LUBI®
Transparent
Collector

- TECHNICAL MANUAL –

Version 1.4- EN
July 2013

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1 Technical specifications

1.1 General information

The Lubi® collector is a solar air heater based on Enerconcept Technologies' patented perforated glazing technology (PGT). Its high performance nearly reaches the physical limits of solar heat transfer, with results of over 80% efficiency in transforming solar light into hot air. Even though the Lubi collector is simple and easy to install, all projects are tailor-designed and site-specific. The design parameters of wall or roof-mounted Lubi 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 (panel mount layout, location of air intakes, inside plenum depth, etc.), Enerconcept will deliver all necessary components and accessories for simple, quick mounting of the Lubi panels (spacing clips, extruded vertical bars and decorative capping) resulting in a simple, quick and aesthetically-pleasing installation.

1.2 Working principle of the Lubi™ collector

All glazed solar thermal collectors, whether it is for air or water heating, lose most of their heat through the front glazed surface. This can be felt when the glazing gets warm: in this case, the collector is losing heat to the environment. The basic principle of the Lubi system consists in reducing these heat losses to the environment to a minimum.

The Lubi system reduces heat loss by means of multiple perforations spread across the entire glazing surface through which incoming outside air is admitted. When the system is designed properly, the entire Lubi glazing surface remains at ambient temperature, thereby, eliminating heat losses on the collector's surface.

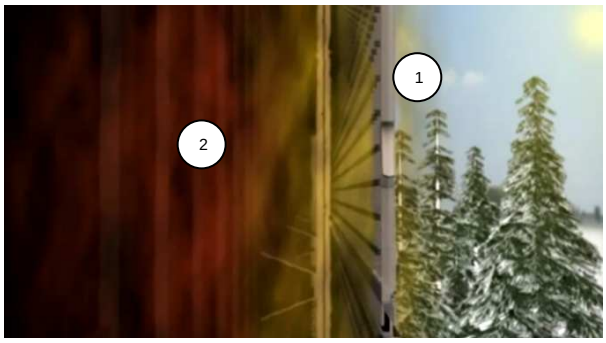
The underlying operating principles governing the transformation of incoming solar rays into useful thermal energy are as follow:

1. Solar radiation passes through the highly transmissive polycarbonate. Some heat is absorbed within the Lubi polycarbonate collector.

2. The solar radiation reaches the back wall. This wall now acts as a solar absorber. The absorber may happen to be the existing wall or the roof of the building, or a special underlayer provided by Enerconcept.

   At this stage, solar radiation turns into heat.

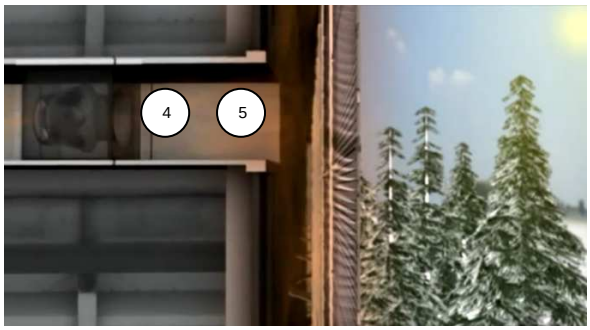
3. The absorber heat is then trapped as hot air between the Lubi panels and the absorber. The air gap is called the collector's "plenum". At optimal solar conditions, the air temperature within the plenum may reach up to 81℉ (45℃) above ambient temperature.



4 When the fan is turned on, the influx of outside air through the Lubi™ panels' perforations cools the panels down continuously, preventing them from warming up. In this way, heat losses to the environment are reduced to an absolute minimum.

5 The solar-heated air is mechanically drawn into the building's ventilation system or process.

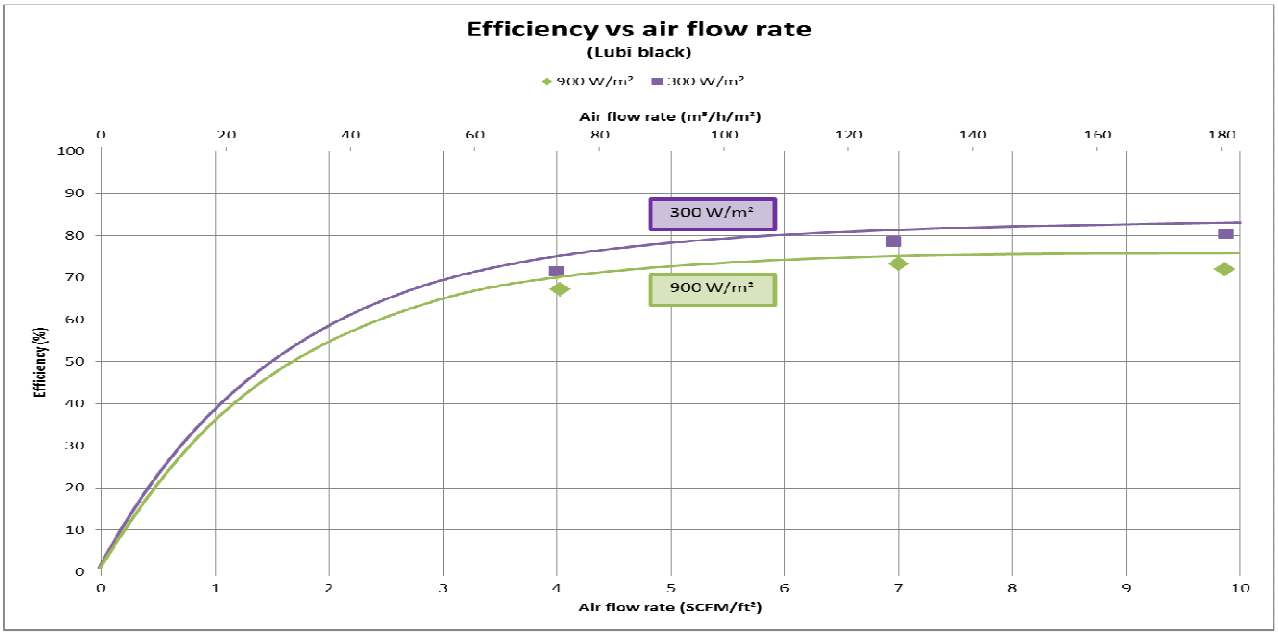
Therefore, the only place where the solar heat can go is into the building or the process to be heated.



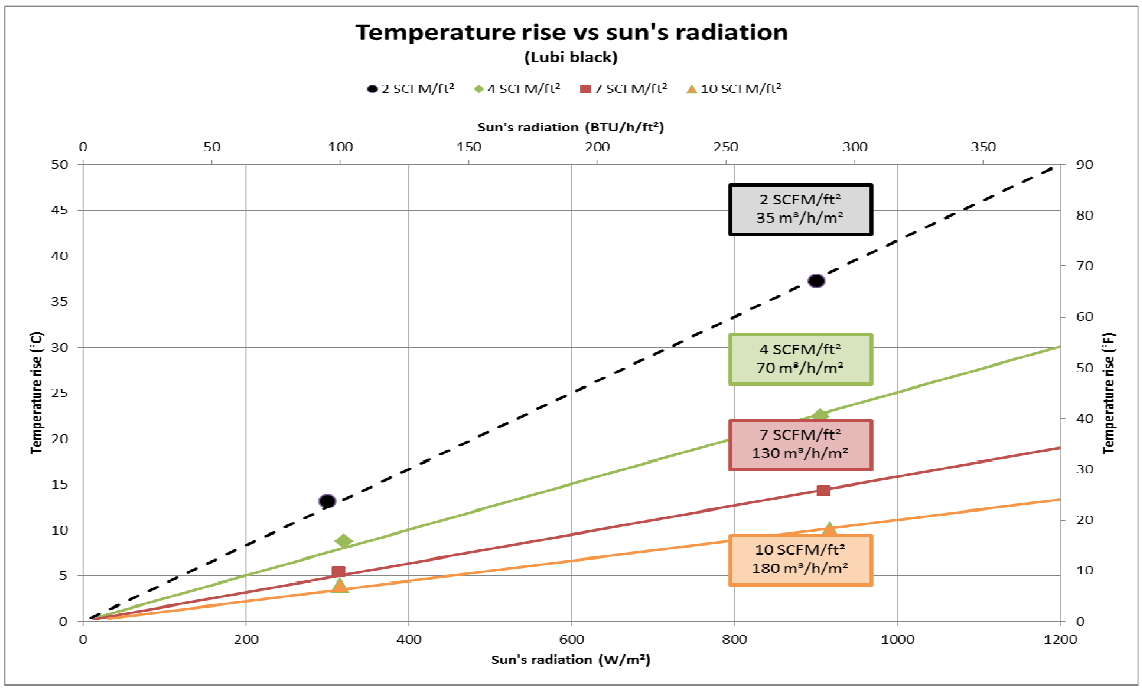
1.3 Efficiency curves of the Lubi collector

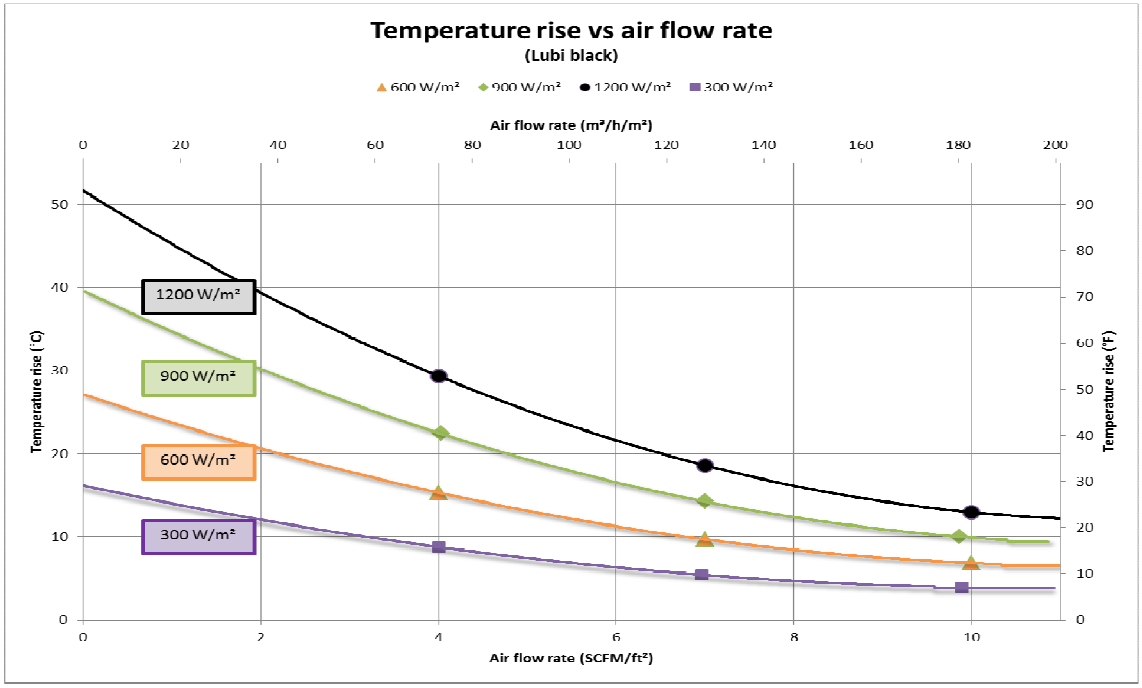
** Graphics are shown in high resolution at the end of this document

The Lubi collector reaches a maximum efficiency of more than 80,7%, the highest figure ever reached by a single-pane solar air heater. The biggest benefit, however, is that this high performance is maintained over a very wide range of air flow rates. Whereas traditional collectors, glazed or metallic, suffer from a loss in performance with air flows lower than 5 cfm/ft^2 (100 m^3/h/m^2), the Lubi collector curve remains as high as 55% with air flows as low as 2 cfm/ft^2 (40 m^3/h/m^2).



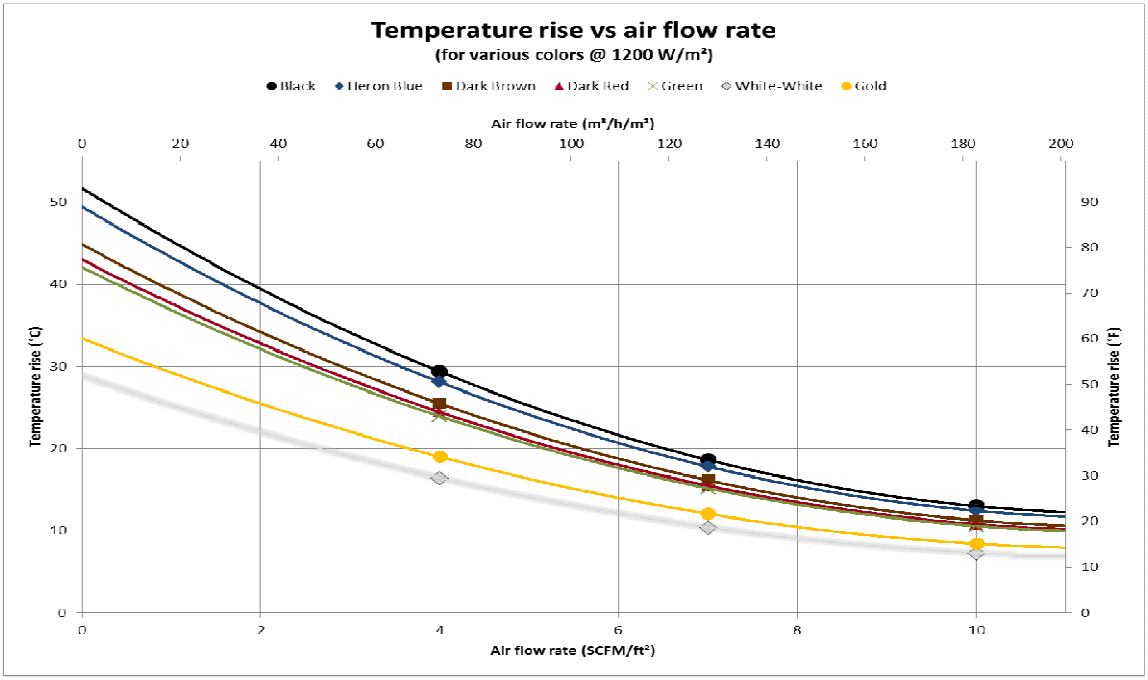
This allows for a substantial temperature increase as high as 81 ºF (45ºC) above ambient temperature, which makes the Lubi collector ideally suited for all solar air heating applications such as building space heating, coupling to heat pumps, industrial or drying processes and, of course, preheating of outside air.

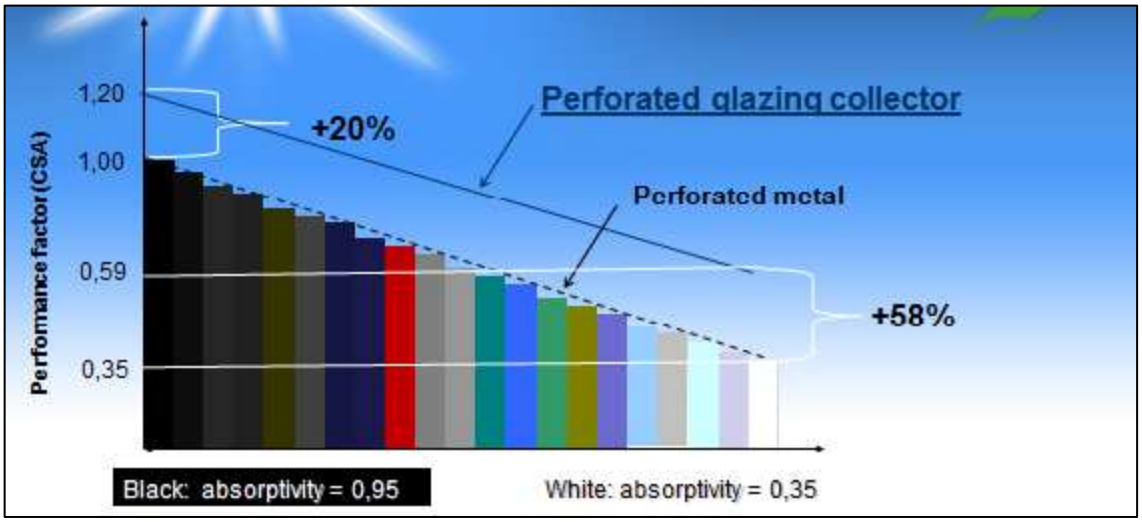




1.4 Influence of absorber colour

One of the numerous advantages of the Lubi collector is that the absorber is located in the back of the collector. Heat is then trapped in the plenum. Less energy is lost by reflection off the absorber since the glazed panels reflect some energy back to the absorber. This results in a lesser drop in efficiency due to absorptivity. Black absorbers are the most effective however, light colour absorbers are also very efficient.

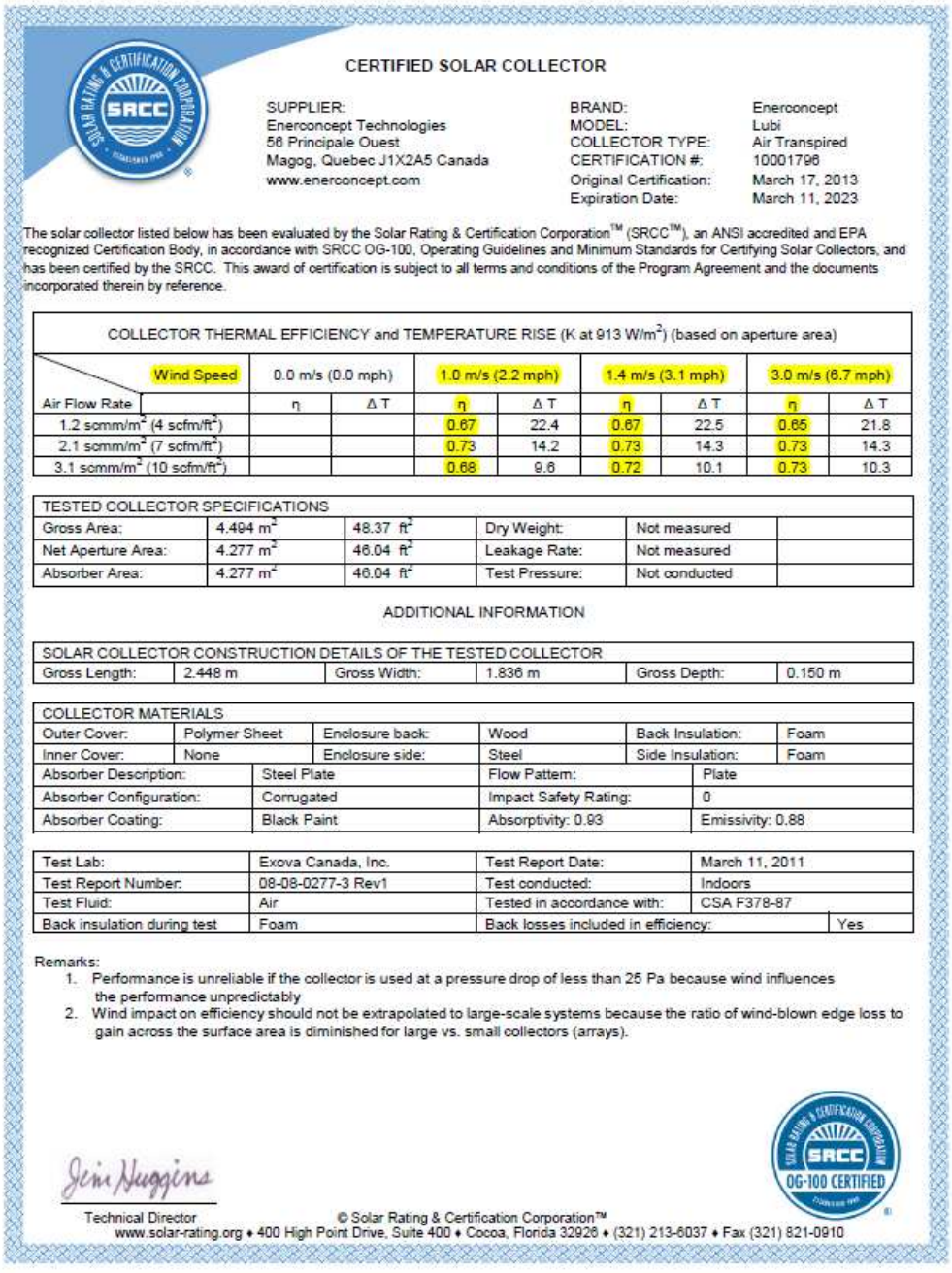




Performance comparison of metal transpired collector and Lubi perforated glazing technology over entire range of available colors.

1.5 Influence of wind

The Lubi collector has been tested and certified to have no efficiency loss due to lateral winds. As per report 08-08-0277-3 Rev1, published by Exova[1] on March 2nd 2011, a certified test laboratory, the Lubi is "insensitive to wind". Therefore, the user can expect greater thermal output than our metal collector for high wind areas.



CERTIFIED SOLAR COLLECTOR

SUPPLIER:
Enerconcept Technologies
56 Principale Ouest
Magog, Quebec J1X2A5 Canada
www.enerconcept.com

BRAND: Enerconcept
MODEL: Lubi
COLLECTOR TYPE: Air Transpired
CERTIFICATION #: 10001796
Original Certification: March 17, 2013
Expiration Date: March 11, 2023

The solar collector listed below has been evaluated by the Solar Rating & Certification Corporation™ (SRCC™), an ANSI accredited and EPA recognized Certification Body, in accordance with SRCC OG-100, Operating Guidelines and Minimum Standards for Certifying Solar Collectors, and has been certified by the SRCC. This award of certification is subject to all terms and conditions of the Program Agreement and the documents incorporated therein by reference.

COLLECTOR THERMAL EFFICIENCY and TEMPERATURE RISE (K at 913 W/m²) (based on aperture area)

Wind Speed	0.0 m/s (0.0 mph)		1.0 m/s (2.2 mph)		1.4 m/s (3.1 mph)		3.0 m/s (6.7 mph)	
Air Flow Rate	η	ΔT	η	ΔT	η	ΔT	η	ΔT
1.2 scmm/m² (4 scfm/ft²)			0.67	22.4	0.67	22.5	0.65	21.8
2.1 scmm/m² (7 scfm/ft²)			0.73	14.2	0.73	14.3	0.73	14.3
3.1 scmm/m² (10 scfm/ft²)			0.68	9.6	0.72	10.1	0.73	10.3

TESTED COLLECTOR SPECIFICATIONS					
Gross Area:	4.494 m²	48.37 ft²	Dry Weight:	Not measured	
Net Aperture Area:	4.277 m²	46.04 ft²	Leakage Rate:	Not measured	
Absorber Area:	4.277 m²	46.04 ft²	Test Pressure:	Not conducted	

ADDITIONAL INFORMATION

SOLAR COLLECTOR CONSTRUCTION DETAILS OF THE TESTED COLLECTOR					
Gross Length:	2.448 m	Gross Width:	1.836 m	Gross Depth:	0.150 m

COLLECTOR MATERIALS					
Outer Cover:	Polymer Sheet	Enclosure back:	Wood	Back Insulation:	Foam
Inner Cover:	None	Enclosure side:	Steel	Side Insulation:	Foam
Absorber Description:	Steel Plate		Flow Pattern:	Plate	
Absorber Configuration:	Corrugated		Impact Safety Rating:	0	
Absorber Coating:	Black Paint		Absorptivity: 0.93	Emissivity: 0.88	

Test Lab:	Exova Canada, Inc.	Test Report Date:	March 11, 2011	
Test Report Number:	08-08-0277-3 Rev1	Test conducted:	Indoors	
Test Fluid:	Air	Tested in accordance with:	CSA F378-87	
Back insulation during test	Foam	Back losses included in efficiency:		Yes

Remarks:
1. Performance is unreliable if the collector is used at a pressure drop of less than 25 Pa because wind influences the performance unpredictably
2. Wind impact on efficiency should not be extrapolated to large-scale systems because the ratio of wind-blown edge loss to gain across the surface area is diminished for large vs. small collectors (arrays).

Technical Director

www.solar-rating.org ♦ 400 High Point Drive, Suite 400 ♦ Cocoa, Florida 32926 ♦ (321) 213-6037 ♦ Fax (321) 821-0910

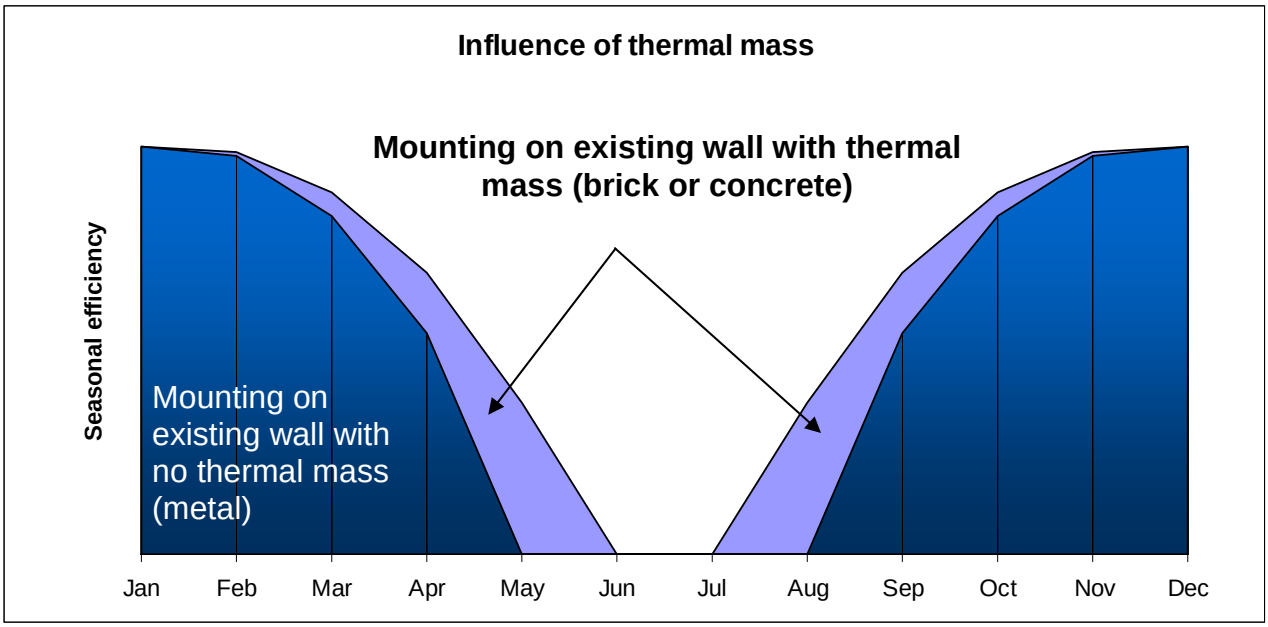
Extract from: http://www.solar-rating.org/ratings/transpired_10001796_20130628.pdf

[1] *Exova – 2395 Speakman Dr., Mississauga (ON), Canada – L5K 1B3*

1.6 Influence of thermal mass

A Lubi collector installed on a wall made of thermal massive materials, such as brick or cement, will provide greater heat recovery over the months of lower heating loads. The thermal energy stored in the wall's mass during the day will be available to use up to several hours through the night.

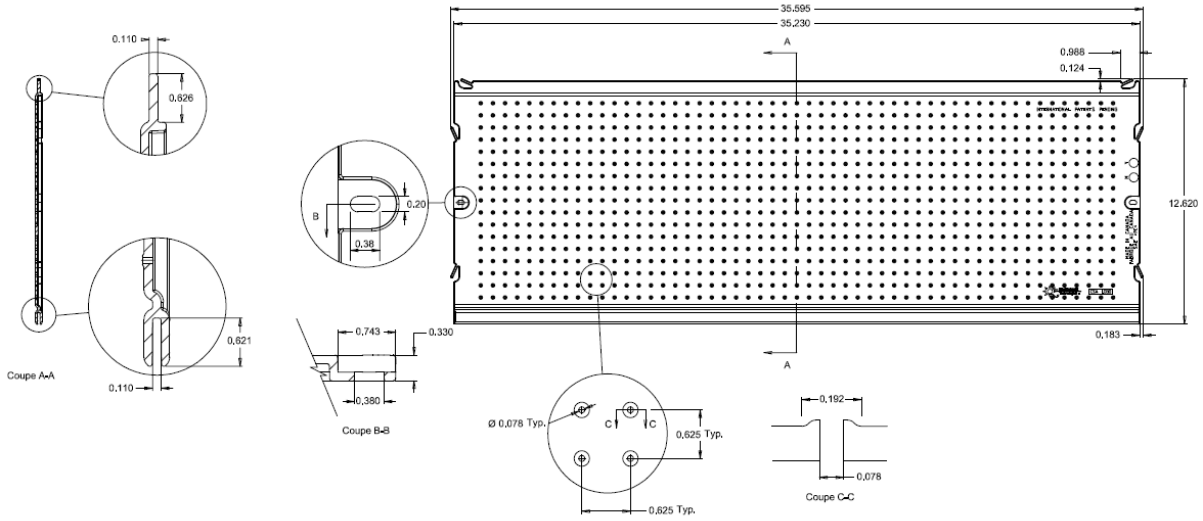
This characteristic is illustrated in the figure below and is currently being investigated by our R&D team. Tools to determine how much energy can be saved using thermal mass will be available and described in the following manual's update.



1.7 Typical pressure drop

As every Lubi installation is different in width, height and thickness, depending on site specifications, design consideration, fresh air needs and multiple other items, the final pressure drop may differ from site to site. However, typical installations of Lubi collectors as designed by Enerconcept will lead to a total pressure drop varying between 0.25 to 0.5 in. wg (60 to 125 Pa).

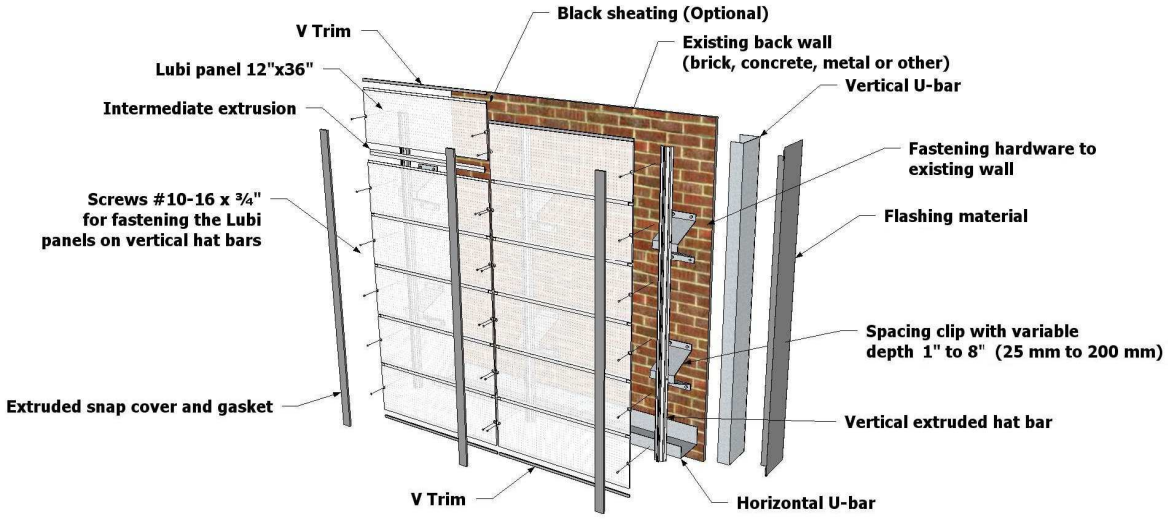
1.8 Lubi panel specifications



System General data	IP	SI
Peak instantaneous efficiency	80,7%	
Maximum power output	254 BTU/h/pi^2	800 W/m^2
Air flow range per panel	3-30 cfm	5-50 m^3/h
Operation mode	outside air, open-loop	
Maximum temperature increase	81 °F	45 °C
Max. pressure drop. @ 30 cfm (50 m^3/h) per panel	1/2 in. H_2O	125 Pa
Solar absorptance (black absorber)	0,95	
Hemispheric emissivity (black absorber)	0,88	
Solar transmittance of polycarbonate	0,86	
Test standard	CSA-F-378	
Date of testing in SRCC-accredited laboratory	Jan. 2010	
Efficiency drop due to wind	none below 6,7mi/h (3 m/s) windspeed	

Lubi™ panel	IP	SI
Length	35.6 in.	904 mm
Height	12.6 in.	320 mm
Overall panel depth	0.33 in.	8,3 mm
Glazing thickness	0.11 in.	2,8 mm
Weight	2 lbs	0,9 kg
Perforations - number	906	906
Perforations - diameter	0.078 in.	2 mm
Perforations - distance c/c	0.625 in.	16 mm
Spacers for horizontal thermal expansion	4	
Spacers for vertical thermal expansion	2	
Maximum thermal expansion (longitudinal)	0.3 in.	7,5 mm
Material	UV-treated polycarbonate	
Surface finish	textured, with smooth back side	

1.9 Assembly parts & accessories supplied by Enerconcept



Assembly	IP	SI
Spacing clips - depth	1 - 8 in	25 - 200 mm
Vertical extruded hat bar	¾ in	18 mm
Mounting of hat bars on clips	2 screws #10 - 16 x ¾"	
Mounting on building	vertical strips	
Distance between each vertical strips	36 in	905 mm
Assembly of panel strips	per panel, from bottom to top	
Assembly between each Lubi™ panel	grooved insert	
Screws required per panel	2 screws #10 - 16 x ¾"	
Surrounding "U" bars	1 - 8 in	25 - 200 mm
Extruded snap cover	insertion into vertical hat bars	
Intermediate Extrusion	33 ½"	851mm
V Trim	36 po	905 mm

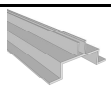
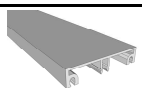
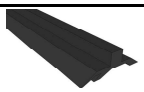
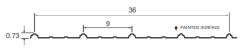
1.10 Mounting angle

The Lubi collector has been designed and tested for vertical installations where water penetration is limited due to shape of glazing perforations that prevent water from entering the collector. Limited quantity of water inside the collector is then recovered by the bottom framing which allows water to exit the collector without accumulating. 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.

Roof mounted

Wall mounted

1.11 Parts list

	Name	Number
	Lubi panel	Li-110 (C)
	Intermediate extrusion	Li-111 (Al-A)
	V trim	Li-112 (QC7500)
	Spacing clip - variable depth (horizontal installation)	Li-210-H (G)
	Spacing clip - variable depth (vertical installation)	Li-210-V (G)
	U-bar (horizontal installation)	Li-211-H (G)
	U-bar (vertical installation)	Li-211-V (G)
	Extruded hat bar	Li-212 (Al-N)
	Extruded snap cover	Li-310 (Al-A)
	Gasket (1,000 ft roll)	Li-311 ()
	Screw 10-16 x ¾"	Li-400 (G)
	Black sheating (variable - minimum 1,000 ft²)	Li-500

Li - 215 - H X - (Al-A)

Product family
Li - Lubi
La - Luba
U - Unitair
G - Grammer

Serie
100 – Panel & accessories
200 – Sub-structure
300 – Finish
400 – Screws
500 – Others / Accessories

Part number
00 – 09 (Assembly)
10 – 99 (Part out of a serie)

Part finish
Aluminum
Al-A / Al-N (anodised or natural)
RAL-0000
Steel
G (galvanised)
QC0000
RAL-0000
Plastic
C (clear) / B,V,J (blue, green, yellow …)
I / II / II (color intensity)

Width (optional)
X – in inches

Installation type (optional)
H – Horizontal
V – Vertical

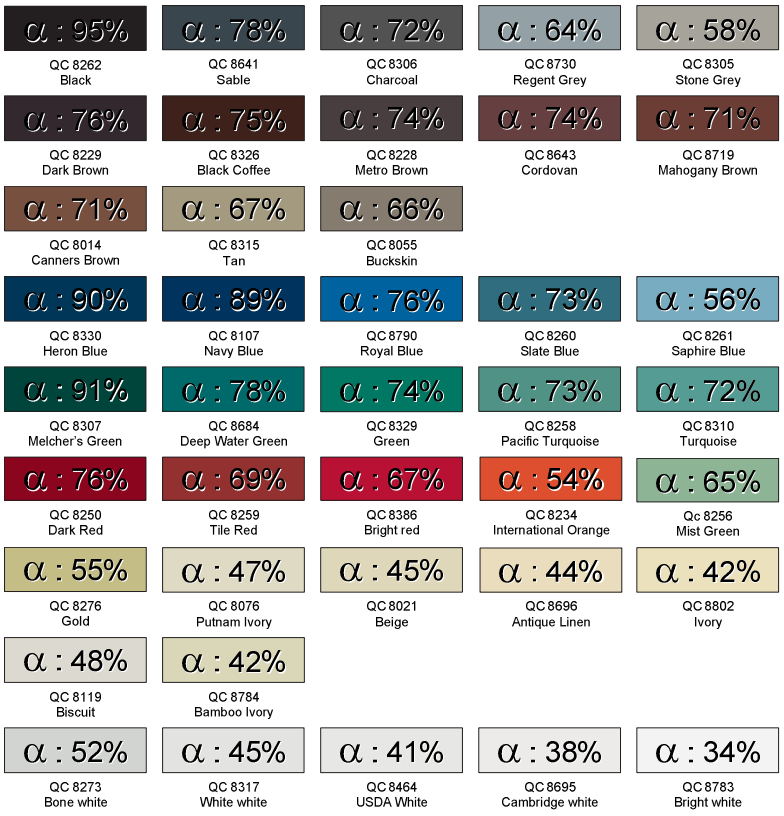
2 Colors

2.1 Absorber (back of Lubi collector)

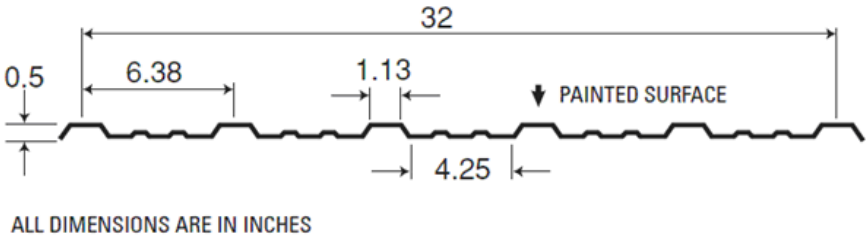
In certain cases, adding an absorber to the back of the Lubi collector in order to increase absorptivity may be needed. In this case, Enerconcept uses top of the line quality products. Their in-shop painted cladding offers long-term durability and appearance.

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 pretreatments, in combination with an upgraded primer, provide excellent corrosion resistance. The system provides outstanding film integrity, leading edge colour retention and superior chock resistance.

The standard profile used as an absorber in Lubi collectors is illustrated below.



(α): colour absorptivity



2.2 Extrusions and substructure

The standard finish for the exposed aluminum parts is anodized clear (*snap cover and intermediate extrusion*) and the finish is natural for the unexposed part (*extruded hat bar*). The standard finish for the substructure (*U bars and spacing clips*) is galvanised steel.

Enerconcept Technologies' aluminum extruded profiles and substructure parts of the Lubi collector may be prepainted or anodized in-shop in order to give the greatest architectural appeal to the building receiving the Lubi collector.

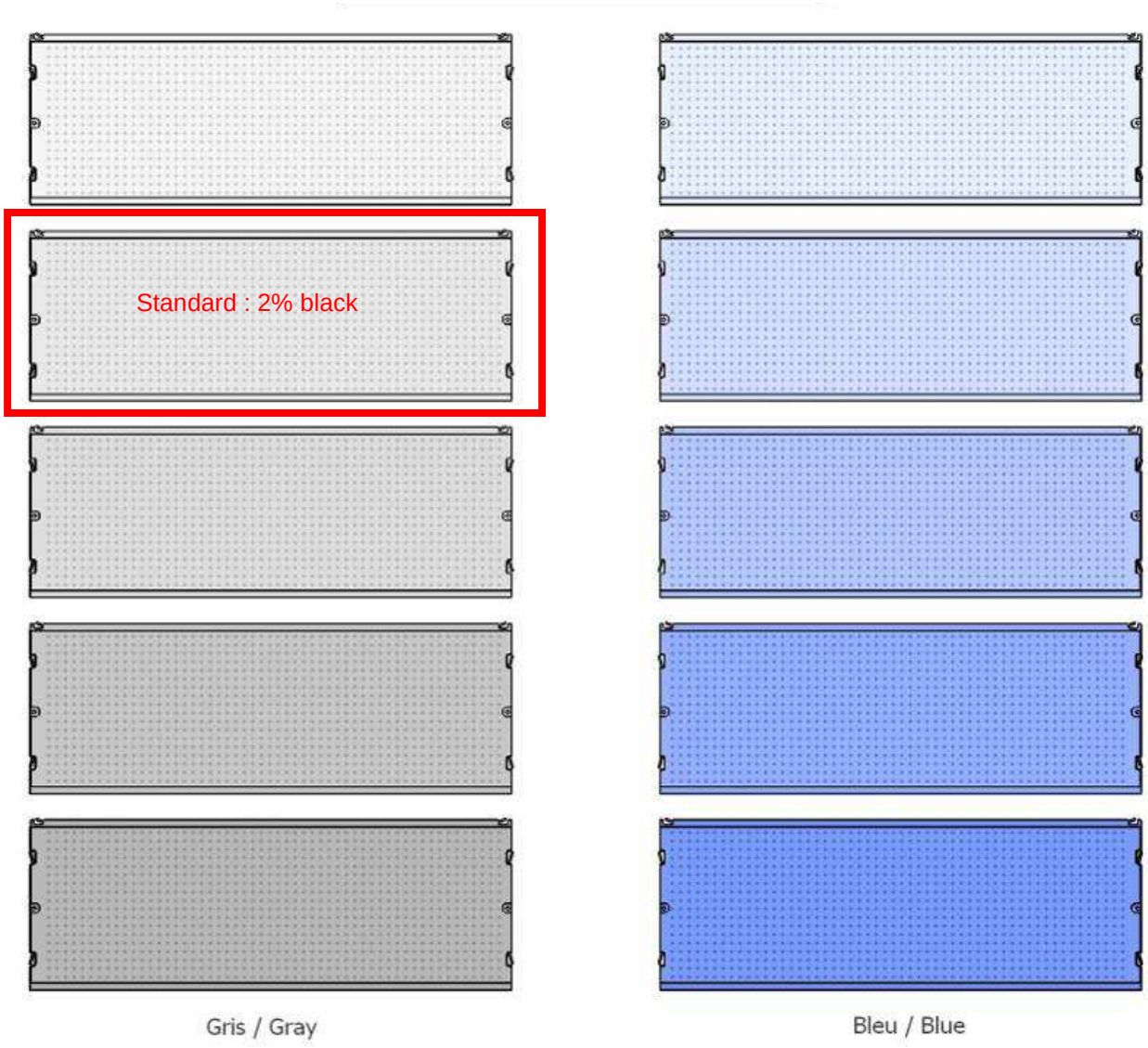
The colour is applied to the surfaces using a process called « powder coating » with a pretreatement according to the current industry standards in order to ensure long-term resistance of the painted surfaces. Below are standard colours, according to the Classic RAL[2,3] system.

Below are the available anodized finishes.
(*Since clear is the standard finish, additional cost should be considered for other anodized finishes*)

[2] http://www.ralcolor.com/
[3] *Additional costs should be considered for colours using mostly red and yellow pigmentation.*

2.3 Panels

The standard Lubi panels are injected using a slightly black tinted polycarbonate resin. The injection process allows us to cover a wide range of panel tints, hence creating endless architectural designs using the optics of the transpired glazing surface. Other colours are available through customised orders.



2.4 Load Table

The Lubi collector has been designed to withstand most climates in respect to wind/snow loads. The Lubi panels are made of polycarbonate, which is a flexible material that has a high yield limit providing high resistance to external loads. In order to limit the flexion of the panel, intermediate aluminum extrusions are installed between each panel. Therefore, using that information and the fact that each Lubi panel is 35,6" (904 mm) wide, this fixes the horizontal span of the substructure to 3' (915mm). However, the vertical span can be modulated depending on the actual site to optimize labour and material for any given project.

The table shown below illustrates the maximum wind pressure allowed for a specific wall depending on the amount of vertical span of the substructure related to that specific wall.

Load table

Space (c/c) between supports	Pressure Suction	Span			
		1 span	2 span	3 span	4 span and more
2'-0" (0,6096 m)	Pressure (kpa)	6,45	7,66	7,66	7,66
	Suction (kpa)	-7,66	-7	-7,66	-7,66
3'-0" (0,9144 m)	Pressure (kpa)	2,84	3,72	4,37	5,47
	Suction (kpa)	-3,61	-3,06	-3,72	-4,37
4'-0" (1,2192 m)	Pressure (kpa)	1,53	2,08	2,41	3,06
	Suction (kpa)	-2,08	-1,64	-2,08	-2,52
6'-0" (1,8288 m)	Pressure (kpa)	0,66	0,87	1,09	1,31
	Suction (kpa)	-1,09	-0,77	-0,87	-1,09

As an example, let us consider the building shown below on which a Lubi collector is projected to be installed.

Knowing the actual dimensions of the building, its orientation, the city in which it is based and the surroundings of the building (terrain, slopes, other buildings), a civil/structural engineer would be able to calculate the maximum positive and negative pressure load due to wind over the projected Lubi collector.

Let us consider that the maximum allowed loads calculated are :

- Positive : 2.5 kPa
- Negative : -0.4 kPa

Using a projected Lubi collector 16' high (4.88 m), data from the load table starting from the widest span possible would lead to a minimum of material and labour.

- **Using vertical spans of 6'-0" (1,83 m) between spacing clips the amount of spans would be**
  - 16 / 6 = 2.67 [4,88 / 1,83 = 2,67] → **3 spans**
  - Maximum allowed positive load (from the table) : 1,09 kPa
  - Maximum allowed negative load (from the table) : -0,87 kPa
  - Using spans of 6'-0" (1,83 m) the Lubi collector wouldn't resist the maximum loads

- **Using vertical spans of 4'-0" (1,22 m) between spacing clips the amount of spans would be:**
  - 16 / 4 = 4 [4,88 / 1,22 = 4] → **4 spans**
  - Maximum allowed positive load (from the table) : 3,09 kPa
  - Maximum allowed negative load (from the table) : -2,52 kPa
  - **Using spans of 4'-0" (1,22 m) the Lubi collector would resist the maximum load**

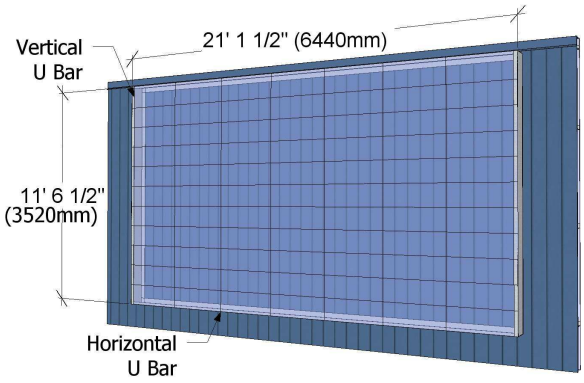
Every project can be designed to suit the building's site needs working with skilled civil/structural engineers and using data from the load table.

3 Wall mounting instructions

3.1 U bars

- Installation of the horizontal and vertical U bars on the perimeter of the Lubi collector.

- Since the Lubi panels with the extrusions represent 36" x 12 5/8˝ (915mm x 320mm), the distance between vertical U-bars will typically be a multiple of 36" (915mm) and 12 5/8˝ (320mm) for the horizontal U-bars. The vertical U-bars exceed by ¾" (20mm) on both sides of the collector.

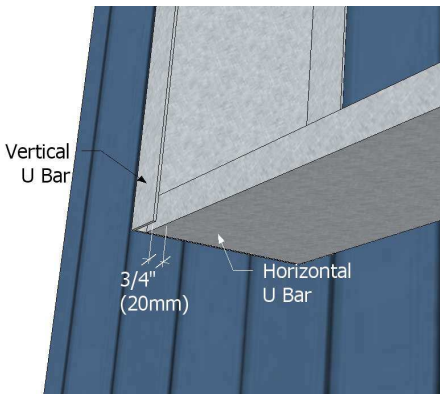


Example :
For an installation of 7 Lubi panels wide by 11 high (see right-side illustration), the width of the collector would be 21'-1 ½" (6440mm) and height of 11'-6½ " (3520mm).
(Refer to shop drawings for exact dimensions.)

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

Comment :
The vertical U bars are ¾" (20mm) wider than the horizontal U bars.

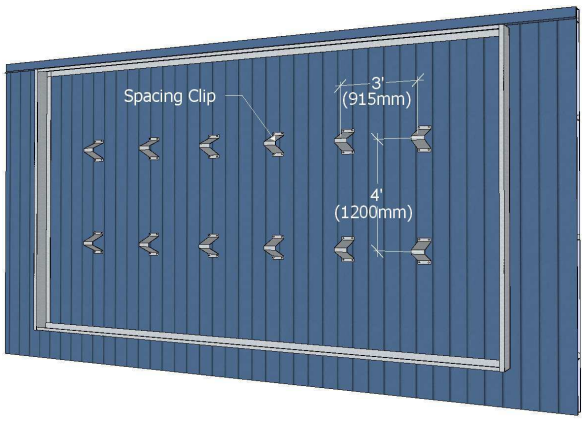
The installer will provide and install strips of foam closure adapted to the existing wall cladding behind the U bars.



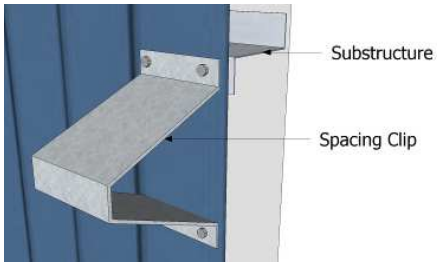
3.2 Spacing Clips

- Install the spacing clips every 3'-0" (915mm) c/c on horizontally (3'-¾" (933mm) from the edge of the collector) and typically ±4'-0" ±(1200mm) c/c vertically (aligned with the wall's substructure).

- In case the width of the collector is not a 3'-0" (915mm) multiple, determine the center of the spacing clips on the center of the collector to have the same spacing on each end of the collector.



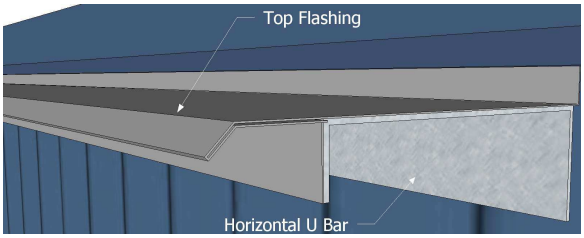
Note:
Mounting hardware (screws, anchors) to existing wall will be **provided by the installer** depending on the structure of the existing wall.



Comment:
The spacing clip must be fixed to the horizontal substructure in the existing wall.

3.3 Top flashing

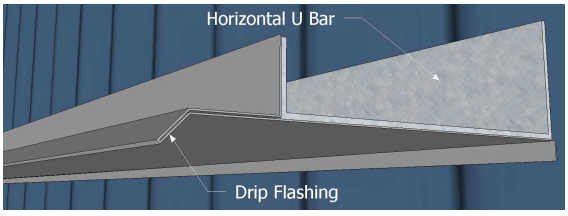
- The top flashing should be fixed to the U-bar and inserted under the existing flashing.



Note:
Flashing material is **provided by the installer** (for flashing dimensions, see flashing table in the typical shop drawing section).

3.4 Drip flashing

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



Note:
Flashing material is **provided by the installer** (for flashings dimensions, see flashing table in the typical shop drawing section).

3.5 Extruded hat bars

- Install the extruded hat bar at 3'-0"(915mm) c/c and at 3'-¾" (933mm) from center to edge of the collector.

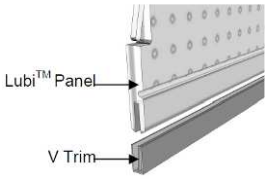
- In case the width of the collector is not consistent with 3'-0" (915mm) multiples as mentioned in the previous step, determine the center of the extruded hat bars on the center of the collector to have the same spacing on each end of the collector.

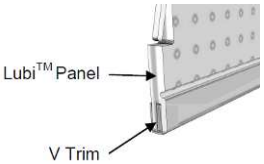
Note:
The extruded hat bars are supplied in 12'-0" (3658mm) length. When the collector height is greater than 12'-0" (3658mm), install a spacing clip behind the joint of the two extruded hat bars.

Comment :
Extruded hat bars are attached to the spacing clips and horizontal U-bars using #10-16 x ¾" screws provided with the material.

3.6 V-Trim (first row of collectors)

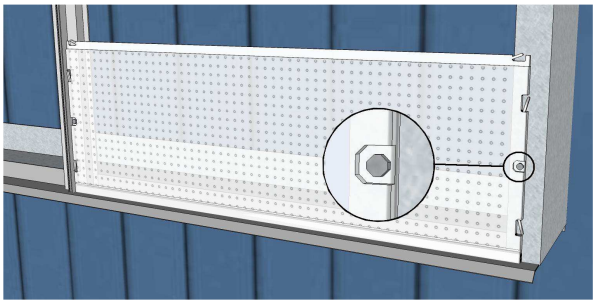
- Insert the V-Trim on the Lubi panels to be installed on the first row at the bottom of the collector.





3.7 Lubi panel (first row of collectors)

- Install the Lubi panels on the extruded hat bars using #10-16 x ¾" screws provided with the material. **Take special care not to tighten the screws completely to allow expansion and contraction of the panels.**

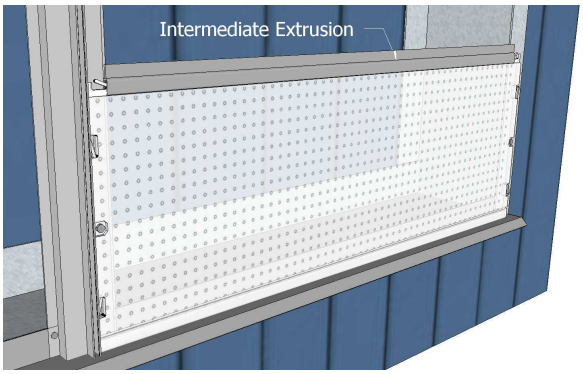


Note :
On the edges of the collector, the Lubi panels are fixed to the vertical U-bar.

3.8 Intermediate extrusion

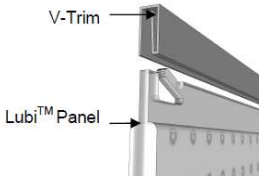
- Install the intermediate extrusion between each Lubi panel (one between each panel).

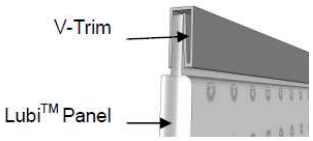
Note:
See the next step for the last row at the top of the collector.



3.9 V-Trim (last row of collectors)

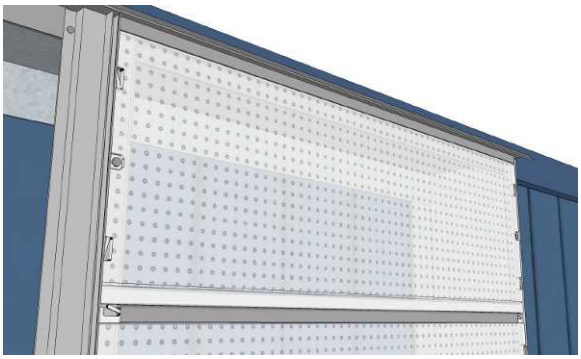
- Insert the V-Trim on the Lubi panels to be installed on the last row at the top of the collector.





3.10 Lubi panel (last row of collectors)

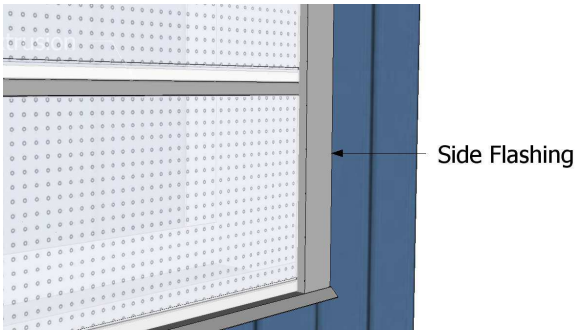
- Install the last panel at the top of the collector. Do not screw the panels in the second to last row for an easier insertion of the last panels under the top flashing. Once the panels are in place, screw in the panels of the two last rows.



3.11 Side flashing

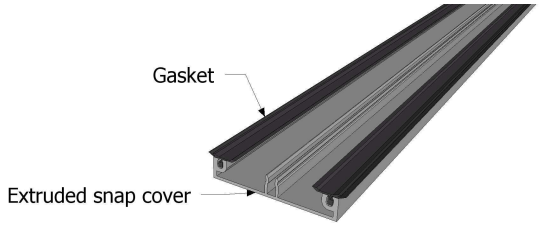
- Once the installation of the Lubi panels is complete, install the side flashing on both sides of the collector.

Note:
Flashing material is **provided by the installer** (for flashings dimensions, see flashing table in the typical shop drawing section).



3.12 Gasket

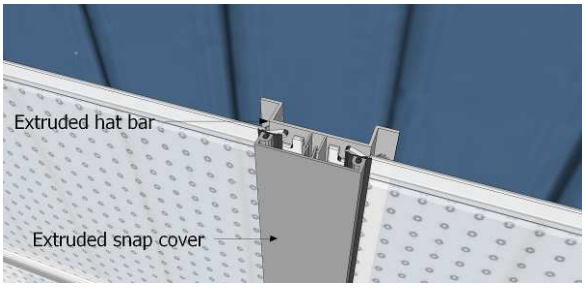
- Insert the rubber gasket into the extruded snap cover.



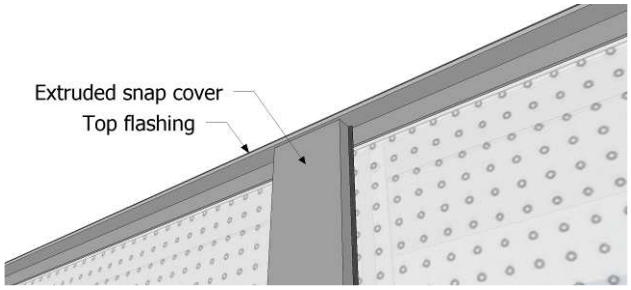
3.13 Extruded snap cover

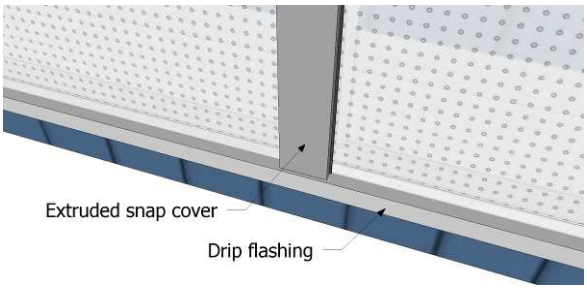
- Insert by pressure the extruded snap cover on the extruded hat bar.

Note: Preferably use a white rubber mallet.
Be careful not to hit the extruded snap cover with a hammer or other object that might damage or leave marks on the aluminum.



Comment:
The extruded snap cover has to go up to the top flashing and down to the drip flashing





3.14 Recommendations – Lightning protection

For the installation of lightning arrestors, follow the national and local building codes. In the absence of such regulations for the building in question, it is the building owner's responsibility to decide, after consulting with professionals, if a lightning protection system should be installed.

4 Typical specification

4.1 General specifications

The glazed perforated polycarbonate solar collector Lubi is manufactured by Enerconcept Technologies Inc. and approved by Can/CSA-F378 standard and has a performance factor of 1.20. The collector will have a surface area of _____ft² (_____m ²) for an airflow of _____ cfm (_____L/s). The admission of fresh air supply in the collector will mainly be through the perforated surface.

4.2 Collector composition

1. Lubi Panels

The Lubi panels are made of polycarbonate, standard colour tinted black 2%, with UV resistant treatment and a total of 900 holes of (5/64 ″) 2 mm for the air admittance. Dimensions: 35,6“ (904mm) by 12,6“ (320 mm).

For colour options, see section 10.

2. Intermediate extrusion

The intermediate extrusions are made of extruded aluminum (alloy 6063-T5), standard finish: clear anodized. Length 33 ½″ (850 mm).

For colour options, see section 10.

3. V trims

The V trims are made of 26 gauge pre-painted steel, standard colour QC-7500. Length 34 ¾″. (880 mm).

For colour options, see section 10.

4. Extruded hat bars

Hat bars are made of extruded aluminum (alloy 6063-T5), standard finish: natural aluminum. Length: 144″ (3657mm).

For colour options, see section 10.

5. Extruded snap covers

The extruded snap covers are made of extruded aluminum (6063-T5), standard finish: clear anodized. Length 144″ 3657mm.

For colour options, see section 10.

6. U-bars

The U-bars are made of galvanized steel (grade 33) 18-gauge, thickness 4 ″ to 10 ″ (100 to 250 mm). The thickness will be determined during the production of the shop drawings according to the amount of air that passes through the collector. Length 120 ″ (3000 mm).

For colour options, see section 10.

7. Gaskets

The gaskets will be installed on the extruded snap covers by the installer.

8. Spacing clips

The spacing clips are made of galvanized steel (grade 33) 18-gauge, thickness 1″ to 8″ (25 to 200 mm). The thickness will be determined during the production of the shop drawings according to the amount of air that passes through the collector. Length 6″ (150 mm).The spacing clips will be painted according to the collector's background colour (colour to be determined by the architect).

9. Screws

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

10. Options

- Tinted Lubi panels (other than black 2%)
- Colour in replacement of the anodised finish on the intermediate extrusions. (RAL-0000)
- Color in replacement of Sterling QC-7500 on the V trims (QC-0000).
- Colour in replacement of the galvanized finish on the bars U. (RAL-0000)
- Colour in replacement of the natural finish on the extruded hat bar. (RAL-0000)
- Colour in replacement of the anodised finish on the extruded snap covers. (RAL-0000)

Not included

The following items are not provided by Enerconcept:

- Manufacturing elements of the wall under the collector (wall covering, air barrier, insulation, Z bars, etc.);
- Flashing material: All the perimeter of the solar collector is covered with pre-painted steel flashing 26-gauge (standard colour QC-7500). This material is not provided by Enerconcept;
- Foam closures under the U-bars adapted to the wall's cladding under the collector;
- Wall mounting hardware.

- **Realization**

Preparatory work
Before starting any work the contractor shall check all dimensions on site and 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 Lubi collector see the latest edition of this manual available on Enerconcept Technologies' website at: http://www.enerconcept.com/en

The load of the collector on the existing wall is 1,8 to 2,8 pound per square foot (8,8 to 13,7 kg/m²) for a plenum of 4˝ (100mm) to 8˝ (200mm) thick.

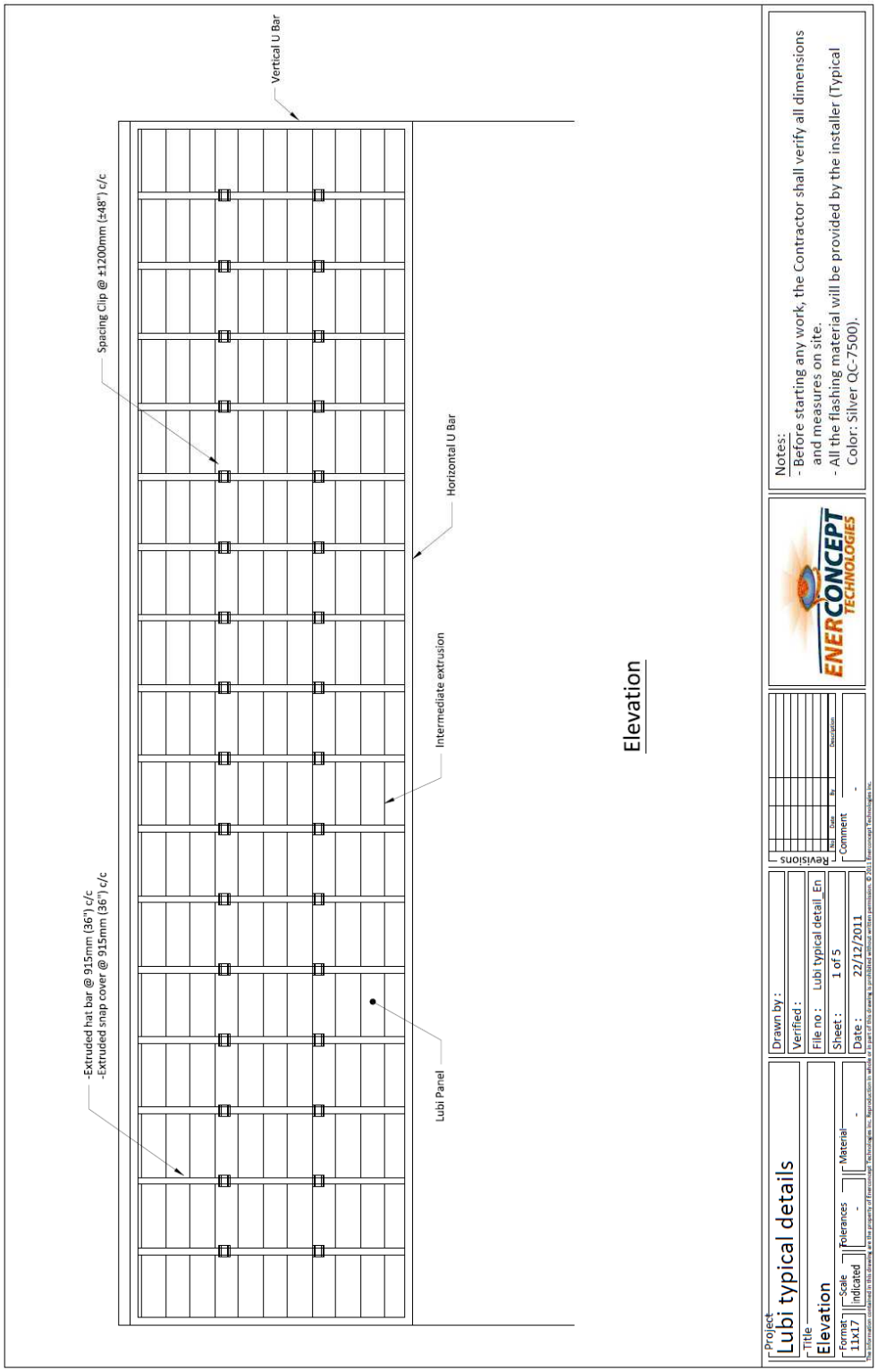
- **Performance Guarantee**

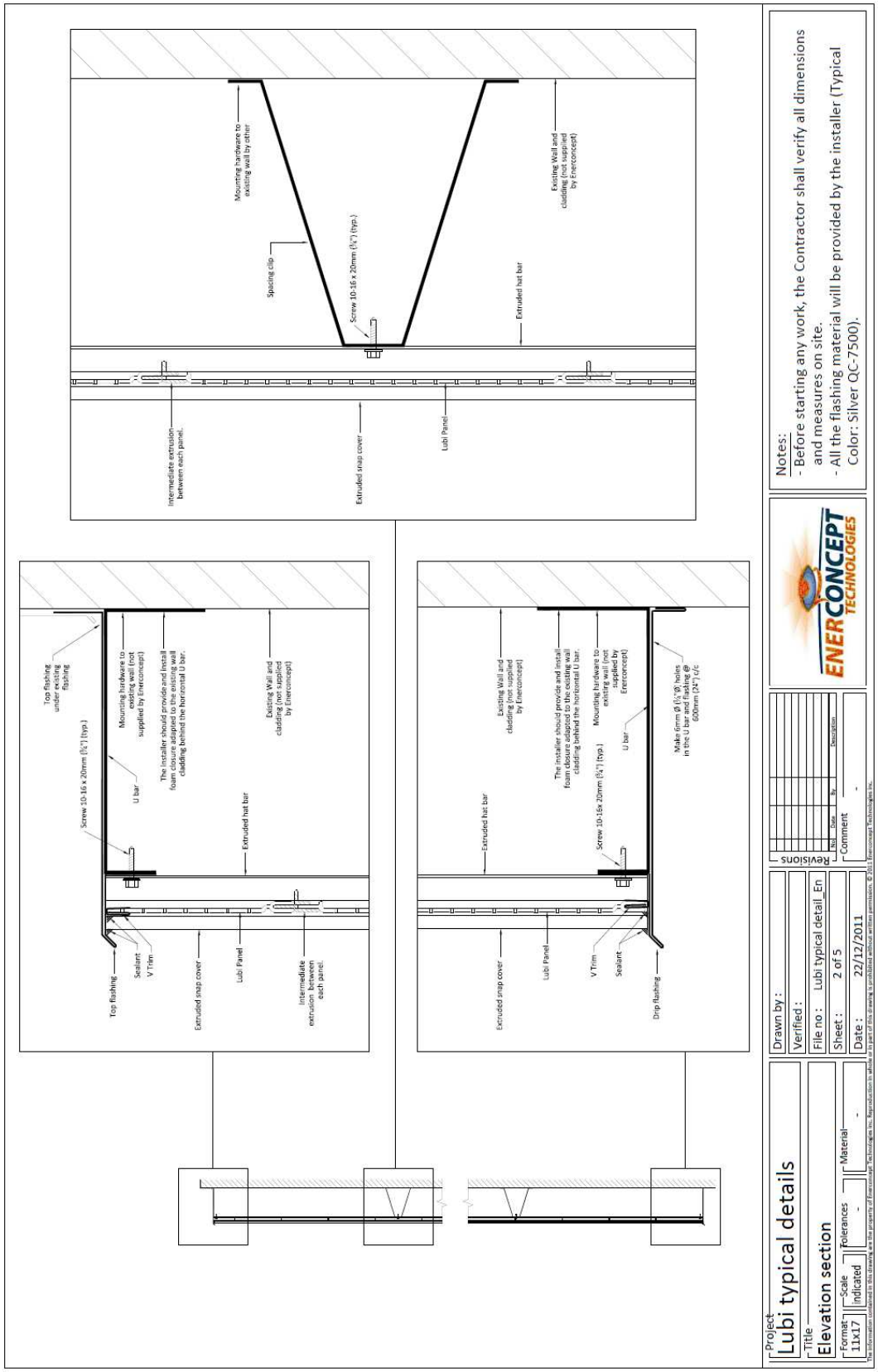
Note to the designer:

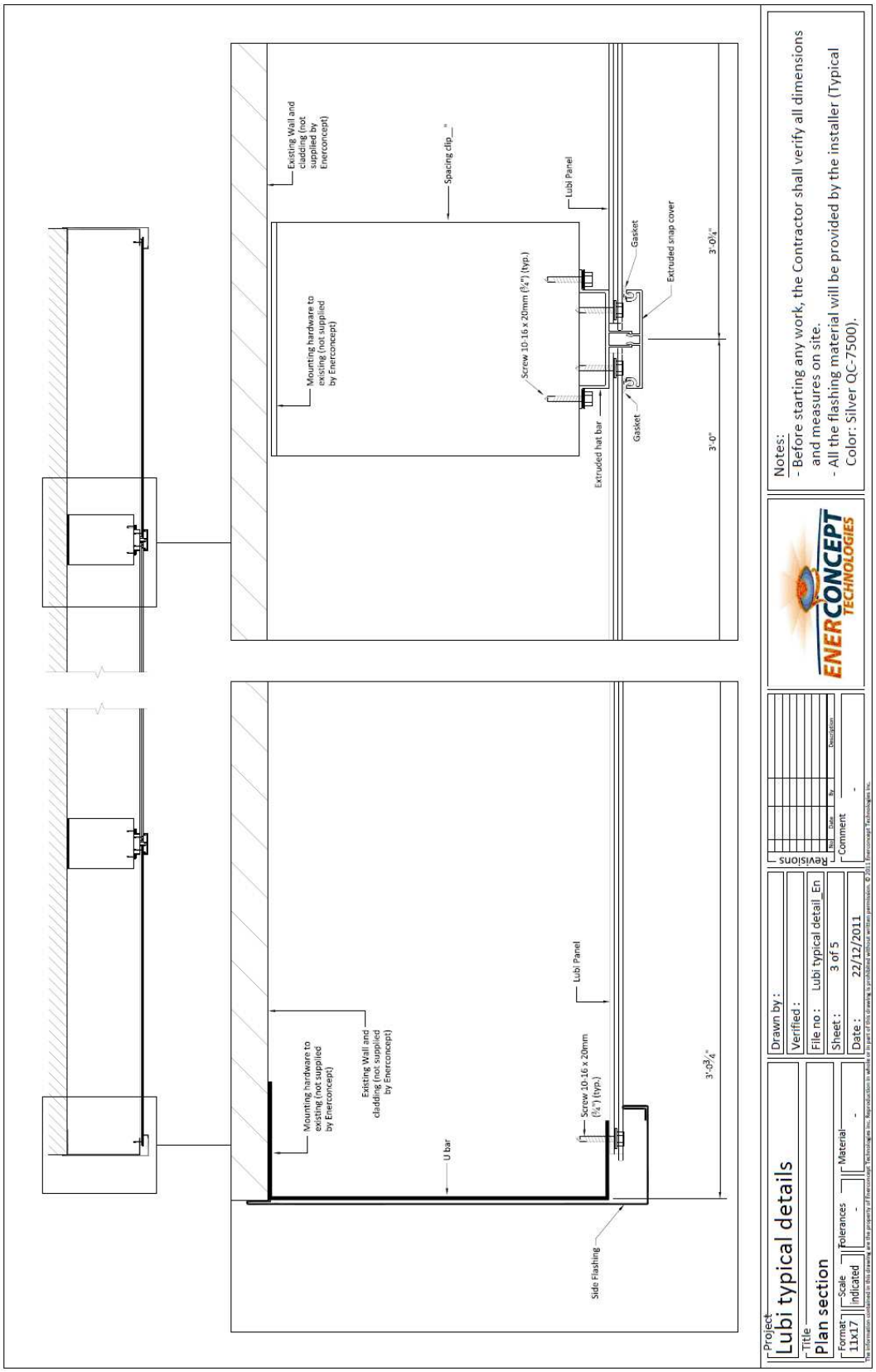
If desired by the engineer or architect, Enerconcept may, in a separate agreement (budget), do a thermal analysis on site (thermography, temperature and Flow measurements).

Accepted manufacturer : Enerconcept Technologies Inc.

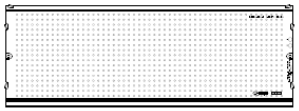
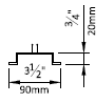
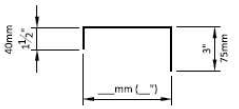
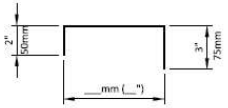
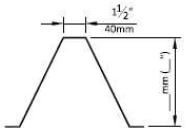
5 Typical shop drawings (as provided by Enerconcept)




Mounting hardware to existing wall by other
Spacing clip
Screw 10-16 x 20mm (¾") (typ.)
Existing Wall and cladding (not supplied by Enerconcept)
Extruded hat bar
Intermediate extrusion between each panel.
Extruded snap cover
Lubi Panel
Top flashing under existing flashing
Screw 10-16 x 20mm (¾") (typ.)
U bar
Mounting hardware to existing wall (not supplied by Enerconcept)
The installer should provide and install foam closure adapted to the existing wall cladding behind the horizontal U bar.
Existing Wall and cladding (not supplied by Enerconcept)
Extruded hat bar
Top flashing
Sealant
V Trim
Extruded snap cover
Lubi Panel
Intermediate extrusion between each panel.
Extruded hat bar
Existing Wall and cladding (not supplied by Enerconcept)
The installer should provide and install foam closure adapted to the existing wall cladding behind the horizontal U bar.
Screw 10-16x 20mm (¾") (typ.)
Mounting hardware to existing wall (not supplied by Enerconcept)
U bar
Make 6mm ø (¼"ø) holes in the U bar and flashing @ 600mm (24") c/c
Extruded snap cover
Lubi Panel
V Trim
Sealant
Drip flashing
Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be provided by the installer (Typical Color: Silver QC-7500).
Revisions
Rev. Date By Description
Comment -
Drawn by :
Verified :
File no : Lubi typical detail_En
Sheet : 2 of 5
Date : 22/12/2011
Project
Lubi typical details
Title
Elevation section
Format 11x17
Scale indicated
Tolerances -
Material -
The information contained in this drawing are the property of Enerconcept Technologies Inc. Reproduction in whole or in part of this drawing is prohibited without written permission. © 2011 Enerconcept Technologies Inc.


Existing Wall and cladding (not supplied by Enerconcept)
Spacing clip
Lubi Panel
Mounting hardware to existing (not supplied by Enerconcept)
Screw 10-16 x 20mm (¾") (typ.)
Gasket
Extruded snap cover
3'-0¼"
Extruded hat bar
Gasket
3'-0"
Mounting hardware to existing (not supplied by Enerconcept)
Existing Wall and cladding (not supplied by Enerconcept)
Lubi Panel
U bar
Screw 10-16 x 20mm (¾") (typ.)
3'-0¾"
Side Flashing
Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be provided by the installer (Typical Color: Silver QC-7500).
Revisions
No. Date By Description
Comment -
Drawn by :
Verified :
File no : Lubi typical detail_En
Sheet : 3 of 5
Date : 22/12/2011
Material -
Tolerances -
Scale Indicated
Format 11x17
Title
Plan section
Project
Lubi typical details

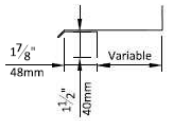
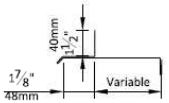
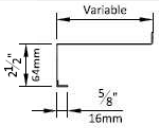
Parts supplied by Enerconcept

#	Name	Qty	Drawing	Length mm (po)
1	Lubi™ panel	0		905x320 (35.6"x12.6")
2	Intermediate extrusion anodised aluminium finish	0		850 (33 ½")
3	V Trim color Silver QC-7500	0		880 (34 ¾")
4	Extruded hat bar aluminium natural finish	0		3658mm (12"-0")
5	Extruded snap cover anodised aluminium finish	0		3658mm (12"-0")
6	Gasket	0		Roll 305m (1000')
7	Screw 10-16 x 20mm (¾")	0		20 (¾")
8	Horizontal U bar ___mm (__") (18ga)	0		3050 (10'-0")
9	Vertical U bar ___mm (__") (18ga)	0		3050 (10'-0")
10	Spacing Clip ___mm (__") (18ga)	0		150 (6")

Project: Lubi typical details
Title: Parts
Format: 11x17 | Scale: indicated | Tolerances: - | Material: -
Drawn by :
Verified :
File no : Lubi typical detail_En
Sheet : 4 of 5
Date : 22/12/2011
Revisions: No | Date | By | Description
Comment: -

Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be provided by the installer (Typical Color: Silver QC-7500).

Flashing Table

Name	Drawing
Top flashing	
Drip flashing	
Side flashing	

Note: All the flashing material will be provided by the installer (Typical Color: Silver QC-7500)

Project: Lubi typical details
Title: Flashing Table
Format: 11x17 | Scale: indicated | Tolerances: - | Material: -

Drawn by :
Verified :
File no : Lubi typical detail_En
Sheet : 5 of 5
Date : 22/12/2011

Revisions

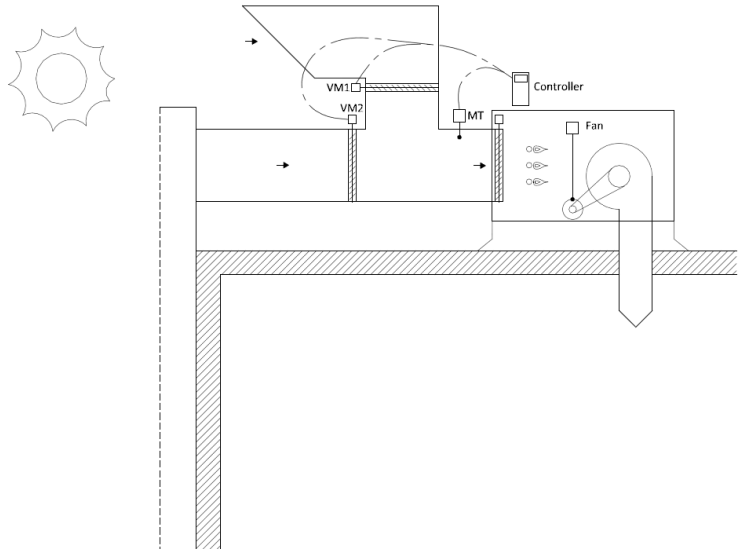
No	Date	By	Description

Comment: -

Notes:
- Before starting any work, the Contractor shall verify all dimensions and measures on site.
- All the flashing material will be provided by the installer (Typical Color: Silver QC-7500).

6 HVAC configurations and RETScreen inputs

6.1 Roof unit with solar collector bypass



Operation Sequence

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

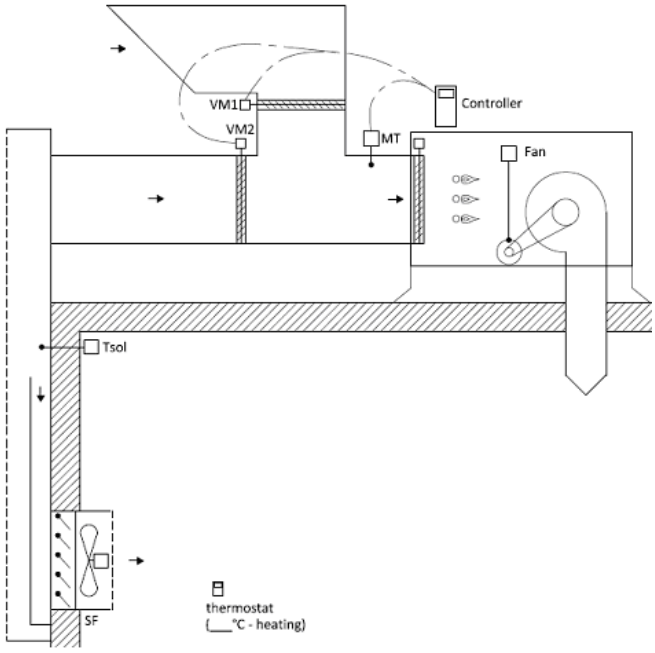
System in function:
The fan is working, the damper VM2 is fully open and VM1 is closed. When mixing temperature is beyond ___℃/℉ the dampers VM1 and VM2 modulate to maintain MT set point (___℃/F).

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 system’s actual operation schedule.
3. Check the “Percent of month used” box and specify the building’s months with a heating load.

6.2 Combination of a roof unit and a solar heating fan



Operation Sequence

System turned off (Make-up Air):
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 >___°C/°F the supply fan (SF) starts. When heating demand is met or when Tsol temperature is <___°C/°F the supply fan (SF) is stopped.

System in function (Make-up Air):
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 ___°C/°F the dampers VM1 and VM2 modulate to maintain MT set point (___°C/°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	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%

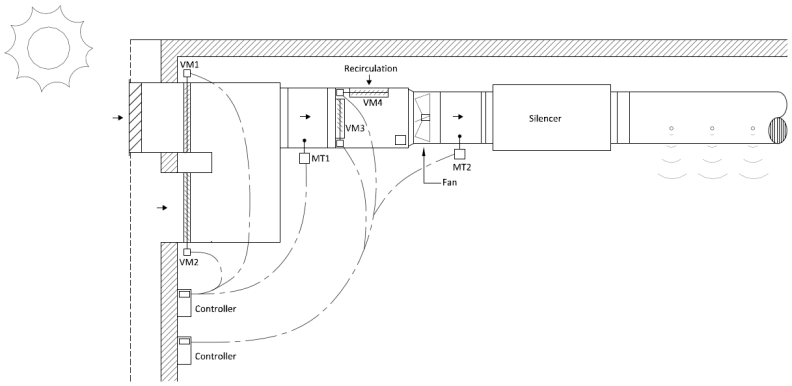
RETScreen Energy Model - Heating project

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.

6.3 Recirculation fan with bypass of 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 (___℃/℉)

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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%
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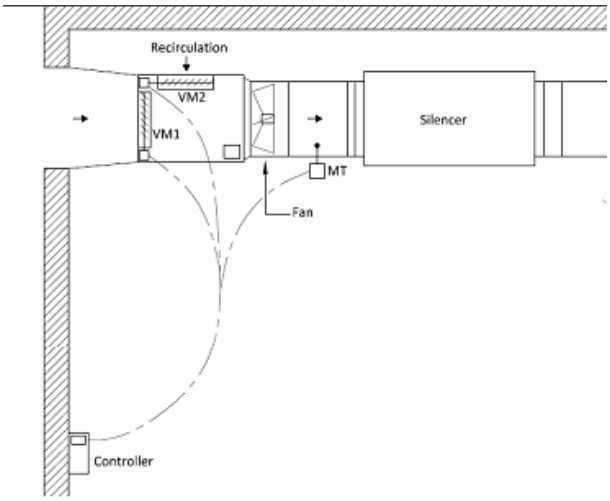
	May	100%	100%
	June	100%	100%
	July	100%	100%
	August	100%	100%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

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 0.22℉/ft (0.4℃/m) in stratified air spaces).

6.4 Recirculation fan with no bypass of the 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).

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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
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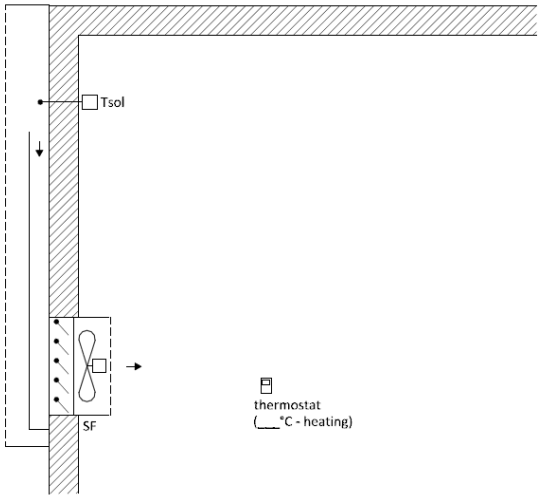
	July	0%	0%
	August	0%	0%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

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 0.22℉/ft (0.4℃/m) in stratified air spaces)

6.5 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)

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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
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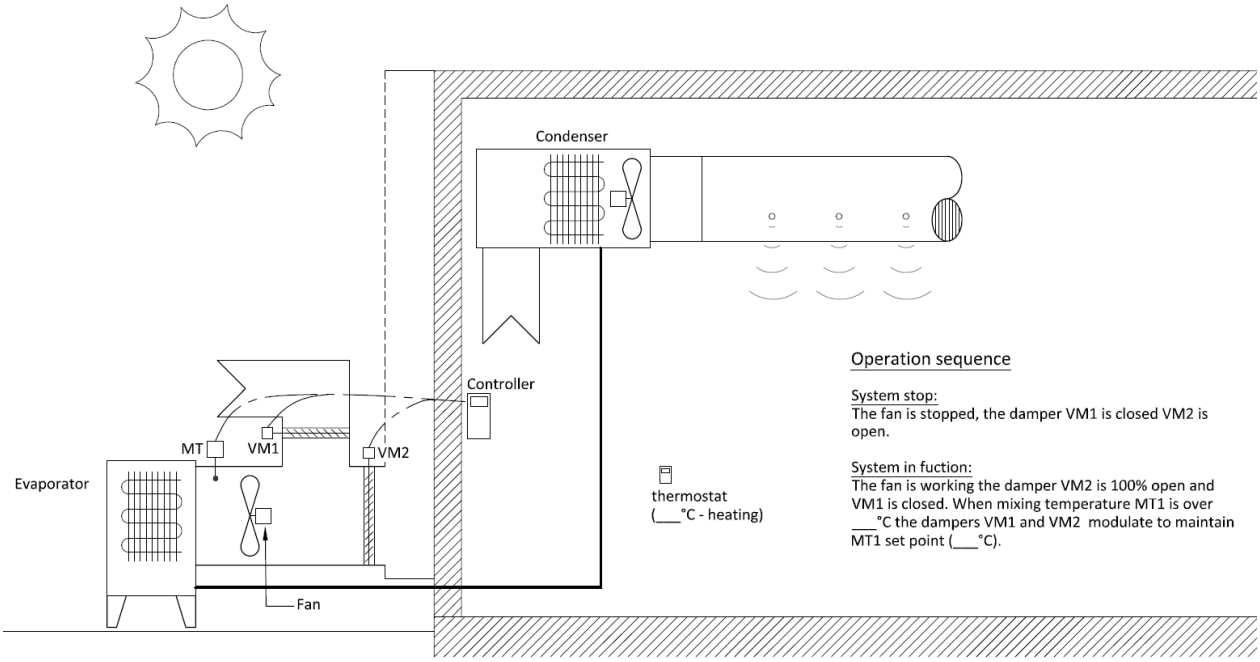
	August	0%	0%
	September	100%	100%
	October	100%	100%
	November	100%	100%
	December	100%	100%

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.

6.6 Solar collector with heat pump



Applications:

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

7 Maintenance

The Lubi system is a maintenance-free system, the only moving parts of the system being the fan and the dampers required for proper operation. Maintenance of the Lubi itself is generally not required.

7.1 Cleaning the collector

In most cases, rainfall should be sufficient to clean the collector.

7.2 Availability of parts

Every part of the Lubi collector system is available from Enerconcept's authorized manufacturer/distributor.

7.3 Replacement parts

In the unlikely event that the collectors should become damaged by major climatic conditions or during installation, Enerconcept Technologies keeps a sufficient amount of parts to be able to replace any part within the week following a claim.

WARRANTY

This warranty applies to the new solar collector purchased by you as a retail buyer and is in lieu of all other warranties, express or implied by law, and in lieu of any and all representations, written or oral, made by dealers,distributors, installers, contractors, sales persons or others.

This warranty covers the Lubi system as a whole as well as all component parts, only to the extent of those provided by Enerconcept Technologies. It extends to the first retail buyer and to any subsequent owners of the system in its original location. Enerconcept warrants the solar hot air system to be free from defects in material and workmanship, or other malfunction or failure to perform, under normal use and services, for;

1. Aluminum & Steel Components (10) years from _____ (date of shipment).
2. Polycarbonate Components (10) years from_____(date of shipment) for defective operation, structural strength and thermal resistance and (2) years from_____(date of shipment) for transmissivity & color.
3. Absorber Panels (30) years paint fade warranty.

Specifically excluded is yellowing or transmissivity changes beyond two years, due to the variables in climatic conditions, absorber colors, orientation and collector angles and operating characteristics that make testing for changes in appearance compared to its original state very difficult to measure.

If a defect in material, workmanship or other failure in the collector becomes evident during the warranty period, Enerconcept will repair, or at its option, replace the defective part. Except for repair labor at Enerconcept's facility, Enerconcept is not liable under this warranty for any field labor such as inspection, removing, packing or reinstalling components, nor for transportation charges incurred for shipment to and from designated dealer or service station.

To obtain service, notify Enerconcept Technologies by telephone, fax or letter, giving identification of the product, model, size, date of purchase, and nature of the defect. If warranted, warranty repair will be performed by factory personnel or authorization issued to a local service facility.

Damage or failure resulting from faulty installation, scratching of surface coatings or lack of maintenance shall void this warranty. Also excluded from this warranty are conditions resulting from a defect in a component or part which is not part of Enerconcept Technologies' systems.

This warranty is voided by any alteration to the system as designed by Enerconcept Technologies or any component part. No responsibility will be assumed by Enerconcept Technologies for damage to a collector caused by neglect, abuse, faulty installation, misuse, handling, normal weathering of components or other cause not in Enerconcept Technologies' control.

With respect to our warranties, Enerconcept Technologies shall not be liable for consequential damage or expenses. The total liability of Enerconcept shall be limited to replacement and repair as aforesaid. Some states or provinces do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to: *Name of customer*

8 Lubi collector – Photos of completed projects

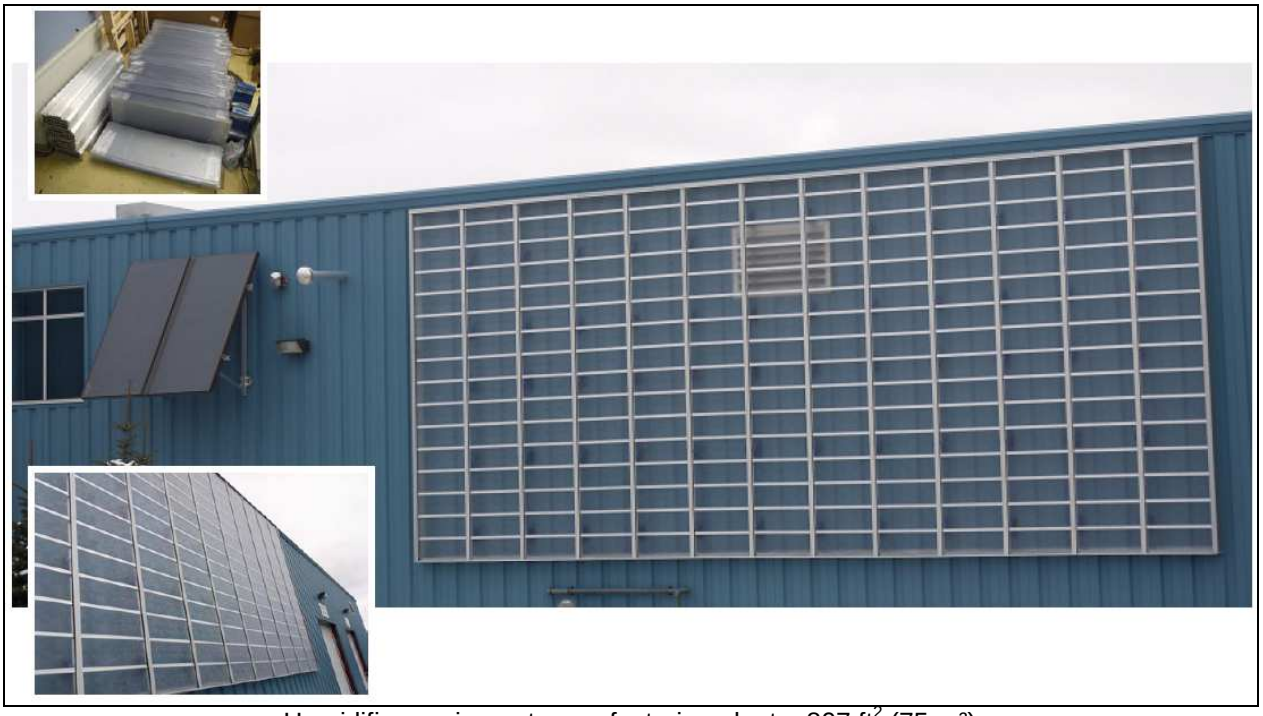
Plastic injection plant – 2422 ft^2 (225 m²)

Airplane assembly plant – 1991 ft^2 (185 m²)

Welding shop – 968 ft^2 (90 m²)

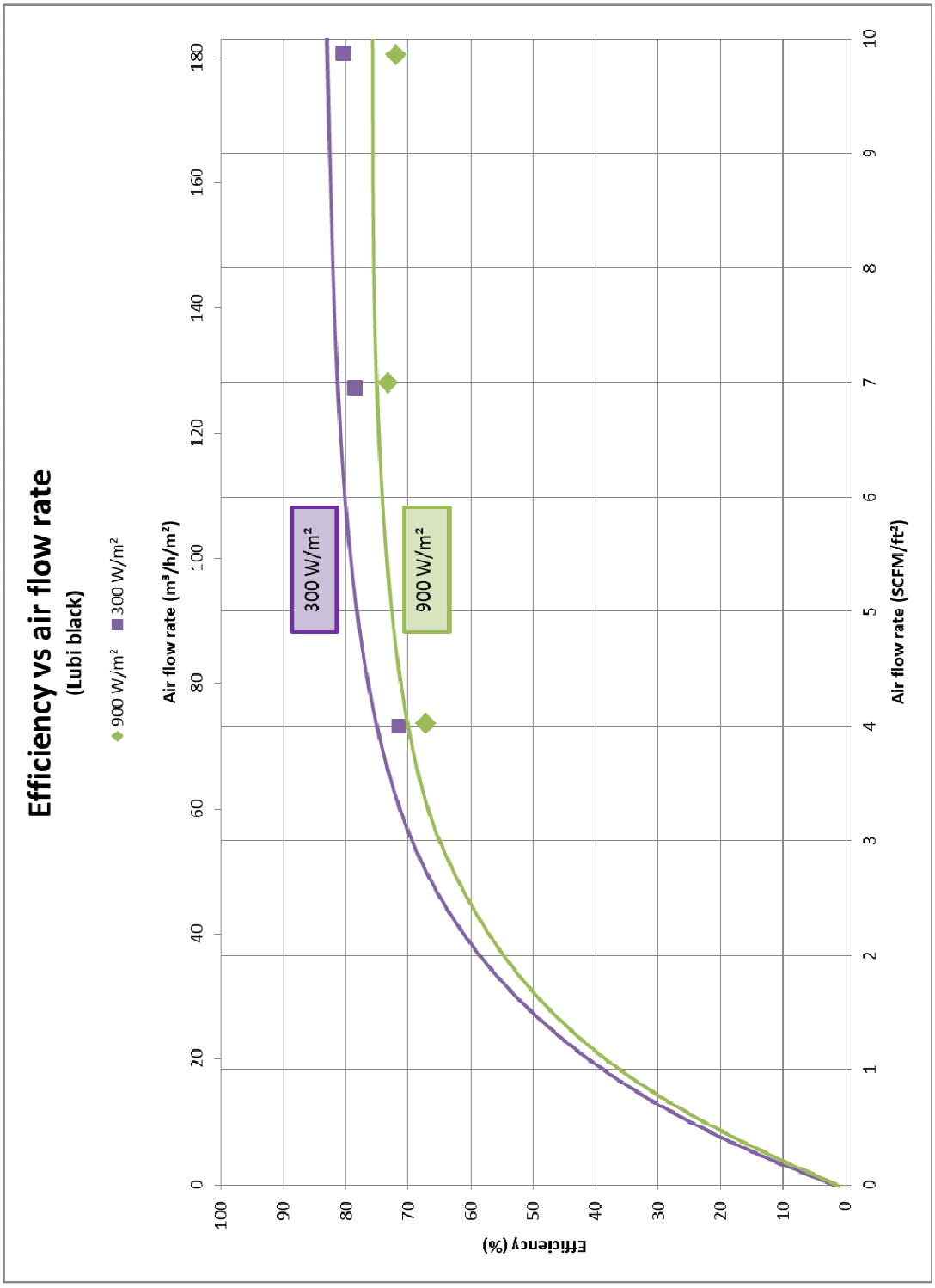
Lubi collector - Roof mounted – Manufacturing shop - 495 ft^2 (46 m²)

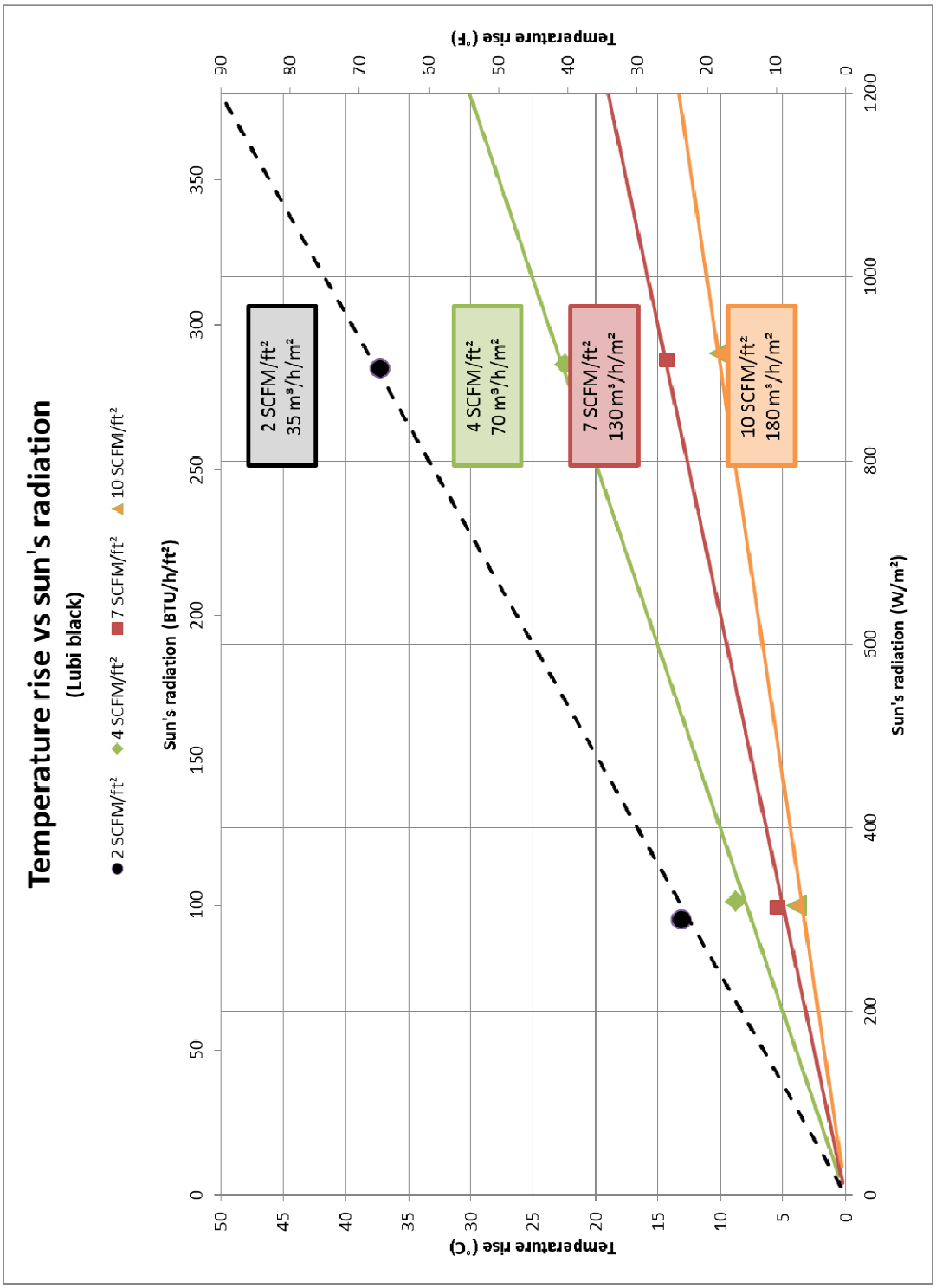
Natural gas technologies test facility- – 861 ft^2 (80 m^2)

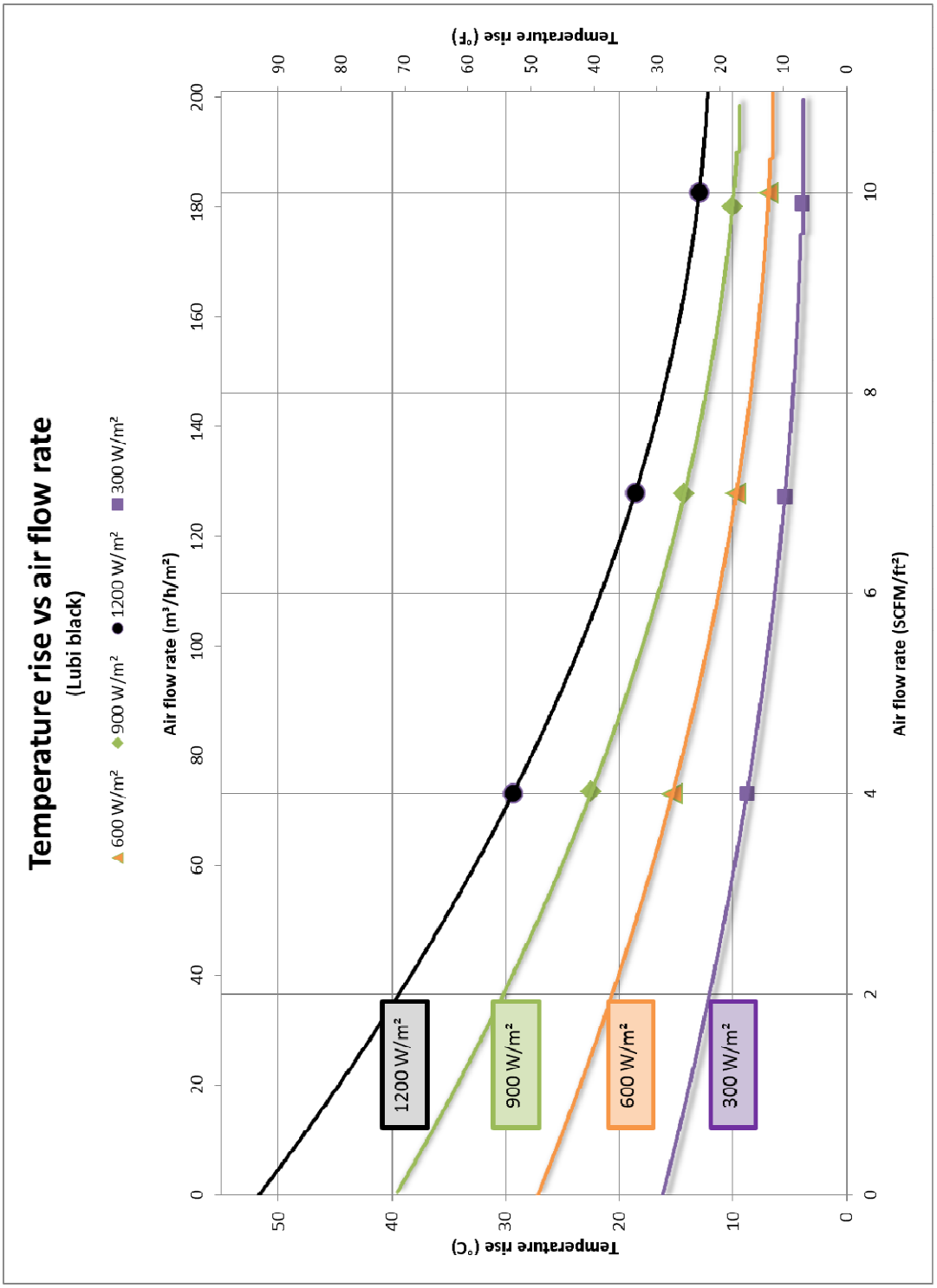


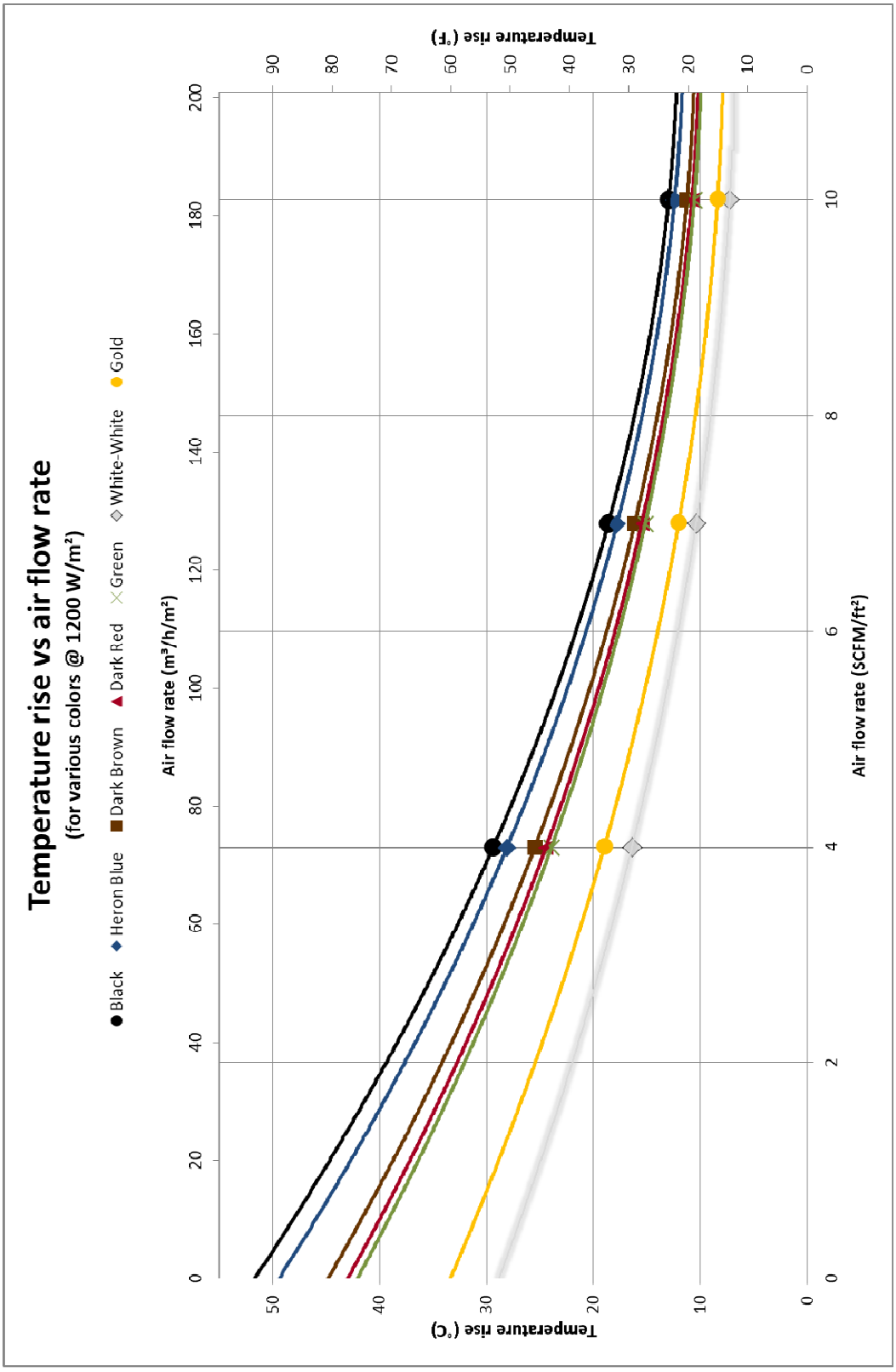
Humidifier equipment manufacturing plant – 807 ft^2 (75 m²)

9 Curves efficiency temperature rise




Temperature rise vs sun's radiation
(Lubi black)
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 (°F)
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
(Lubi black)
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)
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)