HUVCO, L.L.C.
Daylighting Solutions©
PHONE: 800-832-6116 – FAX: 301-432-7185
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HUVCO LLC - High Performance Daylighting System

Analysis of steady state thermal properties

Daylighting Portion of Device			**Framing of Roof opening** (based on 4' x 4' model)				
Section	R-factor		Section	R-factor	Insulation Path portion A	Fastener/Brkt Path portion A	Corrected Assembly R-factor
Exterior Air film	0.17		Exterior air film	0.170	100.0%	0.0%	0.170
Glazing element outer	0.28		Galv cladding	0.002	100.0%	0.0%	0.002
Enclosed horiz air space	0.75		1.5 inch HD foam insulation	7.500	100.0%	0.0%	7.500
Glazing element inner	0.28		Air gap, varies	0.450	95.0%	5.0%	0.428
Reflective cavity*	2.67		Corner bracket	0.250	10.0%	90.0%	0.027
Diffuser, acrylic 0.25"	0.62	est.	Fasteners, sht. Mtl screws	0.002	5.0%	95.0%	0.002
Interior air film	0.68		Light well material, inc film	5.820	85.0%	15.0%	4.947
		Less Refl. Cavity	Interior film (included)	0.000	100.0%	0.0%	0.000
Total R-value calculated	5.45	*3.53*	Total R-value calculated				13.076
U-value calculated	**0.183**	*0.283*	**U-value calculated**				**0.076**

* Reflective cavity combines the effects of air films and the four low emittance surfaces (high reflectance), per ASHRAE HOF.
Note- interior air films are included in the R-factor cited, not added to it.

System Properties Table		
CRI	100	by others
LSG	3.67	by others
SHGC	0.24	by others
Vis LT	0.89	by others
Glazing system U-value	0.183	B.E.S.T.
Light well Roof penetration area U-value	0.076	B.E.S.T.

System Thermal Estimates (4' by 4' daylighting unit)

	Area (SF)	U-value	Sub section Heat loss (U * A)
Glazed portion	18.56	0.183	3.406
Dome Retainer (2 ")	2.67	1.220	3.253
DW Insul Curb Assy.	13.33	0.076	1.020
Roof penetration section#	10.67	0.167	1.781
Overall Assembly values	45.23	**0.209**	9.459
Calculated R-factor		**4.781**	

Note: # section affected by dT to ambient temperatures

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Sample of HPDS Customers

Customer	Date	Location	Usage	Product
STTS Sensor	10/2000	New Stanton, PA	Factory - Instrumentation	30 - 4' x 4' Units
Kaufman's Harness Shop	4/2000	Loganton, PA	Factory - Leather Goods	4 - 4' x 4' Units
Petershiem Grocery	5/2000	Lancaster, PA	Retail - Food	4 - 2' x 4' Units
Outpost Natural Foods	7/2000	Milwaukee, WI	Retail - Food	17 - 4' x 4' Units
Weathertek Design Studio	8/2000	Waukesha, WI	Showroom - Roof Products	1– 4' x 4' Units
HEALTHSOUTH	6/1999	Montgomery, AL	Medical - Rehab	2 - 21" Units
Paneling Sales	1/1999	Gordonville, PA	Retail - Construction	2 - 2' x 2' Units 1 - 4' x 8' Units
EcoSmart Homes	9/2000	Sarasota, FL	Showroom - Bldg Prod.	1 - 2' x 4' Units
Edison Electric CTAC		Azusa, CA	Showroom - Technology	4 - 4' x 4' Units 2 - 4' x 8' Units
Natural Lighting Technology	6/1998	Ventura, CA	Factory - Skylights	6 - 4' x 4' Units 1 - 2' x 4' Unit
Ice Rink	9/2000	Valencia, CA	Entertainment	65 - 4' x 4' Units
Osteopathic Clinic	6/2000	Jasper, IN	Medical - Surgery	28 - 3' x 3' Units
Ryder Truck	2/1999	PA, CT, NY, NJ	Maintenance - Truck	54 - 4' x 4' Custom
TURA Manufact.	10/1998	Folcroft, PA	Factory - Machine Shop	20 - 4' x 4' Units
Kent Co. Govt. Ctr	12/1998	Chestertown, MD	Public - Govt.	8 - 12" DayLite
Energy Smart Store	5/2000	Philadelphia, PA	Retail - Energy Prod.	3 - 4' x 4' Units
US Postal Service	6/1999	Houston, TX	Production - Mail	2 - 21" DayLite
Creative Crafts	5/1999	Myerstown, PA	Retail - Construction	12 - 4' x4' Units
BIH Windows	6/2000	Bird-in-Hand, PA	Showroom - Windows	10 - 4' x 4' Units 10 - 2' x 2' Units

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SAMPLE Results for Huvco, L.L.C. 4'X4' HPDS System (SLX440000)

SkyCalc: Skylight Design Assistant - Tabular Results

Company Name:
Project Description: DAYLIGHTING PROJECT

Electric Lighting Usage	kWh/yr		
Ltg. Energy without Skylights	102,200	Lighting Fraction Saved	39%
Lighting Energy w/ Skylights	61,989	Full daylighting (h/yr)	2,385

	Savings from Design Skylighting System		
Savings		Annual Energy Savings (kWh/yr)	Annual Cost Savings ($/yr)
Lighting		40,211	$2,413
Cooling		4,133	$248
Heating		-2,080	-$32
Total		**42,263**	**$2,629**

Skylighting System Description

Skylight unit size (ft^2)	16.0
Number of Skylights	12
Total Skylight Area (ft^2)	192
Skylight to Floor Ratio (SFR)	1.9%
Effective Aperture	1.8%
Floor Area per Skylight	833
Skylight U-value	0.540
Skylight SHGC	22%
Skylight T_{vis}	95%
Well Efficiency (WF)	100%
Dirt and Screen Factor	100%
Overall Skylight System Tvis	95%
Skylight CU	100%

Site Description

Climate Location		
Climate Zone	3	
Building Type	Grocery	
Building Area	10,000	(ft^2)

Elecric Lighting System Description

Lighting Type	Industrial fluorescent	
Lighting Control	Dimming min 20% light	
Light Level Setpoint	50	fc
Lighting Density	2.00	W/ft^2
Connected Load	20.0	kW
Fraction Controlled	95%	

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SAMPLE Results for Huvco, L.L.C. 4'X4' HPDS System

SkyCalc: Skylight Design Assistant - Graphic Results

Company Name:

Project Description: DAYLIGHTING PROJECT

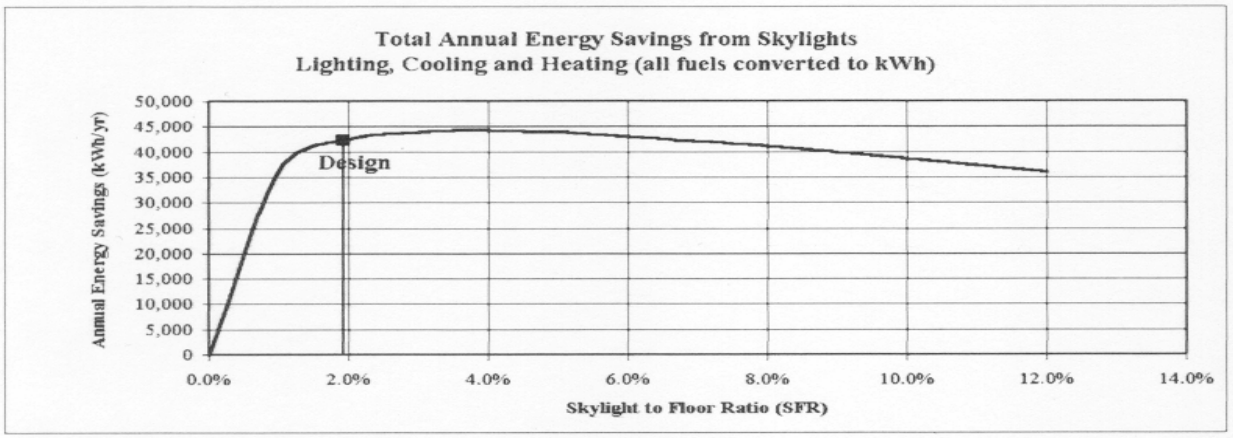
Effective Aperture = 1.82%, Skylight to Floor Ratio (SFR) = 1.92%

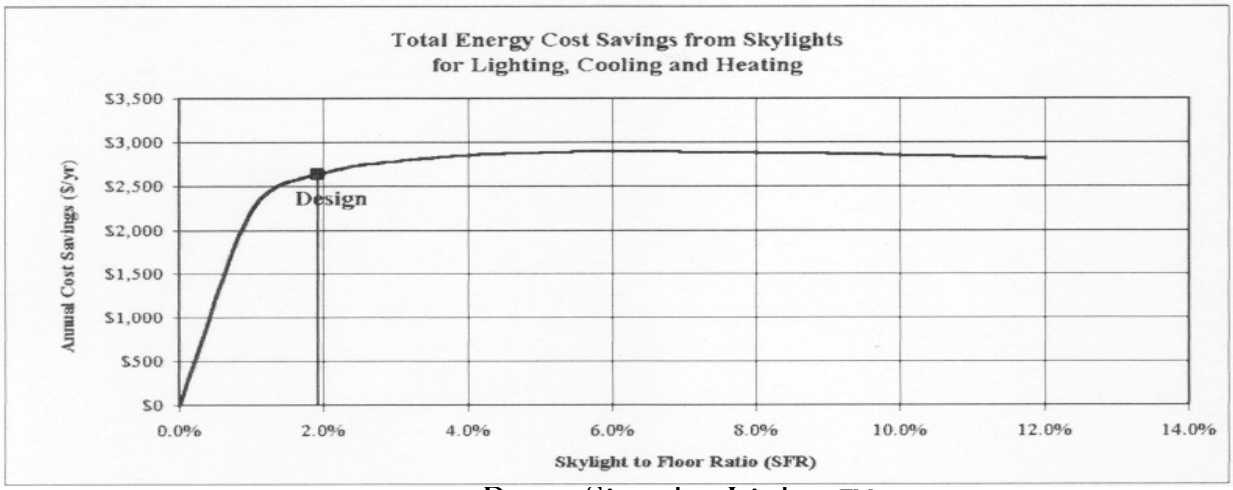
Average daylight footcandles (fc)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0	0	0	0	0	0	0	3	13	30	50	65	70	61	43	22	8	0	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	5	21	45	73	86	89	86	71	42	18	5	0	0	0	0	0	0
Mar	0	0	0	0	0	0	3	13	39	66	89	103	109	104	92	64	31	10	0	0	0	0	0	0
Apr	0	0	0	0	0	2	10	31	70	101	124	137	140	131	110	85	45	18	4	0	0	0	0	0
May	0	0	0	0	0	5	19	51	87	117	139	153	154	145	132	98	61	27	8	0	0	0	0	0
Jun	0	0	0	0	0	6	21	50	86	116	145	160	167	159	139	111	72	35	12	0	0	0	0	0
Jul	0	0	0	0	0	4	17	48	89	126	152	171	177	168	148	116	77	36	13	2	0	0	0	0
Aug	0	0	0	0	0	2	12	35	72	106	140	157	164	158	132	100	60	25	7	0	0	0	0	0
Sep	0	0	0	0	0	0	7	26	64	100	131	145	149	138	113	78	36	12	1	0	0	0	0	0
Oct	0	0	0	0	0	0	4	16	45	72	100	108	110	98	73	41	16	3	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	7	24	46	66	75	75	65	41	19	6	0	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	3	12	29	45	62	60	51	34	17	5	0	0	0	0	0	0	0

Design Illuminance = 50 fc

< 5 fc; < 25 fc; < 50 fc; > 50 fc;





Pure. Simple. Light. ™

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HUVCO High Performance Daylighting System (HPDS) Installation Guide

WARNING: *Installation of HUVCO, L.L.C. products requires* working on the roof, and handling materials with sharp edges. Both are hazardous to your health and could hurt you or cause serious lacerations. Always be careful when working on the roof, watching out for power lines, etc.

The HUVCO, L.L.C. recommends professional installation of the HPDS by a competent, licensed contractor. HUVCO, L.L.C. is not an insurer of, or for any Contractor/Installer of its products and has no control over the installation process. Therefore HUVCO, L.L.C. is to be held completely harmless from any litigation arising from an installation mishap, regardless of cause or severity. We recommend using only reputable contractors that are experienced, licensed, and bonded.

1. Verify all materials are on site, and suitable weather is expected.
2. Layout according to predetermined spacing criteria.
3. Clear area below the construction area and cover with protective plastic.
4. Mark hole locations from inside using long screw. All four corners must be marked to verify proper alignment. Verify absence of obstructions for light well.
5. Clear roof area to be cut, and mark straight and square template on roof deck.
6. Cut roof deck with proper equipment. The opening must be square.
7. Lay curb (see Chart A for dimensions) in place over hole, verify accurate placement.
8. Remove curb and caulk where curb mates with roof.
9. Replace curb, check for square, and fasten to roof deck.
10. Flash curb to roof deck using appropriate and accepted roofing procedures.
11. Prepare light well: On the roof surface, preferably a flat area, begin assembly of HPDS light well.
    - A.) Insert leading edge of panels into U-channel of corresponding panel making sure it is verti cally and horizontally flush. Make sure it slides all the way in before securing to channel with #1 metal tap screws. (Fig. 1)
    - B.) Continue securing panels together until light well is completely assembled. (Fig. 2)
    - C.) Using a razor knife, cut along inside channel to loosen protective liner. Do not completely remove liner until step 3.
    - D.) Attach light well to a 2 x 4 or other material (not provided) using brackets (not provided) to the inside edge of the light well as shown in Fig. 3 and 4.
    - E.) After securing box, lift assembled box and lay over on other side making sure the HPDS is ‘square’and ‘flush’.

12. Lower Lens Assembly

    - A.) Remove lower lens assembly (consisting of lens, lens retainer frame and gasket). Be careful not to lay the lens down on the prismatic surface.
    - B.) Apply gasket to inside lens around the outside edge of aluminum lens retainer frame. Note: Prismatic lens will "BOW' around the retainer frame and straighten out upon application on HPDS Box.
    - C.) After gasketing the lens assembly, lift carefully and apply on HPDS. Make sure it is

"SEATED" and flush. Apply slight pressure downward and attach with supplied #1 screws. Make sure screws "GRAB" the interior metal and pull the box sides tightly into the aluminum retainer frame. (Fig. 5 & 6.)

13. Lay the light well over carefully, making sure prismatic lens does not rest on any surface. Carefully begin peeling the liner from inside, making sure all liner is removed and unit is clean.

14. Raise the light well up (2 people recommended) so prismatic lens is pointed downward. Carefully lower the light well through the curb. (Fig. 7)

15. Lower down until light well is flush with the curb. Make sure light well is flush with the curb. Screw in at least 3 of #2 screws into each panel into the curb. After securing the light well, remove lifting bracket assembly. (Fig. 8)

16. Apply metal tape (not supplied) and seal the gap in-between curb and the light well panel. Apply tape as shown. (Fig 8A and 8B)

17. Remove any debris inside the light well (screws, liner and etc.) which may be on lower lens with vacuum, tape, etc.

18. Remove blue liner from the dome assembly. Apply gasket around the curb and lower dome onto curb. Make sure it is square on the curb and attach with supplied screws. (Fig. 9).

19. Remove all debris from roof.

Once installed, the HPDS should require no maintenance. Normal rainfall should keep the skylight clean. However, washing with soap and water will not harm the unit. No petroleum or ammonia based cleaners should be used.

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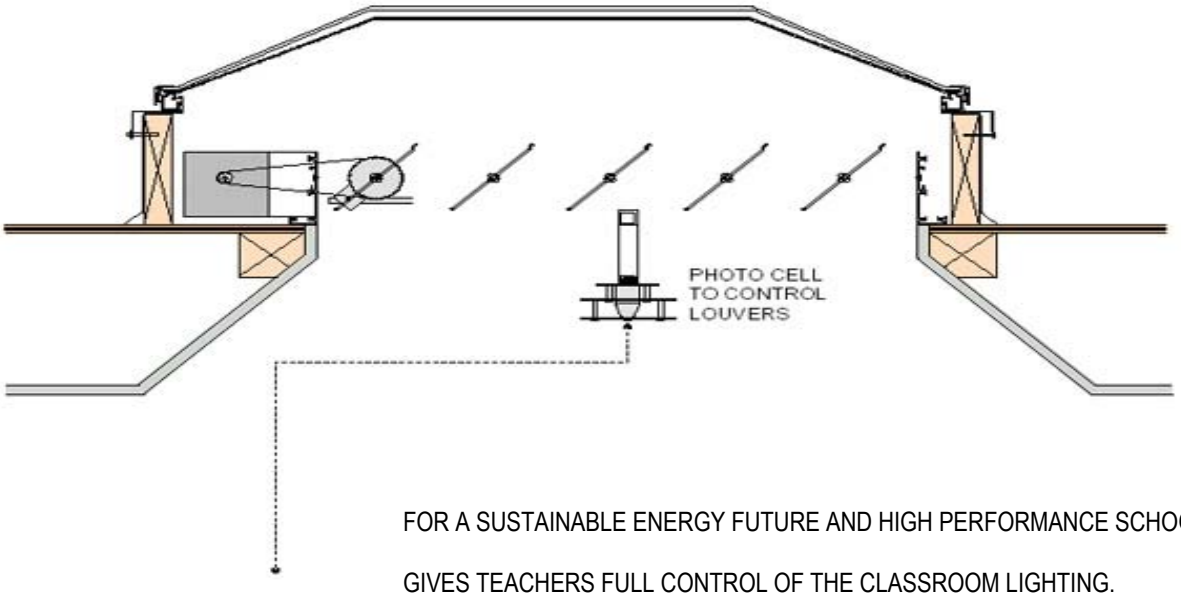
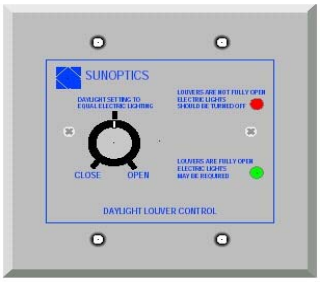


FOR A SUSTAINABLE ENERGY FUTURE AND HIGH PERFORMANCE SCHOOLS.

GIVES TEACHERS FULL CONTROL OF THE CLASSROOM LIGHTING.

INDICATOR SHOWS CORRECT POSITION OF THE DAYLIGHT SETTING KNOB TO MAINTAIN DESIGN LIGHT LEVELS IN THE CLASSROOM WITH DAY LIGHTING

Maintaining daylight setting will reduce air conditioning loads, adding to the electric light savings. The louvers will automatically open of close to maintain light levels.



RED LED INDICATES THE LOUVERS ARE NOT FULLY OPEN AND THE ELECTRIC LIGHTS SHOULD BE MANUALLY TURNED OFF.

Daylighting can replace electric lighting 2/3 of the daylight hours on an annual average basis. Demonstrating energy savings without sacrifice on a daily basis, teaches students a valuable lesson.

GREEN LED INDICATES THE LOUVERS ARE FULLY OPEN AND THE ELECRIC LIGHTING MAY BE REQUIRED TO MAINTAIN ADEQUATE LIGHT LEVELS IN THE CLASSROOM.

Teacher discretion is expected.

THE DAYLIGHT ADJUSTMENT KNOB ALLOWS THE TEACHER TO CHANGE THE LOUVER TO ANY POSITION FROM COMPLETELY CLOSED TO FULLY OPEN.

As a standard practice the knob should be returned to the daylight setting for the next day