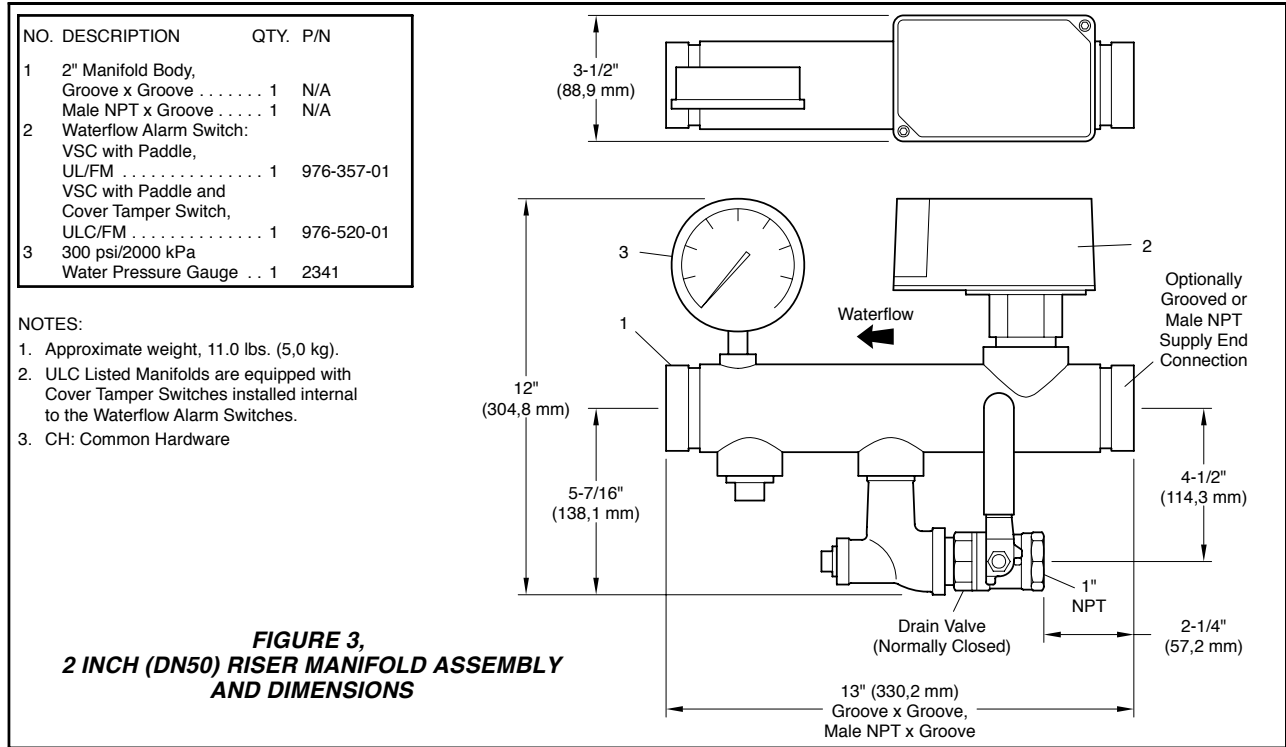
Step 3. Refer to Figure 4 for wiring guidance. All wiring must be performed in accordance with the Authority Having Jurisdiction and/or the National Electrical Code.

Step 4. Place the system in service by filling the system with water. When filling the system, partially open the control valve to slowly fill the system. Filling the system slowly will help avoid damaging the waterflow alarm switch.

After the system is fully pressurized, completely open the control valve.

Step 5. Secure all supply valves open.





Care and Maintenance

The following inspection procedure must be performed as indicated, in addition to any specific requirements of the NFPA, and any impairment must be immediately corrected.

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 authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

NOTES

No attempt is to be made to repair any Riser Manifold component in the field. Only the pressure gauge or waterflow alarm switch can be replaced. If any other problems are encountered the entire riser manifold must be replaced.

The flow and alarm test procedure will

result in operation of the associated alarms. Consequently, notification must be given to the owner and the fire department, central station, or other signal station to which the alarms are connected, and notification must be given to the building occupants.

Before closing a fire protection system control valve for inspection or maintenance work on the fire protection system that it controls, permission to shut down the effected fire protection system must first be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.

Flow Test Procedure

Step 1. Fully open the drain valve. Make certain that drainage water will not cause any damage or injury.

Step 2. Verify that the residual (flowing) pressure indicated by the pressure gauge is no less that originally recorded for the system when it was first installed.

Step 3. Close the drain valve.

Step 4. Verify that the static (not flowing) pressure indicated by the pressure gauge is no less that originally

recorded for the system when it was first installed.

Alarm Test Procedure With A Test Orifice (See Installation Note 2)

Step 1. Temporarily install a test orifice in the drain line outlet.

Step 2. Fully open the drain valve. Make certain that drainage water will not cause any damage or injury.

Step 3. Verify operation of the associated alarms.

Step 3. Close the drain valve.

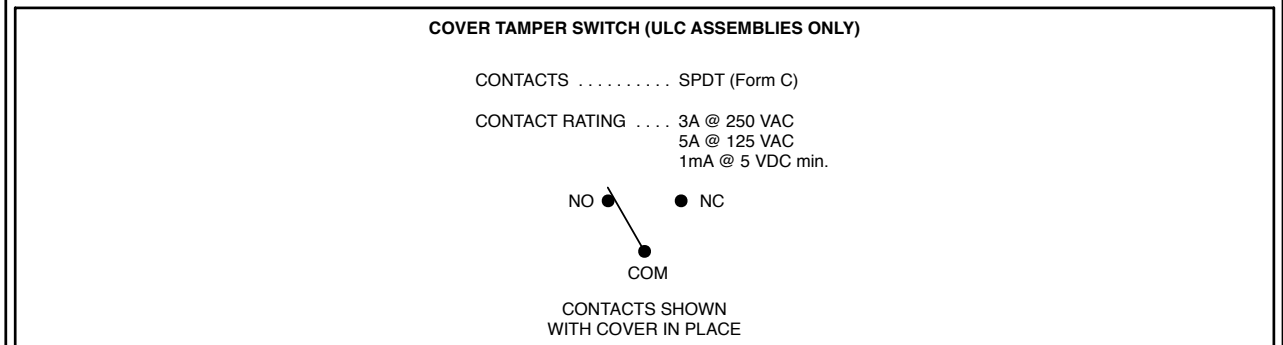
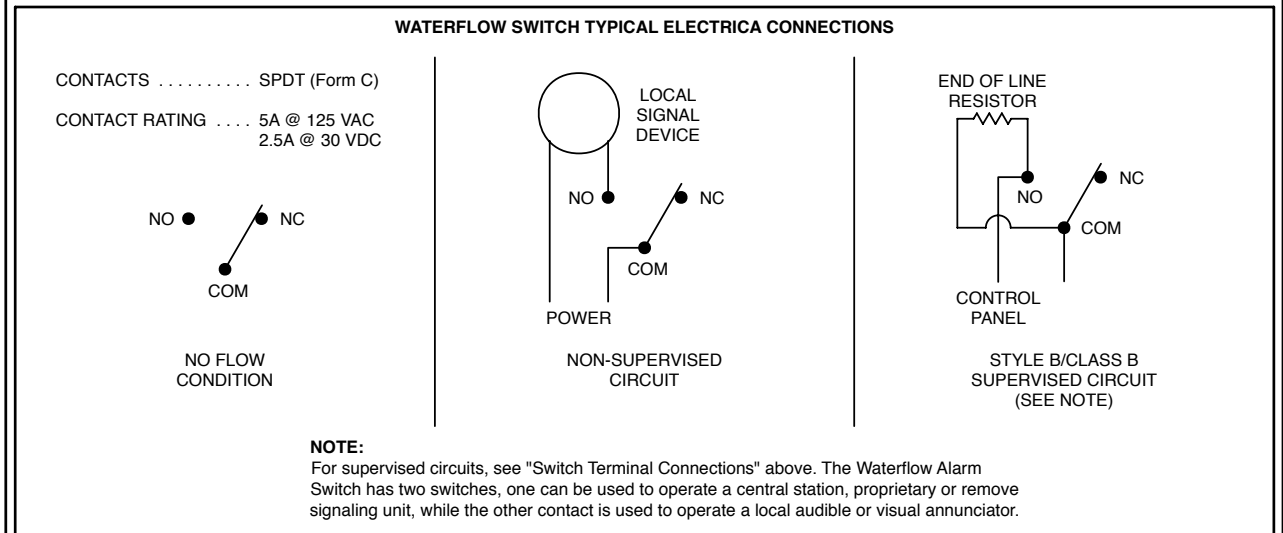
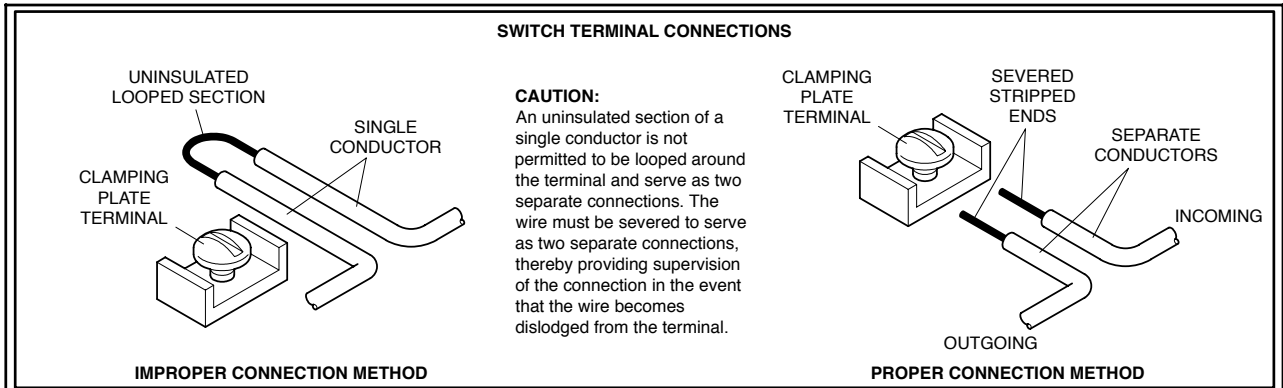
Step 4. Remove the test orifice from the drain line outlet.

Alarm Test Procedure With An Inspector's Test Connection (See Installation Note 2)

Step 1. Fully open the Inspector's Test Connection Valve. Make certain that drainage water will not cause any damage or injury.

Step 2. Verify operation of the associated alarms.

Step 3. Close the Inspector's Test Connection Valve.



**FIGURE 4
WIRING GUIDANCE**

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Information

Riser Manifold:

Specify; Size (specify), Figure (specify 513D or 513D/R, (specify connection type inlet x outlet) Riser Manifold (specify - without or with) a cover tamper switch for the waterflow alarm switch, P/N (specify).

NOTES

Orders for Figure 513D or 513D/R may be filled with a Figure 13D or 13D/R, respectively. The two assemblies are completely interchangeable in function, application, and end-to-end laying length.

If a ULC Listing is required, the Riser Manifold must be ordered with a cover tamper switch for the waterflow alarm switch.

UL/ULC/FM Assemblies With Cover Tamper Switch

1 Inch (DN25)	
FT x FT	P/N 4085
1-1/2 Inch (DN40)	
MT x FT	P/N 4088
1-1/2 Inch (DN40)	
MT x MT	P/N 4089
2 Inch (DN50)	
G x G	P/N 4093
2 Inch (DN50)	
MT x G	P/N 4094

UL/FM Assemblies Without Cover Tamper Switch

1 Inch (DN25)	
FT x FT	P/N 4047
1-1/2 Inch (DN40)	
MT x FT	P/N 4057
1-1/2 Inch (DN40)	
MT x MT	P/N 4058
2 Inch (DN50)	
G x G	P/N 4059
2 Inch (DN50)	
MT x G	P/N 4064

Replacement Parts:

Specify: (description) for use with Figure 513D, 513D/R, 13D, or 13D/R Riser Manifold, P/N (Ref. Figure 1, 2 or 2, as applicable).

TYCO FIRE & BUILDING PRODUCTS, 451 North Cannon Avenue, Lansdale, Pennsylvania 19446

RAPID RESPONSE Series LFII Residential 4.9 K-factor Concealed Pendent Sprinkler Flat Plate, Wet Pipe and Dry Pipe Systems

General Description

TYCO RAPID RESPONSE Series LFII Residential 4.9K Concealed Pendent Sprinklers (TY3596) are decorative, fast response, fusible solder sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels.

The cover plate assembly conceals the sprinkler operating components above the ceiling. The flat profile of the cover plate provides the optimum aesthetically appealing sprinkler design. In addition, the concealed design of the Series LFII Residential Concealed Pendent Sprinklers (TY3596) provides 1/2 inch (12,7 mm) vertical adjustment. This adjustment provides a measure of flexibility when cutting fixed sprinkler drops.

The Series LFII Residential Concealed Sprinklers are intended for use in the following scenarios:

- wet and dry pipe residential sprinkler systems for one- and two-family dwellings and mobile homes per NFPA 13D
- wet and dry pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R
- wet and dry pipe sprinkler systems for the residential portions of any occupancy per NFPA 13

The Series LFII Residential Concealed Pendent Sprinklers (TY3596) 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 Concealed Pendent Sprinklers (TY3596) are shipped with a Disposable Protective Cap. The Protective Cap is temporarily removed for installation, and then it can be replaced to help protect the sprinkler while the ceiling is being installed or finished. The tip of the Protective Cap can also be used to mark the center of the ceiling hole into plaster board, ceiling tiles, etc. by gently pushing the ceiling product against the Protective Cap. When the ceiling installation is complete the Protective Cap is removed and the Cover Plate Assembly installed.

Dry Pipe System Application

The Series LFII Residential Concealed Pendent Sprinklers offers a laboratory approved option for designing dry pipe residential sprinkler systems, whereas, most residential sprinklers are laboratory approved for wet systems only.

Through extensive testing, it has been determined that the number of design sprinklers (hydraulic design area) for the Series LFII Residential Concealed Pendent Sprinklers (TY3596) need not be increased over the number of design sprinklers (hydraulic design area) as specified for wet pipe sprinkler systems, as is accustomed for density/area sprinkler systems designed per NFPA 13.

Consequently, the Series LFII Residential Concealed Pendent Sprinklers offer the features of non-water filled pipe in addition to not having to increase the number of design sprinklers (hydraulic design area) for systems designed to NFPA 13, 13D, or 13R.



NOTICE

The Series LFII Residential Concealed Pendent Sprinklers (TY3596) described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association (NFPA), in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

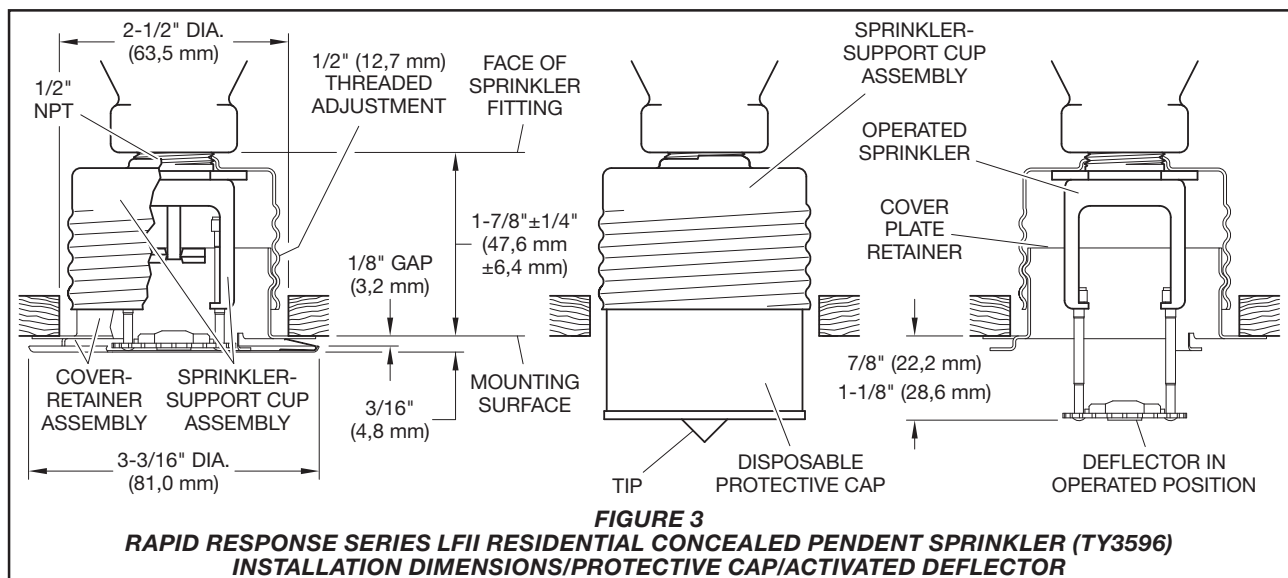
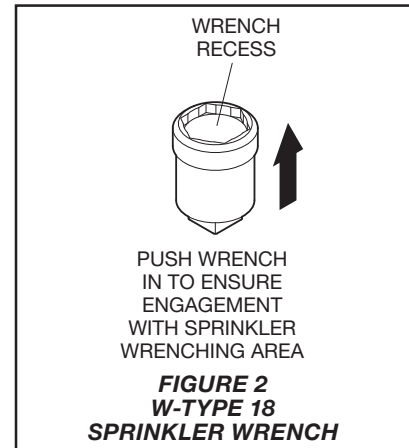
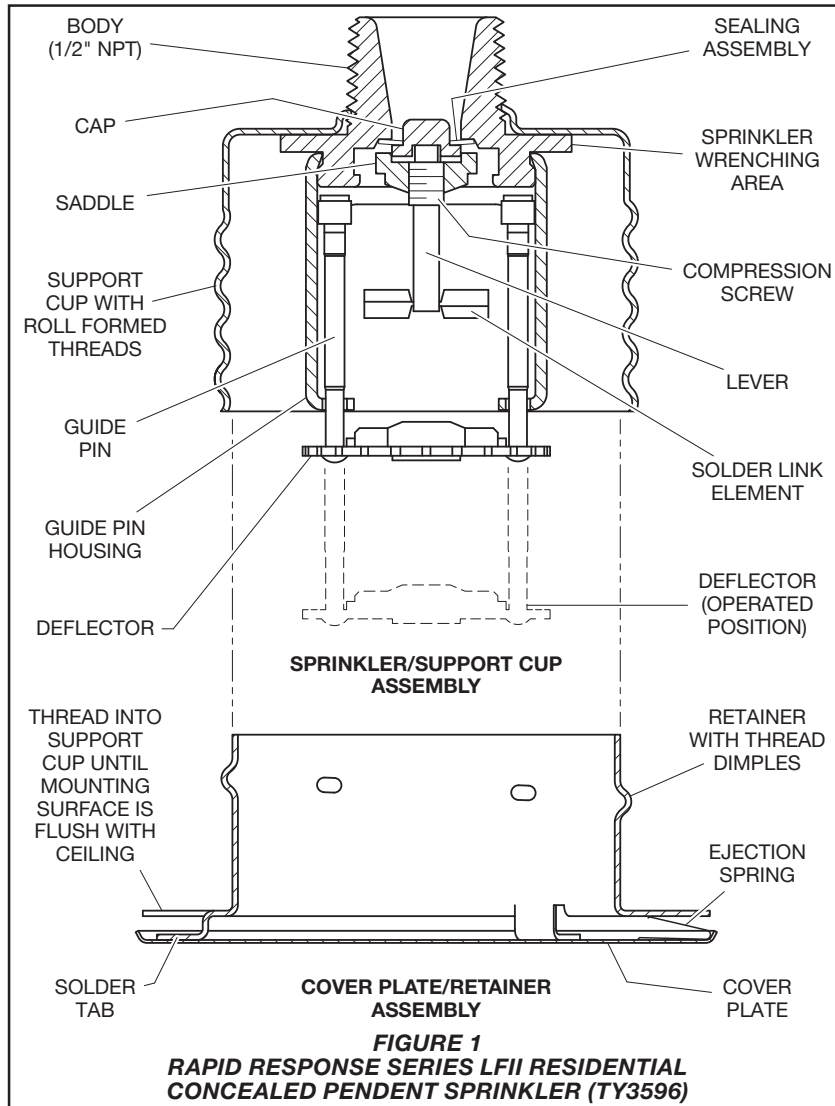
The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

Sprinkler Identification Number (SIN)

TY3596

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 prematurely.



Technical Data

Approvals

UL and C-UL Listed
 NYC Approved under MEA 44-03-E-2NSF
 Certified to NSF/ANSI 61

The TYCO RAPID RESPONSE Series LFII Residential Concealed Pendent Sprinklers are only Listed with the Series LFII Concealed Cover Plates having a factory-applied finish.

Cover Plates can be ordered by following the instructions in the Ordering Procedure section.

Maximum Working Pressure
 175 psi (12,1 bar)

Discharge Coefficient
 K=4.9 gpm/psi^{1/2} (70,6 lpm/bar^{1/2})

Temperature Rating
 160°F (71°C) Sprinkler with
 139°F (59°C) Cover Plate

Vertical Adjustment
 1/2 inch (12,7 mm)

Finishes

Refer to Ordering Procedure section.

Physical Characteristics

Body	Brass
Cap	Bronze
Saddle	Brass
Sealing Assembly	Beryllium Nickel w/TEFLON
Soldered Link Halves	Nickel
Lever	Bronze
Compression Screw	Brass
Deflector	Copper or Brass
Guide Pin Housing	Bronze
Guide Pins	Stainless Steel or Bronze
Support Cup	Steel
Cover Plate	Copper
Retainer	Brass
Cover Plate	
Ejection Spring	Stainless Steel

Operation

When exposed to heat from a fire, the Cover Plate, which is normally soldered to the Support Cup at three points, falls away to expose the sprinkler assembly. At this point the Deflector supported by the Arms drops down to its operated position. The fusible link of the sprinkler assembly is comprised of two link halves that are soldered together with a thin layer of solder. When the rated temperature is reached, the solder melts and the two link halves separate allowing the sprinkler to activate and flow water.

Design Criteria

TYCO RAPID RESPONSE Series LFII Residential Concealed Pendent Sprinklers (TY3596) are UL and C-UL Listed for installation in accordance with this section.

Note: When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the authority having jurisdiction.

System Types

Per the UL Listing, wet pipe and dry pipe systems may be utilized. Per the C-UL Listing, only wet pipe systems may be utilized.

Refer to Technical Data Sheet TFP485 about the use of residential sprinklers in residential dry pipe systems.

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)

For systems designed to NFPA 13D or NFPA 13R, the minimum required sprinkler flow rates are given in Tables A and B 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. The number of "design sprinklers" specified in NFPA 13D and 13R for wet pipe systems is to be applied when designing dry pipe systems.

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 Tables A and B as a function of 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 (4) most hydraulically demanding sprinklers for actual coverage areas protected by the four (4) sprinklers

The number of design sprinklers specified in NFPA 13 for wet pipe systems is to be applied when designing dry pipe

Dry Pipe System Water Delivery

When using the Series LFII Residential Concealed Pendent Sprinklers (TY3596) in dry pipe sprinkler systems, the time for water delivery must not exceed 15 seconds for the most remote operating sprinkler.

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 Technical Data Sheet TFP490.

Operational Sensitivity

The sprinklers are to be installed relative to the ceiling mounting surface as shown in Figure 3.

Sprinkler Spacing

The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (Ref. Table A or B) being hydraulically calculated (e.g., maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 20 feet for a 20 ft. x 20 ft. coverage area).

The Series LFII must not be used in applications where the air pressure above the ceiling is greater than that below. Down drafts through the Support Cup could delay sprinkler operation in a fire situation.

Maximum Coverage Area ¹ Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	WET PIPE SYSTEM Minimum Flow and Residual Pressure ^{2,3}				
		Ordinary Temp. Rating 160°F (71°C)		Deflector to Ceiling	Installation Type	Minimum Spacing Ft. (m)
		Flow gpm (lpm)	Pressure psi (bar)			
12 x 12 (3,7 x 3,7)	12 (3,7)	13 (49,2)	7.0 (0,48)	Smooth Ceilings 7/8 to 1-1/8 inches Beamed Ceilings per NFPA 13D or 13R, or 13. Installed in beam 7/8 to 1-1/8 inches below bottom of beam	Concealed	8 (2,4)
14 x 14 (4,3 x 4,3)	14 (4,3)	13 (49,2)	7.0 (0,48)			
16 x 16 (4,9 x 4,9)	16 (4,9)	13 (49,2)	7.0 (0,48)			
18 x 18 (5,5 x 5,5)	18 (5,5)	17 (64,3)	12.0 (0,83)			
20 x 20 (6,1 x 6,1)	20 (6,1)	20 (75,7)	16.7 (1,15)			

Notes:

1. 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.
2. 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.
3. For NFPA 13 residential applications, the greater of 0.1 gpm/ft.² 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 4.9 K-FACTOR FLAT PLATE CONCEALED PENDENT SPRINKLER (TY3596)
NFPA 13D, 13R, AND 13 HYDRAULIC DESIGN CRITERIA

Maximum Coverage Area ¹ Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	DRY PIPE SYSTEM Minimum Flow and Residual Pressure ^{2,3}				
		Ordinary Temp. Rating 160°F (71°C)		Deflector to Ceiling	Installation Type	Minimum Spacing Ft. (m)
		Flow gpm (lpm)	Pressure psi (bar)			
12 x 12 (3,7 x 3,7)	12 (3,7)	13 (49,2)	7.0 (0,48)	Smooth Ceilings 7/8 to 1-1/8 inches Beamed Ceilings per NFPA 13D or 13R, or 13. Installed in beam 7/8 to 1-1/8 inches below bottom of beam	Concealed	8 (2,4)
14 x 14 (4,3 x 4,3)	14 (4,3)	14 (53,0)	8.2 (0,57)			
16 x 16 (4,9 x 4,9)	16 (4,9)	15 (56,8)	9.4 (0,65)			
18 x 18 (5,5 x 5,5)	18 (5,5)	18 (68,1)	13.5 (0,93)			
20 x 20 (6,1 x 6,1)	20 (6,1)	21 (79,5)	18.4 (1,27)			

Notes:

1. 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.
2. 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.
3. For NFPA 13 residential applications, the greater of 0.1 gpm/ft.² over the design area or the flow in accordance with the criteria in this table must be used.

TABLE B
DRY PIPE SYSTEM
RAPID RESPONSE SERIES LFII RESIDENTIAL 4.9 K-FACTOR FLAT PLATE CONCEALED PENDENT (TY3596)
NFPA 13D, 13R, AND 13 HYDRAULIC DESIGN CRITERIA

Installation

TYCO RAPID RESPONSE Series LFII Residential Concealed Pendent Sprinklers (TY3596) must be installed in accordance with this section.

General Instructions

Damage to the fusible Link Assembly during installation can be avoided by handling the sprinkler by the support cup only (i.e., do not apply pressure to the fusible Link Assembly).

A 1/2 inch NPT sprinkler joint should be obtained with a minimum to maximum torque of 7 to 14 lbs.-ft. (9,5 to 19,0 Nm). Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Cover Plate / Retainer Assembly by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.

Step 1. The sprinkler must only be installed in the pendent position and with the centerline of the sprinkler perpendicular to the mounting surface.

Step 2. Remove the Protective Cap.

Step 3. With pipe thread sealant applied to the pipe threads, and using the W-Type 18 Wrench shown in Figure 2, install and tighten the Sprinkler / Support Cup Assembly into the fitting. The W-Type 18 Wrench will accept a 1/2 inch ratchet drive.

Step 4. Replace the Protective Cap by pushing it upwards until it bottoms out against the Support Cup. The Protective Cap helps prevent damage to the Deflector and Guide Pins during ceiling installation and/or during application of the finish coating of the ceiling. It may also be used to locate the center of the clearance hole by gently pushing the ceiling material against the center point of the Cap.

Note: *As long as the protective Cap remains in place, the system is considered to be "Out Of Service."*

Step 5. After the ceiling has been completed with the 2-1/2 inch (63 mm) diameter clearance hole and in preparation for installing the Cover Plate Assembly, remove and discard the Protective Cap, and verify that the Deflector moves up and down freely.

If the sprinkler has been damaged and the Deflector does not move up and down freely, replace the entire sprinkler assembly. Do not attempt to modify or repair a damaged sprinkler.

Step 6. Screw on the Cover Plate Assembly until its flange comes in contact with the ceiling.

Do not continue to screw on the Cover Plate Assembly such that it lifts a ceiling panel out of its normal position.

If the Cover Plate Assembly cannot be engaged with the Mounting Cup or the Cover Plate Assembly cannot be engaged sufficiently to contact the ceiling, the Sprinkler Fitting must be repositioned.

Care and Maintenance

TYCO RAPID RESPONSE Series LFII Residential Concealed Pendent Sprinklers (TY3596) 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 which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Absence of a Cover Plate may delay the sprinkler operation in a fire situation.

When properly installed, there is a nominal 1/8 inch (3,2 mm) air gap between the lip of the Cover Plate and the ceiling, as shown in Figure 3. This air gap is necessary for proper operation of the sprinkler by allowing heat flow from a fire to pass below and above the Cover Plate to help assure appropriate release of the Cover Plate in a fire situation. If the ceiling is to be repainted after the installation of the Sprinkler, care must be exercised to ensure that the new paint does not seal off any of the air gap.

Factory painted Cover Plates must not be repainted. They should be replaced, if necessary, by factory painted units. Non-factory applied paint may adversely delay or prevent sprinkler operation in the event of a fire.

Do not pull the Cover Plate relative to the Enclosure. Separation 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 or over heated sprinklers must be replaced.

Care must be exercised to avoid damage before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced.

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 product manufacturer with any questions.

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.

Automatic sprinkler systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit
www.tyco-fire.com.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product name and part number (P/N).

Sprinkler Assemblies

Specify: Series LFII (TY3596) 4.9K Residential Concealed Pendent Sprinkler without Cover Plate Assembly, P/N 51-112-1-160

Cover Plate Assemblies

Specify: Cover Plate Assembly with (specify) finish for the Series LFII (TY3596) 4.9K Residential Concealed Pendent Sprinkler, P/N (specify):

Ivory (RAL1015)	P/N 56-202-0-135
Beige (RAL1001)	P/N 56-202-2-135
Pure White * (RAL9010)	P/N 56-202-3-135
Signal White ** (RAL9003)	P/N 56-202-4-135
Grey White (RAL9002)	P/N 56-202-5-135
Brown (RAL8028)	P/N 56-202-6-135
Black (RAL9005)	P/N 56-202-7-135
Brushed Brass	P/N 56-202-8-135
Brushed Chrome	P/N 56-202-9-135
Custom Paint	P/N 56-202-X-135

* Eastern Hemisphere sales only
** Previously known as Bright White

Note: All Custom Cover Plates are painted using Sherwin Williams Interior Latex Paint. Contact Tyco Customer Service with any questions related to custom orders.

Sprinkler Wrench

Specify: W-Type 18 Sprinkler Wrench, P/N 56-000-1-265

GLOBAL HEADQUARTERS | 1400 Pennbrook Parkway, Lansdale, PA 19446 | Telephone +1-215-362-0700

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TEFLON is trademark of The DuPont Corporation.





Tech specs

Power

Battery

Six long-life AA Energizer® Ultimate Lithium batteries

Wired

120V Connector

Three long-life AA Energizer® Ultimate Lithium backup batteries

Color

White

Black

Available exclusively on nest.com

Features

Voice alarms with custom location

Phone alerts include:

- Low-battery
- Smoke
- Carbon monoxide
- Sensor failure

Split-Spectrum Sensor

Nest App

App Silence

Detects carbon monoxide

Heads-Up alerts

10-year product lifetime

Sound Check

Nightly Promise

Self Test

Pathlight

Steam Check

Wireless Interconnect

Safety History

What To Do

Home Report

Emergency Shutoff with Nest Learning Thermostat

Emergency clip record with Nest Cam

Languages

Pre-installed languages by country

United States: English, Spanish

Canada: English, French (Québécois)

United Kingdom: English (British)

France, Belgium and Netherlands: French and Dutch

Note: After setup, you can change the language Nest Protect speaks to any of the above languages.

Sensors

Split-Spectrum Sensor, 450nm and 880nm wavelength

10 year electrochemical carbon monoxide sensor

Heat sensor, $\pm 1.8^{\circ}\text{F}$ ($\pm 1^{\circ}\text{C}$)

Humidity sensor, $\pm 3\%\text{RH}$

Occupancy sensor, 120° field of view to 20 feet

Ambient light sensor, 1-100k Lux Dynamic Range
Omnidirectional microphone, 70dBA SNR

Speaker, horn, and light ring

2 Watt Speaker
Horn: 85dB SPL at 10 feet (3 m)
RGB color ring with 6 LEDs

Size and Weight

Battery

Height: 5.3 inches (13.5 cm)
Width: 5.3 inches (13.5 cm)
Depth: 1.5 inches (3.85 cm)
Mass: 13.9 ounces (379 g)

Wired

Height: 5.3 inches (13.5 cm)
Width: 5.3 inches (13.5 cm)
Depth: 1.5 inches (3.85 cm)
Mass: 13.2 ounces (375 g)

Connectivity requirements

Wi-Fi connection
Phone or tablet with iOS 8 or later, or Android 4.1 or later
Free Nest Account

Wireless

Working Wi-Fi connection: 802.11b/g/n @ 2.4GHz
Wireless Interconnect: 802.15.4 @ 2.4GHz
Bluetooth Low Energy (BLE)

Certification

Nest Protect has been tested to comply with safety standards in the United States set out by:
UL
California State Fire Marshal
Nest Protect complies with all of the following smoke and carbon monoxide alarm standards:

UL 2034 - "Single and Multi Station Carbon Monoxide Alarms"
UL 217 - "Single and Multi Station Smoke Alarms"
NFPA-72 - "National Fire Alarm and Signaling Code"

Operating Temperature

The alarm should not be installed in locations where the normal ambient temperature is below 40°F (4°C) or exceeds 100°F (38°C).

Humidity range: 20%RH to 80%RH (non condensing).

Warranty

2-year limited warranty. For support, visit nest.com/support.

Our support team is also available by phone 24/7.

In the box

Nest Protect (Battery)

Six long-life batteries (Energizer® Ultimate Lithium "L91" AA)

Backplate

Four screws

User's Guide

Welcome Guide

2-year limited hardware warranty

Nest Protect (Wired 120V)

Three long-life backup batteries (Energizer® Ultimate Lithium "L91" AA)

120V AC connector

Three wire nuts

Backplate

Four screws

User's Guide

Welcome Guide

2-year limited hardware warranty

NEST STORE

+

PROGRAMS

+

COMPANY

+



Legend I --- 13D Residential Pump Systems

.75 – 3 hp



5 – 7.5 hp



LEGEND I SPECIFICATIONS

Basic System Includes:

- Stainless Steel Pump Components (304L)
- Stainless Steel Sensing Line (316)
- Pressure Switch (pre-wired to motor): factory set at 40psi On & 60 psi Off, cut in setting range 5-60 psi w/ 20-30 psi differential, cut out range 25-80 psi. Call if different range is required.
- Industrial-grade, unidirectional, non-overloading motor
- Discharge Check Valve
- Lockable/Indicating Control Valve (Per NFPA 13D)
- Liquid filled gauge
- Drain
- All piping/valves are bronze/brass
- Stainless-lined Expansion Tank (Pre-charged & re-chargeable to 35 psi, minimizes surges, stored energy acts like jockey pump)

Basic System Specifications:

- Suction Connection: 1.25" / 1.5" / 2" fnpt depending on model
- Discharge Connection: 1 1/4" fnpt
- 1Ø / 60hz ODP continuous duty unidirectional motors (optional TEFC motors)
- Std voltage 230v (per NFPA 13D)
- 5 hp & 7.5 hp incorporates auxiliary motor starter in addition to the pressure switch
- 5 hp & 7.5 hp includes adjustable overload protection

		Service Factor Amps Required at 230V						
HP		¾	1	1-½	2	3	5	7.5
Amps Req'd		8.6	8.6	11.1	13.5	15.9	27.6	42.6

* Amps may vary depending on motor manufacturer

Subject to change without notice.

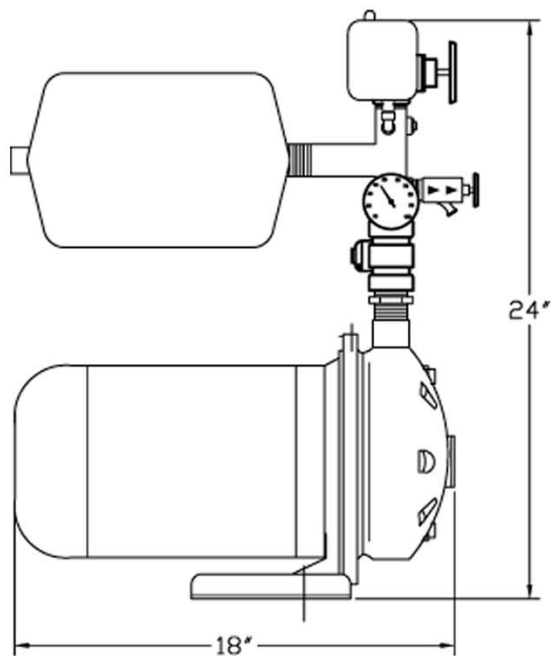
CB Marketing, Inc. 12559 South Laramie Avenue, Alsip IL 60803

Phone 708-202-0033 Fax 708-385-5415

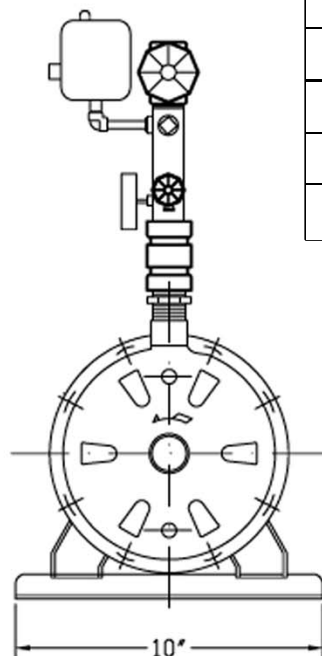
www.cbmarketing.com

Service Factor Amps
Required at 230v

hp	SFA
.75	8.6
1	8.6
1.5	11.1
2	13.5
3	15.9



SIDE VIEW



FRONT VIEW



Legend I - 13D Residential Pump System

12559 s. Laramie Avenue; Alsip, IL 60803

Phone: 708-202-0033

Fax: 708-385-5415

www.cbmarketing.com

D 5010 FACILITY POWER GENERATION**A. SYSTEM DESCRIPTION**

1. Power is provided by premium monocrystalline solar panels connected in two strings. Each string has a unique max power point tracker/charge controller and DC/AC inverter. The system is supported by a bank of AGM batteries.

B. FUNCTIONAL REQUIREMENTS

1. Provide energy for 110% of annual home energy usage using products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Refer to Manufacturer's Product Data sheets provided at the end of this section where indicated.
3. GAF Solar System
 - a. PV monocrystalline solar panel with mounting equipment and interconnection. Product data sheet CSI# 48 14 00.
4. Schneider Electric Conext MPPT 80 600
 - a. Charge controller/Max power point tracker. Product data sheet CSI# 48 14 00.
5. Schneider Electric Conext XW+ 6848 NA
 - a. AC/DC Inverter and battery charger. Product data sheet CSI# 48 19 16.
6. Schneider Electric Conext Battery Monitor
 - a. Battery bank monitoring with battery string health detection. Product data sheet CSI# 26 33 46.
7. Schneider Electric Conext ComBox
 - a. Advanced diagnostics for solar and battery systems. Product data sheet CSI# 26 33 46.
8. Schneider Electric Conext System Control Panel
 - a. Monitor and configure inverter/charger systems. Product data sheet CSI# 48 19 00.
9. Schneider Electric Conext XW+ Power Distribution Panel
 - a. Integrate multiple inverters/chargers with single battery bank. Product data sheet CSI# 48 19 00.

10. SunXtender PVX Deep Cycle AGM battery for Solar applications.

D 5020 ELECTRICAL SERVICE AND DISTRIBUTION

A. SYSTEM DESCRIPTION

1. Electricity is distributed throughout the home from a main and sub-electrical panel fed by the utility connection supplied by the competition organizers.

B. FUNCTIONAL REQUIREMENTS

1. Supply a constant source of electricity to the home's receptacles using products that are manufacture and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. All EMT Conduit within SIP panel walls is to be fitted with concrete-rated couplings and photographed to show inspection compliance prior to installation of the insulating foam around the connection.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.

D 5040 LIGHTING

A. SYSTEM DESCRIPTION

1. A multitude of high-efficiency lighting fixtures are installed in the home in the ceiling and on the walls. These fixtures are adjustable via switch and internet.

B. FUNCTIONAL REQUIREMENTS

1. Provide suitable and customizable light levels year around at all times of day using products that are manufacture and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
 - a. Product data sheets CSI# 26 50 00.

D 5080

MISCELLANEOUS ELECTRICAL SYSTEMS

A. SYSTEM DESCRIPTION

1. A dedicated electric vehicle charging station within the garage.

B. FUNCTIONAL REQUIREMENTS

1. Charge the electric vehicle completely overnight using products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

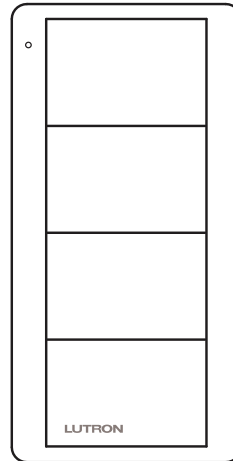
1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Schneider Electric EVlink Parking Wall Mounter 7kW 1xT2 EV Charging Station
 - a. Product data sheet CSI# 26 33 43.

Pico® 4-Button Wireless Remote

The Pico® wireless remote is a flexible and easy to use device that allows the user to control Lutron® wireless load-control devices from anywhere in the space. This battery-operated control requires no external power or communication wiring.

Features

- Provides control for the following:
 - Energi Savr Node™ systems programmed with handheld App, through the use of a QS sensor module (QSM)
 - Energi TriPak® systems, including:
 - Maestro Wireless® controls
 - PowPak® relay module, CCO module, and 0–10 V== (EcoSystem® module not available)
 - GRAFIK Eye® QS wireless systems
 - HomeWorks® QS wireless systems
 - RadioRA® 2 systems
 - Serena® RF remote control shades
 - Sivoia® QS wireless systems
 - Caséta® Wireless controls
 - Quantum® systems¹, through the use of a QS sensor module (QSM)
 - myRoom® prime and plus systems
- Custom engraving options.
- Control available in a variety of button marking options.
- Easy reconfiguration for use as:
 - Handheld remote
 - Wall-mount control (with or without faceplate; faceplate adapter kit sold separately)
 - Car visor control (car visor clip sold separately)
 - Table-top control (table-top pedestal sold separately)



Pico® 4-Button Wireless Remote

- Utilizes Lutron® reliable Clear Connect® RF technology.
- Battery-powered. Requires no wiring.
- 10 year battery life² (one CR2032 battery included).
- Can provide control of shades, drapes, or lighting devices within a range of 30 ft (9 m) through walls and 60 ft (18 m) line-of-sight.

¹ Available 1st quarter, 2016.

² Based on a 1 year shelf life, an average of 10 button presses per day, and an ambient temperature of 86 °F (30 °C). Actual life may vary based on usage and environmental conditions.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 95%; height: 20px;" type="text"/>	
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>

Specifications

Regulatory Approvals

- Lutron® Quality Systems registered to ISO 9001:2008.
- FCC Certified (U.S.A.)
- IC Certified (Canada)
- COFETEL Certified (Mexico)
- SUTEL Certified (Costa Rica)
- Anatel Certified (Brazil)

Power

- Operating Voltage 3 V⁼⁼
- (1) CR2032 battery (included)

System Communication and Capacity

- Communicates using Radio Frequency (RF) at 431 MHz to 437 MHz.
- Thousands of system addresses prevent interference between systems.
- Can be assigned to control shades, drapes, or lighting devices within a range of 30 ft (9 m) through walls and 60 ft (18 m) line-of-sight.

Mounting Considerations

- Mounting of any RF devices on or in close proximity to a metal surface will drastically reduce the effective range of radio signal transmission or reception. For mounting on metal surfaces, please contact Lutron.
- All RF devices must be mounted on non-conductive materials to ensure proper performance.
- Wall mounting adhesive included. See **Mounting Options** section for other options.

Environment

- Ambient operating temperature: 32 °F to 140 °F (0 °C to 60 °C)
- Maximum 90% non-condensing relative humidity
- Indoor use only

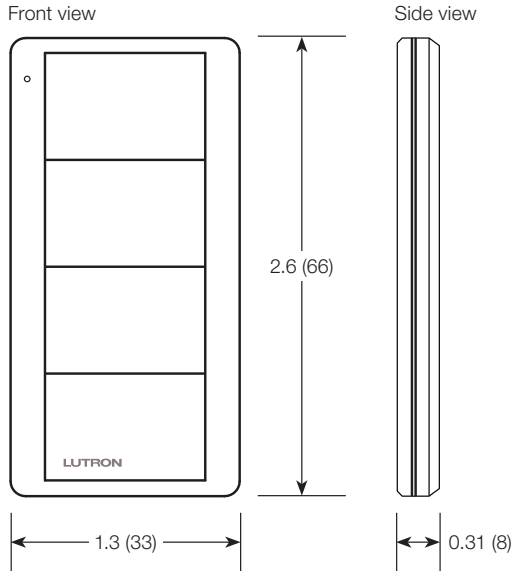
Warranty

- 1 Year Limited Warranty. For additional Warranty information, please visit www.lutron.com/TechnicalDocumentLibrary/369-119_Wallbox_Warranty.pdf

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>	
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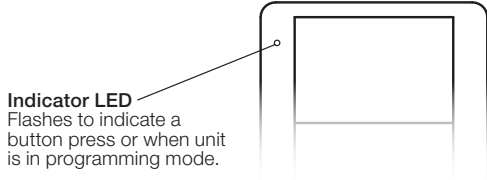
Dimensions

Measurements shown as: in (mm)



Job Name: <input type="text"/>	Model Numbers: <input type="text"/>	
Job Number: <input type="text"/>	<input type="text"/>	<input type="text"/>

Operation

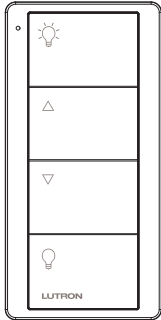


Indicator LED
Flashes to indicate a button press or when unit is in programming mode.

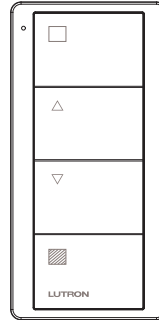
Zone Controls (2BRL)

Lights Models: L01, EL1

Shades Models: S01, ES1



- ON Button**
Lights brighten to full intensity.
- Raise Button**
Lights increase in intensity.
- Lower Button**
Lights decrease in intensity.
- OFF Button**
Lights dim to off.



- OPEN Button**
Shades open fully.
- Raise Button**
Shades open gradually.
- Lower Button**
Shades close gradually.
- CLOSE Button**
Shades close fully.

Zone Controls (-S01, -ES1) Shade Functionality

System Type	Serena® Wireless	Triathlon® Wireless	Sivoia® QS Wireless	Sivoia® QS Wired
Standalone Pico®	Yes ¹	Yes ¹	Yes	Yes ²
Caséta® Smart Bridge™	Yes	—	—	—
Caséta® Smart Bridge™ Pro	Yes	Yes	Yes	—
RadioRA® 2	—	Yes	Yes	—
HomeWorks® QS	—	Yes ³	Yes ³	Yes ³
Quantum® systems ¹	—	—	—	Yes ²
myRoom™ prime	Yes ¹	Yes ¹	Yes	Yes ²
myRoom™ plus	—	Yes ³	Yes ³	Yes ³

¹ Available 1ST quarter, 2016.
² QS sensor module required.
³ Either a QS sensor module or a Hybrid Repeater is required.

(continued on next page...)

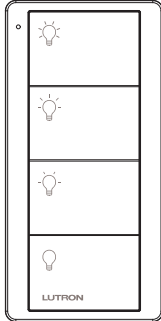
LUTRON® SPECIFICATION SUBMITTAL

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Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>

Operation (continued)

Scene Controls (Default settings: 100%, 66%, 33%, 0)

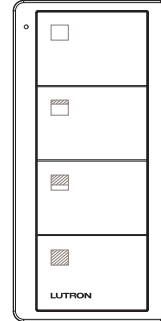
Lights Models: L31, EL2



3 Scene Buttons
Tap once: Sends device to preset levels.
Press and hold for 6 seconds: Saves new preset level or position.

OFF Button
Lights dim to off.

Shades Models: S31, ES2



OPEN Button
Shades open fully.

2 Scene Buttons
Tap once: Sends device to preset levels.
Press and hold for 6 seconds: Saves new preset level or position.

CLOSE Button
Shades close fully.

Scene Controls (-S31, -ES2) Shade Functionality

System Type	Serena® Wireless	Triathlon® Wireless	Sivoia® QS Wireless	Sivoia® QS Wired
Standalone Pico®	—	—	Yes	—
Caséta® Smart Bridge™	Yes	—	—	—
Caséta® Smart Bridge™ Pro	Yes	Yes	Yes	—
RadioRA® 2	—	Yes	Yes	—
HomeWorks® QS	—	Yes ¹	Yes ¹	Yes ¹
Quantum® systems ²	—	—	—	Yes ³
myRoom™ prime	—	—	Yes	—
myRoom™ plus	—	Yes ¹	Yes ¹	Yes ¹

¹ Either a QS sensor module or a Hybrid Repeater is required.
² Available 1st quarter, 2016.
³ QS sensor module required.

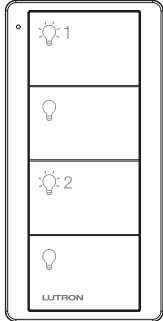
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Job Number: <input type="text"/>	<input type="text"/>	<input type="text"/>

Operation (continued)

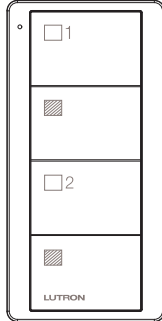
2-Group Controls

Lights Model: L21



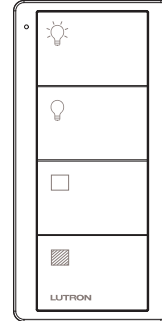
- ← **ON Button #1**
Lights brighten to full intensity.
- ← **OFF Button #1**
Lights dim to off.
- ← **ON Button #2**
Lights brighten to full intensity.
- ← **OFF Button #2**
Lights dim to off.

Shades Model: S21



- ← **OPEN Button #1**
Shades open fully.
- ← **CLOSE Button #1**
Shades close fully.
- ← **OPEN Button #2**
Shades open fully.
- ← **CLOSE Button #2**
Shades close fully.

Lights/Shades Model: LS21



- ← **ON Button**
Lights brighten to full intensity.
- ← **OFF Button**
Lights dim to off.
- ← **OPEN Button**
Shades open fully.
- ← **CLOSE Button**
Shades close fully.

2-Group Controls (-S21, -LS21) Shade Functionality

System Type	Serena® Wireless	Triathlon® Wireless	Sivoia® QS Wireless	Sivoia® QS Wired
Standalone Pico®	—	—	Yes	—
Caséta® Smart Bridge™	Yes	—	—	—
Caséta® Smart Bridge™ Pro	Yes	Yes	Yes	—
RadioRA® 2	—	Yes	Yes	—
HomeWorks® QS	—	Yes ¹	Yes ¹	Yes ¹
Quantum® systems ²	—	—	—	Yes ³
myRoom™ prime	—	—	Yes	—
myRoom™ plus	—	Yes ¹	Yes ¹	Yes ¹

¹ Either a QS sensor module or a Hybrid Repeater is required.
² Available 1st quarter, 2016.
³ QS sensor module required.

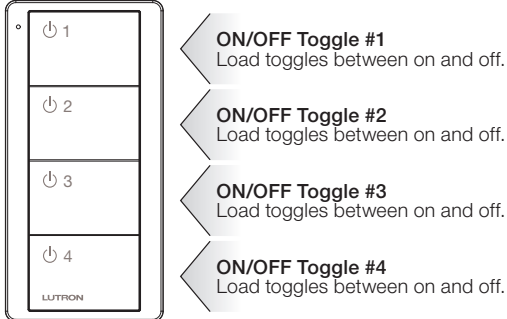
(continued on next page...)

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 95%; height: 20px;" type="text"/>
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>

Operation (continued)

4-Group Toggle (HomeWorks® QS, Quantum®, and myRoom™ plus systems only)

Model: L41



4-Group Toggle Controls (-L41) Shade Functionality

System Type	Serena® Wireless	Triathlon® Wireless	Sivoia® QS Wireless	Sivoia® QS Wired
Standalone Pico®	—	—	—	—
Caséta® Smart Bridge™	—	—	—	—
Caséta® Smart Bridge™ Pro	—	—	—	—
RadioRA® 2	—	—	—	—
HomeWorks® QS	—	Yes ¹	Yes ¹	Yes ¹
Quantum® systems ²	—	—	—	Yes ³
myRoom™ prime	—	—	—	—
myRoom™ plus	—	Yes ¹	Yes ¹	Yes ¹

¹ Either a QS sensor module or a Hybrid Repeater is required.
² Available 1st quarter, 2016.
³ QS sensor module required.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>	
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>	

Model Number

For order quantities of 96 pieces or greater of the same model number, bulk packaging may be available. Mounting hardware is not included with bulk packaging. For availability, please contact Lutron® Customer Service at 1.888.LUTRON1 (1.888.588.7661).

Standard Icon Models



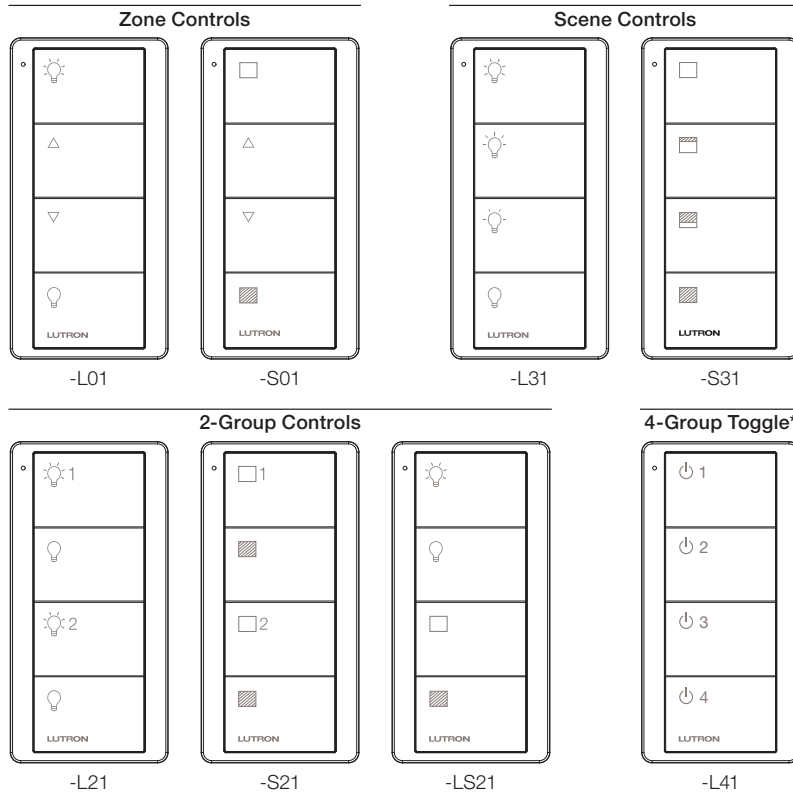
Frequency/Channel Code

J: 431.0–437.0 MHz

Color Codes

Gloss Color	Code
White	WH
Black	BL
Ivory	IV
Light Almond	LA

Button Marking Codes



* HomeWorks® QS, myRoom™, and Quantum® systems only

(continued on next page...)

LUTRON® SPECIFICATION SUBMITTAL

Job Name:	Model Numbers:	
<input type="text"/>	<input type="text"/>	<input type="text"/>
Job Number:	<input type="text"/>	<input type="text"/>

Model Number (continued)

Customizable Engraving Models

Pico® 4-Button wireless remote will be the first Pico® product to offer customizable engraving on Zone and Scene controls for both lights and shades. The following text restrictions and button marking codes must be considered when ordering from Lutron® Customer Service:

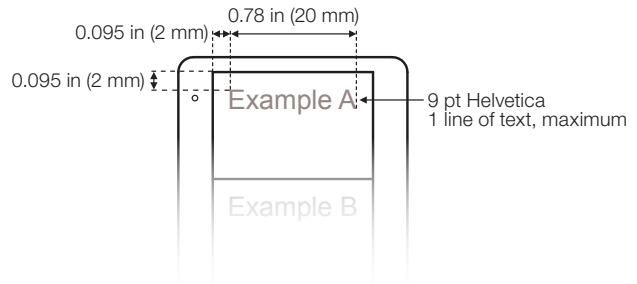


Frequency/Channel Code

J: 431.0–437.0 MHz

Color Codes

Gloss Color	Code
White	WH
Black	BL
Ivory	IV
Light Almond	LA

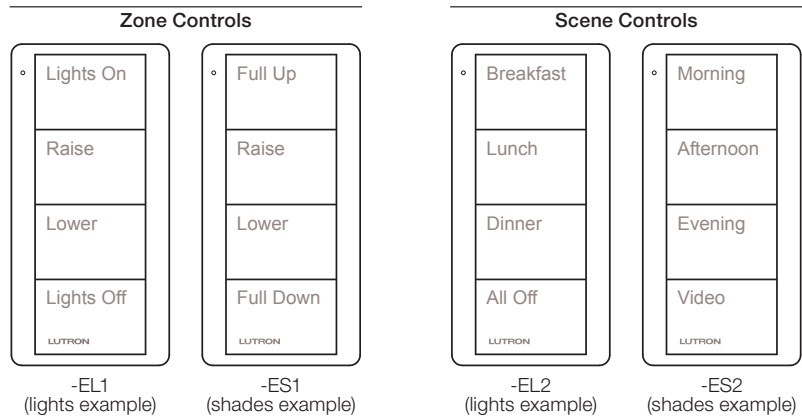


Button Marking Codes

Custom-engraved models for Zone control keypads (-L01, -S01) and Scene control keypads (-L31, -S31) are available but require a different set of button marking codes when ordering (**Note:** 2-Group [-L21, -S21, -LS21] and 4-Group Toggle [-L41] controls are not offered with the custom engraving option).

	Button Marking Codes	
	Standard Engraving	Custom Engraving
Zone Control of Lights	-L01	-EL1
Zone Control of Shades	-S01	-ES1
Scene Control of Lights	-L31	-EL2
Scene Control of Shades	-S31	-ES2

When selecting alternate labels for buttons, remember button functionality presets as shown in the **Operation** section on pages 4 and 5. The examples to the right show sample text choices:



Job Name:	Model Numbers:	
<input type="text"/>	<input type="text"/>	<input type="text"/>
Job Number:	<input type="text"/>	<input type="text"/>

Pico® Pedestal Model Number

Pedestals sold separately.



Capacity Codes

Capacity	Code
Single	1
Double	2
Triple	3
Quadruple	4

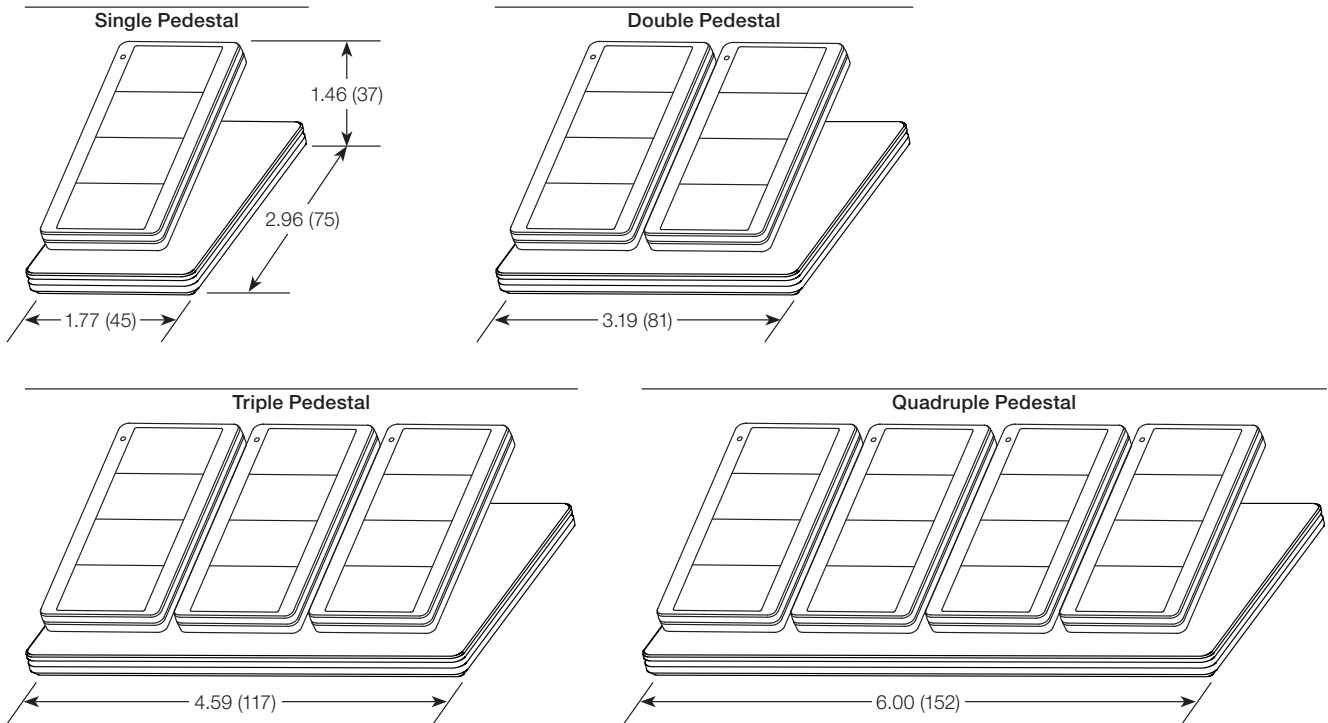
Color Codes

Available in gloss finish only.

Color	Code
White	WH
Black	BL

Dimensions

Measurements shown as: in (mm)



<p>Job Name: <input style="width: 95%;" type="text"/></p> <p>Job Number: <input style="width: 100%;" type="text"/></p>	<p>Model Numbers:</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 60%; height: 20px;"><input style="width: 98%;" type="text"/></td> <td style="width: 40%; height: 20px;"><input style="width: 98%;" type="text"/></td> </tr> <tr> <td style="width: 60%; height: 20px;"><input style="width: 98%;" type="text"/></td> <td style="width: 40%; height: 20px;"><input style="width: 98%;" type="text"/></td> </tr> </table>	<input style="width: 98%;" type="text"/>	<input style="width: 98%;" type="text"/>	<input style="width: 98%;" type="text"/>	<input style="width: 98%;" type="text"/>
<input style="width: 98%;" type="text"/>	<input style="width: 98%;" type="text"/>				
<input style="width: 98%;" type="text"/>	<input style="width: 98%;" type="text"/>				

Mounting Options

Standalone Mounting: Adhesive-Mount

Included with Pico® wireless remote



Standalone Mounting: Screw-Mount

Model PICO-SM-KIT (sold separately)

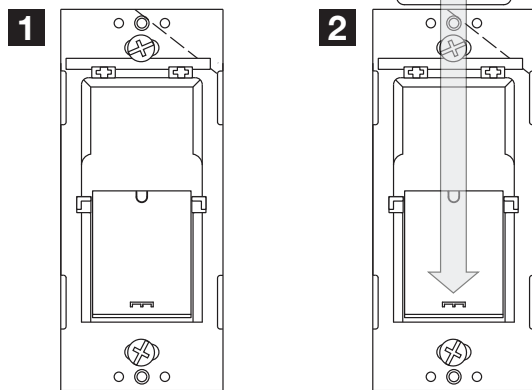
Kit includes special screws to be used for more permanent mounting and/or for non-smooth surfaces.



Wallbox Adapter

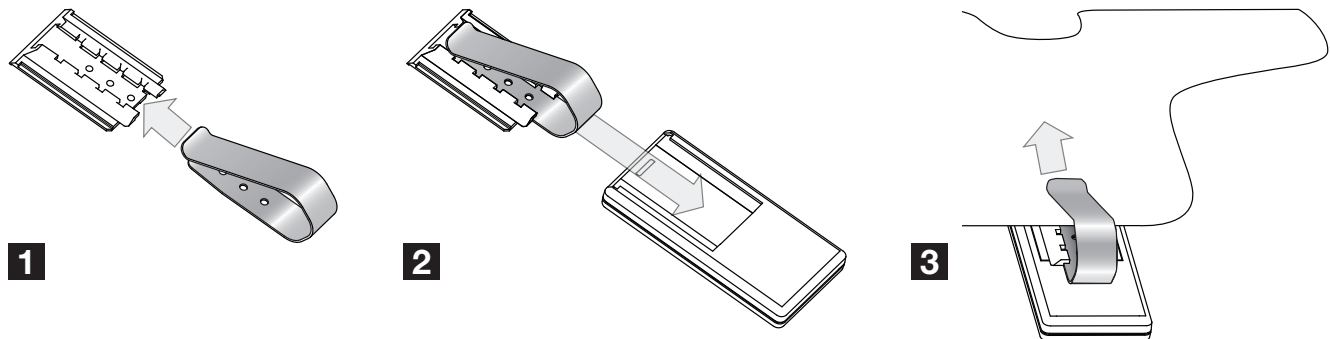
Model PICO-WBX-ADAPT (sold separately)

Wallplate adapter/wallplate sold separately.



Mounting to a Car Visor

Model PICO-CARVISOR-CL (sold separately)

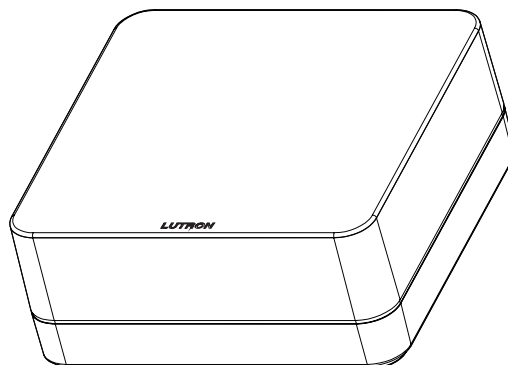


LUTRON® SPECIFICATION SUBMITTAL

Job Name: <input style="width: 90%;" type="text"/>	Model Numbers: <input style="width: 98%;" type="text"/>	
Job Number: <input style="width: 80%;" type="text"/>	<input style="width: 98%;" type="text"/>	<input style="width: 98%;" type="text"/>

Lutron® Smart Bridge and Lutron® Smart Bridge PRO

The Smart Bridge and Smart Bridge PRO allow for setup, control, and monitoring of Caséta® Wireless devices and Lutron® wireless shades from a smartphone or tablet using the Lutron® App¹.



Lutron® Smart Bridge and Smart Bridge PRO

Models Available

- L-BDG2-WH 5 V $\overline{=}$ 300 mA (Lutron® Smart Bridge)
- L-BDGPRO2-WH 5 V $\overline{=}$ 300 mA (Lutron® Smart Bridge PRO)

¹ The Lutron® App is required for setup and use with the Smart Bridge/Smart Bridge PRO. The Lutron® App is compatible with iOS® devices version 8.0 or later and Android™ devices 4.1 or later.

iOS is a registered trademark of Cisco in the U.S. and other countries and is used under license. Android is a trademark of Google Inc. Apple, Apple TV, iPad, iPod touch, iPhone, and Siri are registered trademarks and Apple Watch and HomeKit are trademarks of Apple Inc., registered in the U.S. and other countries.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 95%; height: 20px;" type="text"/>	
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>

Features	Smart Bridge	Smart Bridge PRO
Supports up to 50 wireless devices (Caséta® Wireless dimmers, plug-in dimmers, and switches, Pico® remote controls, wireless shades). Smart Bridge/Smart Bridge PRO counts as one device.	√	√
Programmed via the Lutron® App (available for iOS® and Android™).	√	√
Scene control via the Lutron® App.	√	√
Timeclock scheduling of daily events via the Lutron® App.	√	√
Connects to Wi-Fi router via Ethernet.	√	√
Local device operation will continue to function if internet connection is lost or Smart Bridge/Smart Bridge PRO is powered down or not communicating.	√	√
System access from anywhere in the world using the Lutron® App.	√	√
Supports Caséta® Wireless devices, Serena® shades, and Pico® remote controls.	√	√
Control outside the app via widgets (iOS® and Android™).	√	√
Supports Geofencing from the Lutron® App.	√	√
Control from <i>Apple Watch</i> .	√	√
Supports <i>Siri</i> and <i>Apple HomeKit</i> technology. ¹	√	√
Supports Sivoia® QS Triathlon® and select Sivoia® QS Wireless shades (venetian and horizontal sheer blinds are not supported).		√
Integration with select A/V and security systems (see www.casetawireless.com/integration for details).		√

¹ HomeKit requires an iPhone, iPad, or iPod touch with iOS 8.1 or later. Controlling HomeKit-enabled accessories from home also requires an Apple TV (3rd generation or later) with Apple TV software 7.0 or later. Smart Bridge enables plug-in lamp dimmers to work with HomeKit technology. See CasetWireless.com/Support for more details.

iOS is a registered trademark of Cisco in the U.S. and other countries and is used under license. Android is a trademark of Google Inc.

Apple, Apple TV, iPad, iPod touch, iPhone, and Siri are registered trademarks and Apple Watch and HomeKit are trademarks of Apple Inc., registered in the U.S. and other countries.

LUTRON® SPECIFICATION SUBMITTAL

Page 2

Job Name: <input type="text"/>	Model Numbers: <input type="text"/>	<input type="text"/>
Job Number: <input type="text"/>	<input type="text"/>	<input type="text"/>

Specifications (Smart Bridge/Smart Bridge PRO)

Regulatory Approvals

- cULus Listed
- NOM certified
- FCC approved. Complies with the limits of a Class B digital device, pursuant to Part 15 of the FCC rules
- IC certified
- COFETEL certified

Power

- 5 V \equiv 300 mA
- Power Supply (included): 5 V \equiv 550 mA, cable length 6 ft (1.83 m)

Typical Power Consumption

- Lutron® Smart Bridge: 1.3 W
- Lutron® Smart Bridge PRO: 1.3 W
- Test Conditions: LED on, Ethernet cable plugged in, powered by the 5 V \equiv adapter

Environment

- Ambient operating temperature: 32 °F to 104 °F (0 °C to 40 °C)
- 0% to 90% humidity, non-condensing
- Indoor use only

Communications

- All devices must be located within 30 ft (9 m) of Smart Bridge/Smart Bridge PRO
- System devices operate on frequencies between 431.0 MHz to 437 MHz
- Internet connection required for initial setup and to maintain system date/time and receive periodic firmware updates

Protection

- Tested to withstand electrostatic discharge without damage or memory loss in accordance with IEC 61000-4-2
- Tested to withstand surge voltages without damage or loss of operation, in accordance with IEEE C62.41-1991

Power Failure Memory

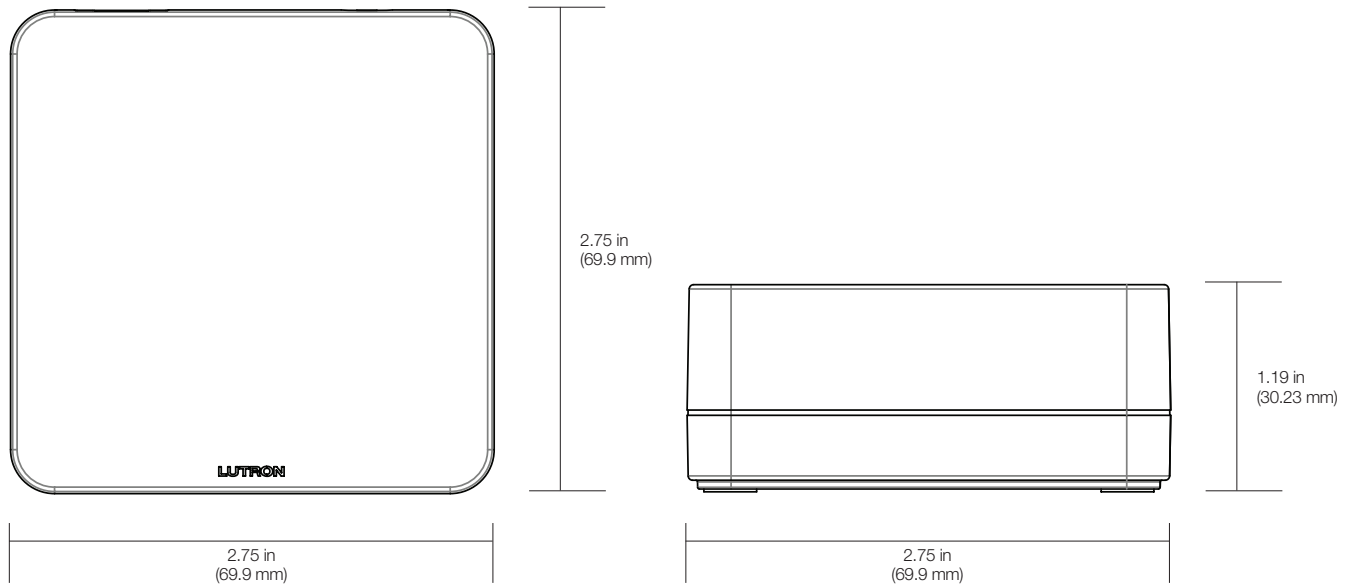
- Should power be interrupted, the Smart Bridge/Smart Bridge PRO will return to its previous state when power is restored

Connections

- Ethernet: 3 ft (0.92 m) cable included (for internet and Lutron® App connection)
- USB (power only)

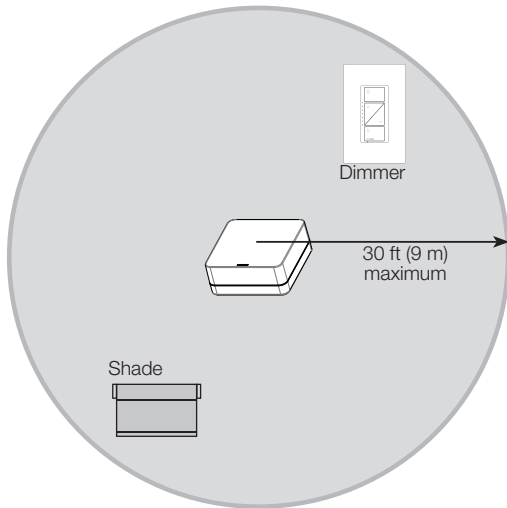
Job Name: <input type="text"/>	Model Numbers: <input type="text"/>	
Job Number: <input type="text"/>	<input type="text"/>	<input type="text"/>

Dimensions (Smart Bridge/Smart Bridge PRO)



Job Name: <input type="text"/>	Model Numbers: <input type="text"/>	
Job Number: <input type="text"/>	<input type="text"/>	<input type="text"/>

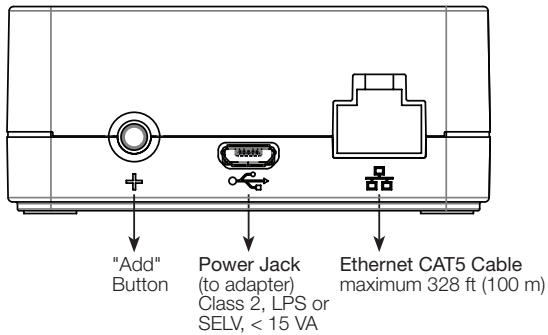
RF Range (Smart Bridge/Smart Bridge PRO)



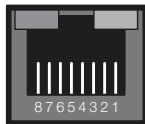
All devices must be located within 30 ft (9 m) of Smart Bridge/Smart Bridge PRO

Connections (Smart Bridge and Smart Bridge PRO)

Back View



Ethernet Pin Numbering



Ethernet	Pin #
T+Ve	1
T-Ve	2
R+Ve	3
R-Ve	6

Job Name: <input type="text"/> Job Number: <input type="text"/>	Model Numbers: <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
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Pico Remote Control for Audio

The Pico remote control for audio is a simple keypad for direct control of audio from anywhere in the home. This battery-operated control requires no external power or communication wiring.

Features

- Compatible systems include:¹
 - Caséta Wireless
 - RadioRA 2
 - HomeWorks QS
- Works with Sonos and other select audio control systems. Visit lutron.com/AudioPico for more information
- Easy reconfiguration for use as:
 - Handheld remote
 - Wall-mount control (with or without faceplate; faceplate adapter kit sold separately)
 - A table top control (table top pedestal sold separately)
- Battery-powered. Requires no wiring.
- 10-year battery life (one CR2032 battery included).
- Can be assigned to a Lutron Smart Bridge, Lutron Smart Bridge PRO, or a Lutron Repeater that is within a range of 30 ft (9 m).



Pico Remote Control for Audio

¹ Compatible systems require a Lutron Smart Bridge, Lutron Smart Bridge PRO, or a Lutron Connect Bridge. Setup the Pico remote control using the Lutron App for Caséta Wireless or the Lutron Connect App for RadioRA 2 and HomeWorks QS.

Job Name:	Model Numbers:
Job Number:	

Specifications

Regulatory Approvals

- Lutron Quality Systems registered to ISO 9001:2008.
- FCC Certified (U.S.A.)
- IC Certified (Canada)
- COFETEL Certified (Mexico)
- SUTEL Certified (Costa Rica)
- Anatel Certified (Brazil)

Power

- Operating Voltage 3 V⁻⁻⁻
- (1) CR2032 Battery (included)

System Communication and Capacity

- Communicates using Radio Frequency (RF) at 431 MHz to 437 MHz.
- Thousands of system addresses prevent interference between systems.
- Can be assigned to a Lutron Smart Bridge or a Lutron Repeater that is within a 30 ft (9 m) range.

Mounting Considerations

- Mounting of any RF devices on, or in close proximity to, a metal surface will drastically reduce the effective range of radio signal transmission and reception.
- All RF devices must be mounted on non-conductive materials to ensure proper performance.
- If you wish to mount your Pico remote control to a metal surface, the PICO-MOUNT-1-XX-CPN5733 will be required in order to maintain proper RF performance. For availability, please contact your local Lutron® sales office.

Environment

- Ambient operating temperature: 32 °F to 140 °F (0 °C to 60 °C)
- Maximum 90% non-condensing relative humidity
- Indoor use only

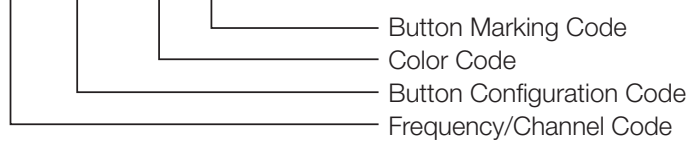
Warranty

- 1 Year Limited Warranty
For additional Warranty information, please visit www.lutron.com/TechnicalDocumentLibrary/369-119_Wallbox_Warranty.pdf

Job Name:	Model Numbers:
Job Number:	

Model Number

PJ2-XXXX-GXX-XXX



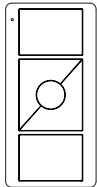
Frequency/Channel Codes:

Code

J — 431.0 - 437.0 MHz

Button Configuration Codes:

<u>Button Configuration</u>	<u>Code</u>
3 Button with Raise/Lower	3BRL



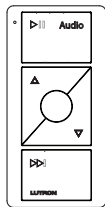
3 Button with Raise/Lower (3BRL)

Color Codes:

<u>Gloss Color</u>	<u>Code</u>
White	WH
Black	BL

Button Marking Codes:

3 Button with Raise/Lower



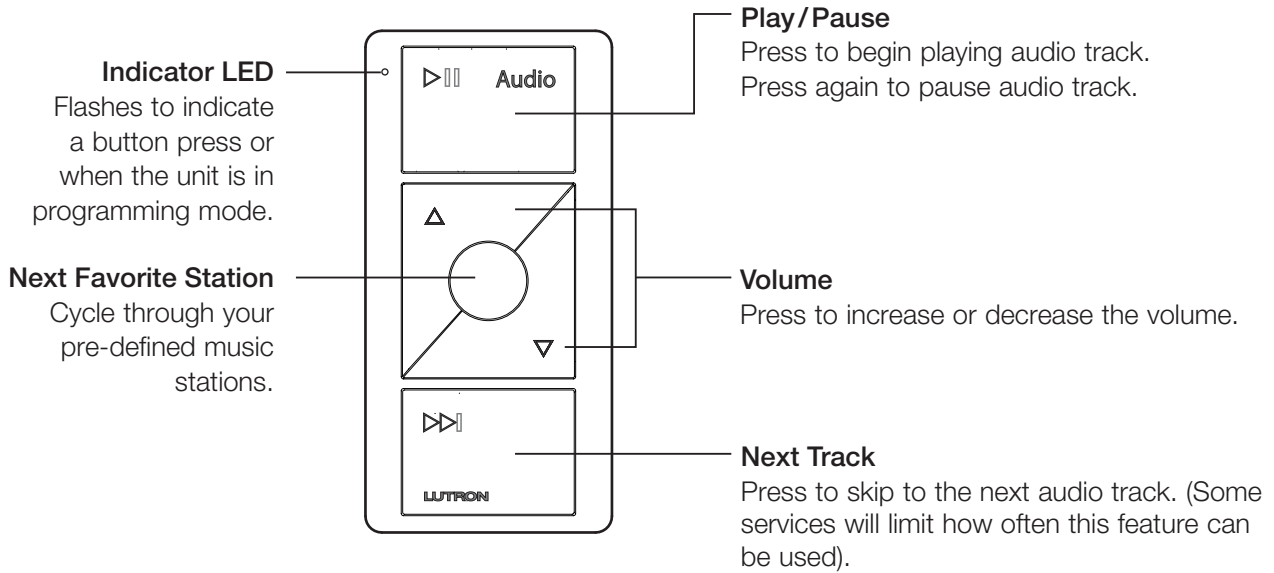
Audio (A02)

LUTRON SPECIFICATION SUBMITTAL

Page:

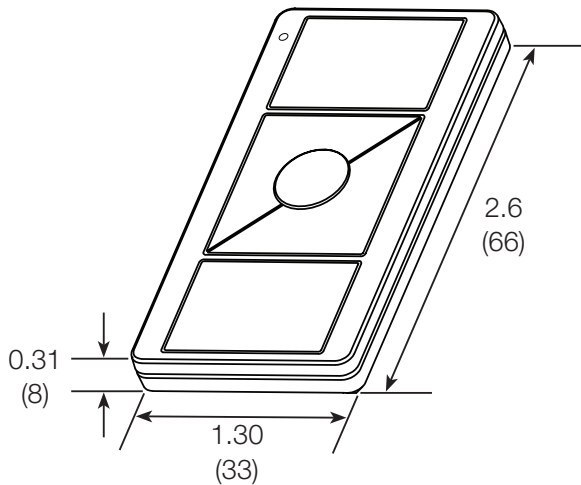
Job Name:	Model Numbers:
Job Number:	

Operation



Dimensions

Measurements shown as: in (mm)

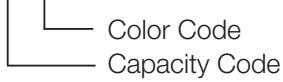


Job Name:	Model Numbers:
Job Number:	

Pico Pedestal Model Number

Pedestals sold separately. Available in gloss finish only.

L-PEDX-XX



Capacity Codes:

Capacity	Code
Single	1
Double	2
Triple	3
Quadruple	4

Color Codes:

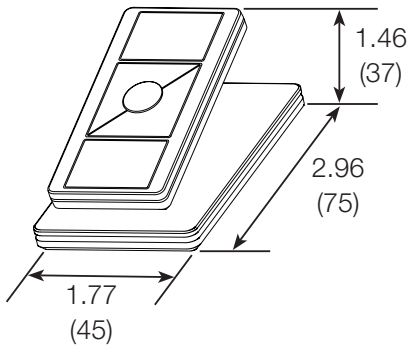
Gloss Color	Code
White	WH
Black	BL

Dimensions

Measurements shown as: in (mm)

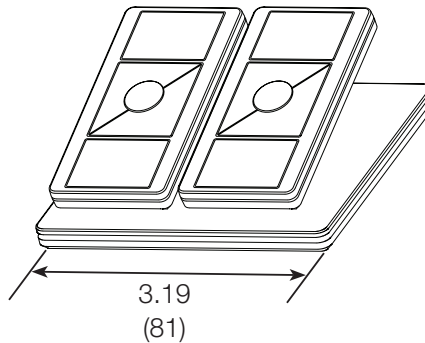
Single Pedestal

Pedestals sold separately.



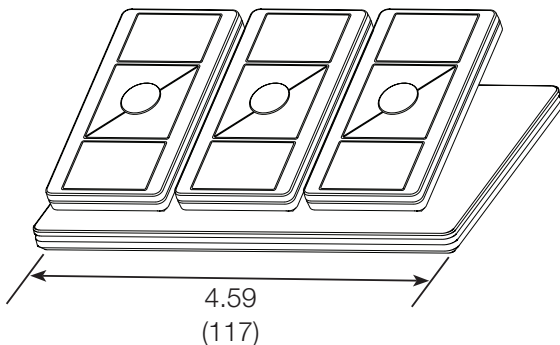
Double Pedestal

Pedestals sold separately.



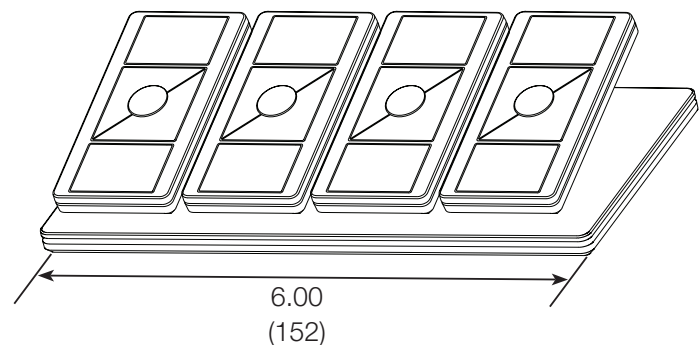
Triple Pedestal

Pedestals sold separately.



Quadruple Pedestal

Pedestals sold separately.

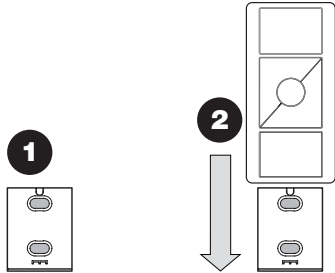


Job Name:	Model Numbers:
Job Number:	

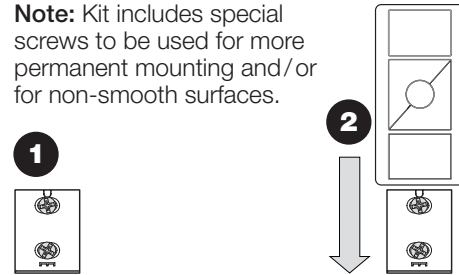
Mounting Options

Stand Alone Mounting

Adhesive-Mount
(included with Pico remote control)



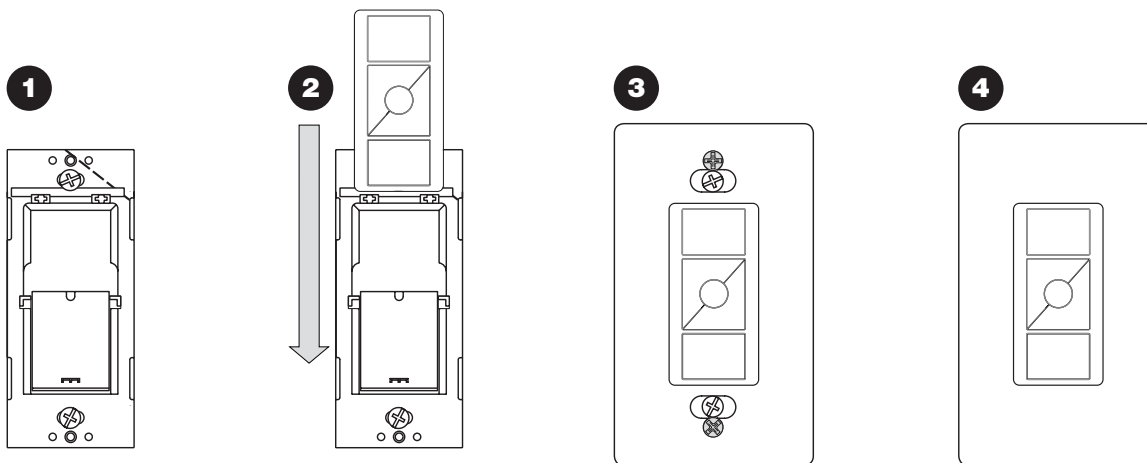
Screw-Mount (sold separately)
Model PICO-SM-KIT



Note: Kit includes special screws to be used for more permanent mounting and/or for non-smooth surfaces.

Wallbox Adapter

Model PICO-WBX-ADAPT
(sold separately)



*Wallplate adapter / wallplate sold separately

Continued on next page...

LUTRON SPECIFICATION SUBMITTAL

Page:

Job Name:	Model Numbers:
Job Number:	

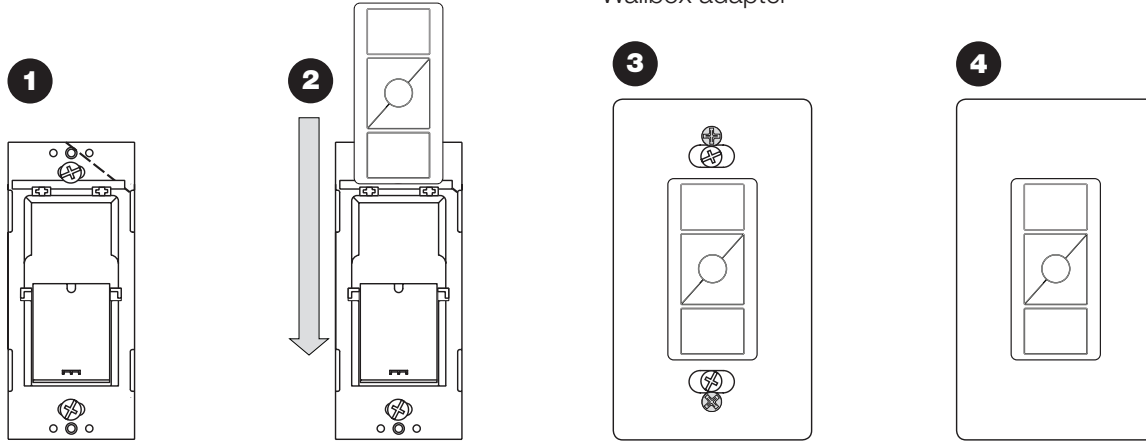
Mounting Options *(continued)*

Wall-Mounting Kit

Model PJ2-WALL-WH-L01R
(sold separately)

Kit includes:

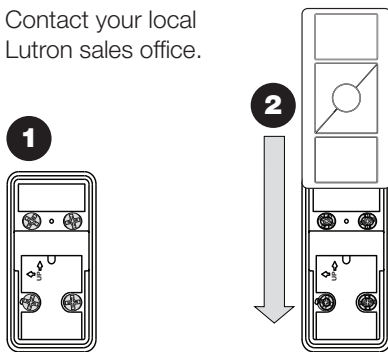
- Pico remote control
- Claro wallplate (with wallplate adapter)
- Wallbox adapter



Mounting to Metal Surfaces

Model: PICO-MOUNT-1-XX-CPN5733 (sold separately)

Contact your local Lutron sales office.



Lutron, Lutron, Caséta, Claro, HomeWorks, Pico and RadioRA are trademarks of Lutron Electronics Co., Inc., registered in the U.S. and other countries.

Lutron Connect and Smart Bridge are trademarks of Lutron Electronics Co., Inc.

Sonos is a registered trademark of Sonos, Inc. in the United States, Canada, United Kingdom, Benelux (Belgium, Luxembourg and The Netherlands), Japan, Mexico, Germany, Russia, Australia, Italy, Norway and Sweden, and a trademark of Sonos, Inc. in other countries.

LUTRON SPECIFICATION SUBMITTAL

Page:

Job Name:	Model Numbers:
Job Number:	

Caséta® Wireless Load Controls

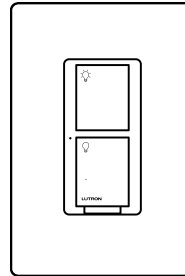
The Caséta® Wireless family of Dimmers and Switches can be controlled directly and remotely when paired with Pico® Remote Controls providing a system that delivers convenience and ease of installation.

Caséta® Wireless Dimmers and Switches use Lutron® patented Clear Connect® RF Technology which enables wireless communication with Pico® Remote Controls and the Lutron® Smart Bridge and Smart Bridge PRO.

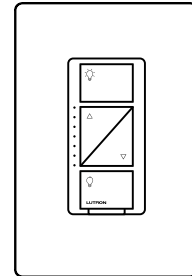
Features

- Works with Pico® Remote Control
- Works with the Lutron® App (via a Smart Bridge or Smart Bridge PRO)¹
- Lutron® patented Clear Connect® RF Technology works through walls and floors
- Includes Front Accessible Service Switch (FASS™) for safe lamp replacement
- Works with Lutron® Radio Powr Savr™ Occupancy and Vacancy Sensors in standalone applications (sensors do not work with Smart Bridge or Smart Bridge PRO)

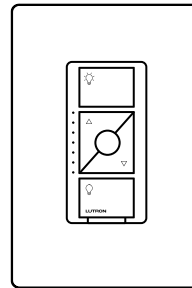
Caséta® Wireless In-Wall Switch



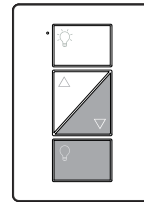
Caséta® Wireless In-Wall Dimmer



Caséta® Wireless ELV+ Dimmer



Caséta® Wireless Plug-In Lamp Dimmer



Note: Certain models or load types will require a neutral connection. (see Load Types and Capacity sections)

¹ The Lutron® App is required for setup and usage with the Smart Bridge and Smart Bridge PRO. The Lutron® App is compatible with iOS® devices version 8.0 or later and Android™ devices 4.0 or later. iOS is a registered trademark of Cisco in the U.S. and other countries and is used under license. Android is a trademark of Google Inc.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 95%; height: 20px;" type="text"/>	
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>

Specifications

Regulatory Approvals

- cULus Listed
- NOM Certified
- FCC Approved. Complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules
- Industry Canada Certified
- IFTEL Certified
- NEMA 410 (-6ANS, -5WS, -10NXD, and -5NE)

Power

Operating voltage:

- 120 V~ 50/60 Hz: -3PCL, -6WCL, -10NXD, -6ANS, -5NE
- 120/277 V~ 50/60 Hz: -5WS-DV

Key Design Features

- Tested to withstand electrostatic discharge without damage or memory loss, in accordance with IEC 61000-4-2.
- Tested to withstand surge voltages without damage or loss of operation, in accordance with IEEE C62.41-1991 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- Load controls always operate locally and do not require system control.
- Power failure memory: should power be interrupted, the control will return to its previously set level prior to the interruption when power is restored.
- PD-5WS-DV, PD-6ANS, and PD-10NXD use conventional 3-way wiring.
- Uses Lutron® Claro® Wallplates or designer-style wallplates from other manufacturers. Wallplates are sold separately.
- Lutron® Claro® Wallplates snap on with no visible means of attachment.
- Requires a 1-gang U.S. wallbox. 3½ in (89 mm) depth recommended, 2¼ in (57 mm) depth minimum.
- Green status LED(s) to indicate load status.

System Communications and Capacity

- Caséta® Wireless In-Wall Switches and Dimmers communicate with Pico® remote controls and the Lutron® Smart Bridge/Smart Bridge PRO through Radio Frequency (RF).
- The Caséta® Wireless In-Wall Switches and Dimmers communicate with Lutron® Radio Powr Savr™ Occupancy and Vacancy Sensors in a standalone application. Sensors do not work with Smart Bridge or Smart Bridge PRO.
- The Caséta® Wireless In-Wall Switches and Dimmers must be located within 60 ft (18 m) line-of-sight or 30 ft (9 m) through walls, of Pico® remote controls and Lutron® Smart Bridge devices.

Device limits

- Pico® Remote Controls and Radio Powr Savr™ Occupancy Sensors: up to 10 devices (total) may be paired to each Caséta® Wireless In-Wall Switch/Dimmer (with no Smart Bridge installed).
- Smart Bridge or Smart Bridge PRO system: up to 50 total wireless devices (Caséta® Wireless Dimmers/Switches, Pico® Remote Controls, and Shades) are supported per system. Smart Bridge or Smart Bridge PRO counts as one device.

Environment

- Ambient operating temperature: 32 °F to 104 °F (0 °C to 40 °C), 0% to 90% humidity, non-condensing. Indoor use only.
- PD-5WS-DV, PD-6ANS, and PD-10NXD can be used with mechanical switch in 3-way applications.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>

Features

	PRO Dimmer PD-10NXD	Plug-In Dimmer PD-3PCL	In-Wall Dimmer PD-6WCL	ELV+ Dimmer PD-5NE	2-wire Switch PD-5WS-DV	Neutral Switch PD-6ANS
Simple two-wire installation (no neutral wire required)	√ ¹		√		√	
Capable of dimming loads	√	√	√	√		
Favorite button (user defined one touch light level)				√		
Works with Hi-lume® 1% 2-Wire LED Drivers (Forward-phase only)	√			√	√	√
Works with Power Interfaces (PHPM and GRX TVI)	√			√		
Works with Power Interfaces (PHPM-SW)						√
No wiring required		√				

¹ In some low-wattage applications the PD-10NXD will require a neutral wire connection.

Job Name: <input style="width: 95%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 60%; height: 20px;" type="text"/> <input style="width: 35%; height: 20px;" type="text"/>	
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/>	<input style="width: 100%; height: 20px;" type="text"/>

Load Type and Capacity - Switches

Model Number	Description	Voltage	Load Type	Minimum Load	Maximum Load ³		
					Not Ganged	End of Gang	Middle of Gang
PD-5WS-DV ¹	Two-wire switch	120 V~	Incandescent/Halogen	25 W	600 W	450 W	350 W
		277 V~	Incandescent/Halogen	25 W	1350 W	1100 W	800 W
		120 V~	MLV	25 W	600 VA/475 W	450 VA/350 W	350 VA/275 W
		277 V~	MLV	25 W	1350 VA/1075 W	1100 VA/875 W	800 VA/625 W
		120 V~	General Purpose Fan	0.4 A	3 A	3 A	3 A
		120/277 V~	LED	Use LUT-MLC ²	5 A	4 A	3 A
		120/277 V~	Fluorescent	Use LUT-MLC ²	5 A	4 A	3 A
		120 V~	ELV	Use LUT-MLC ²	600 W	450 W	350 W
PD-6ANS	Neutral-wire switch (neutral connection required)	120 V~	Incandescent/Halogen	10 W	720 W	720 W	600 W
			MLV	10 W	720 VA	720 VA	600 VA
			Fan	0.1 A	3.6 A	3.6 A	3.6 A
			LED	1 bulb	6 A	6 A	5 A
			Fluorescent	1 ballast	6 A	6 A	5 A
			ELV	10 W	720 VA	720 VA	600 VA
			PHPM-SW	1 interface	3 interfaces	3 interfaces	3 interfaces

¹ No neutral wire required.
² To ensure proper operation of the switch with LED, fluorescent, and ELV loads, a LUT-MLC may be required, especially at lower wattages. If the status LED on the switch is flashing or solid red in color, a LUT-MLC must be installed. To guarantee best performance, installing a LUT-MLC with these load types regardless of wattage is recommended. Rarely, some load types may still flicker or glow in the off state even with the LUT-MLC installed, in which case a different load may be required or more than one LUT-MLC is required.
³ See "Ganging and Derating" section.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 95%; height: 20px;" type="text"/>
Job Number: <input style="width: 100px; height: 20px;" type="text"/>	<input style="width: 95%; height: 20px;" type="text"/>

Load Type and Capacity - Dimmers

Model Number	Description	Voltage	Load Type	Minimum Load	Maximum Load			
					Not Ganged	End of Gang	Middle of Gang	
PD-10NXD	Wireless In-Wall Dimmer PRO (neutral connection required for certain load types) ⁴	120 V~	Incandescent/ Halogen	10 W with neutral (25 W without neutral)	1000 W	800 W	600 W	
			MLV Halogen	10 W	1000 VA	800 VA	600 VA	
			MLV LED	See Application Note #559				
			CFL/LED (120 V~ Rated) ³	1 bulb ³	250 W	250 W	250 W	
			Hi-lume® 1% 2-Wire LED drivers	1 driver	1000 W (13 drivers)	800 W (13 drivers)	600 W (13 drivers)	
			Dimmable Ballasts ⁵	1 ballast	1000 VA	800 VA	600 VA	
			PHPM-PA/3F and GRX-TVI ⁴	1 interface	3 interface	3 interface	3 interface	
PD-3PCL ¹	Wireless Plug-In Lamp Dimmer	120 V~	Incandescent/ Halogen	10 W	300 W	N/A	N/A	
			CFL/LED (120 V~ Rated) ³	1 bulb ³	100 W	N/A	N/A	
PD-5NE	Phase Selectable Dimmer (neutral connection required)	120 V~	Incandescent/ Halogen	10 W	500 W	400 W	300 W	
			CFL/LED (120 V~ Rated) ^{3, 6, 7}	1 bulb ³	250 W	250 W	250 W	
			MLV Halogen ^{2, 6, 7}	10 W	400 VA	400 VA	400 VA	
			ELV Halogen	10 W	500 W	400 W	300 W	
			Hi-lume® 1% 2-Wire LED drivers ^{6, 7}	1 driver	400 W (20 drivers)	400 W (20 drivers)	400 W (20 drivers)	
			Dimmable Ballasts ^{5, 6, 7}	1 ballast	400 VA	400 VA	400 VA	
			PHPM-PA/3F and GRX-TVI ^{6, 7}	1 interface	3 interfaces	3 interfaces	3 interfaces	
			ELV LED	See Application Note #559				
MLV LED	See Application Note #559							
PD-6WCL	Wireless In-Wall Dimmer	120 V~	Incandescent/ Halogen	25 W	600 W	500 W	400 W	
			CFL/LED (120 V~ Rated) ³	1 bulb ³	150 W	150 W	150 W	

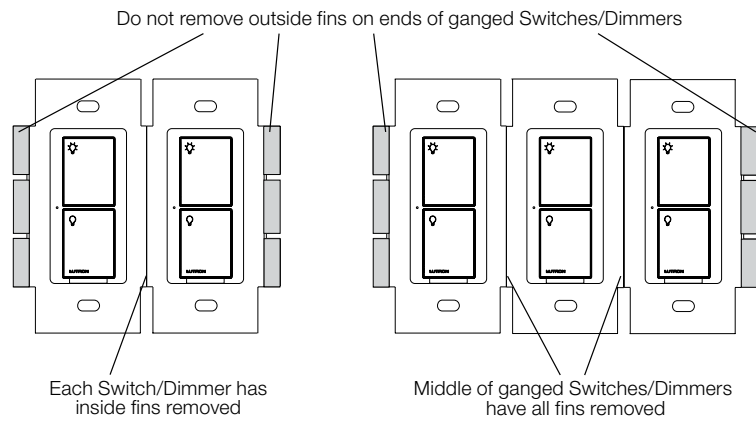
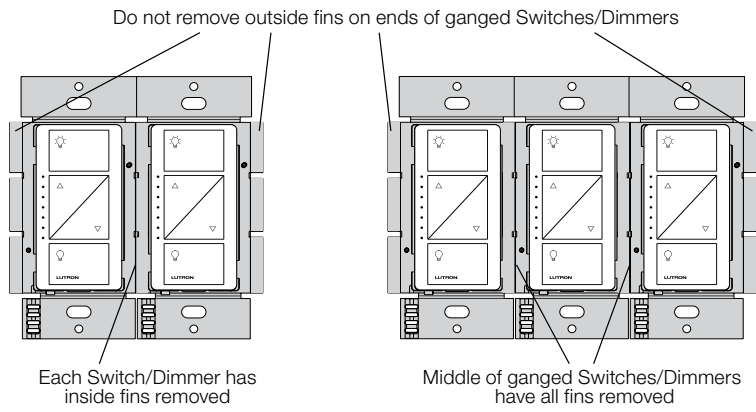
1 Cannot be ganged.
 2 Need to change load type to MLV. See www.casetawireless.com/change_phase
 3 See bulb list at www.lutron.com/led
 4 For PD-10NXD, a neutral connection is required for MLV loads, LED drivers, dimmable ballasts, and power modules (PHPM-PA, PHPM-3F, and GRX-TVI).
 5 Compatible dimmable ballasts include Tu-Wire®, Mark X, and PowerSense®.
 6 These loads are best operated using a forward-phase control. Consult www.lutron.com/bulblist to ensure the appropriate phase for bulb models used.
 7 SSL7 compliant when in forward-phase.

PowerSense is a registered trademark of Osram Sylvania.

Job Name: <input style="width: 90%; height: 20px;" type="text"/>	Model Numbers: <input style="width: 95%; height: 20px;" type="text"/>
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Ganging and Derating

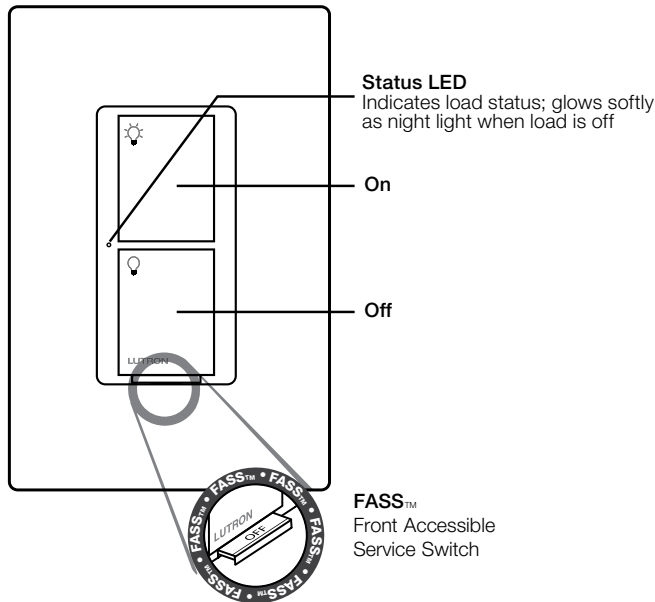
When ganging with other Switches/Dimmers in the same wallbox, derating is required. See “Load Type and Capacity” charts.



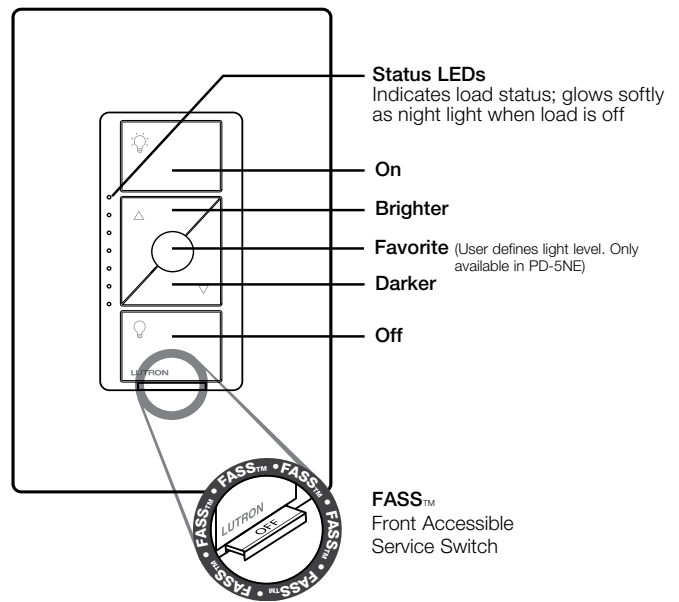
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Job Number: <input type="text"/>	<input type="text"/>

Operation

In-Wall Switch



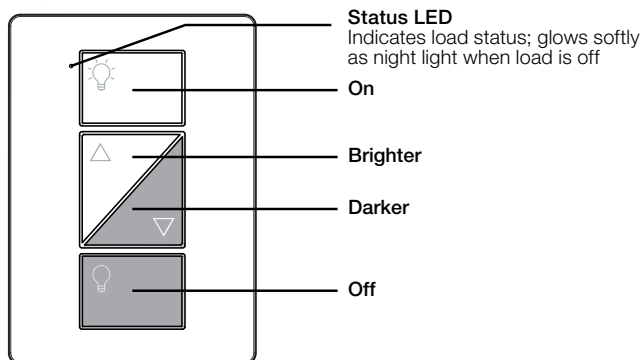
ELV+ Dimmer and In-Wall Dimmer



FASS™ – Front Accessible Service Switch

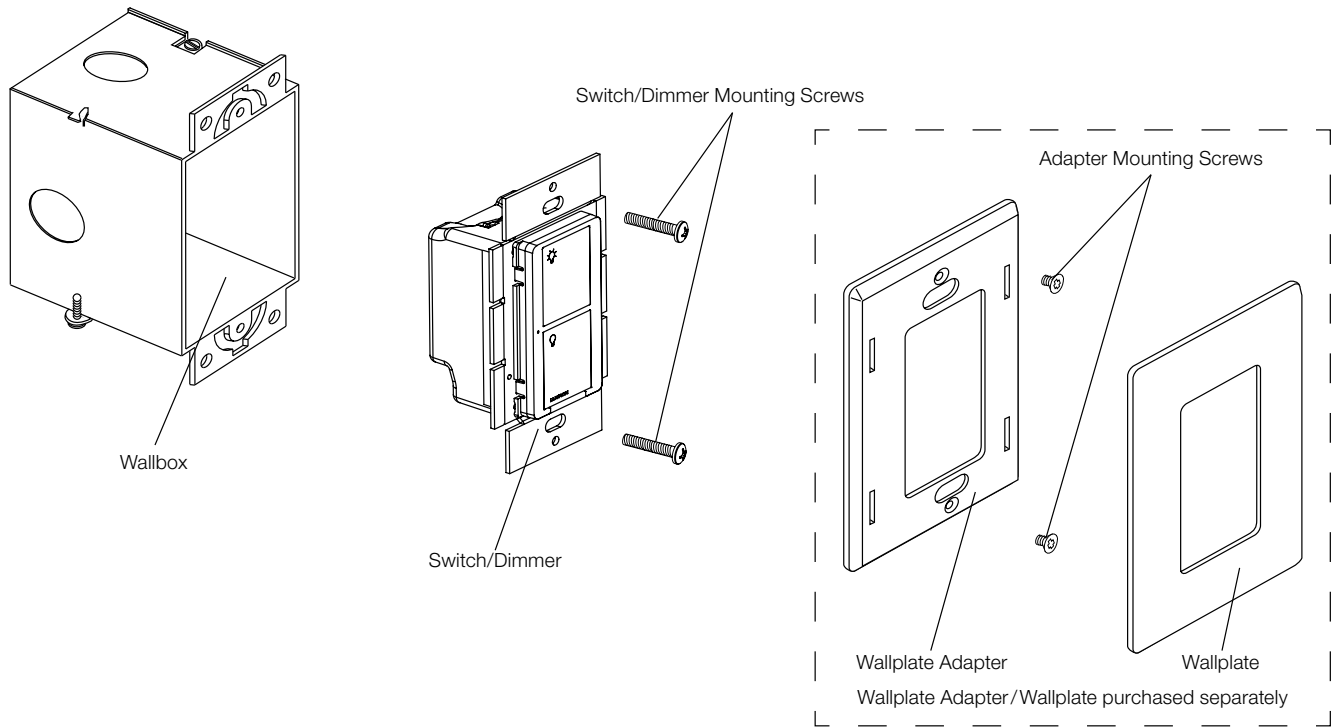
Important Notice: To service load, remove power by pulling out the FASS™ as far as possible. To restore power after servicing load, push the FASS™ back in completely.

Plug-In Dimmer



Job Name: <input type="text"/>	Model Numbers: <input type="text"/>	<input type="text"/>
Job Number: <input type="text"/>	<input type="text"/>	<input type="text"/>

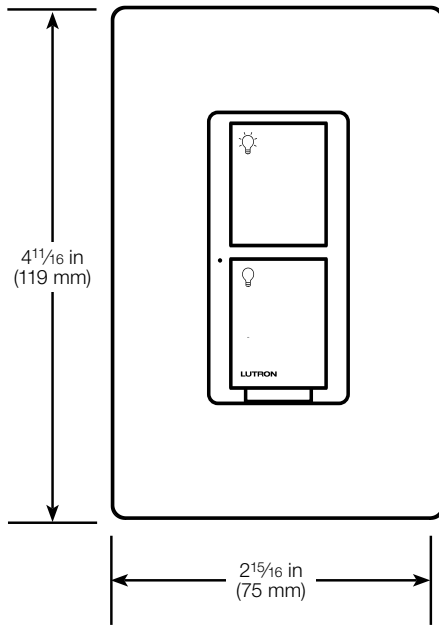
Mounting



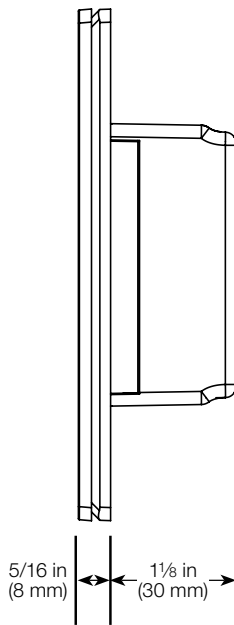
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Job Number: <input type="text"/>	<input type="text"/>

Dimensions In-Wall Switches and Dimmers

Front View

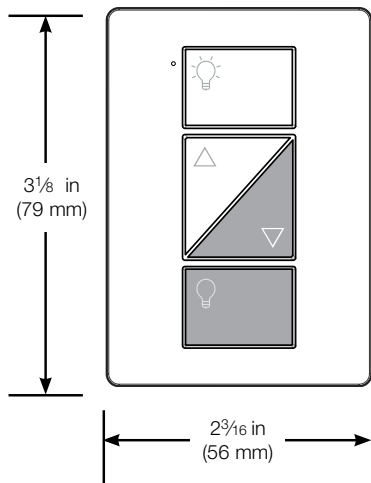


Side View

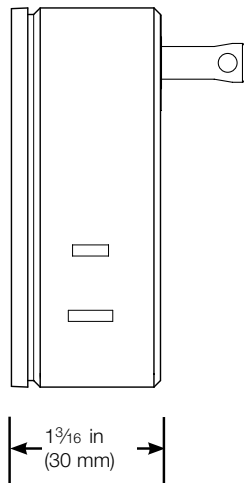


Plug-In Dimmer

Front View



Side View

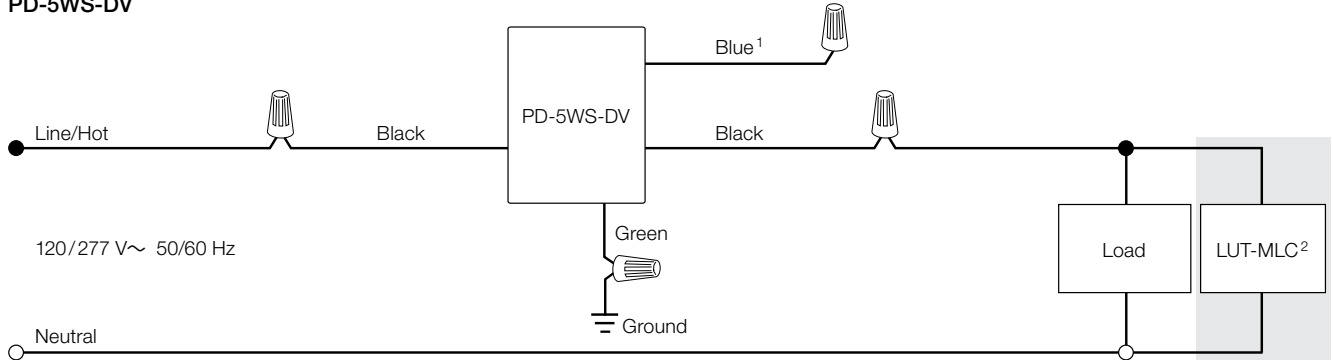


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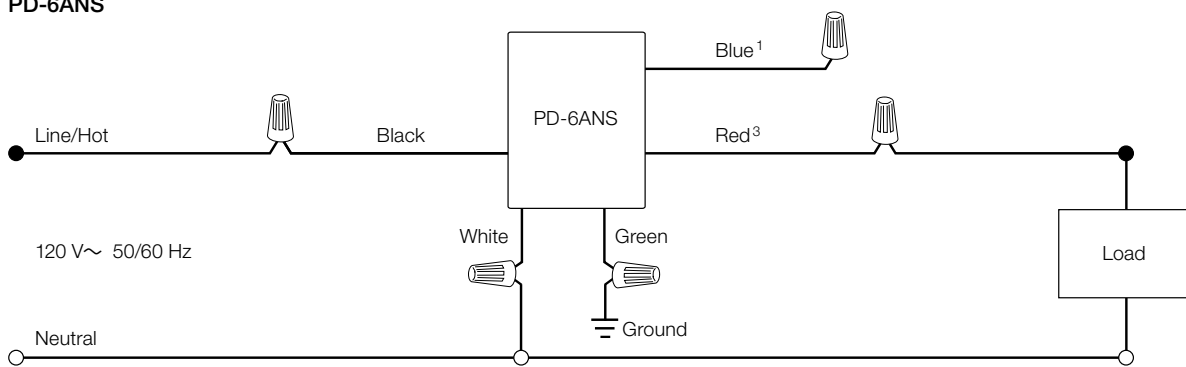
Wiring Diagrams - Switches

Single Location Installation

PD-5WS-DV



PD-6ANS



¹ When using controls without a mechanical 3-way switch, cap the blue terminal. **Do not** connect the blue wire to any other wiring or to ground.

² A LUT-MLC ensures proper function when LED, fluorescent, or ELV loads are used. Install the LUT-MLC inside a load fixture or in a separate junction box within the circuit.

³ The red wire must be connected to the load and the black wire must be connected to Line/Hot. The switch will not work if the wires are reversed.

(continued on next page...)

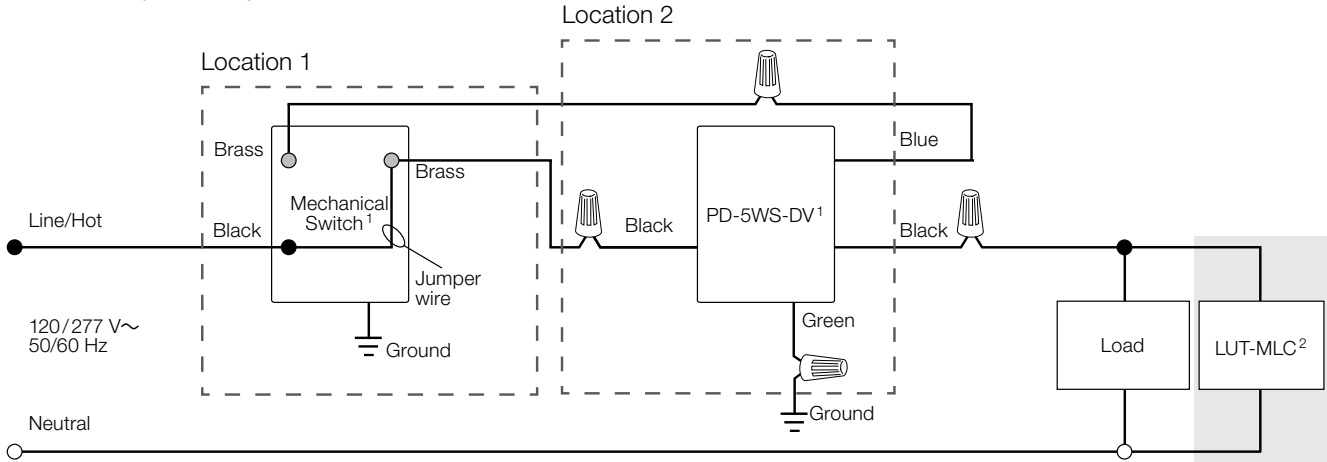
LUTRON SPECIFICATION SUBMITTAL

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Job Number:	<input type="text"/>	<input type="text"/>

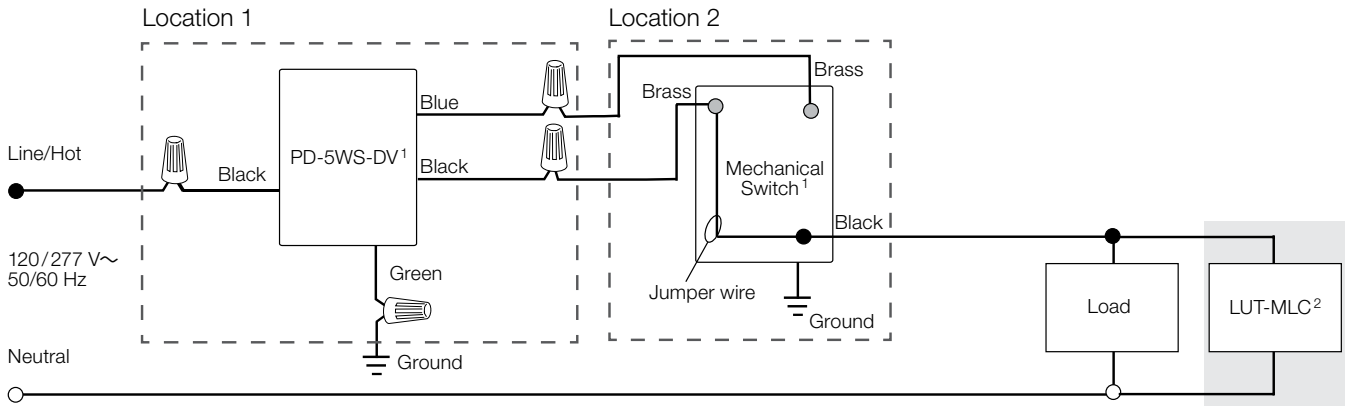
Wiring Diagrams - Switches (cont.)
3-Way Installation (with mechanical switch)

Option 1

PD-5WS-DV (Load-side)



PD-5WS-DV (Line-side)



¹ Location of Caséta® Wireless In-Wall Switch and mechanical switch may be reversed.

² A LUT-MLC ensures proper function when LED, fluorescent, or ELV loads are used. Install the LUT-MLC inside a load fixture or in a separate junction box within the circuit.

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LUTRON® SPECIFICATION SUBMITTAL

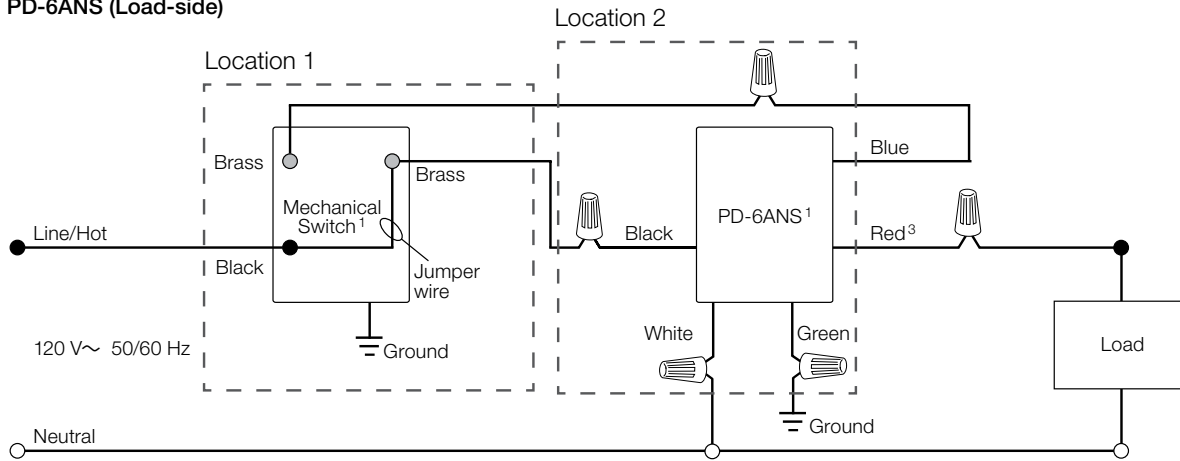
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Wiring Diagrams - Switches (cont.)

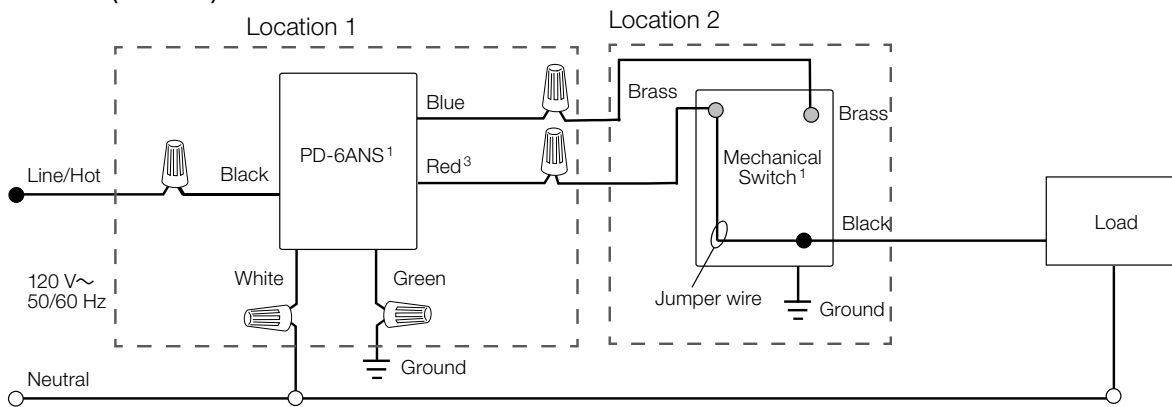
3-Way Installation (with mechanical switch)

Option 1 (cont.)

PD-6ANS (Load-side)



PD-6ANS (Line-side)



¹ Location of Caséta® Wireless In-Wall Switch and mechanical switch may be reversed.

² A LUT-MLC ensures proper function when LED, fluorescent, or ELV loads are used. Install the LUT-MLC inside a load fixture or in a separate junction box within the circuit.

³ The red wire must be connected to the load and the black wire must be connected to Line/Hot. The switch will not work if the wires are reversed.

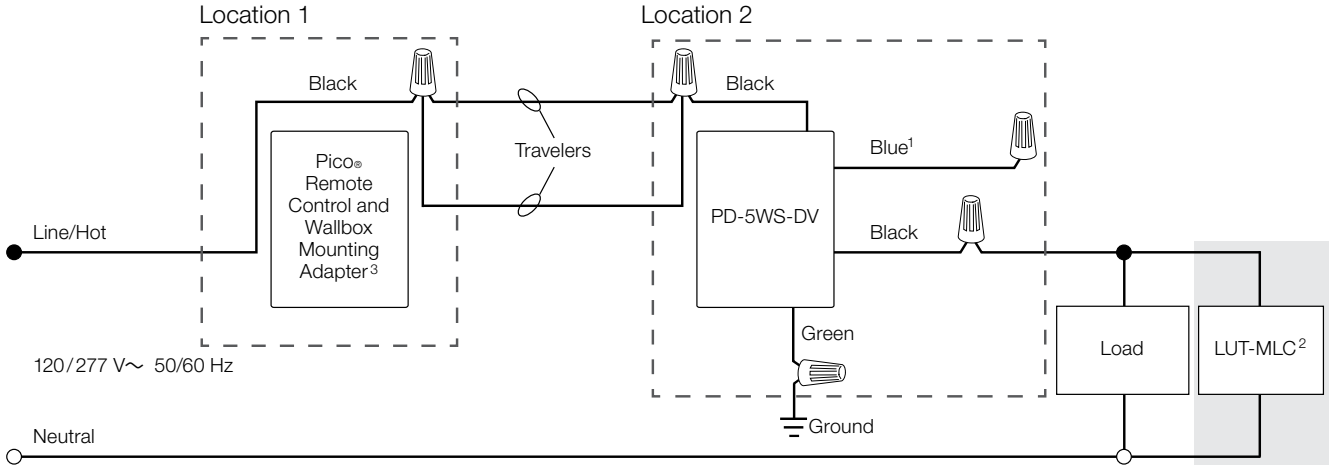
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Job Number:	<input type="text"/>	<input type="text"/>

Wiring Diagrams - Switches (cont.)

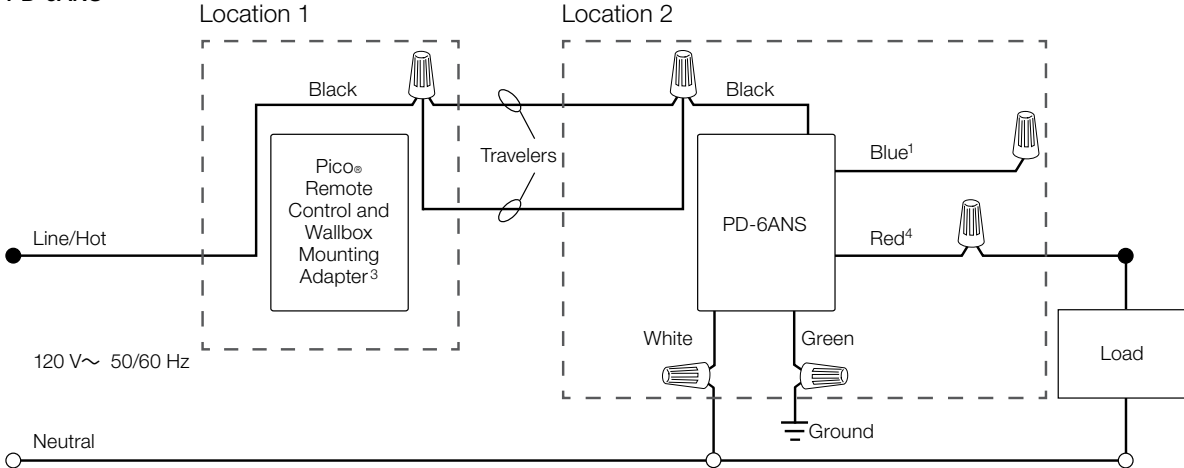
3-Way Installation (with Pico® remote controls)

Option 2: PJ2-2B-xx and wallbox mounting adapters (PICO-WBX-ADAPT)

PD-5WS-DV



PD-6ANS



- ¹ When using controls without mechanical 3-way switch, cap the blue terminal. **Do not** connect the blue wire to any other wiring or to ground.
- ² A LUT-MLC ensures proper function when LED, fluorescent, or ELV loads are used. Install the LUT-MLC inside a load fixture or in a separate junction box within the circuit.
- ³ The mechanical switch will need to be removed so the Pico® Remote Control can be installed.
- ⁴ The red wire must be connected to the load and the black wire must be connected to Line/Hot. The switch will not work if the wires are reversed.

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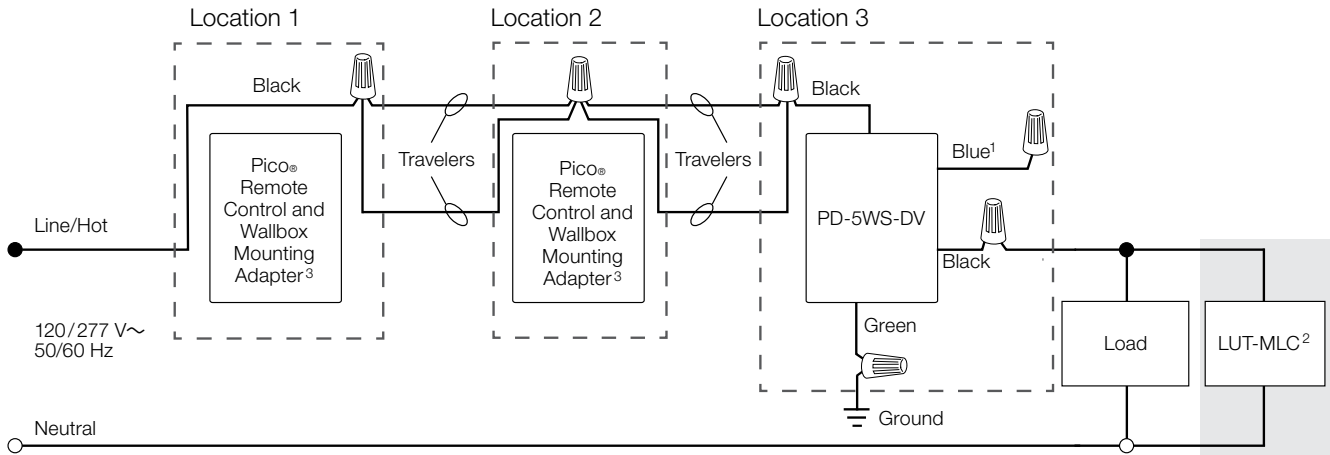
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Wiring Diagrams - Switches (cont.)

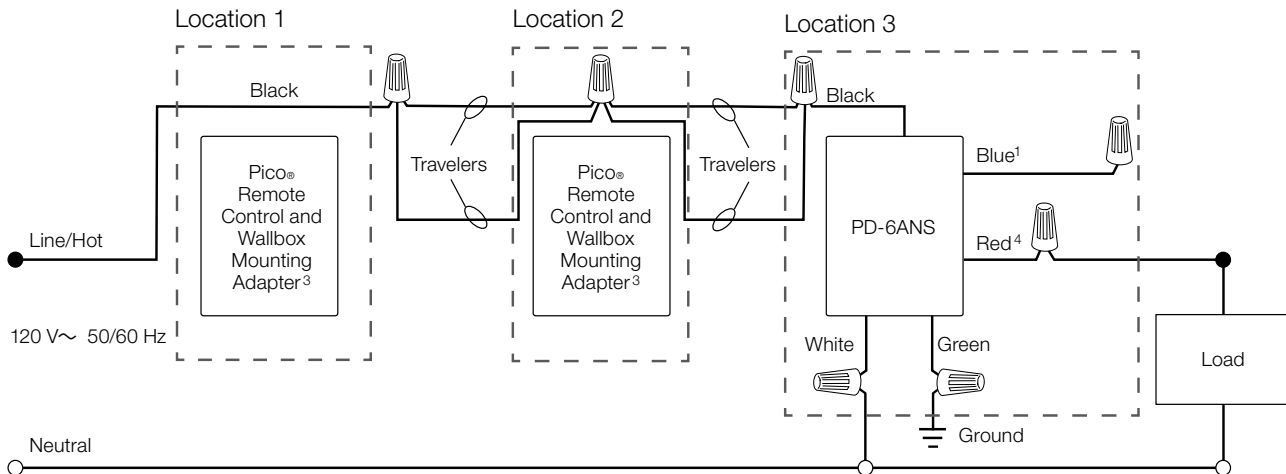
Multi-location Installation (3 or more switches control the load)

With Pico® remote controls (PJ2-2B-xx) and wallbox mounting adapters (PICO-WBX-ADAPT)

PD-5WS-DV



PD-6ANS



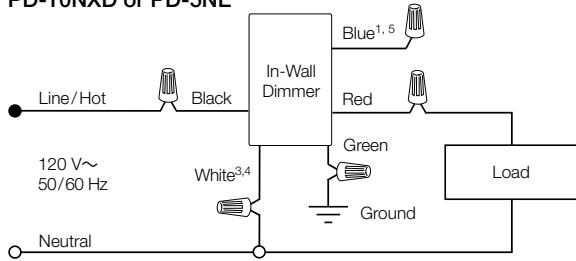
- ¹ When using controls without mechanical 3-way switch, cap the blue terminal. **Do not** connect the blue wire to any other wiring or to ground.
- ² A LUT-MLC ensures proper function when LED, fluorescent, or ELV loads are used. Install the LUT-MLC inside a load fixture or in a separate junction box within the circuit.
- ³ The mechanical switch will need to be removed so the Pico® Remote Control can be installed.
- ⁴ The red wire must be connected to the load and the black wire must be connected to Line/Hot. The switch will not work if the wires are reversed.

Job Name:	Model Numbers:	
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Job Number:	<input type="text"/>	<input type="text"/>

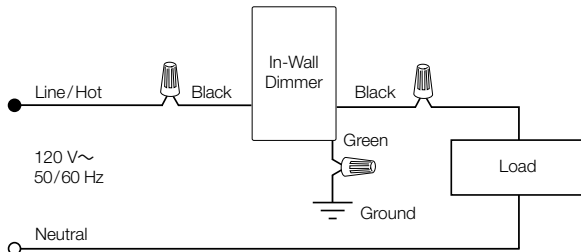
Wiring Diagrams - Dimmers

Single Location Installation

PD-10NXD or PD-5NE



PD-6WCL



¹ When using controls without mechanical 3-way switch, cap the blue terminal. **Do not** connect the blue wire to any other wiring or to ground.

² Location of Caséta® Wireless In-Wall Dimmer PRO and mechanical switch may be reversed.

³ For PD-10NXD only, neutral connection optional except for MLV loads, LED drivers, and power modules (PHPM-PA, PHPM-3F, and GRX-TVI).

⁴ For PD-5NE, neutral is required.

⁵ Blue wire is only present on the PD-10NXD model.

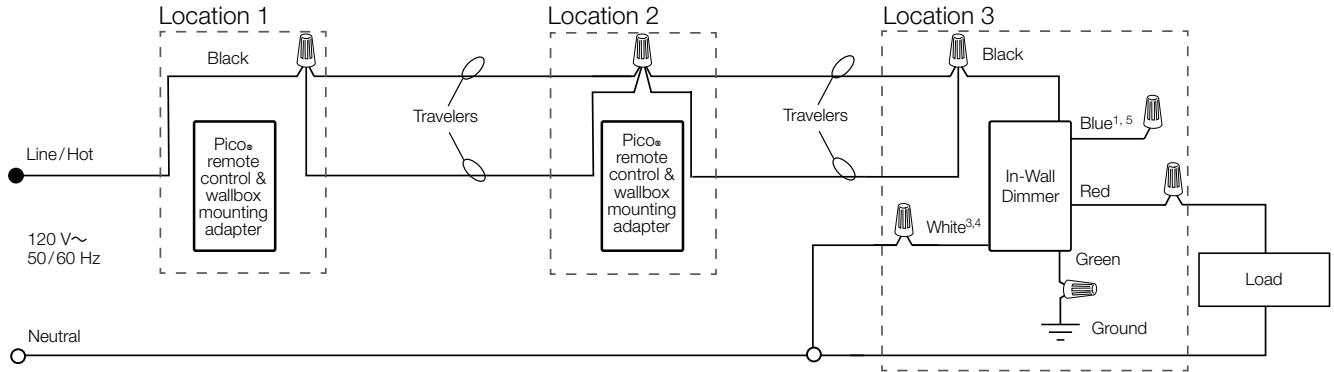
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Wiring Diagrams - Dimmers (cont.)

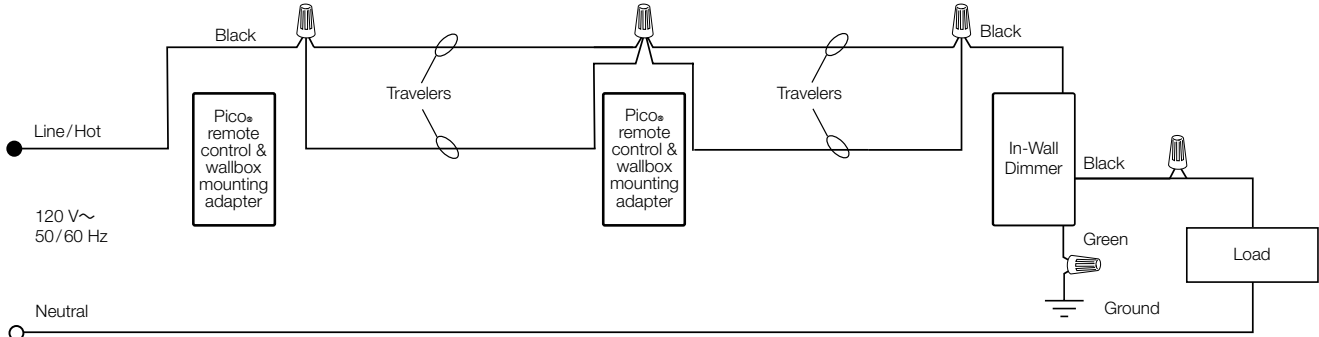
Multi-Location Installation

With Pico® remote controls (PJ2-XX-XX) and wallbox mounting adapters (PICO-WBX-ADAPT)

PD-10NXD and PD-5NE



PD-6WCL



¹ When using controls without mechanical 3-way switch, cap the blue terminal. **Do not** connect the blue wire to any other wiring or to ground.

² Location of Caséta® Wireless In-Wall Dimmer PRO and mechanical switch may be reversed.

³ For PD-10NXD only, neutral connection optional except for MLV loads, LED drivers, and power modules (PHPM-PA, PHPM-3F, and GRX-TV).

⁴ For PD-5NE, neutral is required.

⁵ Blue wire is only present on the PD-10NXD model.

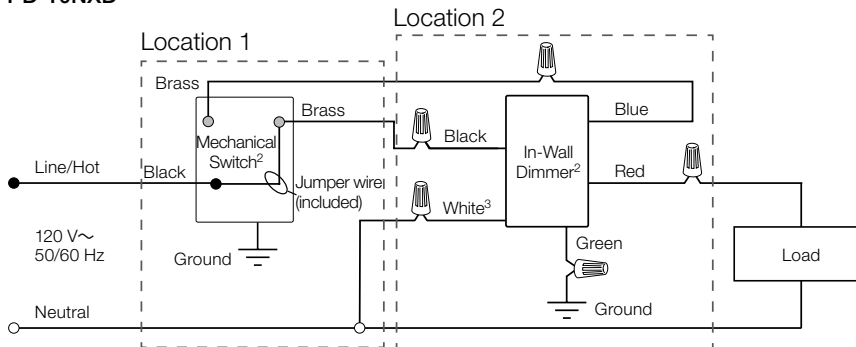
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Wiring Diagrams - Dimmers (cont.)

3-Way Installation

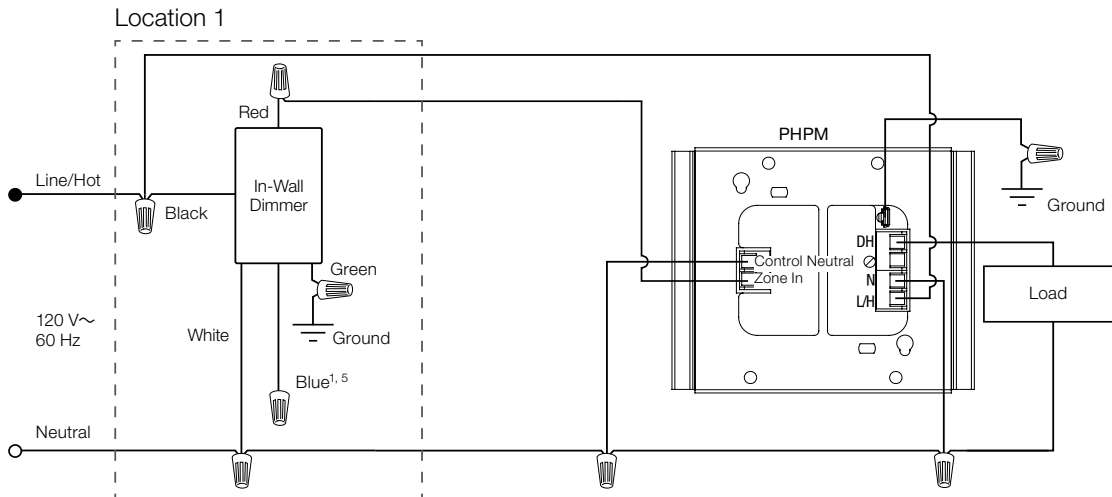
With mechanical switch

PD-10NXD



Installation with PHPM - Neutral required⁴

PD-10NXD and PD-5NE



¹ When using controls without mechanical 3-way switch, cap the blue terminal. **Do not** connect the blue wire to any other wiring or to ground.

² Location of In-Wall Dimmer and mechanical switch may be reversed.

³ Neutral connection optional except for MLV loads, LED drivers, and power modules (PHPM-PA, PHPM-3F, and GRX-TVI).

⁴ See Lutron® P/Ns 369356 and 369355 for additional wiring diagrams.

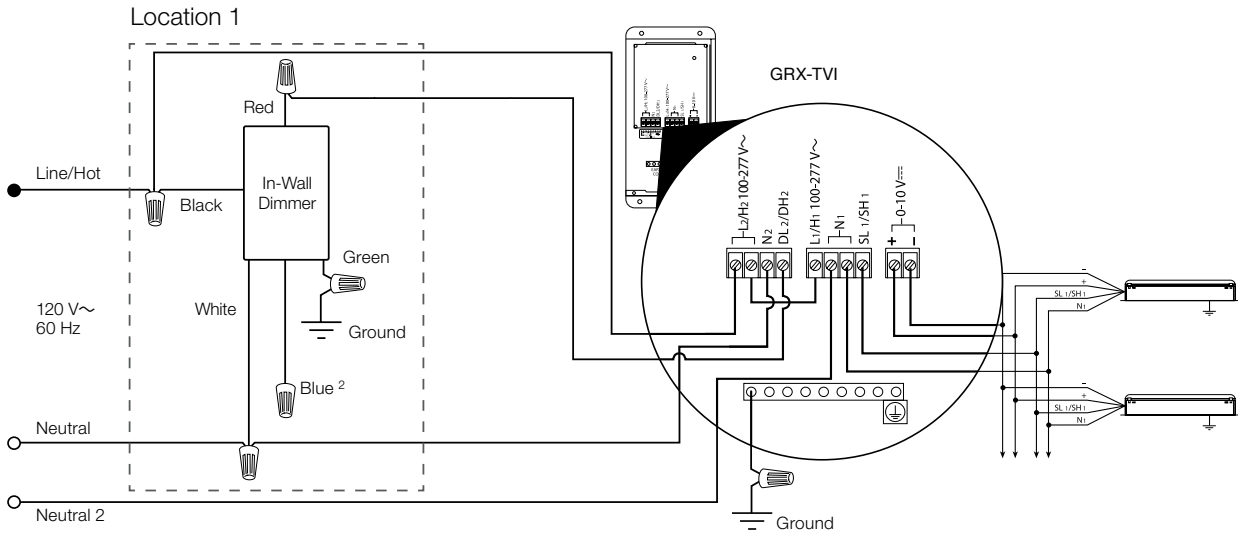
⁵ Blue wire is only present on the PD-10NXD model.

Job Name:	Model Numbers:	
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Job Number:	<input type="text"/>	<input type="text"/>

Wiring Diagrams - Dimmers (cont.)

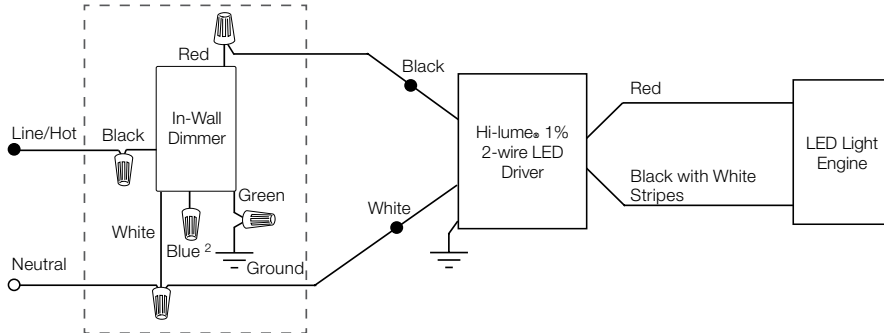
Installation with GRX-TVI - Neutral required¹

PD-10NXD and PD-5NE



Installation with Hi-lume® 1% 2-wire LED Drivers - Neutral required

PD-10NXD and PD-5NE



Note: For more information on Hi-lume® 1% 2-wire LED Drivers, see www.lutron.com

¹ See Lutron® P/N 369247 for additional wiring diagrams.

² Blue wire is only present on the PD-10NXD model.

Job Name:	Model Numbers:	
<input type="text"/>	<input type="text"/>	<input type="text"/>
Job Number:	<input type="text"/>	<input type="text"/>

Colors and Finishes

Gloss Finishes



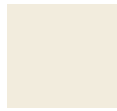
White
WH



Black
BL



Ivory
IV



Light Almond
LA

Due to printing limitations, colors and finishes shown cannot be guaranteed to perfectly match actual product colors.

Job Name: <input type="text"/>	Model Numbers: <input type="text"/>
Job Number: <input type="text"/>	<input type="text"/>

EV230WS

EVlink Level 2 Wall Mounted 7.2 kW Residential Indoor Charging Station

Product availability : Stock - Normally stocked in distribution facility



Price* : 1150.00 USD



Main

Range	EVlink
Product or component type	Charging station
Device application	Residential
Type of installation	Indoor
Mounting mode	Wall mount

Complementary

NEMA degree of protection	NEMA 1
Material	Enclosure : plastic and white
[Us] rated supply voltage	240 V AC at 60 Hz, single phase
Supply current	<= 30 A
Poles description	2P (power circuit)
Nominal output power	7.2 kW at 30 A, 208...240 V
Level or class	Level 2
Output type	Bottom of enclosure : 1 black charging cable of 5.5 m and non retractable
Connector type	SAE J1772
Protection type	Ground fault protection with CCID20 (automatic test at the beginning of each charge cycle) Automatic restart after ground fault or main power loss
Control type	Delay charging : 1 orange illuminated push-button Stop : 1 red illuminated push-button
Local signalling	Charging : 8 green indicator light Delay start : 8 green indicator light Power ON/fault detected : 1 green/red indicator light
Height	12.72 in (323 mm)
Width	9.53 in (242 mm)
Depth	4.37 in (111 mm)
Product weight	17 lb(US) (7.71 kg)

Feb 12, 2017



1

Disclaimer: This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications



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Feb 12, 2017



1

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Environment

Electromagnetic compatibility	Immunity to radiated fields : 20 V/m Electrical fast transient/burst immunity test : 2 kV Electrostatic discharge : 8 kV contact Electrostatic discharge : 15 kV open air Surge immunity test : 6 kV Immunity to conducted disturbances : 20 V
Standards	UL 2594 CSA C22.2
Product certifications	FCC Class B

Ordering and shipping details

Category	21002 - EV CHARGING STATION RESIDENTIAL
Discount Schedule	DE10
GTIN	00785901237532
Nbr. of units in pkg.	1
Package weight(Lbs)	19.030000000000001
Returnability	Y
Country of origin	US



Conext Battery Monitor

Battery bank monitoring with battery string health detection

Conext™ Battery Monitor indicates hours of battery based runtime and determines battery bank state of charge. Conext Battery Monitor shares key battery bank parameters with Conext XW+ inverter/chargers improving overall system performance of 24V and 48V battery banks. Detecting battery string imbalance is determined using innovative mid-point sensing technology providing time to address the issue before performance is significantly impacted.

Conext Battery Monitor features built-in data logging and a local display to selectively show the voltage, current, consumed amp-hours, remaining capacity and remaining hours. The same information and battery bank data is reported by ComBox and distributed to other Conext devices such as XW+ inverter chargers as well as MPPT Solar Charge Controllers, Automatic Generator Start module and System Control Panel via Xanbus™ network connectivity enhancing performance of the overall system.

Industrial and telecom customers can integrate Conext Battery Monitor with energy management systems over Modbus™ RS485.

Why choose Conext Battery Monitor?



Higher return on investment

- Get the most out of battery based Conext inverter charger systems
- Clearly understand hours of available battery based autonomy
- Detect imbalance between battery-strings before it becomes an issue



Designed for reliability

- Extensive quality and reliability testing
- Highly Accelerated Life Testing (HALT)



Flexible

- Stand-alone application or integration with Conext XW+ inverter charger systems
- Enables State of Charge triggers for AGS module control of diesel generators
- Enables balancing of multi-battery bank systems for large clustered Conext XW+ inverter charger systems



Easy to service

- Remotely monitor, troubleshoot or upgrade firmware with Conext ComBox
- Built-in data logger



Easy to install

- Wall-mount, DIN-rail mount, panel mount
- RJ45 connections for XanBus network and battery signals
- Configure with front-panel buttons, Conext ComBox or RS485 Modbus



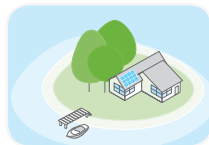
Product applications



Backup power



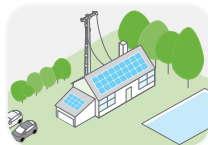
Residential grid-tie solar with backup power



Off-grid solar



Community electrification



Self-consumption

solar.schneider-electric.com



Device short name	Conext Battery Monitor
Electrical specifications	
Supply voltage	18 - 66 VDC
Supply current (backlight off, logging-disabled)	80 mA @ VIN=48 VDC, 150 mA @ VIN=24 VDC
Input voltage range	0 - 70 VDC
Input current range	-9999 - +9999 A
Battery capacity range	20 - 10, 000 Ah
Operating temperature range	-20 - +50°C
Displayed increments	
Voltage	0 - 70 V (0.01 V)
Current	0 - 200 A / 200 - 9999 A (0.1 A / 1 A)
Amp-hours	0 - 200 Ah / 200 - 99990 Ah (0.1 Ah / 1 Ah)
State-of-charge	0 - 100% (0.1%)
Time remaining	0 - 24 hrs / 24 - 240 hrs (1 min / 1 hr)
Temperature	-20 to +50°C (0.1°C)
Accuracy	
Voltage measurement	+/- 0.3%
Current measurement	+/- 0.4%
Features	
Network	Protocol: Xanbus / Connectors: RJ45
USB 2.0	Protocol: MSD (data extraction) Connector: USB mini-B
ModBus	Isolated RS-485, 2-wire serial
Data Logging	10 data points every 10 mins for 10 years
Display	Backlight LCD
Front-panel interface	3 menu buttons, 1 power button
Battery string-imbalance detection	Two point sensing
Temperature sensor(included)	762 cm
Warranty	2 - 5 years (depending on country)
General specifications	
Product dimensions (H x W x D)	8.5 x 8.5 x 9.0 cm (3.3 x 3.3 x 3.5 in)
Product / shipping weight	0.2 kg (0.4 lb) / 1.95 kg (4.3 lb)
Mounting options	Panel-mount, wall-mount, DIN-rail: 35 mm
IP rating / location	IP 20, NEMA 1, indoor only
Storage temperature range	-30 - +70°C
Part number	865-1080-01
Battery interface kit with shunt (included)	
Connection to battery	300 cm cable with ring-terminals
Connection to battery-monitor	500 cm CAT5 cable RJ45
Shunt	500 A / 50 mv
Regulatory approval	
Markings	CE, RCM, UL, CSA
Safety	IEC / EN62109-1, UL1741, CSA 107.1
EMC	Directive 2004/108/EC, IEC/EN61000-6-3, IEC/EN61000-6-1, FCC Part 15 Class B, Industry Canada ICES-003 Class B
Compatible products	
Conext XW+ (230 V)	XW 7048 E product no. 865-7048-61 XW 8548 E product no. 865-8548-61
Conext XW+ (120/240 V)	XW 5548 NA product no. 865-5548-01 XW 6848 NA product no. 865-6848-01
Conext SW (230 V)	SW 2524 product no. 865-2524-61 SW 4024 product no. 865-4024-61 SW 4048 product no. 865-4048-61
Conext SW (120 V)	SW 2524 product no. 865-2524 SW 4024 product no. 865-4024 SW 4048 product no. 865-4048
Conext MPPT 80 600	Product no. 865-1032
Conext MPPT 60 150	Product no. 865-1030-1
Conext System Control Panel	Product no. 865-1050
Conext Automatic Generator Start	Product no. 865-1060
Conext ComBox	Product no. 865-1058
Conext Portable Installation and Configuration Tool	Product no. 865-1155-01

Specifications are subject to change without notice.

Advanced diagnostics for solar and battery systems

Conext™ ComBox

Schneider Electric brings a powerful analytic solution to monitor residential and off-grid solar installation performance, making life simpler for installers and system owners.



Solution at a glance

Conext ComBox is a true System Manager for your battery based solar installation allowing you to visualize, monitor and control.

- **Cost effective:** monitor solar system performance to ensure optimal returns and uptime.
- **Flexible:** multiple visualization options for trends and analysis as well as custom data logging for diagnostics.
- **Connected:** have your system performance data at your fingertips through emails alerts and portal access.
- **Scalable:** for large multi-cluster systems, the Conext ComBox can be setup in a master-slave configuration to monitor multiple separate Xanbus networks and supported Modbus devices, such as power meters.
- **Simple and powerful:** change or configure the settings of Conext Xanbus devices through the user-interface. Modbus interface on ComBox allows you to link Conext devices with third-party systems for further diagnostic and control.

Conext ComBox easily connects with **Conext Insight** to enable you to remotely monitor a portfolio of sites from any web-connected device.



Conext Insight



Conext ComBox
Tablet App

Homeowners can reap maximum benefits from their battery based solar installation by keeping realtime track of system performance using the **Android Tablet App**.

Conext ComBox can be coupled with **Conext RL** grid-tie inverters to enable zero export in regions where homeowners have no incentives to sell PV energy to the grid.

Technical Specifications

Conext ComBox

Device short name	Conext ComBox
Electrical specifications	
Communication interfaces	
Xanbus	Connector: 2 x RJ45 Products Supported: Conext™ XW+, SW, MPPT 60-150, MPPT 80-600, AGS, SCP, Battery monitor
Ethernet	Connector: 1 x RJ45, 10 / 100 MBPS Server: FTP, Web, Modbus TCP/IP slave, SMTR, SNTP, Auto discovery: DPWS
RS485	Modbus (1 x Connector: Screw 5-terminal, 16-24AWG, 2-wire serial, 19200 bps)
Data Interfaces	
USB 2.0-Host	Connector: USB-A, Protocols: MSD (firmware upgrades and device locator)
USB 2.0-Device	Connector: USB-mini B, Protocols: MSD (data extraction)
Power supply options	
DC input	Certified / Listed / CE, using a 6.5 mm power plug, 9 - 24 Vdc (universal multi-pin AC adapter included)
Power consumption	<2 W typical / 10 W peak
Xanbus	When connected to Conext™ XW+ or MPPT 80 600
RS485 connector	24 Vdc input(safety extra low-voltage only)
Memory	
Internal	96 MB flash
External	Micro-SD Card (2GB or more, class 2 or better recommended)
Conext ComBox Android tablet application*	
Software	Minimum Android version 4.0 (Ice Cream Sandwich), download via Google Play
Hardware	Minimum tablet screen size (7", 1024 x 600, e.g. Acer Iconia Tab A100, Acer Iconia Tab A500, Google Nexus™ 7, Asus Transformer TF700T, Samsung Galaxy Tab*2 10.1)
General specifications	
Weight	0.25 kg (0.55 lb)
Dimensions (H x W x D)	11.4 x 16.9 x 5.4 cm (4.5 x 6.7 x 2.1 in)
Housing/mounting system	ABS Plastic / DIN-rail: 35 mm, Wall-mount: 2-screw
IP rating/mounting Location	IP 20, NEMA 1, Indoor only
Status display	5 x LEDs
Temperature	Operating: -4 to 122 °F (-20 to 50 °C) / storage: -40 to 185 °F (-40 to 85 °C)
Humidity	Operating: < 95%, non-condensing / storage: < 95%
Part number	865-1058
Features	
Programmable dry contact relay	Screw 3-terminal, 16-24 AWG, NC-Com-NO, Form: Class 2, 24 Vdc 4 A max
Graphical user interface	Internet Browser, Android tablet app
Remote firmware upgrades	Yes (ComBox and connected Xanbus devices)
Custom datalogger	Yes (requires Micro-SD card)
Warranty	5 years
Number of Xanbus devices	Up to 20 (depending on device type)
Regulatory approvals	
Marking	CE, RCM
EMC immunity	EN61000-6-1 residential / commercial
EMC emission	EN61000-6-3, FCC Part 15 Class B, Ind. Canada ICES-003 Class B
Substances/environmental	RoHS

Specifications are subject to change without notice. *Tablet not included

Conext ComBox communication device works with the following Schneider Electric products



Conext XW inverter/charger
XW 5548 NA Product no. 865-5548-01
XW 6848 NA Product no. 865-6848-01
XW 7048 E Product no. 865-7048-61
XW 8548 E Product no. 865-8548-61



Conext SW inverter/charger
SW 2524 120 Product no. 865-2024
SW 4024 120 Product no. 865-3524
SW 2524 230 Product no. 865-2524-61
SW 4024 230 Product no. 865-4024-61



Conext MPPT 60 150 solar charge controller
Product no. 865-1030-1



Conext MPPT 80 600 solar charge controller
Product no. 865-1032



System Control Panel (SCP)
Product no. 865-1050-01



Automatic Generator Start (AGS)
Product no. 865-1060-01



Conext Battery Monitor
Product no. 865-1080-01



Conext RL 3000/4000/5000 E/ E-S
3000 Product no. PVSNC3000/3000S
4000 Product no. PVSNC4000/4000S
5000 Product no. PVSNC5000/5000S



Conext Insight

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DS20160610_ConextComBox

Life Is On | **Schneider Electric**



4" IC AND TC 1000 LUMEN INTERNALLY ADJUSTABLE LED DOWNLIGHT NEW CONSTRUCTION

IC104AL, TC104AL RECESSED HOUSING
DOWNLIGHT TRIMS








ORDERING INFORMATION: Housing and trim each ordered separately.

Example: IC104AL-3K-F-1

Series	Color Temperature	Beam Optics	Input Voltage
IC104AL	27K 2700K 3K 3000K 35K 3500K 41K 4100K	S 18° Spot N 30° Narrow Flood F 40° Flood	1 Dedicated 120V Only (Forward Phase + ELV Dimmable) U Universal Voltage 120-277V (0-10V Dimmable)

Series	Color Temperature	Beam Optics	Input Voltage
TC104AL	27K 2700K 3K 3000K 35K 3500K 41K 4100K	S 18° Spot N 30° Narrow Flood F 40° Flood	L† Lutron Hi-Lume® 3-Wire Dimming EcoSystem Compatible † Not ENERGY STAR® or T24 compliant

Example: 42LHZ-WH

Trim/Description
 42LC-WH Downlight Cone - Clear Alzak®
 42LB-WH Downlight Cone - Black Alzak®
 42LPT-SC Downlight Cone - Pewter Alzak®
 42LW-WH Downlight Cone - Gloss White
 42LHZ-WH Downlight Cone - Haze
 42LWHZ-WH Downlight Cone - Wheat Haze
 42LWHZ-ABZ Downlight Cone - Wheat Haze

Trim Size: 5" O.D.

Trim Finish: ABZ - Classic Aged Bronze, SC - Satin Chrome, WH - White.
Alzak is a registered trademark of Alcoa Corp.

Note: In Canada when insulation is present, Type IC fixtures must be used.

ACCESSORIES

Catalog No.	Description
T741	Med. Pink Color Filter
T742	Warm Red Color Filter
T743	Daylight Blue Color Filter
T744	Med. Blue Color Filter
T745	Med. Amber Color Filter
T746	Med. Green Color Filter
T7401	Red Dichroic Lens
T7403	Med. Green Dichroic Lens
T7404	Med. Blue Dichroic Lens
T7405	Yellow Dichroic Lens
T7406	Magenta Dichroic Lens
T7411	Blue Green Dichroic Lens
T7416	Daylight Blue Correction Lens
T7420	Diffuse Spread Lens
T7422	UV Filter Lens
T7459BL	Hexcell Louver
T7478	Linear Spread Lens
T7477	Prismatic Lens
TIR-2-SP	18° Spot Optic
TIR-2-NFL	30° Narrow Flood Optic
TIR-2-FL	40° Flood Optic



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220 Chrysler Drive • Brampton, Ontario • Canada L6S 6B6 • Phone (905) 792-7335 • Fax (905) 792-0064
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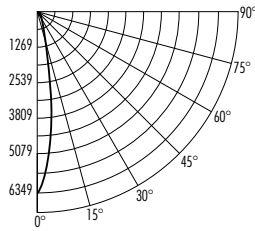
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4" IC AND TC 1000 LUMEN INTERNALLY ADJUSTABLE LED DOWNLIGHT NEW CONSTRUCTION

IC104AL, TC104AL RECESSED HOUSING DOWNLIGHT TRIMS

PHOTOMETRIC REPORT

Test Report#: PTO9152801R
 Catalog No: IC104AL-35K-S-1
 with 42LHZ-WH, Downlight Cone Haze Finish Trim and Spot Optic
 Luminaire Spacing Criteria: 0.30
 Luminaire LPW: 64



CANDLEPOWER DISTRIBUTION (Candelas)

Degrees Vertical	0°
0	6349
5	4828
15	1260
25	420
35	105
45	14
55	0
65	0
75	0
85	0
90	0

Multipliers:
 27K - 0.93 35K - 1.00
 3K - 0.96 41K - 1.03

AVERAGE INITIAL FOOTCANDLES

Multiple Units (Square Array, 60'x60' room)
 Ceiling 80%, Wall 50%, Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	74	67	61
5.0'	47	43	39
6.0'	33	30	27
7.0'	27	24	22
8.0'	21	19	17
9.0'	16	15	13
10.0'	12	11	10

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixture
0-30°	956	N/A	91.3
0-40°	1031	N/A	98.5
0-60°	1046	N/A	100.0
0-90°	1046	N/A	100.0

INITIAL FOOTCANDLES

(One Unit, 16.4W, 16.9° Beam)

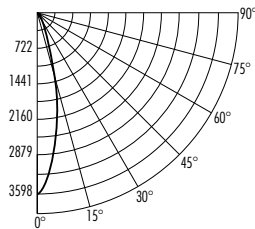
Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Beam Diameter
4	396.8	1.2
6	176.4	1.8
8	99.2	2.4
10	63.5	3.0

LUMINANCE (Average cd/m²)

Degrees	Average 0° Luminance
45	3709
55	105
65	0
75	0
85	0

PHOTOMETRIC REPORT

Test Report#: PTO9152803R
 Catalog No: IC104AL-35K-N-1
 with 42LHZ-WH, Downlight Cone Haze Finish Trim and Narrow Flood Optic
 Luminaire Spacing Criteria: 0.46
 Luminaire LPW: 62



CANDLEPOWER DISTRIBUTION (Candelas)

Degrees Vertical	0°
0	3598
5	3318
15	1497
25	423
35	115
45	25
55	1
65	0
75	0
85	0
90	0

Multipliers:
 27K - 0.93 35K - 1.00
 3K - 0.96 41K - 1.03

AVERAGE INITIAL FOOTCANDLES

Multiple Units (Square Array, 60'x60' room)
 Ceiling 80%, Wall 50%, Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	71	64	59
5.0'	46	41	38
6.0'	32	29	26
7.0'	26	23	21
8.0'	20	18	17
9.0'	15	14	13
10.0'	11	10	9

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixture
0-30°	910	N/A	89.5
0-40°	993	N/A	97.7
0-60°	1016	N/A	100.0
0-90°	1016	N/A	100.0

INITIAL FOOTCANDLES

(One Unit, 16.4W, 27.0° Beam)

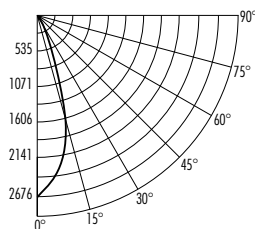
Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Beam Diameter
4	224.9	1.9
6	99.9	2.9
8	56.2	3.8
10	36.0	4.8

LUMINANCE (Average cd/m²)

Degrees	Average 0° Luminance
45	6597
55	244
65	0
75	0
85	0

PHOTOMETRIC REPORT

Test Report#: PTO9152805R
 Catalog No: IC104AL-35K-F-1
 with 42LHZ-WH, Downlight Cone Haze Finish Trim and Flood Optic
 Luminaire Spacing Criteria: 0.58
 Luminaire LPW: 68



CANDLEPOWER DISTRIBUTION (Candelas)

Degrees Vertical	0°
0	2676
5	2552
15	1626
25	659
35	157
45	30
55	0
65	0
75	0
85	0
90	0

Multipliers:
 27K - 0.93 35K - 1.00
 3K - 0.96 41K - 1.03

AVERAGE INITIAL FOOTCANDLES

Multiple Units (Square Array, 60'x60' room)
 Ceiling 80%, Wall 50%, Floor 20%

Spacing	RCR1	RCR3	RCR5
4.0'	78	70	63
5.0'	50	45	40
6.0'	35	31	28
7.0'	28	25	23
8.0'	22	20	18
9.0'	17	15	14
10.0'	13	11	10

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixture
0-30°	980	N/A	87.5
0-40°	1091	N/A	97.4
0-60°	1120	N/A	100.0
0-90°	1120	N/A	100.0

INITIAL FOOTCANDLES

(One Unit, 16.4W, 35.0° Beam)

Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Beam Diameter
4	167.3	2.5
6	74.3	3.8
8	41.8	5.0
10	26.8	6.3

LUMINANCE (Average cd/m²)

Degrees	Average 0° Luminance
45	8041
55	35
65	0
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.



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 Visit us at www.junolightinggroup.com

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Project: _____
 Fixture Type: _____
 Location: _____
 Contact/Phone: _____

4" IC AND TC 1000 LUMEN INTERNALLY ADJUSTABLE LED DOWNLIGHT NEW CONSTRUCTION

IC104AL, TC104AL RECESSED HOUSING
 LENSED TRIMS



PRODUCT DESCRIPTION

Patent pending dedicated LED, Air-Loc® sealed new construction housing with integral internally adjustable light engine • Double wall, shallow housing construction • IC104AL series can be completely covered with insulation and installs in 2 x 6 construction • TC104AL series for use in non-insulated areas (If installed where insulation is present, the insulation must be pulled back 3" from all sides of the TC housing) • Fully sealed housing stops infiltration and exfiltration of air, reducing heating and cooling costs without the use of additional gaskets • LED housing is designed to provide 50,000 hours of life • 5 year limited warranty on LED components.

ENVIRONMENTALLY FRIENDLY, ENERGY EFFICIENT

- No harmful ultraviolet or infrared wavelengths
- No lead or mercury, RoHS compliant
- Comparable light output to 75W incandescent

PRODUCT SPECIFICATIONS

LED Light Engine LED array attached to cast aluminum sliding heatsink integrated directly with housing provides superior heat transfer to ensure long life of the LED • Replaceable light engine mounts directly to inner housing assembly and incorporates the latest generation, high lumen output LED array • LEDs are binned within a 3-step MacAdam Ellipse exceeding ENERGY STAR® requirements for superior fixture to fixture color uniformity • 2700K, 3000K, 3500K, or 4100K color temperatures available • 90 CRI minimum.

Optics Three field interchangeable, TIR optics available in 18°, 30° and 40° beam angles • Module can accommodate one 2-inch diameter beam control lens or filter • Adjustable light engine module provides up to 35° vertical adjustment and 360° rotation.

Aesthetic Trim Selections Adjustable perimeter frosted lensed trim • 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 [JUNOICLED-DIM](#).

Life Rated for 50,000 hours at 70% lumen maintenance.

Labels UL listed for U.S. and Canada for 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

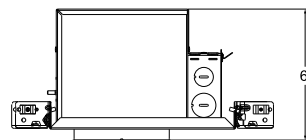
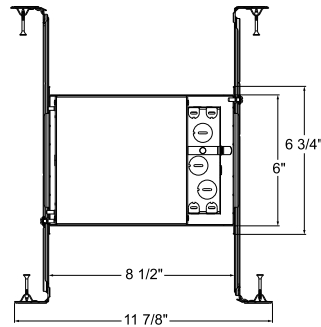
Housing IC104AL designed for use in IC (insulated ceiling) or non-IC construction • TC104AL designed for use in non-IC construction • Aluminum housing sealed for Air-Loc® compliance • Housing is vertically adjustable to accommodate up to a 1 1/2" ceiling thickness.

Junction Box Pre-wired junction box provided with (6) 1/2" and (1) 3/4" knockouts, (4) knockouts for 12/2 or 14/2 NM cable and ground wire • UL listed and cUL listed for through-branch wiring, maximum 4 #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 Patented (US Patent D552,969) Real Nail® 3 bar hangers: telescoping 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.

DIMENSIONS



4 1/2" CEILING CUTOUT

ELECTRICAL DATA

Dedicated 120V Only Driver Option (-1) 120V

Input Power	16.4W (+/-5%)	
Input Current	0.15A	
Frequency	50/60Hz	
EMI/RFI	FCC Title 47 CFR, Part 15, Class B (Residential)	
Minimum starting temp	-25°C (-13°F)	

Universal Voltage Driver (-U)

	120V	277V
Input Power	16.0W (+/-5%)	16.0W (+/-5%)
Input Current	0.15A	0.06A
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	-20°C (-4°F)	-20°C (-4°F)

Lutron Hi-Lume® LED Driver (-L)

	120V	277V
Input Power	16.4W (+/-5%)	16.6W (+/-5%)
Input Current	0.15A	0.07A
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	0°C (32°F)	0°C (32°F)

REV-4/16



4" IC AND TC 1000 LUMEN INTERNALLY ADJUSTABLE LED DOWNLIGHT NEW CONSTRUCTION


IC104AL, TC104AL RECESSED HOUSING LENSED TRIMS

ORDERING INFORMATION: Housing and trim each ordered separately.

Example: IC104AL-3K-F-1

Series	Color Temperature	Beam Optics	Input Voltage
IC104AL	27K 2700K 3K 3000K 35K 3500K 41K 4100K	S 18° Spot N 30° Narrow Flood F 40° Flood	1 Dedicated 120V Only (Forward Phase + ELV Dimmable) U Universal Voltage 120-277V (0-10V Dimmable)
Series	Color Temperature	Beam Optics	Input Voltage
TC104AL	27K 2700K 3K 3000K 35K 3500K 41K 4100K	S 18° Spot N 30° Narrow Flood F 40° Flood	L Lutron Hi-Lume® 3-Wire Dimming EcoSystem Compatible

Example: 41L-WH

Trim/Description
 41L-ABZ Frosted Perimeter Lens 41L-SC 41L-WH

Trim Size: 5" O.D.

Trim Finish: ABZ - Classic Aged Bronze, SC - Satin Chrome, WH - White.

Note: In Canada when insulation is present, Type IC fixtures must be used.

ACCESSORIES

Catalog No.	Description
T741	Med. Pink Color Filter
T742	Warm Red Color Filter
T743	Daylight Blue Color Filter
T744	Med. Blue Color Filter
T745	Med. Amber Color Filter
T746	Med. Green Color Filter
T7401	Red Dichroic Lens
T7403	Med. Green Dichroic Lens
T7404	Med. Blue Dichroic Lens
T7405	Yellow Dichroic Lens
T7406	Magenta Dichroic Lens
T7411	Blue Green Dichroic Lens
T7416	Daylight Blue Correction Lens
T7420	Diffuse Spread Lens
T7422	UV Filter Lens
T7459BL	Hexcell Louver
T7478	Linear Spread Lens
T7477	Prismatic Lens
TIR-2-SP	18° Spot Optic
TIR-2-NFL	30° Narrow Flood Optic
TIR-2-FL	40° Flood Optic



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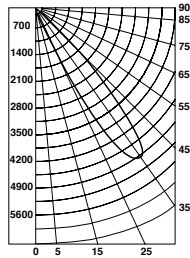
4" IC AND TC 1000 LUMEN INTERNALLY ADJUSTABLE LED DOWNLIGHT NEW CONSTRUCTION

IC104AL, TC104AL RECESSED HOUSING LENSED TRIMS

PHOTOMETRIC REPORT

Test Report: PT09153003R
 Catalog No: IC104AL-35K-S-1
 with 41L-WH
 and Spot Optic

Watts: 16.4
 Lumens: 848
 Luminaire LPW: 52



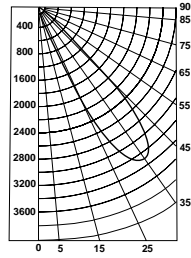
Candlepower Distribution (Candelas)

Degrees	Vertical	Candela
0°	142	
5°	191	
10°	271	
15°	452	
20°	828	
25°	1735	
30°	3387	
35°	4633	
40°	3756	
45°	2039	
50°	903	
55°	318	
60°	150	
65°	84	
70°	54	
75°	32	
80°	15	
85°	4	
90°	0	

PHOTOMETRIC REPORT

Test Report: PT09152923R
 Catalog No: IC104AL-35K-N-1
 with 41L-WH and
 Narrow Flood Optic

Watts: 16.4
 Lumens: 867
 Luminaire LPW: 53



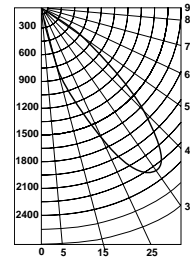
Candlepower Distribution (Candelas)

Degrees	Vertical	Candela
0°	135	
5°	183	
10°	233	
15°	468	
20°	1208	
25°	2208	
30°	2836	
35°	3030	
40°	2782	
45°	2169	
50°	1288	
55°	408	
60°	149	
65°	93	
70°	53	
75°	27	
80°	12	
85°	3	
90°	0	

PHOTOMETRIC REPORT

Test Report: PT09152903R
 Catalog No: IC104AL-35K-F-1
 with 41L-WH
 and Flood Optic

Watts: 16.4
 Lumens: 936
 Luminaire LPW: 57

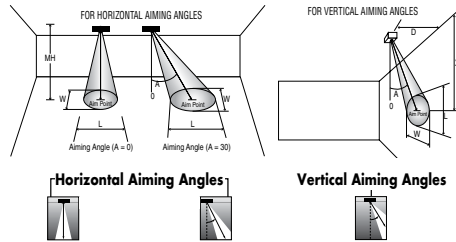


Candlepower Distribution (Candelas)

Degrees	Vertical	Candela
0°	139	
5°	254	
10°	487	
15°	826	
20°	1280	
25°	1782	
30°	2142	
35°	2305	
40°	2226	
45°	1716	
50°	1107	
55°	619	
60°	405	
65°	224	
70°	95	
75°	28	
80°	10	
85°	1	
90°	0	

CBCP - Centerbeam candlepower
FC - Footcandles at beam center (aim point)

In vertical aiming applications, aim point (X) is determined by dividing distance from the wall (D) by the tangent of the desired aim angle (A) (0.5774 for 30°, 1.0 for 45°).



FIXTURE	Beam Type	Beam Spread°	CBCP	0°			30°			30°					
				MH	FC	L	W	FC	L	W	D	FC	X	L	W
IC104AL LED, 3500K Spot	SPT	18°	4633	4	290	1.3	1.3	188	1.7	1.5	2	145	3.5	2.7	1.3
				6	129	1.9	1.9	84	2.6	2.2	3	64	5.2	4.1	1.9
				8	72	2.5	2.5	47	3.4	2.9	4	36	6.9	5.5	2.5
				10	46	3.2	3.2	30	4.3	3.7	5	23	8.7	6.9	3.2
				12	32	3.8	3.8	21	5.1	4.4	6	16	10.4	8.2	3.8
IC104AL LED, 3500K Narrow Flood	NFL	30°	3030	4	189	2.1	2.1	123	2.9	2.5	2	95	3.5	5.5	2.1
				6	84	3.2	3.2	55	4.4	3.7	3	42	5.2	8.2	3.2
				8	47	4.3	4.3	31	5.9	5.0	4	24	6.9	10.9	4.3
				10	30	5.4	5.4	20	7.3	6.2	5	15	8.7	13.7	5.4
				12	21	6.4	6.4	14	8.8	7.4	6	11	10.4	16.4	6.4
IC104AL LED, 3500K Flood	FLD	40°	2305	4	144	2.9	2.9	94	4.1	3.4	2	72	3.5	9.7	2.9
				6	64	4.4	4.4	42	6.1	5.0	3	32	5.2	14.5	4.4
				8	36	5.8	5.8	23	8.1	6.7	4	18	6.9	19.3	5.8
				10	23	7.3	7.3	15	10.2	8.4	5	12	8.7	24.2	7.3
				12	16	8.7	8.7	10	12.2	10.1	6	8	10.4	29.0	8.7

Multipliers: 27K - 0.93
 3K - 0.96
 35K - 1.00
 41K - 1.03



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Project: _____
 Fixture Type: _____
 Location: _____
 Contact/Phone: _____

4" BASICS SERIES™ LED SURFACE MOUNT FIXTURE

FOR J-BOX OR RECESSED HOUSING
INSTALLATION

4RLS 700 LUMEN

PRODUCT DESCRIPTION

Sleek, ultra-low profile energy efficient LED surface mount fixture
 • Installs directly onto industry standard junction boxes and round mud rings
 • When used with accessory retrofit kit, can be installed into 4" IC or non-IC recessed housings
 • Replaces traditional 65W incandescent fixture performance, delivering 700 lumens
 • Dimmable with most standard incandescent dimmers and electronic low voltage dimmers
 • LED surface mount fixture is designed to provide over 50,000 hours of life
 • 5 year warranty.

PRODUCT SPECIFICATIONS

Construction Decorative beveled aluminum trim frame with white finish
 • Diffusing dome lens conceals the LEDs from direct view and provides uniform lens luminance.

LED Light Engine LED board mounted directly to aluminum housing designed to provide superior thermal management and ensure long life
 • 2700K or 3000K LED color temperature
 • LED's binned for 3-step MacAdam ellipse color consistency
 • 90 CRI minimum
 • Accommodates 120 volts AC at 60Hz
 • Dimmable with most standard incandescent, magnetic low voltage and electronic low voltage dimmers
 • For a list of compatible dimmers, see [JUNORETROBASICS-DIM](#).

Electrical Connections Fixture provided with leads for direct wire connection in j-box
 • Low profile fixture design is free from external electrical components, so j-box volume and box fill is not compromised
 • Accessory retrofit kit ships with a medium base socket adapter whip for installation as a retrofit trim into 4" incandescent housings with medium base sockets.

Life Rated for 50,000 hours at >70% lumen maintenance.

Labels ENERGY STAR® Qualified • Certified to the high efficacy requirements of California T24 • UL listed for US and Canada
 • Suitable for damp locations
 • Suitable for wet locations (indoor covered ceilings) when fixture is sealed to ceiling with field applied caulk (see instruction sheet for details).

Testing All reports are based on published industry procedures; field performance may differ from laboratory performance.

Product specifications subject to change without notice.

INSTALLATION

Junction Box Mounting Installs directly to industry standard junction boxes
 • Compatible boxes include 3-1/2" and 4" octagon junction boxes (1-1/2" minimum depth), round mud rings with 2-3/4" mounting centers, and 3" & 4" diameter non-metallic boxes
 • Quick-mount strap and spring securement system provides fast installation of fully assembled fixture to junction box
 • Suitable for ceiling or wall mount
 • Suitable for use within closet storage spaces when installed per NEC requirements.

Recessed Housing Mounting (must use 4RLS-RETROKIT)

The 4RLS fixture is compatible with most 4" recessed housings with an inside diameter between 4" and 4-1/2", and a minimum height of 4".

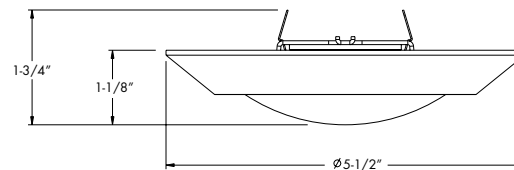
Compatible 4" Juno housings include:

Juno housings: IC1 and TC1 Series

VuLite housings: V4IC and V4TC Series



DIMENSIONS



PRODUCT CODES

Catalog Number	Description
4RLS-927-6-WH	4" LED surface mount fixture, 2700K
4RLS-930-6-WH	4" LED surface mount fixture, 3000K

ACCESSORY

Catalog Number	Description
4RLS-RETROKIT	Allows 4RLS to retrofit in 4" recessed housing Kit contains: medium base adapter, mounting springs, and electrical connectors

PERFORMANCE DATA

	927	930
Input Voltage	120V	120V
Input Power Typical	10W	10W
Frequency	60Hz	60Hz
EMI/RFI	FCC Title 47, Part 15 Class B (consumer)	FCC Title 47, Part 15 Class B (consumer)
Minimum starting temp	-40°C (-40°F)	-40°C (-40°F)
CRI	90 min.	90 min.
CCT	2700K	3000K



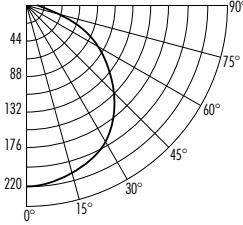
4" BASICS SERIES™ LED SURFACE MOUNT FIXTURE

FOR J-BOX OR RECESSED HOUSING INSTALLATION

4RLS 700 LUMEN

PHOTOMETRIC REPORT

Test Report#: PT11153001R
Catalog No: 4RLS-927-6-WH
Luminaire Spacing Criteria: 1.28
Luminaire LPW: 66

**CANDLEPOWER DISTRIBUTION (Candelas)**

Degrees Vertical	0°
0	220
5	219
15	213
25	199
35	179
45	152
55	122
65	89
75	56
85	29
90	19

AVERAGE INITIAL FOOTCANDLES
Multiple Units (Square Array, 60'x60' room)

Ceiling 80%, Walls 50%, Floors 20%

Spacing	RCR1	RCR3	RCR5
4'	44	33	26
5'	28	21	17
6'	20	15	12
7'	16	12	9
8'	13	9	7
9'	10	7	6
10'	7	5	4

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixture
0-30°	172	N/A	25.0
0-40°	284	N/A	41.1
0-60°	510	N/A	73.9
0-90°	691	N/A	100.0

INITIAL FOOTCANDLES

(One Unit: 10.4W, 117° Beam)

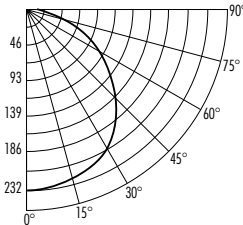
Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Beam Diameter
4'	13.8	13.1
6'	6.1	19.7
8'	3.4	26.3
10'	2.2	32.8

LUMINANCE (Average cd/m²)

Angle in Degrees	Average 0-90°
45°	27087
55°	26710
65°	26514
75°	27301
85°	42153

PHOTOMETRIC REPORT

Test Report#: PT11153002R
Catalog No: 4RLS-930-6-WH
Luminaire Spacing Criteria: 1.28
Luminaire LPW: 70

**CANDLEPOWER DISTRIBUTION (Candelas)**

Degrees Vertical	0°
0	232
5	231
15	225
25	210
35	188
45	161
55	128
65	94
75	59
85	30
90	19

AVERAGE INITIAL FOOTCANDLES
Multiple Units (Square Array, 60'x60' room)

Ceiling 80%, Walls 50%, Floors 20%

Spacing	RCR1	RCR3	RCR5
4'	46	35	28
5'	30	22	18
6'	21	16	12
7'	17	13	10
8'	13	10	8
9'	10	8	6
10'	7	6	4

ZONAL LUMEN SUMMARY

Zone	Lumens	%Lamp	%Fixture
0-30°	182	N/A	25.1
0-40°	300	N/A	41.3
0-60°	538	N/A	74.1
0-90°	726	N/A	100.0

INITIAL FOOTCANDLES

(One Unit: 10.4W, 117° Beam)

Distance to Illuminated Plane (Feet)	Footcandles Beam Center	Beam Diameter
4'	14.5	13.1
6'	6.4	19.6
8'	3.6	26.2
10'	2.3	32.7

LUMINANCE (Average cd/m²)

Angle in Degrees	Average 0-90°
45°	28560
55°	28130
65°	27819
75°	28419
85°	43209



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TYPE J
ALR1-0-1-T-47-1-4-S-N-V-ST-K-N-W

Albeo™ LED Luminaire

Heavy Industrial Low Bay Lighting
(ALR1 - Series)



Project name _____
Date _____
Type _____

Product Description:

The Albeo™ ALR1-series LED luminaire is an energy-efficient, low maintenance alternative to traditional fluorescent in a variety of commercial, low bay lighting applications. The ALR1 expands the linear product offering to include IP65 rated fixtures for demanding industrial environments.

Applications:

- Designed to meet recommended luminance and illuminance requirements for low bay and task level applications in commercial, industrial, warehouse, office, education, health, retail and data center settings.
- Certified for IP 65.
- Recommended for low bay lighting applications at 20 feet or lower.

Housing:

- Fiberglass housing with diffuser.

LED & Optical Assembly:

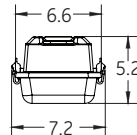
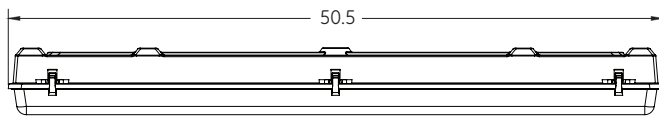
- Precision lens system provides optimized illumination for open floor plan.
- Utilizes high brightness LEDs, 70 CRI at 4000K & 5000K typical.
- LM-79, LM-80 tests and reports are performed in accordance to IESNA standards.
- Directional LEDs put light where it is needed without reflectors to greatly increase efficiency.

Ratings:

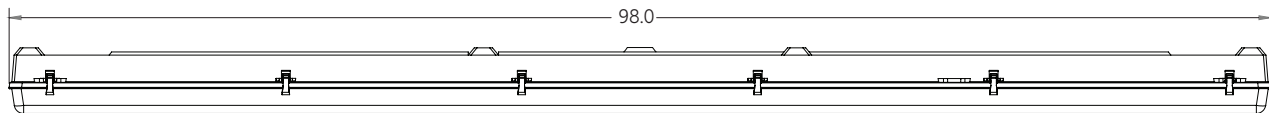
- DLC qualified. Please refer to: <http://www.designlights.org/QPL> for complete information.
- UL 1598 Suitable for Wet Locations.
- UL 8750 LED equipment in Lighting Products.
- Temperature Rated at -30°C up to 45°C (-22°F up to 113°F)
- Projected L70 (10k) ≥ 100,000 Life Hours per IES TM-21.
- RoHS

Product Dimensions:

4 Ft.



8 Ft.



Mounting:

- Surface Mount
- Chain

Finish:

- White

Controls:

- IP 66 rated motion sensors

Electrical:

- 120-277 volt and 347-480 volt available.
 - System power factor is >90%* and THD <20%*.
 - Internal Surge Protection
 - EMI: Title 47 CFR 15 Class A
- * System power factor and THD is tested and specified at 120V input and maximum load conditions.

Warranty:

- 5-year limited system warranty standard



imagination at work

Ordering Number Logic

Heavy Industrial Low Bay Lighting (ALR1)



ALR1 - 1 - - - 1 - S - - - ST - - N - W

PRODUCT ID	VOLTAGE	MODULE	DRIVE CURRENT	LED COLOR TEMP	OPTICS BEAM	FIXTURE LENGTH	FIXTURE TYPE	MOTION/DAYLIGHT SENSOR	CONTROL WIRING	MOUNTING	CORD	PLUG	FINISH
A = Albeo L = Linear R = Rugged Series 1 = LED Generator	0 = 120V-277V 1 = 120V 2 = 208V 4 = 277V 5 = 480V D = 347V	1 = 1 module	T = Standard H = High Output V = Very High Output	70 Plus CRI 47 = 4000K 57 = 5000K	1 = 120°	4 = 4 ft 8 = 8 ft	S = Stand Alone	N = None V = Motion, 360° W = Motion, Aisle* X = Daylight * Field-installed sticker included. Note: All sensors are IP66 rated. 0-10V dimming sensors are not compatible with 480V option.	N = None V = 0-10V Dimming* *Note: 2-conductor cord for dimming is factory installed. See images below.	ST = Standard, Chain & Surface Mount ready. See Mounting & Accessories	K = Knock out access plug A = 6 ft. 18-3 cord B = 12 ft. 18-3 cord	N = None	W = White



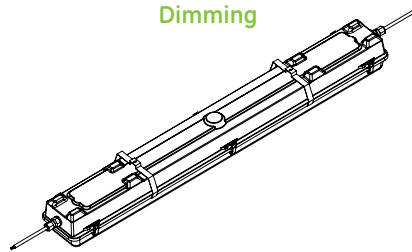
70 CRI

MODULE #	DRIVE CURRENT	FIXTURE LENGTH	TYPICAL INITIAL LUMENS 70 CRI			TYPICAL SYSTEM WATTS			LPW 4000K & 5000K			MAXIMUM AMBIENT TEMPERATURE
			4000K & 5000K			120-277V	347V	480V	120-277V	347V	480V	
1	T	4	3350			23	27	30	146	124	112	45° C
1	H	4	5350			38	41	45	141	130	119	45° C
1	V	4	7350			55	58	59	134	127	125	45° C
1	T	8	6300			41	45	48	154	140	131	45° C
1	H	8	10700			75	79	81	143	135	132	40° C
1	V	8	14800			111	117	117	133	126	126	35° C

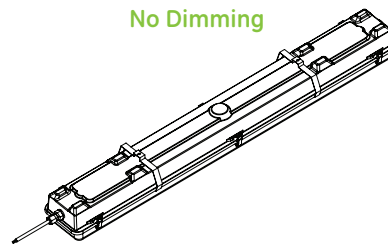
OPTICS BEAM	% OUTPUT
120° CLEAR	100%

MODULE CONFIGURATION	MAX WEIGHT
4 Ft. 120-277V	8 lbs. max
4 Ft. 347/480V	11 lbs. max
8 Ft. 120-277V	16 lbs. max
8 Ft. 347/480V	19 lbs. max

Dimming



No Dimming



www.gelighting.com

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ALB024 (Rev 05/28/15)



VISTA 12302TT
TITANIUM

WIDTH:	5.0"
HEIGHT:	18.8"
WEIGHT:	2.0 LBS
MATERIAL:	ALUMINUM
GLASS:	ACRYLIC LENS
BACKPLATE WIDTH:	5.0"
BACKPLATE HEIGHT:	6.0"
SOCKET:	1-15W LED *INCLUDED
LED INFO:	
LUMENS:	1200
COLOR TEMP:	2700k
CRI:	90
LED WATTAGE:	15w
INCANDESCENT EQUIVALENCY:	120w
DIMMABLE:	Yes, on any Incandescent, MLV, ELV, or C-L dimmer.
NOTES:	LED COMPONENTS CARRY A 5-YEAR LIMITED WARRANTY.
EXTENSION:	3.0"
TTO:	9.5"
VOLTAGE:	120V
UPC:	640665123227
INSTALL OPTIONS:	UP AND VERTICALLY

AT HINKLEY, WE EMBRACE THE DESIGN PHILOSOPHY THAT YOU CAN MERGE TOGETHER THE LIGHTING, FURNITURE, ART, COLORS AND ACCESSORIES YOU LOVE INTO A BEAUTIFUL ENVIRONMENT THAT DEFINES YOUR OWN PERSONAL STYLE. WE HOPE YOU WILL BE INSPIRED BY OUR COMMITMENT TO KEEP YOUR 'LIFE AGLOW.'

*life*AGLOW®



5125205EN-839: Five Light Hall / Foyer



Collection: Goliad

UPC #:785652010507

Finish: Blacksmith (839)

Dimensions:

Diameter: 25" **Overall Height:** 151 3/4"
Height: 30 1/2" **Wire:** 144" (color/Black)
Weight: 18 lbs. **Chain:** 120"
Mounting Proc.: Center Lock-Up
Connection: Mounted To Box

Bulbs:

5 - LED Medium A19 10w Max. 120v - included

Features:

- ENERGY STAR® Qualified
- LED Bulbs are an efficient, versatile and durable light source that deliver exceptional performance.
- Meets Title 24 energy efficiency standards
- Title 24 compliant when used with included Joint Appendix (JA8) approved lamp.

Material List:

1 Body - Steel - Blacksmith
 1 Chain - Steel - Blacksmith

Safety Listing:

Safety Listed for Damp Locations

Instruction Sheets:

Trilingual (English, Spanish, and French) (990CH512520_-GOL)

Shade / Glass / Diffuser Details:

Part	Material	Finish	Quantity	Item Number	Length	Width	Height	Diameter	Fitter Diameter	Shade Top Length	Shade Top Width	Shade Top Diameter
Shade	Glass	Undefined	5	G560195-303			4 5/16	5 7/8				

Backplate / Canopy Details:

Type	Height / Length	Width	Depth	Diameter	Outlet Box Up	Outlet Box Down
Canopy	1			5		

Replacement Bulb Data:

Product #		Type	Base	Watts	Watts Consumed	Volts	Hours	Lumens	Temp (°K)	CRI
10A19DLED27JA8	Frosted	A19	Medium	10	10	120v	25000	800	2700	90

Shipping Information:

Package Type	Product #	Quantity	UPC	Length	Width	Height	Cube	Weight	Fr. Class	UPS Ship
Individual	5125205EN-839	1	785652010507	30	28	27.5	13.368	24.1	250	No
NJ Pallet		2		48	40	60	66.667	48.2		No
NV Pallet		2		48	40	60	66.667	48.2		No

Sea Gull Lighting reserves the right to revise the design of components of any product due to parts availability or change in safety listing standards without assuming any obligation or liability to modify any products previously manufactured and without notice. This literature depicts a product design that is the sole and exclusive property of Sea Gull Lighting. In compliance with U.S. copyright and patent requirements, notification is hereby presented in this form that this literature, or the product it depicts, is not to be copied, altered or used in any manner without the express written consent of, or contrary to the best interests of Sea Gull Lighting, a Generation Brands Company.

TYPE L



6125201EN-839: One Light Mini-Pendant



Collection: Goliad

UPC #: 785652013300

Finish: Blacksmith (839)

Dimensions:

Diameter: 7 7/8" **Overall Height:** 61 5/8"
Height: 18 1/8" **Wire:** 120" (color/Black/White)
Weight: 3 lbs. **Mounting Proc.:** Center Lock-Up
Connection: Mounted To Box

Bulbs:

1 - LED Medium A19 10w Max. 120v - included

Features:

- ENERGY STAR® Qualified
- LED Bulbs are an efficient, versatile and durable light source that deliver exceptional performance.
- Sloped ceiling mounting hardware included

Material List:

1 Body - Steel - Blacksmith
 1 6" Stem - Steel - Blacksmith
 3 12" Stem - Steel - Blacksmith

Safety Listing:

Safety Listed for Damp Locations

Instruction Sheets:

Trilingual (English, Spanish, and French) (990P6125201-GOL)

Shade / Glass / Diffuser Details:

Part	Material	Finish	Quantity	Item Number	Length	Width	Height	Diameter	Fitter Diameter	Shade Top Length	Shade Top Width	Shade Top Diameter
Shade	Glass	Undefined	1	G560195-303			4 5/16	5 7/8				

Backplate / Canopy Details:

Type	Height / Length	Width	Depth	Diameter	Outlet Box Up	Outlet Box Down
Canopy	1			5		

Replacement Bulb Data:

Product #	Material	Finish	Type	Base	Watts	Watts Consumed	Volts	Hours	Lumens	Temp (°K)	CRI
10A19DLED27JA8	Frosted		A19	Medium	10	10	120v	25000	800	2700	90

Shipping Information:

Package Type	Product #	Quantity	UPC	Length	Width	Height	Cube	Weight	Frts. Class	UPS Ship
Individual	6125201EN-839	1	785652013300	20.5	9.5	9	1.014	4	250	Yes
NJ Pallet		80		48	40	77	85.556	320		No
NV Pallet		80		48	40	77	85.556	320		No

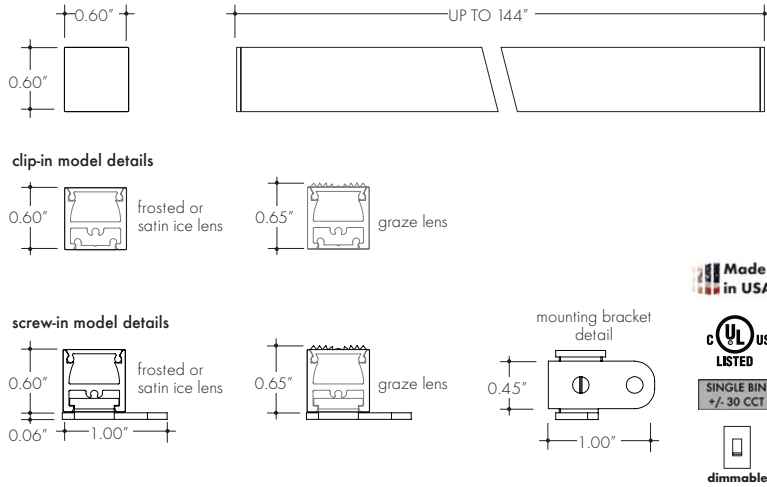
Sea Gull Lighting reserves the right to revise the design of components of any product due to parts availability or change in safety listing standards without assuming any obligation or liability to modify any products previously manufactured and without notice. This literature depicts a product design that is the sole and exclusive property of Sea Gull Lighting. In compliance with U.S. copyright and patent requirements, notification is hereby presented in this form that this literature, or the product it depicts, is not to be copied, altered or used in any manner without the express written consent of, or contrary to the best interests of Sea Gull Lighting, a Generation Brands Company.

TYPE N
BOS-Length-30K-SO-F-S-SA-F1/PSD-96-24V

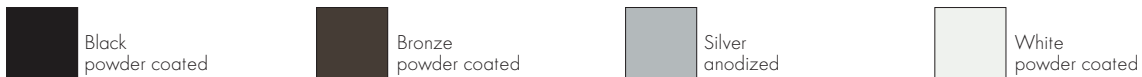


Bosca | Linear Illumination system

Extruded aluminum linear illumination system, Bosca is available in sections up to 144". Specifically designed LED engine provides constant illumination levels from the beginning to the end of the runs. Bosca is suitable for cove lighting, architectural accents, under or above cabinets, display cases and many other applications. Class 2 listed for damp locations.



Finish options



Technical information

Output type	Output Options			CCT INFO/LUMEN MULTIPLIER			TM-30-15		
	SO (LL36)	HO (LL54)	VHO (LL72)	Color temperature	Multiplier (referenced from 3000K)	CRI	R _f	R _g	
Lumens at 3000K (Satin ice lens)	162 lum/ft	250 lum/ft	355 lum/ft	2200K	0.87	82	81	99	
Average power consumption at 4'	3.2 W/ft	5.2 W/ft	6.5 W/ft	2400K	0.73	98	95	101	
Maximum system length	35'	26'	18'	2700K	0.81	98	95	102	
Operating Voltage	24VDC	24VDC	24VDC	2900K	0.86	97	95	102	
				3000K	1.00	91	90	101	
				3500K	1.05	95	90	97	
				4100K	1.28	93	88	96	

Ordering code

MODEL	LENGTH	CCT	OUTPUT	LENS	MOUNTING	FINISH	POWER FEED
BOS - Bosca	12 - 144" 4" increments	22K - 2200K 24K - 2400K 27K - 2700K 29K - 2900K 30K - 3000K 35K - 3500K 41K - 4100K	SO - Standard HO - High VHO - Very High	F - Frosted SI - Satin Ice G - Graze	C - Clip-in S - Screw-in	SA - Silver BK - Black BZ - Bronze WH - White <small>[BK,BZ,WH finishes will have an upcharge and require longer lead times]</small>	F1 - 72" wire leads F2 - 72" wire leads at one end and quick connect at other F3 - Single quick connect F4 - Dual quick connect

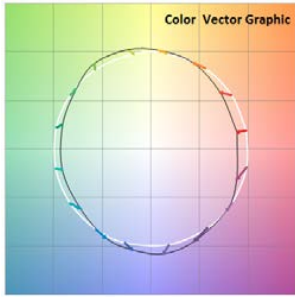
REVO.5

page 1 of 4

www.luminii.com tel: 224-333-6033

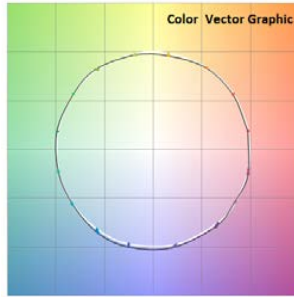
TM-30-15: Data

22K CCT



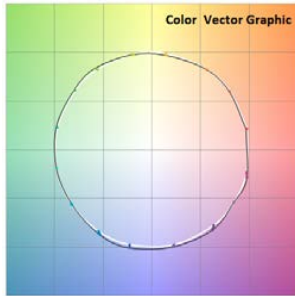
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	79	-10%	0%
2	79	-8%	8%
3	70	-2%	14%
4	85	2%	8%
5	90	5%	5%
6	90	6%	-3%
7	84	-2%	-8%
8	89	-6%	-4%
9	85	-6%	3%
10	78	-6%	11%
11	77	2%	14%
12	79	6%	9%
13	88	8%	-7%
14	67	4%	-20%
15	84	0%	-10%
16	75	-7%	-14%

24K CCT



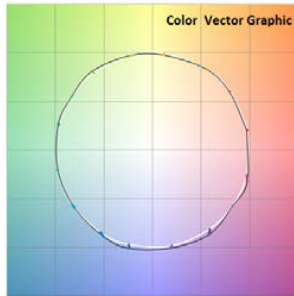
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	97	-1%	0%
2	97	-1%	0%
3	97	0%	1%
4	95	-3%	-1%
5	96	-1%	2%
6	96	1%	3%
7	97	0%	1%
8	98	1%	0%
9	97	0%	2%
10	95	0%	3%
11	93	3%	4%
12	93	3%	1%
13	93	3%	-6%
14	92	2%	-4%
15	95	-1%	-1%
16	91	0%	-6%

27K CCT



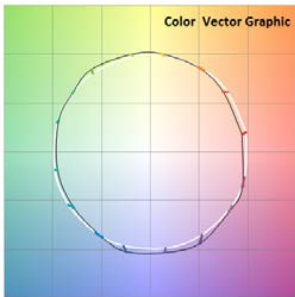
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	97	-1%	0%
2	98	0%	0%
3	96	0%	1%
4	96	-2%	0%
5	96	0%	2%
6	95	2%	2%
7	96	1%	0%
8	98	1%	-1%
9	98	0%	1%
10	95	0%	3%
11	92	2%	5%
12	93	3%	1%
13	95	2%	-3%
14	93	3%	-3%
15	96	0%	-1%
16	91	1%	-6%

29K CCT



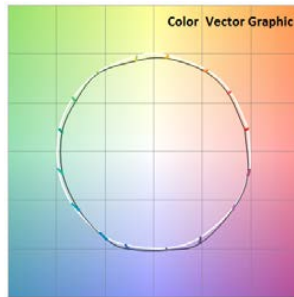
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	79	-10%	0%
2	79	-8%	8%
3	70	-2%	14%
4	85	2%	8%
5	90	5%	5%
6	90	6%	-3%
7	84	-2%	-8%
8	89	-6%	-4%
9	85	-6%	3%
10	78	-6%	11%
11	77	2%	14%
12	79	6%	9%
13	88	8%	-7%
14	67	4%	-20%
15	84	0%	-10%
16	75	-7%	-14%

30K CCT



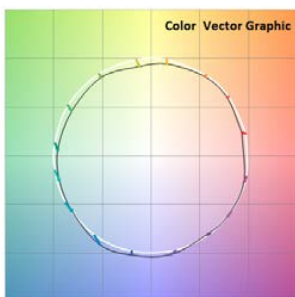
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	90	-4%	-1%
2	91	-4%	3%
3	86	-1%	7%
4	91	1%	5%
5	92	2%	3%
6	93	4%	-1%
7	92	0%	-4%
8	95	-1%	-2%
9	94	-3%	1%
10	87	-3%	6%
11	84	0%	10%
12	88	6%	4%
13	92	4%	-1%
14	88	6%	-6%
15	89	1%	-7%
16	85	0%	-11%

35K CCT



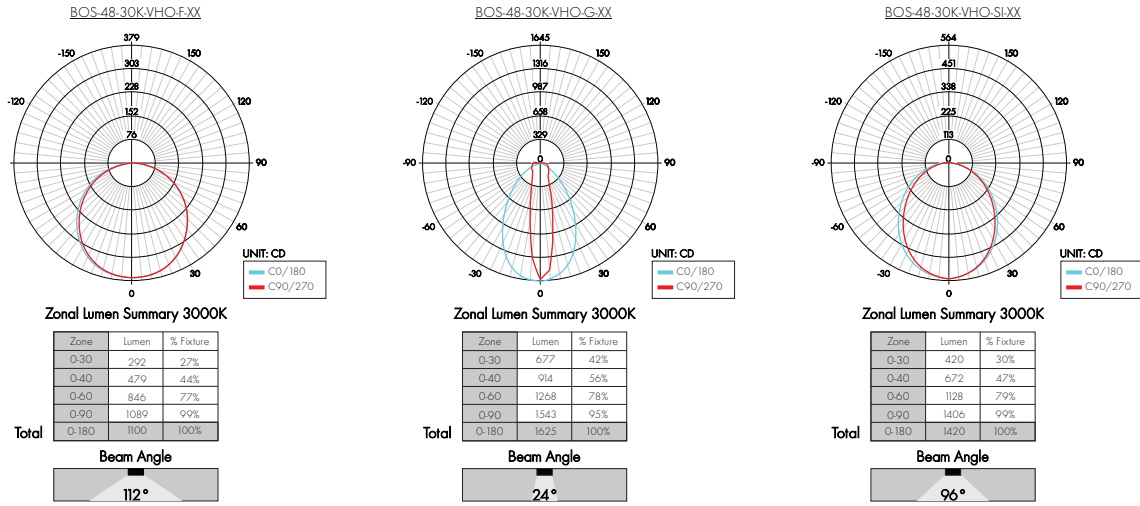
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	91	-4%	0%
2	93	-3%	0%
3	92	-2%	2%
4	92	-3%	1%
5	91	-5%	1%
6	96	-1%	1%
7	92	-4%	1%
8	93	-3%	2%
9	90	-4%	5%
10	83	-3%	10%
11	83	2%	10%
12	89	3%	4%
13	95	2%	-1%
14	90	5%	-4%
15	90	1%	-5%
16	88	0%	-6%

41K CCT



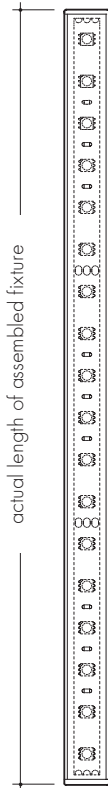
Hue Bin	R_f	Graphic shifts (%)	
		Chroma	Hue
1	88	-4%	1%
2	93	-2%	1%
3	93	-2%	1%
4	89	-4%	-2%
5	88	-7%	-1%
6	93	-4%	0%
7	88	-7%	3%
8	87	-4%	6%
9	82	-3%	12%
10	79	0%	12%
11	83	5%	9%
12	91	4%	0%
13	89	3%	-6%
14	92	-1%	-3%
15	84	0%	-7%
16	84	-1%	-6%

Photometry



Power consumption per fixture length

Based on operation with PSD series of power supplies.



Nominal Length	Actual Length	SO		Actual Length	HO		Actual Length	VHO	
		W/ft	Total wattage		W/ft	Total wattage		W/ft	Total wattage
12"	13-2/16"	3.25	3.25	13"	5.35	5.30	12-15/16"	6.75	6.75
16"	17"	3.25	4.00	16-15/16"	5.33	7.06	16-15/16"	6.75	9.00
20"	20-14/16"	3.25	5.25	20-15/16"	5.31	8.82	20-13/16"	6.75	11.25
24"	24-14/16"	3.25	6.50	24-13/16"	5.30	10.60	24-12/16"	6.75	13.50
28"	28-12/16"	3.25	7.75	28-12/16"	5.28	12.33	28-11/16"	6.75	16.75
32"	32-11/16"	3.25	8.50	32-11/16"	5.26	14.06	32-10/16"	6.75	19.00
36"	36-10/16"	3.25	9.75	36-10/16"	5.25	15.80	36-10/16"	6.65	19.95
40"	40-9/16"	3.25	10.25	40-9/16"	5.23	17.40	40-8/16"	6.65	22.20
44"	44-8/16"	3.20	11.75	44-5/16"	5.21	19.00	44-7/16"	6.65	24.40
48"	48-7/16"	3.20	12.80	48-7/16"	5.20	20.60	48-6/16"	6.55	26.20
52"	52-6/16"	3.20	13.30	52-6/16"	5.18	22.40	52-5/16"	6.55	28.50
56"	56-5/16"	3.20	14.80	56-5/16"	5.16	24.20	56-4/16"	6.55	30.50
60"	60-4/16"	3.20	16.00	60-4/16"	5.15	26.00	61-3/16"	6.45	32.25
64"	64-3/16"	3.20	17.00	64-3/16"	5.13	27.60	64-7/16"	6.45	34.40
68"	68-2/16"	3.15	18.00	68-2/16"	5.11	29.20	68-1/16"	6.45	36.55
72"	72-1/16"	3.15	18.90	72-1/16"	5.10	30.80	73"	6.40	38.40
76"	76"	3.15	19.00	76"	5.08	32.40	76-15/16"	6.40	40.50
80"	79-15/16"	3.15	21.50	79-15/16"	5.06	34.00	80-13/16"	6.40	43.00
84"	83-14/16"	3.15	22.05	83-15/16"	5.05	35.70	84-12/16"	6.25	43.75
88"	87-13/16"	3.15	23.00	87-12/16"	5.03	37.10	88-11/16"	6.25	46.00
92"	91-12/16"	3.10	24.00	91-12/16"	5.01	38.50	92-10/16"	6.25	48.00
96"	95-12/16"	3.10	24.80	97"	5.00	40.00	96-10/16"	6.15	49.20
100"	99-10/16"	3.10	26.30	100-15/16"	4.98	41.60	100-9/16"	6.15	51.25
104"	103-8/16"	3.05	27.10	104-11/16"	4.96	43.20	103-8/16"	6.15	53.00
108"	107-7/16"	3.05	28.00	108-12/16"	4.95	44.80	108-7/16"	6.00	54.00
112"	111-7/16"	3.05	28.50	112-12/16"	4.93	46.20	112-6/16"	6.00	56.00
116"	115-6/16"	3.05	30.00	116-11/16"	4.91	47.60	116-5/16"	6.00	58.00
120"	119-5/16"	3.00	30.50	120-11/16"	4.90	48.90	120-4/16"	5.90	59.00
124"	123-4/16"	3.00	31.50	124-9/16"	4.88	50.40	124-3/16"	5.90	60.60
128"	127-3/16"	3.00	32.50	128-9/16"	4.86	51.90	128-7/16"	5.90	62.20
132"	132-2/16"	2.95	33.50	132-7/16"	4.85	53.30	133-1/16"	5.80	63.80
136"	136-1/16"	2.95	34.30	136-7/16"	4.83	54.70	138"	5.80	65.30
140"	140"	2.95	35.20	140-6/16"	4.81	56.10	141-15/16"	5.80	66.80
144"	143-15/16"	2.90	36.00	144-5/16"	4.80	57.40	145-13/16"	5.70	68.40

Power supply

See fixture and power supply instructions & spec sheet for wiring information. Dimming possible in select models - view Luminii website for list of compatible dimmers.

MODEL	POWER	OUTPUT	DIMMING	LOCATION
PSV	40	24V	U2DIM	D
PSV - PSV Series	40 - 40 W 60 - 60 W 96 - 96 W	24 - 24 VDC	U2DIM - Dimming 0-10V U2ND - Non Dimming	D - Dry Location IP65 - Wet Location

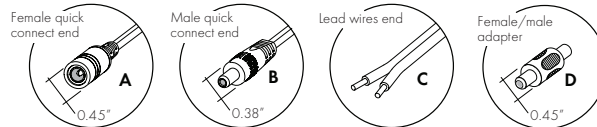
MODEL	POWER	OUTPUT	INPUT
PSD	48	24	
PSD - PSD Series	48 - 48 W 96 - 96 W 288 - 288 W (3x 96W)	24 - 24 VDC	Blank - 120 V 240 - 240 V 277 - 277 V

MODEL
ITEA4U1UKL-CV240
Lutron - Hi-lume™ 1% 2-wire LED driver (120V forward phase only)

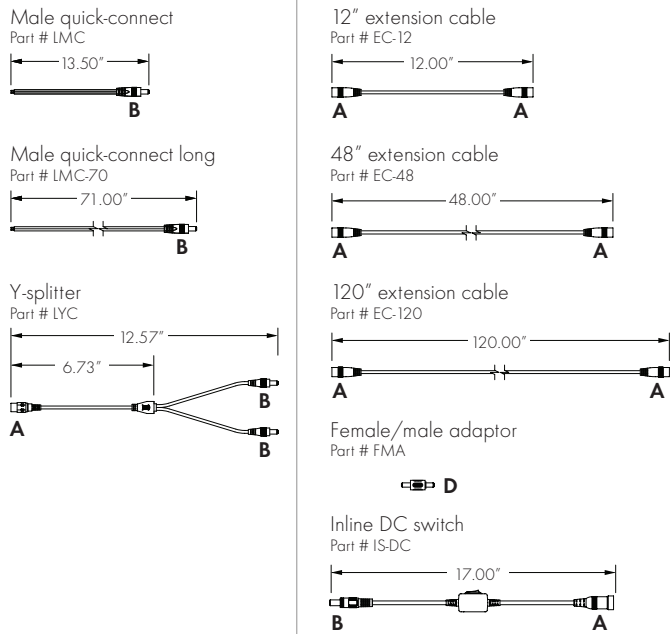
MODEL
L3DA4U1UKL-CV240
Hi-lume™ 1% EcoSystem Voltage LED Driver

MODEL
L3D0-96W24V-U
Hi-lume™ 0.1% EcoSystem Voltage LED Driver with Soft-On, Fade-to-Black™

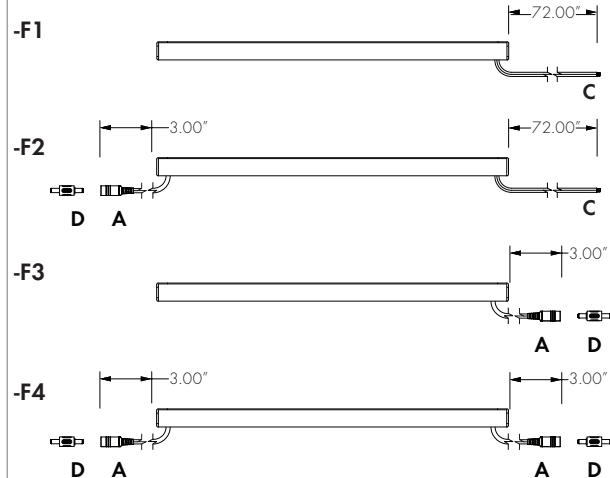
Connectors



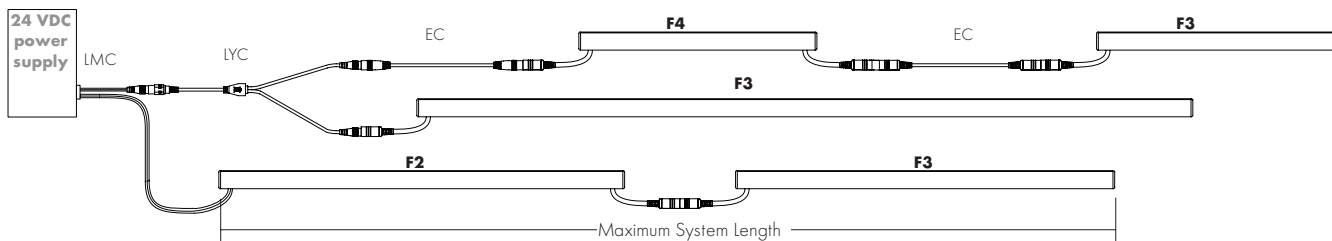
Linking and extension cable options



Powerfeed options



Sample layout of powerfeed connections





Wisp

52" CEILING FAN



MODEL 59284

Fresh White
3 Fresh White Plastic Exclusive blades included

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★★★★★ [0 reviews](#)

TYPE P
T40F-COLOR



Juno®

TRAC-MASTER®

Mounting Accessories

MONOPOINTS and SPECIAL MOUNTINGS

Project: _____

Fixture Type: _____

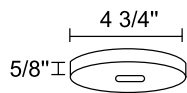
Location: _____

Contact/Phone: _____

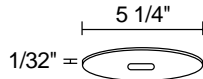
PRODUCT DESCRIPTION

Special adapters permit the flexibility of mounting trac lights in various ways to meet special requirements.

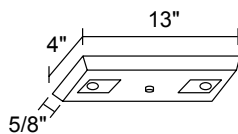
Line Voltage Monopoint Adapters



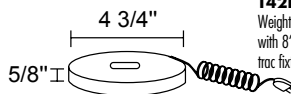
T40N-WH, T40N-BL, T40N-SL
Monopoint Adapter. Mounts directly to outlet box. Accepts one 120V Juno trac fixture.



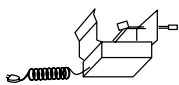
T40F-WH, T40F-BL, T40F-SL
Flush Monopoint Adapter. Mounts directly to 4" outlet box only. Accepts one 120V Juno trac fixture with standard size trac adapter.



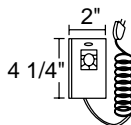
T41N-WH, T41N-BL, T41N-SL
Duo-Point Adapter. Mounts directly to an outlet box. Accepts two 120V Juno trac fixtures.



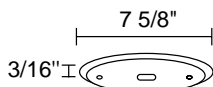
T42N-WH, T42N-BL
Weighted Base. For portable use. Supplied with 8' cord and plug. Accepts one 120V Juno trac fixture.



T46
Clamp/Monopoint Adapter. Clamps to pipe or planking up to 2 1/2" thick. Accepts 120V Juno trac fixture with standard size trac adapter. Supplied with 8' three-wire cord and plug.



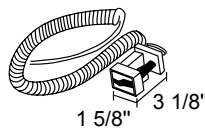
T45WH, T45BL
Pin-Up/Monopoint Adapter. Supplied with 8' cord and plug. Accepts one 120V Juno trac fixture with standard size trac adapter.



T57N-WH
Monopoint Line Voltage Cover. Attaches one 120V trac fixture directly to Juno's 6" recessed universal housings.

Line Voltage Coil - Cord Clamp-Ons

2' Coil Cord extends to 5'. 1-3/4" Clamp opening.



T132WH, T132BL

120V Monopoint with trac adapter for electrical connection to Trac. Accepts one 120V Juno trac fixture with standard size trac adapter.

T132WA-WH, T132WA-BL

Same as above but accepts one 120V Juno trac fixture with wide trac adapter.

T133WH, T133BL

120V Monopoint with male plug (120V) attaches to receptacle. Accepts one 120V Juno trac fixture with standard size trac adapter. 2'

T133WA-WH, T133WA-BL

Same as above but accepts one 120V Juno trac fixture with wide trac adapter.

Line Voltage Extension Wands

TW12, TW18, TW24, TW36, TW48

Line Voltage Extension Wands (12", 18", 24", 36", 48") - For use with one or two circuit trac and line voltage monopoints. Accepts one 120V Juno trac fixture with standard size trac adapter. WH, BL, SL



TW12WA, TW18WA, TW24WA, TW36WA, TW48WA

Same as above but accepts one 120V Juno trac fixture with wide trac adapter. WH, BL, SL

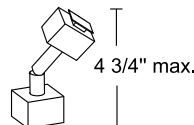
TWS24WH, TWS24BL, TWS24SL

24" Wand with Slope Adapter. Accepts one 120V Juno trac fixture with standard size trac adapter.

TWS24WA-WH, TWS24WA-BL, TWS24WA-SL

Same as above but accepts one 120V Juno trac fixture with wide trac adapter.

Line Voltage Sloped Ceiling Adapter



T95WH, T95BL, T95SL

Sloped Ceiling Adapter. Attaches to trac, permitting Trac-Master or Trac-Lites Trac fixtures with standard size trac adapter to be hung vertically from sloped ceiling. 90° maximum adjustable.

T95WA-WH, T95WA-BL, T95WA-SL

Same as above but accepts one 120V Juno trac fixture with wide trac adapter.

REV-8/10/15

Product specifications subject to change without notice.



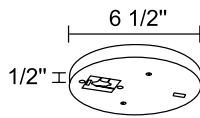
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TRAC-MASTER®

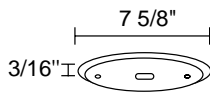
Mounting Accessories

MONOPOINTS and SPECIAL MOUNTINGS

Low Voltage Monopoint Adapters

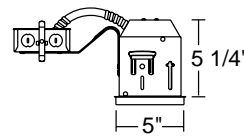


T58WH, T58BL, T58SL
Monopoint Adapter for T537, T538 or Trac-Lites R Series Low-Voltage Power Packs. Mounts directly to outlet box. Adapter is offset to accept all Power Pack styles. Power Pack latch locks in detent.

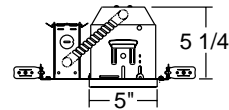


T539WH
Monopoint Low Voltage Cover. Contains integral electronic transformer. Designed to accept one Juno 12V halogen low voltage trac spotlight directly to Juno's 6" recessed universal housings.

Low Voltage Recessed Monopoint Adapters

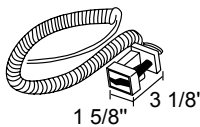


T542WH
Monopoint Power Pack (recessed) for remodel construction. TC housing. Includes 50VA-12V magnetic transformer, wiring box, canopy and thermal protector. Designed to accept one Juno 12V halogen low voltage trac spotlight.



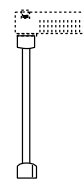
T543WH
Monopoint Power Pack (recessed) for new construction. TC housing. Includes 50VA-12V magnetic transformer, pre-wired recessed housing, canopy, adjustable bar hangers and thermal protector. Designed to accept one Juno 12V halogen low voltage trac spotlight.

Low Voltage Coil - Cord Clamp-Ons

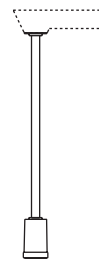


T135WH, T135BL
12V Low Voltage Monopoint attaches to T537 or T538. 2' Coil Cord extends to 5'. Accepts one Juno 12V low voltage spotlight.

Low Voltage Extension Wands



TWL12, TWL18, TWL24, TWL36, TWL48
Low Voltage Extension Wands (12", 18", 24", 36", 48") - Accepts one Juno 12V low voltage spotlight. Attaches to T537 or T538 Power Pack. WH, BL, SL



TWLED12, TWLED18, TWLED24, TWLED36, TWLED48
T252L Extension Wands (12", 18", 24", 36", 48") - Attaches between T252L fixture housing and LED driver housing to move the light source closer to illumination point without lowering the trac mounting height. WH, BL, SL

MH₂ CMH Extension Wands



TMW12, TMW18, TMW24, TMW36, TMW48
Extension Wands. Accepts one MH₂ CMH Trac fixture. Attaches to TM Series Ballast or Monopoint. WH, BL, SL

Product specifications subject to change without notice.



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TRAC-MASTER®

Avant Garde

13W VERTICAL CYLINDER LED

T381L

Project: _____

Fixture Type: _____

Location: _____

Contact/Phone: _____

PRODUCT DESCRIPTION

The classic, simple appearance of the Vertical Cylinder LED fixtures offers a fresh take on a traditional aesthetic. The subtle elegance is carried through the entire design producing an understated charm. The 13W Vertical Cylinder LED fixtures have integral TIR optics which enable uniform spot, narrow flood, flood or wide flood distributions to be achieved. These fixtures have an integral, bayonet-mounted accessory holder that accommodates one accessory if desired. The 13W Vertical Cylinder LED can deliver up to 1187 lumens, at efficacies up to 89LPW and having a rated life of 50,000 hours. Available in 2700K, 3000K, 3500K and 4000K color temperatures, the white-light 13W Vertical Cylinder LED is compatible with all Juno line voltage trac and standard adapter accessories.



PRODUCT SPECIFICATIONS

Construction All-metal housing and custom designed concealed heat sink provides outstanding thermal management, yielding 70% average lumen maintenance at 50,000 hours of operation • Passively-cooled design – no moving parts to break or wear-out • Extruded aluminum vertically mounted LED driver housing • Concealed fixture wiring for a clean aesthetic • Fashionable, elegant design complements any decor • Available in white, black and silver painted finishes.

LED High performance LED array provides outstanding reliability, performance and color quality/consistency • 2700K, 3000K, 3500K or 4000K white phosphor high performance LEDs • Chromaticity range within a 3-step MacAdam Ellipse • 80 CRI minimum on standard product • Optional high CRI versions offer 90 CRI minimum, with an R9 value greater than 50 • Optional SpectralWhite versions are also available which make whites appear naturally brilliant and render colors more richly.

Driver Assembled in a side-mount vertical housing to minimize overall fixture footprint • Insulating air gap between driver and LED light engine optimizes thermal operation • Provides quiet operation with or without dimming • Dimmable using high quality reverse phase ELV dimmers approved by Juno - see [T381L-DIM](#) • Solid state electronic, Class 2 compliant • Integral overcurrent and short circuit protection • Class B FCC Part 15 rated.

Optics Interchangeable computer-designed custom TIR optics available in four factory-configured beam spreads • One TIR optic provided with fixture (as specified in catalog number) • Accessory optics available to enable beam changes in the field • Beam patterns can be altered as desired using a variety of available light control accessories.

Adapter Copper alloy contacts provide precise spring action – no arcing and will not take a set • True, positive electrical ground • On/off switch included • Patented embossed polarity arrows on bottom of adapter • Spring-loaded positive latch with embossed polarity arrows secures trac light to trac • “Pull-up” contact to up position for two-circuit application.

Accessory Holder Integral to fixture design • Die cast aluminum construction • Precision bayonet mounting • Accommodates one accessory if desired.

Aiming 360° horizontal coverage • Greater than 90° vertical aiming capability.

Labels UL and C-UL Listed.

Warranty Warranty period is 5 years from date of purchase • Standard Juno Lighting Group product guarantee terms and conditions apply.

Product specifications subject to change without notice.

ORDERING INFORMATION

Fixture Type	Color Temperature	Color Rendering Index	Beam Spread	Finish
T381L 13W Vertical Cylinder LED	27 2700K 3 3000K 35 3500K 4 4000K	Blank 80 CRI Minimum HC 90 CRI Minimum V ¹ SpectralWhite	S Spot N Narrow Flood F Flood W Wide Flood	BL Black SL Silver WH White

¹3000K & 3500K only

Ordering Examples: T381L-27SBL, T381L-3VNWH

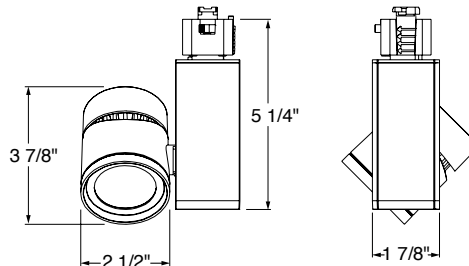
ACCESSORIES

Cat. No.	Description	Cat. No.	Description
T7459BL	Hexcell Louver	T7477	Prismatic Spread Lens
T741-6	Color Filters	T7478	Linear Spread Lens
T7401-16	Dichroic Filters	TIR-1-SP	TIR Optic - Spot
T7418	Color Correction Filter ¹	TIR-1-NFL	TIR Optic - Narrow Flood
T7420	Diffusion Lens	TIR-1-FL	TIR Optic - Flood
T7421	Uniformity Lens	TIR-1-WFL	TIR Optic - Wide Flood

See specification sheet [D1.2.2](#) for details.

¹T7418 corrects 3000K color to approximately 2700K and 4000K color to approximately 3400K.

REV-11/17/16



TRAC-MASTER®

Avant Garde

13W VERTICAL CYLINDER LED**T381L****PERFORMANCE DATA¹:**

Catalog Number	Voltage	Input Watts (Typical)	Lumens	Efficacy (LPW)	Rated Life (Hours)
T381L-27S	120V	13.4	1025	76	50,000
T381L-27N	120V	13.4	988	74	50,000
T381L-27F	120V	13.4	1019	76	50,000
T381L-27W	120V	13.4	929	69	50,000
T381L-27HCS	120V	13.4	896	67	50,000
T381L-27HCN	120V	13.4	863	64	50,000
T381L-27HCF	120V	13.4	891	66	50,000
T381L-27HCW	120V	13.4	812	61	50,000
T381L-3S	120V	13.4	1079	81	50,000
T381L-3N	120V	13.4	1040	78	50,000
T381L-3F	120V	13.4	1073	80	50,000
T381L-3W	120V	13.4	978	73	50,000
T381L-3HCS	120V	13.4	939	70	50,000
T381L-3HCN	120V	13.4	905	68	50,000
T381L-3HCF	120V	13.4	934	70	50,000
T381L-3HCW	120V	13.4	851	64	50,000
T381L-3VS	120V	13.4	939	70	50,000
T381L-3VN	120V	13.4	905	68	50,000
T381L-3VF	120V	13.4	934	70	50,000
T381L-3VW	120V	13.4	851	64	50,000
T381L-35S	120V	13.4	1133	85	50,000
T381L-35N	120V	13.4	1092	81	50,000
T381L-35F	120V	13.4	1127	84	50,000
T381L-35W	120V	13.4	1027	77	50,000
T381L-35HCS	120V	13.4	971	72	50,000
T381L-35HCN	120V	13.4	936	70	50,000
T381L-35HCF	120V	13.4	966	72	50,000
T381L-35HCW	120V	13.4	880	66	50,000
T381L-35VS	120V	13.4	971	72	50,000
T381L-35VN	120V	13.4	936	70	50,000
T381L-35VF	120V	13.4	966	72	50,000
T381L-35VW	120V	13.4	880	66	50,000
T381L-4S	120V	13.4	1187	89	50,000
T381L-4N	120V	13.4	1144	85	50,000
T381L-4F	120V	13.4	1180	88	50,000
T381L-4W	120V	13.4	1076	80	50,000
T381L-4HCS	120V	13.4	993	74	50,000
T381L-4HCN	120V	13.4	957	71	50,000
T381L-4HCF	120V	13.4	987	74	50,000
T381L-4HCW	120V	13.4	900	67	50,000

¹Performance data, including Rated Life, is based on measurements of an individual fixture operating in a 25°C ambient.

ELECTRICAL DATA

Input Voltage	120V
Input Current (max.)	0.12A
Power Factor	>0.90
T.H.D.	<20%



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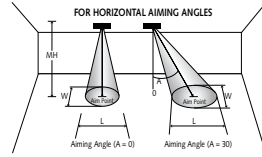
Avant Garde

13W VERTICAL CYLINDER LED

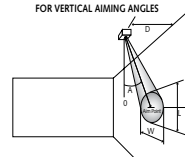
T381L

CBCP • Centerbeam candlepower
FC • Footcandles at beam center (aim point)

In vertical aiming applications, aim point (X) is determined by dividing distance from the wall (D) by the tangent of the desired aim angle (A) (0.5774 for 30°, 1.0 for 45°, 1.732 for 60°).



Horizontal Aiming Angles



Vertical Aiming Angles



Fixture	Beam Type	Beam Spread	Rated Life	CBCP	0°		30°			30°			45°			60°									
					MH	FC	L	W	FC	L	W	D	FC	X	L	W	FC	X	L	W	D	FC	X	L	W
Cylinder 13W LED, 3000K Spot	S	16°	50000	10386	6	289	1.7	1.7	187	2.3	2.0	3	144	5.2	3.6	1.7	408	3.0	1.7	1.2	6	187	3.5	2.3	2.0
					8	162	2.3	2.3	105	3.0	2.6	4	81	6.9	4.8	2.3	230	4.0	2.3	1.6	8	105	4.6	3.0	2.6
					10	104	2.8	2.8	67	3.8	3.3	5	52	8.7	6.0	2.8	147	5.0	2.9	2.0	10	67	5.8	3.8	3.3
					12	72	3.4	3.4	47	4.6	3.9	6	36	10.4	7.2	3.4	102	6.0	3.5	2.4	12	47	6.9	4.6	3.9
					14	53	4.0	4.0	34	5.3	4.6	7	26	12.1	8.4	4.0	75	7.0	4.0	2.8	14	34	8.1	5.3	4.6
Cylinder 13W LED, 3000K Narrow Flood	N	26°	50000	4278	4	267	1.9	1.9	174	2.5	2.1	2	134	3.5	4.4	1.9	378	2.0	2.0	1.3	4	174	2.3	2.5	2.1
					6	119	2.8	2.8	77	3.8	3.2	3	59	5.2	6.6	2.8	168	3.0	2.9	2.0	6	77	3.5	3.8	3.2
					8	67	3.7	3.7	43	5.0	4.3	4	33	6.9	8.8	3.7	95	4.0	3.9	2.6	8	43	4.6	5.0	4.3
					10	43	4.6	4.6	28	6.3	5.4	5	21	8.7	11.1	4.6	61	5.0	4.9	3.3	10	28	5.8	6.3	5.4
					12	30	5.6	5.6	19	7.6	6.4	6	15	10.4	13.3	5.6	42	6.0	5.9	3.9	12	19	6.9	7.6	6.4
Cylinder 13W LED, 3000K Flood	F	39°	50000	2309	4	144	2.8	2.8	94	4.0	3.3	1	289	1.7	4.6	1.4	816	1.0	1.6	1.0	3	167	1.7	3.0	2.5
					5	92	3.6	3.6	60	4.9	4.1	2	72	3.5	9.1	2.8	204	2.0	3.3	2.0	4	94	2.3	4.0	3.3
					6	64	4.3	4.3	42	5.9	4.9	3	32	5.2	13.7	4.3	91	3.0	4.9	3.0	5	60	2.9	4.9	4.1
					7	47	5.0	5.0	31	6.9	5.7	4	18	6.9	18.3	5.7	51	4.0	6.5	4.0	6	42	3.5	5.9	4.9
					8	36	5.7	5.7	23	7.9	6.6	5	12	8.7	22.8	7.1	33	5.0	8.1	5.0	7	31	4.0	6.9	5.7
Cylinder 13W LED, 3000K Wide Flood	W	51°	50000	1182	2	296	1.9	1.9	192	2.7	2.2	1.0	148	1.7	11.7	1.9	418	1.0	2.5	1.3	2	192	1.2	2.7	2.2
					3	131	2.8	2.8	85	4.1	3.3	1.5	66	2.6	17.6	2.8	186	1.5	3.7	2.0	3	85	1.7	4.1	3.3
					4	74	3.8	3.8	48	5.5	4.4	2.0	37	3.5	23.5	3.8	104	2.0	4.9	2.7	4	48	2.3	5.5	4.4
					5	47	4.7	4.7	31	6.8	5.5	2.5	24	4.3	**	4.7	67	2.5	6.1	3.4	5	31	2.9	6.8	5.5
					6	33	5.7	5.7	21	8.2	6.6	3.0	16	5.2	**	5.7	46	3.0	7.4	4.0	6	21	3.5	8.2	6.6

For 2700K fixtures, use 0.95 multiplier; for 2700HC fixtures, use 0.83 multiplier; for 3000HC fixtures, use 0.87 multiplier; for 3000V fixtures, use 0.87 multiplier; for 3500K fixtures, use 1.05 multiplier; for 3500HC fixtures, use 0.90 multiplier; for 3500V fixtures, use 0.90 multiplier; for 4000K fixtures, use 1.10 multiplier; for 4000HC fixtures, use 0.92 multiplier

**Due to steep aiming angle, length of beam extends beyond 25'



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TYPE R
M-LENGTH-27K-MO-LT-PR-LX-RX-XXX-
M-IC-90-MO-LT-PR-LM-RN-PFX
PSD-96-24V

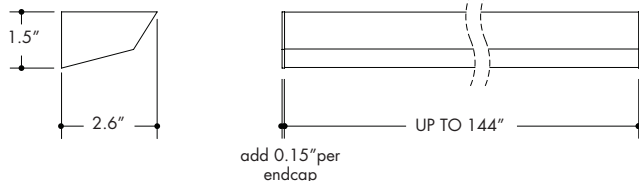
mCove | Linear illumination system



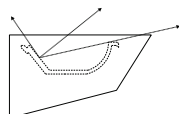
Designed with high efficacy and minimal size in mind, the mCove lighting system is available with long throw and tall throw reflectors, multiple light outputs and color temperature. The Black, and White finishes are complemented by a paint ready option. Individual fixtures connect easily together to reach long continuous run with no visible dark spots. Remote power supplies required. Approved for closet/storage space installation per NEC 410.16(A)(3) and 410.16(C)(5).



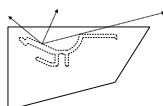
dimensions



reflector options

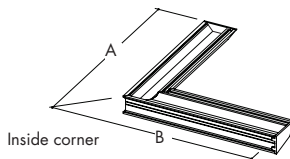


Long Throw

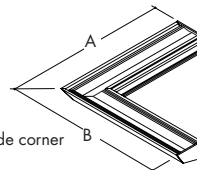


Tall Throw

corner options



Inside corner



Outside corner



Made in USA



dimmable

Finish options



Black powder coated



White powder coated



Paint Ready

Technical information

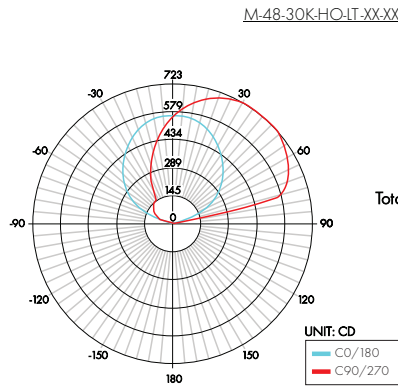
Output type	Output Options					CCT INFO/LUMEN MULTIPLIER			TM-30-15		
	LO (LL18)	SO (LL30)	MO (LL36)	HO (LL54)	VHO (LL72)	Color temperature	Multiplier (referenced from 3000K)	CRI	R _f	R _g	
Light output 3000K	125 lum/ft	227 lum/ft	253 lum/ft	250 lum/ft	493 lum/ft	2200K	0.87	82	81	99	
Average power consumption at 15'	1.6 W/ft	2.5 W/ft	3.2 W/ft	5.2 W/ft	6.5 W/ft	2400K	0.73	98	95	101	
Maximum system length	80'	48'	39'	26'	18'	2700K	0.81	98	95	102	
Operating Voltage	24V DC	24V DC	24V DC	24V DC	24V DC	2900K	0.86	97	95	102	
						3000K	1.00	91	90	101	
						3500K	1.05	95	90	97	
						4100K	1.28	93	88	96	

Ordering code

MODEL	LENGTH	CCT	OUTPUT	REFLECTOR	FINISH	LEFT END	RIGHT END	POWER FEED
M	12	22K	LO	LT	BK	LE	RE	PFL
M - Micro Cove	12" - 144" 4" increments	22K - 2200K 24K - 2400K 27K - 2700K 29K - 2900K 30K - 3000K 35K - 3500K 41K - 4100K	LO - Low SO - Standard MO - Medium HO - High VHO - Very High	LT - Long Throw TT - Tall Throw	BK - Black WH - White PR - Paint Ready	LE - W/ end cap LN - WO/ end cap	RE - W/ end cap RN - WO/ end cap	PFL - Power feed left PFR - Power feed right NPF - No Power feed

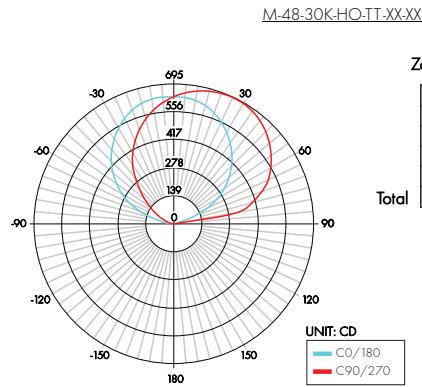
*Refer to the sample layout on page 2, to choose the correct end cap & power feed.

Photometry



Zonal lumen Summary 3000K

Zone	Lumen	% Fixture
0-30	433	22%
0-40	713	37%
0-60	1333	69%
0-90	1911	99%
0-180	1932	100%



Zonal lumen Summary 3000K

Zone	Lumen	% Fixture
0-30	492	25%
0-40	809	41%
0-60	1450	74%
0-90	1942	99%
0-180	1963	100%

Power consumption per fixture length

Based on operation with PSD series of power supplies.

Nominal length	LO (LL18)			SO (LL30)			MO (LL36)			HO (LL54)			VHO (LL72)		
	*Actual length	W/ft	Total wattage	*Actual length	W/ft	Total wattage	*Actual length	W/ft	Total wattage	*Actual length	W/ft	Total wattage	*Actual length	W/ft	Total wattage
12	12.9/16"	1.65	1.65	10.10/16"	2.70	2.70	12.9/16"	3.25	3.25	12.7/16"	5.35	5.30	12.7/16"	6.75	6.75
16	16.5/16"	1.65	2.00	15.3/16"	2.70	3.60	16.5/16"	3.25	4.00	16.6/16"	5.33	7.06	16.2/16"	6.75	9.00
20	20.5/16"	1.65	2.80	21.6/16"	2.70	4.50	20.5/16"	3.25	5.25	20.6/16"	5.31	8.82	20.1/16"	6.75	11.25
24	24.4/16"	1.65	3.00	25.5/16"	2.70	5.40	24.4/16"	3.25	6.50	24.4/16"	5.30	10.60	24.2/16"	6.75	13.50
28	28.3/16"	1.65	3.90	27.12/16"	2.70	6.30	28.3/16"	3.25	7.75	28.3/16"	5.28	12.33	28.3/16"	6.75	16.75
32	32.2/16"	1.65	4.00	32.10/16"	2.70	7.20	32.2/16"	3.25	8.50	32.2/16"	5.26	14.06	32.2/16"	6.75	19.00
36	36-1/16"	1.65	5.00	35.2/16"	2.70	8.10	36-1/16"	3.25	9.75	36-1/16"	5.25	15.80	36-1/16"	6.65	19.95
40	40 "	1.64	5.50	40-1/16"	2.65	8.90	40 "	3.25	10.25	40 "	5.23	17.40	40 "	6.65	22.20
44	43-14/16"	1.64	6.00	45 "	2.65	9.70	43-14/16"	3.20	11.75	43-15/16"	5.21	19.00	44 "	6.65	24.40
48	47-14/16"	1.63	6.60	47-7/16"	2.65	10.60	47-14/16"	3.20	12.80	47-14/16"	5.20	20.60	47-14/16"	6.55	26.20
52	51-13/16"	1.63	7.10	53-6/16"	2.65	11.40	51-13/16"	3.20	13.30	51-13/16"	5.18	22.40	51-14/16"	6.55	28.50
56	55-12/16"	1.63	7.70	54-13/16"	2.65	12.20	55-12/16"	3.20	14.80	55-12/16"	5.16	24.20	55-12/16"	6.55	30.50
60	59-11/16"	1.63	8.20	59-12/16"	2.65	13.30	59-11/16"	3.20	16.00	59-11/16"	5.15	26.00	59-11/16"	6.45	32.25
64	63-10/16"	1.63	8.80	64-11/16"	2.65	14.20	63-10/16"	3.20	17.00	63-10/16"	5.13	27.60	63-10/16"	6.45	34.40
68	67-9/16"	1.62	9.30	67-2/16"	2.65	15.10	67-9/16"	3.15	18.00	67-9/16"	5.11	29.20	68-10/16"	6.45	36.55
72	71-8/16"	1.62	9.80	72-1/16"	2.65	15.90	71-8/16"	3.15	18.90	71-8/16"	5.10	30.80	72-2/16"	6.40	38.40
76	75-7/16"	1.62	10.40	74-8/16"	2.60	16.70	75-7/16"	3.15	19.00	75-7/16"	5.08	32.40	76-3/16"	6.40	40.50
80	79-6/16"	1.62	10.90	79-7/16"	2.60	17.50	79-6/16"	3.15	21.50	79-6/16"	5.06	34.00	80-2/16"	6.40	43.00
84	83-5/16"	1.62	11.50	84-6/16"	2.60	18.20	83-5/16"	3.15	22.05	83-6/16"	5.05	35.70	84-2/16"	6.25	43.75
88	87-4/16"	1.62	12.00	86-13/16"	2.55	19.10	87-4/16"	3.15	23.00	87-3/16"	5.03	37.10	88-4/16"	6.25	46.00
92	91-3/16"	1.62	12.50	91-12/16"	2.55	20.00	91-3/16"	3.10	24.00	91-3/16"	5.01	38.50	92-3/16"	6.25	48.00
96	95-3/16"	1.62	13.1	96-10/16"	2.55	20.80	95-3/16"	3.10	24.80	96-7/16"	5.00	40.00	96-2/16"	6.15	49.20
100	99-1/16"	1.61	13.5	101-5/16"	2.55	21.70	99-1/16"	3.10	26.30	100-6/16"	4.98	41.60	100-1/16"	6.15	51.25
104	102-15/16"	1.61	14.00	104-1/16"	2.55	22.50	102-15/16"	3.05	27.10	104-2/16"	4.96	43.20	104-1/16"	6.15	53.00
108	106-14/16"	1.60	14.50	109 "	2.50	23.40	106-14/16"	3.05	28.00	108-4/16"	4.95	44.80	107-14/16"	6.00	54.00
112	110-14/16"	1.60	15.00	111-7/16"	2.50	24.10	110-14/16"	3.05	28.50	112-3/16"	4.93	46.20	111-14/16"	6.00	56.00
116	114-13/16"	1.60	15.50	116-6/16"	2.50	24.80	114-13/16"	3.05	30.00	116-2/16"	4.91	47.60	115-14/16"	6.00	58.00
120	118-12/16"	1.59	16.50	119-13/16"	2.50	25.50	118-12/16"	3.00	30.50	120-2/16"	4.90	48.90	119-11/16"	5.90	59.00
124	122-11/16"	1.59	17.00	123-12/16"	2.45	26.30	122-11/16"	3.00	31.50	124 "	4.89	50.40	123-10/16"	5.90	60.60
128	126-10/16"	1.59	17.50	127-11/16"	2.45	27.30	126-10/16"	3.00	32.50	128 "	4.88	51.80	127-14/16"	5.90	62.20
132	131-9/16"	1.59	18.10	132-2/16"	2.45	28.10	131-9/16"	2.95	33.50	131-14/16"	4.86	53.30	132-8/16"	5.80	63.80
136	135-8/16"	1.59	18.60	136-1/16"	2.45	28.90	135-8/16"	2.95	34.30	135-14/16"	4.84	54.70	137-7/16"	5.80	65.30
140	139-7/16"	1.59	19.10	140-8/16"	2.40	29.80	139-7/16"	2.95	35.20	139-13/16"	4.82	56.10	141-6/16"	5.80	66.80
144	143-6/16"	1.58	19.64	142-14/16"	2.40	30.60	143-6/16"	2.90	36.00	143-12/16"	4.80	57.40	143-4/16"	5.70	68.40

*add an addition 0.15" for each endcap used

Power supply

See fixture and power supply instructions & spec sheet for wiring information. Dimming possible in select models - view Luminii website for list of compatible dimmers.

MODEL	POWER	OUTPUT	DIMMING	LOCATION
PSV	40	24V	U2DIM	D
PSV - PSV Series	40 - 40 W 60 - 60 W 96 - 96 W	24 - 24 VDC	U2DIM - Dimming 0-10V U2ND - Non Dimming	D - Dry Location IP65 - Wet Location

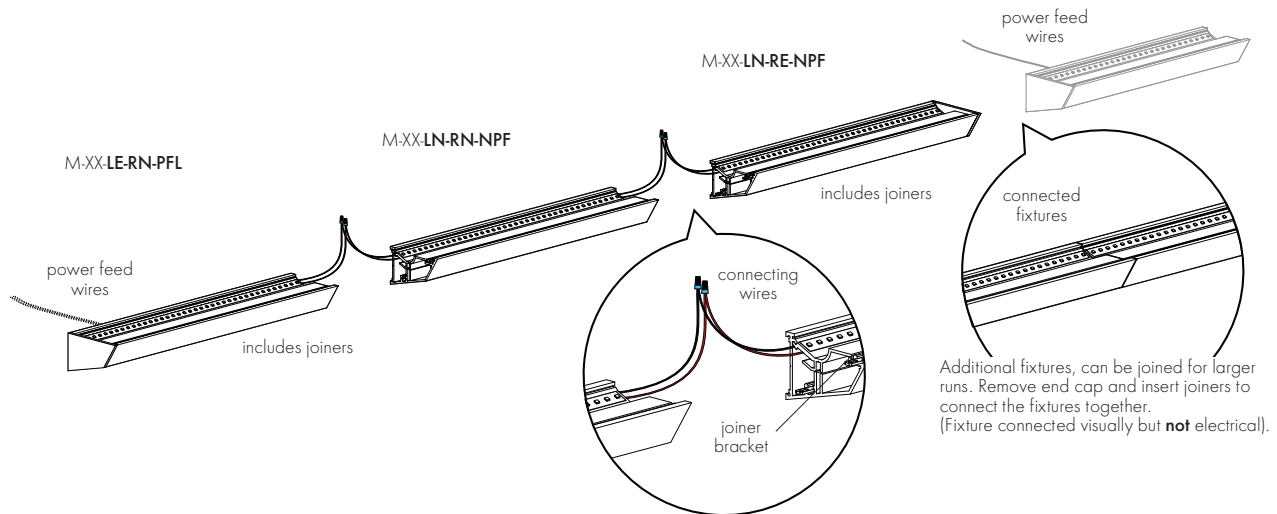
MODEL	POWER	OUTPUT	INPUT
PSD	48	24	
PSD - PSD Series	48 - 48 W 96 - 96 W 288 - 288 W (3x 96W)	24 - 24 VDC	Blank - 120 V 240 - 240 V 277 - 277 V

MODEL
LTEA4U1UKL-CV240
Lutron -Hi-lume™ 1% 2-wire
LED driver (120V forward phase only)

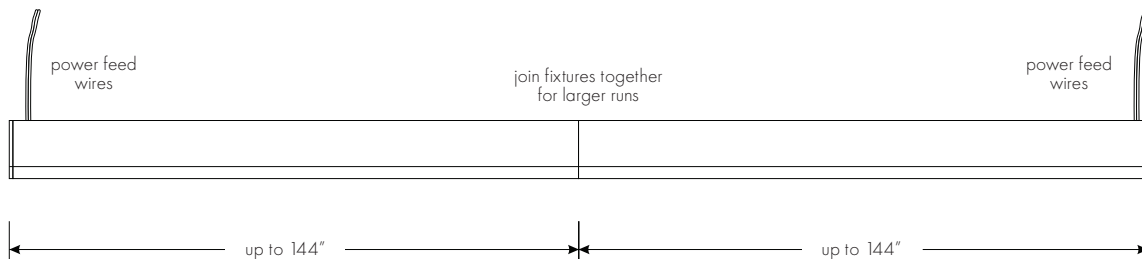
MODEL
L3DA4U1UKL-CV240
Hi-lume™ 1% EcoSystem Voltage
LED Driver

MODEL
L3D0-96W24VU
Hi-lume™ 0.1% EcoSystem Voltage
LED Driver with Soft-On, Fade-to-Black™

Sample layout of powerfeed connections

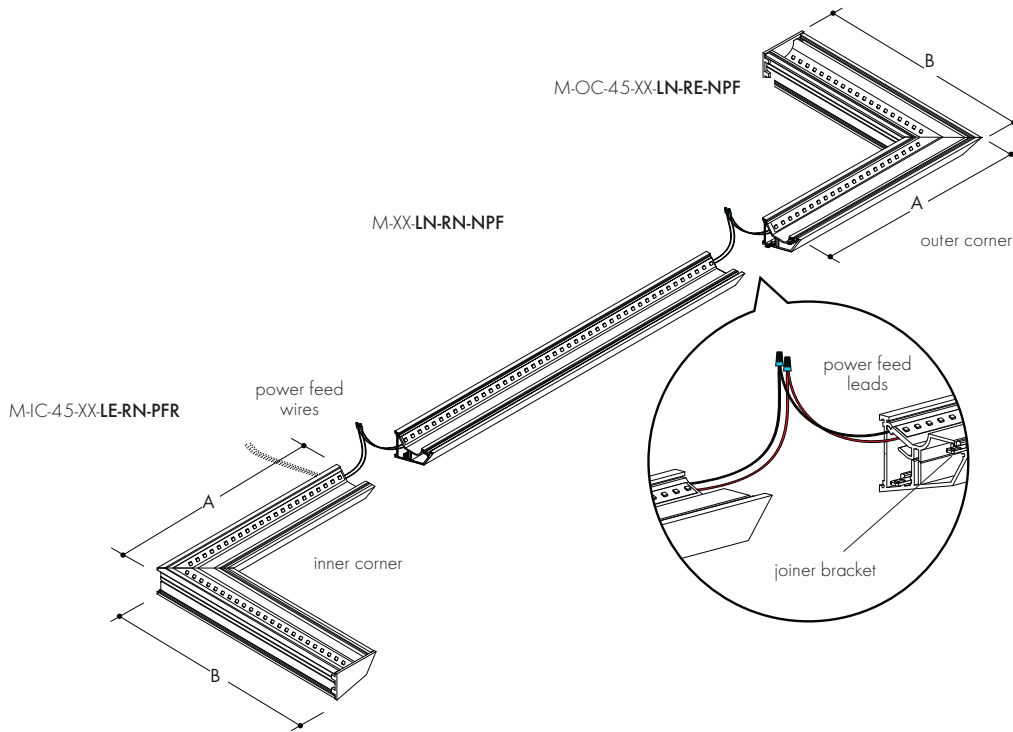


join fixtures together



mCove corner

Sample layout of mCove corners with powerfeed connections



Ordering code

MODEL	CORNER TYPE	ANGLE	CCT	OUTPUT	REFLECTOR	FINISH	LEFT END	RIGHT END	POWER FEED
M - Micro Cove	IC - Inside corner OC - Outside corner	90 - 90° C - Custom°	22K - 2200K 24K - 2400K 27K - 2700K 29K - 2900K 30K - 3000K 35K - 3500K 41K - 4100K	LO - Low SO - Standard MO - Medium HO - High	LT - Long Throw TT - Tall Throw	BK - Black WH - White PR - Paint Ready	LE - W/ end cap LN - WO/ end cap	RE - W/ end cap RN - WO/ end cap	PFL - Power feed left PFR - Power feed right NPF - No Power feed

Power consumption per Corner type

Based on operation with PSD series of power supplies.

Inside Corner Type (output)	Actual length (AxB)	Total wattage	Outside Corner Type (output)	Actual length (AxB)	Total wattage
LO (LL18)	12-9/16" x 12-9/16"	3.00	LO (LL18)	14-3/8" x 14-3/8"	3.00
SO (LL30)	12-3/16" x 12-3/16"	5.40	SO (LL30)	13" x 13"	5.40
MO (LL36)	12-3/16" x 12-3/16"	6.50	MO (LL36)	12-9/16" x 12-9/16"	6.50
HO (LL54)	12-12/16" x 12-12/16"	11.40	HO (LL54)	14" x 14"	12.30
VHO (LL72)	12-3/16" x 12-3/16"	13.50	VHO (LL72)	12-9/16" x 12-9/16"	13.50

Sunmodule[®] Plus

SW 280-295 MONO BLACK



TUV Power controlled:
Lowest measuring tolerance in industry



Every component is tested to meet
3 times IEC requirements



Designed to withstand heavy
accumulations of snow and ice



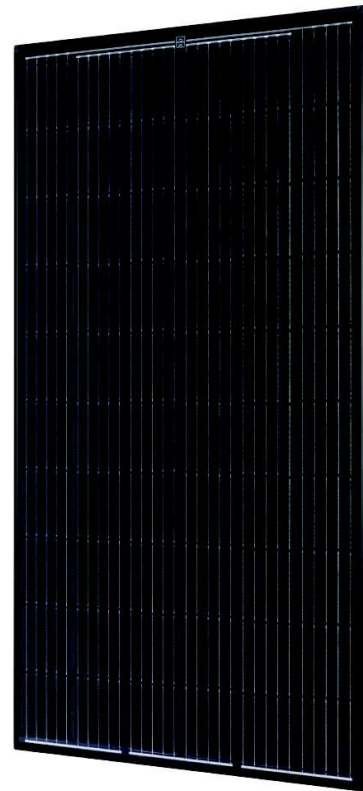
Sunmodule Plus:
Positive performance tolerance



25-year linear performance warranty
and 10-year product warranty



Glass with anti-reflective coating



World-class quality

Fully-automated production lines and seamless monitoring of the process and material ensure the quality that the company sets as its benchmark for its sites worldwide.

SolarWorld Plus-Sorting

Plus-Sorting guarantees highest system efficiency. SolarWorld only delivers modules that have greater than or equal to the nameplate rated power.

25-year linear performance guarantee and extension of product warranty to 10 years

SolarWorld guarantees a maximum performance digression of 0.7% p.a. in the course of 25 years, a significant added value compared to the two-phase warranties common in the industry, along with our industry-first 10-year product warranty.*

*in accordance with the applicable SolarWorld Limited Warranty at purchase.
www.solarworld.com/warranty



- Qualified, IEC 61215
- Safety tested, IEC 61730
- Blowing sand resistance, IEC 60068-2-68
- Ammonia resistance, IEC 62716
- Salt mist corrosion, IEC 61701
- Periodic inspection



- Periodic inspection
- Power controlled



UL 1703



ISO 9001
ISO 14001
Certified



solarworld.com



Sunmodule[®] Plus

SW 280-295 MONO BLACK



PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

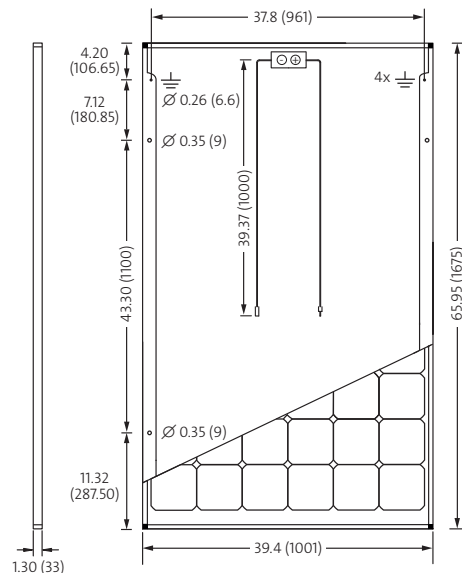
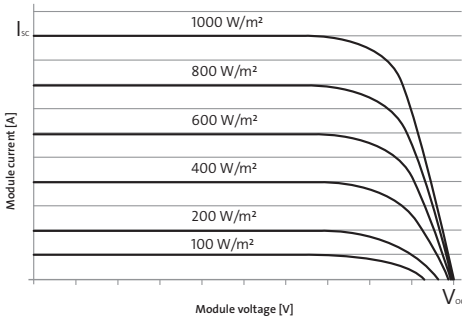
		SW 280	SW 285	SW 290	SW 295
Maximum power	P_{max}	280 Wp	285 Wp	290 Wp	295 Wp
Open circuit voltage	V_{oc}	39.5 V	39.7 V	39.9 V	40.0 V
Maximum power point voltage	V_{mpp}	31.2 V	31.3 V	31.4 V	31.5 V
Short circuit current	I_{sc}	9.71 A	9.84 A	9.97 A	10.10 A
Maximum power point current	I_{mpp}	9.07 A	9.20 A	9.33 A	9.45 A
Module efficiency	η_m	16.70 %	17.00 %	17.30 %	17.59 %

*STC: 1000W/m², 25°C, AM 1.5

PERFORMANCE AT 800 W/M², NOCT, AM 1.5

		SW 280	SW 285	SW 290	SW 295
Maximum power	P_{max}	207.2 Wp	211.1 Wp	215 Wp	218.4 Wp
Open circuit voltage	V_{oc}	35.8 V	36.0 V	36.2 V	36.3 V
Maximum power point voltage	V_{mpp}	28.3 V	28.4 V	28.5 V	28.6 V
Short circuit current	I_{sc}	7.85 A	7.96 A	8.06 A	8.17 A
Maximum power point current	I_{mpp}	7.33 A	7.43 A	7.54 A	7.64 A

Minor reduction in efficiency under partial load conditions at 25° C: at 200 W/m², 100% of the STC efficiency (1000 W/m²) is achieved.



All units provided are imperial. SI units provided in parentheses.
SolarWorld AG reserves the right to make specification changes without notice.

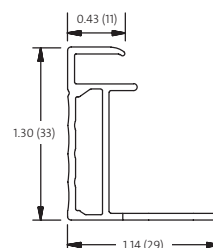
COMPONENT MATERIALS

Cells per module	60	Front	Low-iron empered glass with ARC (EN 12150)
Cell type	Monocrystalline 5-busbar	Frame	Black anodized aluminum
Cell dimensions	6.17 in x 6.17 in (156.75 x 156.75 mm)	Weight	39.7 lbs (18.0 kg)
THERMAL CHARACTERISTICS		ADDITIONAL DATA	
NOCT	48 °C	Power sorting	-0 Wp/+5 Wp
TCL_{sc}	0.044 %/C	J-Box	IP65
TCV_{oc}	-0.31 %/C	Connector	PV wire per UL4703 with H4/UTX connectors
TCP_{mpp}	-0.43 %/C	Module fire performance	(UL 1703) Type 1
Operating temp	-40 to +85 °C		

PARAMETERS FOR OPTIMAL SYSTEM INTEGRATION

Maximum system voltage SC II / NEC	1000 V	
Maximum reverse current	25 A	
Number of bypass diodes	3	
Design loads*	Two rail system	113 psf downward, 64 psf upward
Design loads*	Three rail system	178 psf downward, 64 psf upward
Design loads*	Edge mounting	178 psf downward, 41 psf upward

* Please refer to the Sunmodule installation instructions for the details associated with these load cases.



- Compatible with both "Top-Down" and "Bottom" mounting methods
- ⚡ Grounding Locations:
 - 4 locations along the length of the module in the extended flange.

SW-01-7515US 160906

Heavy Duty Roofing Fastener

PRODUCT DATA SPECIFICATIONS

PRODUCT DESCRIPTION

The OMG Heavy Duty Roofing Fastener (#14) is designed to secure insulation and single-ply membrane to steel 18 to 22 ga. (1.25 to 0.75mm) steel, wood and structural concrete decks. It is available in lengths from 1¼- to 24-inches (30 to 610mm), and Factory Mutual and Miami-Dade County approved.

FEATURES & BENEFITS

- Heavier shank and thread diameters for maximum strength.
- Deep thread for high pullout resistance.
- Extra sharp spade point for quick installation in new or reroof applications
- In concrete applications, fastener may be reversed out of predrilled hole without damaging the deck.

COATING

OMG CR-10 corrosion resistant coating exhibits less than 15% red rust after 30 Kesternich cycles. CR-10 coating exceeds FM Approval Standard 4470.

APPLICATION

For steel decks, ¾-in. (20mm) penetration is the minimum allowable. Factory Mutual requires that fasteners penetrate the top flute.

For OSB and plywood*, ¾-in. (20mm) penetration through the underside of the board is the minimum allowable. For wood deck (wood beams, wood plank, tongue & groove), 1-in. (25mm) penetration is the minimum allowable.

For structural concrete decks 1-in. (25mm) embedment is the minimum allowable. Pre-drill a ⅜-in. (5mm) pilot hole at least ½-in. (13mm) deeper than the fastener embedment using a carbide tip SDS or straight shank bit.

Using a screw gun, drive the fastener until a slight depression is seen in the insulation and the plate. On rigid cover boards, care must be taken not to strip the deck.

The strength of different roof decks can vary widely and can be adversely affected by moisture and other conditions. Therefore, it is recommended that a fastener pull test be conducted to help evaluate deck condition and fastener suitability. Call OMG to schedule testing.

Note: Care must be taken not to overdrive the fastener. Fastener must be tight enough so that the plate doesn't turn. For best results, use a variable speed 0-2500 RPM screw gun.

To speed installation, this fastener can be used with the AccuTrac® System and is also available pre-assembled. See AccuTrac or ASAP®.

PLATES & ACCESSORIES

Use appropriate steel or plastic plates, depending on the application. **See Plates Section.** On structural concrete decks, use a ⅜-in. (5mm) carbide tip SDS or straight shank bit.

APPROVALS



Factory Mutual listings refer to this product as **OMG #14 Heavy Duty and OMG Heavy Duty #14 RoofGrip.**



USE WITH
S
W
SC
DECK TYPES

PHYSICAL DATA†

The data below is constant for each OMG Heavy Duty Roofing Fastener.

HEAD	THREAD
#3 Phillips Truss Head .435" (11.04mm) Diameter	.245" (6.22mm) Diameter
SHANK	COATING
.190" (4.82mm) Diameter	CR-10

#3 Phillips bit included in each carton.

ORDERING INFORMATION

CAT. NO.	LENGTH IN (MM)	THREAD IN (MM)	PKG	WEIGHT LBS (KG)
CR114	1¼" (30)	Full	1000	12 (5.45)
CR134	1¾" (45)	Full	1000	16 (7.26)
CRHD2	2" (50)	Full	1000	18 (8.17)
CRHD3	3" (75)	Full	1000	26 (11.80)
CRHD4	4" (100)	3" (76)	1000	34 (15.44)
CRHD5	5" (125)	4" (102)	500	22 (9.98)
CRHD6	6" (150)	4" (102)	500	26 (11.80)
CRHD7	7" (175)	4" (102)	500	30 (13.62)
CRHD8	8" (200)	4" (102)	500	34 (15.44)
CRHD9	9" (230)	4" (102)	500	37 (16.79)
CRH10	10" (255)	4" (102)	500	40 (18.16)
CRH11	11" (280)	4" (102)	500	44 (19.97)
CRH12	12" (305)	4" (102)	250	25 (11.35)
CRH14	14" (355)	4" (102)	250	29 (13.16)
CRH16	16" (405)	4" (102)	250	37 (16.79)
CRH18	18" (455)	4" (102)	250	41 (18.61)
CRH20	20" (510)	4" (102)	250	47 (21.33)
CRH21	21" (530)	4" (102)	250	48 (21.79)
CRH22	22" (560)	4" (102)	250	50 (22.70)
CRH24	24" (610)	4" (102)	250	56 (25.42)

†All sizes are nominal.

KEY:

S Steel	SC Structural Concrete
W Wood	LC Lightweight Concrete
G Gypsum	LWIK Lightweight Insulating Concrete
P Purlins	CWF Cementitious Wood Fiber



Heavy Duty Roofing Fastener

PRODUCT DATA SPECIFICATIONS

SPECIFICATION

The fastener will be an OMG Heavy Duty Roofing Fastener (#14) with a shank diameter of .190-in. (4.82mm) and a thread diameter of .245-in. (6.22mm). The fastener must have 10 threads per inch and have a 30° spade point. Also, the fastener must be heat treated per specification OMG-1. The OMG Heavy Duty Roofing Fastener will be used with a Factory Mutual approved, OMG pressure plate. The fastener must be Factory Mutual approved.

COATING REQUIREMENT

The fastener will be coated with the OMG CR-10 corrosion resistant coating. When subjected to 30 Kesternich cycles (DIN 50018), the fastener must show less than 15% red rust and surpass Factory Mutual Approval Standard 4470.

APPLICATION

For steel decks, 3/4-in. (20mm) penetration is the minimum allowable. Factory Mutual requires that fasteners penetrate the top flute.

For OSB and plywood*, 3/4-in. (20mm) penetration through the underside of the board is the minimum allowable. For wood deck (wood beams, wood plank, tongue & groove), 1-in. (25mm) penetration is the minimum allowable.

For structural concrete decks 1-in. (25mm) embedment is the minimum allowable. Pre-drill a 3/16-in. (5mm) pilot hole at least 1/2-in. (13mm) deeper than the fastener embedment using a carbide tip SDS or straight shank bit.

Using a screw gun, drive the fastener until a slight depression is seen in the insulation and the plate. On rigid cover boards, care must be taken not to strip the deck.

The strength of different roof decks can vary widely and can be adversely affected by moisture and other conditions. Therefore, it is recommended that a fastener pull test be conducted to help evaluate deck condition and fastener suitability. Call OMG to schedule testing.

Note: Care must be taken not to overdrive the fastener. Fastener must be tight enough so that the plate doesn't turn. For best results, use a variable speed 0–2500 RPM screw gun.

To speed installation, this fastener can be used with the AccuTrac® System and is also available pre-assembled. See AccuTrac or ASAP®.

*FM does not approve OSB or plywood deck types.

HEAVY DUTY ROOFING FASTENER LENGTH SELECTION PROCEDURE

1. If applicable, determine the thickness of the existing roofing material.
2. Add thickness of new insulation.
3. **For steel, OSB and plywood applications:** Add 3/4-inch (20mm) minimum fastener penetration.
For structural concrete and wood plank applications: Add 1-in. (25mm) minimum fastener penetration. **NOTE:** When predrilling for structural concrete, allow an extra 1/2-in. (13mm).
4. If odd size requirement, always size up in length, not down. See example:

Steel Deck:	Example:	Your Project:
Existing Roofing	1 3/4" (45mm)	_____
New Insulation	1/2" (13mm)	_____
Min. Embedment	3/4" (20mm)	3/4" (20mm)
Total Fastening	3" (75mm)	_____
Correct Length	3" (75mm)	_____

The proper Heavy Duty Roofing Fastener for this steel deck example is 3-in. (75mm).

Structural Concrete Deck:	Example:	Your Project:
Existing Roofing	2 1/4" (57mm)	_____
New Insulation	1/2" (13mm)	_____
Min. Embedment	1" (25mm)	1" (25mm)
Total Fastening	3 3/4" (95mm)	_____
Correct Length	4" (100mm)	_____

The proper Heavy Duty Roofing Fastener for this structural concrete deck example is 4-in. (100mm).



ROOFING PRODUCTS

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CB & CABLE ASSEMBLIES RELAYS TOOLING SENSORS SWITCHES CONTACTORS CONNECTORS WIRE & CABLE EMI/RFI FILTERS
SENSORS SWITCHES CONTACTORS CONNECTORS WIRE & CABLE EMI/RFI FILTERS CIRCUIT BREAKERS HARNESSING & PROTEC-
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EMI/RFI FILTERS CIRCUIT BREAKERS

Introducing SolKlip Ground Clips and Solar AWG Cable for Photovoltaic Applications



SolKlip Ground Clips and Solar AWG Cable

SOLKLIP GROUND CLIP KEY FEATURES

Product comes as an assembled kit that includes a #10-32 thread cutting screw

Contact design provides 4 points of contact to the ground wire for high reliability

Product is easy to install with simple tools that are readily available

Removal of the installed ground wire requires a screwdriver, thus meeting the tooled extraction requirements

Ground clip can be re-used up to 5 times on normal extractions

RoHS Compliant

SOLAR AWG CABLE KEY FEATURES

Outside wire jacket provides a robust layer of protection and is UV resistant.

DESCRIPTION

SolKlip ground clips are designed for solar panel grounding applications using solid un-insulated copper 10 AWG and 12 AWG.

The Solar AWG Cable is approved for outdoor use.

APPLICATIONS

Solar panels and related products that require grounding for safety reasons.

This UV resistant cable can be used in photovoltaic applications: Applications include: wire jumpers between solar panels, solar roof tiles and between panels and the AC/DC inverters

ELECTRICAL

The electrical performance of this product will meet the tough requirements of photovoltaic grounding applications

Cable: Center conductor uses uncoated, stranded copper in the 10, 12 and 14 AWG wire sizes

PRODUCT OFFERING & DIMENSIONS

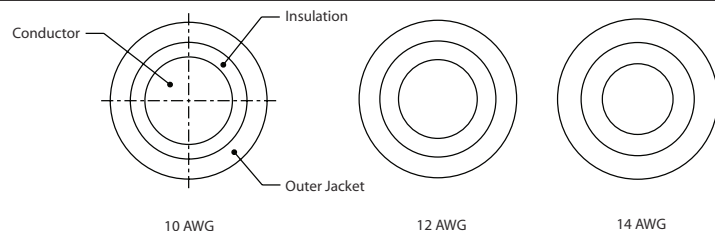
SolKlip for Solar Grounding

Part Number 1954381-1 to handle 12-10 AWG solid, un-insulated ground wire

Solar AWG Cable

Part Number	Description	Package Quantity
1986164-2	10 AWG	500 feet per reel
1986164-3	10 AWG	1,000 feet per reel
1986165-2	12 AWG	500 feet per reel
1986165-3	12 AWG	1,600 feet per reel
1986166-2	14 AWG	500 feet per reel
1986166-3	14 AWG	2,500 feet per reel

Solar AWG Cable



SolKlip Ground Clips and Solar AWG Cable

APPLICATION TOOLING

No special tooling required - only screwdrivers and pliers (optional)

STANDARDS AND SPECS

SolKlip Grounding Clip:	UL 467 pending, a requirement for UL 1703 solar panel listing UL 486A-B pending, also a requirement as part of the UL 1703 approval listing
Cable:	UL 854 approved RHH, RHW-2, XHH, XHHW and USE-2 rated

MATERIALS

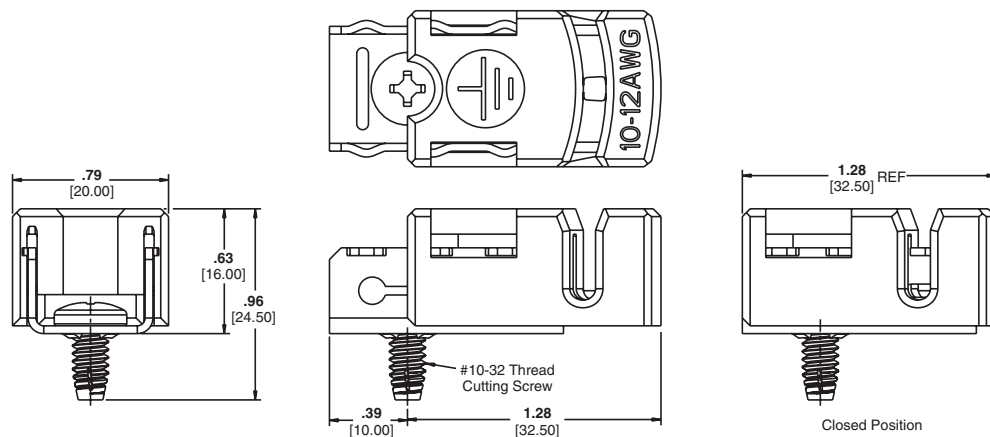
Housing:	Durable PBT 30% glass filled polyester. Material is outdoor, UV sunlight rated
Contact:	High conductivity, copper alloy



MECHANICAL

The mechanical properties of this product will meet the tough requirements for grounding applications. 12 AWG applications will withstand 70 lbs. pull while the 10 AWG applications will withstand 80 lbs. pull

SolKlip Ground Clip



SolKlip Ground Clips | Tyco Electronics

FOR MORE INFORMATION

Technical Support

Internet: www.tycoelectronics.com
E-mail: newproducts@tycoelectronics.com

USA: 1-800-522-6752
Canada: 1-905-470-4425
Mexico: 1-800-733-8926
Central America: 52-55-1106-0803
South America: 55-11-2103-6000
Hong Kong: 852-2735-1628
Japan: 81-44-844-8013
UK: 44-208-420-8341

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Tyco Electronics Corporation
Harrisburg, PA

tycoelectronics.com

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2-1773447-2-5M-GIC/CGX 05-07
SOLKLIP, TE Logo and Tyco Electronics are trademarks.

 **Tyco Electronics**

Our commitment. Your advantage.



All numerical values are in metric units [with U.S. customary units in brackets]. Dimensions are in millimeters [and inches]. Unless otherwise specified, dimensions have a tolerance of ± 0.13 [$\pm .005$] and angles have a tolerance of $\pm 2^\circ$. Figures and illustrations are for identification only and are not drawn to scale.

1. INTRODUCTION

This specification covers the requirements for application of SolKlip Grounding Clip Assembly used with metal-framed photovoltaic (PV) modules (or solar panels) and related products that require grounding for safety reasons. The grounding clip assembly consists of a slider, base, and a 10-32 self-captivating thread-cutting screw or 8-32 screw and hex nut or Keps nut.

The screw is used to mount the grounding clip to the frame (of the solar panel). The slider is used to hold the wire. The slider features a multi-dimensional curved wire slot that provides enhanced wire retention. The base is used to terminate the wire. The base features pointed lances that provide four points of contact to the frame for high reliability and anti-rotation of the grounding clip. The removal slot accepts the tip of a flat-head screwdriver which is used to disengage the slider. When the slider is disengaged, the wire can be removed, and the screw is exposed for removal.

When corresponding with TE Connectivity (TE) Personnel, use the terminology provided in this specification to facilitate your inquiries for information. Basic terms and features of this product are provided in Figure 1.

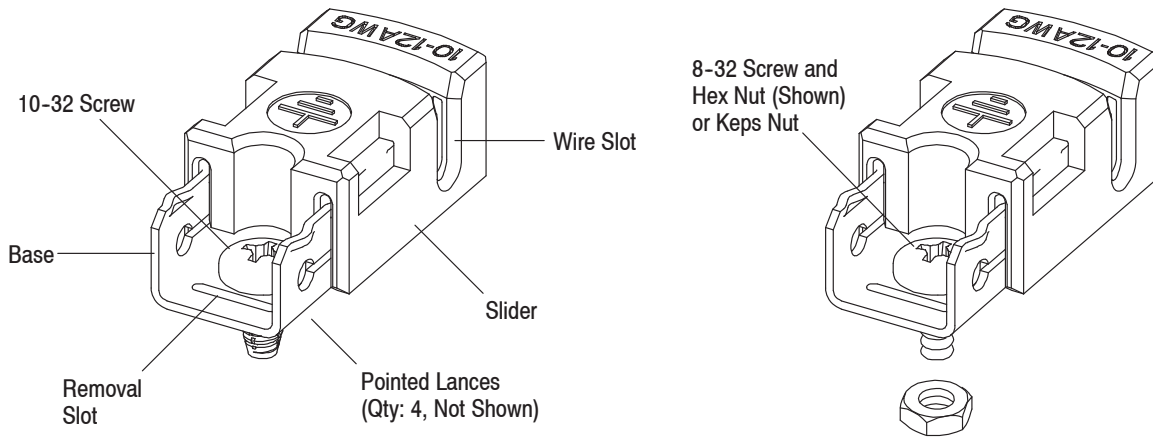


Figure 1

2. REFERENCE MATERIAL

2.1. Revision Summary

- Updated document to corporate requirements
- New logo

2.2. Customer Assistance

Reference Product Base Part Number 1954381 and Product Code G922 are representative of SolKlip Grounding Clip Assembly. Use of these numbers will identify the product line and expedite your inquiries through a service network established to help you obtain product and tooling information. Such information can be obtained through a local TE Representative or, after purchase, by calling PRODUCT INFORMATION at the number at the bottom of this page.

Keps is a trademark.

2.3. Drawings

Customer Drawings for product part numbers are available from the service network. If there is a conflict between the information contained in the Customer Drawings and this specification or with any other technical documentation supplied, call PRODUCT INFORMATION at the number at the bottom of page 1.

2.4. Specifications

Product Specification 108-2312 provides product performance and test information for SolKlip Grounding Clip Assembly.

2.5. Instructional Material

Instruction Sheets (408-series) provide product assembly instructions or tooling setup and operation procedures. Documents available which pertain to this product are:

408-10160 SolKlip Grounding Clip Assemblies 1954381-[]

3. REQUIREMENTS

3.1. Material

The slider is made of polybutylene terephthalate (PBT), UL 94V5. The base is made of copper alloy plated with tin over nickel. Both type of screws and the nut are made of stainless steel.

3.2. Safety

Do not stack product shipping containers so high that the containers buckle or deform.

3.3. Storage

A. Ultraviolet (UV) Light

The slider of the grounding clip is UL rated for UV light and outdoor exposure.

B. Shelf Life

The grounding clips should remain in the shipping containers until ready for use to prevent deformation. The grounding clips should be used on a first in, first out basis to avoid storage contamination that could adversely affect performance.

C. Chemical Exposure

Do not store grounding clips near any chemical listed below as they may cause stress corrosion cracking in the grounding clip.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur	Nitrites	Tartrates

3.4. Wire Selection and Preparation

The grounding clip accepts solid uninsulated copper wire sizes 10 or 12 AWG. The wire must not be nicked, cut, or scraped. There is no preparation required.

3.5. Spacing

Care must be used to avoid interference between adjacent grounding clips and other components for removal of the grounding clip.

3.6. Installation

A. Mounting Grounding Clip to Frame

The grounding clip must be placed onto the frame so that the screw straddles a pre-drilled hole. Optimized hole size based on frame thickness and recommended screw tightening torque is given in Figure 2.

The head of the screw must be flush with the base and the base must be flush with the frame. For the grounding clip assembly with the 8-32 screw and hex nut or Keps nut, the nut must be tight. Refer to Figure 3 for mounting of the grounding clip.

SCREW SIZE	FRAME		DRILL SIZE	SCREW TIGHTENING TORQUE (Nm [in.-lbs])
	THICKNESS	HOLE SIZE (Diameter)		
10-32	1.3 [.050]	4.09 [.161]	20	2.3+0.5/-0.2 [19+4.4/-1.7]
	2.8 [.109]	4.22 [.166]	19	
	4.7 [.187]	4.37 [.172]	11/64	
	6.4 [.250]	4.50 [.177]	16	
8-32	6.6 [.260] Max	4.09-4.83 [.161-.190]	—	1.7+0.5/-0.2 [15+4.4/-1.7]

Figure 2

Grounding Clip with 10-32 Thread-Cutting Screw

Grounding Clip with 8-32 Screw and Hex Nut or Keps Nut

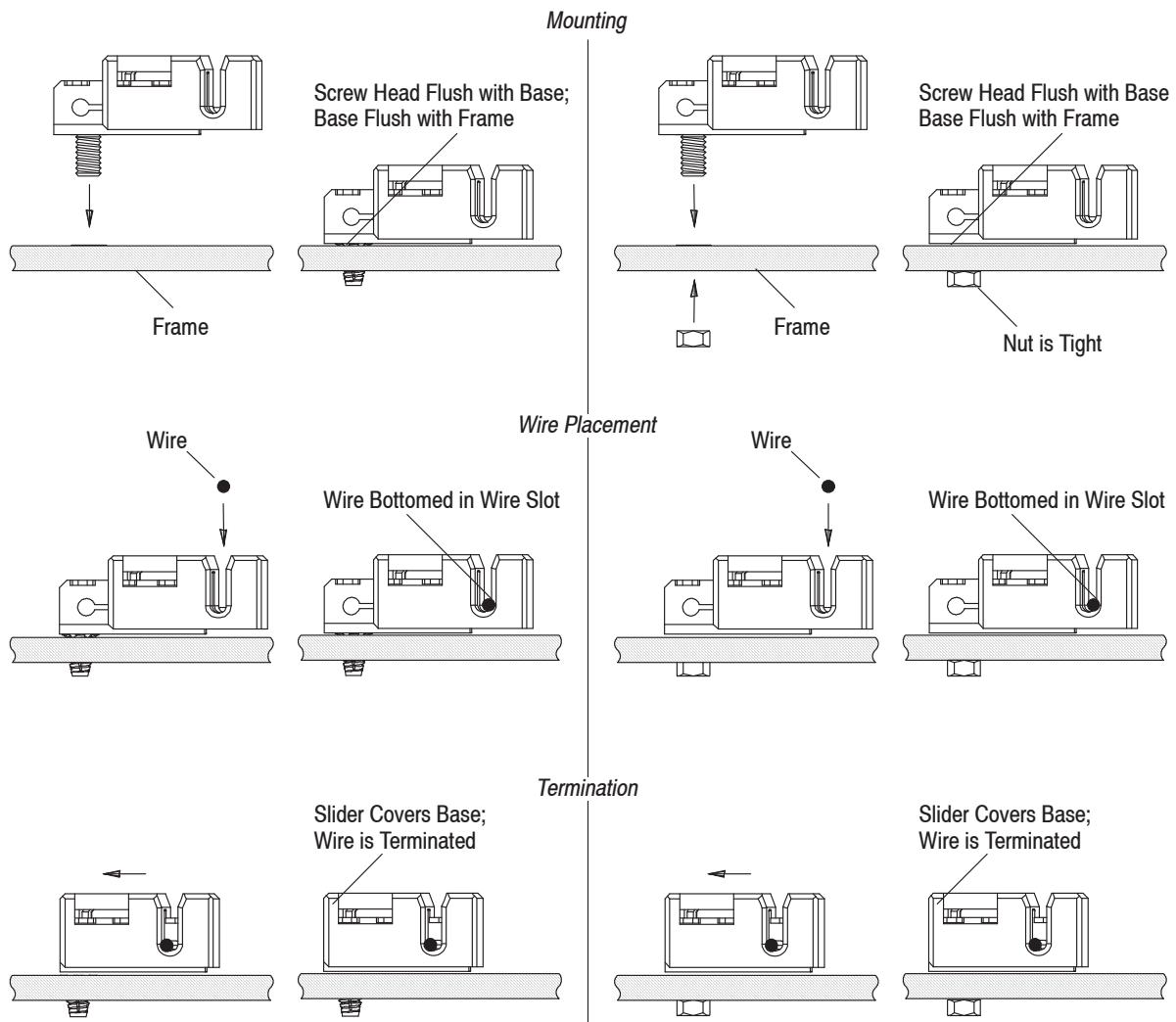


Figure 3

B. Wire Placement

The wire must be bottomed in the wire slot (the wire slot will cause the wire to form a slight curve). Refer to Figure 3.

C. Terminating the Wire

The slider must be engaged (slider covers the base). Refer to Figure 3.

3.7. Removal

The wire can be removed from the grounding clip when the slider is disengaged (slider and screw are exposed). The screw must be loosened before the grounding clip can be removed from the frame.

The grounding clip can be re-used up to 5 times after proper removals (the 8-32 screw and hex nut or Keps nut can be re-used; however, the thread-cutting screw must be replaced). The thread-cutting screw cannot be re-used after removing the grounding clip from the frame.

3.8. Repair

The grounding clip is not repairable. Discard any defective or damaged grounding clips.

4. QUALIFICATION

SolKlip Grounding Clip Assembly is Underwriters Laboratories Inc. (UL) Listed and Listed by UL to Canadian Safety Standards in File E69905.

5. TOOLING

A drill bit is required for drilling the frame holes (specific drill sizes are given in Figure 2).

A No. 2 cross-recessed screwdriver must be used to secure (and remove) the screw of the grounding clip to (and from) the frame. For the grounding clip with the 8-32 screw and hex nut or Keps nut, a $\frac{3}{8}$ -in. wrench must be used to secure (and remove) the nut of the grounding clip to (or from) the frame.

The slider can be engaged manually or channel lock pliers can be used to engage the slider. A flat-head screwdriver must be used to disengage the slider.

6. VISUAL AID

Figure 4 shows a typical application of SolKlip Grounding Clip Assembly. This illustration should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification and in the instructional material shipped with the product or tooling.

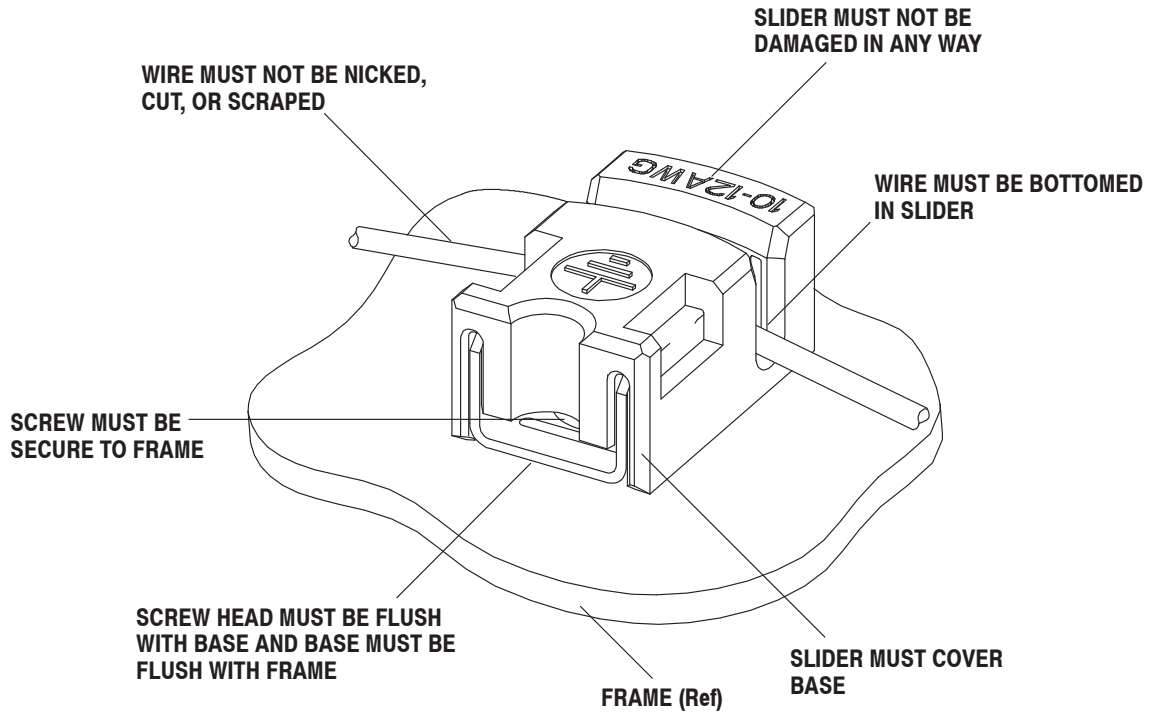


FIGURE 4. VISUAL AID



DYNOBOND™



The DynoRaxx® DynoBond™ is a proprietary UL recognized design that allows the DynoBond™ to be used as a jumper between modules and rows which makes the module frame the medium for the equipment ground path. The DynoBond™ replaces the conventional method of installing one ground lug per solar module and running a solid six gauge copper wire bonding the modules. The DynoBond™ is engineered for commercial and residential applications.



www.dynoraxx.com Phone: 1.866.620.2410 sales@dynoraxx.com

No Tools Required

DynoBond™ is pushed onto bottom flange of module.

Supports flange thicknesses from 1.2mm to 3.1mm

Clean

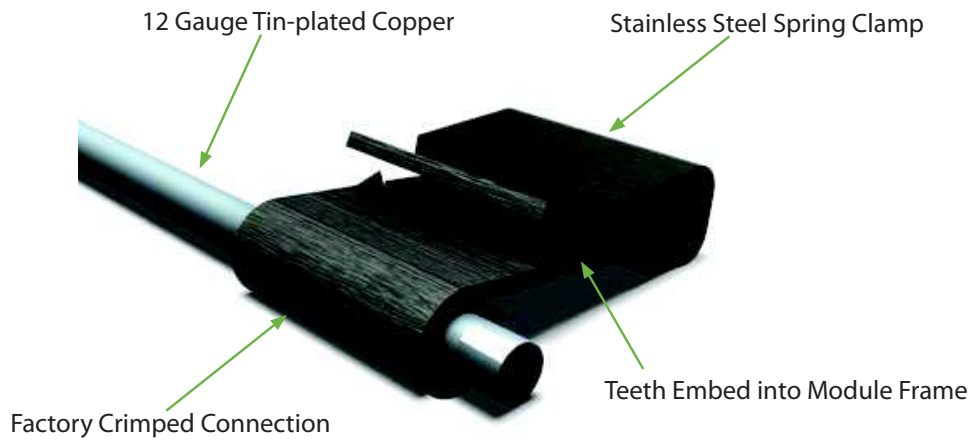
Wire is virtually hidden on system

Corrosion Resistant

Stainless steel clips and tin-plated copper wire paired for reduced electrochemical potential

Superior Design

UL recognized to 467 and 2703



Available Wire Lengths

- 8" (204mm)
- 12" (304 mm)
- 38" (965mm)
- 76" (1930mm)
- 96" (2438mm)



6500 Sheridan Drive, Suite 100
Buffalo NY 14221
Phone: 1.866.620.2410 | Toll Free Fax: 1.866.807.7882 | sales@dynoraxx.com
www.dynoraxx.com



DRXDB042214



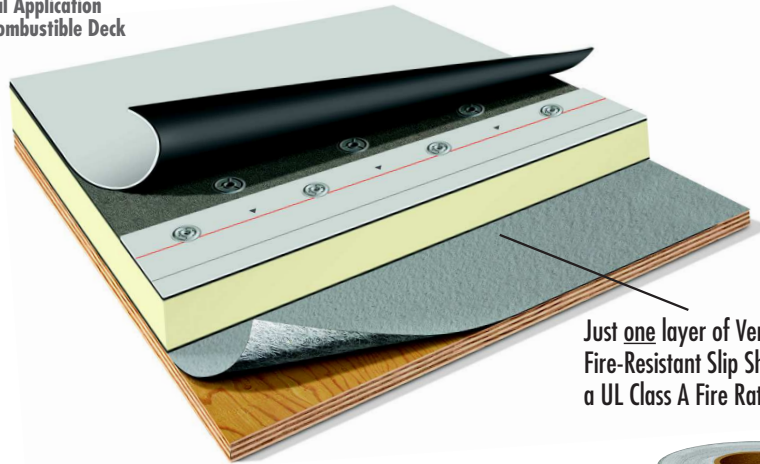
Quality You Can Trust... From North America's Largest Roofing Manufacturer!™

FIRE-RESISTANT
THESE
SLIP SHEETS

www.gaf.com

VERSASHIELD® SOLO™ FIRE-RESISTANT SLIP SHEET

Typical Application For Combustible Deck



Just one layer of VersaShield® Solo™ Fire-Resistant Slip Sheet can provide a UL Class A Fire Rating!*

GAF's VersaShield® Solo™ is a unique, patent-pending Fire-Resistant Slip Sheet for installation within roofing assemblies where an increased fire rating is desired.

- **Highest Fire Ratings...** One layer of VersaShield® Solo™ Fire-Resistant Slip Sheet qualifies for UL Class A Fire Ratings over combustible decks with no incline limitations*
- **Reduced Installation Cost...** One layer of VersaShield® Solo™ Fire-Resistant Slip Sheet will reduce installation costs when compared to other fire-resistant slip sheets that require multiple layers to achieve equivalent fire ratings
- **Eliminates Gypsum-Based Boards...** One layer of VersaShield® Solo™ Fire-Resistant Slip Sheet may produce fire ratings equivalent to gypsum boards at significant labor and material savings
- **Easier For Installers...** Six-foot-wide sheet will cover the roof 50% faster than competitive products
- **Direct Replacement...** One layer of VersaShield® Solo™ Fire-Resistant Slip Sheet qualifies as a direct replacement for Elk FB-1S and FB-2S UL Rated Roofing Systems
- **Dimensions:** 6' X 166.7' (1.83 m X 50.8 m) Nominal
- **Coverage:** 10 Squares (1,000 ft²) (92.9 m²) Nominal
- **Weight:** 110.2 lbs. (50 Kg) Nominal



*Refer to Underwriters Laboratories Certifications Directory for qualifying assemblies



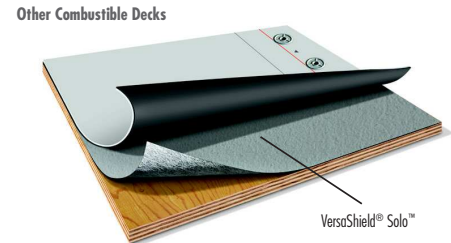
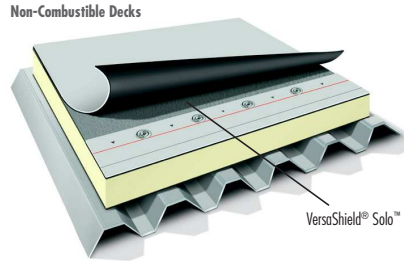
Quality You Can Trust...From
North America's Largest Roofing Manufacturer!™

VERSASHIELD® SOLO™

FIRE-RESISTANT SLIP SHEET

VersaShield® Solo™ is a unique, patent-pending Fire-Resistant Slip Sheet designed to be installed within a roofing system to provide protection from exterior fire exposure. It delivers superior protection against flame penetration and, in some cases, flame spread when installed in accordance with GAF Roofing System Specifications. Our proprietary fire-resistant coating is applied to a heavy weight, dimensionally stable fiberglass mat to ensure VersaShield® Solo™ Fire-Resistant Slip Sheet will roll out smoothly and lay flat.

Other Typical Applications:



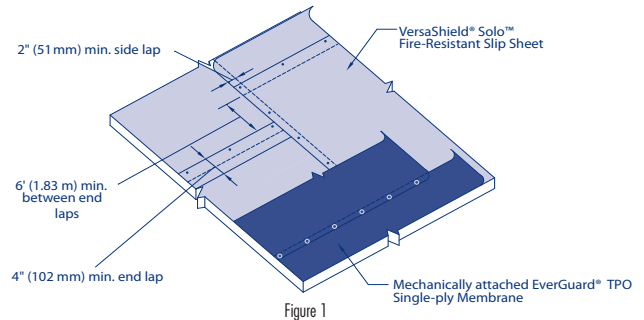
Installation Instructions

Use: For installation under mechanically attached TPO membrane on nailable decks as a fire-resistant slip sheet. Refer to the GAF EverGuard® Single-Ply Roofing Systems TPO/PVC Application & Specifications Manual, call 1-800-ROOF-411, or visit the GAF website at www.gaf.com for more information.

- Step 1: Prepare** deck properly... The deck must be clean, dry, and smooth.
- Step 2: Lay Out** VersaShield® Solo™ Fire-Resistant Slip Sheet... Apply VersaShield® Solo™ Fire-Resistant Slip Sheet without wrinkles or creases, perpendicular to the direction the TPO membrane sheets will be installed.
- Step 3: Overlap** VersaShield® Solo™ Fire-Resistant Slip Sheet before fastening (see Figure 1)...
- a) Minimum 2" (51 mm) overlap at side lap... Extend VersaShield® Solo™ Fire-Resistant Slip Sheet 2" (51 mm) over the preceding course.
 - b) Minimum 4" (102 mm) overlap at end lap... End laps should overlap a minimum of 4" (102 mm) and be offset from adjacent end laps by 6' (1.83 m).
- Step 4: Fasten** VersaShield® Solo™ Fire-Resistant Slip Sheet... Use corrosion-resistant nails with 1" minimum diameter metal or plastic caps. Install only enough nails to hold the VersaShield® Solo™ Fire-Resistant Slip Sheet in place until

the primary roof covering is applied (unless more fasteners are required by code). Nails should be long enough to penetrate at least 3/4" (19 mm) into wood decks, or just through plywood or OSB decks. Nails must be driven flush with the surface of the VersaShield® Solo™ Fire-Resistant Slip Sheet. Overdriving will damage the Fire-Resistant Slip Sheet. Raised fasteners may damage the TPO and/or may back out.

- Step 5: Install** mechanically fastened TPO... Do not install more VersaShield® Solo™ Fire-Resistant Slip Sheet than can be covered by the finished mechanically attached TPO roof membrane the same day. VersaShield® Solo™ Fire-Resistant Slip Sheet is NOT waterproof and should not be exposed to the weather before being covered with the primary roof covering.



Physical Properties

Tensile	MD	ASTM D146/D828	40 lb./in - width min.
Tensile	CMD	ASTM D146/D828	20 lb./in - width min.
Tear	MD	ASTM D1922	300 grams min.
Tear	CMD	ASTM D1922	400 grams min.

Packaging & Storage

- 12 rolls per pallet: 4 rolls laid horizontally, 3 layers high
- 22 pallets per truck, double stacked, 264 rolls / truck
- Double stacking is permissible
- Pallet dimensions: 74" x 48" (1.9 m x 1.2 m)
- Product must be stored protected from precipitation, moisture, sunlight, and extreme temperatures



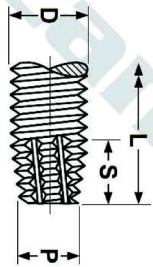
Part of a UL Classified System when used as a component of a rated assembly over combustible and non-combustible decks.

COMGN195

Self-Tapping Screws

Thread Cutting

Type-F



Nominal Size Threads Per Inch Diameter	D		P		S				L				Minimum Torsional Strength, (STEEL SCREWS ONLY)
	Major Diameter		Point Diameter		Point Taper Length		Determinant Length for Point Taper		Minimum Practical Screw Lengths		90° Heads	90° Heads	
	Max	Min	Max	Min	Short Screws	Long Screws	Max	Min	Max	Min			
2	.0890	.0813	.089	.081	.082	.045	.080	.082	5/32	3/16	5/32	3/16	5
4	.1720	.1661	.170	.166	.172	.088	.172	.088	7/32	1/4	7/32	1/4	13
6	.2500	.2462	.248	.246	.250	.125	.250	.125	1/2	5/8	1/2	5/8	23
8	.3250	.3225	.322	.322	.325	.169	.325	.169	3/4	1 1/8	3/4	1 1/8	42
10	.3900	.3880	.388	.388	.390	.214	.390	.214	7/8	1 3/8	7/8	1 3/8	56
12	.4500	.4485	.448	.448	.450	.259	.450	.259	1 1/8	1 7/8	1 1/8	1 7/8	74
14	.5000	.4990	.499	.499	.500	.299	.500	.299	1 3/8	2 1/8	1 3/8	2 1/8	89
16	.5500	.5495	.549	.549	.550	.349	.550	.349	1 7/8	2 3/8	1 7/8	2 3/8	140
18	.6000	.5998	.599	.599	.600	.399	.600	.399	2 1/8	2 7/8	2 1/8	2 7/8	306
20	.6500	.6499	.649	.649	.650	.449	.650	.449	2 3/8	3 1/8	2 3/8	3 1/8	580
24	.7500	.7499	.749	.749	.750	.549	.750	.549	3 1/8	3 7/8	3 1/8	3 7/8	
28	.8500	.8499	.849	.849	.850	.649	.850	.649	3 7/8	4 1/8	3 7/8	4 1/8	
32	.9500	.9499	.949	.949	.950	.749	.950	.749	4 1/8	4 7/8	4 1/8	4 7/8	
36	1.0500	1.0499	1.049	1.049	1.050	.849	1.050	.849	4 7/8	5 1/8	4 7/8	5 1/8	
40	1.1500	1.1499	1.149	1.149	1.150	.949	1.150	.949	5 1/8	5 7/8	5 1/8	5 7/8	
44	1.2500	1.2499	1.249	1.249	1.250	1.049	1.250	1.049	5 7/8	6 1/8	5 7/8	6 1/8	
48	1.3500	1.3499	1.349	1.349	1.350	1.149	1.350	1.149	6 1/8	6 7/8	6 1/8	6 7/8	
52	1.4500	1.4499	1.449	1.449	1.450	1.249	1.450	1.249	6 7/8	7 1/8	6 7/8	7 1/8	
56	1.5500	1.5499	1.549	1.549	1.550	1.349	1.550	1.349	7 1/8	7 7/8	7 1/8	7 7/8	
60	1.6500	1.6499	1.649	1.649	1.650	1.449	1.650	1.449	7 7/8	8 1/8	7 7/8	8 1/8	
64	1.7500	1.7499	1.749	1.749	1.750	1.549	1.750	1.549	8 1/8	8 7/8	8 1/8	8 7/8	
68	1.8500	1.8499	1.849	1.849	1.850	1.649	1.850	1.649	8 7/8	9 1/8	8 7/8	9 1/8	
72	1.9500	1.9499	1.949	1.949	1.950	1.749	1.950	1.749	9 1/8	9 7/8	9 1/8	9 7/8	
76	2.0500	2.0499	2.049	2.049	2.050	1.849	2.050	1.849	9 7/8	10 1/8	9 7/8	10 1/8	
80	2.1500	2.1499	2.149	2.149	2.150	1.949	2.150	1.949	10 1/8	10 7/8	10 1/8	10 7/8	
84	2.2500	2.2499	2.249	2.249	2.250	2.049	2.250	2.049	10 7/8	11 1/8	10 7/8	11 1/8	
88	2.3500	2.3499	2.349	2.349	2.350	2.149	2.350	2.149	11 1/8	11 7/8	11 1/8	11 7/8	
92	2.4500	2.4499	2.449	2.449	2.450	2.249	2.450	2.249	11 7/8	12 1/8	11 7/8	12 1/8	
96	2.5500	2.5499	2.549	2.549	2.550	2.349	2.550	2.349	12 1/8	12 7/8	12 1/8	12 7/8	
100	2.6500	2.6499	2.649	2.649	2.650	2.449	2.650	2.449	12 7/8	13 1/8	12 7/8	13 1/8	
104	2.7500	2.7499	2.749	2.749	2.750	2.549	2.750	2.549	13 1/8	13 7/8	13 1/8	13 7/8	
108	2.8500	2.8499	2.849	2.849	2.850	2.649	2.850	2.649	13 7/8	14 1/8	13 7/8	14 1/8	
112	2.9500	2.9499	2.949	2.949	2.950	2.749	2.950	2.749	14 1/8	14 7/8	14 1/8	14 7/8	
116	3.0500	3.0499	3.049	3.049	3.050	2.849	3.050	2.849	14 7/8	15 1/8	14 7/8	15 1/8	
120	3.1500	3.1499	3.149	3.149	3.150	2.949	3.150	2.949	15 1/8	15 7/8	15 1/8	15 7/8	
124	3.2500	3.2499	3.249	3.249	3.250	3.049	3.250	3.049	15 7/8	16 1/8	15 7/8	16 1/8	
128	3.3500	3.3499	3.349	3.349	3.350	3.149	3.350	3.149	16 1/8	16 7/8	16 1/8	16 7/8	
132	3.4500	3.4499	3.449	3.449	3.450	3.249	3.450	3.249	16 7/8	17 1/8	16 7/8	17 1/8	
136	3.5500	3.5499	3.549	3.549	3.550	3.349	3.550	3.349	17 1/8	17 7/8	17 1/8	17 7/8	
140	3.6500	3.6499	3.649	3.649	3.650	3.449	3.650	3.449	17 7/8	18 1/8	17 7/8	18 1/8	
144	3.7500	3.7499	3.749	3.749	3.750	3.549	3.750	3.549	18 1/8	18 7/8	18 1/8	18 7/8	
148	3.8500	3.8499	3.849	3.849	3.850	3.649	3.850	3.649	18 7/8	19 1/8	18 7/8	19 1/8	
152	3.9500	3.9499	3.949	3.949	3.950	3.749	3.950	3.749	19 1/8	19 7/8	19 1/8	19 7/8	
156	4.0500	4.0499	4.049	4.049	4.050	3.849	4.050	3.849	19 7/8	20 1/8	19 7/8	20 1/8	
160	4.1500	4.1499	4.149	4.149	4.150	3.949	4.150	3.949	20 1/8	20 7/8	20 1/8	20 7/8	
164	4.2500	4.2499	4.249	4.249	4.250	4.049	4.250	4.049	20 7/8	21 1/8	20 7/8	21 1/8	
168	4.3500	4.3499	4.349	4.349	4.350	4.149	4.350	4.149	21 1/8	21 7/8	21 1/8	21 7/8	
172	4.4500	4.4499	4.449	4.449	4.450	4.249	4.450	4.249	21 7/8	22 1/8	21 7/8	22 1/8	
176	4.5500	4.5499	4.549	4.549	4.550	4.349	4.550	4.349	22 1/8	22 7/8	22 1/8	22 7/8	
180	4.6500	4.6499	4.649	4.649	4.650	4.449	4.650	4.449	22 7/8	23 1/8	22 7/8	23 1/8	
184	4.7500	4.7499	4.749	4.749	4.750	4.549	4.750	4.549	23 1/8	23 7/8	23 1/8	23 7/8	
188	4.8500	4.8499	4.849	4.849	4.850	4.649	4.850	4.649	23 7/8	24 1/8	23 7/8	24 1/8	
192	4.9500	4.9499	4.949	4.949	4.950	4.749	4.950	4.749	24 1/8	24 7/8	24 1/8	24 7/8	
196	5.0500	5.0499	5.049	5.049	5.050	4.849	5.050	4.849	24 7/8	25 1/8	24 7/8	25 1/8	
200	5.1500	5.1499	5.149	5.149	5.150	4.949	5.150	4.949	25 1/8	25 7/8	25 1/8	25 7/8	
204	5.2500	5.2499	5.249	5.249	5.250	5.049	5.250	5.049	25 7/8	26 1/8	25 7/8	26 1/8	
208	5.3500	5.3499	5.349	5.349	5.350	5.149	5.350	5.149	26 1/8	26 7/8	26 1/8	26 7/8	
212	5.4500	5.4499	5.449	5.449	5.450	5.249	5.450	5.249	26 7/8	27 1/8	26 7/8	27 1/8	
216	5.5500	5.5499	5.549	5.549	5.550	5.349	5.550	5.349	27 1/8	27 7/8	27 1/8	27 7/8	
220	5.6500	5.6499	5.649	5.649	5.650	5.449	5.650	5.449	27 7/8	28 1/8	27 7/8	28 1/8	
224	5.7500	5.7499	5.749	5.749	5.750	5.549	5.750	5.549	28 1/8	28 7/8	28 1/8	28 7/8	
228	5.8500	5.8499	5.849	5.849	5.850	5.649	5.850	5.649	28 7/8	29 1/8	28 7/8	29 1/8	
232	5.9500	5.9499	5.949	5.949	5.950	5.749	5.950	5.749	29 1/8	29 7/8	29 1/8	29 7/8	
236	6.0500	6.0499	6.049	6.049	6.050	5.849	6.050	5.849	29 7/8	30 1/8	29 7/8	30 1/8	
240	6.1500	6.1499	6.149	6.149	6.150	5.949	6.150	5.949	30 1/8	30 7/8	30 1/8	30 7/8	
244	6.2500	6.2499	6.249	6.249	6.250	6.049	6.250	6.049	30 7/8	31 1/8	30 7/8	31 1/8	
248	6.3500	6.3499	6.349	6.349	6.350	6.149	6.350	6.149	31 1/8	31 7/8	31 1/8	31 7/8	
252	6.4500	6.4499	6.449	6.449	6.450	6.249	6.450	6.249	31 7/8	32 1/8	31 7/8	32 1/8	
256	6.5500	6.5499	6.549	6.549	6.550	6.349	6.550	6.349	32 1/8	32 7/8	32 1/8	32 7/8	
260	6.6500	6.6499	6.649	6.649	6.650	6.449	6.650	6.449	32 7/8	33 1/8	32 7/8	33 1/8	
264	6.7500	6.7499	6.749	6.749	6.750	6.549	6.750	6.549	33 1/8	33 7/8	33 1/8	33 7/8	
268	6.8500	6.8499	6.849	6.849	6.850	6.649	6.850	6.649	33 7/8	34 1/8	33 7/8	34 1/8	
272	6.9500	6.9499	6.949	6.949	6.950	6.749	6.950	6.749	34 1/8	34 7/8	34 1/8	34 7/8	
276	7.0500	7.0499	7.049	7.049	7.050	6.849	7.050	6.849	34 7/8	35 1/8	34 7/8	35 1/8	
280	7.1500	7.1499	7.149	7.149	7.150	6.949	7.150	6.949	35 1/8	35 7/8	35 1/8	35 7/8	
284	7.2500	7.2499	7.249	7.249	7.250	7.049	7.250	7.049	35 7/8	36 1/8	35 7/8	36 1/8	
288	7.3500	7.3499	7.349	7.349	7.350	7.149							

Conext MPPT 80 600 solar charge controller

Install for less, harvest more energy



Product at a glance

The Conext™ MPPT 80 600 solar charge controller offers integration features and top performance that allow for easy installation of large PV array systems to the battery bank for the lowest overall cost. Installing one MPPT 80 600 is faster than installing multiple smaller charge controllers and lowers overall costs further by utilizing fewer PV strings, smaller wiring and conduit, and eliminating the need for PV combiner boxes and DC circuit breakers. Longer distances from array site to battery bank are also easier to accommodate than with smaller charge controllers. Advanced Fast Sweep Maximum Power Point Tracking (MPPT) charging technology helps harvest the most energy available from the PV array, even in partial shade conditions. A battery charge current of 80 A allows for the connection of PV arrays rated up to 600 V STC (2560 W for 24 V systems, 4800 W for 48 V systems).

Why choose Conext MPPT 80 600?

Higher return on investment

- Installs faster with fewer costly components
- Improve battery life with selectable multi-stage temperature-compensated charging
- Harvest more energy with shade-tolerant fast sweep MPPT algorithm

Designed for reliability

- Robust design through rigorous Multiple Environmental Over Stress Testing (MEOST)

Flexible

- Available remote monitoring and configuration
- Compatible with any brand of PV module and any grounding method
- Stand-alone application or full integration with Conext XW inverter charger system

Easy to install

- Fewer string wires
- Smaller AWG wire
- No need for combiner box or GFI circuit breaker

Product applications



Backup power



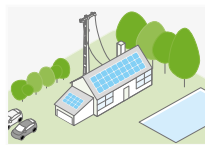
Residential grid-tie solar with backup power



Off-grid solar



Community electrification



Self-consumption

Device short name	MPPT 80 600
Electrical specifications	
Nominal battery voltage	24 and 48 V (Default is 48 V)
PV array operating voltage	195 to 550 V
Max. PV array open circuit voltage	600 V including temperature correction factor
Battery voltage operating range	16 to 67 VDC
Array short-circuit current	35 A (28 A @ STC)
Max. charge current	80 A
Max. and min. wire size in conduit	#6 AWG to #14 AWG (13.5 to 2.5 mm ²)
Max. output power	2560 W (nominal 24 V), 4800 W (nominal 48 V)
Charger regulation method	Three-stage (bulk, absorption, float) plus manual equalization Two-stage (bulk, absorption) plus manual equalization
Supported battery types	Flooded, GEL, AGM, Custom
Efficiency	
Max. power conversion efficiency	94% (nominal 24 V), 96% (nominal 48 V)
General specifications	
Power consumption, night time	< 1 W
Battery temperature sensor	Included
Auxiliary output	Dry contact switching up to 60 VDC, 30 VAC, 8A
Enclosure material	Indoor, ventilated, aluminum sheet metal chassis with 22.22 mm and 27.76 mm (7/8 in and 1 in) knockouts and aluminum heat sink
IP degree of protection	IP20
Product weight	13.5 kg (29.8 lb)
Shipping weight	17.4 kg (38.3 lb)
Product dimensions (H x W x D)	76.0 x 22.0 x 22.0 cm (30.0 x 8.6 x 8.6 in)
Shipping dimensions (H x W x D)	87.0 x 33.0 x 27.0 cm (34.3 x 13.0 x 10.6 in)
Device mounting	Vertical wall mount
Ambient air temperature for operation	-20 °C to 65 °C (-4 °F to 149 °F), power derating above 45 °C
Storage temperature range	-40 °C to 85 °C (-40 °F to 185 °F)
Operating altitude	Sea level to 2000 m (6562 ft)
System network and remote monitoring	Available
Warranty	Five-year standard
Part number	865-1032
Regulatory approvals	
Safety	CSA certified (UL1741, CSA 107.1) and CE marked for the Low-voltage Directive (EN50178)
EMC	FCC and Industry Canada (Class B), CE marked for the EMC Directive (EN61000-6-1, -6-3), C-Tick compliant
Compatible products	
Conext XW+ inverter/charger (230 V)	XW 7048 E product no. 865-7048-61/XW 8548 E product no. 865-8548-61
Conext XW+ inverter/charger (120/240 V)	XW 5548 NA product no. 865-5548-01/XW 6848 NA product no. 865-6848-01
Conext SW (230 V)	SW 2524 product no. 865-2524-61/SW 4024 product no. 865-4024-61/SW 4048 product no. 865-4048-61
Conext SW (120 V)	SW 2524 product no. 865-2524/SW 4024 product no. 865-4024/SW 4048 product no. 865-4048
Conext System Control Panel	Product no. 865-1050
Conext Automatic Generator Start	Product no. 865-1060
Conext ComBox	Product no. 865-1058
Conext portable installation and configuration tool	Product no. 865-1155-01

Specifications are subject to change without notice.

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Conext XW+ Power Distribution Panels

Save time and money installing and integrating XW+ system

Conext™ XW+ Power Distribution Panels (XW+ PDP and Mini PDP) are factory-wired and labeled to support the integration of multiple Conext XW+ inverter/chargers and Conext MPPT Solar Charge Controllers with a single battery bank. The XW+ PDP and Mini PDP ships with breakers, bus bars and cables to install a single XW+ inverter/charger. With space to add wiring and breakers, a single XW+ PDP and Mini PDP supports one XW+ inverter/charger, a diesel generator and either a MPPT 80 600 or MPPT 60 150 Solar Charge Controller. The XW+ PDP and Mini PDP supports single-phase, split phase, or three-phase installations. A field-reversible door and multiple conduit knockout entry points allow for the XW+ PDP and Mini PDP enclosure to be mounted and configured on either side of the inverter/charger.

XW+ Power Distribution Panels are designed to save significant time and money during installation, when compared to custom solutions. A mounting bracket and Conext XW+ Conduit Box are also supplied with each XW+ PDP and Mini PDP.



Mini PDP



XW+ Power Distribution Panel



XW+ Installation Kit for INV 2 INV 3 PDP

XW+ Conduit Box

Why choose a Conext XW+ Power Distribution Panel?



Higher return on investment

- Integrate multiple XW+ inverter chargers and MPPT Solar Charge Controllers with a single battery bank
- Repeatable standard installation that saves time and money



Flexible

- Single-phase split-phase or three phase systems
- Multiple field configurable conduit entry points on the back, bottom, top and sides
- DIN Rail mounting for QOU type and Multi-9 AC breakers



Easy to service

- Breaker configuration allows XW+ inverter/chargers to be AC bypassed for servicing
- Field-reversible door panel allows for visual inspection



Easy to install

- Wall mount with included bracket
- Add additional XW+ inverter chargers with Conext XW+ connection kit

Device short name	XW+ Mini PDP
Product dimensions (H x W x D)	47.0 x 40.6 x 22.5 cm (18.5 x 16 x 8.9 in) *24.9" door swing clearance, measured from back of unit.
Shipping dimensions (H x W x D)	53.5 x 56.5 x 33 cm (21.0 x 28.6 x 13.0 in)
Shipping weight	13kg 28.2lb
Product number	865-1013-01
Included	<p>XW+ Mini-PDP enclosure with a field-reversible panel door and integrated wall mounting bracket</p> <p>Three 60 A, 120/240 Vac, two-pole, Square-D QOU260, DIN-rail mounted AC breakers for AC input, bypass and AC load (factory-installed), plus one additional expansion position for two pole AC breaker, type QOU260. Mini-PDP AC Cabling is pre-wired/pre-measured for easy installation to XW+ unit.</p> <p>One GJ 250A 160 Vdc DC breaker installed</p> <p>Two expansion positions for charge controller DC breakers (PV array or battery)</p> <p>Termination lugs for ground, common and battery connections</p> <p>Integrated DC busbars for direct connection to XW+ DC terminals.</p> <p>3/8" hardware for connection of DC cables to busbars</p> <p>Cable ties for cable management</p> <p>Quick start guide</p> <p>Additional Breaker labels</p> <p>Plastic knockout bushings for connection between Mini-iPDP and XW/XW+ unit.</p> <p>Document holder</p> <p>Sized for easy cable installation and management</p>

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Device short name	XW Power Distribution Panel
Product dimensions (H x W x D)	76.1 x 40.6 x 21.0 cm (30.0 x 16.0 x 8.3 in)
Shipping dimensions (H x W x D)	122.0 x 53.3 x 34.3 cm (48.0 x 21.0 x 13.5 in)
Shipping weight	30.5 kg (67.2 lb)
Product number	865-1015-01
Included	XW+ PDP enclosure with a field-reversible panel door, includes wall mount bracket, and XW+ Conduit Box Three 60 A, 120/240 Vac, two-pole, Square-D, type QOU, DIN-rail mounted AC breakers for AC input, bypass and AC load (factory-installed), plus five AC breaker expansion positions One GJ 250A 160 Vdc, 3/8" stud DC breaker installed, plus two expansion positions Eight expansion positions for charge controller DC breakers (Note: XW supports up to 4 MPPT 80 600 or 4 MPPT 60 150 charge controllers) One ground terminal bus bar, one neutral terminal bus bar and one battery negative terminal bus bar One pair #4/0 AWG Arctic Ultraflex Blue™ battery cables (factory installed and labeled, ready to connect) #6 AWG Arctic Ultraflex Blue™ AC wiring (factory installed and labeled, ready to connect)
Device short name	XW Power Distribution Panel (without AC breakers)
Product number	865-1014-01
Included	Same as XW+ PDP (865-1015-01), but does not include any AC breakers
Device short name	XW Installation Kit for INV 2 INV 3 PDP
Product dimensions (H x W x D)	22.9 x 40.6 x 21.0 cm (8.5 x 16.0 x 8.3 in)
Shipping dimensions (H x W x D)	44.5 x 33.3 x 30.5 cm (17.5 x 13.0 x 12.0 in)
Shipping weight	10.5 kg (23.1 lb)
Product number	865-1020-01
Included	XW+ Conduit Box and AC Sync and Xanbus™ cables #6 AWG AC wiring to connect the inverter to the AC breakers One GJ 250A 160 Vdc, 3/8" stud DC breaker, one bus bar for DC positive and one pair #4/0 AWG battery cables
Device short name	XW Conduit Box
Product dimensions (H x W x D)	22.9 x 40.6 x 21.0 cm (8.5 x 16.0 x 8.3 in)
Shipping dimensions (H x W x D)	44.5 x 33.0 x 30.5 cm (17.5 x 13.0 x 12.0 in)
Shipping weight	4.6 kg (10.0 lb)
Product number	865-1025-01
Included	XW+ Conduit Box
Device short name	Conext 120/240VAC Breaker Kit for Conext XW+ PDP
Usage	XW+ PDP for additional XW+ inverter chargers, single-phase/spit-phase
Product number	865-1215-01
Included	Three 60 A, 120/240 Vac, two-pole, Square-D, type QOU, DIN-rail mountable AC breakers, jumpers, bypass interlock
Device short name	Conext three-phase Breaker Kit for Conext XW+ PDP
Usage	XW+ PDP for additional XW+ inverter chargers, three-phase
Product number	865-1315-01
Included	Three 60 A, 120/208 Vac, three-pole, Square-D, type QOU, DIN-rail mountable AC breakers, jumpers, bypass interlock
Device short name	100A, 125VDC Breaker Master Pack (12 units)
Usage	XW+ PDP for MPPT 80 600 output, battery side
Product number	865-1080
Device short name	80A, 125VDC Breaker Master Pack (12 units)
Usage	XW+ PDP for MPPT 60 150 output, battery side
Product number	865-1070
Device short name	60A, 160VDC Breaker Master Pack (48 units)
Usage	XW+ PDP for MPPT 60 150 input, PV array side
Product number	865-1075
Device short name	250A, 160VDC Breaker Master Pack (6 units)
Usage	XW+ PDP for inverter charger connection to battery
Product number	865-1065
Compatible products	
Conext XW+ (230 V)	XW 7048 E product no. 865-7048-61 XW 8548 E product no. 865-8548-61
Conext XW+ (120/240 V)	XW 5548 NA product no. 865-5548-01 XW 6848 NA product no. 865-6848-01
Conext MPPT 60 150	Product no. 865-1030-1
Conext MPPT 80 600	Product no. 865-1032
Conext Portable Installation and Configuration Tool	Product no. 865-1155-01

Specifications are subject to change without notice.

Conext System Control Panel

Monitor and Configure Conext Inverter Charger Systems and Xanbus Enabled Accessories

The Conext™ System Control Panel (SCP) eliminates the need for separate control panels for each device and gives a single point of control to set up and monitor the entire Conext inverter charger system, including Conext MPPT Solar Charge Controllers. Featuring a graphical backlit liquid crystal display, the SCP selectively displays configuration, status and diagnostic information for all devices connected to the Xanbus™ network.

Why choose Conext System Control Panel?

True bankability

- Warranty from a trusted partner with 178 years of experience
- World leader in industrial power drives, UPS and electrical distribution
- Strong service infrastructure worldwide to support your global needs

Higher return on investment

- Get the most out of Conext inverter charger systems and Conext MPPT Solar Charge Controllers
- Clearly understand status and settings
- Optimize system set up and device performance

Designed for reliability

- Extensive quality and reliability testing

Flexible

- Monitor and configure Conext XW+, SW, MPPT 60 150, MPPT 80 600, AGS, Battery Monitor
- Multiple SCP can be used on the same Xanbus network
- Compatible with Conext ComBox

Easy to service

- Access and troubleshoot Xanbus enabled devices on the network from one location
- Remove and replace without the loss of device settings

Easy to install

- Surface mount or panel mount on wall
- RJ45 connections for Xanbus network cables



Product applications



Backup power



Residential grid-tie solar with backup power



off-grid solar



Community electrification



Self-consumption

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Device short name	Conext System Control Panel
Electrical specifications	
Nominal voltage	15 VDC
Min. operating network voltage	14.25 VDC
Max. operating network voltage	15.75 VDC
Max. operating current at nominal voltage	200 mA
General specifications	
Dimensions (H x W x D)	15.2 x 10.3 x 4.0 cm (5.9 x 2.6 x 1.6 in)
Weight	200 g (0.4 lb)
Shipping weight	800 g (1.8 lb)
Mounting options	Panel-mount, wall-mount
IP rating / location	IP20, indoor only
Operating temperature range	-20 to 50°C (-4°F to 122°F)
Part number	865-1050-01
Features	
Network	Protocol: Xanbus / Connectors: RJ45
Internal clock	Provides network time
Memory	Non volatile
Alarm	Audible
Display	Backlit LCD. Green / red LED
Front-panel interface	Four menu buttons, One standby button
Warranty	2 to 5 years (depending on country)
Regulatory approvals	
Safety	CSA 107.1, UL 458 4 th Ed
EMC	CE directive 2004 / 108 / EC, IEC / EN61000-6-3, IEC / EN61000-6-1, FCC Part 15B Class B, Industry Canada ICES-00. Class B, C-Tick
Included parts	
	One remote head
	One network terminal
	One CAT5 cable (2.1 m)
	One mounting plate
	One mounting bracket
	Four #8 screws
	Two #6 screws

Specifications are subject to change without notice.

Conext Automatic Generator Start works with the following Schneider Electric products



Conext XW² inverter/charger
 XW 5548 NA Product no. 865-5548-01
 XW 6848 NA Product no. 865-6848-01
 XW 7048 E Product no. 865-7048-61
 XW 8548 E Product no. 865-8548-61



Conext SW inverter/charger
 SW 2524 120 Product no. 865-2024
 SW 4024 120 Product no. 865-4024
 SW 2524 230 Product no. 865-2524-61
 SW 4024 230 Product no. 865-4024-61



MPPT 60 150 solar charge controller
 Product no. 865-1030-1



MPPT 80 600 solar charge controller
 Product no. 865-1032



Conext Automatic Generator Start (AGS)
 Product no. 865-1060-01



Conext Combox communication device
 Product no. 865-1058



Conext Battery Monitor
 Product no. 865-1080-01

Conext XW+ NA hybrid inverter/charger

One solution for global power needs

Conext™ XW+ is an adaptable single-phase and three-phase inverter/charger system with grid-tie functionality and dual AC power inputs. Available solar charge controllers, monitoring, and automated generator control modules enable further adaptability. From a single Conext XW+ unit to clusters up to 102 kW, the Conext XW+ is a scalable system that allows for the integration of solar capacity as required. Adaptable and scalable, the Schneider Electric™ Conext XW+ system is the one solution for grid-interactive and off-grid, residential and commercial, solar and backup power applications.

Why choose Conext XW+ NA?



Higher return on investment

- Excellent load starting with high 30-minute and 5-second power
- Performs in hot environments up to 70°C
- Intelligent functionality enables solar prioritization, load shifting, peak shaving, and assists small generators with heavy loads
- Backup power with grid-tie functionality converts external DC power to AC power for export to the utility grid



Flexible

- Single or three phase systems from 7.0 kW to 102 kW
- Supports DC coupled and AC coupled off-grid and grid-tie architectures
- Supports charging of Lithium Ion battery packs



Easy to service

- Field serviceable with replacement boards and spare parts
- Monitor, troubleshoot or upgrade firmware with Conext ComBox



Designed for reliability

- Extensive quality and reliability testing
- Highly Accelerated Life Testing (HALT)
- Globally proven and recognized field performance



Easy to install

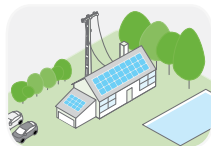
- System configures quickly into compact wall-mounted system
- Integrates both grid and generator power with dual AC inputs
- Balance-of-system components integrates battery bank, solar charge controllers and generators
- Commission the entire system with PC software tool and Conext ComBox



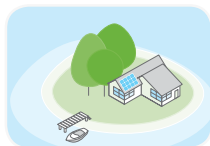
Product applications



Residential grid-tie solar with backup power



Self-consumption



Off-grid solar



Backup power



Community electrification

solar.schneider-electric.com

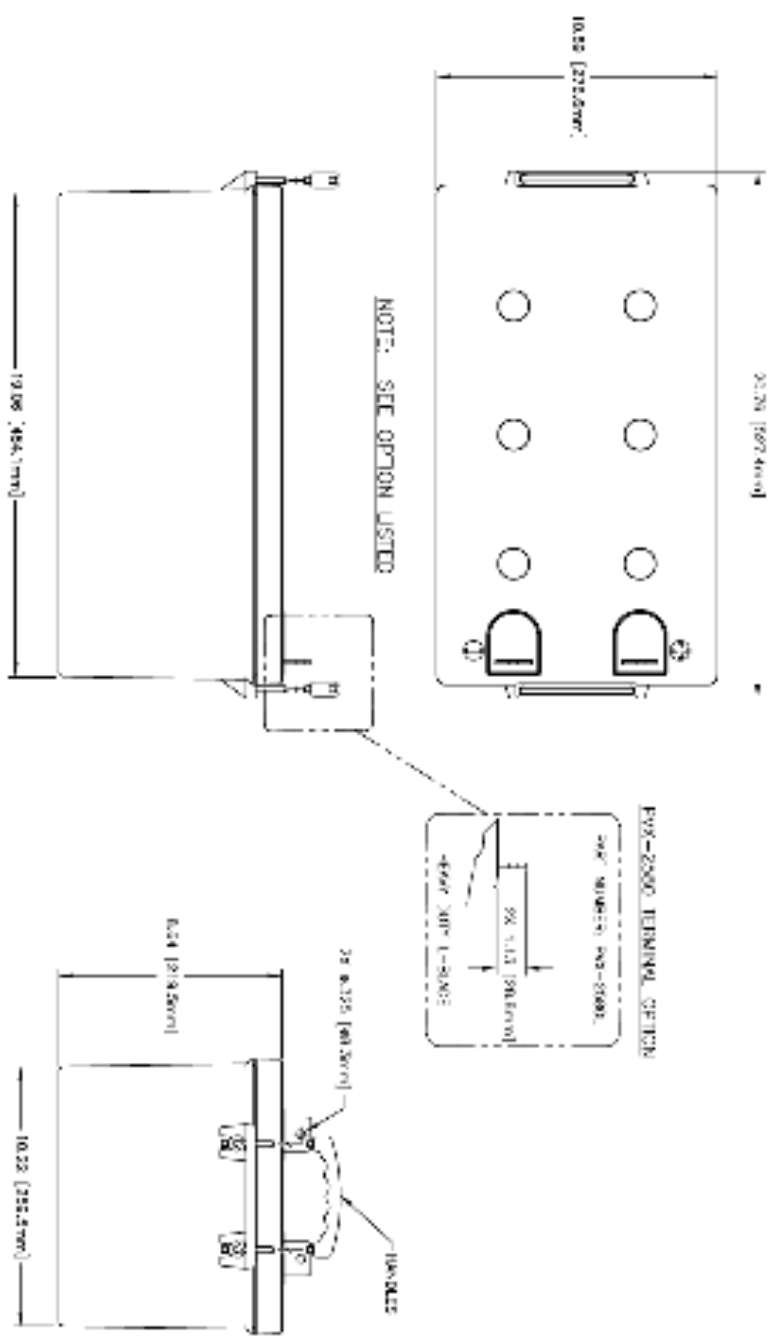


Device short name	XW+ 5548 NA	XW+ 6848 NA
Inverter AC output		
Output power (continuous) at 25°C	5500 W	6800 W
Overload 30 min / 60 sec at 25°C	7000 W / 9500 W	8500 W / 12000 W
Output power (continuous) at 40°C	4500 W	6000 W
Maximum output current 60 seconds (rms)	82 A (120 V); 41 A (240 V)	102 A (120 V); 52 A (240 V)
Output frequency (selectable)	50 / 60 Hz	50 / 60 Hz
Output voltage	L-N: 120 V +/- 3%; L-L: 240 V +/- 3%	L-N: 120 V +/- 3%; L-L: 240 V +/- 3%
Total harmonic distortion (THD) at rated power	< 5%	< 5%
Idle consumption search mode	< 8 W	< 8 W
Input DC voltage range	42 to 60 V (48 V Nominal)	42 to 60 V (48 V Nominal)
Maximum input DC current	150 A	180 A
Charger DC output		
Maximum output charge current	110 A	140 A
Output voltage range	40 - 64 V (48 V Nominal)	40 - 64 V (48 V Nominal)
Charge control	Three stage, two stage, boost, custom	Three stage, two stage, boost, custom
Charge temperature compensation	Battery temperature sensor included	Battery temperature sensor included
Power factor corrected charging	0.98	0.98
Compatible battery types	Flooded (default), Gel, AGM, LiON, custom*	Flooded (default), Gel, AGM, LiON, custom*
Batter bank range (scaled to PV array size)	440 - 10000 Ah	440 - 10000 Ah
AC input		
AC 1 (grid) input current (selectable limit)	3 - 60 A (60 A default)	3 - 60 A (60 A default)
AC 2 (generator) input current (selectable limit)	3 - 60 A (60 A default)	3 - 60 A (60 A default)
Automatic transfer relay rating / typical transfer time	60 A / 8 ms	60 A / 8 ms
AC input voltage limits (bypass/charge mode)	L-N: 78 - 140 V (120 V nominal) L-L: 160 - 270 V (240 V nominal)	L-N: 78 - 140 V (120 V nominal) L-L: 160 - 270 V (240 V nominal)
AC input frequency range (bypass/charge mode)	55 - 65 Hz (default); 52 - 68 Hz (allowable)	55 - 65 Hz (default); 52 - 68 Hz (allowable)
AC grid-tie output		
Grid sell current range on AC1(selectable limit)	0 to 40 A (120 V) / 0 to 20 A (240 V)	0 to 48 A (120 V) / 0 to 27 A (240 V)
Grid sell voltage range on AC1 (auto adjusts entering sell mode)	L-N:105.5 to 132 +/- 1.5 V L-L: 211 to 264 +/- 3.0 V	L-N:105.5 to 132 +/- 1.5 V L-L: 211 to 264 +/- 3.0 V
Grid sell frequency range on AC1 (auto adjust entering sell mode)	59.4 to 60.4 +/- 0.05 Hz	59.4 to 60.4 +/- 0.05 Hz
Efficiency		
Peak	95.7%	95.7%
CEC weighted efficiency	93.0%	92.5%
General specifications		
Part number	865-5548-01	865-6848-01
Product / shipping weight	53.5 kg (118.0 lb) / 75.0 kg (165.0 lb)	55.2 kg (121.7 lb) / 76.7 kg (169.0 lb)
Product dimensions (H x W x D)	58 x 41 x 23 cm (23 x 16 x 9 in)	58 x 41 x 23 cm (23 x 16 x 9 in)
Shipping dimensions (H x W x D)	71.1 x 57.2 x 39.4 cm (28.0 x 22.5 x 15.5 in)	71.1 x 57.2 x 39.4 cm (28.0 x 22.5 x 15.5 in)
IP degree of protection	NEMA Type 1 Indoor	
Operating air temperature range	-25°C to 70°C (-13°F to 158°F) (power derated above 25°C (77°F))	
Warranty (Depending on the country of installation)	2 or 5 years	2 or 5 years
Features		
System monitoring and network communications	Available	
Intelligent features	Grid sell, peak load shave, generator support, prioritized consumption of battery or external DC energy	
Auxiliary port	0 to 12 V, maximum 250 mA DC output, selectable triggers	
Off-grid AC coupling	Frequency control	
Regulatory approval		
Safety	UL1741, CSA 107.1	
EMC directive	FCC and Industry Canada Class B	
Interconnect	IEEE 1547 and CSA 107.1	
Compatible products		
Conext XW+ Power Distribution Panel	865-1014-01	
Conext System Control Panel	865-1050	
Conext Automatic Generator Start	865-1060	
Conext MPPT 60 150	865-1030-1	
Conext MPPT 80 600	865-1032	
Conext ComBox	865-1058	
Conext Battery Monitor	865-1080-01	
Conext Battery Fuse Combiner Box	865-1031-01	
Conext Portable Installation and Configuration Tool	Product no. 865-1155-01	

Specifications are subject to change without notice.

REVISIONS			
REV.	DESCRIPTION	DATE	BY
1	ISSUE FOR BIDDING	6/15/17	JMB

- NOTES: UNLESS OTHERWISE SPECIFIED:**
1. SEE DRAWING NO. CD-0025 AND PROCEEDURE P-1200 FOR SPECIFICATIONS FOR INSTALLATION AND ASSEMBLY. DRAWINGS ARE NOT INTEND TO CONFLICT.
 2. ALL TRENCH IS PERFORMED BY OTHER CONTRACT INTERFERING TRADES.
 3. ALL DIMENSIONS ARE IN (1) INCH.
 4. ASSEMBLY USES IN TITLE IS SCALED AND NOT TO SCALE.



CAPACITY OPTIONS	
PART NUMBER	PWX-2580
NOMINAL WEIGHT	139 LBS [62.1 KG]
APPROXIMATE CAPACITY @ 24 HOURS	250 AH
1.25 WELDED BR/175 CWT 01	

GENERAL INFORMATION		DRAWING INFORMATION	
PROJECT NO.	CD-0025	DRAWING NO.	PWX-2580
DATE	6/15/17	SCALE	AS SHOWN
CONTRACT TITLE: BATTERY ENCLOSURE			
PROJECT LOCATION: 3000 SW PLYMOUTH BLVD, CORVALLIS, OR 97331			
CLIENT: BATTERY, SLA, 2 VOLT			
DESIGNER: PWX-2580			
CHECKER: PWX-2580			
DATE: 6/15/17			
SCALE: AS SHOWN			
SHEET NO: 1 OF 1			

1/2" scale drawing prepared from field notes and drawings for general information only. It is not intended to be used for construction purposes.

H361

Safety Switch , 30A, 600V, Fusible, Heavy Duty, 3-Pole



by Schneider Electric

List Price \$352.00 USD

Availability **Stock Item: This item is normally stocked in our distribution facility.**

Technical Characteristics

Depth	4.88 Inches
Height	14.60 Inches
Width	6.50 Inches
Action	Single Throw
Ampere Rating	30A
Approvals	UL Listed
Catalog Reference Number	3100CT9801
Electrical Interlock	None
Enclosure Material	Steel
Enclosure Rating	NEMA 1
Enclosure Type	General Purpose (Indoor)
Factory Installed Neutral	No
Disconnect Type	Fusible
Terminal Type	Lugs
Mounting Type	Surface
Wire Size	#12 to #2 AWG(Al) or #14 to #2 AWG(Cu)
Type of Duty	Heavy Duty
Short Circuit Current Rating	10kA (Class H or K) - 200kA (Class R,J or L)
Number of Poles	3-Pole
Maximum Voltage Rating	600V

Shipping and Ordering

Category	00008 - Safety Switch, Heavy Duty, 2 & 3 Pole, 30-200 Amp, Indoor
Discount Schedule	DE1
Article Number	785901481843
Package Quantity	1
Weight	8.15 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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Hubbell Fire-Rated Poke-Throughs Featuring Hubbell SystemOne FRPTs



HUBBELL



SystemOne 4x4



SystemOne Multimedia



SystemOne Furniture Feed



Traditional 2x2



Nobody delivers like Hubbell Commercial Solutions



Wiring Systems



Hubbell Fire-Rated Poke-Throughs

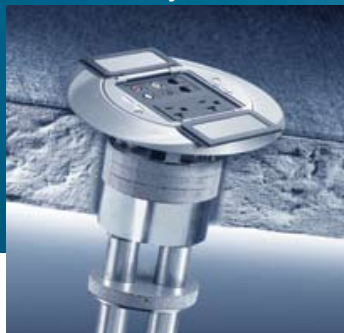
Featuring the innovative capabilities of Hubbell's SystemOne Delivery System line, Hubbell has expanded its offering of Fire-Rated Poke-Through (FRPT) products, making it the most extensive in the industry. Hubbell SystemOne FRPTs install in a 4" core hole and provide users the flexibility to create personal solutions for their most demanding applications.

For those requiring a 3" diameter FRPT, Hubbell continues to provide a wide variety of traditional solutions for flush, pedestal and furniture feed applications. All Hubbell FRPT products include a "step-down" feature, enabling wiring, installation and if necessary, removal from the floor above.

Whatever combination of power, data and audio/video connections are required, Hubbell provides the answer; bringing consistent, aesthetic and functional solutions to the desktop.



Hubbell SystemOne FRPTs for 4" diameter applications...



Multi-Service Applications

This Hubbell SystemOne sub-plate incorporates 2 Style Line® rectangular openings. These can be used for a variety of power and/or data applications. It will accommodate 15 or 20 amp, standard, isolated ground, GFCI or surge protected duplex receptacles. Using communication frames it can provide up to a 6-port multi-service or a 12-port all communication solution.



Multimedia Applications

Other Hubbell SystemOne sub-plates are designed to meet the growing needs of the audio and video markets. Some sub-plates provide power outlets with Hubbell's audio/video products including 15-Pin SVGA, RCA, S-Video, 3.5mm stereo, and XLR microphone jacks. Another sub-plate can accommodate Extron® Electronics's MAAP and AAP series audio/video modules.



4X4 Applications

Provides maximum power capacity for flush, multi-service applications. This sub-plate features a pre-wired four outlet 20A, 125V receptacle and four openings for snap-in flush mount Hubbell modular jacks and audio/video snap-in connectors.





Advantage HUBBELL

- **Best in Class Products**
Easily upgraded as user's needs change.
- **Ease of Installation**
Clips allow installation and removal from above the floor.
- **Application Solutions**
Highest capacity and widest variety of power, data and A/V solutions.

Traditional FRPTs for 3" and 2" diameter applications...



Flush Applications

Hubbell offers a variety of single and multi-service flush fire-rated poke-through products. It incorporates a Hubbell Style Line®, 20 amp, duplex receptacle and two Hubbell Category 5e data jacks. The jacks mount flush to the cover for an unobtrusive appearance. Various colors and all brass versions are available.



Pedestal Applications

Hubbell offers single and multi-service pedestal style FRPTs for those applications requiring above-the-floor connections. Available in 2, 4 or 6 gang sizes, pedestal FRPTs provide additional power and low voltage connections to the desktop than most flush configurations in a 3" core hole.



Furniture Feed Applications

Hubbell offers single and multiple service flush and pedestal style FRPTs that deliver power and voice/data cabling to feed furniture systems. Various models can feed up to 2" conduit and can accommodate up to 36 Category 5e data cables.



Hubbell SystemOne Through-Floor Fitting



Step down installation clips allow the fitting to be installed or removed from the floor above.

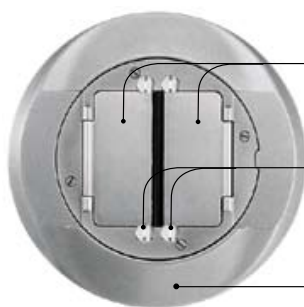
Barrier expands during fire conditions to maintain the floor's fire rating.

Adjustable lower fire barrier accommodates concrete floor thicknesses from 2 1/4" to 7".

Features dual 1" EMT conduit tubes for increased cable capacity.

- Accepts all Hubbell SystemOne covers and sub-plates (4X4 FRPT system uses a separate FRPT and sub-plate).
- Excellent solution for both retrofit and new construction.
- Brings power, voice, data and multimedia precisely where needed.
- Installs in 4" core hole.
- UL listed for use in 1-4 hr fire rated floors.

Hubbell SystemOne Universal Cover



Hinged doors open 180 degrees flush to the carpet flange or tile.

Screws allow each door to be secured independently.

Universal carpet or tile flange can be used for Hubbell SystemOne Fire-Rated Poke-Through or PVC Floor Box.

- Cast aluminum construction available in durable black, gray, brass, aluminum and ivory powder coat finishes.
- Features ScrubShield™ technology that exceeds UL514A and UL514C scrub water exclusion requirements.
- Provides consistent look and maximum functionality throughout.

Hubbell SystemOne Sub-plates




While no one can predict the future, Hubbell's modular sub-plate design allows users to economically upgrade Hubbell SystemOne FRPTs to accommodate future moves, adds and changes.



- Hubbell 4X4 – four 20A, 125V receptacles and four openings for voice/data jacks and multimedia connectors.
- Hubbell INFINESTATION™ front loading modular connectivity.
- Accommodates Extron Electronic's Architectural Series™ audio/video system integration products.
- Ortronics®, Siemon™, Panduit®, SYSTIMAX® and keystone options enable maximum data flexibility.
- Large capacity and multi-service furniture feed applications.
- GFCI, surge and standard Style Line receptacles.
- Twist-Lock® receptacle with or without data jacks.



Hubbell SystemOne FRPT 4" Diameter – One Piece Units

Catalog Number	Catalog Number	Catalog Number
S1PTBRS Brass S1PTAL Aluminum S1PTBL Black S1PTGY Gray Complete assembled unit ■ S1PTFIT floor fitting ■ S1SP sub-plate ■ Universal carpet cover	Dual Style Line Poke-Through 	S1PT3IMBRS Brass S1PT3IMAL Aluminum S1PT3IMBL Black S1PT3IMGY Gray Complete assembled unit ■ S1PTFIT floor fitting ■ S1SP3IM sub-plate ■ Universal carpet cover
	Modular A/V Poke-Through 	S1PT4X4BRS Brass S1PT4X4AL Aluminum S1PT4X4BL Black S1PT4X4GY Gray Complete assembled unit ■ S1PT4X4FIT floor fitting ■ S1SP4X4 sub-plate ■ Universal carpet cover
		4X4 Poke-Through 

Hubbell SystemOne FRPT 4" Diameter – Three Piece Units

Through Floor Fittings

S1PTFIT **Dual Channel Through Floor Fitting**
Through floor fitting with (2) 1" trade size conduit stems to feed power and communication services. For use with Hubbell SystemOne Universal Covers and all sub-plates except S1SP4X4, S1SP4X4PA, S1SP4X4SYS and S1SPTL.



S1PT4X4FIT **4X4 Through Floor Fitting**
Through floor fitting with (2) 3/4" conduit stubs for communications and (1) 3/4" conduit stem for power. For use with Hubbell SystemOne Universal Covers and S1SP4X4, S1SP4X4PA, S1SP4X4SYS and S1SPTL sub-plates only.



Universal Covers

Universal, Cast Aluminum Carpet Flange & Cover Assembly

S1FCBRS Brass
S1FCAL Aluminum
S1FCBL Black
S1FCGY Gray
S1FCFI Ivory

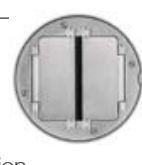
- Cast aluminum construction
- Powder coat finish



Universal, Cast Aluminum Tile Flange & Cover Assembly

S1TFCBRS Brass
S1TFCAL Aluminum
S1TFCBL Black
S1TFCGY Gray
S1TFCI Ivory

- Cast aluminum construction
- Powder coat finish

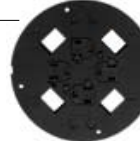


Sub-plates

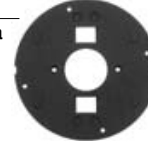
S1SP **Style Line/GFCI**
(2) Style Line® openings for power and/or datacom applications.



S1SP4X4* **Hubbell 4 X 4**
(4) 20A, 125V receptacles.
(4) Keystone openings for Hubbell jacks or flush A/V connectors.



S1SPTL* **Twist-Lock® + Data**
20 or 30 Amp TL rec. (1.56" OD).
(2) Keystone openings for Hubbell jacks or flush A/V connectors.



S1SP4IM **Hubbell Datacom**
1 unit flush INFIneSTATION™ opening. 3 unit recessed INFIneSTATION opening for data, voice, and A/V applications.
(See Page 11 for details)



S1SP3IM **Hubbell A/V + Power**
(1) 20A, 125V receptacle. 3 unit recessed INFIneSTATION opening for data, voice, and A/V applications.
(See Page 11 for details)



S1SPFFBRS Brass **Furniture**
S1SPFFAL Alum. **Feed Cover/**
S1SPFFBL Black **Flange**
S1SPFFGY Gray
(1) 3/4" & (1) 1 1/2" KOs for power and/or datacom applications.
Universal Cover not required.
Includes carpet flange.



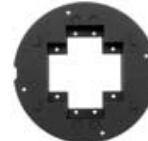
S1SPEXT1 **Extron® MAAP + Power**
(1) 20A, 125V receptacle. Recessed opening for (3) single Extron® MAAP Series adapter plates.



S1SPEXT2 **Extron AAP + Power**
(1) 20A, 125V receptacle. Recessed opening for (1) single Extron MAAP and (2) single AAP Series adapter plates.



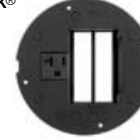
S1SPEXT3 **Extron Datacom**
Recessed opening for (2) single Extron MAAP and (2) single AAP Series adapter plates.



S1SPORT **Ortronics Series II® + Power**
(1) 20A, 125V receptacle. Recessed opening for (3) 1 unit Ortronics® Series II modules.



S1SPTRAC **Ortronics TracJack® + Power**
(1) 20A, 125V receptacle. Recessed bezel for (6) Ortronics TracJack modules.



S1SPMAX **Siemon Max® + Power**
(1) 20A, 125V receptacle. Recessed bezel for (6) Siemon Max modules.



S1SP4X4PA* **Panduit Mini-Com® 4 X 4**
(4) 20A, 125V receptacles
(4) Openings for Panduit Mini-Com Connectivity.



S1SP4X4SYS* **SYSTIMAX® 4 X 4**
(4) 20A, 125V receptacles.
(4) Openings for SYSTIMAX Connectivity.



* Note: S1SP4X4, S1SP4X4PA, S1SP4X4SYS and S1SPTL are for use with S1PT4X4FIT fitting only.

www.hubbell-wiring.com



5



2X2 Flush FRPT 3" Diameter – One Piece Units

Catalog Number

PT2X2BL	Black
PT2X2GY	Gray
PT2X2IGBL*	Black
PT2X2IGGY*	Gray

2X2 Aluminum Poke-Through



* Includes pre-wired 20A isolated ground duplex Style Line receptacle.

Complete assembled unit

- PT2X2FIT through-floor fitting.
- Pre-wired 20A duplex Style Line® receptacle & (2) Category 5e data jacks.
- Non-metallic cover.
- Painted aluminum flange.

Catalog Number

PT2X2BRS3	Black/Brass	2X2 Brass
PT2X2BRS	Brass Finish/Brass	Poke-Through
PT2X2IGBRS3*	Black/Brass	
PT2X2IGBRS*	Brass Finish/Brass	



* Includes pre-wired 20A isolated ground duplex Style Line receptacle.

Complete assembled unit

- PT2X2FIT through-floor fitting.
- Pre-wired 20A duplex Style Line receptacle & (2) Category 5e data jacks.
- Non-metallic cover.
- Solid brass flange.

2X2 Flush FRPT 3" Diameter – Two Piece Units

Through-Floor Fitting

Catalog Number

PT2X2FIT

Multi-Channel Through-Floor Fitting



Through-floor fitting with (1) 3/4" trade size conduit stem with junction box for power and (2) 1/2" low voltage conduit entrances.

Specifications:

- UL Listed and CSA Certified.
- 1- 4 hour fire rating (1-3 hour for steel floor units and concrete topping (D900 Series Design)).
- For 2 1/4" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft. on center and not more than one per 65 sq. ft. of floor area.

Service Fittings

Catalog Number

PT2X2SFBL	Black
PT2X2SFGY	Gray

2X2 Aluminum Service Fitting



- Pre-wired 20A duplex Style Line receptacle & (2) Category 5e data jacks.
- Non-metallic cover.
- Painted aluminum flange.

Catalog Number

PT2X2SFBR3	Black/Brass	2X2 Brass
PT2X2SFBR	Brass Finish/Brass	Service Fitting



- Pre-wired 20A duplex Style Line receptacle & (2) Category 5e data jacks.
- Non-metallic cover.
- Solid brass flange.

Accessories

Catalog Number

PT2X2CBL	Black
PT2X2CGY	Gray
PT2X2CBRS	Brass Finish

Non-Metallic Replacement Covers





Flush Duplex FRPT 3" Diameter – One Piece Units

Catalog Number

PT7FSDBLA Black
 PT7FSDGYA Gray
 PT7FSDIA Ivory
 PT7FSDBRA Brown
 PT7IGFSDGYA* Gray
 PT7IGFSDIA* Ivory

* Includes pre-wired 20A isolated ground duplex receptacle.

Complete assembled unit

- PT7FSD through-floor fitting.
- Pre-wired 20A duplex receptacle.
- Non-metallic flip lid cover with (2) 1/2" diameter low voltage feed through holes.
- Painted aluminum flange.

Flush Aluminum Poke-Through



Catalog Number

PT7FSDBRS2A All Brass
 PT7FSDBRS3A Black/Brass
 PT7IGFSDBRSA* All Brass

* Includes pre-wired 20A isolated ground duplex receptacle.

Complete assembled unit

- PT7FSD through-floor fitting.
- Pre-wired 20A duplex receptacle.
- All brass or black non-metallic cover option.
- Flip lid cover with (2) 1/2" diameter low voltage feed through holes.
- Solid brass flange.

Flush Brass Poke-Through



Flush FRPT 3" Diameter – Two Piece Units

Through-Floor Fitting

Catalog Number

PT7FSD (with Junction Box)
 PT73SD (without Junction Box)

Through-floor fitting with (1) 3/4" trade size conduit stem for power and (2) 1/2" low voltage feed through holes.

Multi-Channel Through Floor Fitting



Specifications:

- UL Listed and CSA Certified.
- 1- 4 hour fire rating (1-3 hour for steel floor units and concrete topping, D900 Series Design).
- For 2 1/4" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft. on center and not more than 1 per 65 sq. ft. of floor area.

Service Fittings

Catalog Number

FRFBLA Black
 FRFGYA Gray
 FRFIA Ivory
 FRFBRA Brown

- Pre-wired 20A duplex receptacle.
- Non-metallic flip lid cover with (2) 1/2" diameter low voltage feed-through holes.
- Painted aluminum flange.

Flush Aluminum Service Fitting



Catalog Number

FRFBRSA Solid Brass

Flush Brass Service Fitting

- Pre-wired 20A duplex receptacle.
- Solid brass flip lid cover with (2) 1/2" diameter low voltage feed-through holes.
- Solid brass flange.



Accessories

Catalog Number

PFBRCBLA Black
 PFBRCBGYA Gray
 PFBRCIA Ivory
 PFBRCBRA Brown

Non-Metallic Replacement Covers



Catalog Number

BRS2RCA Solid Brass

All Brass Replacement Covers





Large Capacity, Low Voltage Flush Furniture Feed FRPT 3" Diameter – Two Piece Units

Catalog Number

PT2FIT

Through floor fitting with (1) 2" trade size conduit stem. Will accommodate up to 36 Category 5e cables.

Specifications:

- UL Listed and CSA Certified.
- 1-2 hour fire rating.
- For 2 1/4" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft on center and not more than 1 per 65 sq. ft. of floor area.

Large Capacity, Low Voltage Through Floor Fitting



Catalog Number

FF2BRS

Brass Finish

FF2BK

Black

FF2GY

Gray

Large Capacity Cover/Flange

- Cover/flange with 1 1/4" & 2" combination knockout.
- Painted aluminum cover and flange.



Flush Furniture Feed FRPT 3" Diameter – One Piece Units

Catalog Number

PT73FFSDGY Gray

PT73FFSDI Ivory

3 Service Furniture Feed Poke-Through

Complete assembled unit

- PT73SD floor fitting.
- Aluminum cover with (2) 1/2" threaded hubs for low voltage and (1) 3/4" threaded hub for power.
- Painted aluminum flange.



Catalog Number

PT7FFSDGY Gray

PT7FFSDI Ivory

Single Service Furniture Feed Poke-Through

Complete assembled unit

- PT71SD floor fitting.
- Aluminum cover with (1) KO to accept a 3/4" connector.
- Painted aluminum flange.



Flush Furniture Feed FRPT 3" Diameter – Two Piece Units

Through-Floor Fittings

Catalog Number

PT73SD

3 Service Furniture Feed Through-Floor Fitting

Through-floor fitting with (1) 3/4" trade size conduit stem for power and (2) 1/2" low voltage conduit holes. Specifications:

- UL Listed and CSA Certified.
- 1- 4 hour fire rating (1-3 hour for steel floor units and concrete topping, D900 Series Design).



Catalog Number

PT71SD

Single Service Furniture Feed Through-Floor Fitting

Through-floor fitting with (1) 3/4" trade size conduit stem for power or low voltage applications.

- For 2 1/4" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft. on center and not more than 1 per 65 sq. ft. of floor area.



Service Fittings

Catalog Number

FRF3BK Black

FRF3GY Gray

FRF3I Ivory

3 Service Furniture Feed Service Fitting

- Aluminum cover with (2) 1/2" threaded hubs for low voltage and (1) 3/4" threaded hub for power.
- Painted aluminum flange.



Catalog Number

FRF1BK Black

FRF1GY Gray

FRF1BRS Brass Finish

Single Service Furniture Feed Service Fitting

- Aluminum cover with (1) KO to accept a 3/4" connector.
- Painted aluminum flange.





Painted Pedestal FRPT 3" Diameter – Two Piece Unit

Painted Pedestal FRPT 2" Diameter – Two Piece Unit

Through-Floor Fitting

Catalog Number

PT7XC

Large Capacity Multi-Service Pedestal Through Floor Fitting

Through floor fitting with (1) 1 ¼" trade size conduit stem for low voltage and (1) ½" trade size conduit stem for power applications. Specifications:

- UL Listed and CSA Certified.
- 1- 4 hour fire rating (1-3 hour for steel floor units and concrete topping, D900 Series Design).
- For 2 ¼" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft. on center and not more than 1 per 65 sq. ft. of floor area.



Through-Floor Fitting

Catalog Number

PT27A

Multi-Service Pedestal Through Floor Fitting

Through floor fitting with (1) ¾" trade size conduit stem for low voltage and (1) ½" trade size conduit stem for power applications. Specifications:

- UL Listed and CSA Certified.
- 1- 4 hour fire rating (1-3 hour for steel floor units and concrete topping, D900 Series Design).
- For 2 ¼" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft. on center and not more than 1 per 65 sq. ft. of floor area.



Pedestal Service Fittings (Order 1 plate per gang)

Catalog Number

FR280BKA Black **2-Gang**
FR280GYA Gray

Use with PT27A only.



Catalog Number

FR480BKA Black **4-Gang**
FR480GYA Gray

Use with PT27A or PT7XC.



Catalog Number

FR680BKA Black **6-Gang**
FR680GYA Gray

Use with PT27A or PT7XC.



- Painted aluminum housing with low voltage barrier(s). Plates and devices sold separately.
- For additional barriers, use catalog number FRBR1 (see page 10).

Pedestal Face Plates (Order 1 plate per gang)

Catalog Number

SS2309DBKA Black **Duplex**
SS2309DGYA Gray



SS2309SLBKA Black **Style Line/**
SS2309SLGYA Gray **GFCI**



SS2309SBKA Black **Single Rec.**
SS2309SGYA Gray **(1.39" OD)**



SS2309BBKA Black **Blank**
SS2309BGYA Gray



Catalog Number

SS2309FBKA Black **Furniture Feed**
SS2309FGYA Gray **(¾" KO)**



SS2309F1BKA Black **Furniture Feed**
SS2309F1GYA Gray **(1" KO)**



SS2309TBKA Black **Bushed Data**
SS2309TGYA Gray **Opening (1" ID)**



- Painted aluminum plates.



Brushed Aluminum Pedestal FRPT 3" Diameter - Two Piece Unit

Through-Floor Fitting

Catalog Number

PT7XC

Large Capacity Multi-Service Pedestal Through-Floor Fitting

Through floor fitting with (1) 1 1/4" trade size conduit stem for low voltage and (1) 1/2" trade size conduit stem for power applications.

Specifications:

- UL Listed and CSA Certified.
- 1- 4 hour fire rating (1-3 hour for steel floor units and concrete topping, D900 Series Design).
- For 2 1/4" to 7" floor thickness.
- UL installation spacing. Minimum 2 ft. on center and not more than 1 per 65 sq. ft. of floor area.



Pedestal Service Fitting

Catalog Number

FR80AL Brushed Aluminum

2-Gang Pedestal Service Fitting

For use with PT7XC only.

- Brushed aluminum housing with low voltage barrier. Plates and devices sold separately.



Plates

Catalog Number

SS309D

Duplex



SS309S

Single Rec. (1.39" OD)



SS309B

Blank



SS309DS

Style Line/GFCI



Catalog Number

SS309T

Bushed Data Opening (1" ID)



SS309SF*

Furniture Feed (3/4" KO)



SS309BF*

Furniture Feed Blank



* For furniture feed applications using SS309SF, a SS309BF blank must be used for 2nd plate.

- 302/304 Stainless steel plates (SS309SF & SS309BF are aluminum).

3" Diameter FRPT Accessories

Catalog Number

FRP250

Gray

Closure Plug

Textured aluminum plug seals 3" core hole when FRPT is no longer required and is removed. Maintains the floor's 1- 4 hour fire rating.



AP2GY

Gray

Flush FRPT

AP2I

Ivory

Abandonment Plate

Use with PT7FSD, PT73SD or PT71SD only. Covers the opening when FRPT is abandoned. Service fitting is removed and through-floor fitting remains.



FF3GY

Gray

Multi-Service Furniture Feed

FF3I

Ivory

Replacement Inserts

Use as a replacement cover for PT73FFSD series, or to convert installed PT7FSD series into furniture feed FRPTs. Includes (2) 1/2" threaded hubs for low voltage and (1) 3/4" threaded hub for power. (UL listed only.)



Catalog Number

EXT13

PT7XC Extension Kit

Extends PT7XC FRPT to accommodate between 7" and 13" floor thickness.



AP22

2-Gang Gray

Pedestal FRPT

AP42

4-Gang Gray

Abandonment Plate

Use with PT27A or PT7XC Only. Covers the opening when FRPT is abandoned. Service fitting is removed and through-floor fitting remains.



FRBR1














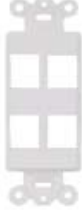








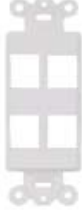




















Low Voltage Barrier

Use with FR280, FR480, and FR680 pedestal service fittings only when additional power/low voltage separation is required.





Power, Data, Audio and Video Accessories

Modular Jacks	Multimedia Connectors	INFINESTATION® Modules (Office White)	Outlet Frames	Wiring Devices
HBL60W* Category 6 Universal Wired Office White 	SIFOW** F-Type F/F Coupler Office White 	DFBM05OW Blank .5 Unit 	FCX2440W++ 2-Port Style Line® Frame Office White 	HBL2152 +++ 15A 125V Style Line Duplex Receptacle Brown 
HBL5EOW* Category 5e Universal Wired Office White 	SIFGOW** Gold F-Type F/F Coupler Office White 	DFBM10W Blank 1 Unit 	FCX3440W++ 3-Port Style Line Frame Office White 	HBL2162 +++ 20A 125V Style Line Duplex Receptacle Brown 
HBLUOW* USOC 6-Position Office White 	SIRCAXx*** RCA 110 Punch Down Black 	DFBM15OW Blank 1.5 Unit 	FCX4440W++ 4-Port Style Line Frame Office White 	HBL2310 20A 125V Twist-Lock Receptacle (1.56" boss diameter) Black 
SIBOWPK10** Blank Module Office White 	SIRCAFFxx + Gold RCA F/F Coupler Pass-Thru Office White 	DF1KOW 1-Port Keystone Flat 1 Unit 	FCX6440W++ 6-Port Style Line Frame Office White 	HBL2320 20A 250V Twist-Lock Receptacle (1.56" boss diameter) Black 
<p>* Office White is standard color. For other colors, replace 'OW' as follows: BK = Black B = Blue EI = Electric Ivory GY = Gray GN = Green OR = Orange R = Red TI = Telco Ivory W = White Y = Yellow.</p> <p>** Office White is standard color. For other colors, replace 'OW' as follows: GY = Gray I = Ivory W = White.</p> <p>***Housing color is Black. Replace 'xx' with one of the following to designate insulator color: OW = Red W = White Y = Yellow</p> <p>+ Housing color is Black. Replace 'xx' with one of the following to designate insulator color: R = Red W = White Y = Yellow BK = Black</p> <p>++ Office White is standard color. For other colors, replace 'OW' as follows: GY = Gray I = Ivory W = White BK = Black</p> <p>+++ Standard color is Brown. For other colors, add one of the following to the end of the catalog number: I = Ivory GY = Gray WA = White BK = Black OW = Office White</p>	SIRCAFFxx + Gold RCA F/F Coupler Pass-Thru Office White 	DF2KOW 2-Port Keystone Flat 1 Unit 	FCX4440W++ 4-Port Style Line Frame Office White 	HBL2310 20A 125V Twist-Lock Receptacle (1.56" boss diameter) Black 
	SIRCASxx + RCA Solder Coupler Office White 	DFA1KOW 1-Port Keystone Angled 1 Unit 	FCX6440W++ 6-Port Style Line Frame Office White 	HBL2320 20A 250V Twist-Lock Receptacle (1.56" boss diameter) Black 
	SISVFFBK S-Video F/F Coupler Black 	DFA2KOW 2-Port Keystone Angled 1 Unit 	DJOOW++ 2-Port 106 Duplex Frame Office White 	HBL2610 30A 125V Twist-Lock Receptacle (1.56" boss diameter) Black 
	SISVOW S-Video 110 Coupler Black 	DFRA1KOW 1-Port Keystone Recessed 1.5 Unit 	DJ106OW++ 4-Port 106 Duplex Frame Office White 	HBL2620 30A 250V Twist-Lock Receptacle (1.56" boss diameter) Black 
	SIBNCOW** BNC Coupler Office White 	DFRA2KOW 2-Port Keystone Recessed 1.5 Unit 		
	SIFSCOW SC Simplex Adapter Office White 	DF115FFOW 15-Pin SVGA F/F, 1 Unit 		
	SISTOW** ST-Style Adapter Office White 	DF19FFOW 9-Pin F/F 1 Unit 		
		DF115SOW 15-Pin SVGA Screw Terminal 1 Unit 		

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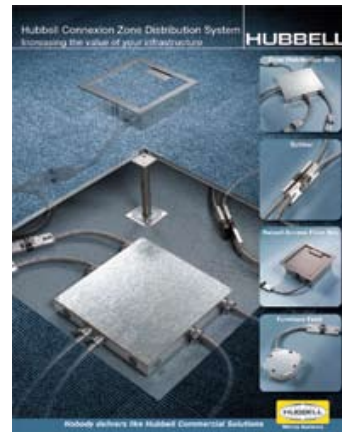
Hubbell expands its line of Raceway to include a complete offering of steel, aluminum and non-metallic systems.



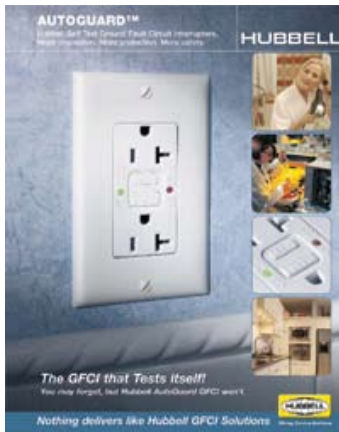
Hubbell SystemOne. The only Floor Box and FRPT system that uses common covers for a seamless look.



Hubbell provides a full offering of Floor Box products including large capacity and Hubbell SystemOne options.



Hubbell offers a line of raised access, zone distribution products for commercial environments.



The GFCI that tests itself! You may forget, but Hubbell's AutoGuard GFCI won't.



Hubbell's full line catalog provides the widest variety of industrial and commercial products available.

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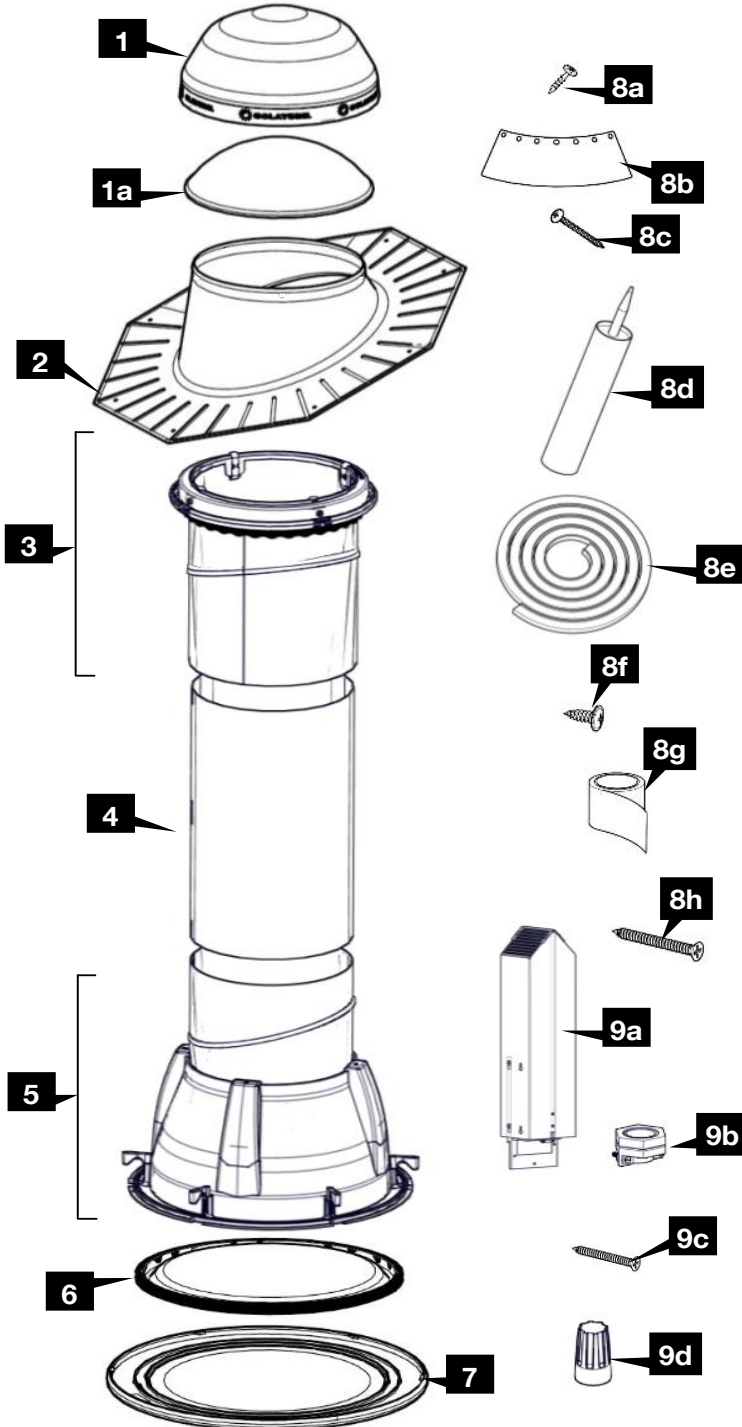


SOLATUBE
Innovation in Daylighting.

Solatube® Smart LED Lighting System Installation Instructions

Primary Unit

For Secondary Unit, see back of this page.



Parts List*	Quantity
1 Dome with Raybender® 3000 Technology	(1)
a. Shock Inner Dome*†	
2 Roof Flashing (pitched or no pitch)	(1)
3 Top Tube Assembly including: Dome Ring, Dome Ring Seal, Spectralight® Infinity Top Tube with Angle Adapter.	(1)
4 Spectralight® Infinity 16 in (400 mm) Extension Tube (not included in some kits, see label on box)	(2)
5 Primary Luminaire Assembly including: Spectralight® Infinity Bottom Tube with Angle Adapter, Amplifier, Light Sensor, LEDs (4)	(1)
6 Effect Lens	(1)
7 Diffuser	(1)
8 Seal and Fasteners	
a. Dome Ring Screws - #8 X 1 in (25 mm)	(5)
b. LightTracker™ Reflector	(1)
c. Flashing Screws - #10 X 2 in (51 mm)	(8)
d. Roof Sealant	(1)
e. Expansion Joint Seal	(1)
f. Tube Screws - #8 X 9/16 in (14 mm)	(10)
g. Foil Tape - 2 in (51 mm) X 18 ft (5.5 m) roll	(1)
h. Drywall Screws - #6 X 1 5/8 in (40 mm)	(4)
9 Junction Box Assembly including DC Driver	(1)
b. 1/2" NMC Connector	(1)
c. Junction Box Screws—1.5 in (38 mm)	(4)
d. Wire Connecting Nut (yellow)	(2)

Required Tools:

Keyhole Saw	Lumber Crayon
Saber or Reciprocating Saw	Magnetic Compass
Hammer	Voltage Tester
Flat Bar	Wire Strippers
Utility Knife	Lineman's Pliers
Tape Measure	Long Nose Pliers
Caulking Gun	Screw Driver Phillips & Flat Head
Screw Gun with Phillips Head	Required Safety Equipment

*Components shown not included in all kits, see label on box.

†High Velocity Hurricane Zones: Shock Inner Dome must be installed with dome. To meet HVHZ requirements, use a six inch no pitch flashing or a pitched flashing with a four inch turret extension.

For the most current Installation Instructions, please visit www.solatube.com/instructions

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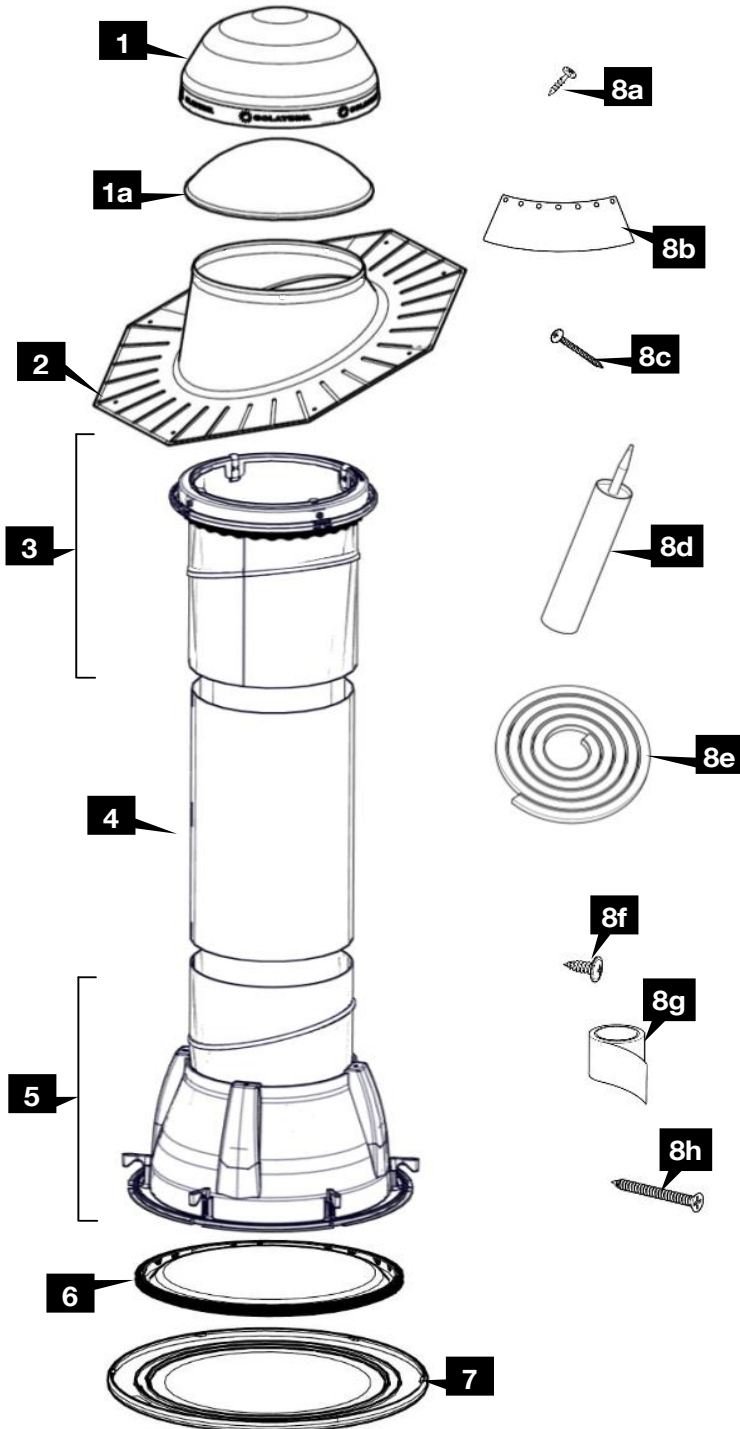
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SOLATUBE
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Solatube® Smart LED Lighting System Installation Instructions

Secondary Unit



Parts List*	Quantity
1 Dome with Raybender® 3000 Technology	(1)
a. Shock Inner Dome†	
2 Roof Flashing (pitched or no pitch)	(1)
3 Top Tube Assembly including: Dome Ring, Dome Ring Seal, Spectralight® Infinity Top Tube with Angle Adapter.	(1)
4 Spectralight® Infinity 16 in (400 mm) Extension Tube (not included in some kits, see label on box)	(2)
5 Secondary Luminaire Assembly including: Spectralight® Infinity Bottom Tube with Angle Adapter, Amplifier, LEDs (4), Secondary Unit Connector Wire with Equipment Bonding Wire	(1)
6 Effect Lens	(1)
7 Diffuser	(1)
8 Seal and Fasteners	
a. Dome Ring Screws - #8 X 1 in (25 mm)	(5)
b. LightTracker™ Reflector	(1)
c. Flashing Screws - #10 X 2 in (51 mm)	(8)
d. Roof Sealant	(1)
e. Expansion Joint Seal	(1)
f. Tube Screws - #8 X 9/16 in (14 mm)	(10)
g. Foil Tape - 2 in (51 mm) X 18 ft (5.5 m) roll	(1)
h. Drywall Screws - #6 X 1 5/8 in (40 mm)	(4)

*Components shown not included in all kits, see label on box.

†High Velocity Hurricane Zones: Shock Inner Dome must be installed with dome. To meet HVHZ requirements, use a six inch no pitch flashing or a pitched flashing with a four inch turret extension.

2 For the most current Installation Instructions, please visit www.solatube.com/instructions

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WARNING

 **Do not proceed with the installation until you have read the entire instructions, including these warnings. (Use of materials or methods not authorized by Solatube International will result in an invalid warranty.)**

Solatube International, Inc. (seller) assumes no responsibility or obligation whatsoever for the failure of an architect, contractor, installer, or building owner to comply with all applicable laws, ordinances, building codes, electrical codes, energy codes, fire and safety codes and requirements, roof warranties and adequate safety precautions. Installation of this product should be attempted only by individuals skilled in the use of the tools and equipment necessary for installation. Protect yourself and all persons and property during installation. If you have any doubt concerning your competence or expertise, consult a qualified expert before proceeding.

Install at your own risk!

Solatube product installations may be dangerous and include the potential for death, personal injury and property damage. The hazardous conditions include but are not limited to the following:

- **During installation, the Solatube Daylighting System's reflective tubes may focus sunlight, causing intense heat or fire. Remove protective film only after the parts have been installed. Prior to and during installation, do not leave tubes in contact with combustible materials or unattended, especially near direct sunlight. Avoid skin burns.**
- Solatube Daylighting System and Solar Star products may have sharp edges. Always wear leather or canvas gloves while handling and installing products.
- Solatube product installations require climbing and working at dangerous heights, including on ladders, scaffolding, roofs and in attic spaces. Risk of death, personal injury and property damage may result from a fall, or from falling objects. Use extreme caution to minimize risk of accidental injury, including, but not limited to the following procedures:
 - Clear area below your work space of all people, animals and other items.
 - Avoid working on surfaces that are slippery or wet.
 - Use foot-wear with excellent traction.
 - Use only strong, well supported ladders.
 - Work only in calm dry weather.
 - When in the attic, ensure that your weight is supported at all times with structurally sound framing; drywall material is not designed to carry a person's weight.
- To reduce the risk of fire, electric shock, and personal injury, basic safety precautions should always be followed when using electric tools, including always wearing safety goggles or other suitable eye protection, and ensuring work area is clear of all electrical wires, gas pipes, water pipes, and other obstacles.
- When working in the attic or other dusty areas, use of a mask or respirator is recommended to avoid lung irritation. Attic spaces may be dark, confined, and subject to extreme temperatures. Beware of sharp protruding objects. Do not attempt installation without having someone within range of your voice or close enough to come to your aid if necessary.
- Solatube products are not designed to withstand the weight of a person, tools or other objects. Walking or placing objects on the system could cause personal injury and property damage. If the product is damaged, the structural capacity may be weakened; therefore the system should be repaired immediately. For safe installation and use, do not deviate from these installation instructions.
- Additional support is recommended for long vertical and all horizontal tube runs. Review local building requirements and consult with appropriate building code official for proper material and placement of additional support. Avoid galvanic reaction (corrosion) if dissimilar metals are used.

Electrical Components

- Before installing, servicing, or cleaning unit, switch power off at service panel and lock service panel to prevent power from becoming switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device such as a tag to the service panel.

Re-Roofing

- Solatube products require special care if removed for re-roofing. In order to ensure proper removal and re-installation, please contact your Solatube International representative.

Please refer to the installation tips for the appropriate product below:

Daylighting Systems Installation Tips

These instructions are a step-by-step guide for the installation of a Solatube Daylighting System in the following conditions. For other roof types, please contact your Solatube International representative for additional information.

Built Up Flat Roof - Single Ply/Membrane - Asphalt Shingle - Low/No Pitched - Pitched - Prefabricated Curbs - Metal Roof Panels

For the most current Installation Instructions, please visit www.solatube.com/instructions

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Daylighting Systems Installation Tips (Continued)

- Allow at least 2-3 hours for the installation, particularly if this is your first installation.
- During the day, turn off all the lights in the room to see how much natural light comes in through the windows, and determine the best position for the Solatube Daylighting System. To light a specific area, place the system over the area, not in the center of the room. This will prevent the desired area from being shaded by tall objects in the room.
- Measure the distance between the roof and the ceiling. If you don't have enough tubing, contact your Solatube International representative for additional tubing.
- Avoid roof locations shaded by trees, ridges and chimneys, or near water channels or valleys. Also avoid roof areas with obstructions such as fire sprinklers, HVAC equipment, gas, water or drain pipes, air ducts or flues and make sure that the roof is adequate to endure an installation without damaging its waterproofing properties or weakening the building structure.
- All adhesives, seals and tapes are recommended to be applied to a clean and dry surface at a minimum of 70°F (21°C) for maximum performance.
- Foil tape contains a pressure sensitive adhesive and pressure must be applied at all seams for proper bonding. Foil tape is not intended for use as structural support of the extension tubes. For structural integrity use manufacturer supplied fasteners on all overlapping extension tube joints.

Daylight Dimmer Installation Tips

- Install Solatube Daylight Dimmer only on a properly aligned Solatube Daylighting System.
- Use only UL recognized components approved for this listing.

Smart LED Installation Tips

500000 Series—Solatube Recessed Smart LED						
Configuration	Suitable for Operation in Ambient Temperature not Exceeding	Input Voltage	Frequency	Max. Current	Output Voltage	Max. Wattage
Primary Only (Part No. 500000)	50°C	100-240 V	50-60 Hz	0.27 A	26 Vdc	17 W
Primary (Part No. 500000) with Secondary (Part No. 500005)	45°C	100-240 V	50-60 Hz	0.55 A	26 Vdc	32 W

- This product is to be installed by qualified electricians only. Disconnect power before installation.
- The Solatube Smart LED is only intended for installation with the Class 2 driver supplied with the product.
- The maximum number of luminaires that can be connected to the Class 2 driver is one Primary Smart LED and one Secondary Smart LED.
- Minimum height from the base of the Luminaire assembly to the roof line of the Dome assembly shall be no less than 16 inches.
- Type IC Recessed—Inherently Protected (insulation may contact housing).
- Access above ceiling required.
- Not for use in fire rated installations.
- For use in one or two family dwellings only.
- Not for use in environmental air handling spaces.
- The Dome assembly is Suitable for Wet Locations.
- The Diffuser assembly is Suitable for Damp Locations.
- For supply connections use wires rated for at least 70°C
- Not for use with dimmers (e.g. dimming switches)
- Use only with Solatube Classic Vusion (L4), OptiView (L11), JustFrost (L9), TierDrop (L10), AuroraGlo (L13), VividShade (L12), Quadrafrost (L14) Trims.

Caution

- Risk of fire and electrical shock. Most dwellings built before 1985 have supply wire rated 60° C.

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Solatube Smart LED System Operation

This section describes the behavior of the Solatube Smart LED Daylight Sensor and the optional Occupancy Sensor.

The Solatube Smart LED System comes equipped standard with a Daylight Sensor, and optional Occupancy Sensor.

- **Solatube Smart LED System and Wall Switch Functionality**
 - The wall switch must be in the “on” position for the LEDs to function.
 - The wall switch in the “off” position will override both sensors, preventing the LEDs from turning on.
- **Solatube Smart LED System with Daylight Sensor only**
 - The Daylight Sensor is a standard feature in all models that continuously monitors light levels. When the wall switch is in the “on” position, the LEDs will turn on immediately when daylight levels are insufficient. The Daylight Sensor will continue checking light levels until daylight levels remain sufficient for a period of 5 minutes. After the 5 minute period, the LEDs will turn off. The Daylight Sensor continues monitoring light levels unless the wall switch is in the “off” position.
- **Solatube Smart LED System with Daylight Sensor and Occupancy Sensor**

When installed with the optional Occupancy Sensor the LEDs will not turn on unless the following three conditions are all met:

 - The wall switch is in the “on” position.
 - The Occupancy Sensor detects an occupant within its range.
 - The Daylight Sensor detects insufficient light levels.
 - Example 1: If the Daylight Sensor detects insufficient light but the Occupancy Sensor does not detect an occupant in its range the LEDs will not come on.
 - Example 2: If the Occupancy Sensor detects an occupant but the Daylight Sensor detects sufficient light levels the LEDs will not come on.
 - Once the LEDs have been turned on, both the Daylight Sensor and Occupancy Sensor will continue to monitor their individual functions until one of them detects a change such as increased light level or the occupant leaves. Either one of these changes must remain constant for 5 minutes for the LEDs to turn off. The cycle starts over at that time.
 - Both sensors must detect a change to turn the LEDs on, but only one sensor needs to detect a change to turn them off.



Solatube Smart LED System Check with Daylight Sensor Only

Prior to system check ensure the wall switch is in the off position and all power is off before attaching the DC connector to the primary unit to prevent damage to the Solatube Smart LED System.

The following system checks should be performed to verify proper functionality of the system. If any failures occur during the system check verify all electrical connections and repeat system check.



When testing the Solatube Smart LED System use care to prevent damage to the Daylight Sensor and the Light Optimization Lens. Use caution when handling Amplifier to prevent damage to reflective material.

Do not use tape or adhesives to cover the Daylight Sensor to prevent damage.

- Once installed follow the directions below according to the outside light conditions.
- For bright, sunny conditions (LEDs off) cover the Daylight Sensor with the Daylight Sensor Cover to trigger LEDs. See example shown on next page.
- Remove the Daylight Sensor Cover and wait for approximately 5 minutes. If daylight levels remain sufficient during this period the LEDs will turn off.
- For cloudy, overcast conditions (LEDs on) shine a bright light onto the top of the Daylight Sensor for approximately 5 minutes and the LEDs will turn off.

For the most current Installation Instructions, please visit www.solatube.com/instructions

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Solatube Smart LED System Check with Daylight Sensor & Occupancy Sensor

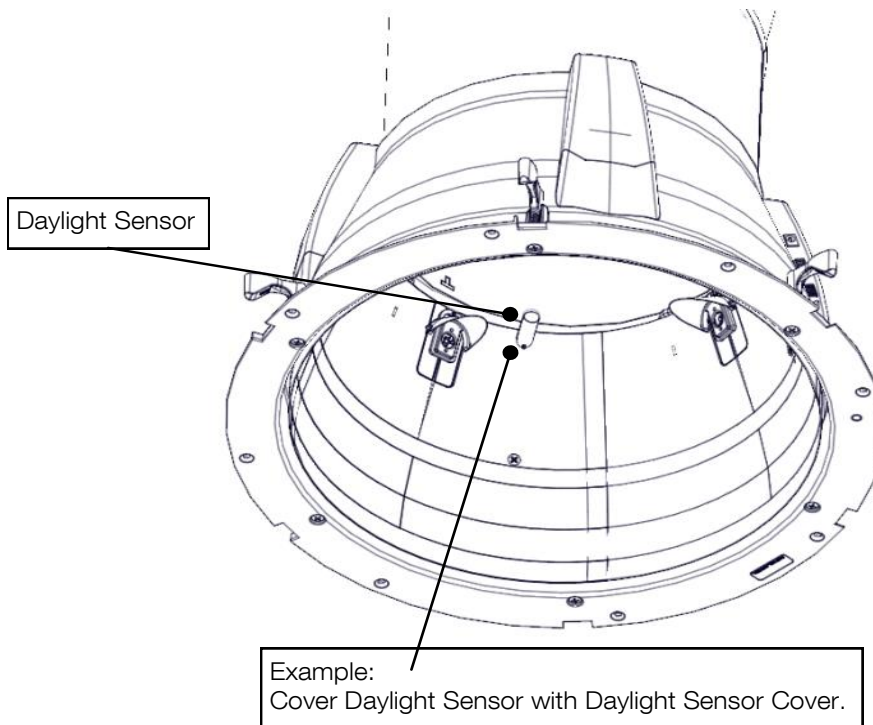
Prior to system check ensure the wall switch is in the off position and all power is off before attaching the DC connector to the primary unit to prevent damage to the Solatube Smart LED System.

For optimum Occupancy Sensor functionality perform the following system check in the order specified.

- Step 1: Test Occupancy Sensor (Occupied Space)
 - Ensure the wall switch is in the off position.
 - Leave the provided Daylight Sensor Cover in place.
 - Switch the wall switch to the “on” position and walk into the range of the occupancy sensor.
 - The LEDs will turn on.

- Step 1a: Test Occupancy Sensor (Unoccupied Space)
 - Exit space and stay out of the range of the occupancy sensor for approximately 5 minutes.
 - The LEDs will turn off.

- Step 2: Test Daylight Sensor
 - Wall switch remains in “on” position.
 - Walk into the range of the occupancy sensor.
 - The LEDs will turn on.
 - Remove Daylight Sensor Cover.
 - If bright, sunny conditions are present the LEDs will turn off in approximately 5 minutes.
 - If cloudy, overcast conditions are present shine a bright light onto the top of the Daylight Sensor for approximately 5 minutes.



6

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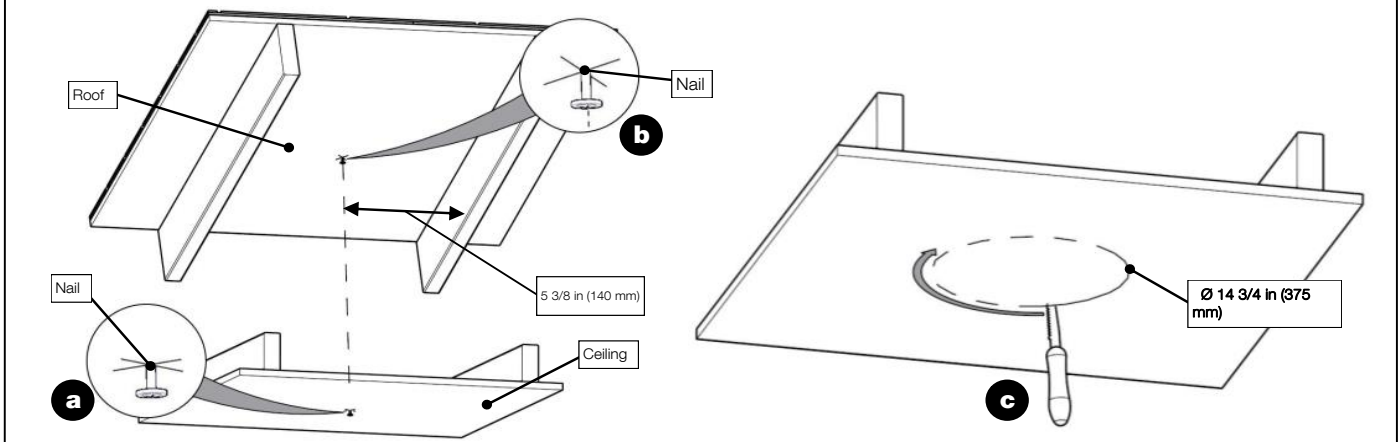
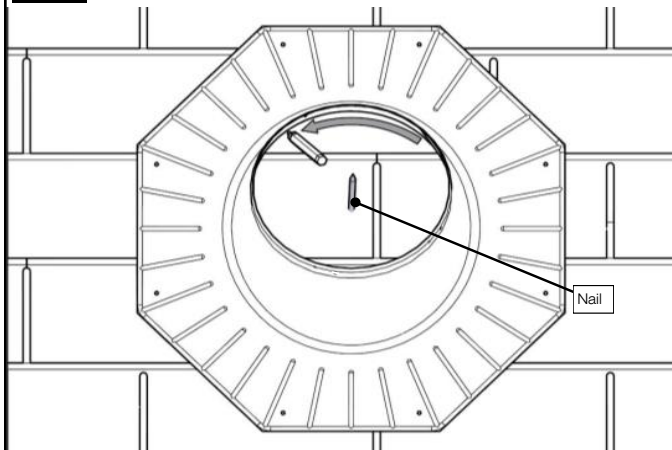
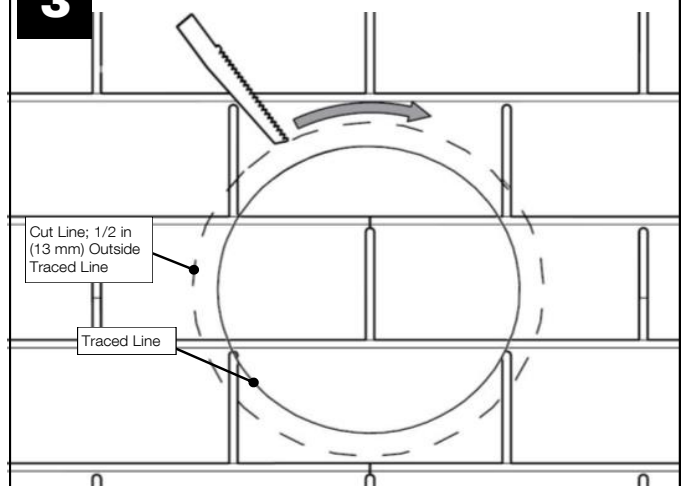
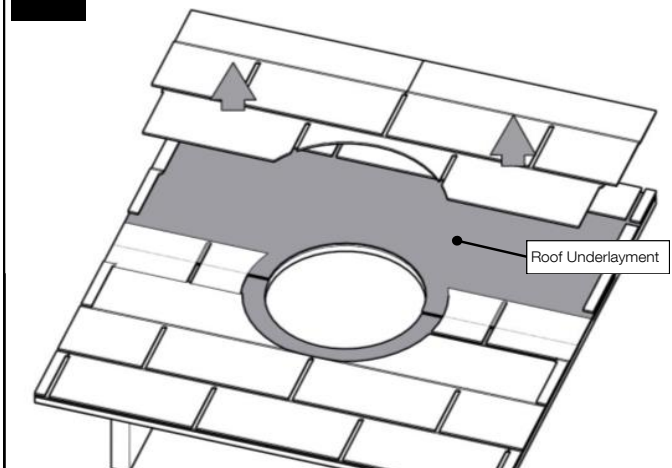
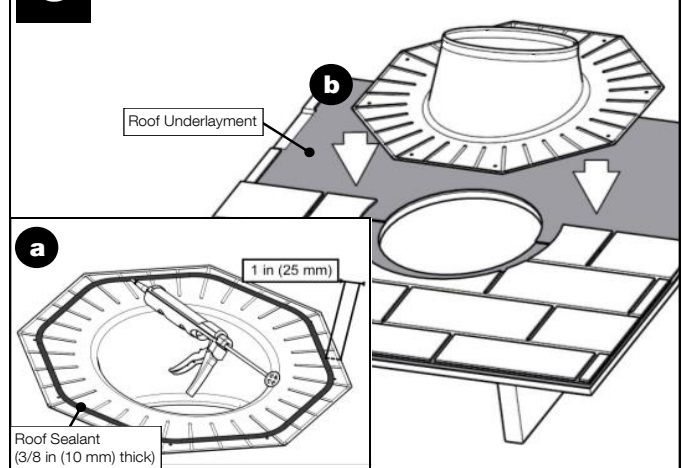
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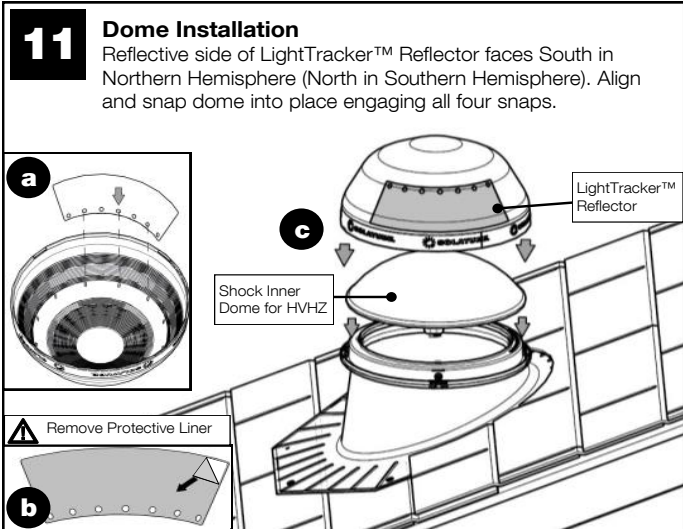
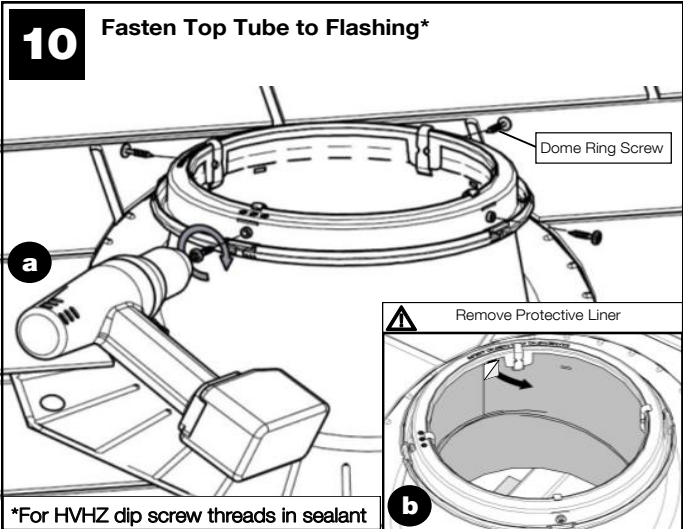
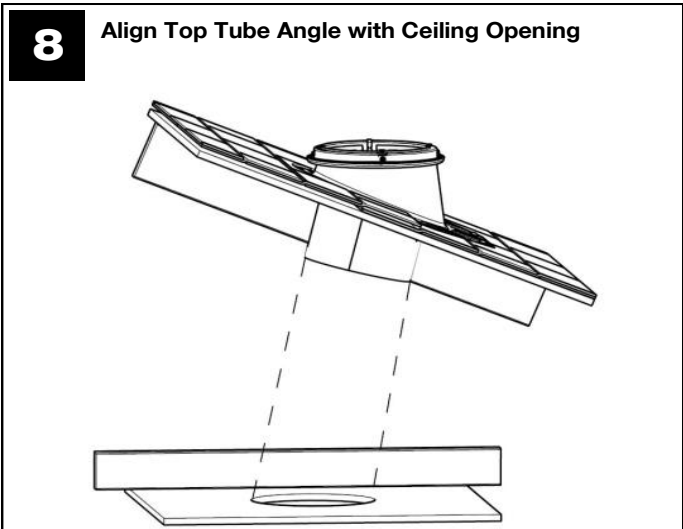
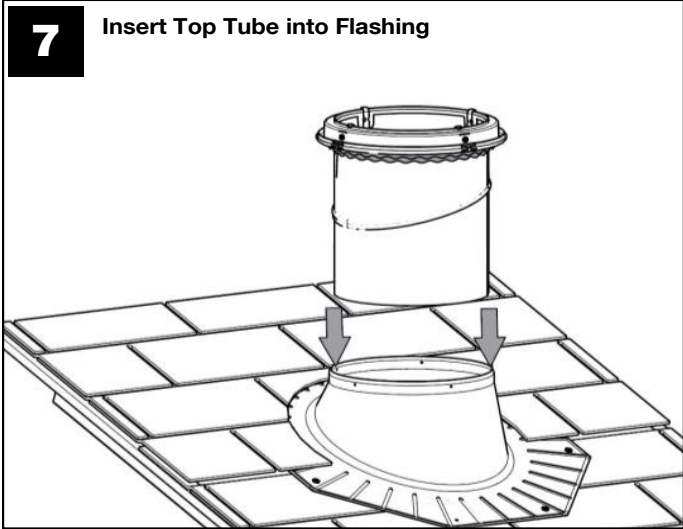
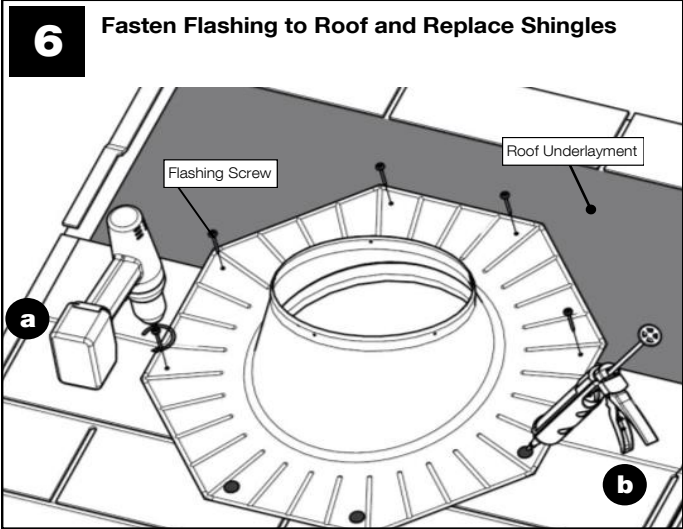
1**Mark Ceiling and Roof Location Between Joists and Rafters Using Nails. Cut Ceiling Hole.**

Minimum clearance of 5 3/8 in (140 mm) between nail hole center and joist.

**2****Center on Nail and Trace Inside Flashing Base****3****Cut Roof Opening****4****Remove Roof Shingles****5****Set Flashing**For the most current Installation Instructions, please visit www.solatube.com/instructionsSolatube International, Inc. | 2210 Oak Ridge Way | Vista, CA 92081-8341 | www.solatube.com | T: 888.SOLATUBE**7**

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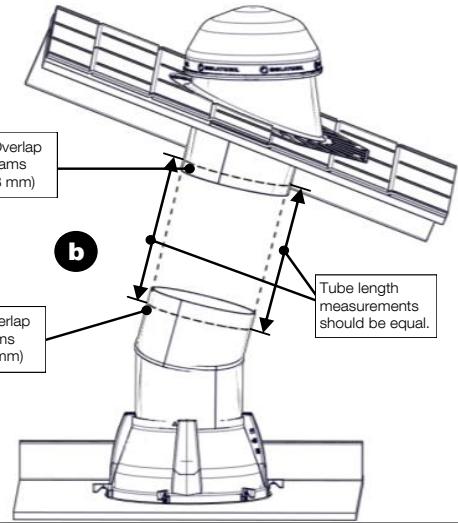
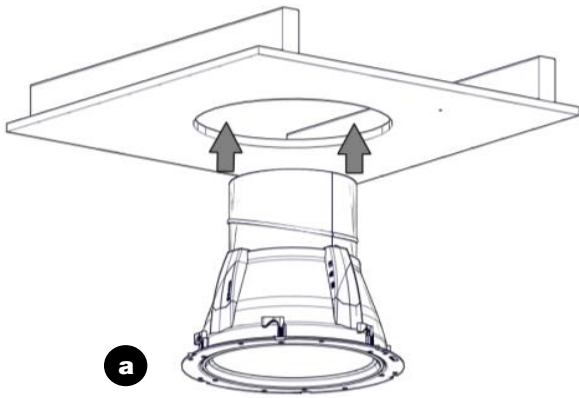
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12

Insert Luminaire Assembly

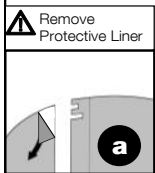
Align and measure tube run.



13

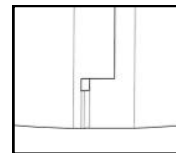
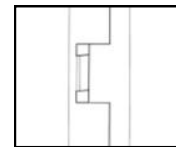
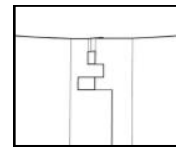
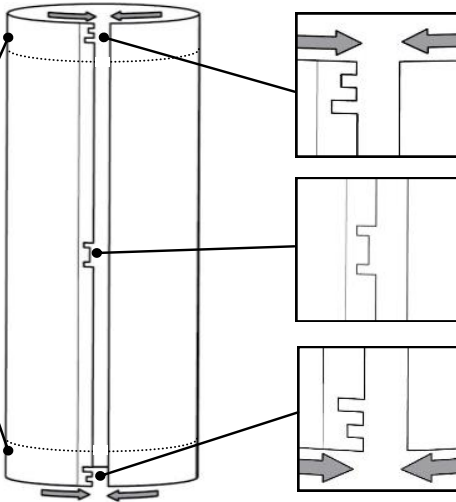
Assemble Tube Run

Use notches to create a tapered tube.



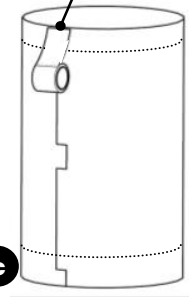
Printed 2" Overlap Markings

b



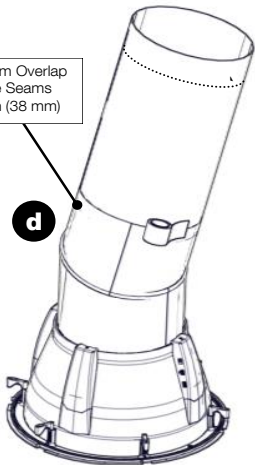
Apply pressure to tape for proper bonding

c

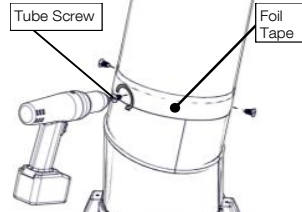


Minimum Overlap at Tube Seams 1 1/2 in (38 mm)

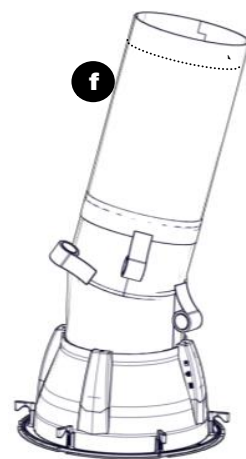
d



e



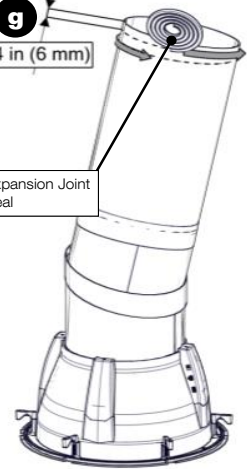
f



1/4 in (6 mm)

g

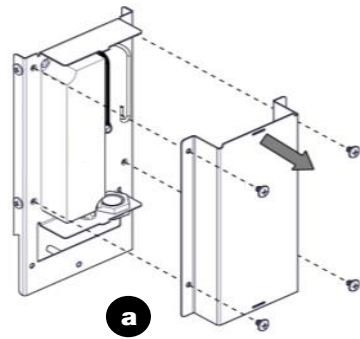
Expansion Joint Seal



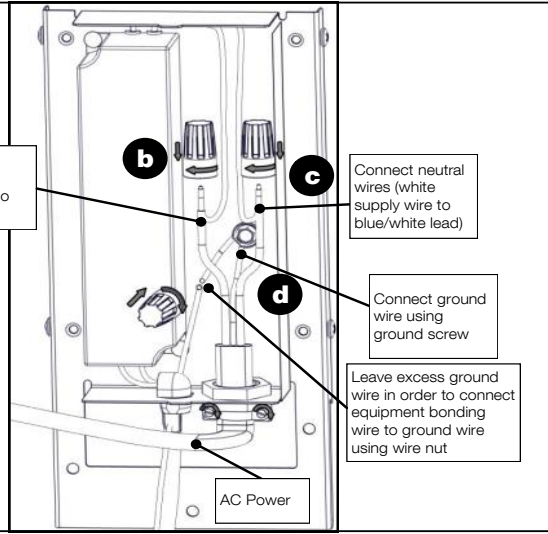
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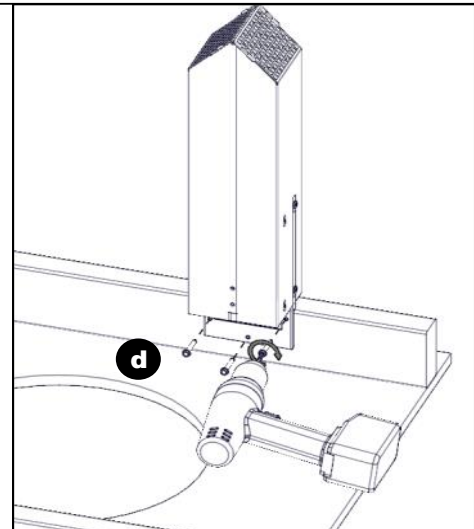
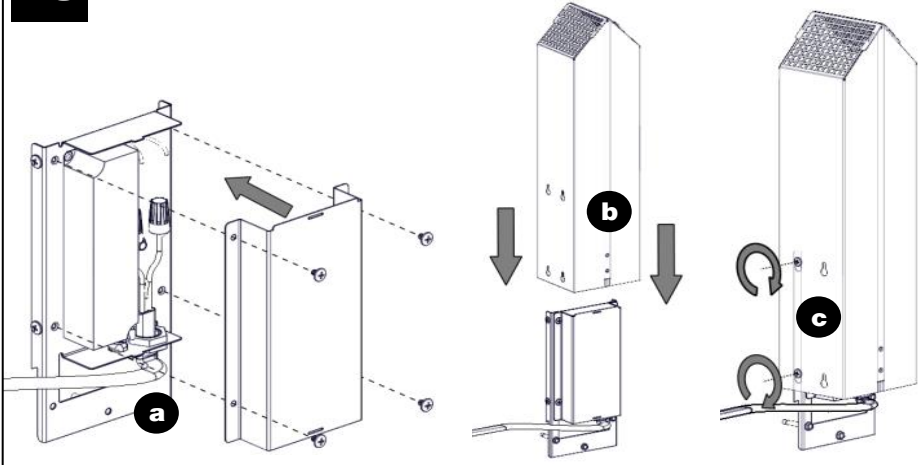
14 Remove Junction Box Assembly Cover and Connect Power



*This step applicable to Primary unit only.

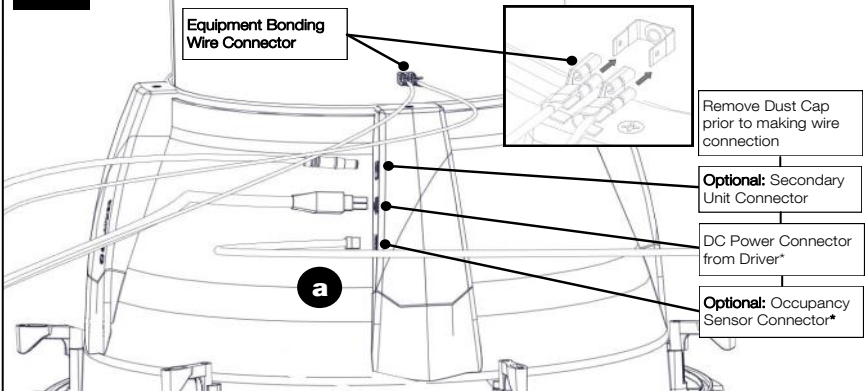


15 Fasten Junction Box Mounting Bracket to Structural Member



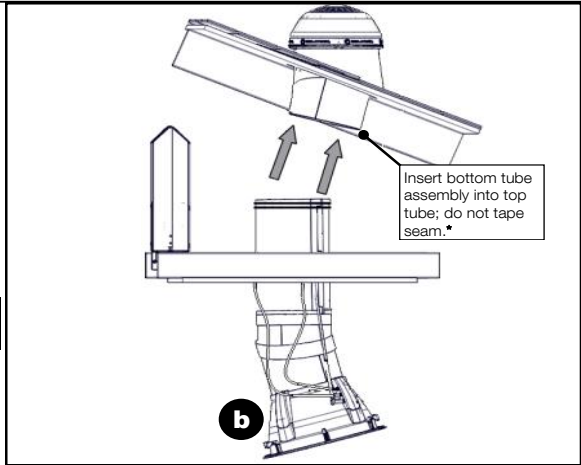
16 Attach DC Connector to Primary Unit and Install Tube Run*

See Alternative Installation for Secondary Unit Connection



*Ensure wall switch is in the off position and power is off before attaching the DC connector to the primary unit.

*Occupancy Sensor Instructions Provided in Appendix Section



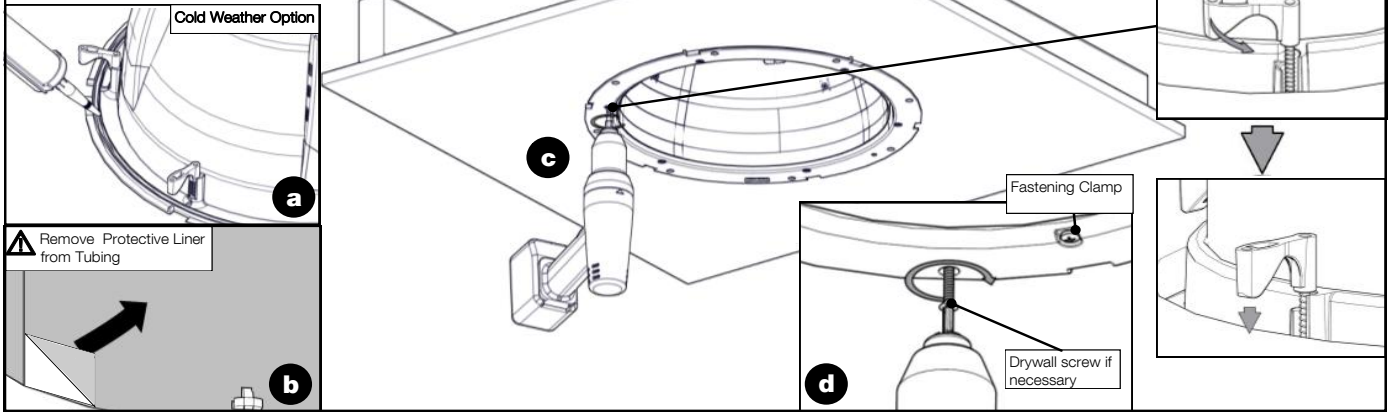
*Tape seam for commercial install with suspended ceiling or for installs in the HVHZ.

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17

Fasten to Ceiling

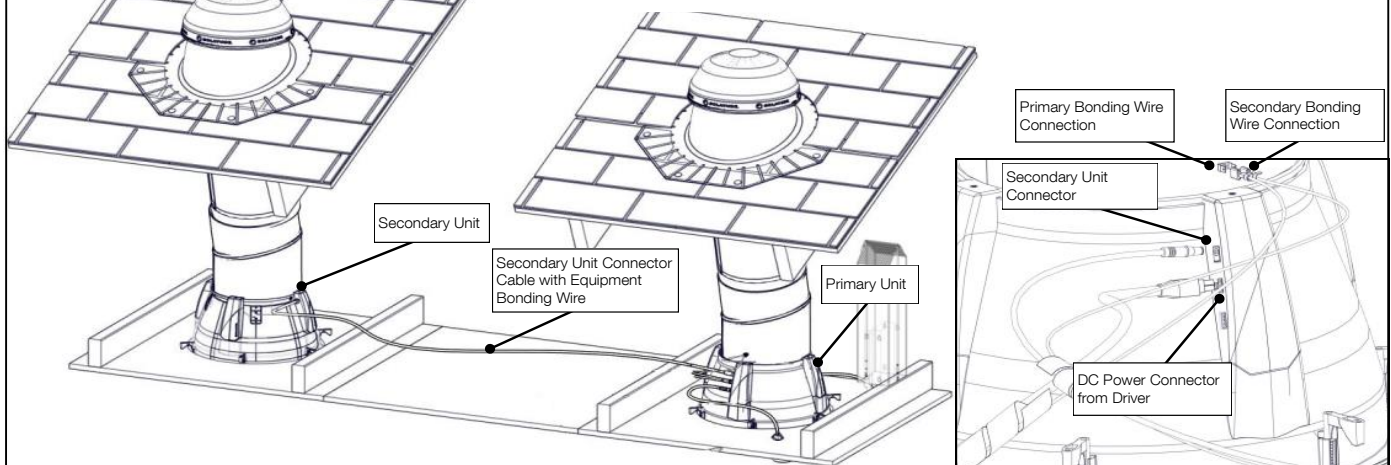
Use drywall screws if fastening clamps do not engage ceiling. For cold weather climates, apply latex caulking to ceiling ring to minimize air transfer.



Alternative Instructions for Secondary Unit

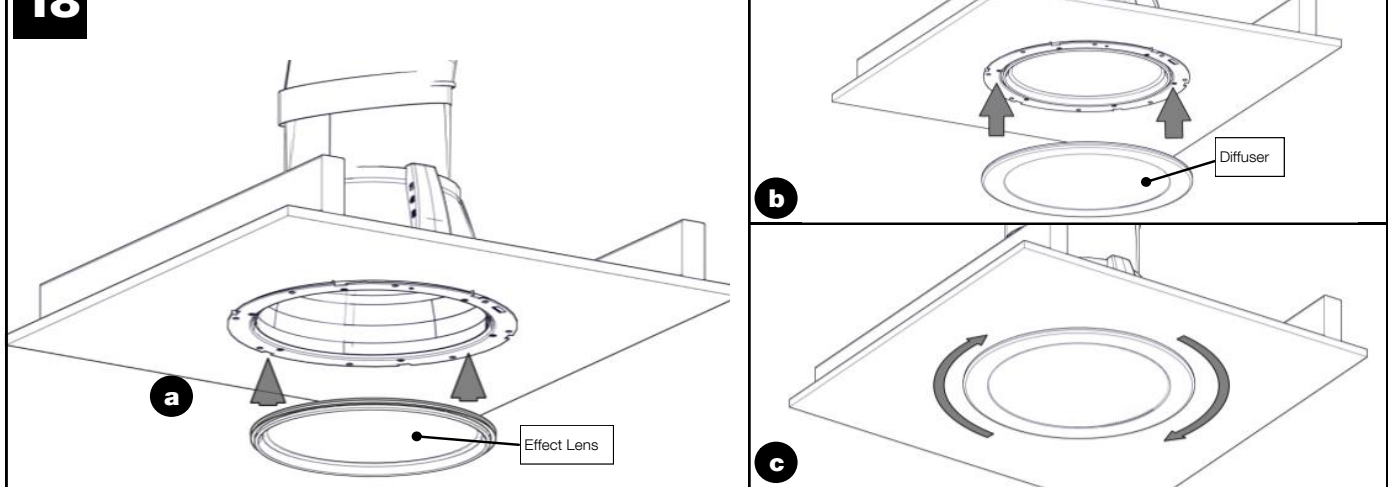
Connect to Primary Unit

Secondary Unit will be powered and controlled by Primary Unit.



18

Install Effect Lens and Diffuser



See Warning Section to Perform System Check

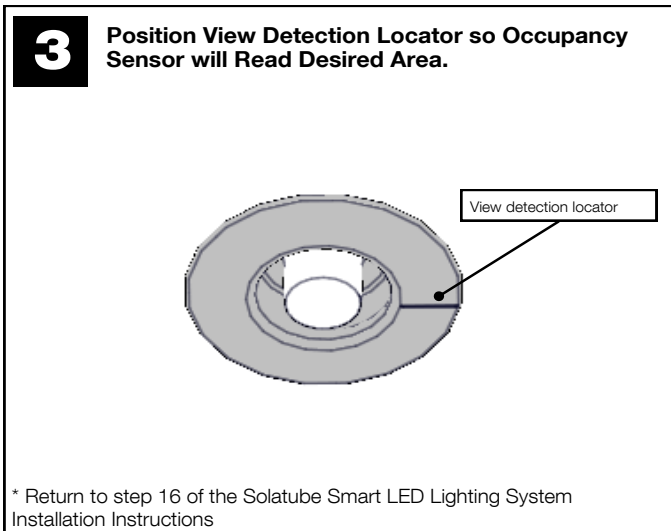
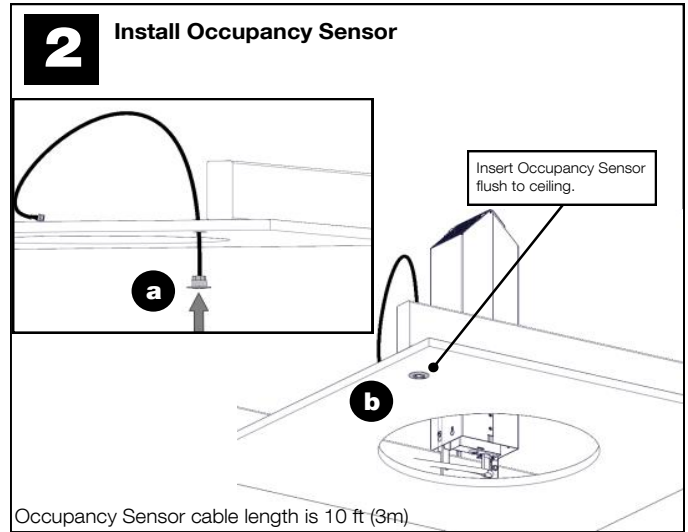
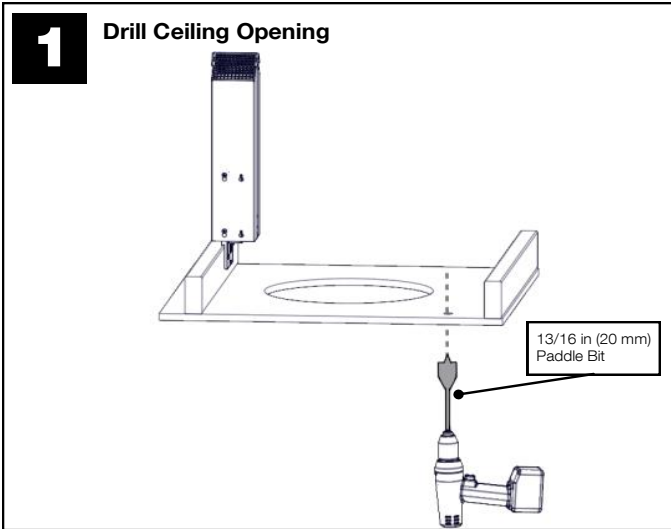
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Smart LED Occupancy Sensor Installation Instructions Appendix

Parts List	Quantity
1 Occupancy Sensor	(1)
* Max install distance from Occupancy Sensor to Primary Luminaire Housing is 10 ft (3m)	
For ease of connection, install Occupancy Sensor prior to installing tube run.	

Additional Materials and Tools	Quantity
1 Paddle Bit 13/16 in (20 mm)	(1)



* See Solatube Smart LED Warning section for detailed system check and Best Practices section for installing and positioning the Occupancy Sensor.

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Smart LED Occupancy Sensor Installation Instructions Appendix

The ideal location for the Solatube Smart LED System Occupancy Sensor is in a ceiling area that provides a full view of the space with an unobstructed path to the entrance way(s), but out of view from hallway or adjacent room traffic. The sensor should be positioned well away (about 6 feet) from HVAC registers to prevent false triggering.

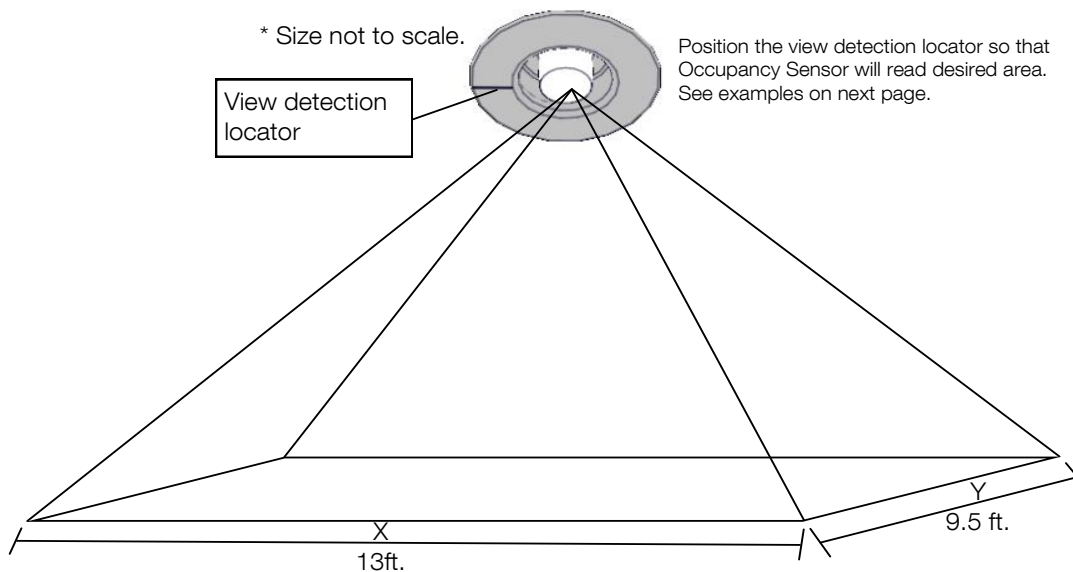
Enclosed Zones	Bathrooms	Locate directly inside and above the door header or position where the Sensor cannot "see" out through an open doorway.
	Closets	
Open Zones	Hallways	Centrally locate to see in both directions (ie: top & bottom of stairs or both ends of hall) but positioned where the sensor cannot "see" movement in adjacent zones such as living rooms.
	Stair Landings	
	Entry Ways	
Task Areas	Offices	Locate within 4-feet above normal Work Position (ie: desk top, kitchen sink) but positioned where the Sensor is unlikely to "see" out through an open doorway; or in an "open kitchen" where the sensor cannot "see" movement in adjacent zones.
	Living / Recreation Rooms	
	Kitchens	
	Bedrooms	

Ceiling Height	X Range	Y Range
8 ft *	13 ft	9.5 ft
9 ft	13 ft	9.5 ft
10 ft	16.5 ft	13 ft
12 ft	13 ft	13 ft

Max depth reading from center of Occupancy Sensor to floor directly below is 16 ft.

* 8 ft Ceiling shown in diagram below.

Occupancy Sensor detection area with sensor installed in 8 ft. ceiling.

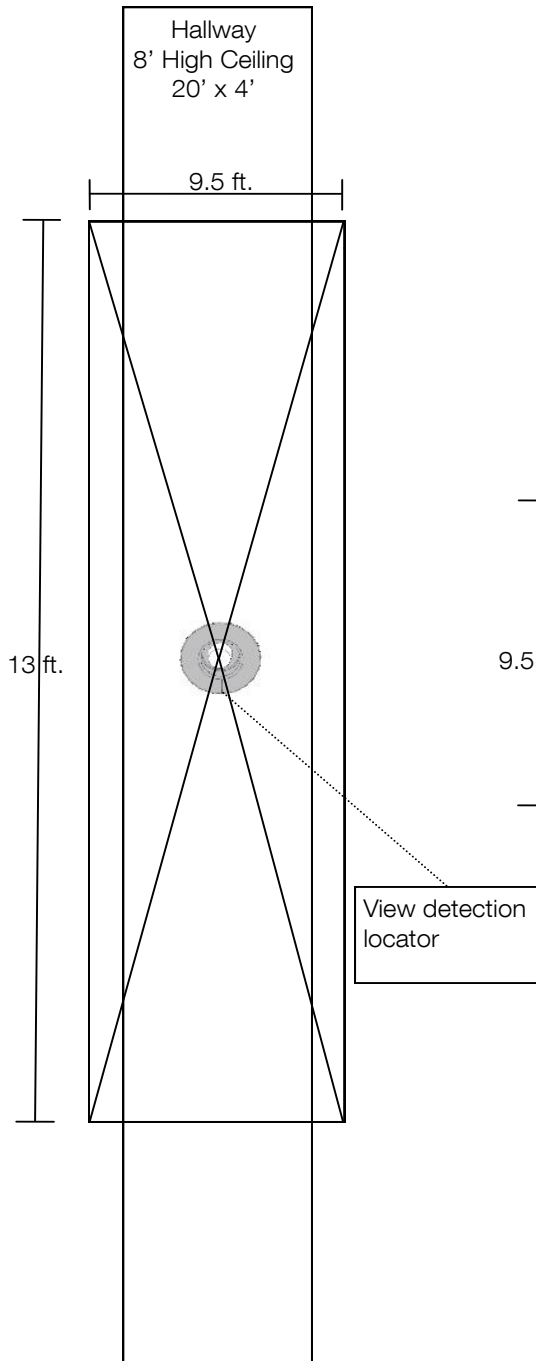


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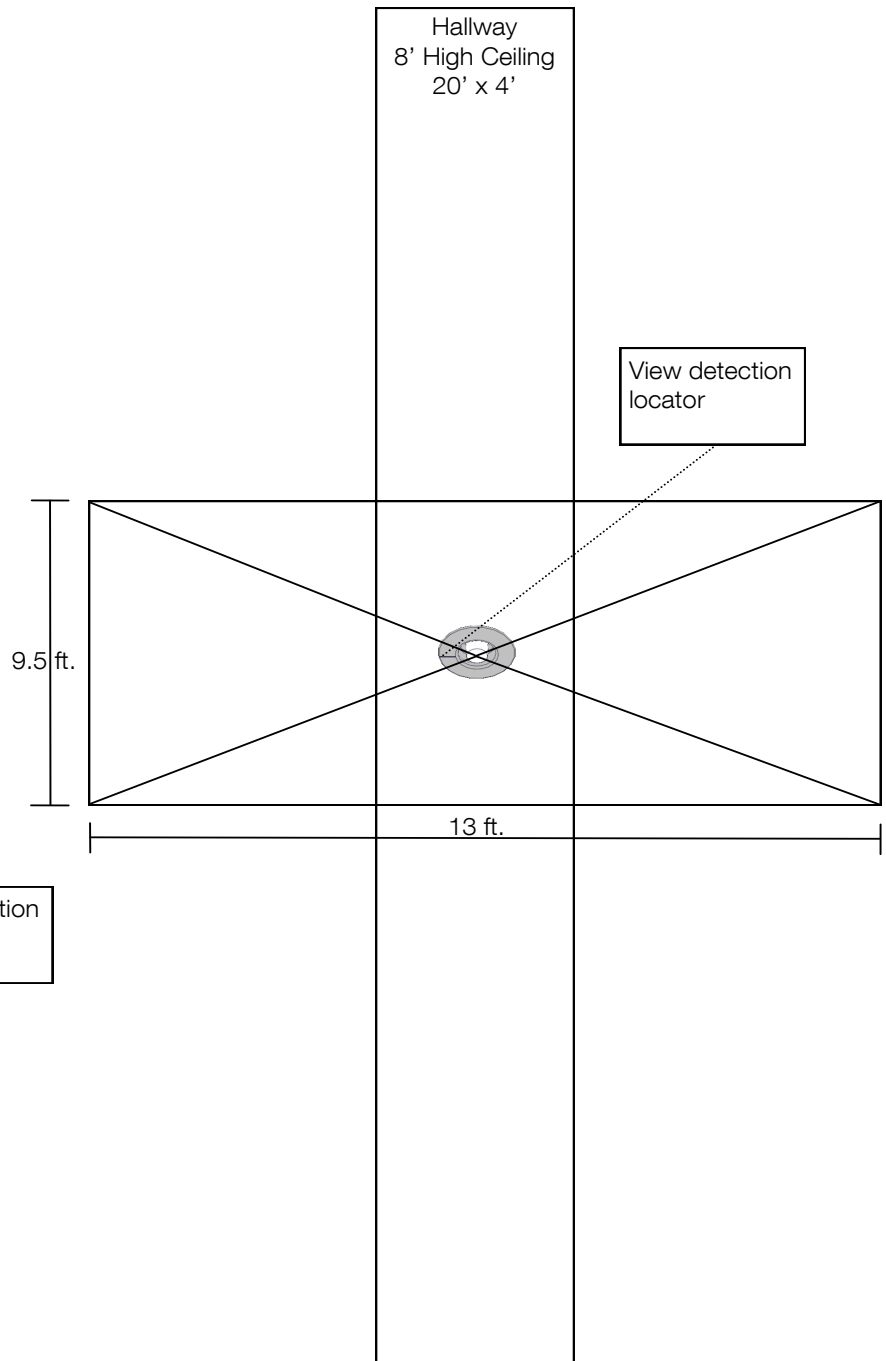
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Smart LED Occupancy Sensor Installation Instructions Appendix

Example of desired orientation of view detection locator.



Example of undesirable orientation of view detection locator.



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Universal Tile Flashing Installation Instructions Appendix

(with Base Flashing)

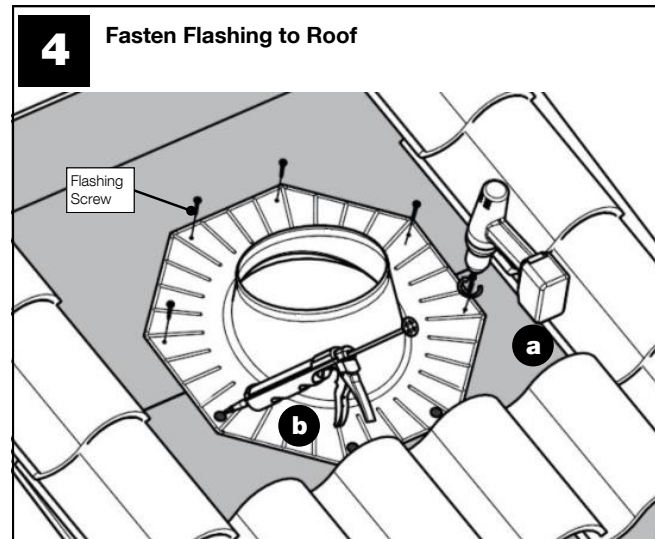
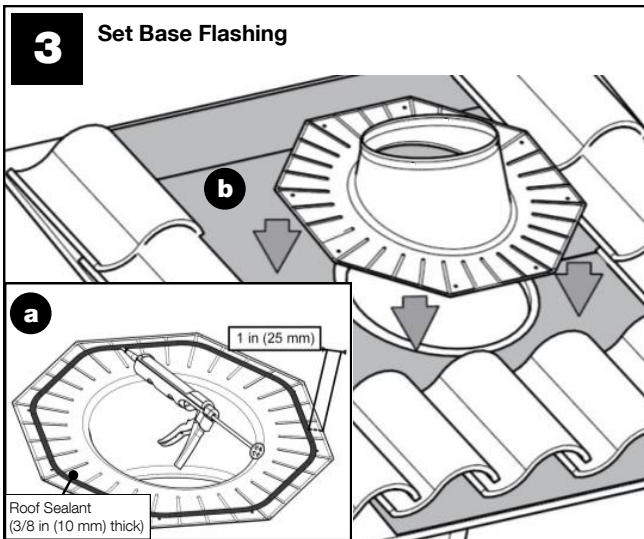
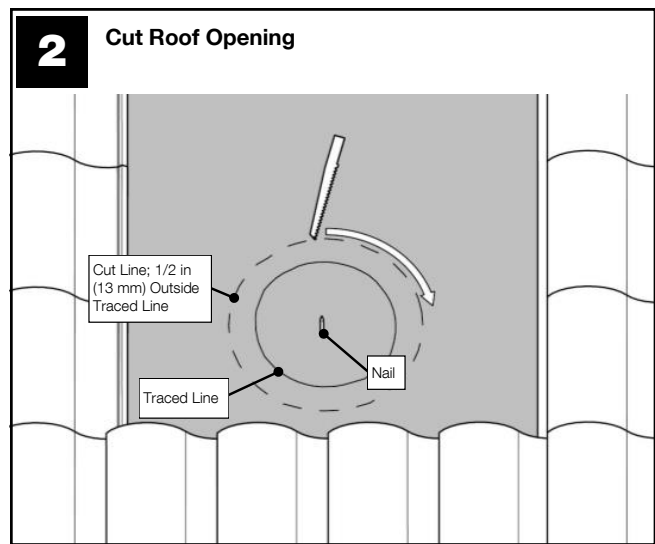
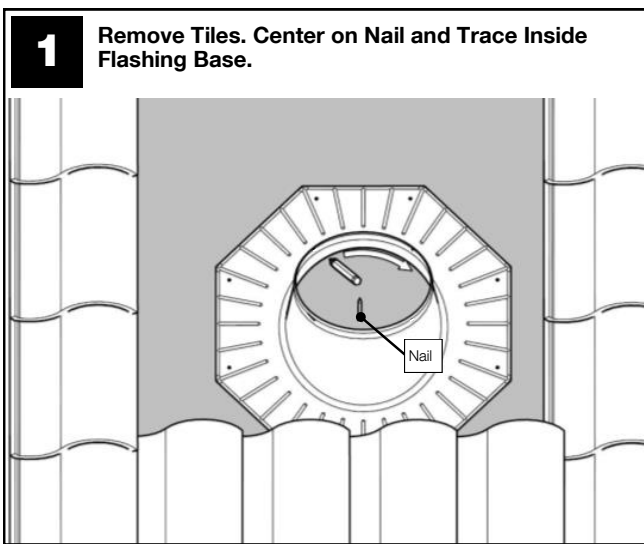
Parts List	Quantity
1 Tile Flashing (Pitched or No Pitch version)	(1)
2 Base Flashing (Pitched or No Pitch version)	(1)
2 Aluminum "L" bracket	(4)
3 #8 X 1/4 in (6 mm) screws	(8)

Additional Materials and Tools	Quantity
1 Roof Sealant	(1)
2 Flashing Screws—#10 X 2 in (50 mm) screws	(8)
3 Tile Grinder	(1)

Note: These instructions are for non-HVHZ areas only. Contact a Solatube International representative for recommendations in HVHZ areas.



Caution: The use of Portland Cement based mastic, grout, or alkaline materials will cause damage to the aluminum flashing.

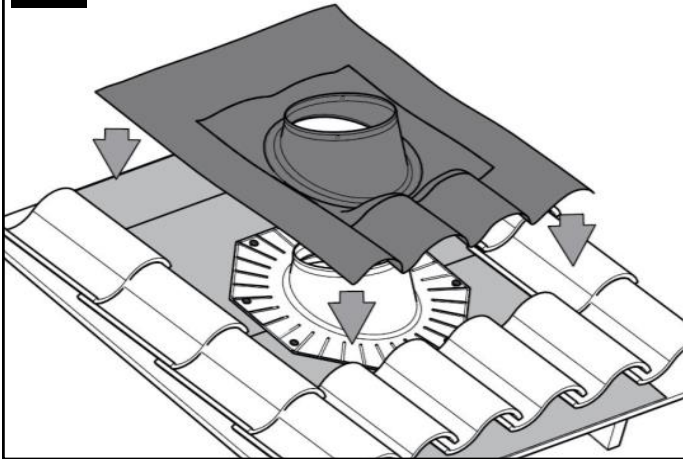
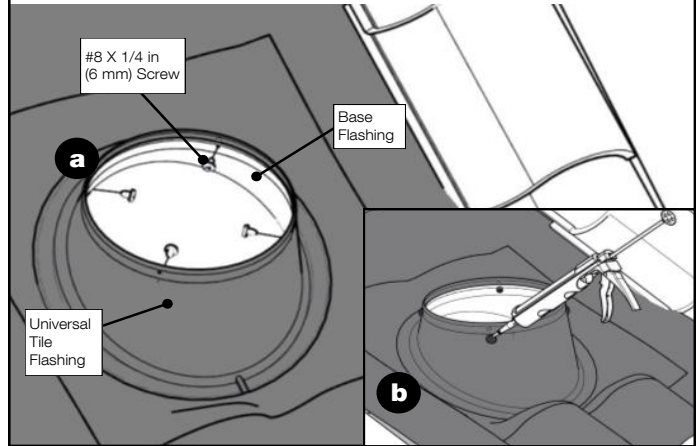
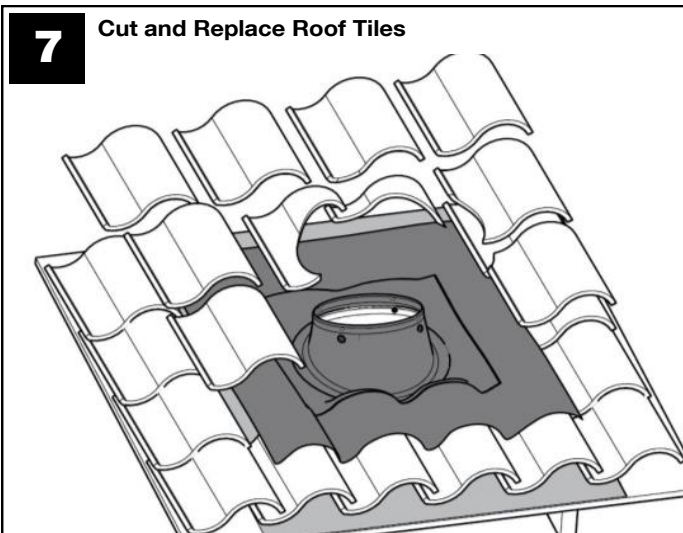
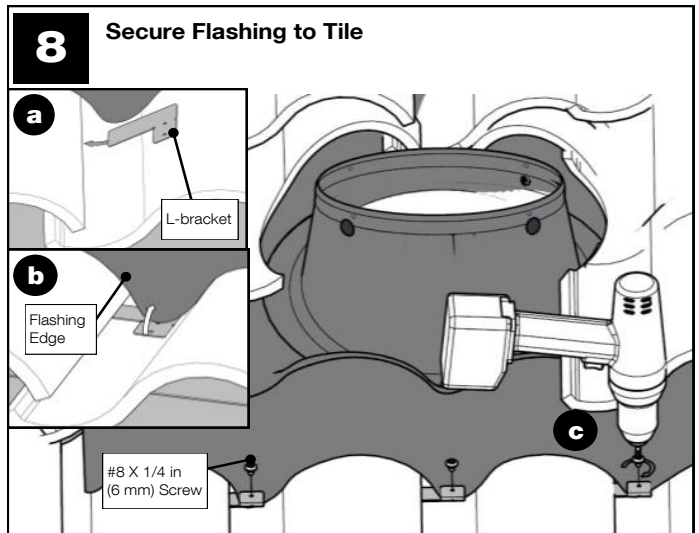


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5**Set Universal Tile Flashing**

Bend front edge of Universal Tile Flashing to fit shape of roof

**6****Fasten Universal Tile Flashing to Base Flashing****7****Cut and Replace Roof Tiles****8****Secure Flashing to Tile****16**For the most current Installation Instructions, please visit www.solatube.com/instructionsSolatube International, Inc. | 2210 Oak Ridge Way | Vista, CA 92081-8341 | www.solatube.com | T: 888.SOLATUBE

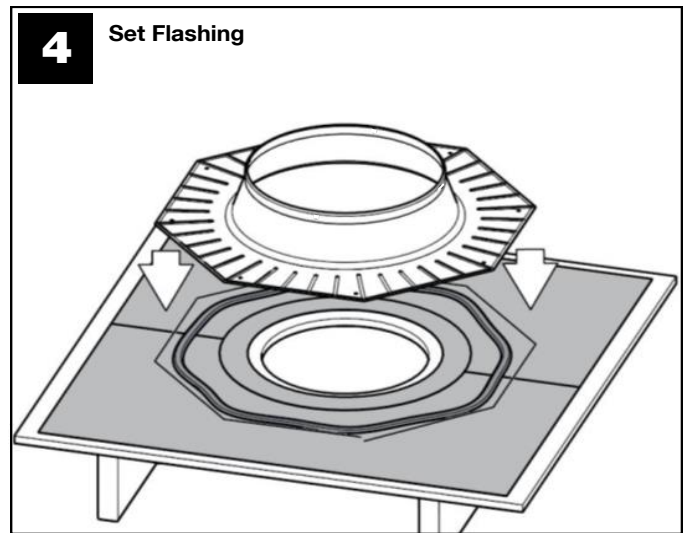
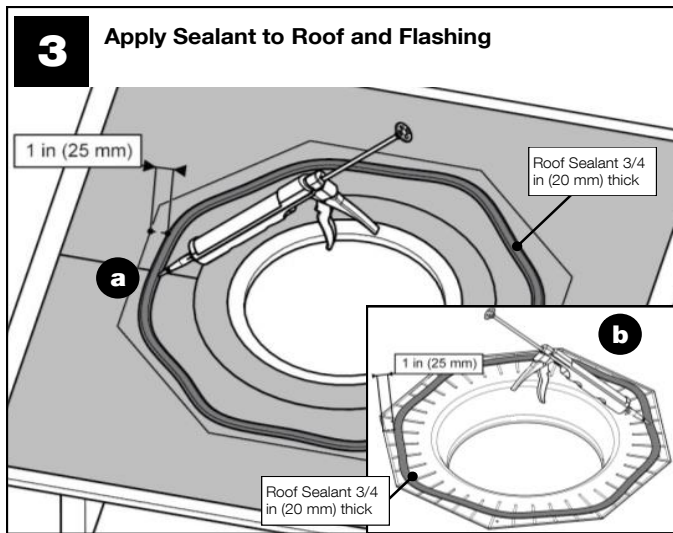
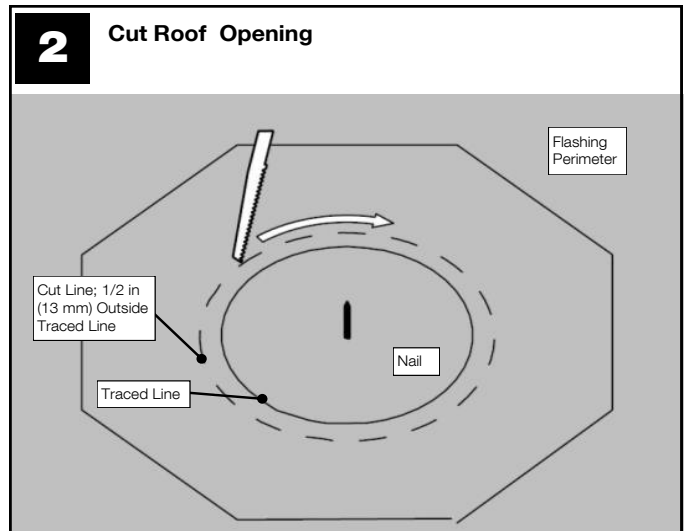
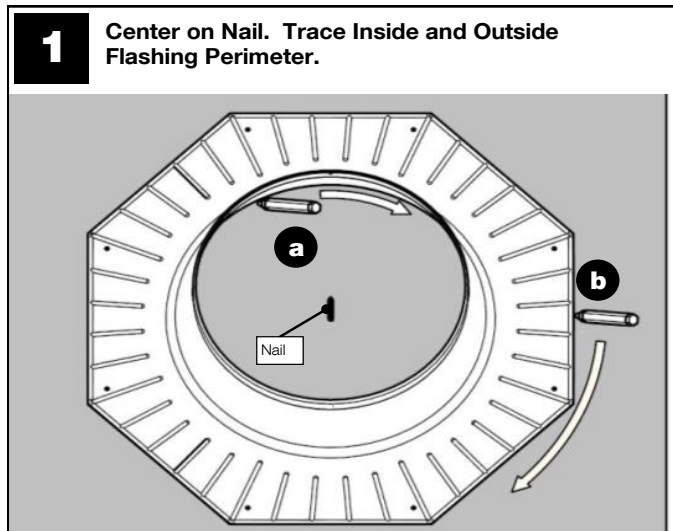
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Flat Roof Installation Instructions Appendix

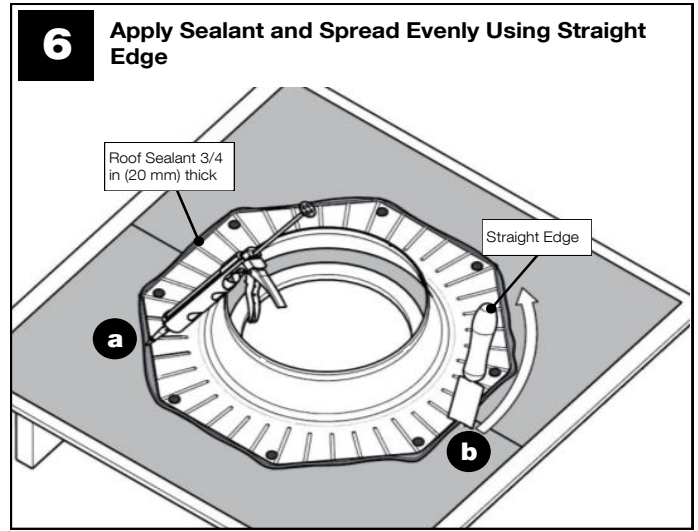
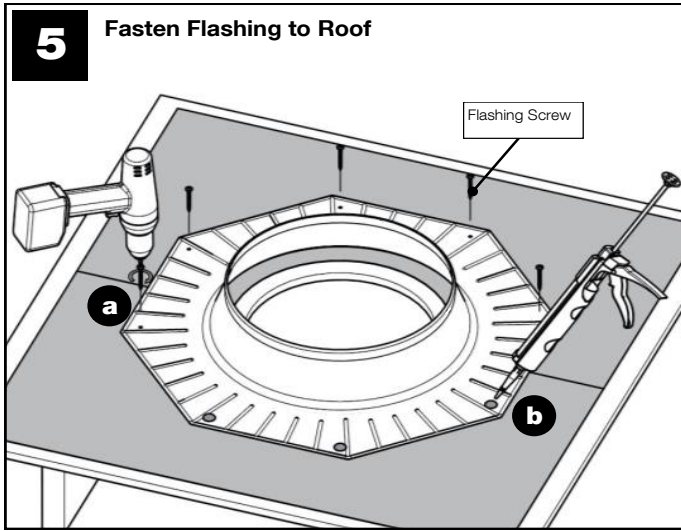
Parts List		Quantity
1	Roof Flashing (no pitch)	(1)
2	Flashing Screws - #10 X 2 in (51 mm)	(8)

Additional Materials and Tools		Quantity
1	Straight Edge	(1)
2	Roof Sealant	(1)



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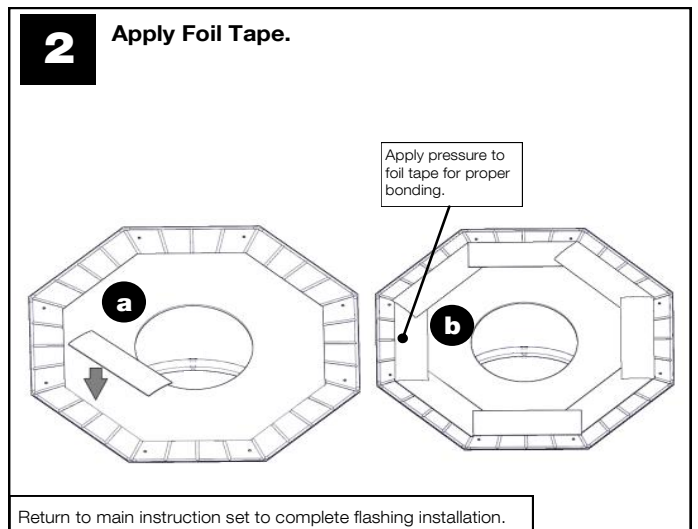
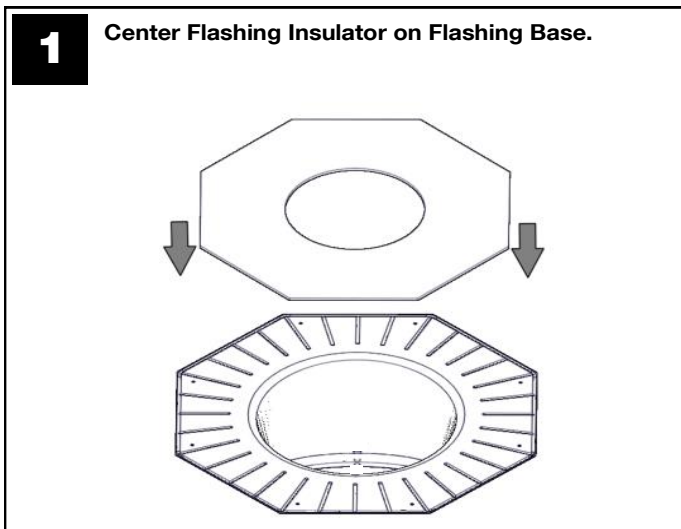


Flashing Insulator Installation Instructions Appendix

Parts List	Quantity
1 Flashing Insulator	(1)
2 Foil Tape	(8)

Warning: Do not expose Flashing Insulator to direct flame.

Additional Materials and Tools	Quantity
1 None	



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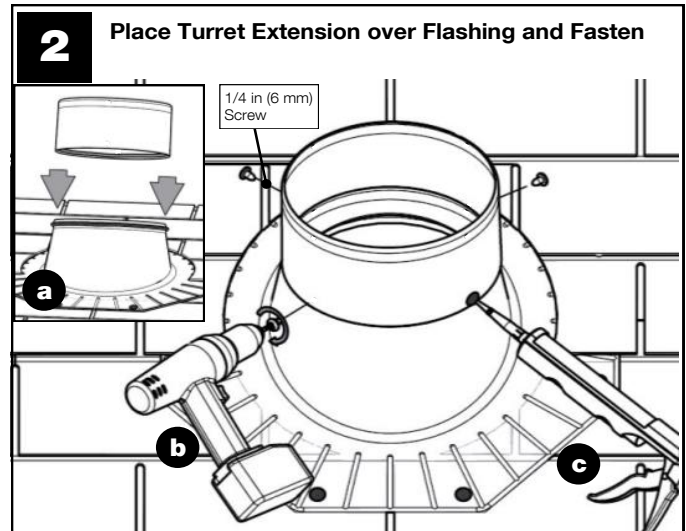
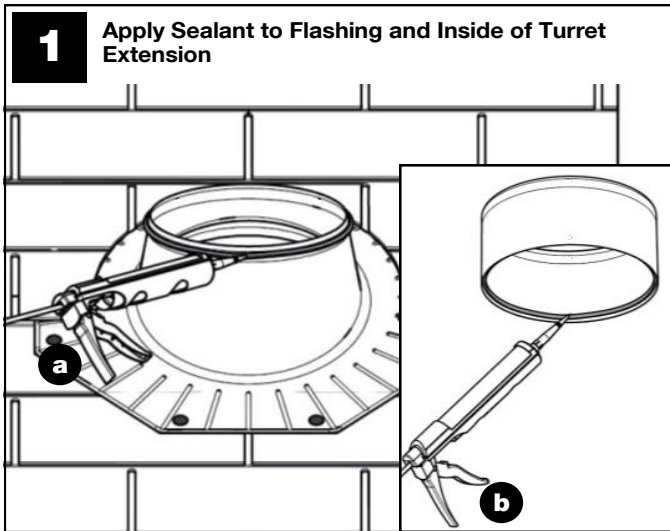
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Turret Extension Installation Instructions Appendix

Parts List		Quantity
1	Turret Extension 2 in (50 mm) or 4 in (100 mm)	(1)
2	1/4 in (6 mm) screws	(4)

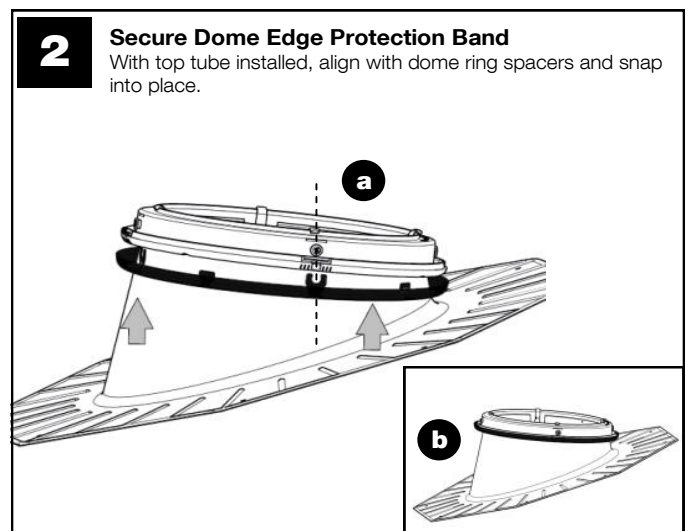
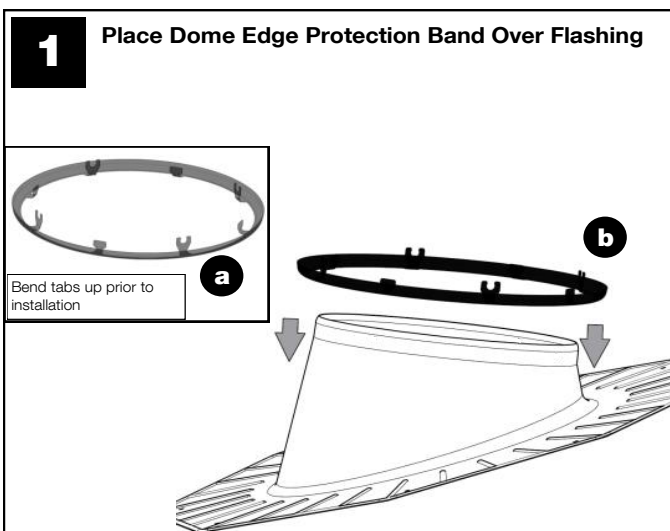
Additional Materials and Tools		Quantity
1	Roof Sealant	(1)



Dome Edge Protection Band Installation Instructions Appendix

Parts List		Quantity
1	Dome Edge Protection Band	(1)

Additional Materials and Tools		Quantity
1	None	



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0-90 Degree Extension Tube Installation Instructions Appendix

Parts List	Quantity
1 0-90 Degree Extension Tube	(1)
2 Tube Screws - #8 X 3/4 in (10 mm)	(4)
3 Foil Tape - 2 in (51 mm) X 6 ft (2 m)	(4)

Additional Materials and Tools	Quantity
1 None	

1 **Install 0-90 Degree Extension Tube**
 Install only between the top tube and an extension tube or two extension tubes.

Minimum overlap at tube seams
1 1/2 in (38 mm)

Foil Tape

Apply pressure to tape for proper bonding

Tube Screw

Additional structural support may be required for horizontal tube runs. Consult local building code.

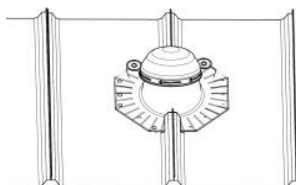
Solatube® Smart LED Accessories

Add more function by upgrading your Solatube Smart LED with any of these great accessories.



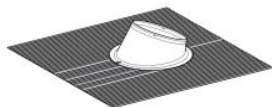
Daylight Dimmer

Because you don't need 100% of the light 100% of the time, the innovative Solatube Daylight Dimmer easily controls the amount of daylight entering a room with the convenience of a switch. Our patented variable butterfly baffle controls the light output.



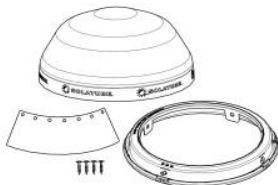
Metal Roof Installation Kit

Order this kit for installation of a Solatube 160 DS or 290 DS flashing onto a standing seam metal roof.



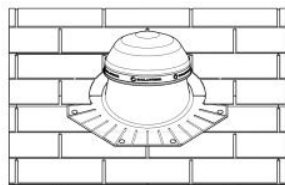
Universal Tile Flashing (for applications without base flashing)

The Universal Tile Flashing integrates seamlessly with most tile profiles. The malleable flashing skirt, available with a pitched or no pitch turret, easily adapts to the shape of the tile.



Dome Upgrade Kit

Upgrade an older Solatube product to take advantage of Solatube's patented Raybender™ 3000 Technology. The dome upgrade kit is installed without removing previous flashing or tubing.



Re-Roofing Recommendations

Solatube products require special care if removed for re-roofing. Refer to the Solatube Re-Roofing Recommendations to ensure proper removal and re-installation.

Not all items available for all markets. Contact your Solatube International representative for availability.

For the most current Installation Instructions, please visit www.solatube.com/instructions

Solatube International, Inc. | 2210 Oak Ridge Way | Vista, CA 92081-8341 | www.solatube.com | T: 888.SOLATUBE

A. SYSTEM DESCRIPTION

1. The telecommunication system shall consists of an internet modem and wireless and ethernet combination router.

B. FUNCTIONAL REQUIREMENTS

1. Provide products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Internet Modem
 - a. Coaxial cable to ethernet modem or other product that converts the available public network to a wired LAN via an ethernet cable.
3. Wireless and ethernet combination router
 - a. Router designed to connect to the public internet via an ethernet cable. Must provide a wireless LAN for use inside the home, and at least 4 active ethernet ports.

E20

FURNISHINGS

E 2020

FIXED FURNISHINGS

A. SYSTEM DESCRIPTION

1. Fixed furnishings in the home consist primarily of the kitchen millwork, island, and appliances.

B. FUNCTIONAL REQUIREMENTS

1. Provide fixed furnishing products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.

E 2050

MOVEABLE FURNISHINGS

A. SYSTEM DESCRIPTION

1. Moveable furnishings in the home compose the majority of the furnishings in the home.

B. FUNCTIONAL REQUIREMENTS

1. Provide floor construction assemblies, materials, and products that are manufactured and installed in compliance with all applicable Building Codes, Regulations and Rules. Refer to Section 1030 Project Criteria.
2. All furnishings shall fit within their plan requirements to not encroach upon the ADA tour and path requirements. Substitutions will not be approved if the dimensions encroach on any tour route or ADA opening requirements.

C. COMPONENTS

1. Exact products to be determined at a later date in accordance with the functional requirements. Current dimensions shown on plan are real products, but not confirmed final.



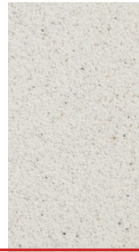
ABOUT GALLERY STYLES FUSED SAMPLES CONTACT

Gilasi is available in different styles to accommodate any decor. Along with our current line, Gilasi can be infinitely customized to fit your personal needs and style. Glass sizes and colors can be mixed with different core colors to create a unique look. Gilasi can also be fused together with different materials like Urban-Forestry wood and reclaimed lumber. The combinations are endless.

Composed of small, sand-like glass, **Gilasi-Micro** offers a clean, contemporary look and feel.



Ice



Vaniya



Samudra Tata

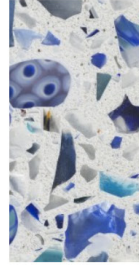
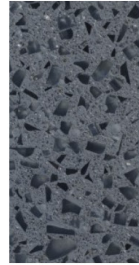


Seixo



Pietra

Made with larger glass, **Gilasi-Classic** creates a bold look, highlighting its presence in any installation.



Countertop for kitchen counter and island, in "Ice" material below

MODEL: 015623-H01
015623-H01
015636-H01

WALL-HUNG COLLECTION

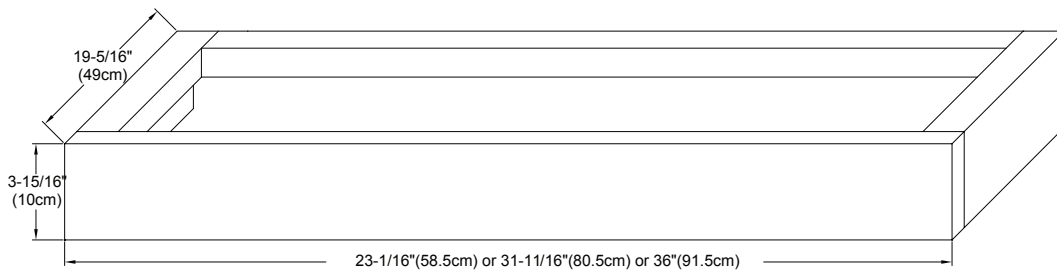
Meets ADA Standards

Extend design with Optional 12", 15" & 18" Drawer Bridge, 15" Shelf Bridge and 35" max Bridge Panel
Matching Mirror, Medicine Cabinet and Wall Cabinet

All Ronbow cabinets are made of solid hardwood or hardwood plywood and meet strict CARB Standards.
No particle Board or Micro-Density Fiberboard (MDF) are used.

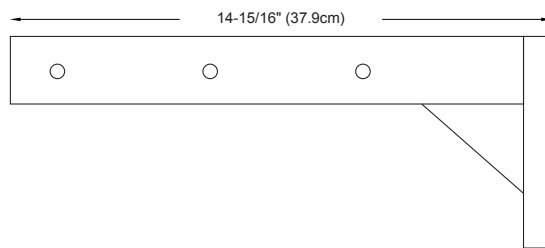
Available finishes:
DARK CHERRY H01

Available tops:
GLASS SINKTOP
CERAMIC SINKTOP
TECHSTONE™ TOP
WIDEAPPEAL™ TOP

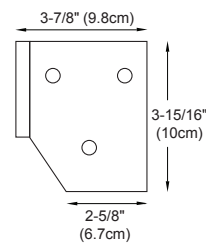


WALL MOUNT HARDWARE

Side



Front



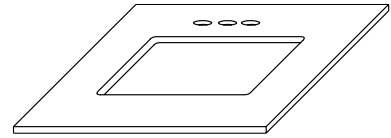
Techstone™ Top for undercounter sink (standard)

Available Colors:

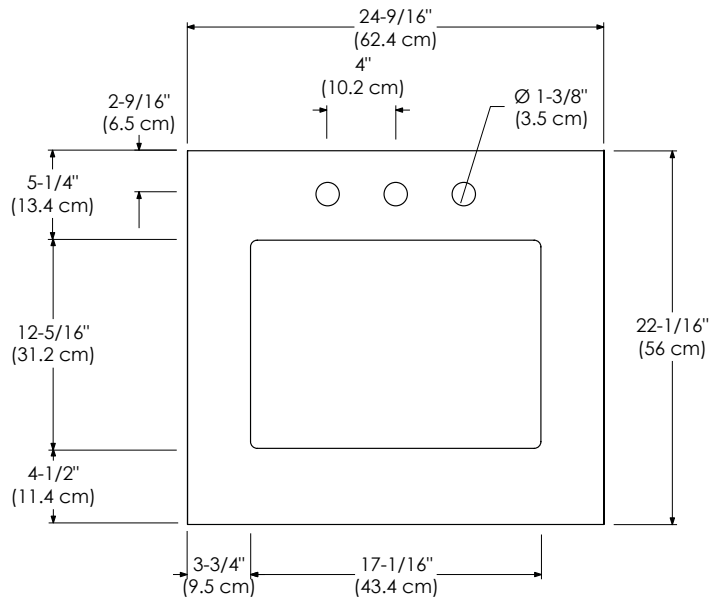
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



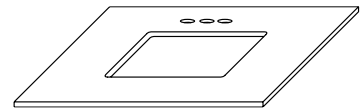
Techstone™ Top for undercounter sink (standard)

Available Colors:

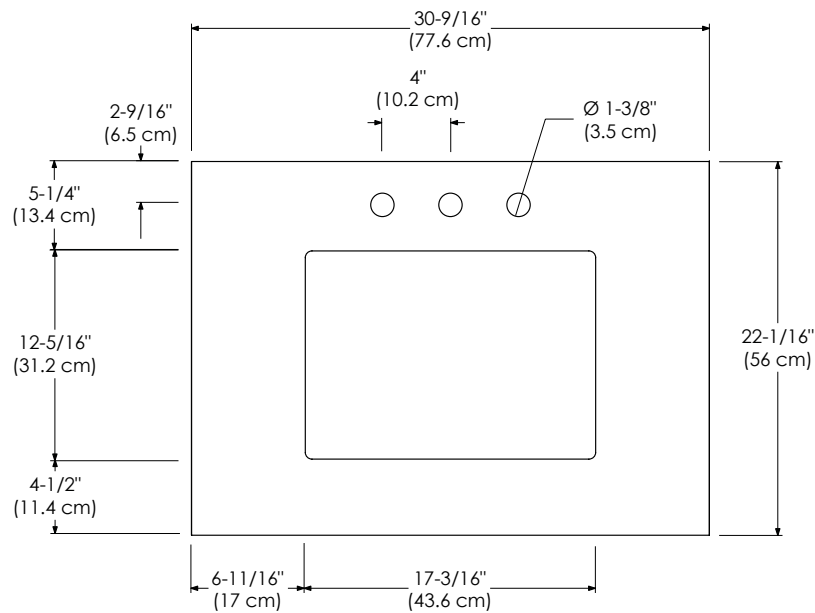
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

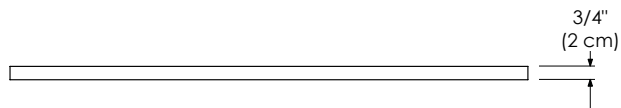
- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



MODEL: 362237-1-COLOR
362237-8-COLOR

SPECIFICATION SHEET

VANITY TOPS

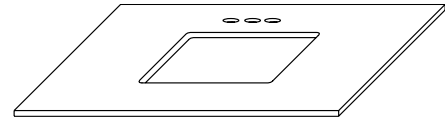
Techstone™ Top for undercounter sink (standard)

Available Colors:

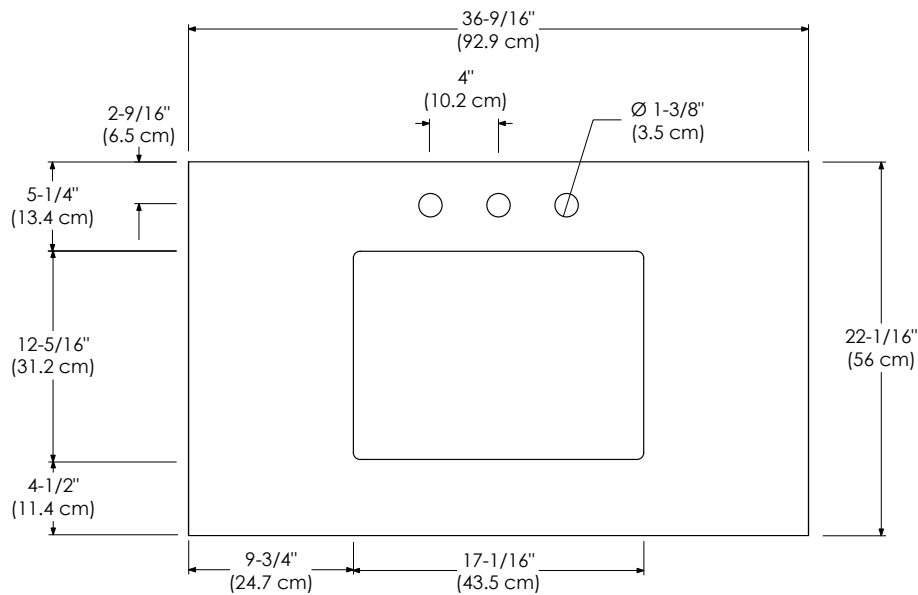
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

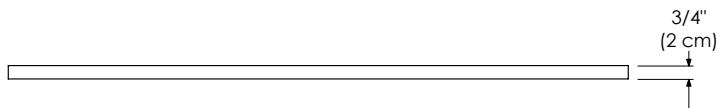
- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



MODEL: 362243-1-COLOR
362243-8-COLOR

SPECIFICATION SHEET

VANITY TOPS

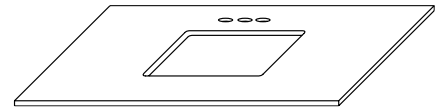
Techstone™ Top for undercounter sink (standard)

Available Colors:

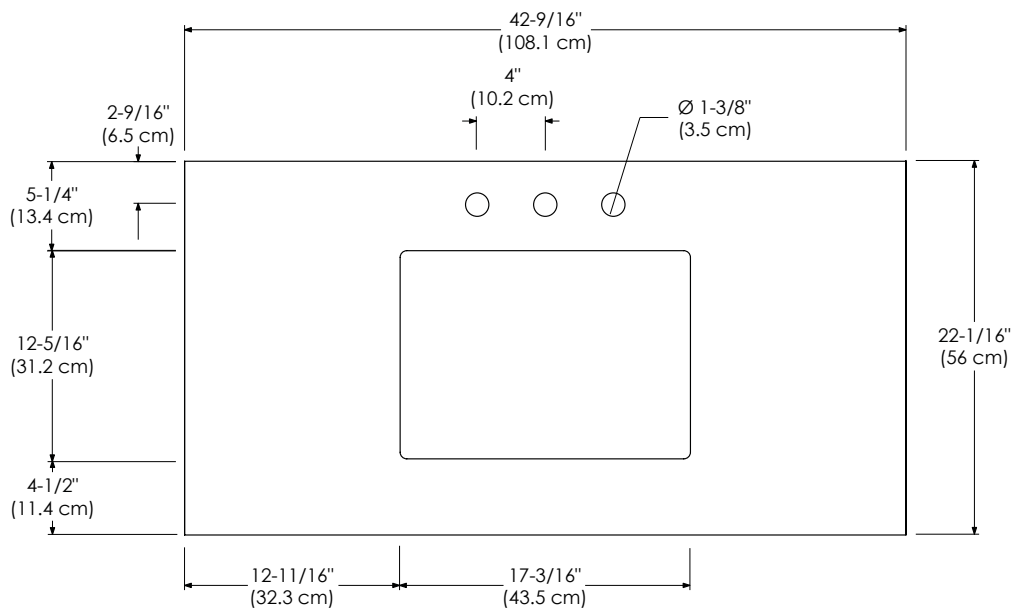
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

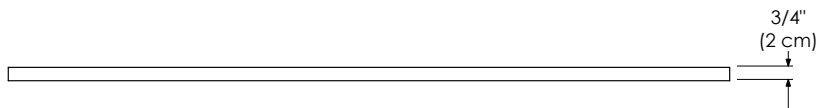
- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



MODEL: 362249-1-COLOR
362249-8-COLOR

SPECIFICATION SHEET

VANITY TOPS

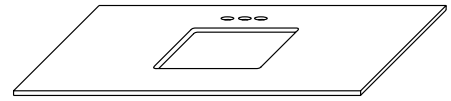
Techstone™ Top for undercounter sink (standard)

Available Colors:

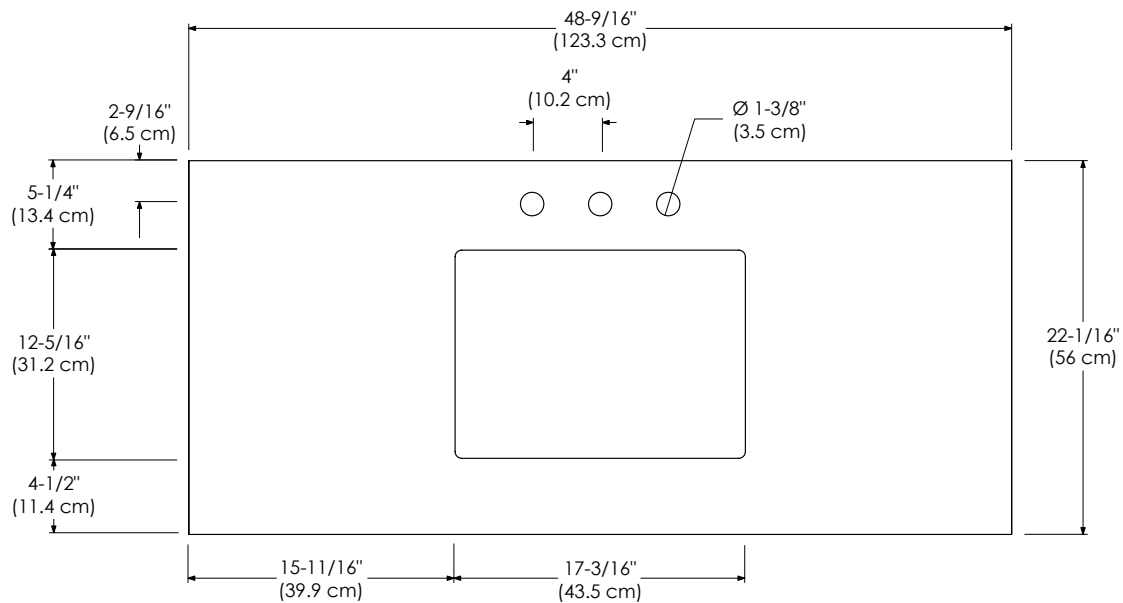
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

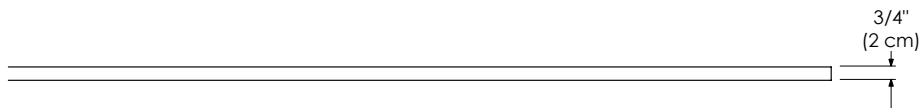
- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



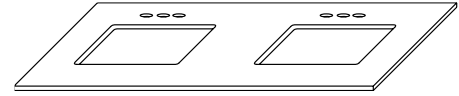
Techstone™ Top for undercounter sink (standard)

Available Colors:

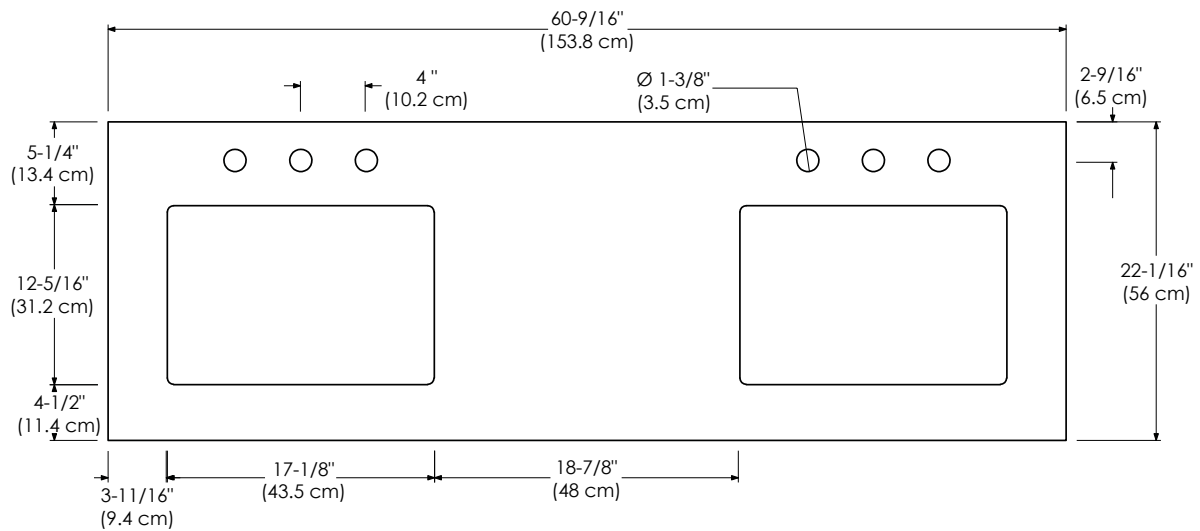
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

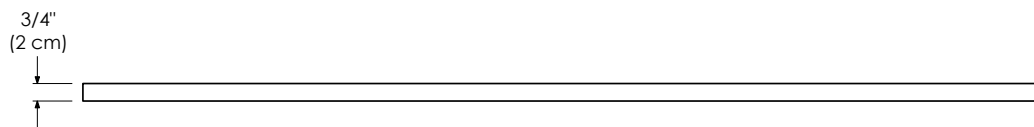
- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



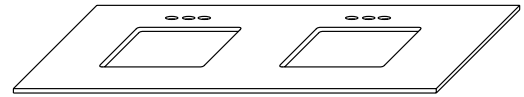
Techstone™ Top for undercounter sink (standard)

Available Colors:

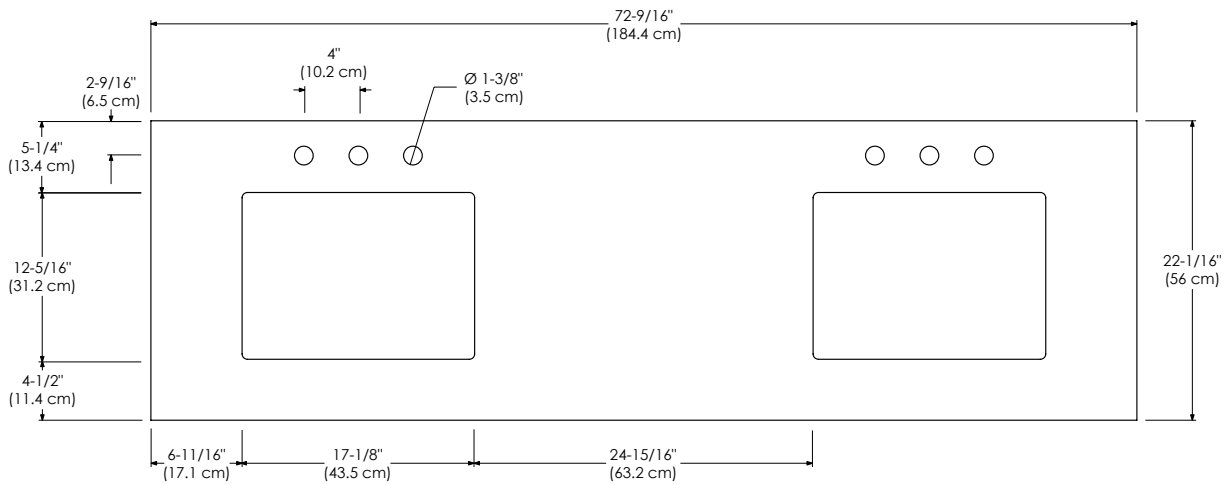
- BROAD BLACK TECHSTONE™ Q02
- GRAND GREEN TECHSTONE™ Q27
- WIDE WHITE TECHSTONE™ Q28
- STONE GRAY TECHSTONE™ Q30

Faucet:

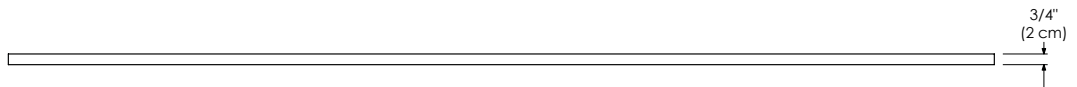
- SINGLE FAUCET HOLE
- 8" WIDESPREAD



TOP VIEW



FRONT VIEW



MODEL: 365562-1D-COLOR
365562-8D-COLOR

SPECIFICATION SHEET

VANITY TOPS

Techstone™ Top for undercounter (non-standard)

Available Colors:

GRAND GREEN TECHSTONE™ Q27

WIDE WHITE TECHSTONE™ Q28

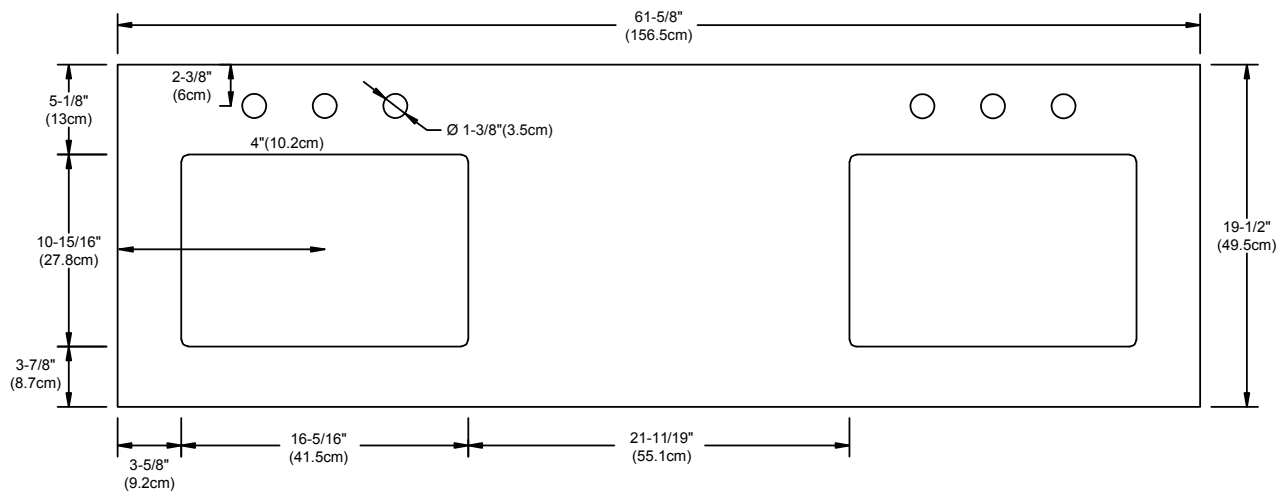
STONE GRAY TECHSTONE™ Q30

Faucet:

SINGLE FAUCET HOLE

8" WIDESPREAD

TOP



FRONT



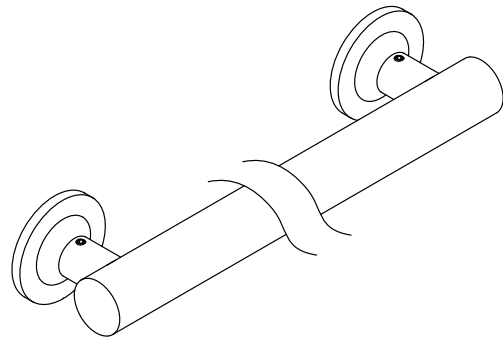
Features

- Metal construction
- Includes installation hardware
- ADA compliant when installed per Accessibility Guidelines of the Act, except for 9" (229 mm) length

Codes/Standards Applicable

Specified model meets or exceeds the following:

- ADA
- ASTM F446
- ICC/ANSI A117.1



Colors/Finishes

- S: Polished Stainless Steel
- Other: Refer to Price Book for additional colors/finishes

Specified Model

Model	Description	Colors/Finishes	
K-11890	9" (229 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11891	12" (305 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11892	18" (457 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11893	24" (610 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11894	32" (813 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11895	36" (914 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11896	42" (1067 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____
K-11897	48" (1219 mm) grab bar	<input type="checkbox"/> S	<input type="checkbox"/> Other _____

Product Specification

The grab bar shall be of metal construction. Product shall be ADA compliant when installed per Accessibility Guidelines of the Act, except for 9" (229 mm) length. Product shall include installation hardware. Product shall be Kohler Model K-____-____.

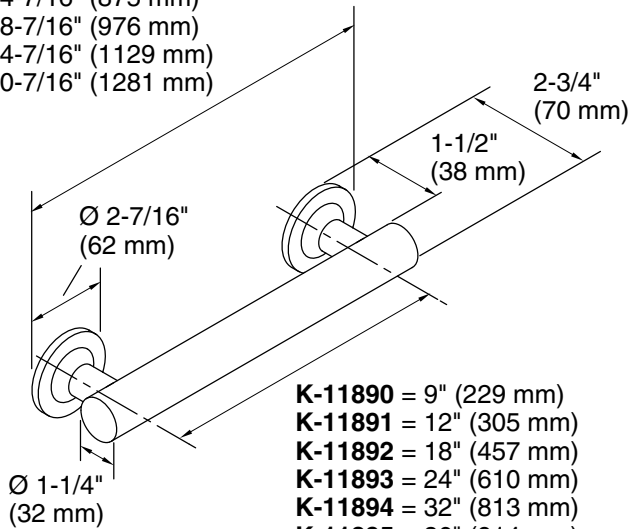
Installation Notes



WARNING: Risk of personal injury. The wall plates on the grab bar must be mounted to a brace between the wall studs. This will ensure that the weight of the user is adequately supported.

Install this product according to the installation guide.

- K-11890 = 11-7/16" (291 mm)
- K-11891 = 14-7/16" (367 mm)
- K-11892 = 20-7/16" (519 mm)
- K-11893 = 26-7/16" (672 mm)
- K-11894 = 34-7/16" (875 mm)
- K-11895 = 38-7/16" (976 mm)
- K-11896 = 44-7/16" (1129 mm)
- K-11897 = 50-7/16" (1281 mm)



- K-11890 = 9" (229 mm)
- K-11891 = 12" (305 mm)
- K-11892 = 18" (457 mm)
- K-11893 = 24" (610 mm)
- K-11894 = 32" (813 mm)
- K-11895 = 36" (914 mm)
- K-11896 = 42" (1067 mm)
- K-11897 = 48" (1219 mm)

Product Diagram

Features

- Dimmable LED lighting integrated into the door of the cabinet.
- Light designed to be of an optimal brightness and color for grooming tasks.
- Light guides provide an even, consistent light.
- Internal shelf with integrated outlets to power and charge small devices such as toothbrushes and shavers.
- Vertically adjustable magnifying mirror on the inside of the door.
- Triple mirror design gives superior visibility with mirrors on the front and back of the door as well as the back of the interior of the cabinet.
- Rust-free aluminum construction provides a clean, lasting finish.
- Designed for surface or recess mount applications (side kits required for surface mount).
- Adjustable glass shelves.
- 110° door swing with slow-close hinges.

Installation

- Hang-and-secure mounting system for easier surface-mount installation.
- Recommend professional electrician installation.
- Requires installation with a compatible LED dimmer switch (sold separately)

Required Accessories

K-99012 Side Mirror Kit

or

K-99675 Medicine Cabinet Side Kit

Optional Accessories

K-99661-40 Medicine Cabinet Surround

K-99662-40 Medicine Cabinet Surround

K-99663-40 Medicine Cabinet Surround



Codes/Standards

UL 962

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

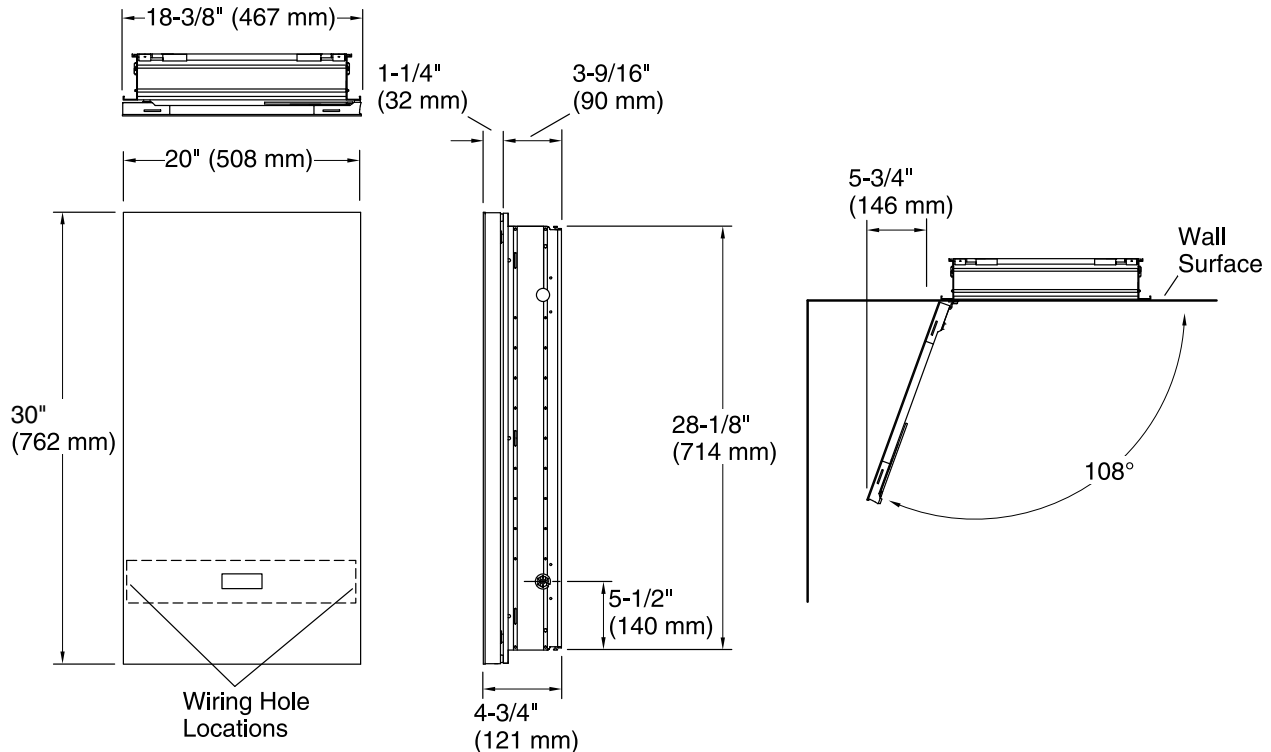
USA/Canada: 1-800-4KOHLER (1-800-456-4537)

Kohler Co. reserves the right to make revisions without notice to product specifications.

For the most current Specification Sheet, go to www.kohler.com.

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THE BOLD LOOK
OF **KOHLER®**



Required Electrical Service

One circuit required, protected with Class A Ground-Fault Circuit-Interrupter (GFCI) or Residual Current Device (RCD).

Outlet, Lights: 120 V, 15 A, 60 Hz

Technical Information

All product dimensions are nominal.

Notes

Install this product according to the installation guide.

To recess mount, the wall cavity must be framed and the cabinet secured to framing studs. Reroute electrical or water supply lines from the cavity. Consult a professional if drain or vent piping is encountered, or if the wall is load-bearing.

To determine the height of the cabinet, ensure the door will clear all obstacles (such as a faucet). A minimum 3" (76 mm) distance is required.

Cutout for recess-mount installations: 18-1/2" (470 mm) wide x 28-1/4" (718 mm) high x 3-11/16" (94 mm) deep.

A dimmer switch is required. This product is compatible with most residential dimmer switches intended for incandescent and dimmable LED bulbs.

USA/Canada: 1-800-4KOHLER (1-800-456-4537)

Kohler Co. reserves the right to make revisions without notice to product specifications.

For the most current Specification Sheet, go to www.kohler.com.

1-30-2017 03:28

THE BOLD LOOK
OF **KOHLER®**

MODEL: 648015-COLOR

ACCESSORIES

Soft Close and Full Extension drawers with dovetail construction
Matching Finish throughout the interior

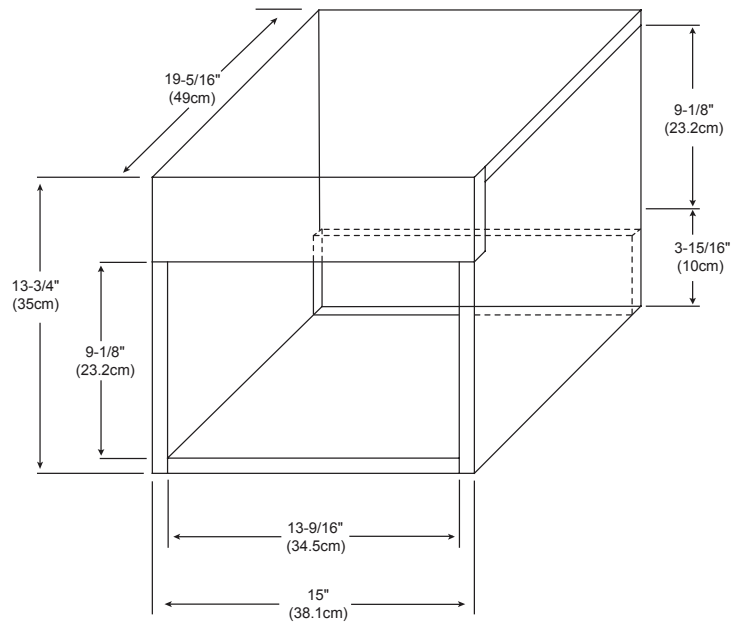
All Ronbow cabinets are made of solid hardwood or hardwood plywood and meet strict CARB Standards.
No particle Board or Micro-Density Fiberboard (MDF) are used.

Available finishes:

CINNAMON F08

DARK CHERRY H01

BLACK B02



Prices and availability are subject to change from the time and date that you print this page.

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For Customer Service, please call 800.967.6696

Montclair Loveseat

\$1,499.00

Eligible for Free Delivery with \$1500 order | SKU: 442583



Fabric: Duet, Natural **Leg:** Drift



Well-balanced and beautifully tailored, Montclair is a model of classic proportions. Trim roll arms set the tone for this refined chair that sits a bit more upright—not too low, not too deep—but with plenty of comfort.

- Frame is benchmade with a certified sustainable hardwood that's kiln-dried to prevent warping
- Flexolator spring suspension system
- Soy-based polyfoam seat cushion wrapped in fiber-down blend and encased in downproof ticking
- Fiber-down blend back cushion encased in downproof ticking
- Hardwood legs stained with a light brown finish
- Made in North Carolina, USA of domestic and imported materials
- See product label or call customer service at 800.967.6696 for additional details on product content

Montclair Loveseat

Overall Dimensions

Width: 63" (inches)
Depth: 38" (inches)
Height: 31" (inches)

Overall With Back Cushion

Width: 6" (inches)
Height: 35" (inches)
Height: 24" (inches)

Will it fit through your door?

Diagonal
Depth: 30" (inches)
Why is this important?

Leg

Height: 5" (inches)

Delivery

Height: 32" (inches)

Seat

Width: 51" (inches)
Depth: 23" (inches)
Height: 18" (inches)

Comfort

How does it sit?



Care

Keep it looking its best.

You've put a lot of care into choosing your furnishings. And with continued care at home, they should share your address for many years to come. Now for your owner's manual...

- Do not leave spills unattended.
- Refer to additional Care Information brochure or our website.
- For indoor use only.
- Avoid direct sunlight.
- Do not leave newspaper or other printed material lying on surface.
- Dimensions of bench-made upholstery may vary slightly.
- Vacuum regularly.

Return/Exchange Policy

What you need to know.

At Crate and Barrel, we take great pride in the quality and craftsmanship of our furniture and rugs. Attention to detail in design, materials and construction is always at the forefront. We encourage you to inspect the item upon receipt. If you have a concern or believe there is a quality issue, we will work with you to correct it, in accordance with the policy below. For furniture and rug orders placed online, please call us at 800.606.6462. For orders placed through a store, please contact the store where the sale originated.

(844) 357-6300 Find Your Store

We're here to help
24/7 Customer Service
(800) 967-6696

Prices and availability are subject to change from the time and date that you print this page.

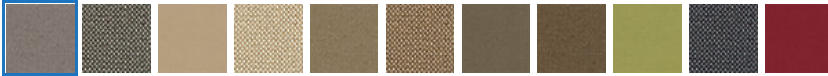
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For Customer Service, please call 800.967.6696

Karnes Twin Sleeper Sofa

\$2,899.00

Eligible for Free Delivery with \$1500 order | SKU: 659458



Fabric: Douglas, Nickel **Leg:** Espresso



Karnes puts to rest the idea that sleeper sofas can't look sleek or sleep in comfort. Tucked inside this tailored, mid-century frame is the firm support of a bed-quality, foam mattress that opens effortlessly with a patented spring-loaded mechanism.

- Frame is benchmade with a certified sustainable hardwood that's kiln-dried to prevent warping
- Tri-fold spring-loaded sleeper mechanisms
- 4" high-density foam mattress
- Soy-based polyfoam seat cushions
- Polyfiber back cushions encased in synthetic ticking
- Hardwood legs stained with espresso brown finish
- Made in North Carolina, USA of domestic and imported materials
- See product label or call customer service at 800.967.6696 for additional details on product content

Karnes Twin Sleeper Sofa

Arm	Open (Sleeper)	Overall With Back Cushion	Leg	
Width: 4" (inches)	Width: 50" (inches)	Height: 38" (inches)	Height: 5" (inches)	<i>Will it fit through your door?</i> Diagonal Depth: 35" (inches) Why is this important?
Depth: 37" (inches)	Depth: 85" (inches)			
Height: 27" (inches)	Height: 36" (inches)			
Mattress	Seat	Overall Dimensions	Delivery	
Width: 39" (inches)	Width: 42" (inches)	Width: 50" (inches)	Height: 37" (inches)	
Depth: 80" (inches)	Depth: 23" (inches)	Depth: 39" (inches)		
Height: 4" (inches)	Height: 21" (inches)	Height: 36" (inches)		

Care

Keep it looking its best.

You've put a lot of care into choosing your furnishings. And with continued care at home, they should share your address for many years to come. Now for your owner's manual...

- Do not leave spills unattended.
- Refer to additional Care Information brochure or our website.
- For indoor use only.
- Avoid direct sunlight.
- Do not leave newspaper or other printed material lying on surface.
- Dimensions of bench-made upholstery may vary slightly.
- Vacuum regularly.
- Protect from heat and liquids.

Return/Exchange Policy *What you need to know.*

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SMART IDEAS

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Reviews

CART

\$0.00

/ 0 items

Junior Giant Table

995.00

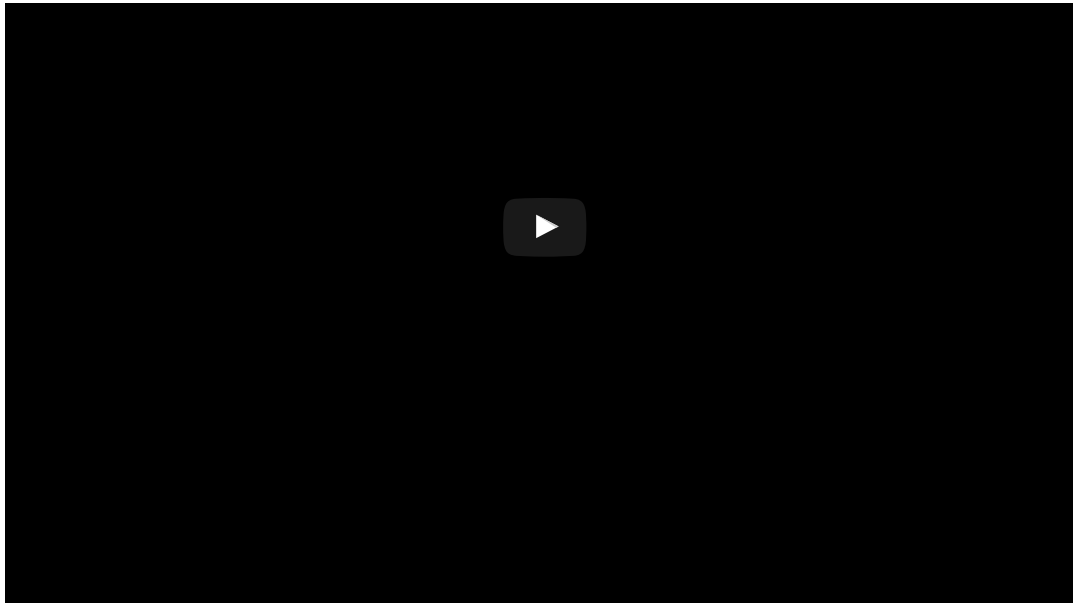
★ REVIEWS

Junior Giant Table

\$1,995.00

A smart console that opens up, extends, and turns into a giant table with leaflets. Impress your friends when you open up this console table at your next dinner party, or conference meeting at the office. Seats 8 people comfortably and up to 10 if needed. Adjustable to multiple sizes, the Junior Giant is very sturdy and can support a large feast while also looking great as a compact table. Finished in gloss white, grey or wood tones. Look for the **video below to view a demonstration**. Also available in a [dining set option here](#).

PANEL FINISH



The Junior Giant table is exactly that, a junior console table that transforms into a giant table. As a small console or work desk it is unobtrusive yet a pleasure to look at. The console splits in half to reveal a chassis that extend out the table an extra 72.4 inches (184 cm). Up to four 18.11 inch (46 cm) leaflets can be placed to make this table as little or as giant as you like. A great idea for someone who likes to entertain and needs extra space for their guests, or turn it into an extra-large workspace for conference meetings. Whatever you choose to use this unit for it will expand the space in your home through the junior giant's multi-functional design. The support leg is able to move a few feet in either direction as a small table, while providing extra support as a large table to host a true feast. The underside of the tables legs are on felt sliders, so the table moves easily whether on hardwood, tile or carpet. [Have a look at the Junior Giant Dining Set with Chairs.](#)

Junior table console size

Height: 29.72 inches (75.5 cm)

Width: 37.4 inches (95 cm)

Depth: 17.32 inches (44 cm) compact

Giant table conference size

Height: 29.72 inches (75.5 cm)

Width: 37.4 inches (95 cm)

Depth/Length: 90.07 inches (228.8 cm) maximum

Leaves: 18.11 inches (4 x 46 cm) leaves – add as many or as few as you like.

In the stretched out table mode it is solid – as if it was a “one-piece” table, this is because we use excellent mechanics and craftsmanship.

Shipping Information

Dearborne Bench with Coat Rack and Cushion

\$869.95

Eligible for Free Delivery with \$1500 order | SKU: 557254



Create the look of a built-in entryway system with this impressive coat rack and bench with cushion. Against a backdrop of framed horizontal planks topped with five hooks, the bench offers a cushioned surface for purses and bags as well as a place to sit and change shoes with an open shelf below for storage. The lift-up top opens to generous concealed storage. The entire unit is made of solid ash and hardwood veneers stained a warm charcoal brown and topped with a neutral grey cushion.

- Ash, poplar and engineered wood with hardwood veneer
- Charcoal brown stain
- Five metal hooks with antique brass finish
- Anti-tip hardware included
- Cushion is high-resiliency foam upholstered in 100% polyester
- Made in Vietnam

Dearborne Bench with Coat Rack and Cushion

Cushion	Bench	Overall Dimensions	Coat Rack	Bench With Cushion
Width: 44.5" (inches)	Width: 48" (inches)	Width: 50" (inches)	Width: 50" (inches)	Width: 48" (inches)
Depth: 15.75" (inches)	Depth: 16" (inches)	Depth: 18.5" (inches)	Depth: 2.5" (inches)	Depth: 16" (inches)
Height: 2" (inches)	Height: 20" (inches)	Height: 77" (inches)	Height: 77" (inches)	Height: 22" (inches)

Assembly *Information and instructions*

Easy-to-follow instructions will also be included in your order.

The Advantages of Ready to Assemble Furniture

Our Ready to Assemble Furniture costs a fraction of what you'd expect because it ships in an economical flat-pack and you do the finished assembly.

In addition to featuring quality materials such as solid hardwoods, hand-forged metals, and beveled glass, the real beauty of this furniture is that each piece is thoughtfully designed to take advantage of efficient new construction methods and affordable high-performance materials. These include new composition leathers, microfiber fabrics, and most importantly, a new generation of high-resistance engineered woods and veneers that not only save you money but ultimately save natural resources as well.

Affordable Delivery

Now our Ready to Assemble furniture can be even more affordable. Some ZIP codes are eligible for Local In-Home Delivery starting at just \$59. We will bring your order into your home and place the package in the room of your choice. Your exact shipping total will be calculated at Checkout.

If you have any questions, please email or call us at 800.967.6696.800.967.6696.



Assembly Instructions

Trouble viewing? Download Adobe Acrobat Reader or email or call us at 800.967.6696.

Return/Exchange Policy *What you need to know.*

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Mitchell Gold
+Bob Williams

BUTLER QUEEN STORAGE PLATFORM BED COMBO

Style # 528-060T-HB-Q



Queen-size bed platform with a storage compartment inside. Offers 22 cubic feet of storage—the equivalent of an eight-drawer chest. Easy to open and close—lifting mechanism features a wood mattress support in a black metal frame with heavy-duty gas cylinders.

Style #	528-060T-HB-Q
Dims	65"w x 5"d x 55"h
C.O.M	8.5 yd

Crate&Barrel

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8/3/2017 3:50:42 PM

For Customer Service, please call 800.967.6696

Elyse 360 Swivel Chair

\$899.00

SKU: 500396



Fabric: Diamond, Silvermist



The perennially classic accent chair does a 360, swiveling its sculpted lines and upright yet comforting proportions in all directions. Taking on the look of brushed linen, the upholstery is woven in a sophisticated diamond pattern that's subtle enough to read as a solid. Detailed with graceful, curving keyhole arms and tailored upholstery, the Elyse swivel chair provides perfect symmetry for traditional rooms, paired with a sofa or as part of an intimate seating arrangement in the living space or bedroom.

- Frame is benchmade with certified sustainable hardwood that's kiln-dried to prevent warping
- Synthetic webbing suspension system
- Soy-based polyfoam seat cushion wrapped in synthetic fiber and down blend in downproof ticking
- Tight back is soy-based polyfoam wrapped in fiber, encased in downproof ticking
- 360-degree swivel mechanism
- Made in North Carolina, USA of domestic and imported materials
- See product label or call customer service at 800.967.6696 for additional details on product content

Dimensions

Will it fit in your space?

Elyse 360 Swivel Chair

Arm	Seat	Overall Dimensions	Delivery
Width: 6" (inches)	Width: 21" (inches)	Width: 33" (inches)	Height: 35" (inches)

<https://www.crateandbarrel.com/elyse-360-swivel-chair/s500396>

Page 1 of 2

Height: 25" (inches) Depth: 21" (inches) Depth: 35" (inches) *your work:*
Height: 18" (inches) Height: 34" (inches) **Diagonal**
Depth: 30" (inches)
Why is this important?

Care

Keep it looking its best.

You've put a lot of care into choosing your furnishings. And with continued care at home, they should share your address for many years to come. Now for your owner's manual...

- Do not leave spills unattended.
- Refer to additional Care Information brochure or our website.
- For indoor use only.
- Avoid direct sunlight.
- Do not leave newspaper or other printed material lying on surface.
- Dimensions of bench-made upholstery may vary slightly.
- Vacuum regularly.

Return/Exchange Policy

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Ameriwood Home Metal Frame Coffee Table

by Ameriwood Home

★★★★★ 101 Reviews

Starting at \$92⁴⁹

FREE SHIPPING*

Quantity: 1



Add to Cart

Color:



Oak/Gunmetal



Espresso/Gunmetal

Color:



Oak/Gunmetal



Espresso/Gunmetal



Share This Product:



Assembled very quickly and it looks great.

★★★★★ See All Reviews

Club O Gold Members Earn \$4.62 | 5% Rewards*

Add Gold to Cart for \$19.95/yr. [Learn More](#)

ITEM# 16271075

Delivery Estimate ⓘ

Warranty Included Warranty: 1 year Limited Manufacturer

Notifications

Add to Registry

Favorites

[See all Ameriwood Home](#) / [See all Ameriwood Home Coffee, Console, Sofa & End Tables](#)

Featured Recommendations



Powell Hertford Sea Green Shutter Door Table
Today: \$124.98



Powell Distressed Shutter Door Cabinet
Today: \$332.98



Metal Finish Aluminum Accent Table
Today: \$74.99



Distressed Pine Console Table
Today: \$349.99

Featured Recommendations



Powell Hertford Sea Green Shutter Door Table
Today: \$124.98



Powell Distressed Shutter Door Cabinet
Today: \$332.98



Metal Finish Aluminum Accent Table
Today: \$74.99



Distressed Pine Console Table
Today: \$349.99

Details

ITEM#: 16271075

Maintain the open, airy feel in your home with this metal frame coffee table from Ameriwood Home. The open-frame design of the table allows you to create organized and decorative displays that guests can see from any angle of the room. Store heavier items on the bottom and place smaller items, such as a chic coasters or decorative books, on the top to optimize the natural design capabilities of the table.

Features:

- Striking metal finish is perfect for modern or industrial styles
- Ideal for use with your living room seating arrangement
- Slim, sleek profile perfect for minimalist design schemes

Specs

Features ⓘ

Style	Americana, Contemporary, Modern, Transitional
Material	Laminate, MDF, Metal, Wood
Type	Accent Tables, Coffee Tables
Finish	Black Finish, Espresso Finish, Oak Finish
Frame Material	Metal
Assembly	Assembly Required

- Versatile design allows for coffee table or accent piece use
- Materials: Metal, paper
- Color: Cherry/ black, espresso/ gunmetal grey, sonoma oak/ gunmetal grey
- Dimensions: 41.34 inches wide x 20.87 inches deep x 17.72 inches high

Assembly Required.

Color	Beige, Black, Brown
Set Includes	1 Piece
Shape	Rectangle
Top Material	Wood
Dimensions	41.34 inches wide x 20.87 inches deep x 17.72 inches high
Warranty	1 year Limited Manufacturer
Model Number	5070X96PCOM
Country of Origin	China



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Advertisement

Customer Reviews

4.1





[Disclosures & Guidelines](#)



Club O members earn Club O Rewards for writing reviews.

[Learn More](#)

Most Helpful

EHHHHH....



Just recently received this table, it came chipped in two different parts. the top and bottom of the coffee table are made of particle wood and the laminate on top seems to crumble when you drill the screws into the table. This is NOT a good table. Ordered replacement parts, so let's see if they are any better, if not than I will be returning the table.

soniajeankhan00 Jun 5, 2014

Very nice

Most Recent

Looks nice



This user earned \$2.00 Club O Rewards for writing this review. [Learn More](#)

This table looks nice and the height is appropriate to put your feet up. The metal is great but the "wood" is cheap and you must use coasters or the moisture will bubble. It also does not seam sturdy enough to sit on if your short on seating.

Melissa M. Jul 19, 2017

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For Customer Service, please call 800.967.6696

Morocco Dining Chair

\$299.00

SKU: 670107



When it comes to relaxing outdoors in affordable modern style, our laid-back Morocco dining chair knows the ropes. Handwoven synthetic resin rope, a resilient new design material that's colorfast and UV-resistant, defines the linear look and comfort.

- Handcrafted
- Polypropylene resin rope
- Aluminum frame with powdercoat finish
- Colorfast and UV-resistant
- Stacks 4 high
- Made in Indonesia

Dimensions

Will it fit in your space?

Morocco Dining Chair

Seat Height

Height: 18" (inches)

Arm Height

Height: 25.75" (inches)

Overall Dimensions

Width: 22.75" (inches)

Depth: 23.5" (inches)

Height: 31.5" (inches)

Care

Keep it looking its best.

You've put a lot of care into choosing your furnishings. And with continued care at home, they should share your address for many years to come. Now for your owner's manual...

- Do not leave spills unattended.
- For outdoor use.

<https://www.crateandbarrel.com/morocco-dining-chair/s670107?a=784&campaignid=319447856&adgroupid=22835990936&targetid=dsa-45664676817&adpos=1t1...> 1/2

8/3/2017

Morocco Dining Chair | Crate and Barrel

- Do not use abrasive cleaner.
- Cover or store indoors during the winter and/or extreme weather.
- We recommend using a soft brush to remove dirt and dust.
- To prevent mildew during storage, fabric and furniture must be dry.
- Clean surfaces with a dry or damp soft cloth.
- We recommend the use of our outdoor furniture covers.
- We recommend the use of our Outdoor Multi Surface Cleaner which can be used on frames and cushions.

Return/Exchange Policy

What you need to know.

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<https://www.crateandbarrel.com/morocco-dining-chair/s670107?a=784&campaignid=319447856&adgroupid=22835990936&targetid=dsa-45664676817&adpos=1t1...> 2/2

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For Customer Service, please call 800.967.6696

Hexa Bistro Table

\$499.00

SKU: 216277



The Hexa bistro table's mosaic of pure marble hexagon tiles recalls the look of vintage tile floors. Elevated atop a flared iron base and defined by subtle grey grout, the table's classic honeycomb pattern brings a conservatory feel to indoor sunrooms or outdoor spaces. Available in three sizes, Hexa tables can layer and nest for dimensional interest. The Hexa Mosaic Bistro Table is a Crate and Barrel exclusive.

- White marble tile
- Iron with graphite grey powdercoat finish
- Clean with damp cloth and dry promptly
- Protect from inclement weather
- Made in China

Keep it looking its best for years to come.



**Outdoor Round Coffee
Table Cover**
\$99.00

Add to cart

Dimensions
Will it fit in your space?

Hexa Bistro Table

Overall Dimensions

Height: 29.5" (inches)

Diameter: 32" (inches)

Assembly
Information and instructions

Assembly may be required for this item based on shipping location and delivery method. Items shipped via In-Home Delivery will be placed in the room of your choice and assembled. All packaging will be removed and recycled at our warehouse for Local In-Home Delivery, or placed at your curbside or nearest trash pickup area for Long Distance In-Home Delivery. Items shipped via Basic Freight Delivery or picked up in store will require assembly. Easy-to-follow instructions will be included in your order and are also available by clicking the Assembly Instructions link. You can view your assigned delivery method in your Cart. If you have any questions, please email or call us at 800.967.6696/800.967.6696.



Assembly Instructions

Trouble viewing? Download Adobe Acrobat Reader or email or call us at 800.967.6696.

Care

Keep it looking its best.

You've put a lot of care into choosing your furnishings. And with continued care at home, they should share your address for many years to come. Now for your owner's manual...

- Do not leave spills unattended.
- Rust spots should be cared for promptly.
- Care for nicks and scrapes immediately with Rustoleum.
- Clean surfaces with a dry or damp soft cloth.
- We recommend the use of our outdoor furniture covers.
- If the powdercoat finish is chipped, the exposed area should be sealed to prevent moisture from getting under the paint.
- Cover or store indoors when not in use and/or during extreme weather
- Store indoors during off season

Return/Exchange Policy
What you need to know.

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For Customer Service, please call 800.967.6696

Rocha Side Table

reg. \$179.00 **Clearance \$129.00**

SKU: 556548



With weather-resistant polystyrene translating the beautiful grain and warm tones of natural Brazilian ipe wood, everyone does a double take when they first see our exclusive Rocha outdoor lounge collection.

- Aluminum with powdercoat finish
- Extruded polystyrene with UV and antioxidant protection
- Levelers
- Made in China

Keep it looking its best for years to come.



303® Protectant
\$25.00

Add to cart



Outdoor Rectangular Side Table Cover
\$65.00

Add to cart

Dimensions

<https://www.crateandbarrel.com/rocha-side-table/s556548?a=784&campaignid=319447856&adgroupid=22835993336&targetid=dsa-143929337599&adpos=1t1&cre...> 1/2

Will it fit in your space?

Rocha Side Table

Overall Dimensions

Width: 16" (inches)
Depth: 16" (inches)
Height: 24.5" (inches)

Distance Between Frame

Width: 21.75" (inches)

Care

Keep it looking its best.

You've put a lot of care into choosing your furnishings. And with continued care at home, they should share your address for many years to come. Now for your owner's manual...

- Do not leave spills unattended.
- For outdoor use.
- Do not use abrasive cleaner.
- Spot clean with mild detergent and water.
- Cover or store indoors during the winter and/or extreme weather.
- Clean surfaces with a dry or damp soft cloth.

Return/Exchange Policy

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8/3/2017 3:55:53 PM
For Customer Service, please call 800.606.6252

tropez natural sofa

★★★★★ 4.8 (10) **\$1,079.00**

SKU: 628615



luxé lounger. If we went to a fancy hotel in the French Riviera, this is what we want in our cabana. A modern interpretation of retro resort style by designer Ceci Thompson. Crafted of natural mahogany—a rich, warm wood that stands up to the elements year after year—this classic slatted silhouette is both elegant and airy. Off-white linen-like cushion in weather-resistant polyester fits perfectly with any outdoor decor. Best of all, cushion cover zips right off for easy cleaning. Learn about [Ceci Thompson](#) on our blog.

Details

- Designed by Ceci Thompson
- Frame: FSC-certified solid plantation-grown mahogany
- Left unprotected, wood will weather and lighten in color
- Cushions: Polyester in natural
- Removable cushion cover for easy cleaning
- Store cushion separately
- Outdoor-safe; cover or store indoors during inclement weather and when not in use
- Storage cover sold separately
- Hand wash cushion; wipe frame with a soft, dry cloth
- See product label or call customer service at 800.606.6252 for additional details on product content
- Made in Indonesia

<https://www.cb2.com/tropez-natural-sofa/s628615>

1/2

dimensions

WILL IT FIT IN YOUR SPACE?

tropez natural sofa

Overall Dimensions

Width: 82" (inches)
 Depth: 32.25" (inches)
 Height: 30.5" (inches)

Seat Height

Height: 16.5" (inches)

Arm Height

Height: 24.25" (inches)

assembly

INFORMATION AND INSTRUCTIONS

Assembly may be required for this item based on shipping location and delivery method. Items shipped via In-Home Delivery will be placed in the room of your choice and assembled. All packaging will be removed and recycled at our warehouse for Local In-Home Delivery, or placed at your curbside or nearest trash pickup area for

Long Distance In-Home Delivery. Items shipped via Basic Freight Delivery or picked up in store will require assembly. Easy-to-follow instructions will be included in your order and are also available by clicking the Assembly Instructions link below. You can view your assigned delivery method in your Cart. If you have any questions, please email or call us at 800.606.6252/800.606.6252.



Assembly Instructions

Trouble viewing? Download Adobe Acrobat Reader or email or call us at 800.606.6252.

return/exchange policy

At CB2, we stand behind the quality of our products and want every purchase to be a positive experience. We will do our best to make things right if you are not satisfied.

non-furniture items

We will accept returns and exchanges of non-furniture items if they are returned within 90 days of customer receipt, a valid proof of purchase is provided, and items are returned in good condition (unused and unwashed).

stock furniture, rugs and rug pads

If you are not satisfied with your Stock furniture, rug or rug pad purchase, you must contact us within 7 days of delivery or pickup to arrange a return. The item must be returned within 30 days of delivery or pickup. The item will be inspected upon return, and a refund amount will be determined based on its condition. For furniture orders placed online, please call us at 800.606.6252. For orders placed through a store, please contact the store where the sale originated.

special order upholstery

We require a 50% deposit for all Special Order upholstery. This deposit is nonrefundable after a 72-hour change/cancellation window. These items are made to your specifications and cannot be returned or exchanged.



DDN 25400 SERIES

14 Place Settings
Top control screen



Main Features

- 5 programs
- 3 wash temperatures
- Prosmart Inverter Motor
- Condensing drying system
- 48 dBA wash noise level
- Program follow-up display
- Time delay up to 1-24 hrs.
- Auto tablet detergent function
- 1/2 Load function
- Sanitize function
- SuperRinse function
- Fast function
- 3 way euro filtering system
- Front adjustable rear feet
- Front adjustable hinge system
- Interior highloop with air gap
- Power plug

Interior Design

- All stainless steel tank
- Three spray arms (lower, upper and ceiling)

Premium Rack Loading System

- 2 adjustable mug shelves
- Sliding cutlery basket

Color

- DDN25400X: Stainless steel
- DIN25400: Fully Integrated



FEATURES



14 Place Settings

Beko dishwashers can perfectly clean dishes upto 14 place settings without leaving any piece of cutlery out.



Fast Function

The dishwasher increases the washing temperature and adjust the water pressure to provide up to 2 times faster cleaning performance.



SuperRinse

Additional rinsing function for households who desire an extra rinsing cycle with more water.



Auto Tablet

Sensors detects rinse aid and automatically sets drying cycle duration. This provides the best drying results without any concern.



Prosmart Inverter Motor

Variable speed circulation motor allows to use optimum necessary amount of water and energy. Due to magnetic design the motor has no persistent low frequency sound, and creates less vibration.

Double Motion Float System

All Beko dishwashers have a double motion float system (DMFS) that provides maximum security against water damage and a bottom tray to prevent flooding.



DDN 25400 SERIES

14 Place Settings Top control screen

CONTROLS

Control Type	Electronic
Position	Top

MAIN FEATURES

Loading Capacity (place settings)	14
Tub material	Stainless Steel
Inner door material	Stainless Steel
Water Softener	-
DMFS overflow protection	✓
5 level wash with 3rd spray arm	✓
Delay timer up to 1-24 hrs	✓
3 way euro filter	✓
Drying	Condensation
Turbidity sensor	✓
Silence level, dBA	48 dBA
InnerClean	✓
Auto Tablet function	✓
1/2 Load function	✓
Sanitize function	✓
SuperRinse function	✓
Extra Drying	-
Fast function	✓
Interior high loop with airgap	✓
Power Plug	✓

PROGRAMS

Number of programs	5
Heavy plus (167°F rinse temp)	✓
Normal (142°F-145°F rinse temp)	✓
Clean&Shine	✓
Delicate (149°F rinse temp)	-
Express (131°F rinse temp)	✓
Rinse & Hold	✓

DISPLAY

Program sequence	✓ / Screen
Rinse aid indicator	Electronic
Rinse aid indicator display	✓
Salt indicator display	-
Light Indicator on Floor	✓

RACK SYSTEM

Easy fold lower rack folding tines	-
Lower rack embossed stainless handle	-
Cutlery basket	Sliding
Upper rack (inset shelves)	2
Easy fold upper rack folding tines	-
Acrobat System, adjustable upper rack	Unloaded
Nylon coated racks	✓

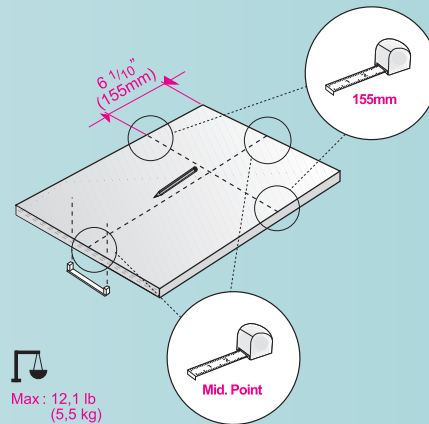
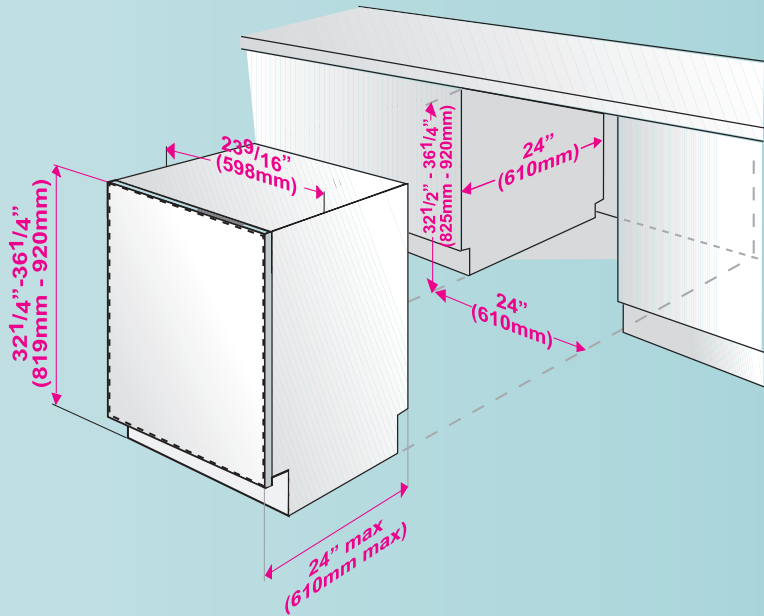
DIMENSIONS

Packed (HxWxD)	in	34 3/8x25 3/16x26
	cm	85.9x64.4x66.1
Packed Weight	(lb/kg)	96/43
Unpacked (HxWxD)	in	32 1/5x23 9/16x22 2/5
	cm	82x59.8x57
Unpacked Weight	(lb/kg)	89/40

ENVIRONMENTAL STANDARDS

Energy Star qualified	✓
Energy consumption, kWh/year	255
Water consumption, gal/cycle	3.5 - 5.0
RoHS* compliant	✓

* Lead-free

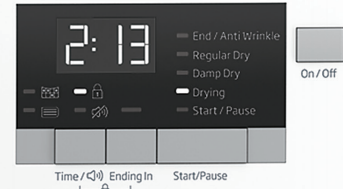


beko

HPD24412W

beko

- Jeans
- Fitness Wear
- Sensor Drying 45'
- Wool
- Silent
- BabyProtect
- Delicates
- Timed Dry
- Normal Damp Dry
- Normal Regular Dry
- Normal Extra Dry
- Perm Press Damp Dry
- Perm Press Regular Dry
- Bulky
- Air Fluff / No Heat
- Quick Dry 30'



Key Features

- The most energy efficient in its class
- Gentle and super efficient drying with EcoGentle™ technology
- Compact 24" design
- Energy Star® HeatPump Ventless dryer
- Dry up to 13 bath towels in one load
- Interior drum LED light
- Automatic water drain
- No damp laundry with OptiSense™ sensor drying technology
- Reduce static cling

Materials and Finishes

Cabinet : White
 Door rim : Chrome
 Cycle knob : Chrome

Dimensions

Product dimensions (HxWxD)
 in 33 5/16 x 23 3/8 x 24 1/2
 cm 84,6 x 60 x 62,2

Packed dimensions (HxWxD)
 in 35 1/4 x 26 x 26 3/8
 cm 89,5 x 66 x 67

Product weight
 kg 52,5
 lbs 116

Packed weight
 kg 56,5
 lbs 125

Technical Features

Rated current amps A: 5
 Voltage/ Frequency V/ Hz:
 208 - 240 / 60
 Watts W: 900

Environmental Standards

Energy Star® qualified ✓

Energy consumption
 kWh/year: 190
 UL listed ✓
 RoHS compliant ✓



OptiSense®

Beko sensor-controlled dryers provide easy use with advanced moisture and temperature sensors. The OptiSense® sensors save you from the time estimation for drying by allowing you to choose the desired dryness level.

The dryer stops automatically when it detects the requested dryness level that has been achieved. The moisture sensor also makes sure that the laundry is evenly dried.



EcoGentle Technology

Low temperature drying with EcoGentle heat pump technology provides ultimate fabric care by keeping colors vibrant for a long time. Low temperature drying also provides high energy efficiency.

beko

HPD24412W

General Properties

Dryer type	Heat Pump Ventless
Capacity cu. ft.	4,1
Dry load capacity kg	8,0
lbs	17,7
Drum material	Stainless steel AquaWave™ drum
Control	Digital display w/ dial knob
Silence level dBA	65
Automatic water drain	✓
Reduce static cling	✓
Delay time	0-24 h

Cycles

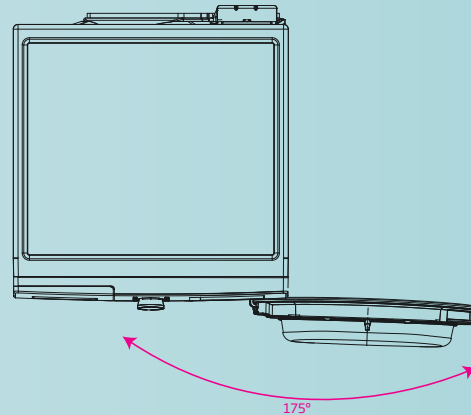
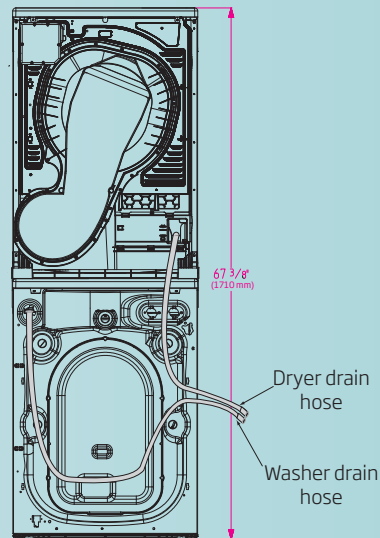
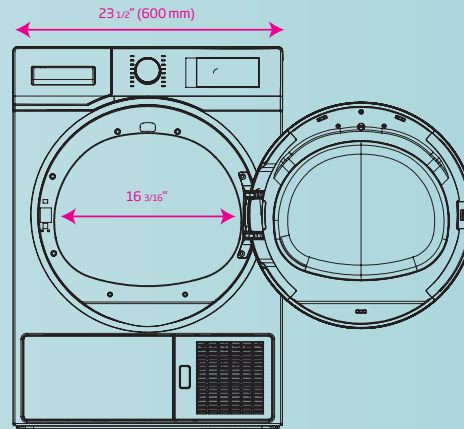
Number of cycles	16
Normal / Cottons regular	✓
Permanent press	✓
Mixed fabric	-
Delicates	✓
Bulky	✓
Air fluff / No heat	✓
Wool	✓
Jeans	✓
BabyProtect	✓
Silent program	✓
Fitness wear	✓
Quick Dry 30'	✓
Timed Dry	10-20-30-40-50-60-70-80-100-120-140-160 min

Convenience Features

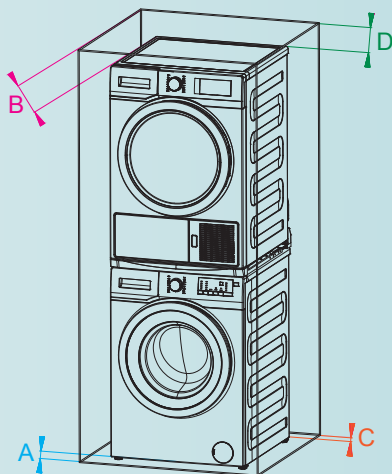
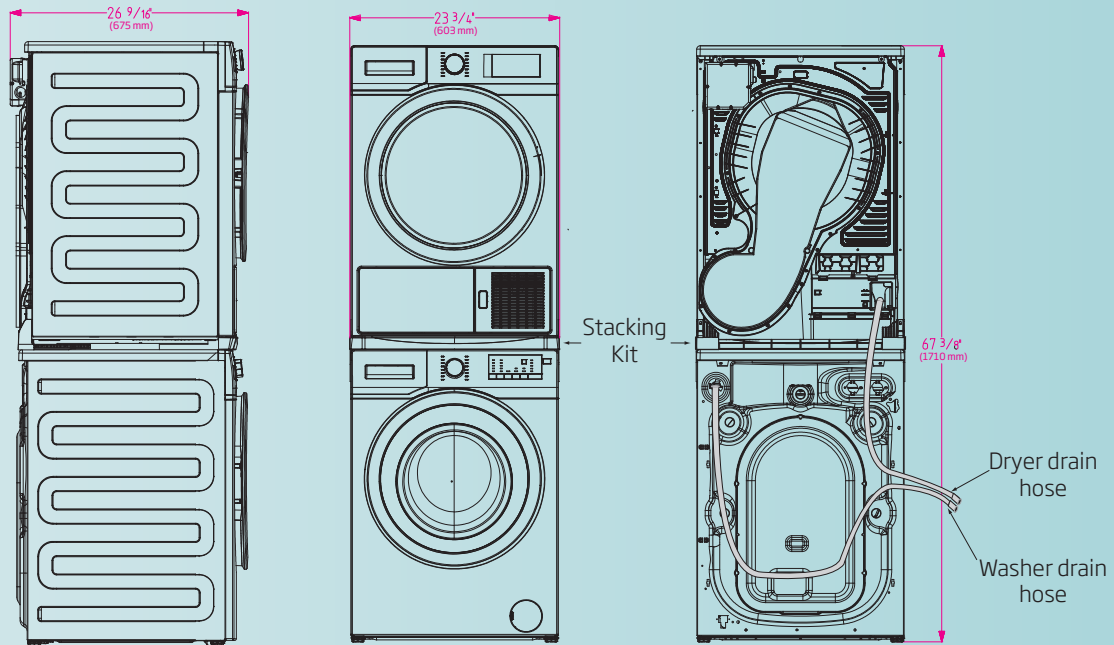
End of cycle buzzer	✓
Child lock	✓
Automatic easy Ironing	✓
Interior drum LED lighting	✓
Glass door with heat protection	✓
Reversible glass door	✓
Program follower	✓
Leveling legs	4
Clean filter indicator	✓
Number of vent options	-

Stacking Kits

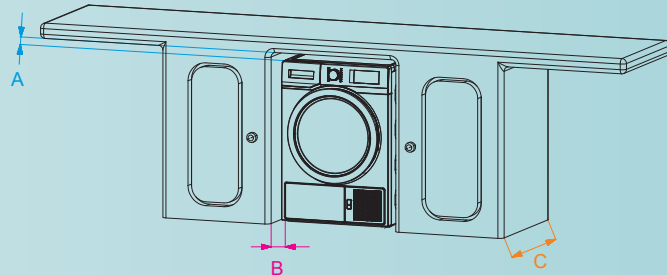
Kit-1 (universal stacking kit): Can be mounted on all clothes washers of any depth	-
Kit-2: Can be mounted on all clothes washers with 50-54-60 cm depth	2985400200



HPD24400W



A Front	1/2 in. (13 mm)
B Both sides	1/2 in. (13 mm)
C Rear	1/2 in. (13 mm)
D Top	6 1/4 in. (159 mm)



A Top	1/2" min.	13 mm
B Both sides	1/2" min.	13 mm
C Counter Depth	27" min.	686 mm



BFSB 3622 SS

21.9 cu.ft (620 L) Total Gross Volume
NeoFrost™ Cooling



Fridge

- 13 cu-ft (368 L) net fresh food volume
- Frost Free
- Water dispenser
- Touch button display
- Chrome coated wine rack
- Illumination with white LED
- 3 safety glass shelves
- 4 door racks
- Energy Star® 2014 qualified
- EverFresh+®

Freezer

- 6.32 cu-ft (179 L) net freezer volume
- Auto defrost
- Automatic ice machine with tap water connection - with water dispenser
- 2 drawers

Hygiene

- Blue zone
- hygAIR ionizing technology
- Hygiene+ antibacterial carbon filter
- Antibacterial seal

Technical Information

- Dimensions (HxWxD) (cm): 182x91x72
- Dimensions (HxWxD) (In): 71 5/8x35 7/8x28 3/8
- *Depth is with door handles. (Without handles depth: 31 15/16")

Color

BFSB 3622 SS: Fingerprint free stainless steel

FEATURES



NeoFrost™ Technology

Certain Beko fridge freezers are equipped with advanced NeoFrost™ Technology, which provides more homogenous, energy efficient and silent cooling. There is no air transfer between the freezer and fresh food compartments. This eliminates odor mixing.



EverFresh+®

Beko refrigerators with the newly designed EverFresh+® compartment help minimize humidity loss and stabilize the temperature control via air channels. EverFresh+® provides the best conditions for your fruits and green vegetables to maintain their freshness longer, providing up to 30 days of storage time.



Hygiene+

Present in some fridges is the photo catalyst filter, which eliminates bacteria potentially present in the refrigerator by working in conjunction with the air-cooling systems of the no frost or static models. This ensures permanently high levels of hygiene, protection from bacteria buildup and reduced fridge odor. The carbon filter can be reactivated easily with just one day's exposure to sunlight.



HygAIR Technology

The exceptional HygAIR Technology, available in select Beko refrigerators, brings the freshness of the pine forests to your kitchen. The technology eliminates airborne bacteria and odor-forming molecules by producing natural negative ions inside the cabinet. The ions capture microorganisms and remove them from the refrigerator via the defrost process. As a result, your food stays fresher for longer, and you can smell nature in your fridge.



White LED Lighting

The majority of models in the Beko range feature illumination with white LED for better aesthetics inside your fridge and less energy consumption.



BFSB 3622 SS

21.9 cu.ft (620 L) Total Gross Volume
NeoFrost™ Cooling

CONTROLS

Type	Side By Side Refrigerator
Control system	Electronic Control
Cooling system	NeoFrost™ Cooling

CAPACITIES

Total net volume, cu.ft	19.3
Total net volume, L	547
Fresh food net volume, cu.ft	13,0
Fresh food net volume, L	368
Freezer net volume, cu.ft	6.3
Freezer net volume, L	179

FRIDGE FEATURES

Water dispenser	x
Electronic control display type	Touch Control
Auto defrost	x
Inner illumination	White LED
Shelves	Cantilever - Partitioned Safety Glass
EverFresh+®	Yes
Crispers	2
Door racks	6
Wine rack	-
Bottle gripper	-
Egg tray	2 x Opaque / 6 Egg Holder
Compressor	Variable Speed VCC
Fan ventilation	x

FREEZER FEATURES

Auto defrost	x
Fast freeze function	x
Number of freezer drawers	2
Number of flaps	-
Automatic ice maker	1.8 lbs/day
Ice cube tray	-

HYGIENE

Blue zone	x
hygAIR ionizing technology	x
Hygiene+ antibacterial carbon filter	x
Antibacterial seal	x

TECHNICAL INFORMATION

Supply voltage, V/Hz	120 V / 60 Hz
Rated current, A	2.5 A
Noise level, dBA	46

DIMENSIONS

Unpacked HxWxD, cm	182x91x72
Unpacked HxWxD, in	71 5/8x35 7/8x28 3/8
Packed HxWxD, cm	191x98x78
Packed HxWxD, in	75 1/4x38 5/8x30 3/4
Product weight, kg	119
Product weight, lbs	262
Packed weight, kg	129
Packed weight, lbs	283

PERFORMANCE

Energy Star® qualified	x
Climatic class	T
Annual energy consumption, kwh/year	580
Cooling gas	R134a

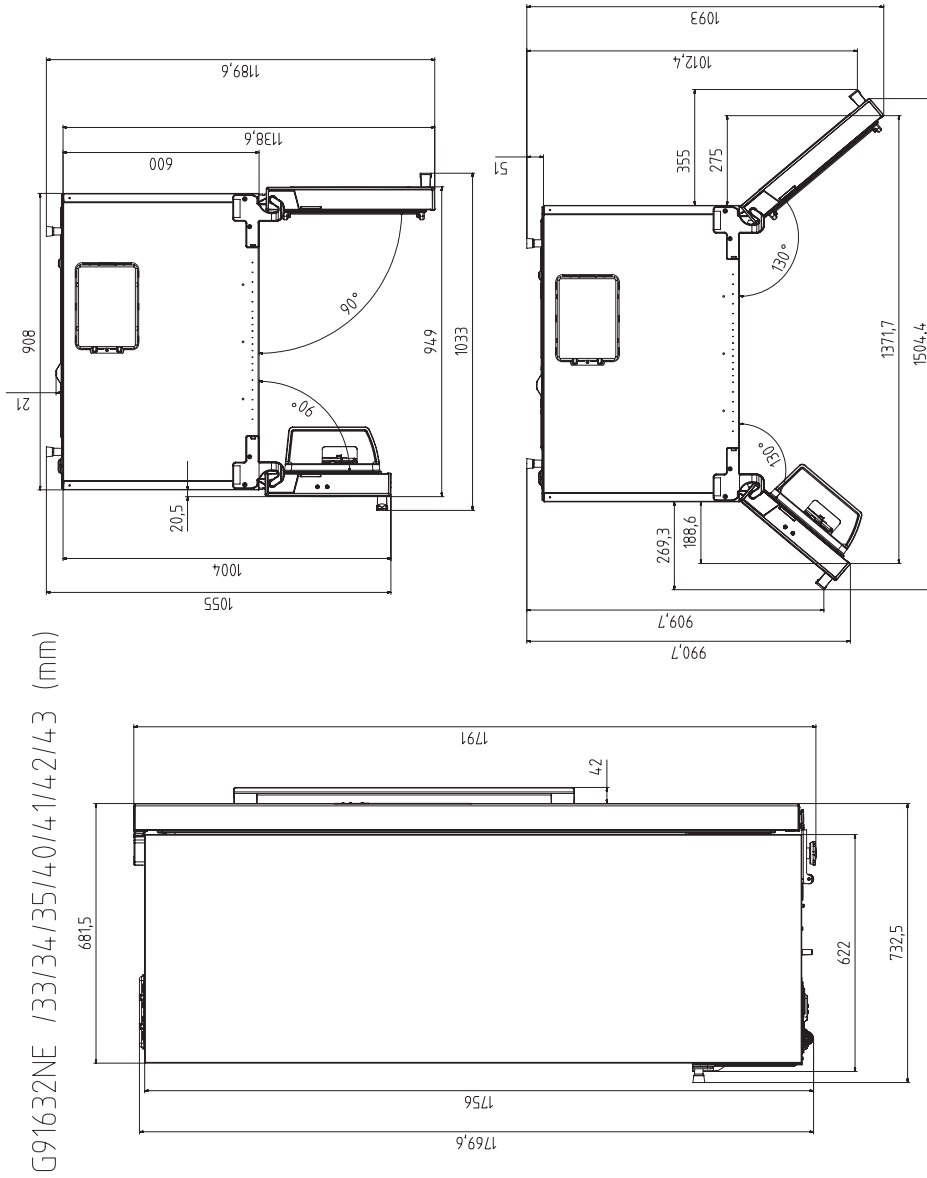
COLOR OPTIONS

WH: White	-
SL: Silver	-
SS: Finger print free stainless steel	x
FFBI: Fully integrated	-



BFSB 3622 SS

21.9 cu.ft (620 L) Total Gross Volume
NeoFrost™ Cooling



G91632NE /33/34/35/40/41/42/43 (mm)



MWOTR30100CSS

Combination Microwave



Main Features

- 44L Interior Capacity
- Touch Control
- Pull-Handle Door
- LED Display
- Glass Turntable

Materials and Finishes

- Cabinet: Stainless Steel
- Handle Color: Inox

Technical Features

- Voltage/Frequency: 120V/60Hz
- Input Power (microwave): 1550W
- Output Power (microwave): 1000W

Dimensions

- Product dimensions (HxWxD)
16 ¹³/₃₂ x 20 ¹/₄ x 15 ⁷/₈ in

FEATURES



Stainless Steel

A special coating on the stainless steel surfaces of selected refrigerator models makes fingerprints nonexistent. Your microwave will always look spotless, clean and shiny.



Multifunction Programmable Control System with Digital Display

Programmable display adds ease and inspiration to everyday cooking.

MWOTR30100CSS

Combination Microwave

FEATURES

Microwave Watts	1000
Control Type	Electric
Type of Microwave Open	Microwave
Timer	Digital Timer
Auto-Cooking	✓
Turntable	✓
Turntable Size	345

APPEARANCE

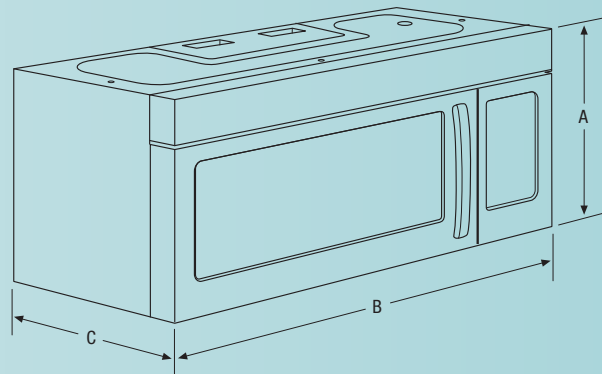
Color	Inox
Door Opening Type	Side Opening - Handle
Control Panel Color	Black + Inox

CAPACITY

Total Capacity (Lt)	44
Exhaust Capacity (cu.ft/min)	300.0
Total Capacity (cu.ft)	Good // MW Only + 1,6 cuft ventilation

ELECTRICAL INFORMATION

Electrical Input (Watt)	1500
Voltage (v)	120
Frequency (Hz)	60

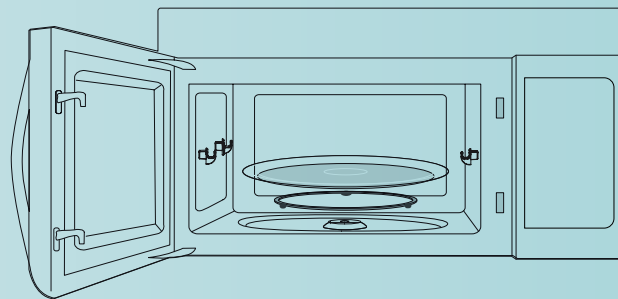


PRODUCT DIMENSIONS

A-Height	16.4" (41.7 cm)
B-Width	29.9" (75.9 cm)
C-Depth	15.2" (38.7 cm)
Weight	64lb (29.0 kg)

CUTOUT DIMENSIONS

Height (Min.)	16.75" (42.5 cm)
Height (Max.)	17.0" (43.2 cm)
Width (Min.)	30.0" (76.2 cm)
Depth (Min.)	12.0" (30.5 cm)
Depth (Max.)	13.0" (33.0 cm)



* Lead-free

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PRIR 34450 SS



Main Features

- 5.7 cu-ft. extra large oven capacity
- Sleek design with slim back splash design & illumination around the knobs
- Self clean oven
- 3D convection Cook 3 meals with no flavor mixing
- 11" XL cooking zone with reduced boiling time
- Sabbath mode,
- A full-extension telescopic rack for safe access to the oven cavity.

GENERAL PROPERTIES

Cooking modes	Bake, Convection Bake, Convection Roast, Broil (High & low)
Cleaning type	Self Clean _ 3 level
Type of grate	Metal
Knob material	-
Drawer type	Dual
Sealed burners	Yes
Interior oven light	Dual

FEATURES

5.7
cu.ft

Largest Cooking Capacity

Large cooking capacity allows you to cook multiple dishes at once. You can cook large size dishes easily.

11"
cooking
zone

11" XL Cooking Zone

Fast boiling and efficient cooking in any size pan with the 11" XL cooking zone.



Knob Illumination

Knob LED lighting lights working knob in red color, and in blue color when not working. Thus, customers can easily understand which zone is working on the cooktop & oven.

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PRGR 34450 SS

GENERAL PROPERTIES

"Bake / broil element watts (W)" 2400/3500

ELEMENT PERFORMANCE

Total number of cooktop elements 4 induction zones
 Power of front left element watts (W) 9' 2,200W /3,300W
 Power of back left element watts (W) 6' 1,400W /1,800W
 Power of center element watts (W) -
 Power of back right element watts (W) 11' 2,400 W/3,600W
 Power of front right element watts (W) 6' 1,400W /1,800W

ELEMENT SIZE

Dimension of back left heating element 6"
 Dimension of front left heating element 9"
 Dimension of center heating element -
 Dimension of back right heating element 11"
 Dimension of front right heating element 6"

TECHNICAL DETAILS

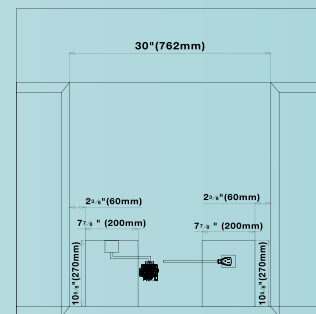
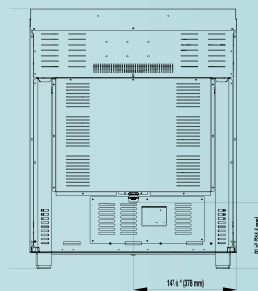
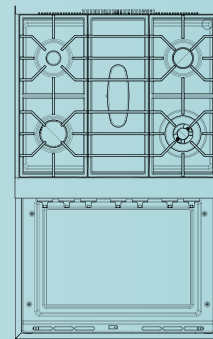
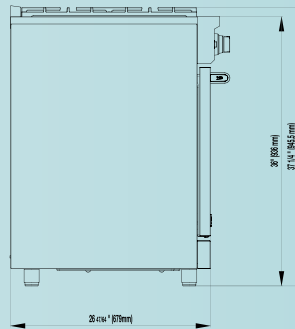
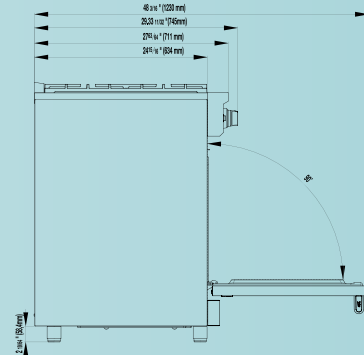
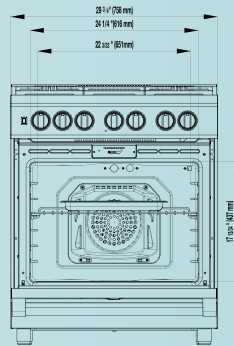
Watts (W) 10.900
 Circuit breaker (A) 40
 Volts (V) 220-240
 Frequency (Hz) 60
 Plug type NO PLUG FOR USA MARKET
 Cord length (in.) NO CORD FOR USA MARKET
 Energy source ELECTRIC

DIMENSIONS & WEIGHT

Overall appliance dimensions (HxWxD)(in.) 45.3" X 32.7" X 30.6"
 Required cutout size (HxWxD) (in.) 36" X 30" X 27"
 Adjustable range height (in.) 36.6" X 29.8" X 26"
 Overall oven interior dimensions (HxWxD)(in.) 36" X 29.8" X 26"
 Usable oven interior dimensions (HxWxD)(in.) 17.2" X 24.3" X 19"
 Net weight (lbs) 328 lbs

ACCESSORIES

Use and care manual Yes
 Installation Guide, Yes
 Meat Probe No
 Standard wire racks Yes
 Broiler Pan Yes
 Telescopic rack 1 level full extension
 Island Trim Yes
 Telescopic rack No



WMY10148C0

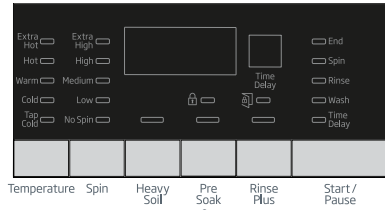
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ProSmartInverter



- Jeans
- Fitness Wear
- Cold Wash
- Wool
- Tub Clean
- Hand Wash
- Delicates
- Rinse
- Normal
- Heavy Duty
- Whites
- Pet Hair Removal Plus
- Wrinkle Free
- Bedding
- Spin & Drain
- Super Quick 20'



WMY10148C0



Key Features

- Hyper efficient technology with exceeding Energy Star® guidelines using 25% less energy*
- Fits up to 16 bath towels 2,5 cu-ft volume in compact foot print
- Prosmart™ Inverter motor technology provides quiet, efficient and durable performance
- Pet Hair Removal cycle
- Cold wash cycle cleans laundry with less energy
- OptiSense™ technology senses the needs of garments and sets the optimal wash conditions
- Internal heater provides extra sanitation for garments
- Tub Clean cycle keeps the washer fresh for cleaner clothes

*Comparing with US Federal Standard (IMEF) value in Energy Star® Certification List

Materials and Finishes

- Cabinet : White
- Door rim : Chrome
- Cyle knob : Chrome

Dimensions

Product dimensions (HxWxD)
in 33 1/8 x 23 5/8 x 24 5/8
cm 84 x 60 x 62,5

Packed dimensions (HxWxD)
in 35 x 25 5/8 x 26
cm 89 x 66,5 x 66

Product weight
kg 84
lbs 185

Packed weight
kg 87
lbs 192

Technical Features

Voltage/ Frequency V/Hz:
208-240V / 60Hz

Rated current amps: 15

Environmental Standards

Energy Star® qualified ✓

Energy consumption
kWh/year: 86 ✓
UL listed ✓
RoHS compliant ✓

Opti Sense

OptiSense®

Beko OptiSense technology clothes washers sense the needs of garments and set optimal wash conditions with 4 smart sensors. Sensors control water temperature and motor speed for enhanced fabric care, provide proper rinsing even in over sudsing and ensure safe operation in power fluctuations.



Pet Hair Removal Plus

Beko has developed a smart solution for pet lovers by creating a wash cycle that removes pet hair on laundry. When the cycle is selected, the machine adds pre-wash and additional rinsing steps to the normal program. Thus, pet hair is removed from your laundry in an effective way, solving one of the main problems of all pet owners.



ProSmart™ Inverter Motor

ProSmart™ Inverter technology provides increased efficiency and reliability by consuming less energy whilst prolonging the life of the motor. Uniquely patented unbalanced load detection and combination of different wash motions will deliver a superior washing experience.



WMY10148C0

General Properties

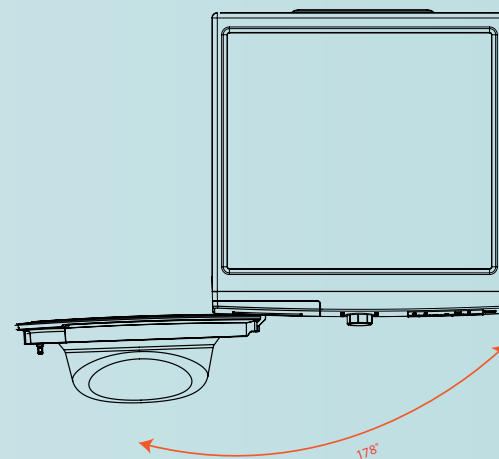
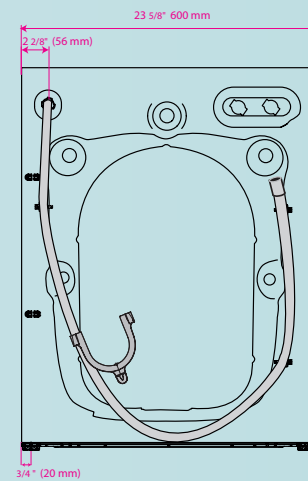
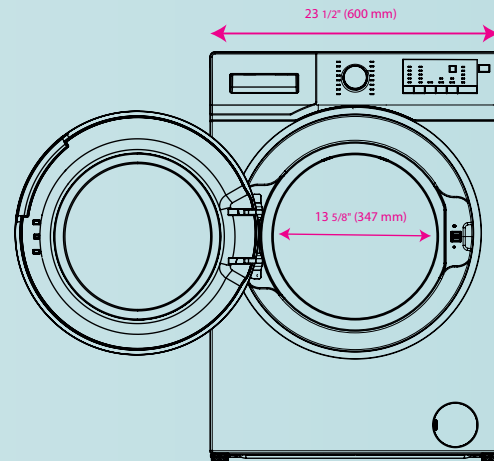
Capacity	cu. ft.	2,5
Washing load capacity	kg	10,1
	lb	22,3
Style		Front-loading
Variable spin speed		Extra high (1400 rpm), high, med, low, off
Automatic temperature control		Extra hot, hot, warm, cold, tap cold
Control		Digital display w/ dial knob
Delay time		0-24h
Remaining time indicator		✓
Silence level (washing) dBA		52
Silence level (spinning) dBA		76
Drum material		Stainless steel AquaWave™ drum
Dispenser		Detergent (liquid/powder)
		Bleach
		Fabric softener

Cycles

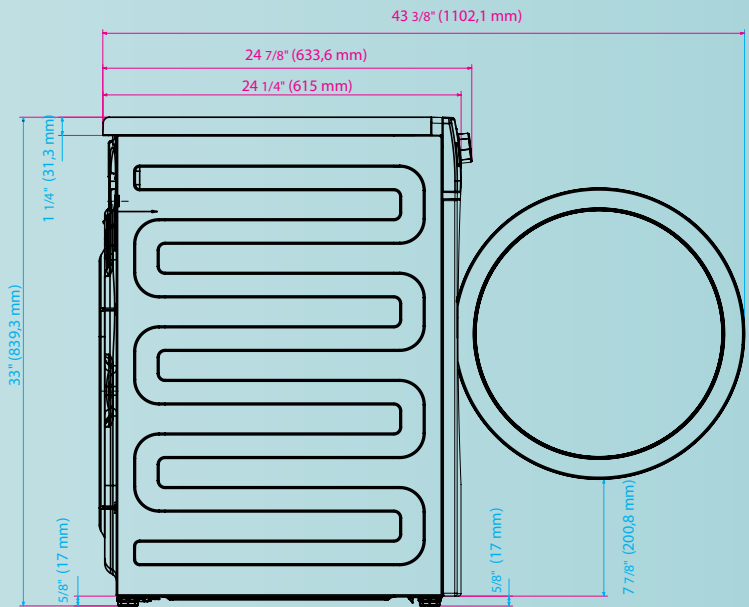
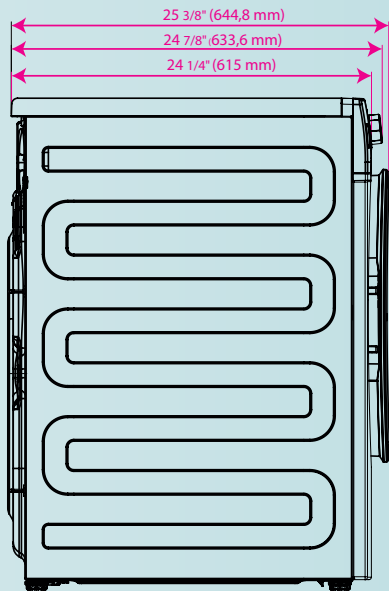
Number of wash cycles	16
Normal / Regular cotton	✓
crease free / Permanent press	✓
Hand wash	✓
Cold wash	✓
Delicates	✓
Wool	✓
Drain & spin	✓
Bedding	✓
Fitness wear	✓
Jeans	✓
Pet Hair Removal Plus	✓
Tub Clean	✓
Super Quick 20'	✓
BabyProtect	-
Rinse	✓

Convenience Features

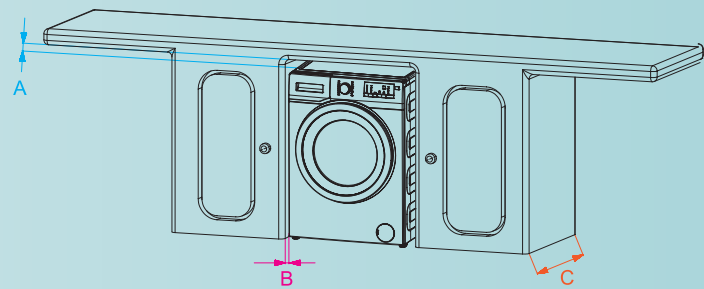
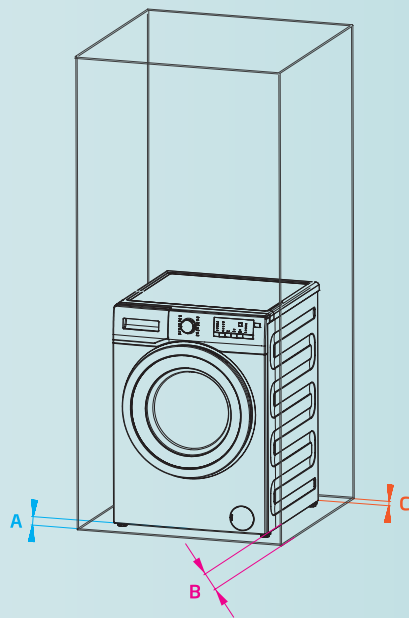
Heavy soil	✓
Super wash	-
PreSoak	✓
Extra rinse / Rinse plus	✓
Anti crease	-
Child lock	✓
Automatic water adjustment system	✓
Automatic detergent dispensing system	✓
Unbalance detection system	✓
Euro wash system with internal water heater	✓
OptiSense™ washing technology	✓
ProSmart™ Inverter technology	✓
Program follower	✓
Adjustable leveling legs	4



WMY10148CO



A Top	1/2 in. (13 mm)
B Both sides	1/2 in. (13 mm)
C Rear	1/2 in. (13 mm)



A Top	1"	26 mm
B Both sides	1/2"	13 mm
C Counter Depth	24 3/8"	620 mm

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G 20 LANDSCAPE SITE DEVELOPMENT

G 2060 SITE DEVELOPMENT

A. SYSTEM DESCRIPTION

1. The competition site is a currently undeveloped site located in Peña Station in Denver, CO.

B. FUNCTIONAL REQUIREMENTS

1. The site will be presented as specified in the U.S. Department of Energy Solar Decathlon Building Code and Draft Rules. Communications with the event organizers regarding site conditions are also used for the purposes of understanding the site.

G 2080 LANDSCAPING

A. SYSTEM DESCRIPTION

1. A temporary landscaping planter system will be placed around the site to add visual interest and greenery to the project.

B. FUNCTIONAL REQUIREMENTS

1. Provide landscaping assemblies, materials, and products that are manufactured and installed in compliance with all applicable local regulations. Refer to Section 1030 Project Criteria.

C. COMPONENTS

1. Basis of design: Subject to compliance with requirements, the design is based on the products, assemblies, and materials as indicated below. Subject to compliance with requirements, provide equal products as determined by the Architect or Engineer.
2. Wooden Planter Boxes
3. Live Plants and associated materials
 - a. Exact plants to be determined by landscape architect.
4. Handheld watering cans and water from primary storage tank will be used for irrigation.
5. Rainwater tank
 - a. Rainwater collection components shall comply with all Solar Decathlon Building Code requirements, specifically but not exclusively section 9-9. It is also to follow all local jurisdiction requirements in Denver, CO and Evanston, IL.