Appendix C | Materials

Material Schedule

Floors

Tag	Description	Manufacturer	Type/Model	Size/Color/Pattern	Properties (assumed)
C-1	Carpet	Bently	Blaze	Bad Chemistry 88754	Reflectance: .2
C-2	Carpet	Shaw	Prisma Tile	Opaque Black 63500	Reflectance: .1
CB-1	Bluestone Curb	-	-	-	Reflectance: .15
PB-1	Plant Bed	-	Grass	-	Reflectance: .18
PV-1	Concrete Pavers				Reflectance: .15
PV-2	Concrete Pavers				Reflectance: .15
RF-1	Rubber	Nora	Environcare 2.0 mm	Delphinium 2943	Reflectance: .23
RF-8	Marmoleum	Forbo	Marmoleum Dual	Barley 707	Reflectance: .25
RF-11	Marmoleum	Forbo	Piano	-	Reflectance: .15
WD-2	Wood	-	Maple	-	Reflectance: .24
WD-3	Wood	-	Cherry	-	Reflectance: .28
TZ-1	Epoxy terrazzo	-	-	-	Reflectance: .2

Walls

Tag	Description	Manufacturer	Product Name/Code	Size/Color/Pattern	Properties (assumed)
AP-1	Acoustic Panel	Armstrong	-	-	Reflectance: .7
BR-1	Face Brick	-	-	-	Reflectance: .4
MP-20	Metal Panel	-	-	-	Reflectance: .6
MP-21	Metal Panel	Centria	-	-	Reflectance: .6
P-1	Paint	Sherwin Williams	Harmony	Amazing Gray SW7044	Reflectance: .7
P-5	Paint	Sherwin Williams	Harmony	Intellectual Gray SW7045	Reflectance: .7
P-9	Paint	Sherwin Williams	Harmony	-	Reflectance: .5
PS-1	Presentation Screen	-	-	-	Reflectance: .85
WC-1	Fabric Wall Covering	-	-	Acrylic Black and Teflon Finish	Reflectance: .2
WC-3	Wall Covering	JM Lynne	Parchment	863.004	Reflectance: .2
WD-1	Wall Covering	Wolf Gordon	Arroyo	Mojave GG124772	Reflectance: .2

Ceilings

Tag	Description	Manufacturer	Product Name/Code	Size/Color/Pattern	Properties (assumed)
ACT-6	Acoustic Ceiling Panel	Armstrong World Industries	Optima 3256	48" X 48"	Reflectance: .9
ACT-10	Acoustic Ceiling Panel	Geometrix Spec. Ceil.	Metal Ceiling Panel	4' x 4'	Reflectance: .85
ACT-11	Acoustic Ceiling Panel	Tectum	Cementitious Wood Fiber Plank	-	Reflectance: .75

Material Schedule

Window Systems

Tag	Description	Manufacturer	Product Name/Code	Size/Color/Pattern	Properties (assumed)
M-1	Aluminum Mullion	-	-	-	Reflectance: .7
GL-1	Glass	-	-	¼" cl. low E insulating, ½" air space, inboard lam. cl. ¼"	Reflectance: .05, Transmittance: .51, SGH Coef: .38, U Value: .29, LSG: 1.85
GL-1A	Glass	-	-	¼" cl. low E insulating, ½" air space, inboard lam. cl. ¼", stormgard entry glass + clear thickness (.1"), inboard lite heat strengthened glas	¼", Reflectance: .05, Transmittance: .45, SGH Coef: .31, U Value: .226
GL-1B	Glass	-	-	¼" cl. low E insulating, ½" air space, inboard lam. cl. ¼", stormgard entry glass + clear thickness (.06"), inboard lite heat strengthened glas	Reflectance: .05, Transmittance: .45, SGH Coef: .31, U Value: .226
GL-2	Glass	-	-	¼" cl. low E insulating, ½" air space, inboard lam. cl. ¼" with frit pattern covering 40% of the glass.	Reflectance: .2, Transmittance: .256, SGH Coef: .29, U Value: .29, LSG: 1.62
GL-2A	Glass	-	-	¼" cl. low E insulating, ½" air space, inboard lam. cl. ¼" with frit pattern covering 40% of the glass.	Reflectance: .15, Transmittance: .18, SGH Coef: .29, U Value: .226
GL-2B	Glass	-	-	¼" cl. low E insulating, ½" air space, inboard lam. cl. ¼" with frit pattern covering 40% of the glass.	Reflectance: .15, Transmittance: .18, SGH Coef: .29, U Value: .226
GL-INT1	Glass	-	-	-	Reflectance: .5
GL-INT2	Glass	-	-	-	Reflectance: .5

Skylight Systems

Tag	Description	Manufacturer	Product Name/Code	Size/Color/Pattern	Properties (assumed)
K-1	Diffusing Skylight	Kalwall	-	Nominal 1' x 2' sections in standard grid layout	Reflectance: .5, Transmittance: .12, SGH Coef: .09, U Value .05
GB-1	Glass Block Skylight	Innovative Building Products and Pittsburgh Corning Glass Block	-	8" clear glass block with metal framing and supports	Reflectance: .3, Transmittance: .55, SGH Coef: .56, U Value: .48

Furnishings Materials and properties are assumed

Tag	Description	Manufacturer	Product Name/Code	Size/Color/Pattern	Properties (assumed)
B-1	Interior Bench	-	-	-	Reflectance: .35
B-2	Exterior Bench	-	-	-	Reflectance: .3
BK-1	Book Stack	-	-	-	Reflectance: .4
CH-1	Plastic Chair	-	-	-	Reflectance: .35
CH-2	Upholstered Chair	-	-	-	Reflectance: .2
PD-1	Podium	-	-	-	Reflectance: .35
PLNT-1	Precast Planter	-	-	-	Reflectance: .3
ST-1	Stool	-	-	-	Reflectance: .25
TB-1	Table	-	-	-	Reflectance: .35

Miscellaneous

Tag	Description	Manufacturer	Product Name/Code	Size/Color/Pattern	Properties (assumed)
MB-2	Metal Beam Enclosure	-	-	-	Reflectance: .5
MP-20	Metal Enclosure	-	-	-	Reflectance: .5
MP-21	Metal Enclosure	-	-	-	Reflectance: .5

Starphire® Ultra-Clear Glass

With its unique blue-edge and superior clarity, ***Starphire***® glass represents the ultimate achievement in ultra-clear glass technology.

Extra-Heavy *Starphire*® Glass

Up to 19 Millimeters

When conventional clear glass is laminated into multiple layers, or specified in increasing thicknesses, its appearance becomes progressively greener. The opposite occurs with ***Starphire*** glass, whose clarity intensifies as the glass gets thicker. Architects can now take advantage of this unique characteristic by specifying ***Starphire*** Extra-Heavy glass, in thicknesses of **16 (5/8")** and **19 (3/4") millimeters**.

The glass also is available monolithically in a variety of thicknesses for vision glass, security glass, spider glass and other specialty and decorative applications.

Tokyo Kasai Rinkai Park View Visitors Center
Location: *Chiba Prefecture, Japan*
Products: Starphire® *Ultra-Clear Glass*
Architect: *Yoshio Taniguchi*
Glazing Contractor: *Arai Glass Co.*
Glass Fabricator: *Sanshiba Glass Co.*

The ultra-clear character of ***Starphire*** *glass is exemplified in this Tokyo visitor center project. The difference between the unglazed lower-level breezeway and the* ***Starphire****-glazed areas is nearly imperceptible. Contrast that to the green appearance of the glass hand rails which are glazed with conventional clear glass.*

Starphire Glass Performance Data

Glass Thickness		Transmittance[2]			Reflectance[2]		U-Value[3] (Imperial)		European U-Value[4]	Shading Coeffi-cient[5]	Solar Heat Gain Coeffi-cient[6]	Light to Solar Gain (LSG)[7]
Inches	mm	Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night-time	Summer Day-time				
Monolithic												
STARPHIRE® **Glass**												
1/4	6	87	91	89	8	8	1.02	0.93	5.75	1.03	0.90	1.01
1/2	12	83	90	86	8	8	0.98	0.89	5.53	1.01	0.88	1.03
5/8	16	81	90	84	8	8	0.97	0.88	5.43	1.00	0.87	1.03
3/4	19	80	90	83	8	7	0.95	0.86	5.34	0.99	0.86	1.04
Clear Glass												
1/4	6	66	89	77	9	7	1.02	0.93	5.75	0.94	0.81	1.09
1/2	12	53	85	64	8	6	0.98	0.88	5.53	0.84	0.72	1.18
5/8	16	49	84	59	8	6	0.97	0.88	5.43	0.80	0.69	1.22
3/4	19	46	83	55	8	6	0.95	0.86	5.34	0.77	0.67	1.24

Notes see page 11.

Cover Photo Credits

Suvarnabhumi Airport-Bangkok Airport, Bangkok, Thailand
Products: ***Sungate***® 500 Glass
Architect: Murphy Jahn
Glass Fabricator: PMK Central Glass Co., Ltd.

Cover Inset Photo Credits (left to right)

1. **Lear World Headquarters**, Southfield, MI
Products: ***Solarban***® 60/Clear Glass
Architect: Albert Kahn Associates
Glazing Contractor: American Glass & Metal Corp.
Glass Fabricator: Oldcastle Glass
Owner: Lear Corporation

2. **St. Regis**, San Fransisco, CA
Products: ***Solarban***® 60/Clear Glass
Architect: Skidmore, Owings & Merrill, LLP
Glazing Contractor: Architectural Glass & Aluminum Co.
Glass Fabricator: Northwestern Industries, Inc.
Owner: Starwood Hotels & Resorts

3. **American Family Children's Hospital**, Madison, WI
Products: ***Solarbronze/ Solarban***® 60 Glass
Architect: HDR Architecture, Inc.
Glazing Contractor: Klein-Dickert Glass
Glass Fabricator: Oldcastle Glass
Owner: University of Wisconsin Hospital and Clinics Board

4. **300 3rd Street**, Little Rock, AR
Products: ***Solarban***® 80 Glass
Architect: AMR Architects
Glazing Contractor: Ace Glass Company
Glass Fabricator: Vitro America
Owner: Moses Tucker Real Estate Inc.

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(top to bottom, left to right)

1. **Leipziger**, Leipzig, Germany
Products: ***Starphire***® Glass
Architect: Von Gerkin, Mark & Partner
Glazing Contractor: Ian Ritchie Architects

2. **Orthopedic Center at Lancaster General Hospital**, Lancaster, PA
Products: ***Sungate***® 500 Glass
Architect: IKM Incorporated
Glazing Contractor: National Glass & Metal Company, Inc.
Glass Fabricator: JE Berkowitz
Owner: Lancaster General Hospital

3. **Sinclair Broadcasting Group**, Hunt Valley, MD
Products: ***Optigray***® 23 Glass
Architect: Roy Kirby & Sons, Inc.
Glazing Contractor: Vision Contract, Inc.
Glass Fabricator: JE Berkowitz
Owner: Beaver Dam LLC

4. **Figge Art Museum**, Davenport, IA
Products: ***Solarban***® 60/Clear Glass
Architect: HLKB/David Chipperfield London
Glazing Contractor: Architectural Wall Systems
Glass Fabricator: Oldcastle Glass
Owner: Figge Art Musuem

5. **The Institute for Advanced Learning and Research**, Danville, VA
Products: ***Solexia***™ Glass
Architect: PSA - Dewberry
Glazing Contractor: Piedmont Glass
Glass Fabricator: Vitro America
Owner: Virginia Tech IALR

6. **Frontrunner Systems/Bolingbrook Glass & Mirror**, Bolingbrook, IL
Products: ***Vistacool Azuria***™/***Sungate***® 500 Glass
Architect: Ekash Associates
Glazing Contractor: Frontrunner Glass & Metal, Inc.
Glass Fabricator: Oldcastle Glass
Owner: FUB Partnership

PPG IdeaScapes™
Glass • Coatings • Paint

One-Inch Insulating Glass Unit Comparisons with PPG Glass*

Insulating Vision Unit Performance Comparisons — 1-inch (25mm) units with 1/2-inch (13mm) airspace and two 1/4-inch (6mm) lites; interior lite clear unless otherwise noted											
Glass Type: Outdoor Lite: *Coating if Any (Surface) Glass* + Indoor Lite: *Coating if Any (Surface) Glass*	Transmittance[2]			Exterior Reflectance[2]		U-Value[3] (Imperial)		European U-Value[4]	Shading Coefficient[5]	Solar Heat Gain Coefficient[6]	Light to Solar Gain (LSG)[7]
	Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night-time	Summer Day-time				
Uncoated											
Clear Glass + Clear	50	79	61	15	12	0.47	0.50	2.81	0.81	0.70	1.13
STARPHIRE® + STARPHIRE	77	84	80	15	14	0.47	0.50	2.81	0.94	0.82	1.02
SOLEXIA™ + Clear	25	69	39	13	8	0.47	0.50	2.81	0.57	0.49	1.41
ATLANTICA™ + Clear	13	60	29	11	7	0.47	0.50	2.81	0.47	0.40	1.50
CARIBIA® + Clear	20	60	28	11	7	0.47	0.50	2.81	0.45	0.39	1.55
AZURIA™ + Clear	34	61	28	11	7	0.47	0.50	2.81	0.45	0.39	1.56
SOLARBRONZE® + Clear	21	47	39	8	7	0.47	0.50	2.81	0.59	0.51	0.93
SOLARGRAY® + Clear	20	40	33	7	7	0.47	0.50	2.81	0.53	0.45	0.88
OPTIGRAY® 23 + Clear	6	21	15	6	5	0.47	0.50	2.81	0.34	0.29	0.71
GRAYLITE® + Clear	6	12	19	5	5	0.47	0.50	2.81	0.39	0.34	0.36
Coated											
***SUNGATE®* 500 Low-E Glass**											
SUNGATE 500 (2) + Clear	42	74	52	17	14	0.35	0.35	1.96	0.71	0.62	1.19
SOLEXIA + SUNGATE 500 (3) Clear	21	64	33	14	9	0.35	0.35	1.96	0.51	0.44	1.45
ATLANTICA + SUNGATE 500 (3) Clear	11	56	25	12	7	0.35	0.35	1.96	0.41	0.35	1.60
CARIBIA + SUNGATE 500 (3) Clear	17	56	24	12	7	0.35	0.35	1.96	0.40	0.34	1.65
AZURIA + SUNGATE 500 (3) Clear	29	57	24	12	7	0.35	0.35	1.96	0.40	0.34	1.66
Bronze + *SUNGATE* 500 (3) Clear	18	44	33	9	9	0.35	0.35	1.96	0.53	0.46	0.96
Gray + *SUNGATE* 500 (3) Clear	17	37	28	8	8	0.35	0.35	1.96	0.47	0.40	0.92
OPTIGRAY 23 + *SUNGATE* 500 (3) Clear	6	19	13	6	6	0.35	0.35	1.96	0.28	0.24	0.80
GRAYLITE + SUNGATE 500 (3) Clear	5	11	16	5	6	0.35	0.35	1.96	0.33	0.28	0.41
***SOLARBAN®* 60 Solar Control Low-E Glass**											
SOLARBAN 60 (2) *STARPHIRE + STARPHIRE*	25	74	38	11	42	0.29	0.27	1.55	0.46	0.40	1.85
SOLARBAN 60 (2) Clear + Clear	19	70	33	11	29	0.29	0.27	1.55	0.44	0.38	1.85
SOLARBAN 60 (2) *ATLANTICA* + Clear	5	54	20	8	7	0.29	0.27	1.55	0.31	0.27	1.98
SOLARBAN 60 (2) *AZURIA* + Clear	13	54	21	8	7	0.29	0.27	1.55	0.32	0.28	1.93
SOLARBAN 60 (2) *CARIBIA* + Clear	8	54	20	8	7	0.29	0.27	1.55	0.31	0.27	1.99
SOLARBAN 60 (2) *SOLEXIA* + Clear	10	61	25	10	11	0.29	0.27	1.55	0.36	0.32	1.92
SOLARBAN 60 (2) *SOLARBRONZE* + Clear	8	42	20	7	16	0.29	0.27	1.55	0.31	0.27	1.56
SOLARBAN 60 (2) *SOLARGRAY* + Clear	8	35	17	6	12	0.29	0.27	1.55	0.28	0.24	1.47
SOLEXIA + SOLARBAN 60 (3) Clear	10	61	25	11	11	0.29	0.27	1.55	0.42	0.36	1.70
ATLANTICA + SOLARBAN 60 (3) Clear	5	53	20	9	7	0.29	0.27	1.55	0.35	0.30	1.78
CARIBIA + SOLARBAN 60 (3) Clear	8	54	20	9	7	0.29	0.27	1.55	0.35	0.31	1.74
AZURIA + SOLARBAN 60 (3) Clear	13	54	21	9	7	0.29	0.27	1.55	0.36	0.31	1.75
Bronze + *SOLARBAN* 60 (3) Clear	8	42	20	7	17	0.29	0.27	1.55	0.36	0.31	1.36
Gray + *SOLARBAN* 60 (3) Clear	8	35	17	7	13	0.29	0.27	1.55	0.32	0.28	1.26
OPTIGRAY 23 + *SOLARBAN* 60 (3) Clear	3	18	9	5	6	0.29	0.27	1.55	0.21	0.18	1.02
GRAYLITE + SOLARBAN 60 (3) Clear	2	11	7	5	10	0.29	0.27	1.55	0.20	0.17	0.64
***SOLARBAN®* 80 Solar Control Low-E Glass**											
SOLARBAN 80 (2) Clear + Clear	13	48	20	33	38	0.29	0.27	1.52	0.28	0.24	1.98
SOLARBAN 80 (2) Clear + *OPTIBLUE*†	10	34	15	32	38	0.29	0.27	1.52	0.27	0.23	1.48
SOLARBAN 80 (2) *OPTIBLUE* + Clear	9	34	15	19	28	0.29	0.27	1.52	0.23	0.20	1.70
SOLARBAN 80 (2) *OPTIBLUE + OPTIBLUE*	7	25	11	19	28	0.29	0.27	1.52	0.23	0.20	1.23
***SOLARBAN®* z50 Solar Control Low-E Glass†**											
SOLARBAN z50 (2) *OPTIBLUE* + Clear	14	51	26	8	23	0.29	0.27	1.55	0.36	0.31	1.64
SOLARBAN z50 (2) *OPTIBLUE + OPTIBLUE*	11	37	20	7	23	0.29	0.27	1.55	0.35	0.31	1.18
AZURIA + SOLARBAN z50 (3) *OPTIBLUE*	10	39	16	8	7	0.29	0.27	1.55	0.35	0.30	1.31
ATLANTICA + SOLARBAN z50 (3) *OPTIBLUE*	4	39	15	8	7	0.29	0.27	1.55	0.34	0.30	1.28
CARIBIA + SOLARBAN z50 (3) *OPTIBLUE*	6	39	15	8	7	0.29	0.27	1.55	0.34	0.30	1.29
SOLEXIA + SOLARBAN z50 (3) *OPTIBLUE*	8	44	19	10	11	0.29	0.27	1.55	0.41	0.35	1.26
Bronze + *SOLARBAN* z50 (3) *OPTIBLUE*	7	30	16	7	17	0.29	0.27	1.55	0.35	0.31	0.98
Gray + *SOLARBAN* z50 (3) *OPTIBLUE*	6	25	14	6	13	0.29	0.27	1.55	0.32	0.28	0.91

* Performance data is based on representative samples of factory production. Actual values may vary slightly due to variations in the production process.

† *Optiblue* is a unique substrate by PPG designed specically for *Solarban* z50. It can also be used for spandrel glass and as an interior lite for *Solarban* 80 glass.

†† *Solarban* 70XL requires the coating on *Starphire* glass.

1. **Figures may vary due to manufacturing tolerances. All tabulated data is based on NFRC methodology using the LBNL Window 5.2 software. Variations from previously published data are due to minor changes in the LBNL Window 5.2 software versus Version 4.1.**
2. **Transmittance and Reflectance** values are based on spectrophotometric measurements and energy distribution of solar radiation.
3. **U-Value** is the overall coefficient of heat transmittance or heat flow measured in BTU/hr. • ft² • °F. Lower U-values indicate better insulating performance.
4. **European U-Value** is the overall coefficient of heat transmittance or heat flow measured in Watts/m²•°C, and is calculated using WinDat WIS version 3.0.1 software.
5. **Shading Coefficient** is the ratio of the total amount of solar energy that passes through a glass relative to 1/8-inch (3.0mm) thick clear glass under the same design conditions. It includes both solar energy transmitted directly plus any absorbed solar energy re-radiated and convected. Lower shading coefficient values indicate better performance in reducing solar heat gain. Note: Performance values were calculated using the LBNL Window 5.2 program using NFRC 100-2001 standard winter and summer design condition.
6. **Solar Heat Gain Coefficient (SHGC)** represents the solar heat gain through the glass relative to the incident solar radiation. It is equal to 86% of the shading coefficient.
7. **Light to Solar Gain (LSG) ratio** is the ratio of visible light transmittance to solar heat gain coefficient.

One-Inch Glass Unit Comparisons*

Insulating Vision Unit Performance Comparisons 1-inch (25mm) units with 1/2-inch (13mm) airspace and two 1/4-inch (6mm) lites; interior lite clear unless otherwise noted

Glass Type Outdoor Lite: *Coating if Any (Surface) Glass* + Indoor Lite: *Coating if Any (Surface) Glass*	Transmittance[2]			Exterior Reflectance[2]		U-Value[3] (Imperial)		European U-Value[4]	Shading Coefficient[5]	Solar Heat Gain Coefficient[6]	Light to Solar Gain (LSG)[7]
	Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night-time	Summer Day-time				
Coated											
***SOLARBAN*® 70XL Solar Control Low-E Glass ††**											
SOLARBAN 70XL (2) *STARPHIRE* + Clear	6	64	25	12	52	0.28	0.26	1.50	0.32	0.27	2.37
SOLARBAN 70XL (2) *SOLEXIA* + Clear	3	55	19	10	12	0.28	0.26	1.50	0.29	0.25	2.18
SOLARBAN 70XL (2) *ATLANTICA* + Clear	2	48	16	9	8	0.28	0.26	1.50	0.26	0.23	2.07
SOLARBAN 70XL (2) *CARIBIA* + Clear	2	48	16	9	7	0.28	0.26	1.50	0.27	0.23	2.07
SOLARBAN 70XL (2) *AZURIA* + Clear	4	48	17	9	7	0.28	0.26	1.50	0.27	0.23	2.09
SOLARBAN 70XL (2) *SOLARBRONZE* + Clear	2	38	14	7	19	0.28	0.26	1.50	0.23	0.20	1.88
SOLARBAN 70XL (2) *SOLARGRAY* + Clear	2	31	12	7	15	0.28	0.26	1.50	0.22	0.19	1.65
SOLEXIA + *SOLARBAN* 70XL (3) *STARPHIRE*	3	56	20	11	13	0.28	0.26	1.50	0.37	0.32	1.74
ATLANTICA + *SOLARBAN* 70XL (3) *STARPHIRE*	2	49	17	10	8	0.28	0.26	1.50	0.32	0.28	1.74
CARIBIA + *SOLARBAN* 70XL (3) *STARPHIRE*	2	49	17	9	8	0.28	0.26	1.50	0.32	0.28	1.75
AZURIA + *SOLARBAN* 70XL (3) *STARPHIRE*	4	49	17	10	8	0.28	0.26	1.50	0.33	0.29	1.70
Bronze + *SOLARBAN* 70XL (3) *STARPHIRE*	3	38	15	8	20	0.28	0.26	1.50	0.30	0.26	1.48
Gray + *SOLARBAN* 70XL (3) *STARPHIRE*	2	32	13	7	15	0.28	0.26	1.50	0.27	0.24	1.34
OPTIGRAY 23 + *SOLARBAN* 70XL (3) *STARPHIRE*	1	17	7	5	7	0.28	0.26	1.50	0.19	0.16	1.04
GRAYLITE + *SOLARBAN* 70XL (3) *STARPHIRE*	1	10	5	5	11	0.28	0.26	1.50	0.16	0.14	0.71
***VISTACOOL*™ Subtly Reflective Glass**											
VISTACOOL (2) *AZURIA* + Clear	29	47	22	21	11	0.47	0.50	2.81	0.39	0.34	1.39
VISTACOOL (2) *CARIBIA* + Clear	16	47	22	21	10	0.47	0.50	2.81	0.39	0.34	1.38
VISTACOOL (2) *SOLARGRAY* + Clear	17	31	28	17	9	0.47	0.50	2.81	0.47	0.40	0.77
***SOLARCOOL*® Glass**											
SOLARCOOL (2) *SOLEXIA* + Clear	7	27	19	24	12	0.48	0.50	2.82	0.36	0.31	0.87
SOLARCOOL (2) *CARIBIA* + Clear	6	24	12	19	9	0.48	0.50	2.82	0.30	0.25	0.94
SOLARCOOL (2) *AZURIA* + Clear	10	24	12	20	10	0.48	0.50	2.82	0.29	0.25	0.95
SOLARCOOL (2) Bronze + Clear	6	19	21	14	12	0.48	0.50	2.82	0.40	0.34	0.55
SOLARCOOL (2) Gray + Clear	6	16	18	11	10	0.48	0.50	2.82	0.36	0.31	0.50
SOLARCOOL (2) *GRAYLITE* + Clear	2	5	12	5	6	0.48	0.50	2.82	0.31	0.26	0.18
***VISTACOOL*™ and *SOLARCOOL*® with *SUNGATE*® 500 Low-E (3)**											
VISTACOOL (2) *AZURIA* + *SUNGATE* 500 (3) Clear	24	44	19	22	11	0.35	0.35	1.96	0.34	0.29	1.53
VISTACOOL (2) *CARIBIA* + *SUNGATE* 500 (3) Clear	14	44	19	22	11	0.35	0.35	1.96	0.34	0.29	1.51
VISTACOOL (2) *SOLARGRAY* + *SUNGATE* 500 (3) Clear	14	29	23	12	10	0.35	0.35	1.96	0.41	0.35	0.83
SOLARCOOL (2) *SOLEXIA* + *SUNGATE* 500 (3) Clear	6	25	15	24	13	0.35	0.35	1.96	0.31	0.26	0.98
SOLARCOOL (2) *CARIBIA* + *SUNGATE* 500 (3) Clear	5	22	10	19	10	0.35	0.35	1.96	0.24	0.20	1.11
SOLARCOOL (2) *AZURIA* + *SUNGATE* 500 (3) Clear	8	22	10	20	10	0.35	0.35	1.96	0.23	0.20	1.11
SOLARCOOL (2) Bronze + *SUNGATE* 500 (3) Clear	5	18	17	14	13	0.35	0.35	1.96	0.34	0.29	0.61
SOLARCOOL (2) Gray + *SUNGATE* 500 (3) Clear	5	15	14	11	10	0.35	0.35	1.96	0.30	0.26	0.56
SOLARCOOL (2) *GRAYLITE* + *SUNGATE* 500 (3) Clear	1	5	9	5	7	0.35	0.35	1.96	0.25	0.21	0.21
***VISTACOOL*™ and *SOLARCOOL*® with *SOLARBAN*® 60 Solar Control Low-E (3)**											
VISTACOOL (2) *AZURIA* + *SOLARBAN* 60 (3) Clear	11	42	16	20	11	0.29	0.27	1.55	0.30	0.26	1.61
VISTACOOL (2) *CARIBIA* + *SOLARBAN* 60 (3) Clear	7	42	16	20	11	0.29	0.27	1.55	0.29	0.25	1.66
VISTACOOL (2) *SOLARGRAY* + *SOLARBAN* 60 (3) Clear	7	27	14	11	15	0.29	0.27	1.55	0.28	0.24	1.13
SOLARCOOL (2) *SOLEXIA* + *SOLARBAN* 60 (3) Clear	3	24	10	24	15	0.29	0.27	1.55	0.22	0.19	1.26
SOLARCOOL (2) *CARIBIA* + *SOLARBAN* 60 (3) Clear	2	21	8	19	10	0.29	0.27	1.55	0.19	0.16	1.30
SOLARCOOL (2) *AZURIA* + *SOLARBAN* 60 (3) Clear	4	21	8	19	10	0.29	0.27	1.55	0.19	0.16	1.31
SOLARCOOL (2) Bronze + *SOLARBAN* 60 (3) Clear	3	17	9	14	18	0.29	0.27	1.55	0.21	0.18	0.92
SOLARCOOL (2) Gray + *SOLARBAN* 60 (3) Clear	2	14	7	11	14	0.29	0.27	1.55	0.19	0.16	0.86
SOLARCOOL (2) *GRAYLITE* + *SOLARBAN* 60 (3) Clear	1	4	3	5	10	0.29	0.27	1.55	0.14	0.12	0.36
***VISTACOOL*™ Subtly Reflective, Color-Enriched Glass with *SOLARBAN*® z50 Solar Control Low-E**											
VISTACOOL (2) *AZURIA* + *SOLARBAN* z50 (3) *OPTIBLUE*	9	30	12	20	11	0.29	0.27	1.55	0.29	0.25	1.20
VISTACOOL (2) *CARIBIA* + *SOLARBAN* z50 (3) *OPTIBLUE*	5	30	12	20	11	0.29	0.27	1.55	0.29	0.25	1.20
VISTACOOL (2) *SOLARGRAY* + *SOLARBAN* z50 (3) *OPTIBLUE*	5	20	11	11	15	0.29	0.27	1.55	0.27	0.24	0.82
***VISTACOOL*™ and *SOLARCOOL*® with *SOLARBAN*® 70XL Solar Control Low-E (3) ††**											
VISTACOOL (2) *AZURIA* + *SOLARBAN* 70XL (3) *STARPHIRE*	4	38	14	21	12	0.28	0.26	1.50	0.27	0.24	1.59
VISTACOOL (2) *CARIBIA* + *SOLARBAN* 70XL (3) *STARPHIRE*	2	38	13	20	11	0.28	0.26	1.50	0.27	0.23	1.65
VISTACOOL (2) *SOLARGRAY* + *SOLARBAN* 70XL (3) *STARPHIRE*	2	25	10	11	17	0.28	0.26	1.50	0.23	0.20	1.24
SOLARCOOL (2) *SOLEXIA* + *SOLARBAN* 70XL (3) *STARPHIRE*	1	22	8	24	16	0.28	0.26	1.50	0.20	0.17	1.28
SOLARCOOL (2) *CARIBIA* + *SOLARBAN* 70XL (3) *STARPHIRE*	1	19	6	19	10	0.28	0.26	1.50	0.18	0.15	1.27
SOLARCOOL (2) *AZURIA* + *SOLARBAN* 70XL (3) *STARPHIRE*	1	19	7	19	10	0.28	0.26	1.50	0.18	0.15	1.27
SOLARCOOL (2) Bronze + *SOLARBAN* 70XL (3) *STARPHIRE*	1	15	6	14	19	0.28	0.26	1.50	0.17	0.15	1.01
SOLARCOOL (2) Gray + *SOLARBAN* 70XL (3) *STARPHIRE*	1	13	5	11	15	0.28	0.26	1.50	0.16	0.14	0.89
SOLARCOOL (2) *GRAYLITE* + *SOLARBAN* 70XL (3) *STARPHIRE*	< 1	4	2	5	10	0.28	0.26	1.50	0.12	0.10	0.39

Important glass design considerations and comprehensive technical information, including performance, thermal stress and wind load data, for all PPG glasses are available at www.ppgideascapes.com/glasstechnical. Monolithic Glass Data can also be found at www.ppgideascapes.com/glasstechnical or by calling 1-888-PPG-IDEA (1-888-774-4332).

PPG Ideascapes™
Glass • Coatings • Paint

PITTSBURGH CORNING GLASS BLOCK®

architectural products

GLASS BLOCK PRODUCTS
& DESIGN INFORMATION

PITTSBURGH CORNING GLASS BLOCK PRODUCTS

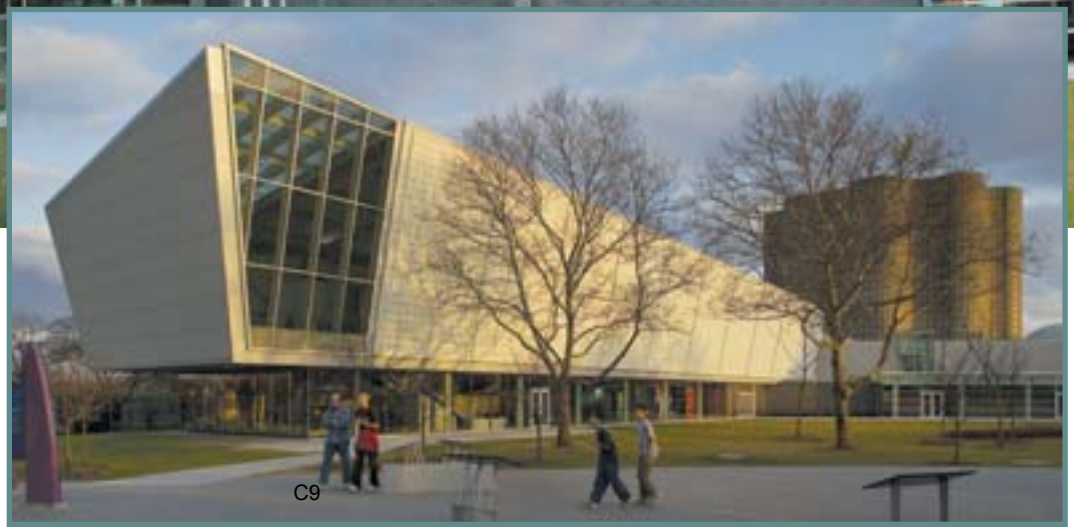
	Pattern	Nominal Size[1] (Actual size is 1/4" less than nominal; mm shown is actual)	Weight (lb/ft²) installed with mortar	Heat Transmission[2] U Value (Btu/hr ft² °F)	Thermal Resistance[2] R Value (hr ft² °F/Btu)	Visible Light Transmission[3] (%)	Shading Coef.[5]	Sound Transmission S.T.C.	Solar Heat Gain Coefficient[7]
HIGH PERFORMANCE LINE	**Solar Reflective Glass Block**								
	SRT Clear	190 mm x 190mm x 95 mm (metric size)	20	0.58	1.72	30	0.55		.40
	SRT Wavy	190 mm x 190 mm x 95 mm (metric size)	20	0.57	1.75	30	0.55		.34
	THICKSET® Block—Nominal Thickness = 4"; Actual Thickness = 3⅞" (98mm)								
	THICKSET® 60 Block—DECORA® & VUE®	8" x 8" (197mm)	25	0.51	1.96	VUE®=75 DECORA®=49	0.65	48	.66-.68[7]
	THICKSET® 90 Block—DECORA® & VUE®	8" x 8" (197mm)	30	0.51	1.96	VUE®=70 DECORA®=38	0.65	50	.66-.68[7]
	THICKSET® 90 Block—ENDURA™	8" x 8" (197mm)	30	0.51	1.96	38	0.65	50	.66-.68[7]
	Glass Block with "LX" Fibrous Glass Inserts—Nominal Thickness = 4"; Actual Thickness = 3⅞" (98mm)								
	DECORA® "LX" Filter	6" x 6" (146mm)	20	0.48	2.06	50-55[4]	0.45[4]		.56
		8" x 8" (197mm)	20	0.48	2.06	50-55[4]	0.45[4]	40	.56
		12" x 12" (299mm)	20	0.48	2.06	50-55[4]	0.45[4]		.56
	VISTABRIK® Solid Glass Block—See Nominal/Actual Sizes Listed								
	VISTABRIK® Solid Glass Block	8" x 8" x 3" Nominal 7⅝" x 7⅝" x 3" Actual (194mm x 194mm x 76mm)	40	0.87	1.15	80		53 (NRC=0.05)	.75-.78[7]
		3" x 8" x 3" Nominal 3" x 7⅝" x 3" Actual (76mm x 194mm x 76mm)	40	0.87	1.15	80			.75-.78[7]
		(Paver) 8" x 8" x 1½" Nominal 7⅝" x 7⅝" x 1½" Actual (194mm x 194mm x 38mm)	N/A	0.87	1.15	80			.75-.78[7]
		4" x 8" x 3" Nominal 3⅝" x 7⅝" x 3" Actual (92mm x 194mm x 76mm)	40	0.87	1.15	80			.75-.78[7]
	STIPPLE Finish	8" x 8" x 3" Nominal 7⅝" x 7⅝" x 3" Actual (194mm x 194mm x 76mm)	40	0.87	1.15	80		53 (NRC=0.05)	.75-.78[7]
SIGNATURE LINE	**Standard Premiere Series Block—Nominal Thickness = 4"; Actual Thickness = 3⅞" (98mm)**								
	ARGUS®	6" x 6" (146mm)	20	0.51	1.96	75	0.65	37	.66-.68[7]
		8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
		12" x 12" (299mm)	20	0.51	1.96	75	0.65	35	.66-.68[7]
	ARGUS® Parallel Fluted	8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
	Bevel (All Patterns)	8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
	DECORA®	6" x 6" (146mm)	20	0.51	1.96	75	0.65	37	.66-.68[7]
		8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
		12" x 12" (299mm)	20	0.51	1.96	75	0.65	35	.66-.68[7]
		4" x 8" (95 x 197mm)	20	0.51	1.96	75	0.65		.66-.68[7]
		6" x 8" (146 x 197mm)	20	0.51	1.96	75	0.65		.66-.68[7]
	ESSEX® AA	8" x 8" (197mm)	20	0.51	1.96	50[4]	0.45[4]	39	.66-.68[7]
	FOCUS™	8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
	IceScapes®	8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
		4" x 8" (95 x 197mm)	20	0.51	1.96	75	0.65		.66-.68[7]
		6" x 8" (146 x 197mm)	20	0.51	1.96	75	0.65		.66-.68[7]
	SeaScapes™	8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
	SPYRA®	8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
	VUE®	6" x 6" (146mm)	20	0.51	1.96	75	0.65	37	.66-.68[7]
		8" x 8" (197mm)	20	0.51	1.96	75	0.65	39	.66-.68[7]
		12" x 12" (299mm)	20	0.51	1.96	75	0.65	35	.66-.68[7]
		4" x 8" (95 x 197mm)	20	0.51	1.96	75	0.65		.66-.68[7]
		6" x 8" (146 x 197mm)	20	0.51	1.96	75	0.65		.66-.68[7]
	Thinline® Series Block—Nominal Thickness = 3"; Actual Thickness = 3⅛" (79mm)								
	DECORA®	6" x 6" (146mm)	16	0.57	1.75	75	0.65		.66-68[7]
		8" x 8" (197mm)	16	0.57	1.75	75	0.65	31[6]	.66-68[7]
		4" x 8" (95 x 197mm)	16	0.57	1.75	75	0.65		.66-68[7]
		6" x 8" (146 x 197mm)	16	0.57	1.75	75	0.65		.66-68[7]
	IceScapes®	6" x 6" (146mm)	16	0.57	1.75	75	0.65		.66-68[7]
		6" x 8" (146 x 197mm)	16	0.57	1.75	75	0.65		.66-68[7]
		8" x 8" (197mm)	16	0.57	1.75	75	0.65	31[6]	.66-68[7]
	DELPHI®	8" x 8" (197mm)	16	0.57	1.75	75	0.65	31[6]	.66-68[7]
		4" x 8" (95 x 197mm)	16	0.57	1.75	75	0.65		.66-68[7]
		6" x 8" (146 x 197mm)	16	0.57	1.75	75	0.65		.66-68[7]
	SeaScapes™	8" x 8" (197mm)	16	0.57	1.75	75	0.65		.66-68[7]
	⅛" FLAT SHEET GLASS COMPARISON (3mm)			1.04	0.96	90	1.00	28	

1 Size: Block are manufactured to a ± 1/16" (2mm) tolerance.
2 Heat Transmission/Thermal Transmission: Winter night values. To calculate instantaneous heat gain through glass panels, see ASHRAE HANDBOOK OF FUNDAMENTALS, 2005, Section 31.3.
3 Light Transmission: Values ±5%.
4 Light Transmission/Shading Coefficient: Estimated figures based on accumulated data.
5 Shading Coefficient: Based on 8"-sq. units; ratio of heat gain through glass block panels vs. that through a single light of double-strength sheet glass under specific conditions.
6 Sound Transmission: Assembly construction with KWiK'N EZ® Silicone System.
7 SHGC: Default values as interpreted from International Energy Conservation Code.

C8

High-Performance Translucent Wall and Skyroof™ Systems

Since 1955
Kalwall®



New York Hall of Science, Queens, NY
Polshek Partnership Architects

kalwall.com

Designing

PANEL-UNIT WALL:
COMPONENTS

Factory-preassembled in any combination up to 5' wide x 35' high (1500 mm x 10700 mm). Panel-units ready for installation with no additional finishing. Panel-units eliminate superfluous structure required with most other systems.

LOUVERS – WALL SYSTEMS
Specify Kalwall louver as required.

THERMAL BREAK SASH
Kalwall-manufactured, AAMA C-70 or HC-70 tested projecting sash for top performance up to 5' wide x 4'6" high (1500 mm x 1400 mm). Fixed and egress units also available. Glazing of all types, including $^{5}/_{8}$" (16 mm) and 1" (25 mm) thick glazing panels available; factory-installed, if specified.

OPAQUE PANELS
Sandwich panel construction with fiberglass, aluminum or other faces can be combined in the same system for aesthetic value or to fine-tune energy performance.

PANEL OPTIONS

STANDARD PANEL SIZES
Width — 4' and 5' (1200 mm and 1500 mm), other widths up to 5'0" (1524 mm) are optional.

Length — 3' to 20' (914 mm to 6096 mm) standard, 16' (4880 mm) maximum for skyroofs.

Thickness — 4" (100mm), $2^{3}/_{4}$" (70 mm). $1^{9}/_{16}$" (40 mm) and 1" (25mm) for window glazing only.

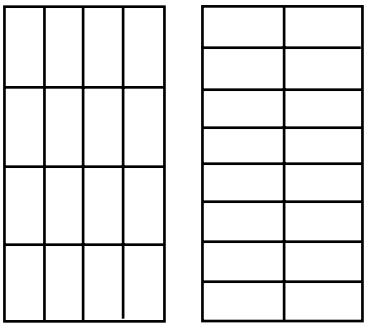
STANDARD GRID DESIGNS
Nominal grid size — 12" x 24" (300 mm x 600 mm) standard; 8" x 20" (200 mm x 500 mm) optional for flat and curved panels.

OPTIONAL GRID DESIGNS
Other designs and grid sizes available. Please note that spans will vary with different grid patterns. Consult factory.

TRANSLUCENT COLORS
White and Crystal are standard but other colors are available. The Kal-tint series and pebble finish are options. Colored translucent insulation inserts are available in an endless palette of colors.

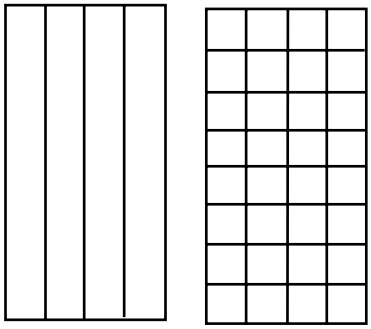
METAL FINISHES
The installation system is available in mill finish or Kalwall Corrosion Resistant Finish, a high-performance coating that meets AAMA 2604, 2605 optional. The finish is highly resistant to acids, alkalis, salt, industrial and moisture-laden atmospheres.

STANDARD GRIDS



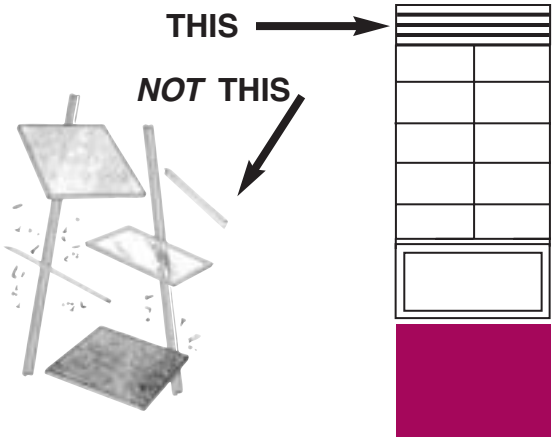
SHOJI REVERSE SHOJI

OPTIONAL GRIDS



VERTI-KAL TUCKERMAN

KAL-TINTS



Installation

QUICK, LOW-COST
Kalwall interconnected structural components form rigid, modular units which replace the heavy mullions and floating panels of other curtainwalls. The unique construction and extreme structural strength of the components permit the largest panel-unit wall sections to be installed quickly and efficiently.

DoD and GSA ANTI-TERRORISM COMPLIANT!
UFC 4-010-01
BLAST-RESISTANT CONSTRUCTION

Merry Hill Shopping Centre Brierley Hill
INC Design Associates, Architects

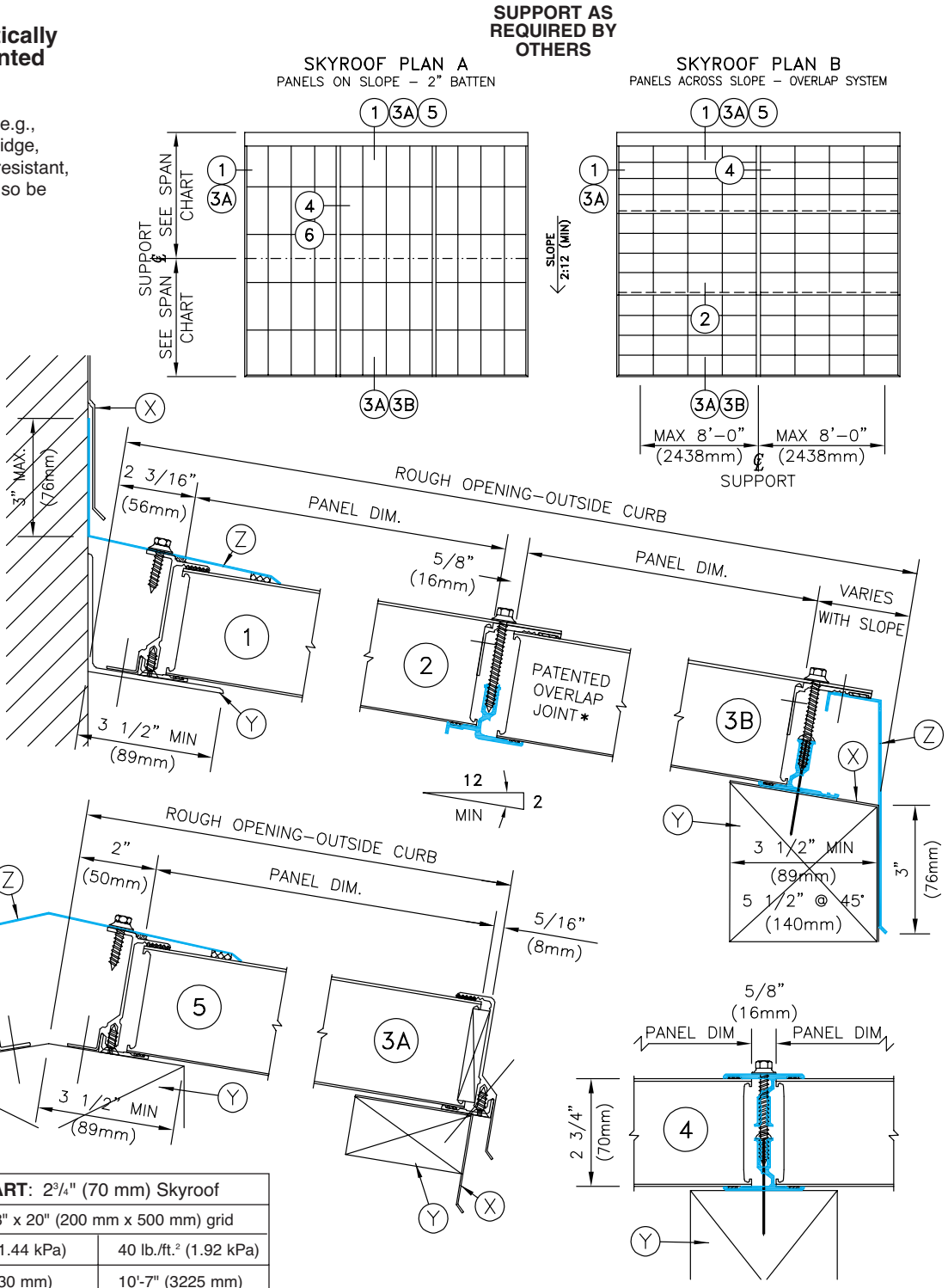
Shed/Supported Ridge Skyroof™ Details

For 2¾" (70 mm) vertically and horizontally oriented flat panels.

Details for other conditions, e.g., Kalcurve™, self-supporting ridge, pyramid, hurricane or blast resistant, are similar, but not identical so be sure to contact Kalwall.

Blue items are field-installed and may require trimming.

Factory-sealed perimeter frames.



SPAN GUIDE CHART: 2¾" (70 mm) Skyroof		
5' (1500 mm) module; 8" x 20" (200 mm x 500 mm) grid		
Live Load	30 lb./ft.² (1.44 kPa)	40 lb./ft.² (1.92 kPa)
Clearspan	11'-7" (3530 mm)	10'-7" (3225 mm)
5' (1500 mm) module: 12" x 24" (300 mm x 600 mm) grid		
Clearspan	10'-2" (3098 mm)	9'-0" (2743 mm)

Clearspan @ 25 p.s.f. (1.2 kPa) wind pressure, L/60 minimum.
Note: Longer clearspans possible. Contact factory.
RECOMMENDED MINIMUM PITCH Skyroofs (field-installed panels) 2":12" (1:6)

Note: Exposed metal systems available in mill finish or Kalwall Corrosion Resistant Finish per AAMA 2604. Special finishes available as options.

(X) COUNTER FLASHING NOT BY KALWALL
(Y) SUPPORT NOT BY KALWALL
(Z) STANDARD FLASHING BY KALWALL

NOTE:
PLEASE CHECK WITH FACTORY FOR ALLOWABLE SPANS IN YOUR LOCALE USING THIS 3¼" I.S.

Technical Summary

Kalwall is a composite sandwich; various combinations are possible and test data should be interpreted from this point of view. Consult Sales Service Department for further clarification.

HEAT & LIGHT TRANSMISSION: Listed below are the light transmissions, solar heat gain coefficients, and U-factors for some 2 3/4" (70mm) thick Kalwall panel face sheet combinations. Others are available. Highlighted values indicate thermally broken panels.

FACE SHEET COMBINATIONS		% LIGHT TRANSMISSION note 1					SKYROOF SOLAR HEAT GAIN COEFFICIENT @0°∠ note 3					WALL SOLAR HEAT GAIN COEFFICIENT @35°∠ note 3				
EXTERIOR COLOR	INTERIOR COLOR	.53 "U"	.29 /.23 "U" note 2	.22 /.14 "U" note 2	.18 /.10 "U" note 2	.05 "U" note 2	.53 "U"	.29 /.23 "U" note 2	.22 /.14 "U" note 2	.18 /.10 "U" note 2	.05 "U" note 2	.53 "U"	.29 /.23 "U" note 2	.22 /.14 "U" note 2	.18 /.10 "U" note 2	.05 "U" note 2
Greenish Blue	White	25	14	5	3	10	0.37	0.18	0.10	0.07	0.11	0.36	0.17	0.10	0.06	0.11
Aqua	White	29	17	6	4	12	0.37	0.19	0.10	0.07	0.11	0.36	0.18	0.10	0.06	0.11
Rose	White	30	18	6	4	12	0.38	0.19	0.10	0.07	0.11	0.37	0.18	0.10	0.06	0.11
Ice Blue	White	35	20	8	6	15	0.44	0.22	0.11	0.07	0.12	0.44	0.21	0.10	0.06	0.12
Greenish Blue	Crystal	37	20	7	4	15	0.47	0.21	0.13	0.08	0.13	0.45	0.21	0.12	0.08	0.13
White	White	20	15	8	5	12	0.30	0.16	0.09	0.06	0.09	0.30	0.15	0.08	0.05	0.09
Crystal	White	35	20	12	8	15	0.42	0.23	0.11	0.07	0.11	0.39	0.19	0.10	0.06	0.11
Crystal	Crystal	50	30	15	10	20	0.55	0.27	0.14	0.09	0.12	0.51	0.23	0.13	0.08	0.12

Kalwall + with nanogel

U = .05 panel, .10 system

Kalwall 100™

NEW Kalwall 4" (100 mm) thick panels for even greater energy and structural performance!

FACE SHEET COMBINATIONS		% LIGHT TRANSMISSION			WALL SOLAR HEAT GAIN COEFFICIENT			ROOF SOLAR HEAT GAIN COEFFICIENT		
EXTERIOR COLOR	INTERIOR COLOR	.08 "U"	.15 "U"	.55 "U"	.08 "U"	.15 "U"	.55 "U"	.08 "U"	.15 "U"	.55 "U"
Crystal	Crystal	8	17	50	0.08	0.18	0.50	0.09	0.21	0.56
Crystal	White	7	14	35	0.08	0.15	0.39	0.08	0.18	0.43
White	White	5	12	20	0.05	0.12	0.29	0.06	0.14	0.33

De Ferrers Specialist Technology College, Burton upon Trent, UK
Aedas Architects Limited

U-value SI conversion: 1.0 W/m²K = 0.176 BTU/(hr·ft²·°F)

1. Approximate values by ASTM E-972. Light transmission values over 30% not recommended for most applications.
2. U-values determined by NFRC test method (ASTM C-236, E-1423 and C-1199 at certified lab). Expressed as BTU/(hr·ft²·°F) for aluminum grid / thermally broken grid, nominal 12" x 24" (300 mm x 600 mm). Perimeter aluminum excluded. Test temperature at 15 mph wind (6.7 m/s): 0°F (-18°C) cold side & 70°F (21°C) warm side.
3. Shading Coefficient (SC) is equal to 1.15 times the Solar Heat Gain Coefficient (SHGC).

NFRC CERTIFIED SYSTEMS: Kalwall systems provide the best overall U-values as low as .10 (.56W/m²K)!

BOND STRENGTH: Panels and adhesives are tested according to the stringent requirements of "Criteria for Sandwich Panels" issued by ICC (International Code Council). Before specifying an alternate, insist on actual field proof of bond integrity over a 20-year period. *Caution is urged in accepting look-alikes as equivalents.*

WEIGHT: Most panels and systems weigh under 3 p.s.f. (14.65 kg/m²).

FIRE TESTS: Although some Kalwall panels contain combustible binder resins (ignition temperature greater than 800°F), they will withstand a 1200°F flame for one hour with no flame penetration; pass the Class "A" Burning Brand Test (ASTM E-108), or UL 790 listed Class A Roof system. All interior faces are CC-1 by ASTM D-635. Optional flame-spread/smoke developed ratings by UL 723 tunnel tests, including Class A, are available. Kalwall is listed by: ICC #PFC-1705; British Standard 476, Parts 3, 6, 7. NFPA 268 – Radiant Panel Test-Exterior Walls.

Whenever reference is made to fire tests, the numerical rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

IMPACT: The shatterproof exterior face will withstand 70 ft.-lbs. (81J) impact. Optional extra-hi-impact faces will withstand 230 ft.-lbs. (311J) impact by UL 972; also small and large missile.

SPECIAL APPROVALS & LISTINGS:

- FM Explosion Venting Walls standard 4440
- FM Wall and Roof Systems standards 4881 and 4471
- Hurricane-Resistant Systems
- NFRC Certified Products Listing
- UL Listings for Class A Roof System and Faces
- UFC 4-010-01 DoD Anti-Terrorism Specifications

Think GAIA
For Life and the Earth

SANYO

Bifacial Photovoltaic Module

HIT Double190
Photovoltaic Module

Power per Square Foot up to 18.6 Watts

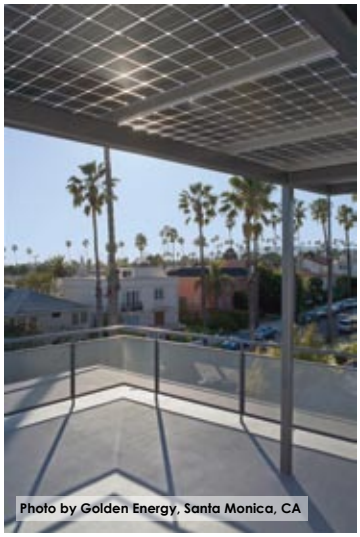


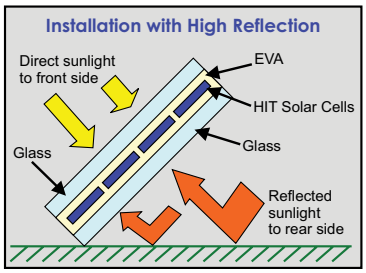
Photo by Golden Energy, Santa Monica, CA

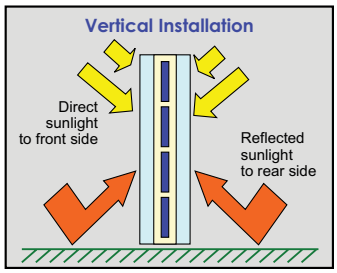

Phatport® - from Phat Energy, L.A., CA

High Efficiency
HIT® Double bifacial solar panels are the World leaders in sunlight conversion efficiency, helping customers to enjoy the maximum power per square foot from available space.

Power Guarantee
SANYO guarantees customers will receive 100% of the panel's rated power (or more) at the time of purchase, enabling owners to generate more kWh per rated watt.

Bifacial Effect
The back face of HIT Double solar panels generates electricity from ambient light reflected off surrounding surfaces, and combines with power from the front face of the panel. Dependant upon system design and site albedo, this results in up to 30% higher power generation (more kWh) per square foot.





Application Possibilities
- Architectural, Awnings, Balconies, Bus Shelters, BIPV
- Deck & Porch Coverings, Canopies, Carports, Facades
- Fences, Siding, Trellises, Tracking Systems

Proprietary Technology
HIT bifacial solar cells are hybrids of single crystalline silicon surrounded by ultra-thin amorphous silicon layers, available solely from SANYO.

High Temperature Performance
As temperatures rise, HIT Double solar panels produce more electricity than conventional solar panels at the same temperature, for good performance in high temperature sites.

Quality Products
SANYO silicon wafers are made in California USA, and assembled in Mexico at SANYO's certified factory. ISO 9001 (quality), 14001 (environment), 18001 (safety).

Valuable Features
HIT Double panels operate silently and have no moving parts. A double glass structure allows some sunlight to penetrate portions of the panel, creating brilliant light and shadows for aesthetic and architectural applications. HIT Double panels are perfect for areas with performance-based incentives and tradable energy credits.

HIT Double190
Photovoltaic Module

Electrical Specifications

Model: HIP-190DA3	STC[1]	Specifications Including Backside Irradiation Contribution in ISC as a Percent of STC 5%	10%	15%	20%	25%	30%
Rated Power (Pmax)[1]	190 W	199 W	208 W	216 W	225 W	234 W	243 W
Maximum Power Voltage (Vpm)	55.3 V	55.30 V	55.36 V	55.42 V	55.50 V	55.52 V	55.56 V
Maximum Power Current (Ipm)	3.44 A	3.60 A	3.75 A	3.91 A	4.06 A	4.22 A	4.37 A
Open Circuit Voltage (Voc)	68.1 V	68.3 V	68.4 V	68.5 V	68.6 V	68.6 V	68.8 V
Short Circuit Current (Isc)	3.7 A	3.89 A	4.07 A	4.26 A	4.44 A	4.63 A	4.81 A
Max. System Voltage (Vsys)	600 V	—	—	—	—	—	—
Series Fuse Rating	15 A	—	—	—	—	—	—
Temperature Coefficient (Pmax)	-0.3% / °C	—	—	—	—	—	—
Temperature Coefficient (Voc)	-0.170 V / °C	—	—	—	—	—	—
Temperature Coefficient (Isc)	0.85 mA / °C	—	—	—	—	—	—
Warranted Tolerance	+10/-0%	—	—	—	—	—	—
Cell Efficiency	18.8%	—	—	—	—	—	—
Module Efficiency[2]	15.7%	16.4%	17.1%	17.8%	18.6%	19.3%	20.0%
Power per Square Foot	14.6 W	15.2 W	15.9 W	16.6 W	17.2 W	17.9 W	18.6 W

Mechanical Specifications

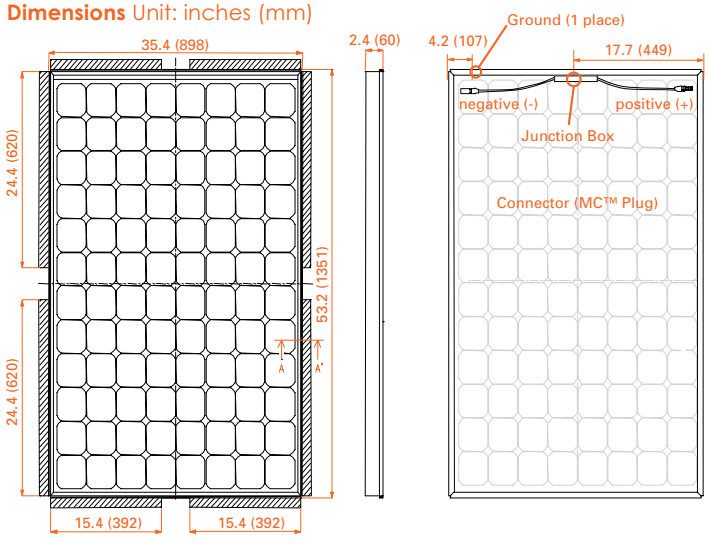
Internal Bypass Diodes	4 Bypass Diodes
Module Area	13.06 Ft^2 (1.21 m^2)
Module Weight	50.7 Lbs. (23 kg)
Module Dimensions LxWxH	53.2 x 35.35 x 2.36 in. (1351 x 898 x 60 mm)
Cable Lengths	39.4 in. each (1000 mm)
Cable Size / Connector Type	No. 12 AWG / MC3™ Connectors
Static Load	50 PSF (2400 Pa)
Pallet Dimensions LxWxH	54.3 x 36 x 70.1 in. (1379 x 912 x 1781 mm)
Full Pallet Quantity & Weight	20 pcs. / 1014 Lbs. (460 kg)
Quantity per 20'/40'/53' Container	200 pcs., 420 pcs., 540 pcs.

Safety Ratings & Limited Warranty

Fire Safety Classification	Class A
Hail Safety Impact Velocity	1" hailstone (25 mm) at 25 mph (23 m/s)
NOCT (°C)	115.8°F (46.6°C)
Safety & Rating Certifications	UL 1703, cUL, CEC
Limited Warranties	2 Years Workmanship / 20 Years Power Output

[1]Standard Test Conditions: Cell Temperature 25°C, Air Mass 1.5, 1000 W/m^2
[2] Equivalent module efficiency, including power from the back face.
Note: Specifications and information above may change without notice.

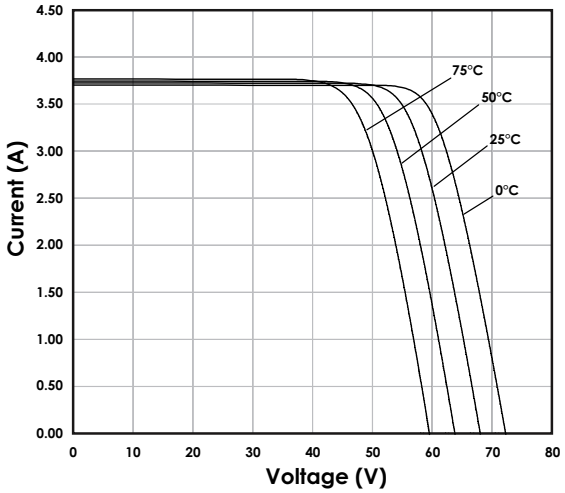
Dimensions Unit: inches (mm)



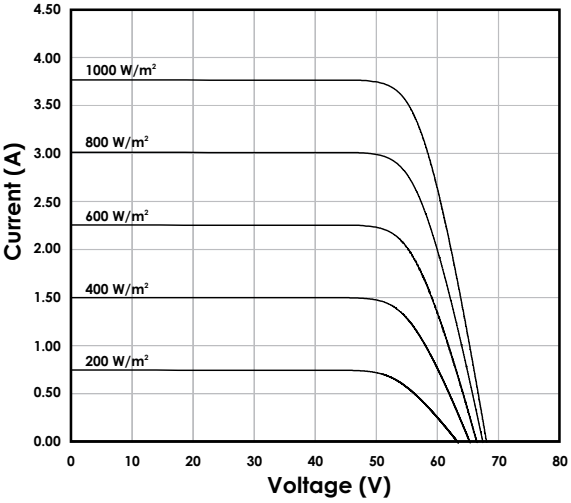
To Maximize Power

1. Elevate panels above a surface as much as possible.
2. Place panels over light-colored surfaces.
3. Do not allow support rails to shade the panel's back face.

Dependence on Temperature



Dependence on Irradiance



IMPORTANT: The rated power of HIT® Double bifacial solar panels is measured under Standard Test Conditions (STC). STC does not account for power produced from the back face of panels. Therefore, HIT Double panels will produce more power than their STC rating, up to 30% more, depending upon the system design and site albedo. Account for the additional power when sizing, selecting system components and wiring.

⚠ CAUTION! Read the operating instructions carefully before use of these products

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Solar Division

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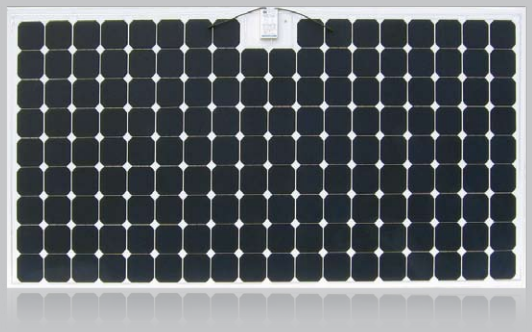
Applied Solar Roofing Membrane

Quiet And Reliable Power Generation

4 x 8 Module



4 x 4 Module

Applied Solar's BIPV Roofing Membrane is a unique product that maintains the natural look of your property while generating clean, safe, efficient electricity from the sun. The Solar BIPV Roofing Membrane product line is designed for commercial flat to lowslope roofs, integrating photovoltaic modules with single-ply roofing membranes.

(Continued on next page)

Applied Solar
Solar Energy for Every Rooftop™

877-APPLSOL (877-277-5765) | info@appliedsolar.com | www.appliedsolar.com

Applied Solar Roofing Membrane

At-A-Glance (Model STP400)

TECHNICAL SPECIFICATIONS Model STP400

Module total length x width (cm x cm)
244 X 122

Module weight (kg)
20.9

Individual cell Area (cm2)
243.3 sq cm

Cell technology (mono-Si, poly-Si, a-Si, CIS, CdTe, etc.)
Mono-Si

Cell thickness (µm)
150

Cell manufacturer and part #
Suntech STP125S I

Cell manufacturing location
China

Total number of cells
160

Number of cells in series
160

Number of series strings – attach wiring diagram
2

Number of bypass diodes
4

Bypass diode rating (A) – attach diode datasheet
20A 100V
VB20100S-E3

Bypass diode max junction temperature (°C)
150

Bypass Diode Location (e.g. - wiring compartment, laminated)
Laminated

Series fuse rating (A)
20

Cell Interconnect material and supplier model no.
ULBRICH 7746-9256 / Equivalent

Cell Interconnect cross-sectional area (µm x µm)
.13 x 2.54 mm

Solder bonding technique and material
Soldering

Superstrate type (e.g. – strengthened glass, tempered glass etc)
ETFE Or PC (TBD)

Superstrate manufacturer and part #Saint Gobain D9470220 / equivalent PC (TBD)

Substrate type (e.g. – glass, Tedlar, TPE, TPT, Polyester, etc)
APA

Substrate thickness – by layer (µm/µm/µm)
0.3mm AL _ 3mm PE _ 0.3mm AL

Substrate manufacturer and part #
Alcan 6055 / equivalent

Frame type/material
No Frame

Frame adhesive material/ manufacturer part no.
No Frame

Mounting adhesive system used? - Yes or No (If yes, list the type)
Yes. as per existing roof membrane

Mounting designed for heavy snow load (5400 Pa)? – Optional, Yes or No
YES

Does the manufacturer intend to sell frameless modules (laminates)? – Yes or No
YES

Encapsulant type
EVA

Encapsulant manufacturer and part #
STR Photocap 15295P/UF / equivalent

Wiring Compartment – type of termination:
A: wire or flying lead;
B: tags, threaded studs, screws, etc.;
C: connector.
Connector

Wiring Compartment manufacturer
Tyco

Wiring Compartment part #
1418867-2

Is Wiring Compartment potted? – Yes or No
No

Wiring Compartment potting material, if any
None

Wiring Compartment backing adhesive
3M 5952 / equivalent

Cable & Connector type
Tyco Integral Connector

Maximum system voltage (V)
1000

Voc (V)
49.2

Isc (A)
10.4

VPmax (V)
41.5

IPmax (A)
9.6

Pmax (W)
400

Fill Factor (%)
78

WARRANTY

- 25-Year Warranty On 80% Power Output

CERTIFICATIONS

- Class A Fire Rated
- CSA certified to UL 1703
- 600 VDC
- FSEC Listed

 v1.0

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Applied Solar
Solar Energy for Every Rooftop™

E-Saver-C3™ The Green Transformer

APPLICATIONS

The E-Saver-C3 transformer is the ideal transformer for institutional and commercial environments where energy efficiency is a priority. Optimized for lowest life cycle cost, the E-Saver-C3 reduces waste by as much as 74%. The E-Saver-C3 is a practical and affordable solution for K-12, colleges and universities, healthcare, governments and commercial buildings where lowest life cycle cost and energy savings are a priority.

DESCRIPTION AND CHARACTERISTICS

The E-Saver-C3 sets new benchmarks for environmental protection, energy efficiency and reliability. Designed to provide the lowest life cycle cost, the E-Saver-C3 goes beyond US DOE Candidate Level 3 efficiency ensuring lower operating losses than standard off-the-shelf transformers. To provide superior performance and reduce environmental impact, the E-Saver-C3 comes with a superior Nomex based insulation system impregnated with an organic epoxy adhesive.

QUIET OPERATION

Workplace productivity can be compromised when noisy transformers are located close to people. To meet this challenge, the E-Saver-C3 has embedded structural and acoustic treatments that combine to ensure quiet-operation. To ensure quiet operation, noise tests are part of our ISO 9001 procedures for every transformer.

OPTIONAL INTEGRATED METERING

To facilitate on-site commissioning and monitoring, Powersmiths SMART meter can be integrated into the transformer. SMART is an energy and power meter that serves as a data acquisition system, providing on-going energy and power quality data for the building's energy management systems and education for sustainability software such as Powersmiths Windows on the World™ (WOW) education for sustainability system. An optional port is available to provide safe external access to live transformer primary and secondary voltages and currents; operating temperature and TVSS status, without opening the transformer enclosure.

OPTIONAL INFRARED VIEWING PORT

Powersmiths Rotatable IR (Infrared) Viewing Port enables safe, non-invasive thermographic imaging of live equipment without exposing maintenance personnel to electrical hazards, including Arc-Flash.

ENVIRONMENTAL BENEFIT

The E-Saver-C3 is built in an ISO 9001 (quality management) and ISO 14001 (environmental management) certified facility. Throughout the manufacturing process, Powersmiths takes steps to ensure that waste is eliminated and hazardous materials are avoided. Because Powersmiths transformers generate lower losses, they reduce power drawn from generating stations resulting in less smog and lower greenhouse gas emissions.

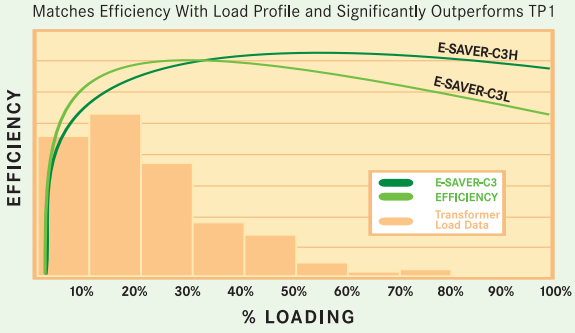
TESTING AND WARRANTY

E-Saver-C3 is subjected to rigorous testing to ensure: efficiency under various load profiles and loading conditions, quiet operation and insulation integrity and production-tests with actual computer-power loading in an ISO 9001 environment.

The E-Saver-C3's long life and dependable performance is backed up by Powersmiths' industry leading 25 year pro-rated warranty.

MAXIMIZE YOUR ENERGY SAVINGS

Matches Efficiency With Load Profile and Significantly Outperforms TP1



KEY FEATURES

- **Reduces electricity waste to help you meet your sustainability goals**
- **Optimized to provide quiet, efficient electrical power for improved productivity**
- **Significantly exceeds NEMA TP-1 efficiency for low operating cost over life of transformer**
- **Provides the lowest life cycle cost of any transformer on the market**
- **Produced in an ISO 9001 and ISO 14001 certified facility to ensure high quality and low environmental impact**

STANDARD CONFIGURATION

Powersmiths E-Saver-C3 is a 3-phase common-core, ventilated, dry type isolation transformer, built in an ISO 9001 and ISO14001 environment to NEMA ST-20 and other applicable ANSI and IEEE standards. Primary and secondary terminals and voltage taps are readily accessible by removing the front cover plate; 10kV BIL.

The E-Saver-C3 has a 220˚C class insulation, is rated for 60Hz, and comes in a NEMA 1 ventilated indoor enclosure. It exceeds the efficiency requirements of DOE candidate Standard Level 3 (CSL 3).

The E-Saver-C3L comes in two models optimized for light loading: copper-wound k-7 listed, and aluminum-wound k-4 listed. Both have a 130˚C temperature rise.

The E-Saver-C3H is optimized for heavy loading, is copper-wound, has a UL listed k-13 rating, and a 105˚C temperature rise. The C3H model has an 80˚C option with k-20 rating.

SELECT

kVA: Rating of unit (15-1000 kVA, up to 5000 kVA)
PV: Primary voltage (600, 480, 415, 400, 380, 208, up to 15kV)
SV: Secondary voltage (208/120V, 480/277V, 600/347V, others available)

SAMPLE PART NUMBER

E-SAVER-C3L-75-480-208

* FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 430, July 29, 2004. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards

TECHNICAL DATA

kVA	Impedance (%Z)	C3L Weight (lbs)	C3H Weight (lbs)	Case Size (Inches)
15	3.0 - 6.0%	200 - 250	210 - 260	A (18W x 17D x 27H)
30	3.0 - 6.0%	320 - 400	350 - 430	B (26W x 18D x 30H)
45	3.0 - 6.0%	400 - 500	420 - 520	B (26W x 18D x 30H)
75	3.0 - 6.0%	570 - 670	610 - 710	C (32W x 22D x 40H)
112.5	3.0 - 6.0%	850 - 950	880 - 1000	C (32W x 22D x 40H)
150	3.0 - 6.0%	1100 - 1300	1150 - 1350	D (38W x 27D x 48H)
225	3.0 - 6.0%	1550 - 1750	1700 - 1900	D+ (38W x 32D x 52H)
300	3.0 - 6.0%	1850 - 2050	1950 - 2150	D+ (38W x 32D x 52H)
500	3.0 - 6.0%	2500 - 2700	2900 - 3100	E+ (52W x 38D x 61H)
750	3.0 - 6.0%	3700 - 4300	4000 - 4400	F (64W x 47D x 67H)

The above data applies to configurations up to 600V, with NEMA 1enclosure and standard temperature rise. Selection of some options may change enclosure size and weight. Consult factory for detailed product data sheet for these and other configurations.
*Specific case used determined by factory unless specified. Special designs available to meet custom requirements.

AVAILABLE OPTIONS

SMART1: Integrated metering port

SMART2: Integrated Power & Energy Meter

SMART3: Integrated Meter with Web access

CYBERHAWK-TX: Efficiency & Power Meter

N3R: NEMA 3R, ventilated enclosure

T80: 80 deg. C operating Temp. rise (C3H model only)

F50: 50Hz design

1S: Single electrostatic shields

2S: Dual electrostatic shields

3S: Triple electrostatic shields

ECO: ECOLOGO certified

SPD: (120/208V OR 277/480V)
- **PRO80:** 80kA, 7 mode, Filter
- **PRO120:**120kA, 7 mode, Filter
- **PRO160:** 160kA, 7 mode, Filter
- **PRO200:** 200kA, 7 mode, Filter
- **PRO240:** 240kA, 7 mode, Filter

PROXX: Where xx is custom ID

LK: Lug kit, screw-type

COL: Color other than the factory standard

TSB: Terminal Safety Barrier

TS: Thermal Sensors at 170˚C and 200˚C

NLT: Nonlinear load test

SE: Sensitive Environment, extra low noise

A: Aluminum windings

WARRANTY: 25 years pro-rated.

Technical specification subject to change without notice.

Printed on acid free, elemental chlorine free paper. Paper contains 50% recycled content including 25% post consumer waste.

POWERSMITHS

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