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Tegral SolarWall™

Profiled Metal Solar Cladding System

LESS THAN 3 YEAR PAYBACK FOR NEW BUILD

NEW

WINNER OF
BEST USE OF PRODUCT DESIGN
World Green Business Awards

A world of experience

Our Company

Tegral Metal Forming is part of the Tegral Group and a subsidiary of the Etex Group, a world-renowned international building products company. For over 25 years, Tegral Metal Forming has been to the forefront of development with regard to roofing, cladding and flooring systems.

Based in Athy, Co. Kildare, the Tegral Group consists of Tegral Building Products and Tegral Metal Forming. Tegral Building Products is Ireland's largest manufacturer and distributor of roofing products and Tegral Metal Forming Ltd. is a leading manufacturer and supplier of metal roofing, cladding and flooring systems for the construction industry.

The comprehensive product range is designed to suit most applications in modern commercial, industrial and agricultural construction. Over the years, Tegral Metal Forming has developed an expertise in every aspect of metal systems application.

Project: Colaiste de hIdé, Dublin
Architects: Campbell Conroy Hickey
Product: Tegral Fineline 19

Our Partners

Through a long-standing partnership with Corus, a world-renowned manufacturer of steel and aluminium, Tegral customers and specifiers are assured of the highest standards and quality in all Tegral products.

Our Standards

All manufacturing in Athy meets with the stringent requirements of Quality Assurance systems to ISO EN 9001:2000 and EN 14001: 2006.

Our People

People really do matter at Tegral Metal Forming. Recently the company proudly embraced and succeeded in achieving the "Excellence Through People" award, Ireland's national standard for human resource development.

Our Industry Associates

Tegral Metal Forming takes an active role in the promotion of the metal industry and is involved in the Roof Manufacturers and Suppliers Association (RMSA) in Ireland, the Metal Cladding and Roofing Manufacturers Association (MCRMA) in the UK and also the Irish Farm Buildings Association.

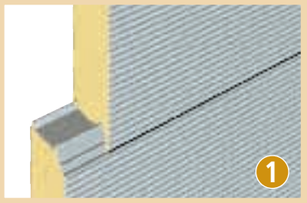
corus

I·F·B·A

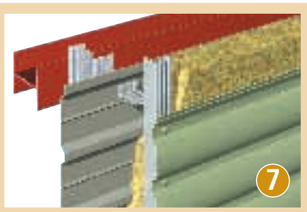
SOLARWALL™ FROM TEGRAL Design Guide

Contents

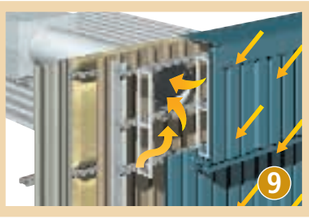
Tegral product range



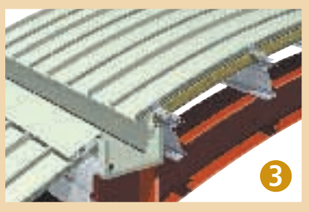
LPCB & FM approved Insulated Panel Range



Built-Up Roofing and Wall Cladding Systems

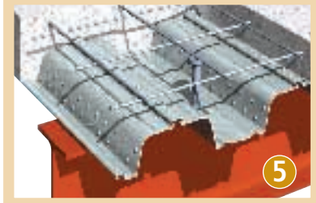


SolarWall™

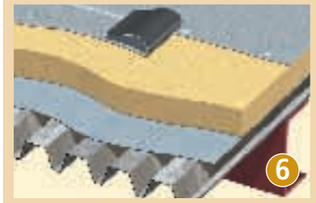


Aluseam® and Seam-Loc Standing Seam Roofing

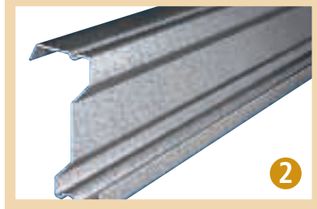
Superdeck Membrane faced Insulated Roof Panel



ComFlor® Flooring Range



Flat Roof Deck Range



Zeta Purlin Range

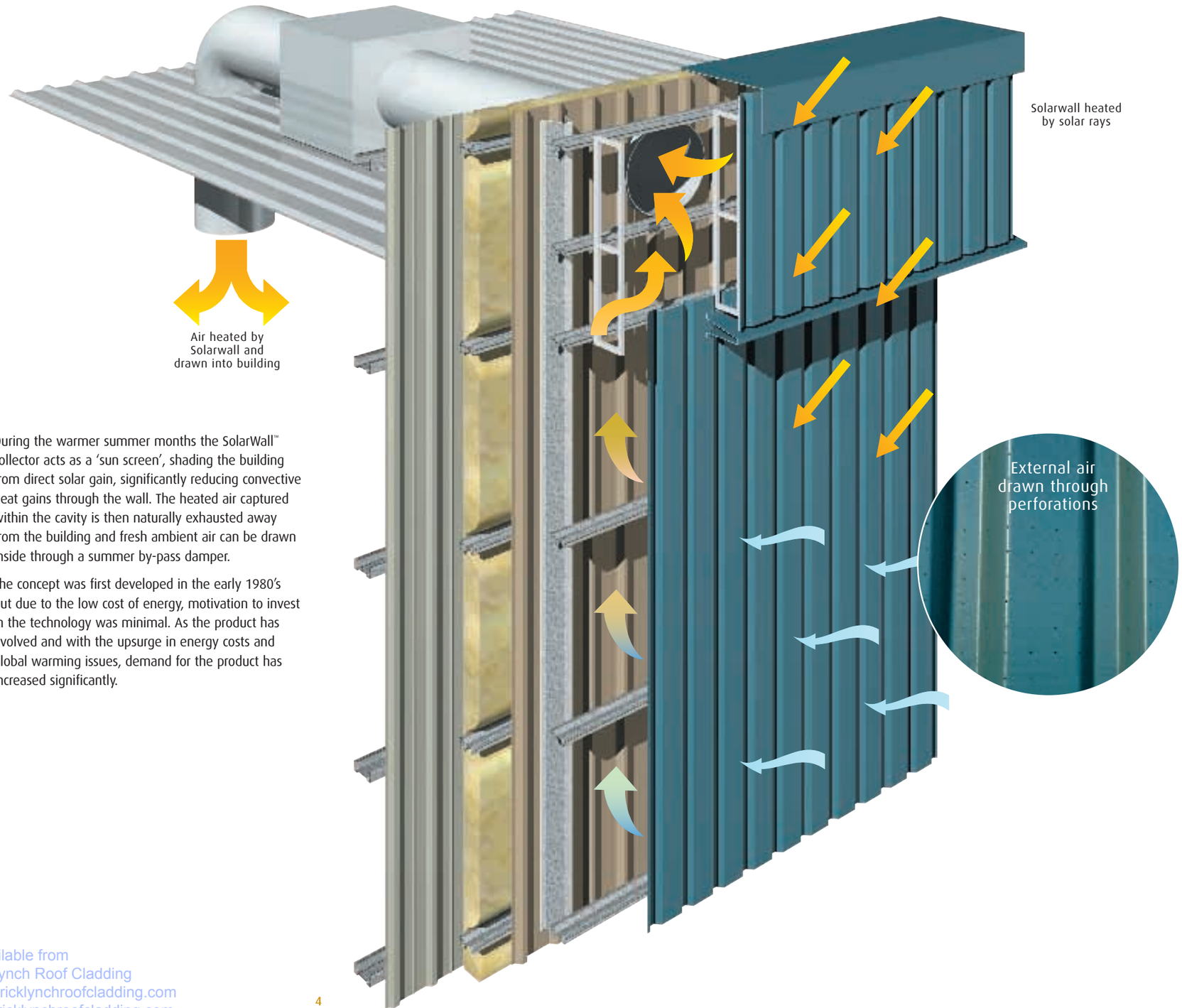
Tegframe® Light Gauge Steel Framing

Flashings

SOLARWALL™ FROM TEGRAL Design Guide

Tegral product range

What is SolarWall™ from Tegral



During the warmer summer months the SolarWall™ collector acts as a 'sun screen', shading the building from direct solar gain, significantly reducing convective heat gains through the wall. The heated air captured within the cavity is then naturally exhausted away from the building and fresh ambient air can be drawn inside through a summer by-pass damper.

The concept was first developed in the early 1980's but due to the low cost of energy, motivation to invest in the technology was minimal. As the product has evolved and with the upsurge in energy costs and global warming issues, demand for the product has increased significantly.

SOLARWALL™ FROM TEGRAL Design Guide

What is SolarWall™ from Tegral

The SolarWall™ Metal Solar Cladding System (also known as the Transpired Solar Collector) heats external air via a southerly facing solar collector. The system consists of a dark steel or aluminium profiled sheet that is perforated to allow air to pass through its surface into a pre-determined cavity. As the air passes through the perforated wall it absorbs the walls warmth.

The warm air rises within the cavity to the top of the wall from where it is drawn into the building via a ventilation fan delivering free, fresh, heated air into the building. No gas, and minimal electricity is required hence significant reductions in CO_2 can be gained, delivering true, economical, socially responsible, environmentally friendly heating.

SolarWall™ is a proven technology worldwide with independently produced software from Natural Resources Canada (RETScreen®) & a weather database from NASA.

It is worth noting that RETScreen v3.1 is unique to the SolarWall™ system, however v4 (which has just been released) also covers other solar air heaters. There is one crucial difference however in that only SolarWall™ has its independent test data embedded within the program. Other solar air heaters, or ones which aren't listed, require the efficiency of the system to be input into the model. It must be ensured that this value has been independently verified!

The benefits of SolarWall™ from Tegral

- **Redcued CO_2 emissions:**
  Solar air heating significantly reduces CO_2 emissions.

- **Proven Technology:**
  SolarWall™ is a proven technology worldwide with independently produced software from Natural Resources Canada (RETScreen®) and a weather database from NASA.

- **Highly Efficient:**
  High collection and system efficiencies, can exceed 70% at high flow rates (versus approxiamtely 20% for standard back pass collectors) and every m2 of SolarWall™ is utilised during normal operation.

- **Enhanced 'U' Values:**
  The solar air cavity on the southerly facing elevation(s) enhances the 'U'-value and maintains the U-Value of original wall.

- **Heat Recovery:**
  Any heated air lost through the southerly facing elevation(s) is collected in the cavity and can be returned back into the building.

- **Award Winner:**
  At World Business 'Green Business Awards' in London winner of award for "Best use of product design" for its use on the Sainsbury distribution centre at Pineham in Northampton. The project was for Prologis, who themselves won "Most Efficient Green Business" and "Best Overall Green Business".

- **Design Flexibility:**
  Can be used on most buildings including, commercial, schools, universities, retail, industrial, distribution, warehousing, etc.

- **Summer Cooling:**
  The SolarWall™ acts as a shield to the buildings original elevation, protecting it from direct sunlight during the summer season, reducing the solar heat transmission to the inside and thus the cooling load.

- **Enhanced Aesthetics:**
  The collector when incorporated into the design can enhance the aesthetics of the building. Can be used vertically, horizontally and even diagonally.

Born and bred locally for a lower carbon footprint

CE

ASSESSED

Tegral Solarwall and all Tegral profiled Roofing & Cladding for Built-Up systems is CE marked for Quality Assurance and Independently Assessed by the Steel Construction Institute for Structural Integrity.

SOLARWALL™ FROM TEGRAL Design Guide

The benefits of SolarWall™ from Tegral

- **De-Stratified Air:**
  The solar pre-heated air distributed through perforated ducts at ceiling level de-stratifies wasted ceiling heat, further increasing energy savings and promoting a more even temperature profile within the building, as well as providing a constant supply of fresh air.

- **Sustainable support systems:**
  Photovoltaic cells could be installed to contribute to the running of the fan, reducing the energy requirement of the unit.

- **Maintenance Free:**
  Virtually maintenance free as there are no liquids and minimal moving parts.

- **Green Business:**
  Winner of the The employment of the system enhances the image of not only the designer but also the developer and building occupier as they demonstrate their contribution to reduce the impact of CO_2 on the environment.

- **Retro-Fit:**
  Can be employed on older buildings, reducing heating costs as well as increasing the life of the building at minimal cost.

- **Recyclability:**
  Similar to all Tegral Built-Up systems, Tegral Solarwall is easy to remove and recycle at end of life. There is a well established process is in place for handling built-Up systems at end of life which is easy and cost effective.
  - The pre-finished steel can be separated & is 100% recyclable.
  - Glass-fibre and mineral wool insulation can be processed for re-use at lower grade and mineral wool could be recycled effectively through the manufacturing process.

  At present the majority of mineral wool and glass-fibre insulation liberated at disposal goes to landfill. Demolition contractors are happy to recover built-up systems and use the scrap value of the steel to offset their costs.

- **Simple Installation:**
  Air cavity (plenum) is built/designed into the system. This ensures that no internal collector is required and only a simple spigot (typically 30m centres) to a fan / heater unit etc.

- **Works around Openings:**
  SolarWall™ systems can be utilised around doors/windows/vents etc, as long as there is a catchment are at the top of the elevation to make the connection to the ductwork/fan unit etc.

- **Low Pressure Drop:**
  SolarWall™ systems have a low pressure drop across the collector circa 25 – 75pa. This is crucial as a higher pressure differential would require more outlay on the M&E kit to cope with the higher pressures.

Award Winner

Perforated cladding

Award Winner

UK installer CA Group installed Solarwall on a Sainsbury Distribution Centre built by leading UK developer, Prologis Developments. Prologis Developments and Sainbury's decided from the outset that their 60,000m² distribution warehouse at Pineham in Northampton would set new standards for sustainable construction, reflecting the fact that environmental impact is a key concern to both companies - and the panel of judges for the World Business Green Business Awards have given their seal of approval that the mission was well and truly accomplished.

Prologis were rewarded with two awards: "Most Efficient Green Business" and "Best Overall Green Business", while CA Group's SolarWall™ Transpired Solar Collector won the award for "Best Use of Product Design" for it's involvement in the Pineham project.

One deciding factor in the use of SolarWall™ system was the independently verified performance data contained in a report by BSRIA (Building Services Research and Information Association) which

summarised the actual energy and CO2 savings achieved during a 12-month monitoring programme conducted on a SolarWall™ installation at the CA Group headquarters in County Durham.

This data then formed the basis of a thermal modeling study undertaken by leading environmental architects, Battle McCarthy, which concluded that in many applications, SolarWall™ more than satisfies the 10% renewable energy requirement in its own right.

SOLARWALL™ FROM TEGRAL Design Guide

Confidex Sustain™

Confidex Sustain™

Tegral Metal Forming are proud to introduce Confidex Sustain™ from their pre-finsihed steel supply partners, Corus. Confidex Sustain™ offers the first Carbon Neutral building envelope in the world, measuring and offsetting its impact from cradle to grave i.e. manufacture through to installation, use and end of life. As part of Corus continued commitment to going beyond mere compliance on environmental issues, action is being taken to reduce to net zero the unavoidable CO2 emissions produced by Colorcoat HPS200® and Colorcoat Prisma® pre-finished steel products and the cladding systems they become part of. Corus has been working over a number of years to make Colorcoat HPS200® and Colorcoat Prisma® the most sustainable pre-finished steel products on the market.

Importantly Confidex Sustain™ will offset the impact from the entire building envelope system rather than just one element such as the prefinished steel.

What is Confidex Sustain™?

Confidex Sustain™ offers the first Carbon Neutral building envelope in the world, measuring and offsetting its impact from cradle to grave i.e. manufacture through to installation, use and end of life. This means for every 1kg of CO2 emitted by the pre-finished steel, cladding, fixings and insulation, Corus will off-set 1kg in climate friendly projects overseas. These have a social as well as environmental benefit and will see Corus investing in projects such as replacing kerosene lamps with solar panels for communities in India.

Building on the success of the Corus Confidex® Guarantee, the first and most reliable construction product guarantee, Confidex Sustain™ offers a zero carbon building envelope system. It goes beyond considering just one element of the cladding system to assess and off-set all parts including the inner and outer pre-finished steel cladding sheets, fixings and insulation. Confidex Sustain™ is available when a Colorcoat HPS200® or Colorcoat Prisma® pre-finished steel product is used as part of a Colorcoat® assessed cladding system.

Balance for the environment

Using Life Cycle Assessment data for each part of the cladding system, Corus can accurately identify how much carbon has been emitted at each stage of the process from manufacture, and installation to use and end of life disposal/recycling. This will be balanced and offset by Corus proactively investing in climate friendly projects which make use of renewable sources such as wind and solar and also improve the efficiency with which energy is used.

Key benefits of Confidex Sustain™

- Assesses the environmental impact of the pre-finished steel cladding system from cradle to grave.
- **Covers the whole pre-finished steel cladding system, not just one element.**
- Tangibly demonstrates the construction supply chain's commitment to sustainability by specifying the first Carbon Neutral building envelope in the world.
- Provides peace of mind for the supply chain in the specification of the most sustainable pre-finished steel products and cladding systems available. These will deliver long-term building envelope solutions with the ultimate levels of performance.
- Provides an important source of differentiation for designers and building owners as more people select climate friendly brands and products.
- Offered by Corus who has an excellent track record for developing well researched, robust and credible products and services, which deliver peace of mind and real benefit for the supply chain.

Confidex Sustain™

Key features of Confidex Sustain™

- Offsets the unavoidable CO2 emissions associated with the pre-finished steel, cladding system, insulation and fixings.
- Includes emissions from pre-finished steel cladding system during manufacture, installation, use and disposal/recycling.
- Backed by a robust, reliable and fully traceable process for investing in climate friendly projects, underpinned by the CarbonNeutral protocol.
- Does not need to be passed along or traded within the supply chain to secure the benefits of zero carbon.
- Provides a direct link between Corus and the client, who will be the main beneficiary of the Carbon Neutral building envelope.
- **Simple to register for, applications can be made at project design stage.**

Applying for Confidex Sustain™

To benefit from the Confidex Sustain™ zero carbon building envelope, building projects will need to:-

- Ensure Corus Colorcoat HPS200® and/or Colorcoat Prisma® pre-finished steel products are specified for exterior of roof and walls
- Ensure Corus Colorcoat® liner is specified for interior of roof and walls
- Use a Corus Colorcoat® assessed cladding system. Full details of these are available on www.colorcoat-online.com

Applications should be made at the start of the building project using the Confidex Sustain™ pre-registration form. This is available electronically on www.tegral.com or telephone Tegral Sales on 00 + 353 (0) 59 86 40740.

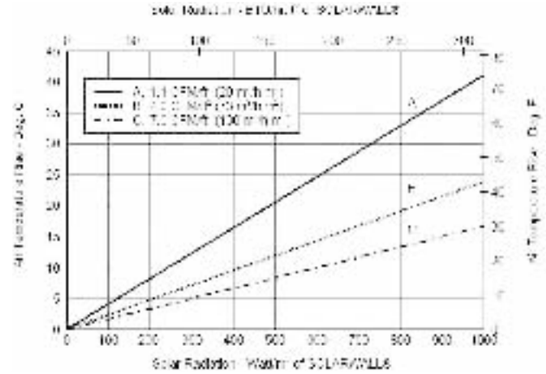
Once the building has been completed, the building owner/occupier will receive a Confidex Sustain™ certificate with details of how much carbon has been off-set and the types of project Corus is investing in.

SOLARWALL™ FROM TEGRAL Design Guide

SolarWall™ Performance

The SolarWall™ collector is highly efficient due to the following factors:

- With no glazing in front of the absorber, the SolarWall™ collector is able to receive 100% of the sun's energy that falls on it's surface. The boundary air layer that lines the metal solar cladding panel is drawn through the tiny perforations before the heat can be lost to the outside. Accordingly, the collector efficiency is greatest at high air flow rates and reduces in proportion with the flow. Even on cloudy days, the unglazed panels can still generate a few degrees of heat and act as a pre-heater for the air before it reaches the auxiliary heater.
- The efficiency of any solar collector is highest when the temperature of the air entering the solar panel equals the temperature of the ambient air. This occurs with the perforated plate collector.
- Most solar efficiency curves show the panel efficiency based on a formula which includes ambient air and air temperature entering the solar panel. The efficiency drops as the difference between the two temperatures increases. With the perforated panel, the two temperatures are always the same, hence the solar panel continually operates at its maximum efficiency. In space heating designs, building air enters a solar panel to be heated above room temperature. On cold, overcast days, there may be insufficient solar energy to achieve this, whereas the SolarWall™ panel generates heat above ambient, whether it be a rise of two degrees or twenty degrees, and this gain is useful energy.
- The solar heated air delivered to the ventilation system will vary in temperature depending on the flow rate, solar intensity and ambient air temperature. Typical temperature rise data is shown below.



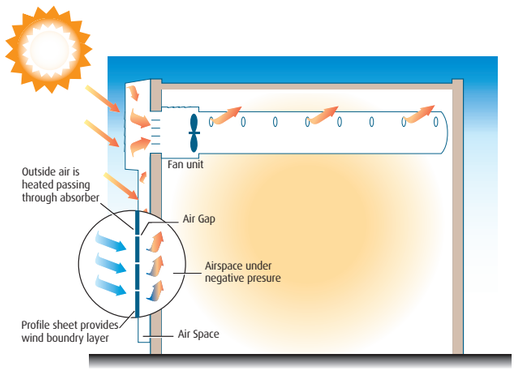
Air temperature rise/solar radiation chart.

SolarWall™ from Tegral

Space heating

The SolarWall™ panels can also be used as a space heater in milder climates or in the warmer spring and fall months.

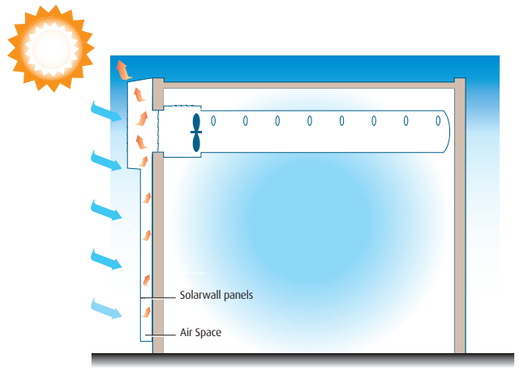
Whenever the fresh air is heated above 20°C (68°F), the solar heat will provide space heating benefits.



SolarWall™ system integrated into a wall and connected to interior fan.

Summer cooling

If the buildings walls and roofs are not insulated, or poorly insulated, the reduction in solar load on the main wall can be very significant when SolarWall™ panels cover the wall or roof.



Summer cooling with perforated unglazed panels.

In fact, in some climates, the summer cooling benefit can exceed the winter heating benefit. The wall is cooled by ambient air entering the bottom half of the wall, rising by convection, then exiting through the top half removing the solar heat. The main wall is spared the direct heat from the sun, reducing the cooling demands of the building. The diagram above illustrates the summer cooling effect.

SOLARWALL™ FROM TEGRAL Design Guide

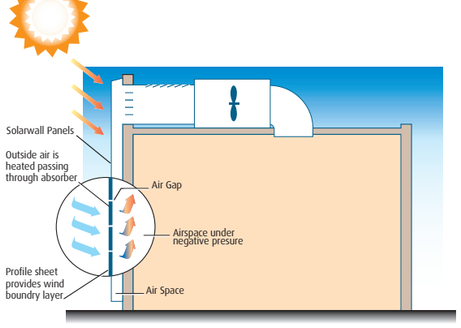
SolarWall™ from Tegral

How SolarWall™ works

1. The SolarWall™ Metal Solar Cladding system is installed as an additional skin, onto an existing structurally sound wall, creating an air space (cavity) between the two walls.

2. The coating on the SolarWall™ panel absorbs the sun's energy and is subsequently heated.

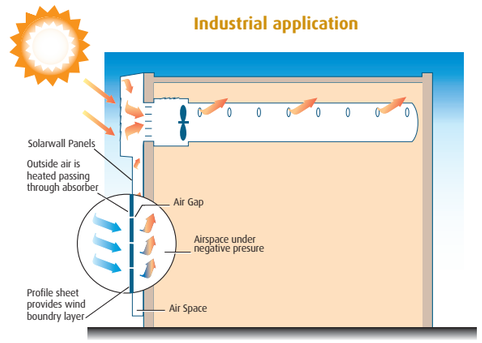
3. A negative air pressure is created within the air space by means of a ventilation fan which draws ambient outside air through tiny perforations in the SolarWall™ surface. The outside air is then heated as it passes through the panel and is collected within the cavity.



Main Components of SolarWall™

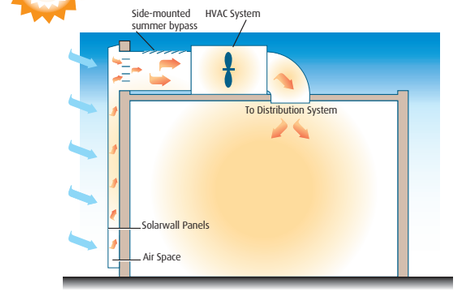
4. From the cavity, the fresh, heated air is then fed either directly into the building as ventilation air (industrial applications), or ducted into an HVAC unit (commercial & residential applications), where it is used as a pre-heater for the main heating system.

Industrial application



Indoor fans and perforated ducting destratify ceiling heat and balance airflow

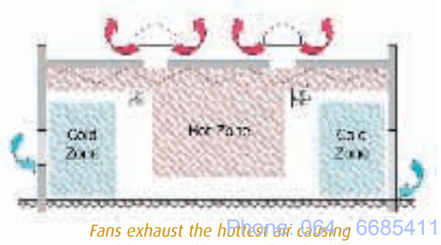
Commercial and residential application



The heated air is then evenly distributed in the building via conventional distibution system

5. The SolarWall™ Metal Solar Cladding system effectively eliminates internal negative pressure and heat stratification problems that are associated with modern air tight buildings, as well as providing CO_2 free heating.

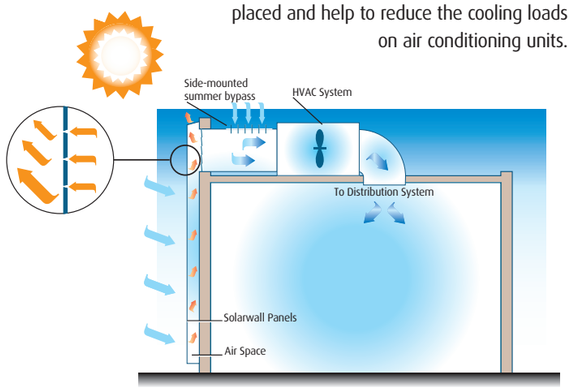
Building heat stratification



Fans exhaust the hottest air causing cold air to infiltrate at floor level

SolarWall™ from Tegral

5. As well as providing heated ventilation air during the winter months, the SolarWall™ system can also provide significant benefits during the summer months. As the SolarWall™ panels are mounted as an additional skin onto the building envelope, this effectively places the original elevation in solar shade. This can lead to a reduction in the solar heat gain through the elevation where SolarWall™ is placed and help to reduce the cooling loads on air conditioning units.



In the summer, the hot air is vented out the top. Panels act as a sunscreen preventing the sunshine from hitting the wall.

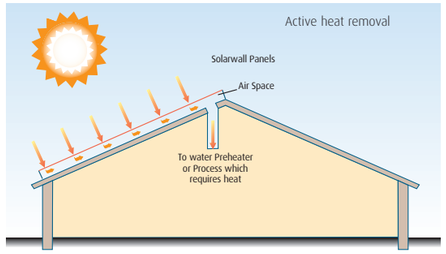
During the summer months, the system works in the same manner as in winter operation, only this time, the heated air captured in the cavity is naturally vented back into the atmosphere (through the perforations at the top of the wall), while cooler air is introduced into the building via a summer by-pass damper.

SolarWall™ process air

As well as providing heated ventilation air, the SolarWall™ system has also been used to provide heated process air for drying products such as tea leaves and coffee beans in equatorial regions. In such locations the SolarWall™ panels can be roof mounted* for increased levels of solar gain*

For a project where a roof mounted SolarWall™ installation is being considered, contact Tegral Metal Forming Technical Services at metaltech@tegral.com or 00 353 (0)59 8640 750 for project specific recommendations and advice.

Building heat stratification

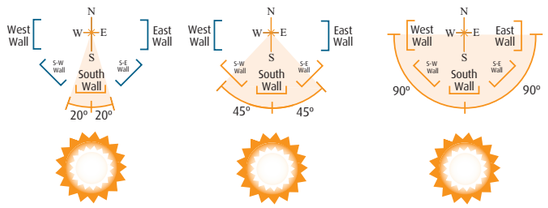


If heat is required for preheating water or other processes, it can be removed actively.

This type of roof mounted system can also have the added benefit of providing a "cool roof" all year round, as in the case of summer cooling outlined previously.

SolarWall™ orientation

The ideal orientation for the SolarWall™ Metal Solar Cladding system is due south, as this provides the maximum amount of exposure and hence solar gain to be absorbed by the collector. If a southerly elevation is not available, the collector can be installed onto different elevations, however the amount of solar gain will be subsequently reduced.



Ideal orientation (96-100% Solar Gain) *Favourable orientation (80-100% Solar Gain)* *Acceptable orientation (60% Solar Gain)*

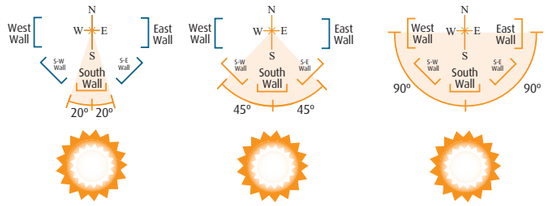
If an elevation other than due south is utilised for the SolarWall™ system e.g. the west wall, this elevation would then only generate heat during the afternoon period. It would prove more beneficial therefore, to utilise both the west and east elevations in SolarWall™ as the east wall could provide heat during the morning periods and vice versa.

SolarWall™ from Tegral

Major design criteria

Select the wall or roof

The perforated cladding absorbs the most sunlight when facing south, plus or minus 20 degrees. If the south wall is not suitable, consider one or both of the east and west elevations. If a large volume of air is to be heated, all three walls can be utilised as shown in diagram below. Only the solar contribution is affected by collector orientation. The heat recovery benefit remains the same for all walls.



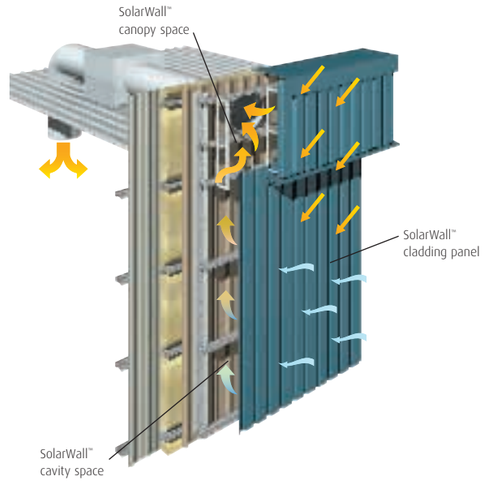
Ideal orientation (96-100% Solar Gain) *Favourable orientation (80-100% Solar Gain)* *Acceptable orientation (60% Solar Gain)*

If no wall is suitable or available, consider using a south facing roof. The slope of the roof should be at least 30° and preferably more. If snowfall occurs often at the proposed site, the minimum slope should be at least 45° to allow the snow to slide off.

The wall area to be considered does not have to be free from openings. Wall surfaces around doors and windows may be suitable if they can be connected together or to fans which deliver air inside the building. This is an important consideration since many buildings will not have uninterrupted surfaces.

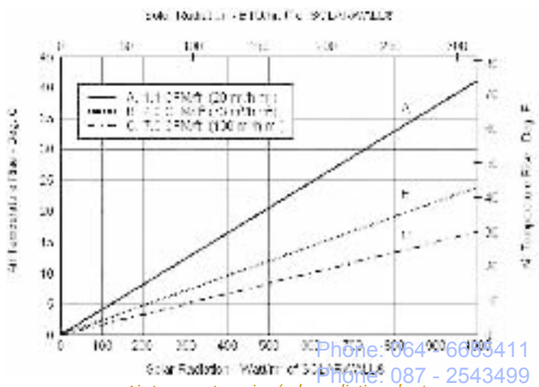
Consider using the perforated panels as the building material for covering the wall around doors and windows and do not be overly concerned about optimising the design. Rather, cover as much of the wall as possible and utilise as much of the free heat as possible. If parts of the wall are shaded or not readily accessible for uniform air flow distribution, again do not sacrifice appearance for highest efficiency.

Instead design the air flow for a range of heating curves, as long as some air is moving through the perforations. The SolarWall™ collector can be applied over many existing structurally sound wall materials from traditional brick to metal or precast concrete.



Determine the air volume to heat

The SolarWall™ Metal Solar Cladding System is used to heat fresh, outside air and not re-circulated building air. For this reason, the volume of outside air to be heated and desired internal temperature must be known. These are mainly dictated by the use of the building and it is the rate at which this air is drawn through the collector that determines the air temperature rise. The diagram below shows an air temperature rise/solar radiation chart for the variations in SolarWall™ flow rates.



Air temperature rise/solar radiation chart.

SolarWall™ from Tegral

Line A represents a typical low flow system, for applications where higher temperatures are required and the panels can provide some space heating needs for the building as well as ventilation air heating.

Line B is typical of most ventilation heating designs and utilise a medium flow panel.

Line C is for a high flow system, generally used in industrial applications where large volumes of air must be heated and only a small temperature rise is required.

If the quantity of outside air to be heated is low in proportion to wall area, then a perforated canopy design may be the most cost effective choice as the capital cost would be less than covering an entire wall. A wall with numerous shipping doors, windows or other obstructions may not be suitable for other configurations so a canopy may be the only option. In such a case, if the doors are a dark colour, they will collect heat when closed, and the heat would rise to the canopy. The face of the canopy would be constructed from the perforated cladding to increase collection efficiency.

Air flow direction

Air behind a perforated panel system normally travels in two directions: vertically up to the top of the wall or cavity, then horizontally to the nearest fan intake. The two directions simplify balancing to ensure that air is drawn through the entire panel surface, otherwise, some of the solar heat may be lost.

Air mixing

Industrial buildings usually require a large amount of fresh air and the usual practice is to supply separate fans with mixing dampers and ducting that distribute the solar air at ceiling level as far into the building as practical. The mixing dampers are temperature controlled and will mix hotter ceiling air with the solar heated air. This mixing is necessary for night use or during cloudy days in order to maintain the required indoor temperature. For non industrial buildings most solar heating projects use the perforated panels as a pre-heater to the conventional ventilation fan with the provision to by-pass the solar panels in the summer months when heating is not necessary.

Design guide

The method of sizing a SolarWall™ Metal Solar Cladding System is relatively simple since different quantities of air can be heated by the same panel area. The temperature rise through the solar panels is dependant upon the volume of air per square meter of solar panel. For sunny days, a high temperature rise is normally in the range of 25°C to 35°C above ambient. If higher temperatures are required, additional heat can be supplied from a conventional heater, with SolarWall™ acting as a pre-heater. Typical solar designs are sized to deliver between 17°C and 25°C above ambient. This gives an economical panel area and good solar efficiencies. Higher air volumes through the solar panels will provide temperature rises of 10°C to 17°C above ambient. Velocity is calculated by dividing the air volume to be heated by the solar panel area.

If a high temperature rise (25°C to 35°C) is required, or low volumes of ventilation air are to be heated, design for lower velocities across the solar collector (lowest solar collection efficiency). Use:

- 18 to 54$m^3/hr/m^2$ (1 to 3 cfm/ft^2)

For ventilation air heating in schools, offices or factories (17°C to 25°C) - typical selection criteria, design for:

- 54 to 109 $m^3/hr/m^2$ (3 to 6 cfm/ft^2)

For higher air volumes (10°C to 17°C), pre-heating of air and low temperature rise, (highest solar efficiency) design for:

- 109 to 183 $m^3/hr/m^2$ (6 to 10 cfm/ft^2)

The perforated panels can be roof-mounted provided the main roof is waterproof. However, the SolarWall™ cladding positioned directly over the opening for the air intake must not be perforated in order to prevent water from entering the system.

SOLARWALL™ FROM TEGRAL Design Guide

SolarWall™ from Tegral

Pressure drop through the perforated collector is approximately 25Pa with the total pressure drop through the SolarWall™ panels, canopy and into the fan approximately 50 - 100Pa. The pressure drop from the inside of the SolarWall™ to the ventilation system should be calculated in the normal manner taking into account duct and other losses.

The vertical air velocity behind the perforated metal panels should not exceed 3m/s as it reaches the top of the wall, with the maximum horizontal velocity at the top not exceeding 5m/s. If multiple fans or duct connections are made to the canopy, then the canopy can be smaller, or possibly eliminated.

If the solar collector area is known, calculate the volume of air that can be heated by multiplying the panel area by the desired temperature curve flow rate from (diagram top left, page 8) or by using the velocity guide indicated above. The lines show the temperature rise of air at different flow rates.

Example

- A school gymnasium has a SolarWall™ area of 500m^2, and a large temperature rise is desired. Pick line B at 73$m^3/hr/m^2$ to give an airflow rate of 36,500 m^3/hr.
- If both panel area and volume of outside air to be heated are known, i.e. SolarWall™ area = 500m^2 and airflow = 50,000m^3/hr. Then the airflow through the panel is 50,000$m^3/hr/500m^2$ = 100$m^3/hr/m^2$. Referring to Figure 6, 100$m^3/hr/m^2$ corresponds to a flow rate between lines B & C for temperature rise of air.

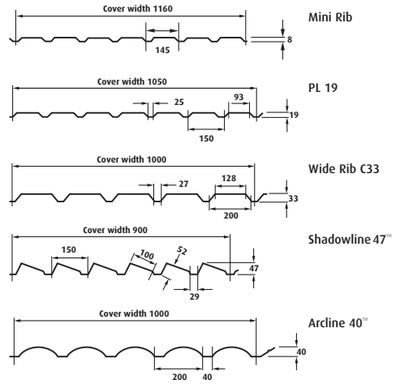
Summary

1. Decide on solar panel size and location. Is the south wall suitable? If not, consider east or west walls. Note that a south wall may actually be south west, and the east wall would then be south east. In this case, both walls could be utilised effectively.
2. Determine the volume of outside air required within the building. Heat as much fresh air as possible. This will improve indoor air quality without increasing fuel costs.
3. Calculate the volume of air per area of solar heater, then refer to temperature chart to determine expected temperature rise.
4. Select Colour (Refer to Solar Absorptivities, Table 1 on page 14).
5. Determine spacing of solar cladding from main wall and whether a separate or internal canopy will be used.
6. Locate fans as close to solar panels as possible. Position the solar fan connections at a maximum spacing of 30 linear metres. Closer spacing will result in a smaller canopy requirement.
7. Industrial buildings can save additional energy from de-stratification. In order to achieve this, determine the amount of ventilation or make-up air required and then position the ducting to distribute the air as high as possible into the building. The distribution ducting should be located in the areas where the ceiling temperatures are hottest to destratify the heat and save energy.

Integration with building

Panels

The metal panels are perforated with very small holes (Ø1.5mm) and resemble conventional metal cladding. They are available in a full range of colours (refer to Solar Absorptivities, Table 1 on page **10**), and are all covered with the latest Corus Confidex® guarantee. The standard SolarWall™ panel profiles are shown in below.



Note: Profiles are subject to IS EN 508 -1 tolerances

SolarWall™ profiles

SolarWall™ from Tegral

The perforated panels are made from either coated steel or aluminium. Initially, the panels were made from aluminium as there was a concern about corrosion around the perforations if steel was utilised. However, no evidence of any rust formation has been noted due to the galvanising which protects the steel from corrosion and the constant air movement through the holes which dries any moisture that may exist. Therefore the Corus Confidex® guarantee is not affected. As the majority of systems are generally mounted vertically, water runs off the wall and the holes are so small that surface tension prevents most water from entering them.

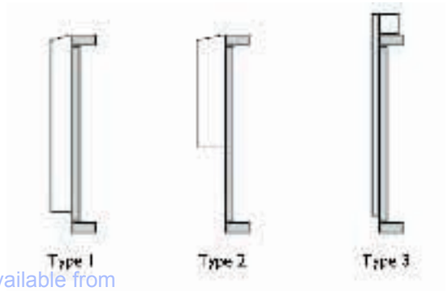
Colour and Finish

As the SolarWall™ panels are part of the main building envelope, it is very important that a durable and proven coating be used which will last for decades without maintenance or repainting. This is why Tegral Solarwall is available in Colorcoat HPS200® Ultra – Europe's most specified pre-finished steel now with an extended Corus Confidex® guarantee of up to 40 years, Colorcoat Prisma® and Colorcoat Verso®.

The perforated panels can be any colour. However, the darker the colour the better, as these will absorb more of the suns energy and hence generate increased air temperatures.

Air Cavity

A calculated air cavity is necessary to allow the heated air to travel up the wall and then across to the nearest fan intake. This air gap can be reduced if the air is drawn from the collector at more locations. Connecting fans at multiple points reduces the required size of the canopy since the volume of air flowing through the air space to each inlet will be lower. The SolarWall™ cladding and canopy can be mounted onto an elevation in various ways, and are displayed below.

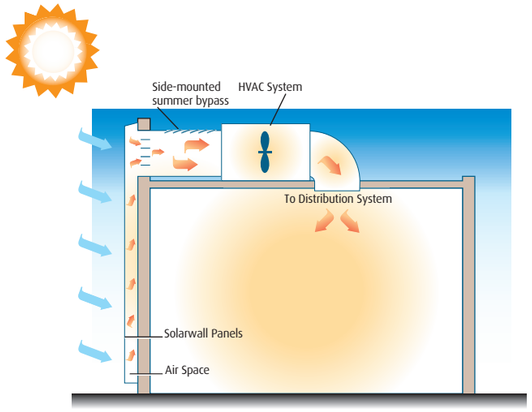


Solar collector elevation designs

Type 1
The entire SolarWall™ elevation is mounted at the same distance from the original wall to give a continuous appearance.

Type 2
The SolarWall™ cladding is mounted at a calculated distance from the original elevation, creating a visible "feature band".

Type 3
The SolarWall™ collector is mounted 'flush' at a set distance from the original elevation with the canopy created via a back parapet on the roof of the building. This design allows for easy connections to be made to existing HVAC systems which may also be located on the roof (see diagram top left, page 9). The back parapet can also be utilised when internal restrictions mean that there is no room to install a standard system.



SolarWall™ panel integrated with HVAC unit

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SolarWall™ from Tegral

The wall and canopy designs are based on three limiting factors: the volume of air being drawn through the collector, cost and appearance. The cost and appearance issues are related as although it may be more expensive to construct a canopy, this could then be used to create a focal point and enhance the aesthetics of the building. If a separate canopy can be omitted with the inclusion of an internal canopy, then construction costs will be lower.

The air space within the cladding profile may be sufficient for low flow systems, but unsuitable for higher air volumes. If more space is needed, the solar panels must be mounted further from the main wall. The method of securing the panel out from the wall will vary depending on the option selected.

The options are listed in cost order, with the lowest cost system being Type1. Types 2 and 3 require a separate support structure for the canopy.

If the architect is planning to include an architectural feature along the top of the wall, (i.e. feature band, bullnose etc) then it should be designed to also act as the canopy to collect the solar heated air. For further information refer to "How SolarWall™ Works" on page 6 of this document.

Variations

Canopy

The main variation for wall mounting is the method of collecting the solar heated air at the top of the SolarWall™ elevation. For small air volumes all of the air can normally be accommodated in the air gap between the perforated absorber and the wall (cavity). For larger air volumes, either multiple fan connections or a larger air space (canopy) is needed. The canopy is located at the top of the wall and can be either on the face of the elevation built as an architectural feature or behind the wall and on the roof (see diagram bottom left page 13).

In some cases, the canopy will be constructed above an un-perforated wall, to collect the solar heated air as it rises up the exterior of the elevation. This setup could be suitable for walls with numerous windows or doors and the canopy soffit would be made from the perforated panel, and air entering the perforations would have been pre-heated by the lower wall surface.

Roof Mounting

Roof mounted systems can be equally effective, but are (mainly) only suitable if snow accumulation is not a concern. Due to the reduced sun angle during the winter period, wall mounted systems tend to be more efficient and are preferred in northern latitudes, particularly Ireland. They can also benefit from reflected solar radiation via concrete and snow covered surfaces in front of the wall. Roof panels are normally only recommended in countries closer to the equator, or in applications where process heat is required during the summer months.

SolarWall™ from Tegral

Construction Details

The unglazed panels are installed in a similar manner as other metal wall facades, with one difference. The panels are mounted out from the main wall to create the cavity for collecting the solar heated air. The supporting wall must be structurally sound and built in accordance with current building regulations.

If the main wall is masonry, attaching the perforated panels with an air gap is relatively simple since the SolarWall™ support system can usually be fastened anywhere on the wall. However, if the main wall is a metal clad elevation with supporting steelwork spaced 1.8 to 2m apart, then supports for the SolarWall™ panels must be connected to this steelwork, and not the external sheets.

Air will be flowing against the main wall which must be a waterproof, non-combustible surface. If a masonry construction is used for the original elevation, then it may provide some heat storage and heating benefit for one or two hours after the sun sets due to the thermal mass properties of this type of construction.

Computer Models

The main program used to simulate the SolarWall™ Metal Solar Cladding System is RETScreen®. Produced by Natural Resources Canada, it is based on actual test data and field monitoring results from SolarWall™ installations.

- RETScreen®
  Feasibility analysis of ventilation solar air heating using Microsoft® Excel software. It uses monthly average weather data direct from NASA and is available free of charge from: www.retscreen.net

For additional information email:
metaltech@tegral.com or contact
Tegral Metal Forming Technical Services
on 00 353 (0)59 8640 750

SOLARWALL™ FROM TEGRAL Design Guide

SolarWall™ from Tegral

Table 1 — Solar Absorptivity of Corus Colorcoat HPS200® & Corus Colorcoat Prisma® Colour Range

Solar Absorptivity Colorcoat HPS200® Ultra		
Colour	Nearest Reference	Solar Absorptivity
Black	*BS 00E53*	*95%*
Burano	*RAL 3004*	*93%*
Sargasso	*RAL 5003*	*92%*
Vandyke Brown	*BS 08B29*	*92%*
Ocean Blue	*BS 18C39*	*89%*
Olive Green	*BS 12B27*	*88%*
Terracotta	*BS 04C39*	*87%*
Heritage Green	*RAL 6002*	*86%*
Petra	*BS 04D44*	*84%*
Solent Blue	*BS 18E53*	*84%*
Merlin Grey	*BS 18C25*	*83%*
Poppy Red	*BS 04E53*	*83%*
Jade	*BS 14C37*	*76%*
Wedgewood	*BS 18C37*	*76%*
Svelte Grey	*BS 10B23*	*74%*
Moorland Green	*BS 12B21*	*64%*
Tangerine Orange	*BS 06E53*	*62%*
Bamboo	*BS 08C35*	*59%*
Mushroom	*BS 10B19*	*56%*
Goosewing Grey	*BS 10A05*	*55%*
Saffron	*BS 08E53*	*49%*
Meadowland	*BS 12B17*	*45%*
Albatross	*BS 18B17*	*45%*
Aztec Yellow	*BS 10E55*	*39%*
Honesty	*BS 10C31*	*31%*
Hamlet	*RAL 9002*	*30%*
White	*BS 00E55*	*12%*

Solar absorptivity Colorcoat Prisma®		
Colour	Nearest Reference	Solar Absorptivity
Black	*RAL 9005*	*96%*
Kronos	*-*	*95%*
Anthracite	*RAL 7016*	*92%*
Atlantis	*-*	*92%*
Pinewood Green	*BS 14C39*	*90%*
Helios	*-*	*87%*
Slate Grey	*RAL 7012*	*86%*
Bahama Blue	*RAL 5015*	*84%*
Zeus	*-*	*81%*
Mountain Blue	*RAL 5014*	*79%*
Pegasus	*-*	*79%*
Aurora	*-*	*78%*
Grey Aluminium	*RAL 9007*	*75%*
Alaska Grey	*RAL 7000*	*74%*
Ariadne	*-*	*68%*
Aquarius	*-*	*63%*
Mercury	*-*	*49%*
Silver Metallic	*RAL 9006*	*48%*
Oyster	*RAL 7035*	*42%*
Flint	*-*	*32%*
White	*RAL 9010*	*18%*

SolarWall™ from Tegral

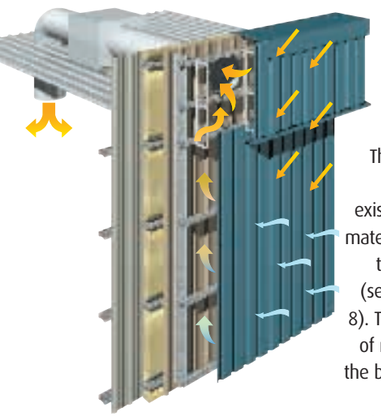
The Solar Ready Building

Solar Ready is a concept that has been developed to address the issue of fitting SolarWall™ systems to buildings which are being constructed speculatively. This system allows building developers & architects the possibility of utilising the SolarWall™ Metal Solar Cladding System as a third "skin" on the planned building envelope delivering a viable renewable energy solution.

The SolarWall™ Metal Solar Cladding System is a **fresh** air heating system, which draws outside ambient air through a transpired solar collector. In doing so, the air is subsequently warmed by absorbing the solar generated heat from the surface of the collector. This warmed air can then be used to provide tempered ventilation air or act as a pre-heater to the buildings existing heating system.

The collector is designed based on information received from either the building owner or tenant. This information details a number of key factors including the **fresh** air requirements, together with recommended indoor temperatures and building layout etc. However; what if these details are unknown and the building is to be constructed on a speculative basis?

During the early stages of a development, the most beneficial size & location of a **Solar Ready** SolarWall™ system would be determined based on the buildings initial orientation & layout. This area would then be clad with a medium porosity SolarWall™ panel, which would enable the collector to cater for many different air flow rates.



SolarWall™ panels mounted over Twin-Therm™ wall.

The **Solar Ready** concept can also be applied over many existing structurally sound wall materials, from traditional brick, to metal or precast concrete (see top left diagram on page 8). This allows for a wide range of materials to be used within the building envelope and gives the building developer and architect the freedom to design modern buildings which fit in with surrounding environments.

The Benefits

1. The Developer

- Enhances the image of the developer as they demonstrate their contribution to reduce the impact of CO_2 on the environment.
- Offers a renewable energy saving solution to the building envelope at minimal cost when compared to the overall cost of the development.
- No M&E fit out is required as this is left for the tenant to undertake.
- No more complicated to install than regular profile cladding systems delivering minimal installation costs.
- Provides a solution that will be used for the life of the building with minimal maintenance requirements.
- Offers the tenant the opportunity to take advantage of a technology which can reduce their fuel consumption.
- Enables easier compliance with Part L & simplifies planning applications.

2. The Architect

- Able to demonstrate their commitment to environmental issues by promoting renewable technologies which are integrated into the building.
- Can offer a solution for renewable technologies which fits in with existing and new building designs.
- Is able to introduce a renewable energy solution to both the developer and the tenant.
- Maintains the aesthetic appearance / design of the building.

3. The Tenant

- Can be utilised either as a stand alone system or integrated into planned M&E package.
- Is able to introduce pre-heated fresh air into the building.
- Reduces fuel consumption and CO_2 levels.
- In summer periods cooler ambient air can be introduced to improve employee comfort levels.

SOLARWALL™ FROM TEGRAL Design Guide

SolarWall™ from Tegral

Another key contribution to the first-class efficiency of the Pineham building is Prologis' insistence on real attention to detail throughout the installation process. "we make every effort to make sure that the junctions and details we propose for our buildings eliminate, or minimise, heat conduction wherever possible," says Stuart McConnell, Technical Manager of CA Roofing Services. "This gives the client a more efficient building envelope by removing escape routes for heat, at no additional cost."

The same attention to detail during installation can significantly enhance air-leakage performance, "Every cubic metre of air leakage directly affects the bottom line for the building tenant," explains McConnell, "It's an unnecessary waste of both money and natural resources."

Ken Hall, Managing Director of Global Construction for Prologis Europe described the building as "...among the most environmentally advanced distribution facilities in the world." The building is the first to be completed under the Planet Positive™ initiative, of which Prologis and CA Group are founder members and which offsets 110% of the CO2 generated in the construction of the completed project.

It is also the largest to be covered by the Corus Confidex SustainTM Guarantee, which delivers a CarbonNeutral building envelope using CA Building Products.

Hall's vision has also ensured that the materials used for the Pineham building envelope will leave no environmental legacy at the end of the building's service life, as the foam-free Twin-therm™ system is fully recyclable at end of use without the need for any of the specialist reprocessing equipment associated with other systems.

Perforated cladding

Perforated cladding

SolarWall™ from Tegral

Case study

Completed in December 2006 by SolarWall™ agents in the UK, CA Building products, the SolarWall™ installation consists of 1211m² mounted over both the south east and south west elevations. The Merlin Grey SolarWall™ cladding cannot be distinguished from the standard Twin-Therm™ installation other than up close when the small perforations can be observed.

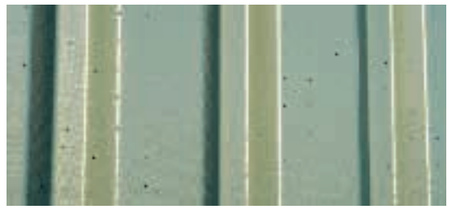


Figure 19 *- Perforated cladding*

System Performance

For this new building, two different strategies have been employed for the SolarWall™ system.

On the south east gable elevation of the building, 293m² of SolarWall™ provides pre-heated fresh air for the building via a conventional fan & mixing box system. This air is then distributed at high level through fabric ductwork (see diagram top right page 3).

The system is positioned over three high bay loading doors, providing increased levels of fresh heated air, with the benefit of reducing the overall building heating load and providing a more comfortable working environment around the loading door area.

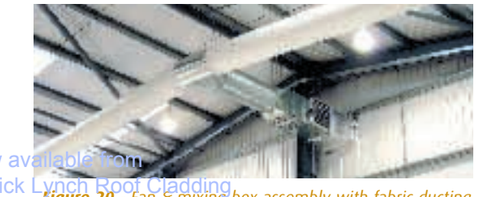


Figure 20 *- Fan & mixing box assembly with fabric ducting*

For the south west elevation, a different design has been utilised for the SolarWall™ system. Unlike the gable wall, the SolarWall™ along the south west elevation is acting as a pre-heater to three gas heating units mounted high within the building roof space (see diagram on left page 8).

When heat is freely available from the SolarWall™, it is distributed within the building utilising lightweight fabric ductwork. This allows for an even temperature profile to be maintained across the entire factory floor, whilst improving the overall air distribution.

When the temperature from the SolarWall™ is not high enough to heat the building for free (during overcast periods or at night), then some internal air can be utilised along with the gas burners to "top up" the air temperature in order to maintain the desired set point.

Figure 21 *- Pre-heater unit and fabric ducting*

In total, over 100 linear metres of fabric ductwork distributes the air within the building. The duct itself is supported using a tensioned cable, and held in position using a simple circular clip. This allows for the duct to be easily moved during maintenance periods or if it should require cleaning.

A further advantage of mounting the heating units in the roof space is that valuable floor space is saved where the heating units would have stood, maximising both production and storage areas.

Total average annual energy savings for this project are estimated to be 299,000kWh & 71tonnes of CO_2.

SOLARWALL™ FROM TEGRAL Design Guide

SolarWall™ from Tegral

Pre-feasibility for a Tegral SolarWall™ installation

In order to complete a pre-feasibility study for a SolarWall™ installation, the following information is required:

- An address & postcode for the area of the development, in order to obtain up-to-date weather data from NASA.
- Building parameters: CAD drawings - both elevations and plan are necessary in order to calculate floor areas, building volumes, available SolarWall™ area(s), cavity & canopy depths and fixing methods. *It is also vital that these drawings include an accurate compass point to determine the exact orientation of each collector.*
- Required fresh air rate(s) for the building(s) in question. *If these are unknown, the SolarWall™ system will be designed to provide the optimum balance between air flow and temperature rise.*
- Mechanical drawings detailing existing or planned ductwork / localised heating / extraction units are necessary to allow for accurate placement of SolarWall™ fans and ducts. Does the building require any special design considerations with regards to ducting?
- Recommended indoor temperatures; will only frost protection be required or 15oC+? What areas of the building are to be serviced, do these areas have different temperature requirements?
- Operating schedule of the building, i.e. will the building be operating 24/7 or 8 till 8, 5 days a week?
- Required colour of the SolarWall™ panels. (Note; the darker the panel, the more efficient, Black = 95%, White = 12%).
- Is the development New Build or Refurbishment? What is the wall build up / system to be used behind the SolarWall™ (manufacturer and type)? CAD drawings detailing steelwork / section through are required to allow for SolarWall™ supporting options and spigot / inlet positions to be determined.
- Does the building contain any racking or storage areas? If so, where are these located and what are their dimensions? Are there any other additional obstructions i.e. cranes etc? (Ideally noted on the building layout plan)
- Is fire an issue? Does the proposed elevation for the SolarWall™ have a firewall requirement? If so, what periods of integrity and insulation are required?

If any of the above points cannot be determined or are unknown email metaltech@tegral.com or contact Tegral Metal Forming Technical Services on 00 353 (0)59 8640 750

Corus Colorcoat® Products and Services

To ensure the long-term performance and appearance of the building, it is important that the pre-finished steel product is specified alongside the cladding system.

Corus Colorcoat® Products and Services

The Colorcoat® brand provides the recognised mark of quality and metal envelope expertise exclusively from Corus. Over the course of 40 years Corus has developed a range of technically leading Colorcoat® pre-finished steel products which have been comprehensively tested and are manufactured to the highest quality standards. These are supported by a range of services such as comprehensive guarantees, colour consultancy and technical support and guidance.

Colorcoat HPS200® Ultra

The latest generation product for roof & wall cladding, Colorcoat HPS200® Ultra offers an exciting new colour range and dramatically improved colour and gloss performance. Maintenance and inspection free, Colorcoat HPS200® Ultra delivers twice the colour and gloss retention of standard plastisols, and is now guaranteed for up to 40 years, combining outstanding performance with unrivalled reliability.

Colorcoat Prisma®

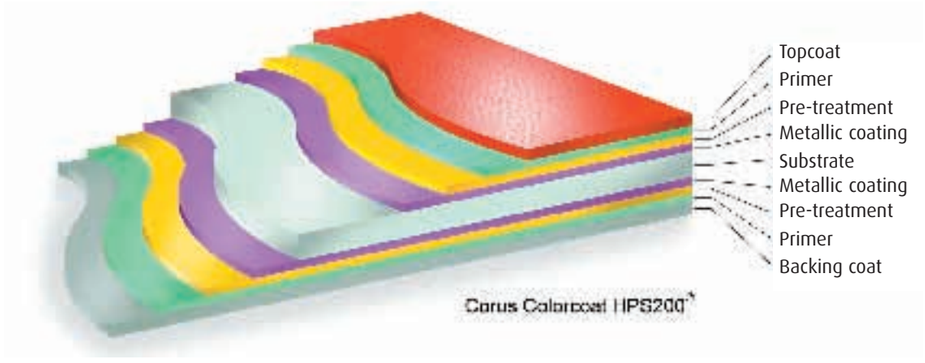
The ideal choice to deliver eye-catching buildings that will stand the test of time. Technically and aesthetically superior to PVDF (PVF2), Colorcoat Prisma® is readily available in the most popular solid and metallic colours. All backed up with the unique Confidex® Guarantee providing cover for up to 25 years.

Repertoire® colour consultancy

The Repertoire® colour consultancy can advise on colours and colour strategies using a range of standard shades, as well as discussing individual bespoke colour requirements. Corus can match almost any shade from physical swatches to commonly used references such as RAL, NCS and British Standard and more unusual standards.

Confidex® Guarantee

Offers the most comprehensive guarantee for pre-finished steel products in Europe and provides peace of mind for up to 30 years. Unlike other guarantees, Confidex® covers cut edges for the entirety of the guarantee period and does not require mandatory annual inspections.



40 Year Maintenance Free Confidex Guarantee from Corus with Colorcoat HPS200® Ultra

SOLARWALL™ FROM TEGRAL Corus Colorcoat®

Corus Colorcoat® Products and Services

Born and bred locally for a lower carbon footprint

Confidex SUSTAIN

Confidex Sustain™

Offers the first CarbonNeutral building envelope in the world. It provides a combined guarantee which covers the durability of the Colorcoat® pre-finished steel product and guarantees to offset unavoidable CO2 emissions from the pre-finished steel and Colorcoat assessed cladding system, including fixings and insulation, from cradle to cradle. More than just offsetting, the aim is to encourage specification of the most sustainable pre-finished steel products and cladding systems.

Colorcoat® Building Manual

Developed in consultation with architects and other construction professionals, the Colorcoat® Building Manual incorporates over 40 years of Colorcoat® expertise. It contains information about sustainable development and the creation of a sustainable specification.

Colorcoat® Technical papers

Working closely with the Corus Colorcoat® Centre for the Building Envelope based at Oxford Brookes University and the Steel Construction Institute, Corus has produced a number of technical papers. These address key construction issues such as the creation of an airtight building envelope and end of life options for pre-finished steel cladding systems.

For more information about Corus Colorcoat® products and services visit **www.colorcoat-online.com** or call the Colorcoat Connection® helpline on **+44 (0)1244 892434**.

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