ENERCONCEPT TECHNOLOGIES

UNITAIR™

Metal

Collector

- TECHNICAL MANUAL -

Version 1.0- EN
February 2012

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1 Technical Specifications

1.1 General information

Developed by Enerconcept Technologies, The Unitair™ is a partially perforated metal solar air heater. Thanks to its high performance, combined with its low cost, the Unitair constitutes an excellent choice when opting for an outside air preheating system. Even though the Unitair collector is simple and easy to install, all projects are tailor-designed and site-specific. The design parameters of wall or roof-mounted Unitair installations must therefore be optimized by Enerconcept in order to allow the whole system to work in the most efficient way.

Once these design parameters are optimized by Enerconcept (baffles, location of air intakes, inside plenum depth, etc.), Enerconcept will deliver all necessary required components and accessories for simple, quick mounting of the Unitair collector (perforated metal siding, spacing clips, Z bars, etc.) resulting in an aesthetically-pleasing installation.

1.2 Working principle of the Unitair collector

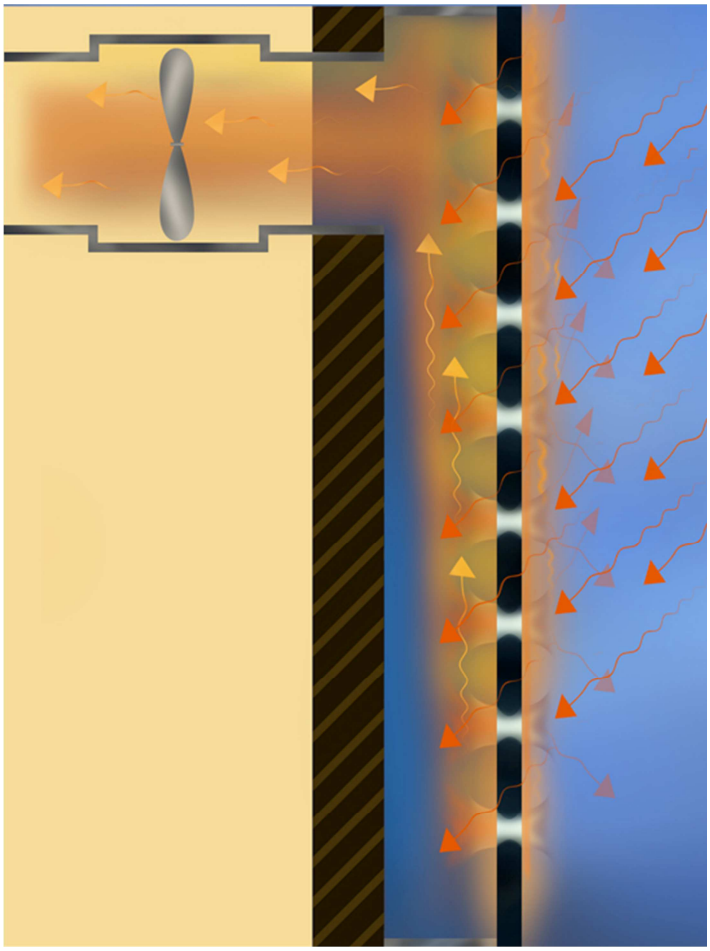
The Unitair is a metal collector that preheats outside make-up air admitted into the building in a very simple manner. Coupled to the ventilation system, the collector admits air evenly through its multiple perforations and side entries. Hot air available at the surface of the wall is drawn into the plenum. To help standardize the air admitted at the surface, baffles can be placed inside the wall. These baffles can also be designed to improve turbulence in the wall hence improving its efficiency

The collector allows recovery of practically all thermal losses of the building's envelope on which it is installed. Air drawn into the collector heats up, therefore diminishing the temperature at its surface thus reducing the collector's losses, both radiative and convective.

The underlying operating principles governing the transformation of incoming solar rays into useful thermal energy are as follows:

1. When solar radiation comes in contact with the absorber, it turns into heat. The absorber heats up the air at its surface.
2. Once turned on, the fan draws the air into the collector's plenum, therefore admitting outside air through the absorber's perforations. When passing through the perforations, air heats up and constantly cools down the absorber, therefore reducing losses by radiation.
3. Afterwards, the preheated air is trapped into the "plenum" and moves on to the ventilation system. Z bars are strategically disposed to create a turbulent flow which promotes the transfer with the absorber and increases the recovery of the building's thermal losses
4. Solar-heated air is mechanically drawn into the building's ventilation or process system.

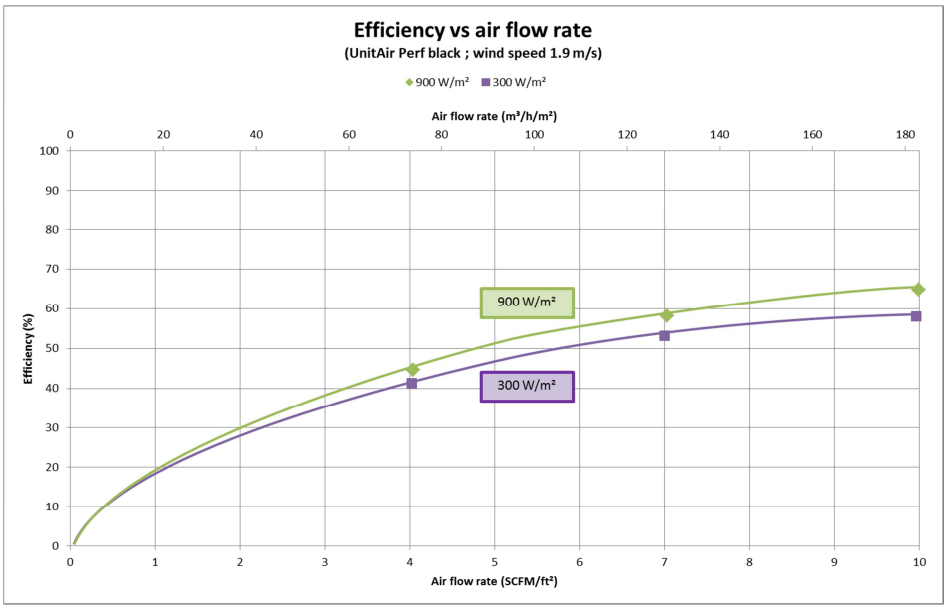
For optimal results, the Unitair collector must be dark coloured and work with a surface air flow of 5 cfm/ft^2 (100 m^3/h/m^2).



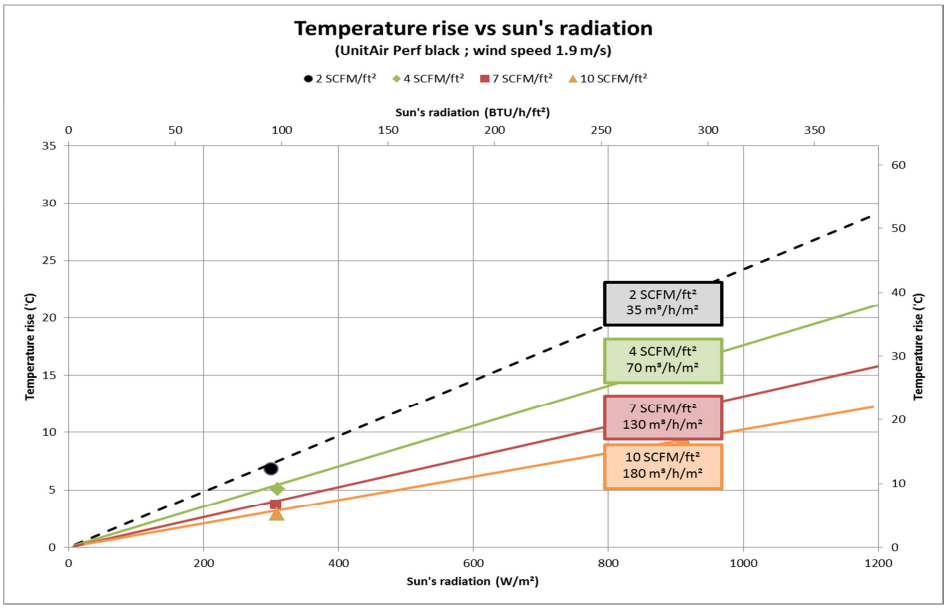
1.3 Efficiency curves of the Unitair collector

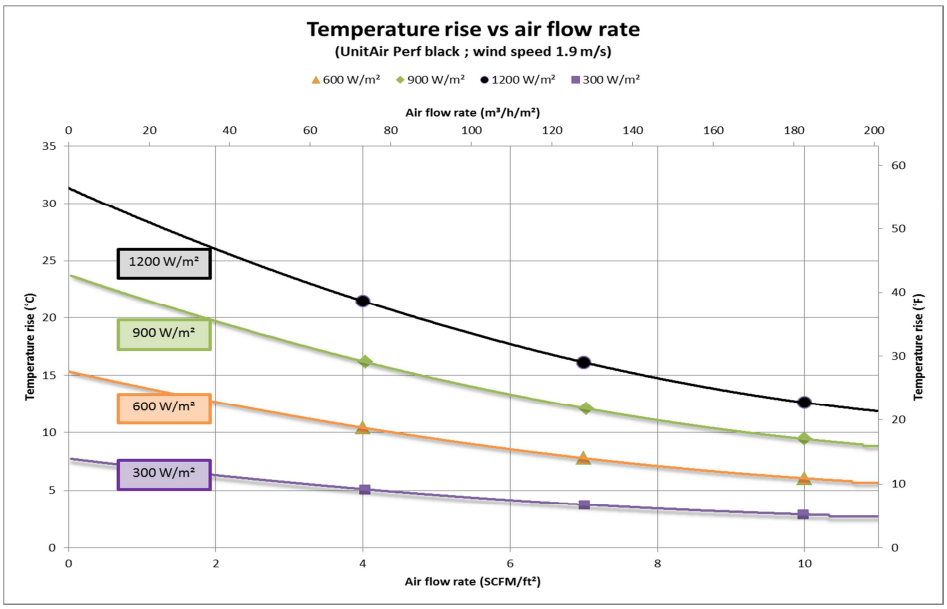
**Graphics are shown in high resolution at the end of this document.

The ideal range of operation of the Unitair collector is at a rate of approximately 5 cfm/ft^2 (100 m³/h/m²) and can reach up to 12 cfm/ft^2 (250 m³/h/m²).



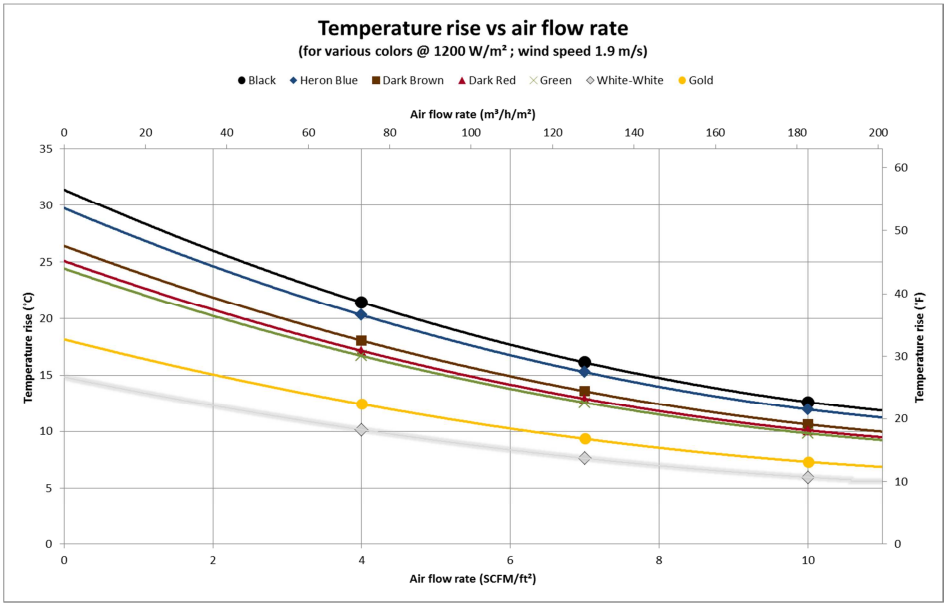
In some applications, the increase in ambient air temperature can reach more than 68℉ (20℃). However , the Unitair collector is mostly used when large quantities of air are involved making it ideal for industrial applications, in both ventilation and processes.

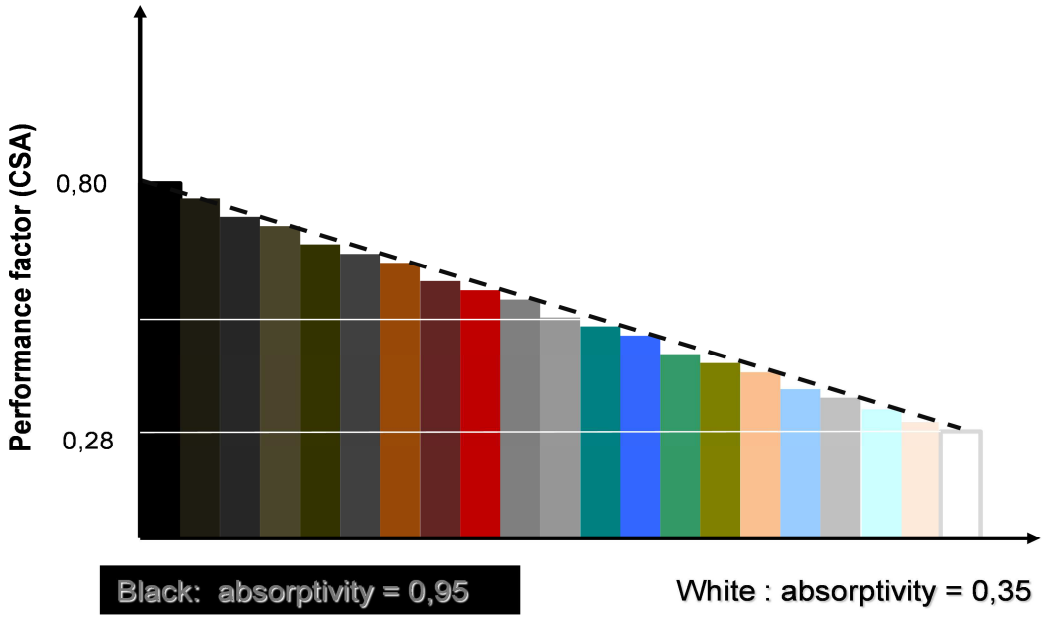




1.4 Influence of absorber's colour

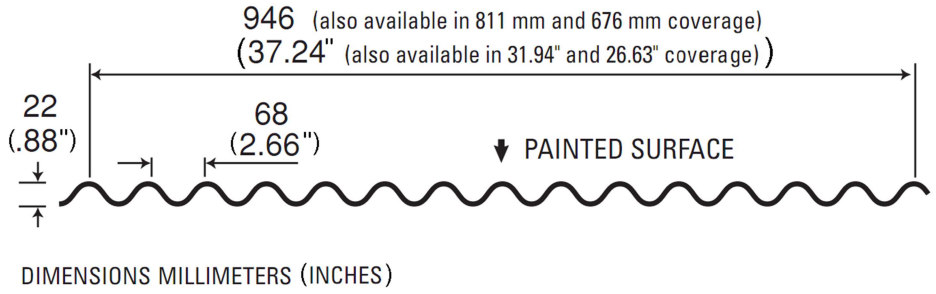
The absorber's colour has a proportional influence on its efficiency. The energy loss caused by the reflexion off the absorber is reduced when absorptivity increases. Therefore, a dark-coloured collector is more efficient than a light-coloured one. The graph below shows the collector's performance in terms of absorptivity. Refer to section 1.8 for colour absorptivity



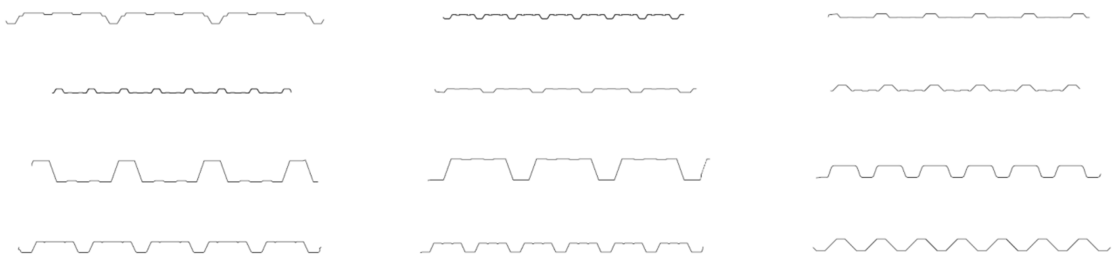


1.5 Absorber's specifications

The standard Unitair absorber is made of 26 gauge (0,018) corrugated steel profiles delivered in 37,24'' (946 mm) wide sheets layed vertically on the wall. Each sheet is perforated on its entire surface with 1/16" (1,58mm) to 7/16" (11,1mm) c/c holes. In some cases, non-perforated sheets are used in order to optimize sections of the collector and eliminate infiltrations in strategic areas. We also offer the possibility to adapt to any available profile on the market.

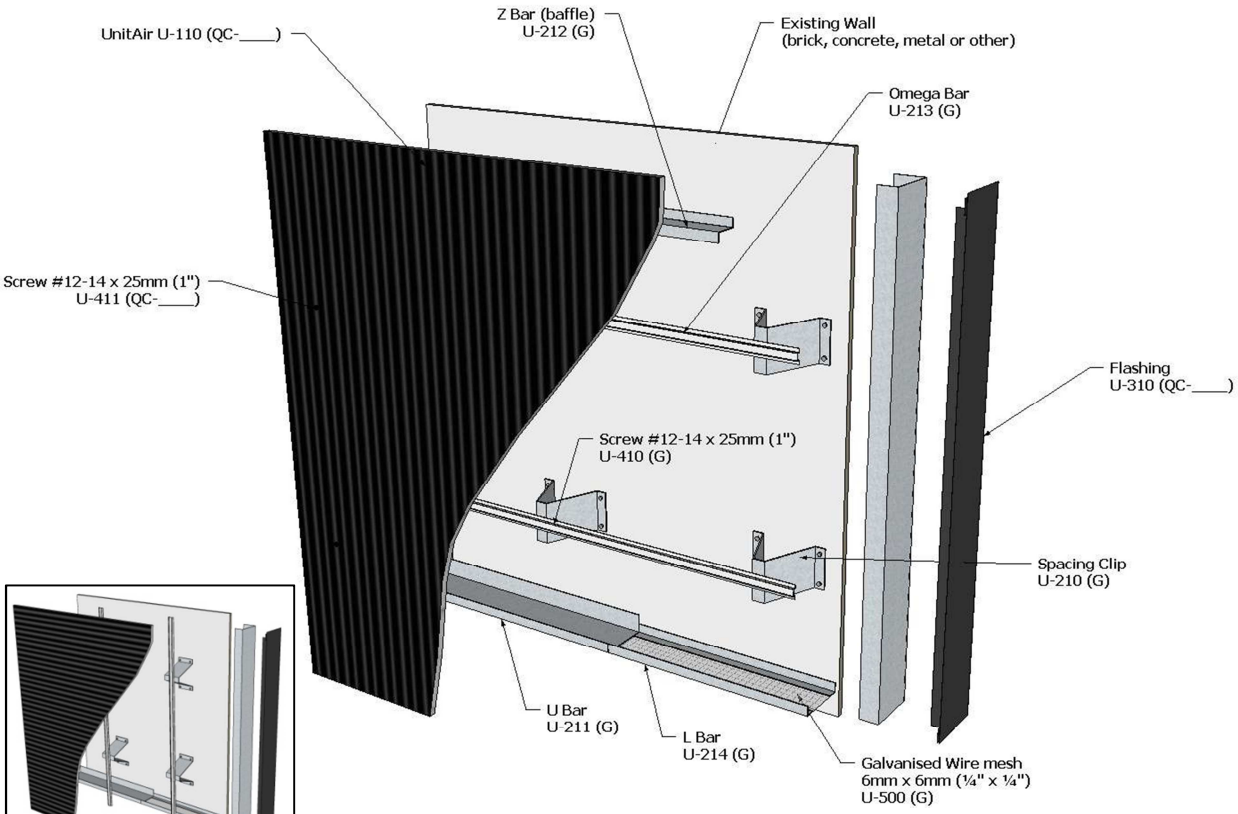


Example of available profiles



Please contact Enerconcept pour your choice of profile

1.6 Assembly parts & accessories supplied by Enerconcept

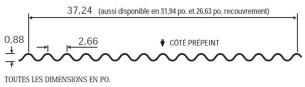
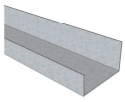
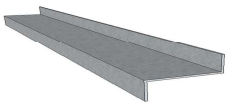
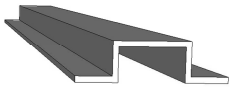
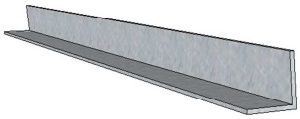
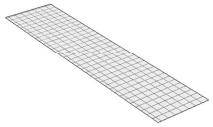


Installation à l'horizontal

Wall or Roof mounting	IP	SI
Spacing Clips - thickness	1 - 8 inch	25 - 200 mm
Omega Bars	¾ inch	18 mm
Assembly of omega bars on clips	2 screw #12 - 14 x 25mm (1")	
Distance between each vertical column	variable	
Contour U Bars	1 - 8 inch	25 - 200 mm

The supplied parts are the same for a roof-mounted system and so is the mounting procedure. It must be ensured, however, that all necessary measures are taken to preserve complete waterproofing of the roof when installing the collectors.

1.7 Parts list

	Name	Number
	Absorber - Cladding	U-120 (QC_____)
	U Bar	U-211 (G)
	Z Bar	U-212 (G)
	Omega Bar	U-213 (G)
	L Bar	U-214 (G)
	Flashing	U-310 (QC____)
	Spacing Clip	U-410 (G)
	Screw 12-14 x 25mm (1")	U-411 (G)
	Screw 12-14 x 25mm (1")	U-411 (QC____)
	Galvanised wire mesh 6mm x 6mm (1/4" x 1/4")	U-500 (G)

1.8 Colours

Even though black Unitair collectors are the most efficient, it is possible to choose a colour that will best suit the existing building.

The Perspectra Series™ is a state-of-the art silicone modified polyester (SMP) paint system that can be applied to either hot dip galvanized or 55% aluminum-zinc coated steel to meet a broad range of interior and exterior applications. The system utilizes either a zinc phosphate pretreatment over hot dip galvanized steel, or a metal oxide conversion coating over 55% aluminum-zinc coated steel. These proven pre-treatments, in combination with an upgraded primer, provide excellent corrosion resistance. The system provides outstanding film integrity, leading edge colour retention and superior chock resistance.

(α): Colour absorptivity

1.9 Loads

With regards to wind and snow loads, the Unitair collector, being a variation of a typical metal siding installation, the load table from the siding supplier can be used.

Load Table

Live Load Factor = 1.4; Importance Factor = 0.75; Importance Category = 1.0

Maximum Specified Uniformly Distributed Loads in psf

Span (ft.)		1-Span Base Steel Thickness (in.)					2-Span Base Steel Thickness (in.)					3-Span Base Steel Thickness (in.)				
		0.018	0.024	0.030	0.036	0.048	0.018	0.024	0.030	0.036	0.048	0.018	0.024	0.030	0.036	0.048
4′-0″	S	50	66	81	95	123	50	66	81	95	123	63	82	101	119	153
	D	45	59	73	86	110	108	142	174	206	265	85	112	137	162	209
4′-6″	S	40	52	64	75	97	40	52	64	75	97	49	65	80	94	121
	D	32	41	51	60	77	76	100	122	144	186	60	78	96	114	146
5′-0″	S	32	42	52	61	78	32	42	52	61	78	40	53	65	76	98
	D	23	30	37	44	56	55	73	89	105	136	44	57	70	83	107
5′-6″	S	26	35	43	50	65	26	35	43	50	65	33	43	53	63	81
	D	17	23	28	33	42	42	55	67	79	102	33	43	53	62	80
6′-0″	S	22	29	36	42	55	22	29	36	42	55	28	36	45	53	68
	D	13	17	22	25	33	32	42	52	61	78	25	33	41	48	62
6′-6″	S	19	25	31	36	46	19	25	31	36	46	24	31	38	45	58
	D	10	14	17	20	26	25	33	41	48	62	20	26	32	38	49
7′-0″	S		21	26	31	40	16	21	26	31	40	20	27	33	39	50
	D		11	14	16	21	20	26	33	38	49	16	21	26	30	39
7′-6″	S			23	27	35	14	19	23	27	35	18	23	29	34	44
	D			11	13	17	16	21	26	31	40	13	17	21	25	32
8′-0″	S				24	31	13	16	20	24	31	16	21	25	30	38
	D				11	14	14	18	22	26	33	11	14	17	20	26
8′-6″	S					27	11	15	18	21	27		18	22	26	34
	D					11	11	15	18	21	28		12	14	17	22
9′-0″	S							13	16	19	24			20	24	30
	D							12	15	18	23			12	14	18

****This load table is illustrated for indicative purposes only**

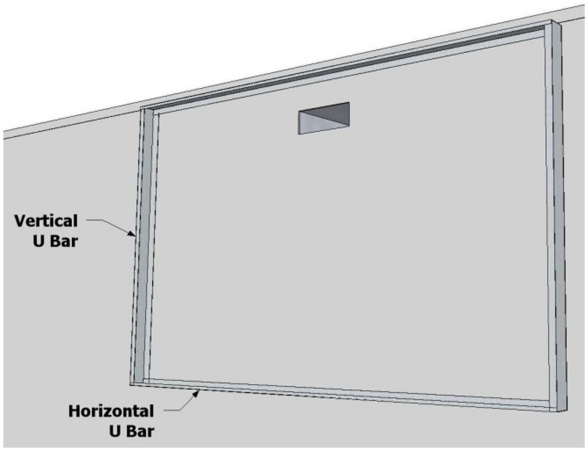
2 Wall mounting instructions

2.1 U bars

- Install the horizontal and vertical U bars on the perimeter of the Unitair collector.

Note:
Mounting hardware (screws, anchors) to existing wall will be **provided by the installer** depending on the structure of the existing wall.

Comment:
The installer will provide and install strips of foam closure adapted to the existing wall cladding behind the U bars.



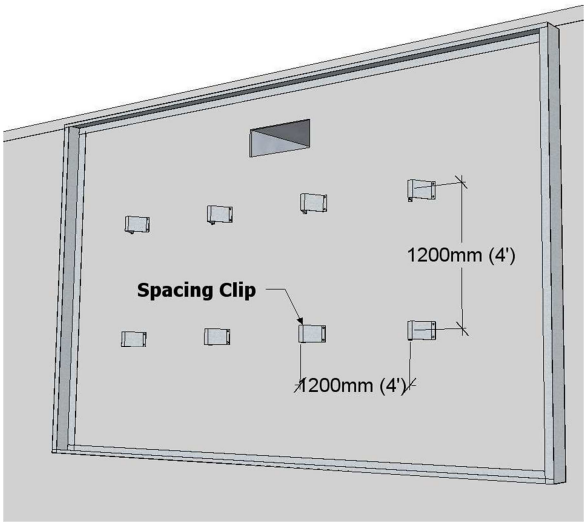
2.2 Spacing clips

- Install the spacing clips as per shop drawings In general, they are installed at ±4´-0˝ c/c (1,2m) vertically and horizontally (aligned on the wall's substructure).

Note:
Mounting hardware (screws, anchors) to existing wall will be **provided by the installer** depending on the structure of the existing wall.

Comment:

The spacing clips must be fixed to the wall's horizontal or vertical substructure.

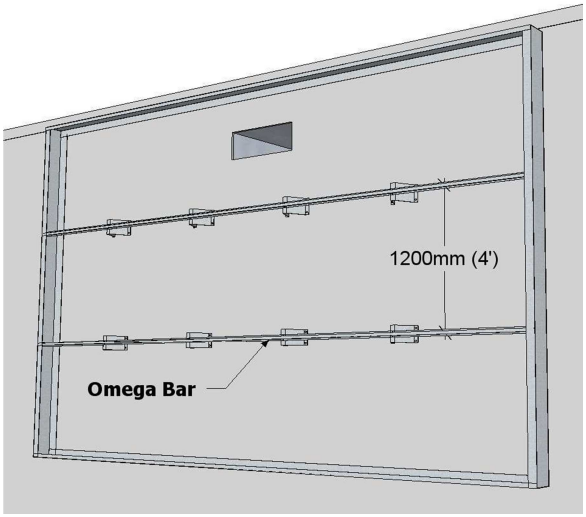


2.3 Omega bars

- Install the omega bars on the spacing clips

Note:

Vertical extruded omega bars are fixed to the spacing clips and the horizontal U bars with #10-16 x ¾˝ screws provided with the material

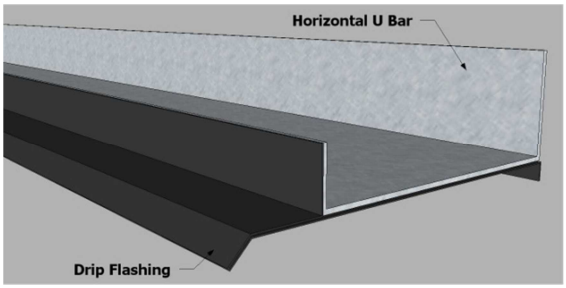


2.4 Drip flashing

- The drip flashing must be fixed to the U bar and folded on the exiting wall. (make ¼" (6mm) weepholes at 24" (600mm) c/c in the U bar, to allow drainage in case of infiltration)

Note:

Flashing material comes in 4' X 10' (1200mm X 3000mm) sheets to be folded on site.

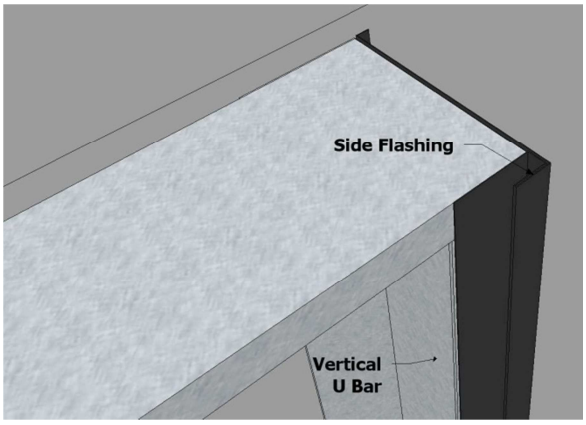


2.5 Side flashing

- The side flashing must be fixed to the vertical U bar and folded on the existing wall.

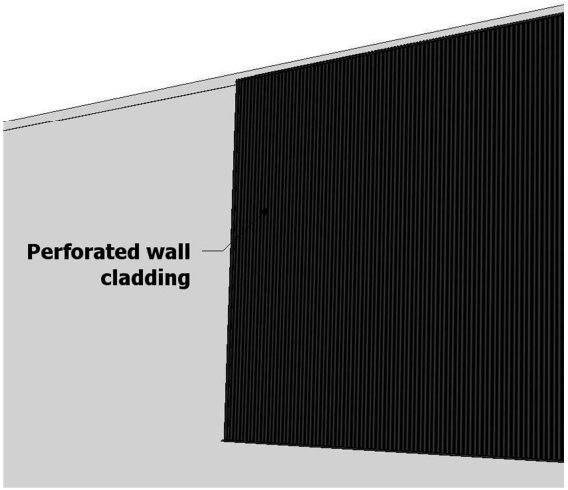
Note:

Flashing material comes in 4' X 10' (1200mm X 3000mm) sheets to be folded on site.



2.6 The absorber

- Install the perforated cladding on the U bars and omega bars

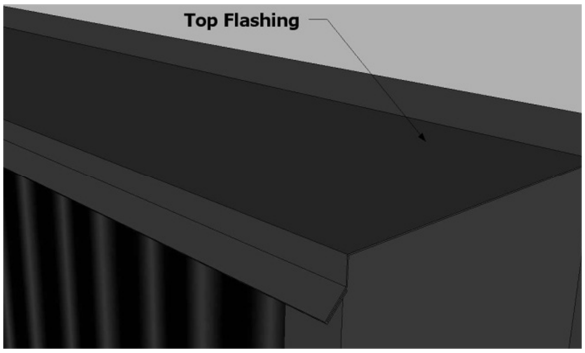


2.7 Top flashing

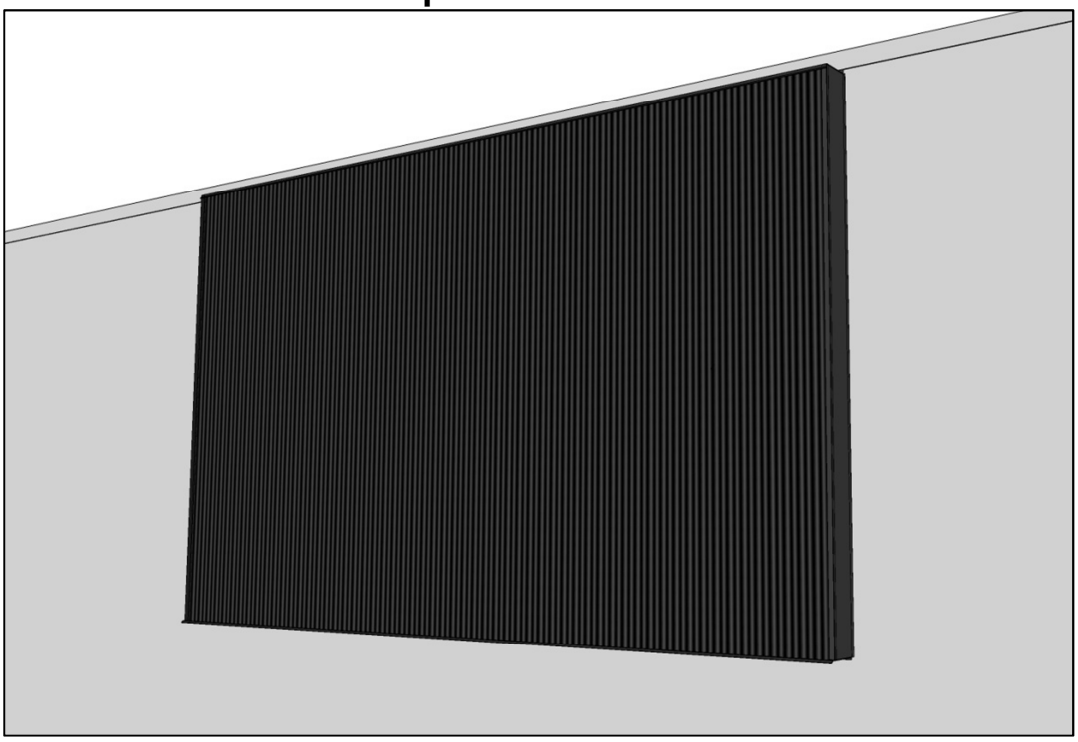
- The top flashing must be fixed to the U bar and inserted under the existing top flashing

Note:

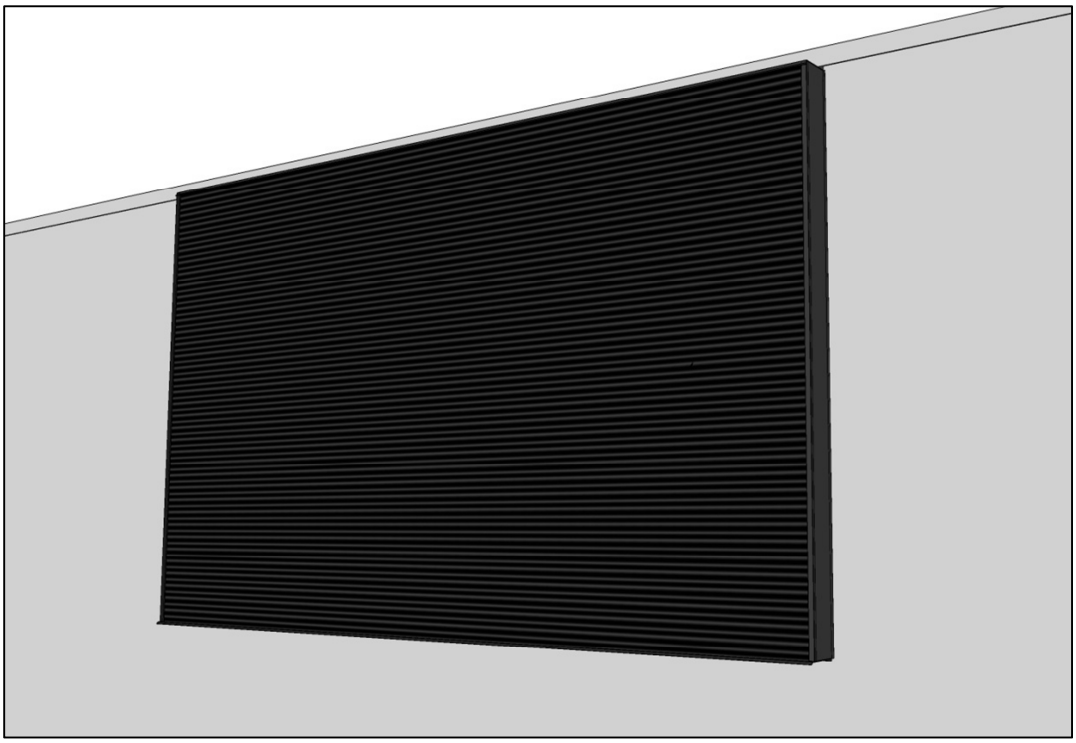
Flashing material comes in 4’ X 10’ (1200mm X 3000mm) sheets to be folded on site.



Completed installation



Installation with a vertical perforated profile



Installation with a horizontal perforated profile

3 Typical specifications

3.1 General specifications

The Unitair perforated metal solar collector is manufactured by Enerconcept Technologies and approved by the Can/CSA-F378 standard. The collector will have a surface of _____ft^2 (_____m^2) for an airflow of _____ cfm (_____L/s). Fresh air will be admitted in the collector mainly by the side entries specified by Enerconcept and the absorber's complete or partial perforations.

3.2 Collector composition

1. The absorber

Standard metal cladding: 26-gauge black (QC-8262) corrugated steel profiles 7/8" (22mm)

For options see section 7

2. U bars

The U-bars are made of 18-gauge galvanized steel, depth of 4 ˝ to 10 ˝ (100 to 250 mm). The depth will be determined during the production of the shop drawings according to the amount of air passing through the collector. Length 120˝ (3000 mm).

3. Spacing clips

The spacing clips are made of 18-gauge galvanized steel, depth 4˝ to 10˝ (100 to 250 mm). The depth will be determined during the production of the shop drawings according to the amount of air passing through the collector. Height 6˝ (150 mm).The spacing clips will be painted according to the collector's background colour (colour to be determined by the architect).

4. Omega bars

Omega bars are made of galvanized steel : Length : 144" (3657 mm).

5. Flashing material

The flashing material required to cover the collector's perimeter is supplied in 4'x10' (1200 X 3000) sheets to be folded on site.

6. Screws

The screws are galvanized self-tapping #10-16x¾.

7. Options

- Absorber colour, other than black. (QC-0000) _____
- Absorber thickness (other than 26 gauge) _____
- Choice of profiles (other than 7/8" (22mm)) _____

Not included

The following items are not provided by Enerconcept:

- Manufacturing elements of the wall under the collector (cladding, air barrier, insulation);
- Foam closures under the U-bars adapted to the wall's cladding under the collector;
- Wall mounting hardware.

- **Installation work**

Preparatory work :

Before starting any work, the contractor shall verify all dimensions on site as well as the position of the substructure.

- **Installation**

The installation will be done according to shop drawings approved by the architect and the manufacturer's recommendations. For installation instructions of the Unitair collector see the latest edition of this manual available on Enerconcept Technologies' website at: http://www.enerconcept.com/en

Collector's load on the existing wall is 1.7 à 2.0 pound per square foot (8,8 to 13,7 kg/m²) for a plenum of 4˝ (100mm) to 8˝ (200mm) thick.

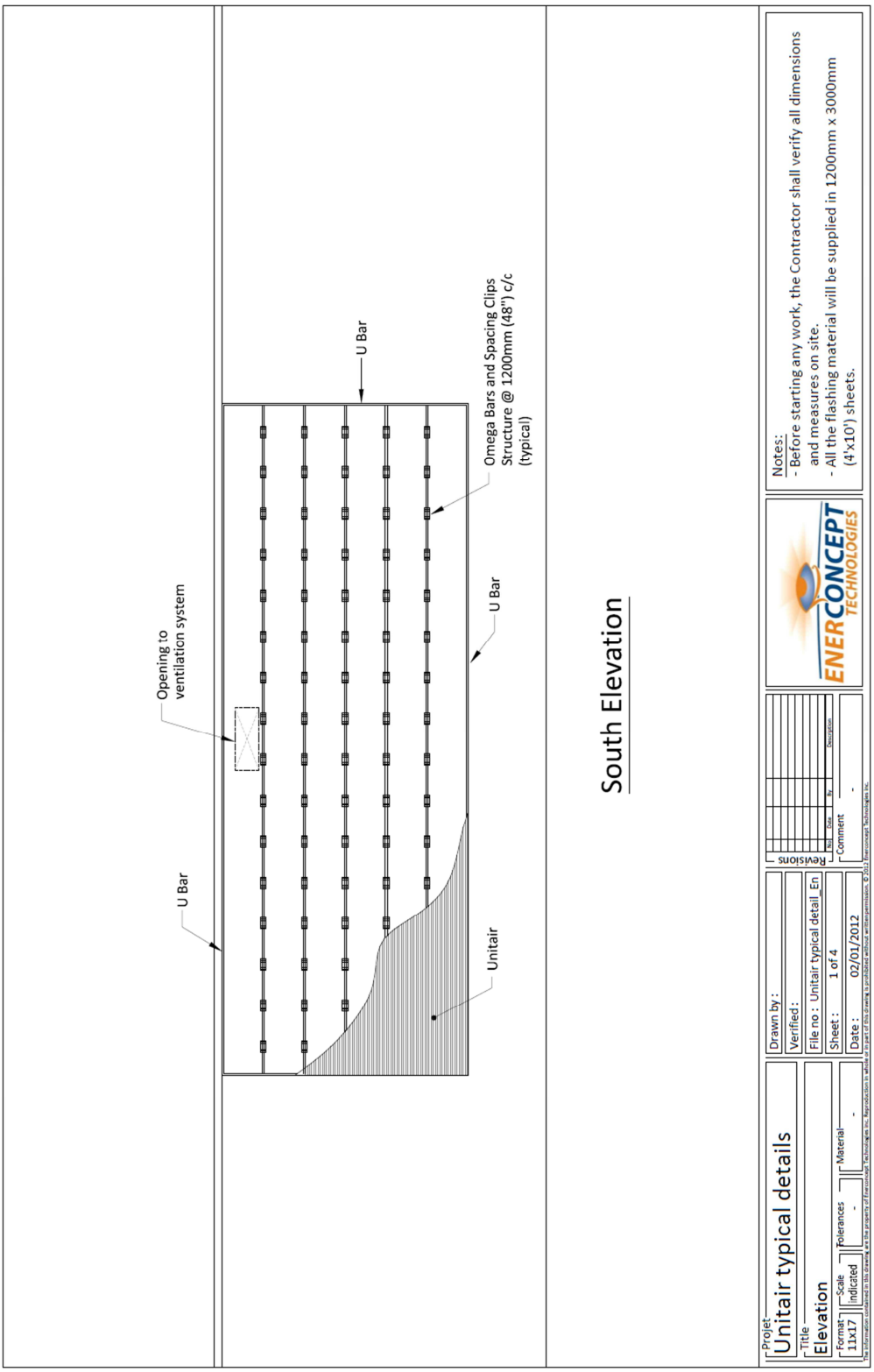
- Performance guarantee

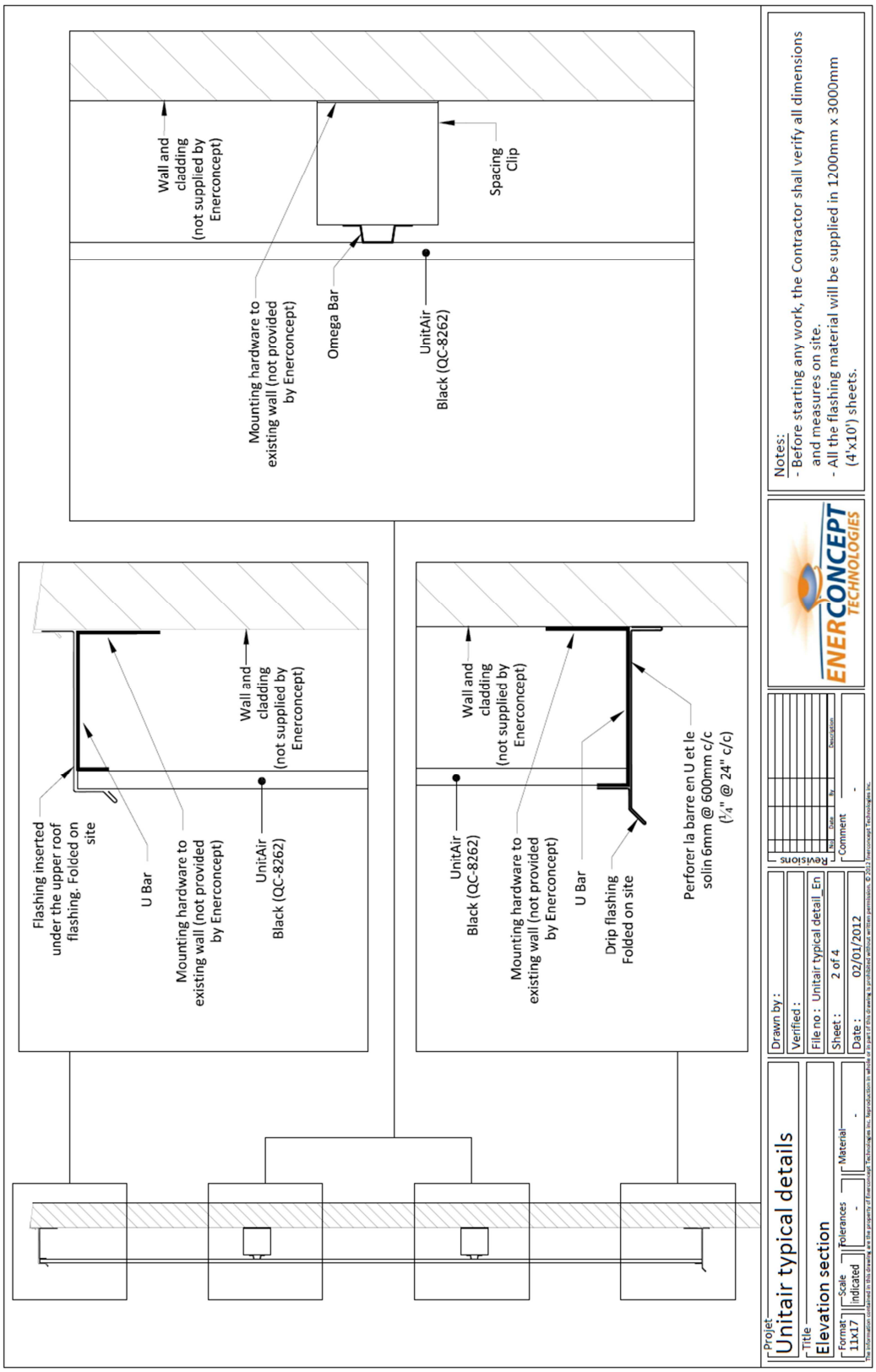
Note to the designer

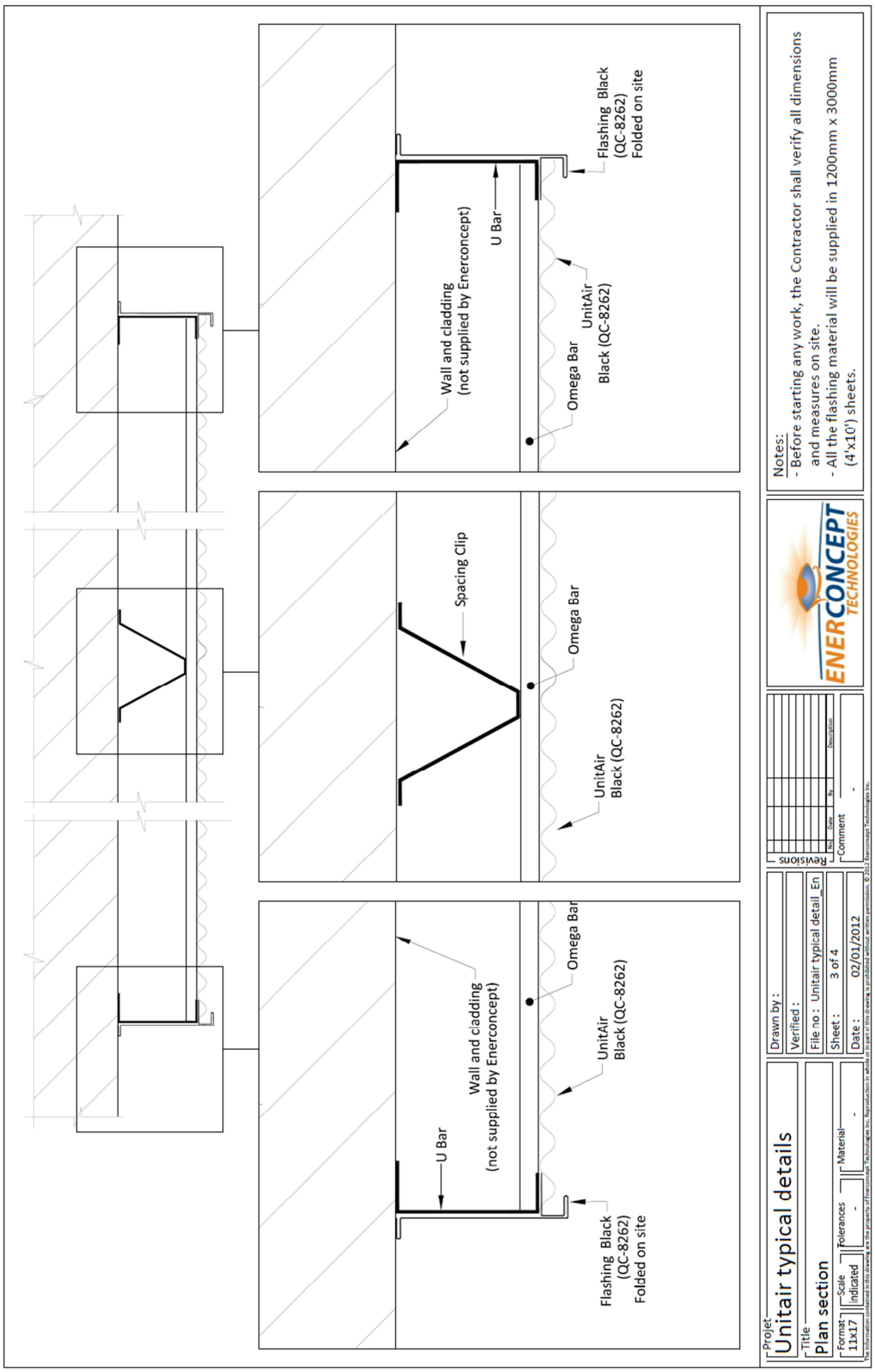
If desired by the engineer or architect, Enerconcept may, in a separate agreement (budget), do a thermal analysis on site (thermography, temperature and flow measurements).

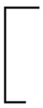
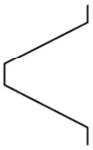
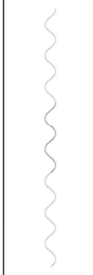
Accepted manufacturer : Enerconcept Technologies Inc.

4 Typical shop drawings (as provided by Enerconcept)




Wall and cladding (not supplied by Enerconcept)
Spacing Clip
Mounting hardware to existing wall (not provided by Enerconcept)
Omega Bar
UnitAir Black (QC-8262)
Flashing inserted under the upper roof flashing. Folded on site
U Bar
Mounting hardware to existing wall (not provided by Enerconcept)
UnitAir Black (QC-8262)
Wall and cladding (not supplied by Enerconcept)
UnitAir Black (QC-8262)
Mounting hardware to existing wall (not provided by Enerconcept)
U Bar
Drip flashing Folded on site
Perforer la barre en U et le solin 6mm @ 600mm c/c (1/4" @ 24" c/c)
Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be supplied in 1200mm x 3000mm (4'x10') sheets.
Revisions
Projet: Unitair typical details
Title: Elevation section
Format: 11x17
Scale: Indicated
Tolerances: -
Material: -
Drawn by :
Verified :
File no : Unitair typical detail_En
Sheet : 2 of 4
Date : 02/01/2012
Comment : -


Wall and cladding
(not supplied by Enerconcept)
U Bar
Omega Bar
UnitAir
Black (QC-8262)
Flashing Black
(QC-8262)
Folded on site
Spacing Clip
Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be supplied in 1200mm x 3000mm (4'x10') sheets.
Unitair typical details
Plan section
Drawn by :
Verified :
File no : Unitair typical detail_En
Sheet : 3 of 4
Date : 02/01/2012
Material
Tolerances
Scale indicated
Format 11x17
Revisions
Comment
ENERCONCEPT TECHNOLOGIES

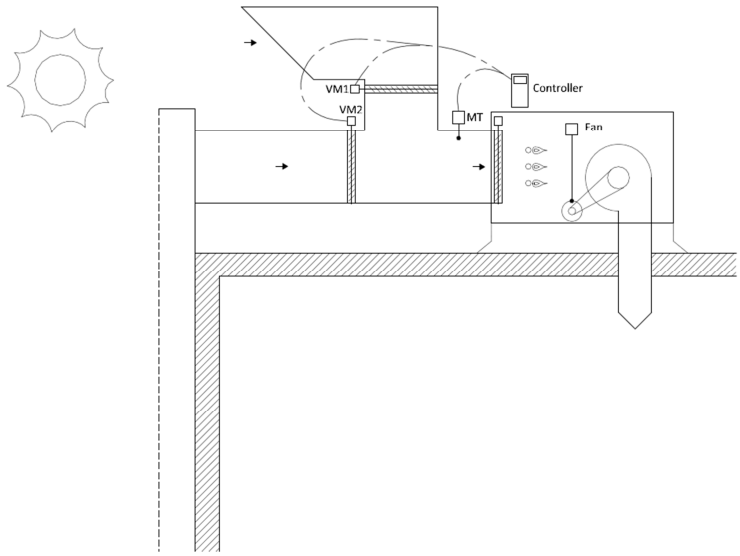
No	Name	Qty	ga	Dimensions	Length
1	U Bar	0	18		3000 mm (10'-0")
2	Omega Bar 20mm (7/8")	0	18		3000 mm (10'-0")
3	Spacing Clip	0	18		150 mm (6")
4	UnitAir Black (QC-8262)	0	26		____ mm (_-_")
5	Flashing material Black (QC-8262)	0	26		1200mm x 3000mm (4'-0" x 10'-0")
6	Screw #12-14 x 25mm (1") prepainted Black (QC-8262)	0	-		25mm (1")
7	Screw #12-14 x25 mm (1") Galvanised	0	-		25mm (1")

Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be supplied in 1200mm x 3000mm (4'x10') sheets.

Projet: Unitair typical details
Title: Parts
Format: 11x17 | Scale: Indicated | Tolerances: - | Material: -
Drawn by :
Verified :
File no : Unitair typical detail_En
Sheet : 4 of 4
Date : 02/01/2012
Revisions: No. | Date | By | Description
Comment : -

5 HVAC configurations and RETScreen inputs

5.1 Roof unit with solar collector bypass



Operation Sequence

System turned off:
The fan is stopped, the VM1 damper is closed VM2 is open.

System in function:
The fan is working, the VM2 damper is fully open and VM1 is closed. When mixing temperature is beyond ___℃/℉ the dampers VM1 and VM2 modulate to maintain MT set point (___℃/F).

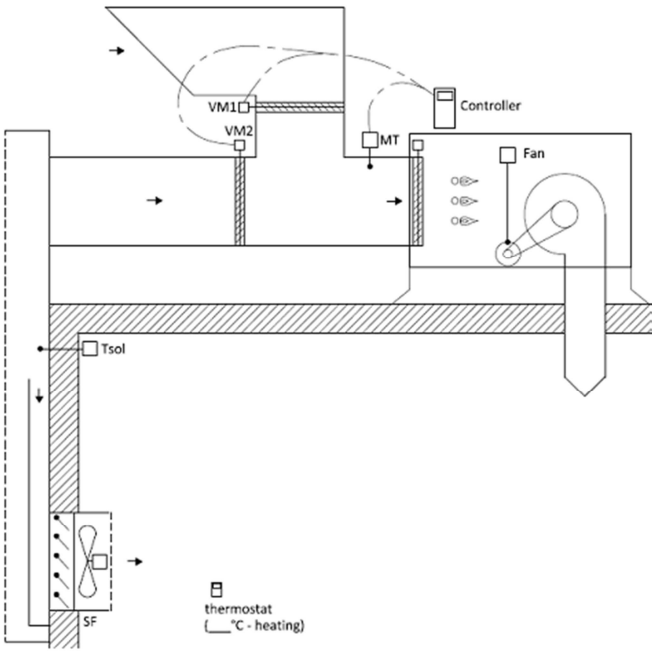
RETScreen Energy Model - Heating project

Heating project

Technology		Solar air heater	
Load characteristics			
Application		⊙ Ventilation ○ Process	
	Unit	**Base case**	**Proposed case**
Facility type		Commercial	
Indoor temperature	°C	21,0	21,0
Air temperature - maximum	°C	28,0	28,0
R-value - wall	ft² - °F/(Btu/h)	15,0	15,0
Design airflow rate	cfm	5 000	5 000
Operating days per week - weekdays	d/w	5,0	5,0
Operating hours per day - weekdays	h/d	24,0	24,0
Operating days per week - weekends	d/w	2,0	2,0
Operating hours per day - weekends	h/d	24,0	24,0
☑ **Percent of month used**	**Month**		
	January	100%	100%
	February	100%	100%
	March	100%	100%
	April	100%	100%
	May	0%	0%
	June	0%	0%
	July	0%	0%
	August	0%	0%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

1. Set the Facility type to “Commercial”.
2. Specify the systems actual operation schedule.
3. Check the “Percent of month used” box and specify the building’s months with a heating load

5.2 Combination of a roof unit and heating fan



Operation Sequence

System turned off (roof unit):
The fan is stopped, the damper VM1 is closed VM2 is open.

On a heating demand of the thermostat and if the temperature Tsol is >___℃/℉ the supply fan (SF) starts. When heating demand is met or when Tsol temperature is <___℃/℉ the supply fan (SF) is stopped.

System in function (roof unit):
The supply fan (SF) is stopped. It cannot work when the make-up unit is in function.

The fan is working the damper VM2 is fully open and VM1 is closed. When mixing temperature is beyond ___℃/℉ the dampers VM1 and VM2 modulate to maintain MT set point (___℃/℉).

RETScreen Energy Model - Heating project

Heating project

Technology		Solar air heater	
Load characteristics			
Application		⊙ Ventilation ○ Process	
	Unit	**Base case**	**Proposed case**
Facility type		Commercial	
Indoor temperature	°C	21,0	21,0
Air temperature - maximum	°C	30,0	30,0
R-value - wall	ft² - °F/(Btu/h)	15,0	15,0
Design airflow rate	cfm	100	100
Operating days per week - weekdays	d/w	5,0	5,0
Operating hours per day - weekdays	h/d	24,0	24,0
Operating days per week - weekends	d/w	0,0	0,0
Operating hours per day - weekends	h/d	0,0	0,0
☑ **Percent of month used**			
Month			
January		100%	100%
February		100%	100%
March		100%	100%
April		100%	100%
May		0%	0%
June		0%	0%
July		0%	0%
August		0%	0%
September		100%	100%
October		100%	100%
November		100%	100%
December		100%	100%

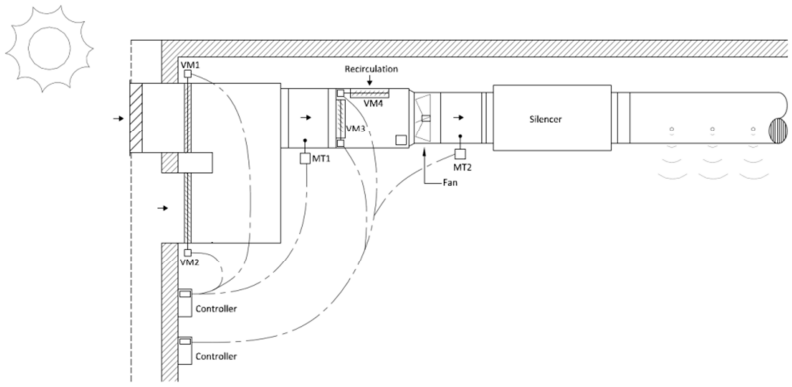
RETScreen Energy Model - Heating project

Heating project

Technology		Solar air heater	
Load characteristics			
Application		⊙ Ventilation ○ Process	
	Unit	**Base case**	**Proposed case**
Facility type		Industrial	
Indoor temperature	°C	21,0	21,0
Air temperature - minimum	°C	22,0	22,0
Air temperature - maximum	°C	30,0	30,0
Indoor temperature - building stratification	°C		0,0
Floor area	m²	0	0
R-value - roof	ft² - °F/(Btu/h)	30,0	30,0
R-value - wall	ft² - °F/(Btu/h)	15,0	15,0
Design airflow rate	cfm	100	100
Operating days per week - weekdays	d/w	0,0	0,0
Operating hours per day - weekdays	h/d	0,0	0,0
Operating days per week - weekends	d/w	2,0	2,0
Operating hours per day - weekends	h/d	24,0	24,0
☑ **Percent of month used**			
Month			
January		100%	100%
February		100%	100%
March		100%	100%
April		100%	100%
May		0%	0%
June		0%	0%
July		0%	0%
August		0%	0%
September		100%	100%
October		100%	100%
November		100%	100%
December		100%	100%

For this configuration, **two** RETScreen simulations must be done. One for the week and one for the weekend. The week simulation inputs are identical to the previous configuration “Roof unit with solar collector bypass”. In order to simulate weekend heating another type of system must be used. The facility type used is industrial, which simulates mixing fresh air and air available near the ceiling of a room to heat and eliminate air stratification. Buy eliminating the floor area and stratification and by accepting minimum air temperature to be one degree above the setpoint, this configuration allows one to evaluate energy savings for weekend heating.

5.3 Fan with recirculation and bypass of the solar collector



Operation Sequence

System turned off:
The fan is stopped, the damper VM1 and VM3 are closed and VM4 is open.

System in function:
The fan is working, the damper VM2 is fully open and VM1 is closed. When mixing temperature MT1 is beyond ___℃/℉ the dampers VM1 and VM2 modulate to maintain MT1 set point (___℃/℉). The dampers VM3 and VM4 modulate to maintain MT2 set point (___℃/℉)

RETScreen Energy Model - Heating project

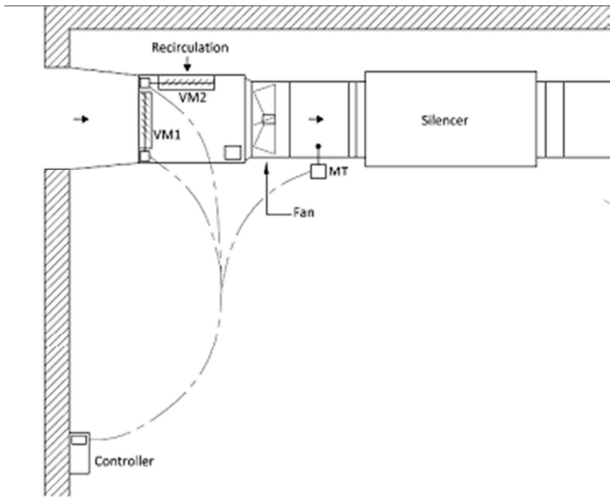
Heating project			
Technology		Solar air heater	
Load characteristics			
Application		⊙ Ventilation ○ Process	
	Unit	**Base case**	**Proposed case**
Facility type		Industrial	
Indoor temperature	°C	21,0	21,0
Air temperature - minimum	°C	10,0	10,0
Air temperature - maximum	°C	22,0	22,0
Indoor temperature - building stratification	°C		3,0
Floor area	ft²	2 500	2 500
R-value - roof	ft² - °F/(Btu/h)	30,0	30,0
R-value - wall	ft² - °F/(Btu/h)	15,0	15,0
Design airflow rate	cfm	10 000	10 000
Operating days per week - weekdays	d/w	5,0	5,0
Operating hours per day - weekdays	h/d	24,0	24,0
Operating days per week - weekends	d/w	2,0	2,0
Operating hours per day - weekends	h/d	24,0	24,0
☑ **Percent of month used**	**Month**		
	January	100%	100%
	February	100%	100%
	March	100%	100%
	April	100%	100%
	May	100%	100%
	June	100%	100%
	July	100%	100%
	August	100%	100%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

1. If the system is designed to operate year-long, specify the maximum inside temperature and let the percentage of month used to 100% for every month of the year.

2. Specify the floor area that will benefit from air de-stratification.

3. Specify the building's stratification, which is the difference in temperature between the floor and the ceiling. (Typically around 0.4℃/m (0.22℉/ft) in stratified air spaces)

5.4 Recirculation fan with no bypass of solar collector



Operation sequence

System turned off
The fan is stopped, the damper VM1 is closed and VM2 is open.

System in function:

The fan is working, the damper VM1 is fully open and VM2 is closed. When mixing temperature MT1 is beyond ___℃/℉ the dampers VM1 and VM2 modulate to maintain MT1 set point (___℃/℉).

Applications :

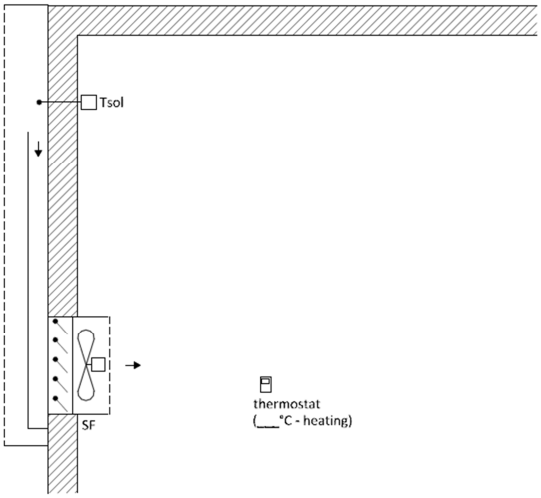
This system is running from September until May. During summer, the air is drawn into the building in a different way (example: garage doors open during the summer).

RETScreen Energy Model - Heating project

Heating project			
Technology		Solar air heater	
Load characteristics			
Application		⊙ Ventilation ○ Process	
	Unit	Base case	Proposed case
Facility type		Industrial	
Indoor temperature	°C	21,0	21,0
Air temperature - minimum	°C	10,0	10,0
Air temperature - maximum	°C	30,0	30,0
Indoor temperature - building stratification	°C		3,0
Floor area	ft²	2 500	2 500
R-value - roof	m² - °C/W	30,0	30,0
R-value - wall	ft² - °F/(Btu/h)	15,0	15,0
Design airflow rate	cfm	10 000	10 000
Operating days per week - weekdays	d/w	5,0	5,0
Operating hours per day - weekdays	h/d	24,0	24,0
Operating days per week - weekends	d/w	2,0	2,0
Operating hours per day - weekends	h/d	24,0	24,0
☑ **Percent of month used**	**Month**		
	January	100%	100%
	February	100%	100%
	March	100%	100%
	April	100%	100%
	May	0%	0%
	June	0%	0%
	July	0%	0%
	August	0%	0%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

1. Specify the maximum temperature allowed inside the building.
2. Specify the floor area that will benefit from air de-stratification.
3. Check the “Percent of month used” box and specify the building’s months with a heating load.
4. Specify the building’s stratification, which is the difference in temperature between the floor and the ceiling. (Typically around 0.4℃/m(0.22℉/ft) in stratified air spaces)

5.5 Solar collector with heating fan



Operation Sequence

On a heating demand of the thermostat and if the temperature Tsol is >___℃/℉ the supply fan (SF) starts. When heating demand is met or when Tsol temperature is <___℃/℉ the supply fan (SF) is stopped.

Applications:
Auxiliary heating system

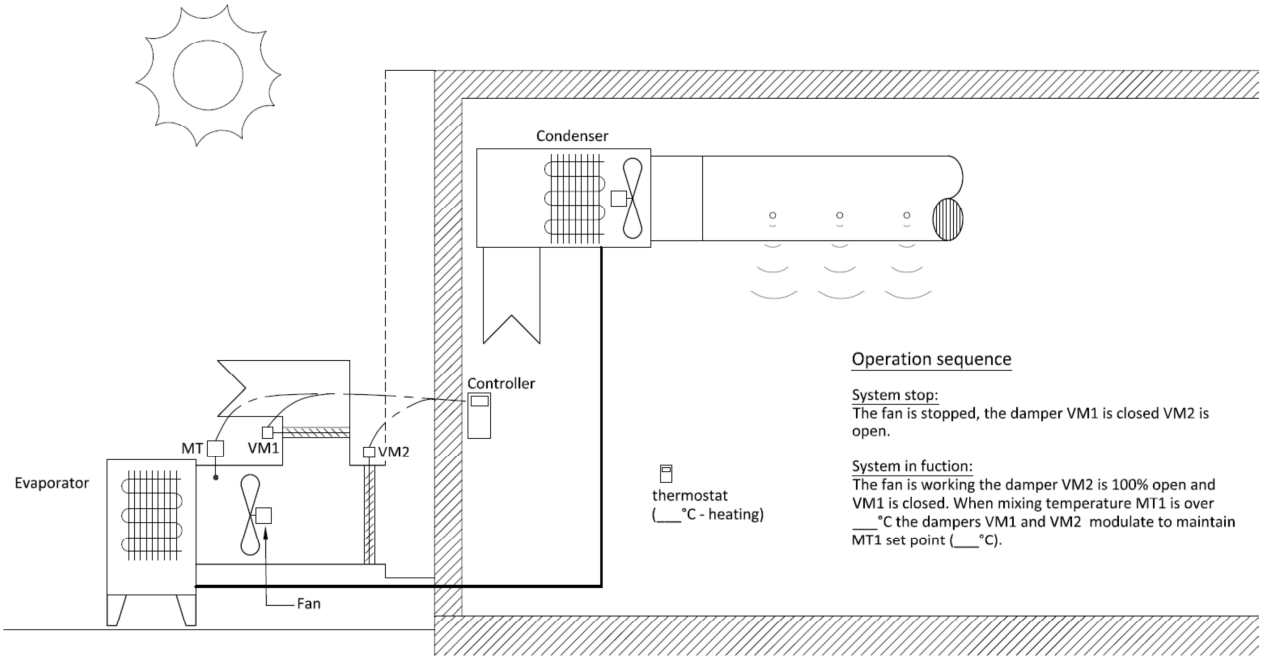
(A variable speed drive can be installed on the fan to vary the speed according to the temperature in the collector)

RETScreen Energy Model - Heating project

Heating project			
Technology		Solar air heater	
Load characteristics			
Application		⊙ Ventilation ○ Process	
	Unit	Base case	Proposed case
Facility type		Industrial	
Indoor temperature	°C	21,0	21,0
Air temperature - minimum	°C	22,0	22,0
Air temperature - maximum	°C	30,0	30,0
Indoor temperature - building stratification	°C		0,0
Floor area	m²	0	0
R-value - roof	ft² - °F/(Btu/h)	30,0	30,0
R-value - wall	ft² - °F/(Btu/h)	15,0	15,0
Design airflow rate	cfm	100	100
Operating days per week - weekdays	d/w	5,0	5,0
Operating hours per day - weekdays	h/d	24,0	24,0
Operating days per week - weekends	d/w	2,0	2,0
Operating hours per day - weekends	h/d	24,0	24,0
☑ **Percent of month used**	**Month**		
	January	100%	100%
	February	100%	100%
	March	100%	100%
	April	100%	100%
	May	0%	0%
	June	0%	0%
	July	0%	0%
	August	0%	0%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

1. Select facility type “industrial” and remove floor area and stratification.
2. Set the minimum air temperature above the indoor temperature.
3. Specify the appropriate airflow rate and operating schedule.
4. Check the “Percent of month used” box and specify the building’s months with a heating load.

5.6 Solar collector with heat pump



Applications:

Increases coefficient of performance (COP) of air-sourced heat pump during cold, sunny days.

6 Unitair collector – Photos of completed projects

- Paint factory 3207pi^2 (298 m²)

- Farming equipment plant 7534 pi^2 (700 m²)

- Paint shop 5242 pi^2 (487 m²)

- Airplane hangar 26 285 pi^2 (2 442 m²)

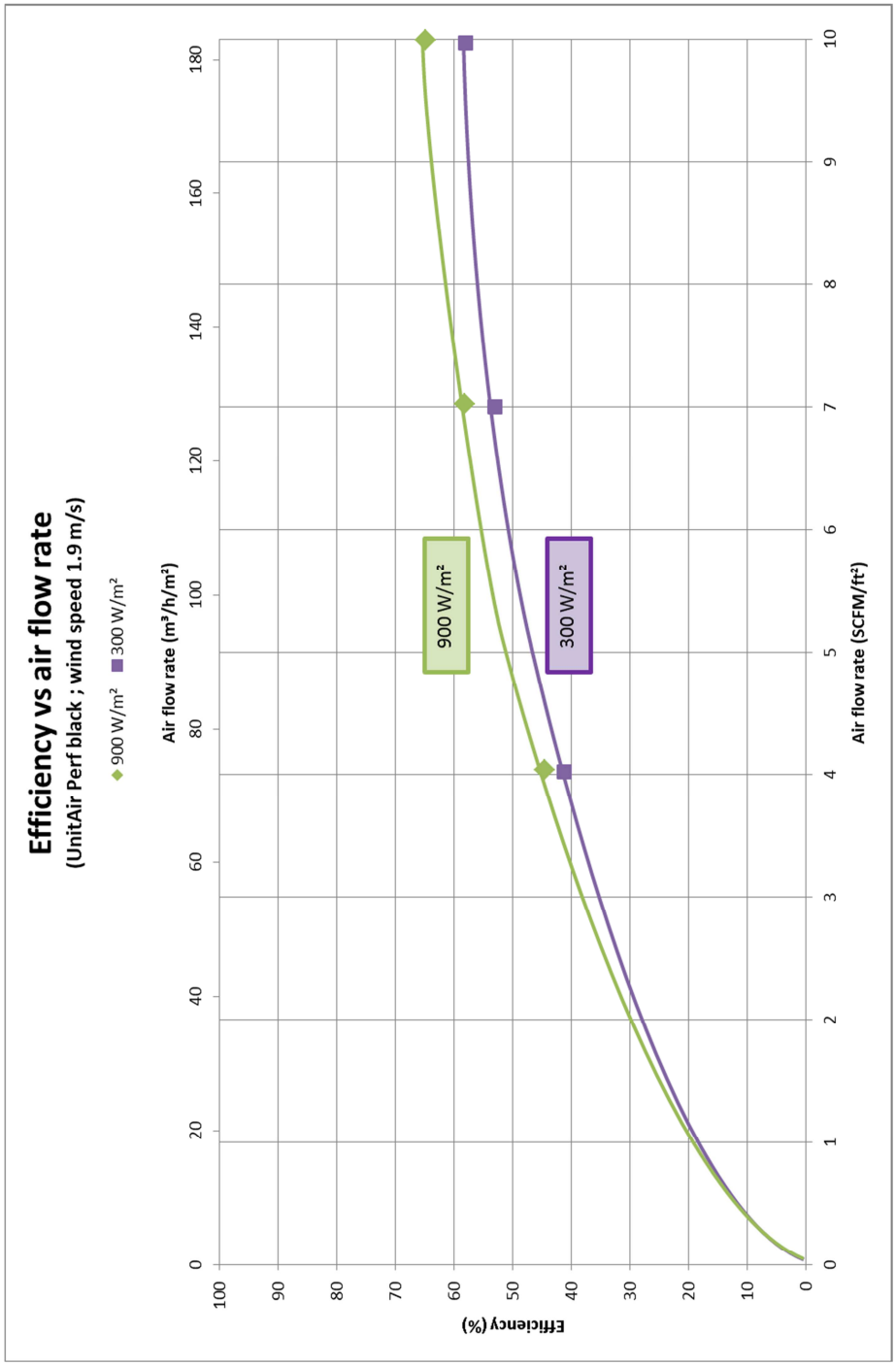
- Airplane assembly plant 12 744 pi^2 (1 184 m²)

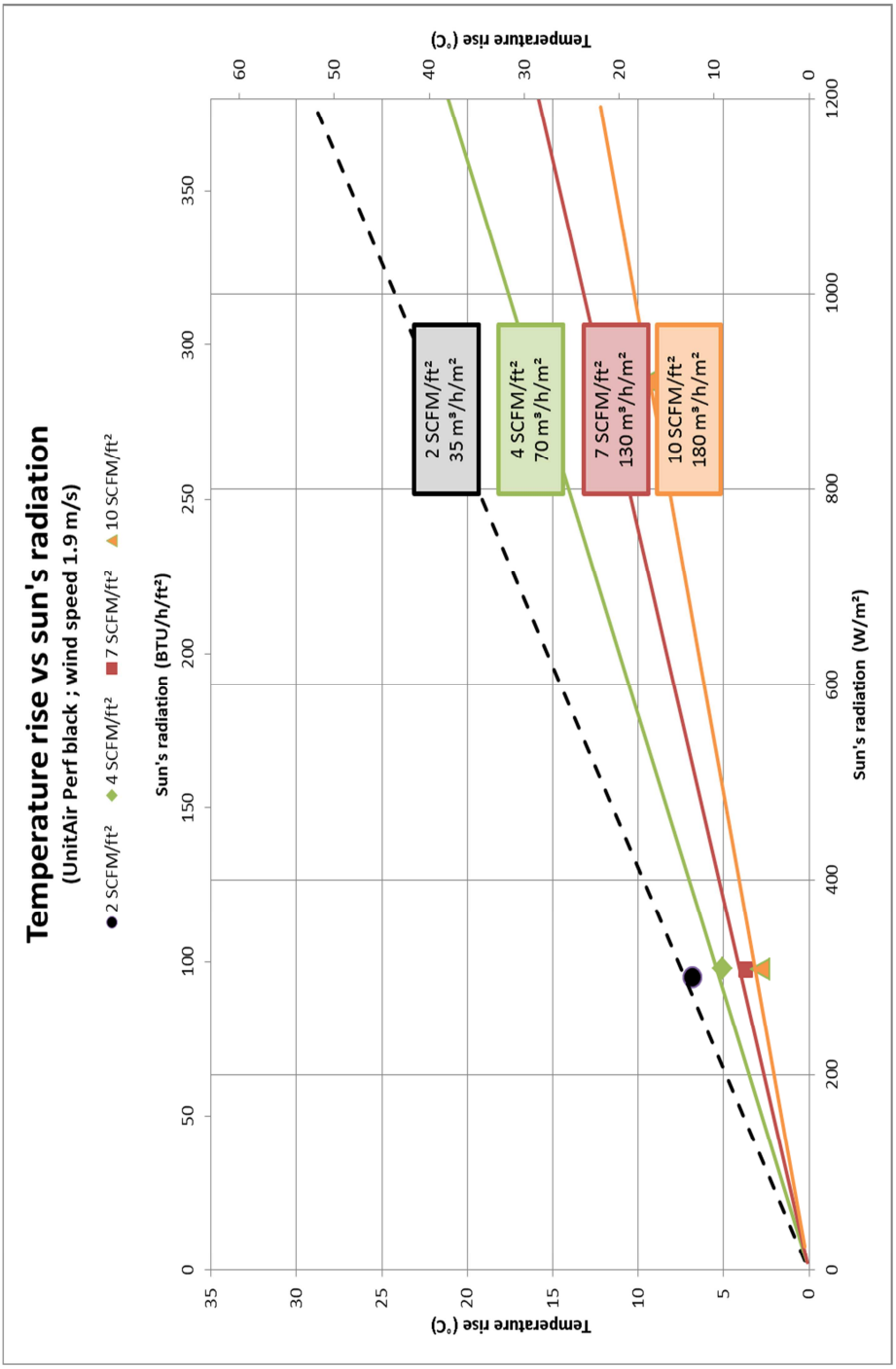
- University 5888 pi^2 (547 m²)

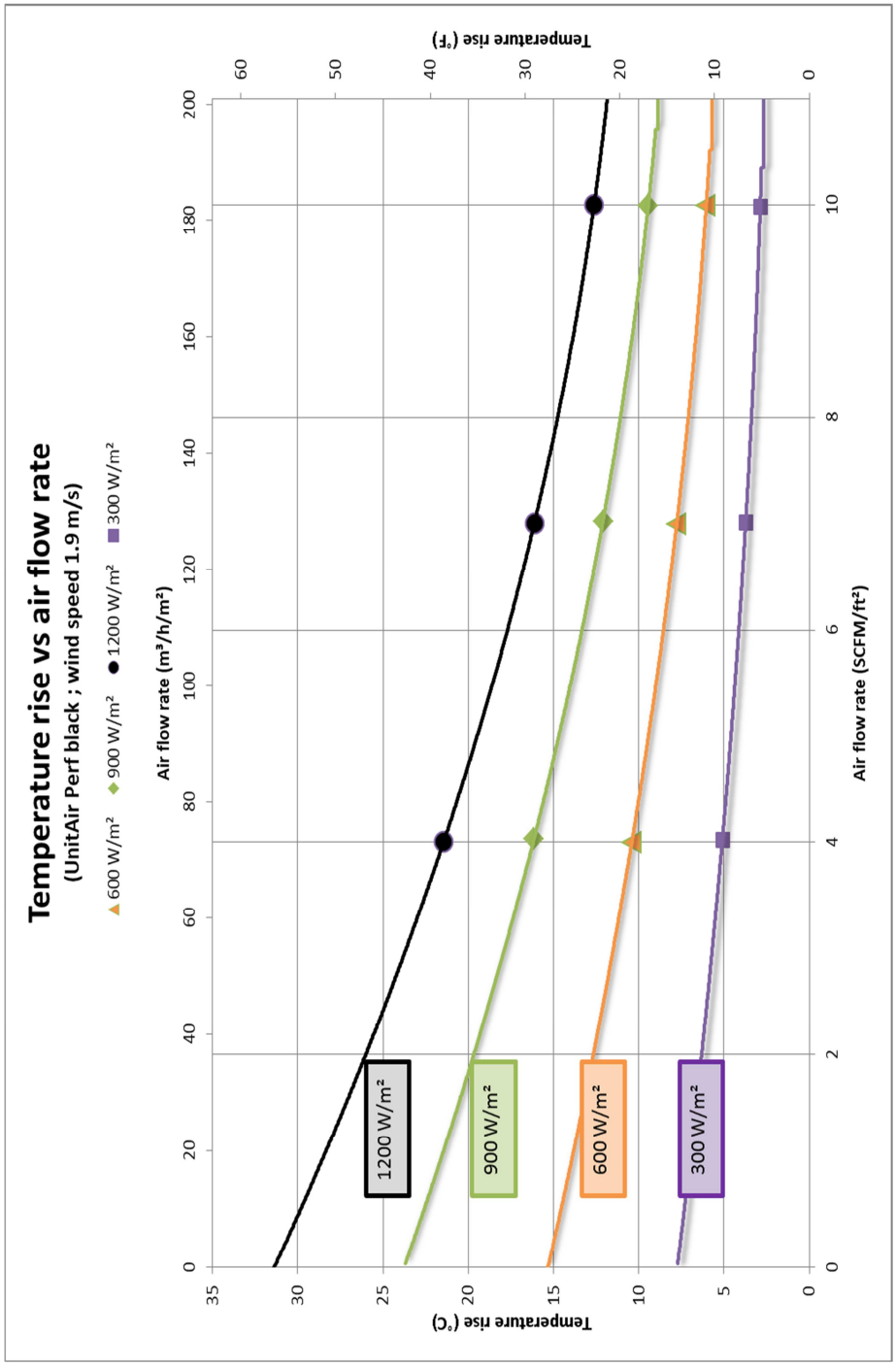
- College 2637 pi^2 (245 m²)

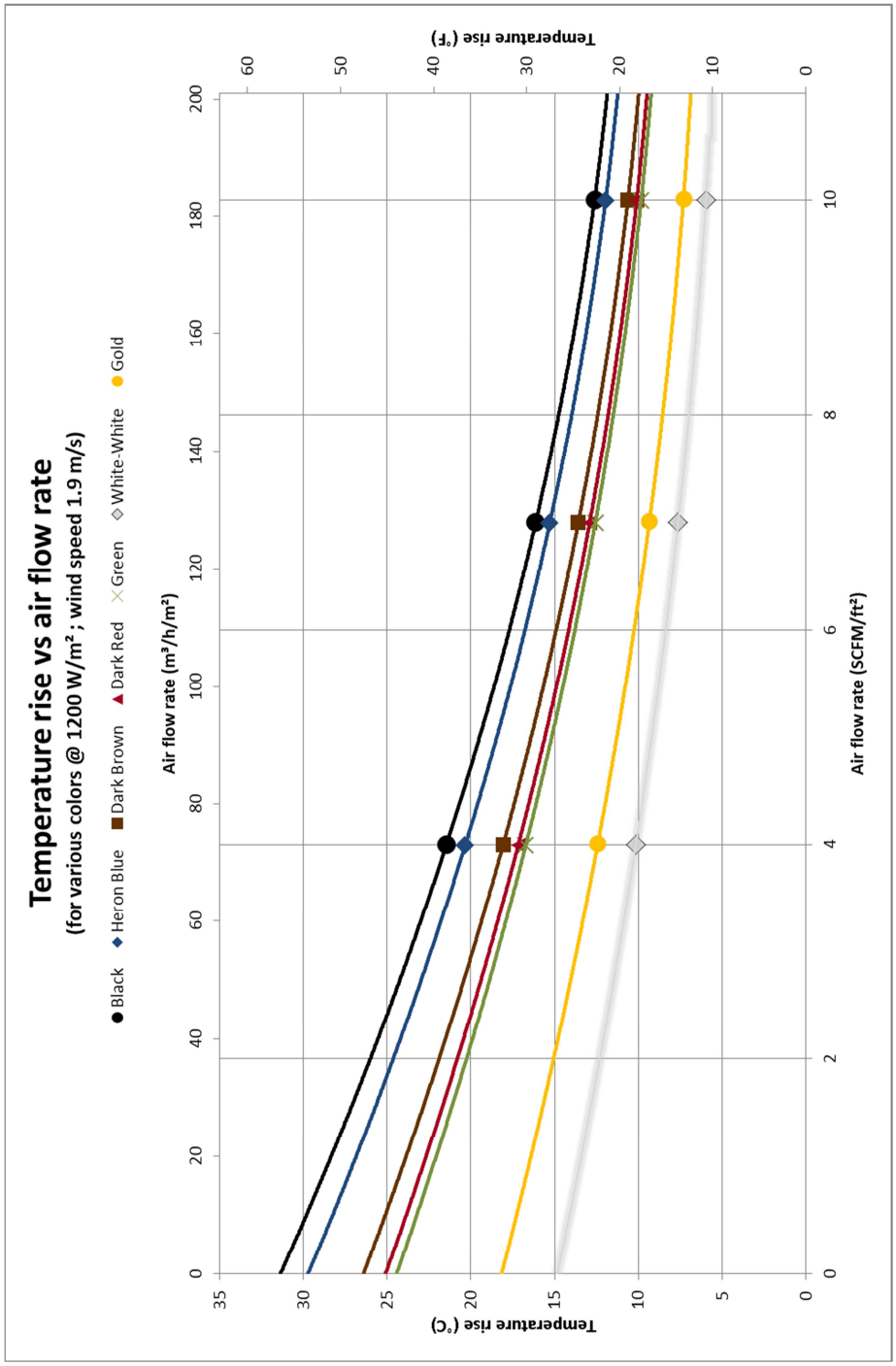
- Residential and recreational center 1292 pi^2 (120 m^2)

7 Curves efficiency temperature rise




Temperature rise vs sun's radiation
(UnitAir Perf black ; wind speed 1.9 m/s)
2 SCFM/ft²
4 SCFM/ft²
7 SCFM/ft²
10 SCFM/ft²
Sun's radiation (BTU/h/ft²)
Sun's radiation (W/m²)
Temperature rise (°C)
Temperature rise (°C)
2 SCFM/ft² 35 m³/h/m²
4 SCFM/ft² 70 m³/h/m²
7 SCFM/ft² 130 m³/h/m²
10 SCFM/ft² 180 m³/h/m²


Temperature rise vs air flow rate
(UnitAir Perf black ; wind speed 1.9 m/s)
600 W/m²
900 W/m²
1200 W/m²
300 W/m²
Air flow rate (m³/h/m²)
Air flow rate (SCFM/ft²)
Temperature rise (°C)
Temperature rise (°F)
1200 W/m²
900 W/m²
600 W/m²
300 W/m²


Temperature rise vs air flow rate
(for various colors @ 1200 W/m² ; wind speed 1.9 m/s)
Black
Heron Blue
Dark Brown
Dark Red
Green
White-White
Gold
Air flow rate (m³/h/m²)
Air flow rate (SCFM/ft²)
Temperature rise (°C)
Temperature rise (°F)