IRISH AGRÉMENT BOARD
CERTIFICATE NO. 10/0352
Clean Energy Ireland,
Rathard, Aherla, Co. Cork.
T: 021 743 2829
M: 087 239 2024
W: www.CleanEnergyIreland.ie

Clean Energy Ireland Solar Heating Systems

Le système solaire de chauffage
Solarheizungssystem

NSAI Agrément (Irish Agrément Board) is designated by Government to issue European Technical Approvals.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2009**.

PRODUCT DESCRIPTION:
This Certificate relates to the following Clean Energy Ireland Solar Heating Systems:

- Integra IDMK Flat Plate Integrated Collector

Each system is comprised of a solar collector, sloping roof kit, hot water cylinder, anti-scald valve, pump station, solar controller, expansion vessel, hydraulic connections, solar discharge vessel, antifreeze, user & installation manual and labelling packs.

This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2009.

USE:
The Clean Energy Ireland Solar Heating Systems can be used in new and existing buildings with a roof pitch of between 25° and 70°. The collector must be fixed to a roof that meets the requirements of I.S. ICP 2:2002 *Code of practice for slating and tiling*, and prior versions of this document or previous Irish codes of practice for slating and tiling.

The Clean Energy Ireland Solar Heating Systems should be installed by competent persons with suitable training and practical experience of the systems, and who have been approved by Clean Energy Ireland and NSAI Agrément to install the system.

MARKETING, DESIGN AND MANUFACTURE:
The solar collectors are designed, manufactured and tested by GREENoneTEC Solarindustrie GmbH, Austria. The solar systems are designed, assembled and distributed by:

Clean Energy Ireland,
Rathard,
Aherla,
Co. Cork.

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the Clean Energy Ireland Solar Heating Systems, if used in accordance with this Certificate can meet the requirements of the Building Regulations 1997 to 2009, as indicated in Section 1.2 of this Agrément Certificate.

1.2 BUILDING REGULATIONS 1997 to 2009

REQUIREMENTS:

Part D – Materials and Workmanship

D3 – Proper Materials

The Clean Energy Ireland Solar Heating Systems, as certified in this Certificate, are comprised of 'proper materials' fit for their intended use (see Part 4 of this Certificate).

D1 – Materials & Workmanship

The Clean Energy Ireland Solar Heating Systems, as certified in this Certificate, meet the requirements for workmanship.

Part A - Structure

A1 – Loading

The Clean Energy Ireland Solar Heating Systems, once appropriately designed and installed in accordance with this Certificate, have adequate strength and stability to meet the requirements of this Regulation (see Part 3 of this Certificate).

Part B – Fire Safety

B4 – External Fire Spread

The Clean Energy Ireland Solar Heating Systems will not affect the external fire rating of the roof structure on which they are installed (see Part 4 of this Certificate).

Part C – Site Preparation and Resistance to Moisture

C4 – Resistance to Weather and Ground Moisture

The Clean Energy Ireland Solar Heating Systems, once appropriately designed and installed in accordance with this Certificate, will not affect a roof's resistance to the ingress of moisture (see Part 4 of this Certificate).

Part L – Conservation of Fuel and Energy

L1 – Conservation of Fuel and Energy

The Clean Energy Ireland Solar Heating Systems can be designed to meet the minimum level of energy provision from renewable technologies stated in this Regulation, i.e. 10kWh/m^2/annum contributing to energy use for domestic hot water heating.

2.1 PRODUCT DESCRIPTION

This Certificate relates to the following Clean Energy Ireland Solar Heating Systems:

- Integra IDMK Flat Plate Integrated Collector

Each system is comprised of a solar collector, sloping roof kit, hot water cylinder, anti-scald valve, pump station, solar controller, expansion vessel, hydraulic connections, solar discharge vessel, antifreeze, user & installation manual and labelling packs. Figure 1 shows the main elements of the flat plate solar heating system.

The Clean Energy Ireland Solar Heating Collectors have been tested to EN 12975-2:2006 *Thermal solar systems and components – Solar collectors – Test methods.*

2.1.1 Integra IDMK Flat Plate Integrated Collector

The Integra IDMK Flat Plate Integrated Collector consists of a double header absorber construction. The exposed panel components are resistant to UV, moisture, freezing and salty environments.

The Integra range has two collector sizes: 2.5m^2 or 1.25m^2 gross areas. In these collectors, the riser pipes are ultrasonically bonded to the absorber plate. The risers are brazed to a manifold on the top and the bottom. The antifreeze enters and leaves the collectors via two 1" fittings located at the top of the housing. The sensor is fitted into a pocket brazed directly to the top manifold ensuring accurate collector temperature readings. Any available energy received onto the collector absorber surface heats the pipe work behind the plate which then heats the antifreeze within. The solar controller can accurately read this temperature and switch on the circulation pump accordingly. The antifreeze solution travels down one side of the absorber and up the other side, exiting to the next collector for additional heating or to the cylinder for depositing the heat.

Up to 6 collectors can be joined in series. They have a maximum operating pressure of 10bar and the mineral wool employed behind the absorber assists in heat retention. The accompanying flashing kit provides water and wind-tight assembly.

2.2 MANUFACTURE

The Clean Energy Ireland Solar Heating Systems are designed, manufactured and tested at the GREENoneTEC ISO 9001 and ISO 14001 registered facility in Austria. GREENoneTEC pressure test and inspect the absorber of every panel.

2.3 DELIVERY, STORAGE AND HANDLING

Clean Energy Ireland supply a full package for each solar heating system installation, which includes (pre-assembled) solar collectors, sloping roof kit, cylinder, anti-scald valve, pump station, solar controller, expansion vessel, hydraulic connections, stainless steel pipes to bring collector hydraulics to attic space, solar discharge vessel, antifreeze, user & installation manual and labelling packs.

Collectors and cylinders should be transported vertically. Heavy goods should not be loaded on top of the kit boxes. Kits are available in 1st fit, 2nd fit or complete format. Care should be taken when opening kits to prevent scratches or sudden shocks to the collectors, and sharp objects shall not be used to open the packaging.

2.4 INSTALLATION

2.4.1 General

The Clean Energy Ireland Solar Heating Systems should be installed by competent persons with suitable training and practical experience of the systems, and who have been approved by Clean Energy Ireland and NSAI Agrément to install the system. The installer shall fully understand the requirements of the customer, have completed a user health & safety risk assessment and an installation health & safety risk assessment.

A solar panel installation must be performed in accordance with all Health & Safety legislation and local building/planning regulations. The necessary plumbing work should be undertaken by a qualified, insured and solar-trained plumber. The necessary electrical work should be undertaken by a qualified electrical contractor.

The solar collectors are allowed be left exposed to solar radiation before commissioning and when the solar loop and manifold have been drained. During commissioning (antifreeze filled), it is advised not to have the panels exposed to the sunlight for extended periods as the antifreeze will degrade more quickly.

Fixings used with the Clean Energy Ireland Solar Heating Systems must comply with Clause 4.11 and 5.9 of I.S. ICP 2:2002. All tiles adjacent to the collectors should be mechanically fixed in place. Flashings used with the systems must comply with Clause 4.12 of I.S. ICP 2:2002.

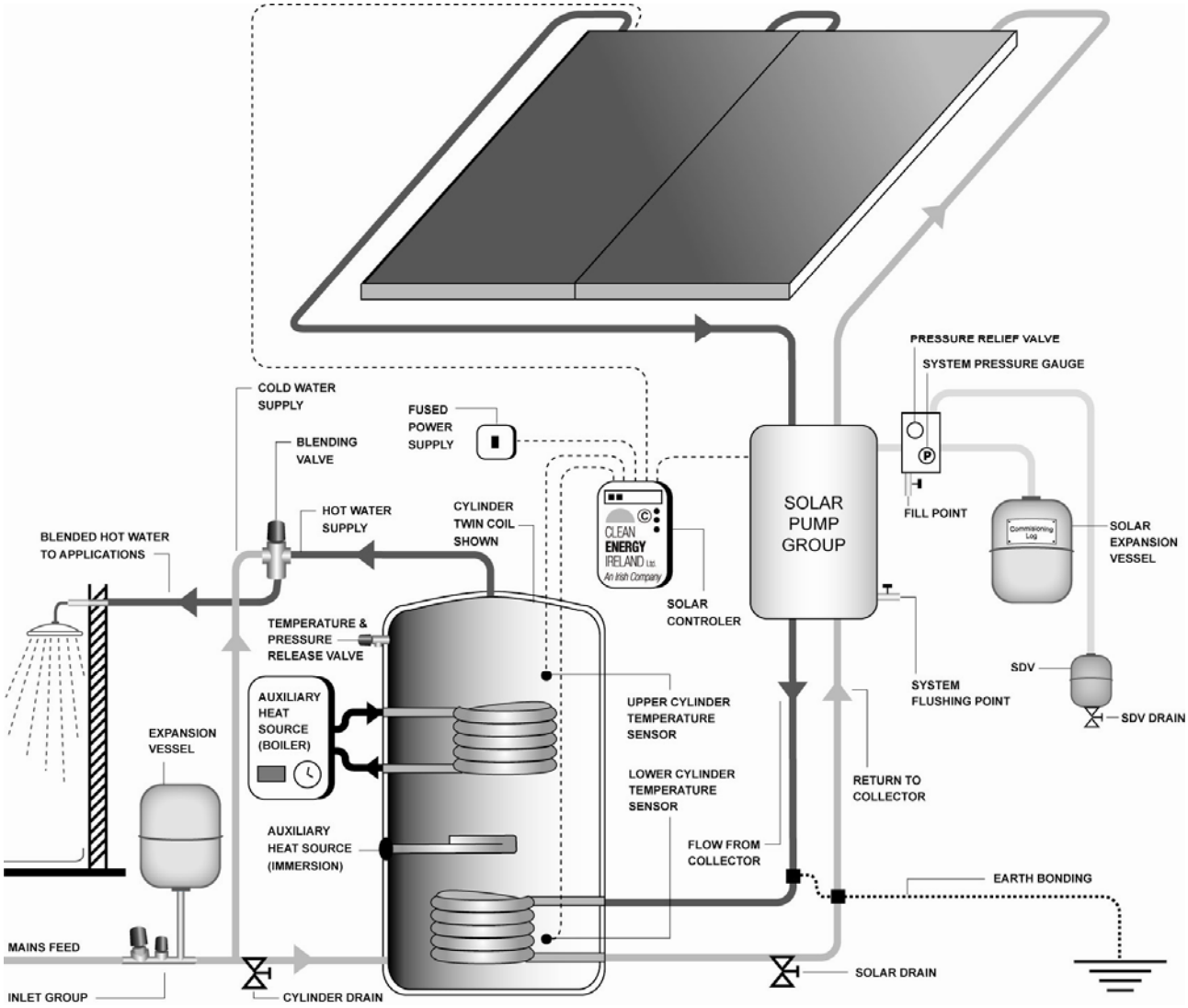


Figure 1: Main components of the Integra IDMK Flat Plate Collector System

Performance (W)		Global solar radiation (W/m²)		
		400	700	1000
$T_m - T_a$[1] (K)	10	633	1176	1719
	30	433	976	1519
	50	210	753	1296
[1] T_m is the mean temperature of system fluid; T_a is the ambient temperature				

Table 1: Power output per collector unit

	Integra IDMK 2.5	Integra IDMK 1.25
Dimensions	2063 x 1228 x 107 mm	1015 x 1228 x 107 mm
Gross Area	2.53 m^2	1.25 m^2
Aperture Area	2.32 m^2	1.1 m^2
Absorber Area	2.29 m^2	1.08 m^2
Height	107 mm	107 mm
Total Weight	54 kg	27 kg
Liquid Volume	1.6 litres	0.67 litres
Nominal Flow	120 l/hr	80 l/hr
Collector Connection	2 x 1" swivel nut	2 x 1" swivel nut
Absorber Type	Harp absorber	Harp absorber
Absorber Coating	Highly selective	Highly selective
Absorption	95%	95%
Emission	5%	5%
Covering	Low iron, structured, solar safety glass	Low iron, structured, solar safety glass
Heat Insulation	50mm mineral wool	50mm mineral wool
Collector Case	Timber (sides & back)	Timber (sides & back)
Efficiency η_0 (aperture)	78.10%	78.10%
Heat Coefficient k1	3.79 W/m^2K	3.79 W/m^2K
Heat Coefficient k2	0.013 W/m^2K	0.013 W/m^2K
Max Stagnation Temperature	210°C	210°C
Max Operating Pressure	10 bar	10 bar
Hydraulic Connection	Series connection	Series connection

Table 2: Product Specifications

2.4.2 Pre-Installation

Sizing of the Solar Heating System

Minimising the risk of stagnation must be considered by the installer when sizing a solar heating system. The system must not be oversized, but must comply with the requirements of Part L of the Building Regulations 1997 to 2009. Clean Energy Ireland will use information gathered on the Solar Quotation Enquiry Form to design the system. The following steps should be taken to correctly size a solar heating system:

- Determine the daily hot water demand.
- Calculate the hot water heat requirement.
- Calculate the storage volume.
- Size the required collector area.
- Size the system components.

Sizing of Safety Equipment

Component sizes and output parameters are relative to the output performance of the system – the Clean Energy Ireland Technical Design Guide should be consulted for each system.

Installation Health & Safety Risk Assessment

During the pre-installation site survey, a health & safety risk assessment must be completed and recorded by the installer on the Clean Energy Ireland risk assessment form. Items assessed include:

- Access to roof (can scaffolding be erected).
- Ability of roof structure to accommodate all applied loadings.
- Working at height.
- Effects of wind and snow loads.
- High temperature pipe work and liquids.
- Antifreeze storage and discharge release.
- Water quality.
- Fire safety (installation of high temperature components).
- Risk of legionella.
- Access for routing pipes.
- Overhead wire protection.

Site Survey

Following completion of the initial risk assessment, contained within the Solar Quotation Enquiry Form, a site survey must be carried out by the installer using the Clean Energy Ireland Pre-Installation Survey Form. This survey will typically cover the following points:

- Verify details from the Solar Quotation Enquiry Form.
- Identify any special user usage requirements.
- Shading (current and potential risk).
- Suitability of roof (is the roof finish in good condition)
- Roof orientation.
- Access to collector location.
- Pre-heat storage location (is there adequate space for the cylinder and solar control system)
- Configuration of occupants DHW system and anticipated usage patterns.
- Sizing of the solar heating system.
- Location of pump station assembly.
- Control panel location and fixing height.

2.4.3 Roof Fixings

The collectors are mechanically fixed to the roof trusses with aluminium L-brackets, 70mm coach screws and stainless steel screws. Adverse bi-metallic reactions are prevented with nylon washers where required. The bracket system is designed for up to and including 4-storey high buildings and covers all Irish wind zones (as illustrated in Figure NA.1 in Irish National Annex to Eurocode 1). It is recommended that a structural engineer is used to advise on the

strength of the roof structure and its ability to accommodate all the applied loadings.

The collector's location should be measured and special concern given to the final positioning of the flashing periphery. Four bracket sets per collector are required, two at the top and two at the bottom. These should be directly fixed into the rafters (preferred) or to additional, structurally designed and adequately supported timber bearers (not standard roof battens). The coach screw locations are pre-drilled with a 5mm drill bit to prevent damaging the structure of the truss when installing the coach screw. The installer shall ensure the coach screws are centred on the available truss and applied perpendicular to the truss top surface.

The collectors are mounted onto treated timber bearers, designed and specified for roof installation, to provide support underneath the collector. The stainless steel screws (with fitted nylon washers) are drilled into the collector's timber frame.

Figure 2: Fixing bracket on lower side ready to take collector

Figure 3: Collectors fixed on roof before installation of flashings

2.4.4 Roof Penetrations

The Certificate holder supplies a felt grommet for carrying the insulated solar pipes and collector sensor through the roof felt into the attic space. This grommet is manufactured from EPDM (Ethylene Propylene Diene Monomer) and is used to ensure water will not breach the felt.

When installed in accordance with the Certificate holder's instructions, this system creates a permanent seal which ensures the water tightness and wind tightness of the external building envelope is maintained. Where pipes penetrate the interior of the attic space, e.g. through the roof underlay, insulation or plasterboard, they must be made airtight through use of suitable airtight tapes, seals of grommets, and additional grommets can be supplied by the Certificate holder for this purpose. Where existing insulation and/or plasterboard is displaced, it must be replaced with similar material and made airtight.

Figure 4: Felt grommet where pipework penetrates felt

2.4.5 Flashing Kit Installation

Clean Energy Ireland supplies four separate flashing kits for the following roof finish types:

- Irish Slate (Anthracite)
- Flat Tile (Anthracite)
- Curved Tile with Lead Skirting (Anthracite)
- Irregular Tile with Lead Skirting (Dark Brown)

They are manufactured in Austria and comply with Section 4 of I.S. ICP 2:2002 and have been assessed as being appropriate for use with the Integra IDMK Collector. Stainless steel plumb screws for fixing the flashings to the frame of the collector are supplied with the flashing kit. No additional lead, sealants or fixings are required.

Figure 5: Side flashing for tiled roof

Figure 6: Finished flashing kit on slate roof

The installer shall start applying the flashings at the base of the collector. The side and centre flashings are then fitted, followed by the top tapering flashing. The supplied plumb screws must be used to prevent moisture entering through the flashing. Soakers shall be applied if slate is the roof finish; alternatively a solid flashing side piece is used incorporating a double channel for capturing the flowing rain and utilizing a foam fillet as shown in Figure 5.

2.4.6 Connections

In any solar heating system, the 'return' refers to the intake in the collector where liquid is returning to be reheated. The 'flow' refers to the collector side where the liquid is flowing to the heat exchanger.

It is essential that the collector temperature sensor is located in the flow of the collector, as shown in Figure 1.

All copper pipework should meet the requirements of I.S. EN1057:2006+A1:2010: *Copper and copper alloys – Seamless round copper tubes for water and gas in sanitary and heating applications* and be clearly marked in accordance with BS 1710:1984 *Identification of pipelines and services*. Ideally, pipes should take the shortest route to the solar store and always slope back to the pump station. In order to reduce heat losses, anti-thermal siphoning measures should be taken in the pipework between cylinder and pump.

The PT1000 collector sensor shall be inserted into the sensor pocket next to the flow pipe. The sensor must be mechanically fixed with a metal pipe clip to ensure the sensor won't inadvertently get displaced from the sensor pocket. The gaskets employed in the fittings are made from graphite which has an operating temperature range -100°C to +500°C, and is compatible with a wide range of chemicals including the supplied antifreeze. The brass fittings comply with IS EN 12164:2000 *Copper and copper alloys – Rod for free machining purposes*, and the solar pipe is manufactured from AISI 316L stainless steel and has an operating temperature range of -270°C to +600°C.

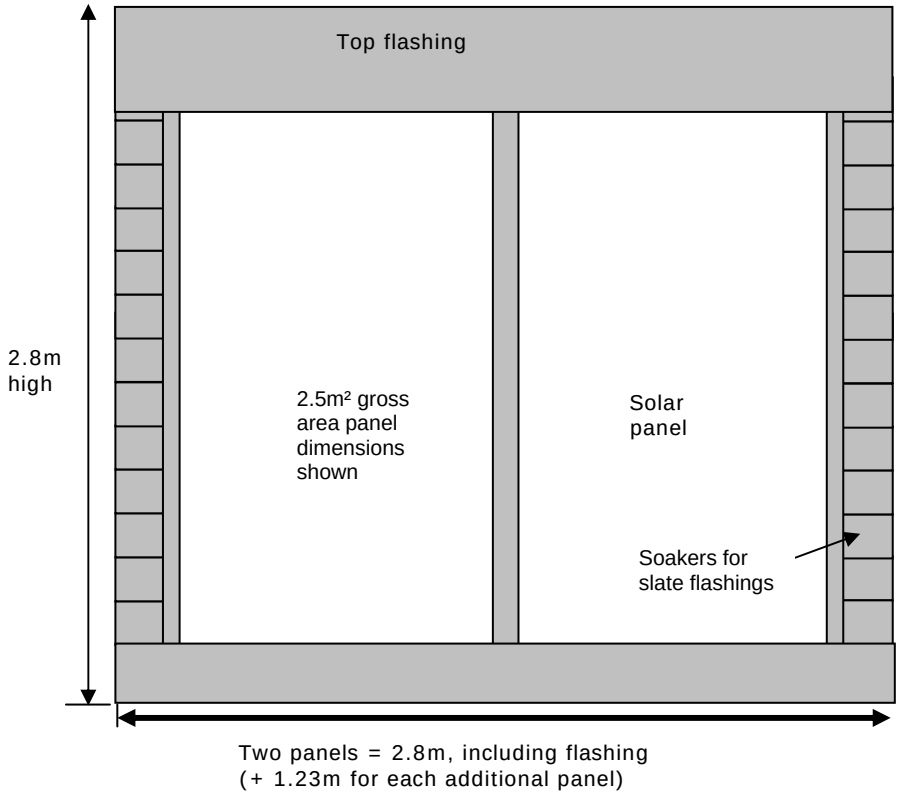


Figure 7: Plan of flashings for 2-panel Integra IDMK Collectors on slated roof

Figure 8: Completed installation on slate roof

Flexible Pipe Connections

Flexible pipe connections are required to connect the collectors through the building fabric and allow flexibility in connecting to the internal pipe work. Flexible stainless steel pipes are available in both ¾" and 1" diameter. If connecting one diameter pipe to another, a suitable reducer compression fitting is required to make the connection.

Types of Connections

The only pipes which should be used with a solar installation are copper pipe (to IS EN 1057:2006+A1:2020), continuous flexible stainless steel or mild steel (to ISO 9329-1:1989 *Seamless steel tubes for pressure purposes – Technical delivery conditions – Unalloyed steels with specified room temperature properties*). When using copper pipe, only compression or brazed joints can be used. Solder and galvanised fittings will not withstand high temperature or expansion and are therefore not suitable for solar pipe work.

Note: PEX/Plastic/PEX-ALU-PEX or galvanised tubing or fittings should NOT be used under any circumstances.

Insulation

All pipe work on the solar loop shall be insulated with high temperature insulation suitable for use at temperatures above 150°C, such as HT/Armaflex. This is essential as regular pipe insulation will degrade at temperatures experienced by solar pipes. The insulation applied must conform to Part L of the Building Regulations 1997 to 2009. When the insulated solar pipes are outside the heated building envelope, the wall thickness of the insulation should be at least equal to the diameter of the pipe. The only pipes which should not be insulated are the pipes to the safety vessel as they should allow heat to dissipate when the system is experiencing excessive heat and pressure.

2.4.7 Cylinder

Consideration should be given to the load bearing requirements of the cylinder and the space required to house the cylinder, pump station, expansion vessel, valves and pipework with regard to installation, inspection and maintenance.

The Certificate holder supplies the Telford Solar Cylinder, the Kingspan Albion Ultrasteel Solar Cylinder and the Kingspan Coppercraft ECO Cylinder. In addition, other DHW cylinders may be used, provided they have NSAI Agrément certification for use with this system.

The Telford Cylinder is a Duplex stainless steel with one, two or three coils, and is available for pressurised systems and open vented systems. The Kingspan Albion Ultrasteel Cylinder is a

duplex two coil stainless steel cylinder, and is used for pressurised systems. The Kingspan Coppercraft ECO Cylinder is a two coil copper cylinder and is used for open vented systems only.

A twin coil hot water storage cylinder enables energy input from the central heating system to the top half of the tank, and energy input from the solar heating system to the bottom half of the tank. Cylinder storage size is calculated at approximately 130% of the household's hot water demand, which is estimated at 50-60 litres/adult/day. The Certificate holder recommends a 200 litre cylinder for a two to three adult household, and a 300 litre cylinder for a four to five adult household.

2.4.8 Solar Pump Station

Both single string and dual string WATT pump stations are available for use with the Clean Energy Ireland Solar Heating Systems. A dual string pump station has an air vent that allows bleeding of air during the filling process. Each WATT pump station is available in two flow rates: 2-12 litres and 8-28 litres. The Tiemme 4745 pump station can also be used with the Clean Energy Ireland Solar Heating Systems. This pump station is available in three flow rates: 1.5-6 litres, 4-16 litres and 8-28 litres. The flow rate required on a system is typically 1 litre/minute per square metre installed. Therefore, a 2-12 litre pump station will be sufficient for systems up to 12m^2.

Connections of flow and return pipe work to the pump station are made with ¾" flat seal male threads. Each pump station has an expansion vessel hose and bracket for rapid mounting of the vessel. There is a vessel isolating valve fitted as standard on the bracket to allow removal of the vessel prior to pressure testing the system hydraulics.

The pump station and vessel must be fixed to a sound surface suitable for holding the weight of the unit, and should be in an accessible location and not obstructed or concealed.

Figure 9: WATT Dual String pump station with air vent

Figure 10: Tiemme 4745 pump station

2.4.9 Safety Vessel Connections

The Pressure Relief Valve (PRV) is rated at 6bar, and conforms to EN 4757-1 and Directive PED 97/23/CEE, and is certified to TÜV Solar. The PRV may discharge heat transfer fluid which must be channelled into a container capable of withstanding high temperature discharge and containing 1.5 times the total collector volume. The container should be secured so it cannot be removed or spilled and have a drain facility. The PRV must not be channelled into a drain or any pipe work which will allow it to enter the normal water course.

2.4.10 Solar Expansion Vessel

The Zilmet solar expansion vessel supplied with the Clean Energy Ireland Solar Heating Systems complies with DIN 4757 and is available in incremental sizes between 12 litres and 105 litres. The vessel is pre-charged to 2.5bar and has a maximum working pressure of 10bar. While the vessel membrane can tolerate temperatures of 100^{o}C, it is recommended to fit the vessel on the return string of the pump station (cooler side).

2.4.11 Solar Discharge Vessel

The Solar Discharge Vessel (SDV) is supplied with a mounting bracket and screws, and comes with the necessary hose length and hose fittings to be applied to the PRV. The SDV comes in three sizes: 5 litres, 12 litres and 18 litres. A brass drain is fitted to the base of the SDV. Un-insulated copper or stainless steel pipe shall be used between the pump station and discharge vessel.

Figure 11: Solar Discharge Vessel

2.4.12 Solar Differential Controller

Clean Energy Ireland supplies two types of solar controller: Resol Deltasol BS Plus and Prozeda Solar Reg II Basic Controller. The Resol Deltasol BS Plus accepts 4 x PT1000 inputs and provides 2 x output relays. The functions in this controller allow auxiliary heating functions which could be used where there is a risk of legionella. It also controls East-West collector configurations and facilitates priority heating of cylinder zones and two storage cylinder set-ups.

Wiring the Solar Controller

All electrical aspects of the installation should be undertaken in accordance with ETCI regulations by a qualified electrician. For safety, the pump and sensor connections should always be wired prior to connecting power to the solar control panel. The solar control panel must have a permanent electrical power supply which must not be interrupted by a time switch. A switchable fused spur with LED should be used for the system. The solar heating system does not have to be drained if the power is disconnected. However, if the system is unused for extended periods it is recommended to drain the system to prevent degradation of the anti-freeze.

The solar control panel should be located in a prominent location that is readily accessible and frequently occupied, normally on the landing outside the solar store, fixed not less than 1.5m above floor level. The control panel display should be readily visible at all times with clear access and not concealed or obstructed. In order to protect the normal operation of the control panel, it should be located at least 100mm from insulated pipes which may become hot during operation.

Clean Energy Ireland can supply a lightning protection kit To limit potential damage to the systems from lightning. See Section 3.6 of this Certificate.

Figure 12: Resol & Prozeda control panels

2.5 COMMISSIONING

Commissioning must be carried out by a Clean Energy Ireland trained and approved installer of the system. The system should not be commissioned if the collectors are in excess of 70^{o}C because the pressures recorded will not be stable in the long term.

Expansion Vessel

Prior to filling the system, the expansion vessel pressure must be set 0.3bar below the system pressure.

The pressure is checked at the base of the expansion vessel and the bleed valve may be bled or topped up with a pump. Omitting to perform this check will result in irregular pressure readings during the commissioning and normal use of the system.

Filling the Loop

It is important that a motorised flush and fill centre is used to fill and pressurise the system with the antifreeze as per the commissioning instructions in the installation manual.

1. Remove the expansion vessel at the vessel isolation valve.
2. Check all joints are closed tightly.
3. Connect the pump station filling valve closest to the manometer to the filling station flow (from pump).
4. Close the flow meter by turning the flow control screw to horizontal position.
5. Connect the valve closest to the flow meter to the filling station return (hose back to reservoir).
6. Check that flush and fill valves are open while the cylinder and SDV drain valves are closed.
7. Fill the filling pump reservoir with the supplied antifreeze, open the filling pump supply and switch on.
8. Allow the jet pump to run for approximately 10 minutes. If fitted, manual air vents should be cleared at intervals during this time.
9. Open the solar pump vent screw with a large screwdriver to release any trapped air.
10. Increase pressure in the system to 4bar and close all valves.
11. Check all joints for leaks, allow system to settle for 30 minutes.
12. Test pressure release valve by turning once.
13. When satisfied all pipe work is tight, release pressure back into filling station.
14. Fit the expansion vessel and measure the pressure within, which should read 2.5bar.
15. Repeat steps 4 to 9.
16. Set pressure to 3bar.
17. Manually turn on solar pump and bleed any remaining air through air vents.
18. Adjust the system pressure to a final value of 2.7bar by releasing liquid from the filling point.
19. Adjust flow rate as follows: 2 panels = 4 litres/minute; 3 panels = 6 litres/minute.

20. Manually turn on solar pump and allow it to run for a minimum of 30 minutes, bleeding any remaining air.

Setting the Flow Rate

The pump may only be run when the system has been filled as dry operation will damage the pump. The desired flow rate is 1 litre/minute/panel m^2 (1 panel = 2.32m^2).

- Set the pump to the first speed and run it manually from the controller.
- If the desired flow rate is exceeded, set the flow meter to the desired rate by adjusting the flow meter valve with the pump running.
- Otherwise repeat this step at the next pump speed and continue until the desired flow rate is achieved.
- Stop the pump.
- Set the solar controller to "Automatic".

Final Commissioning Requirements

- The installer must complete two copies of the Commissioning Certificate. One copy is left with the customer in the User Manual and the second copy is kept by the installer.
- The installer must complete the Maintenance Log, and apply it in a viewable position, for example on the expansion vessel or the cylinder.
- The installer must apply the Product ID label to the controller and the HOT PIPE warning labels (x2) to the cylinder flow and return.
- The installer shall hand over the User Manual to owners, and instruct users on all aspects of the documentation and how to effectively use the solar equipment.

User Manual

After commissioning, a user manual is given to the homeowner which contains important information about the system. The user manual includes a recommended maintenance schedule, commissioning certificate, full contact details of the installer and guidance on use.

Decommissioning the System

Due to temperatures potentially exceeding 170^{o}C and pressures up to 6bar, a solar installation should only be decommissioned by a trained individual. The system should be decommissioned in low light, ideally in the morning when the solar loop should be coolest.

2.6 RETROFITTING/REPLACING

The IDMK collectors are easily retrofitted to existing roofs. During the pre-installation survey, special attention must be given to the condition of the existing roof structure and its ability to take the additional applied loadings of the collector as described in the Clean Energy Ireland Structural Verification Procedure.

The required slates/tiles are removed. The panels are fixed as described in Section 2.4. The slates/tiles are then integrated into the correct flashing assembly.

Should the collectors require replacing then the flashings are removed in reverse order to the installation, collectors replaced and the flashing reinstated.

Figure 13: Panels being retrofitted to tiled roof

3.1 STRENGTH AND STABILITY

When tested in accordance with EN 12975-2:2006, the Integra IDMK Collector was tested to 3000 Pa positive pressure (i.e. downward pressure) without failure occurring. Using the safety factor of 1.5 for positive pressure (Section 5.9.1 of EN 12975-2:2006), the Clean Energy Ireland Solar Heating Systems can withstand a positive pressure of up to 2000 Pa. The Integra IDMK Collector was also tested to 2000 Pa negative pressure (i.e. upward pressure/uplift) without failure occurring. Using the safety factor of 2.0 for negative pressure (Section 5.9.2 of EN 12975-2:2006), the Clean Energy Ireland Solar Heating Systems can withstand a negative pressure of 1000 Pa.

The Clean Energy Ireland Solar Heating Systems and fixing system are designed to cover dwellings up to 4 storeys in height in all zones shown in Figure 14. For buildings greater than 4 storeys, and for sites with altitudes greater than 130m in Zone IV, 160m in Zone III and 275m in Zone II, Clean Energy Ireland's structural engineer will calculate the site specific wind loads in accordance with I.S. EN 1991-1-4 *Eurocode 1 – Actions on structures – General actions – Wind actions* to verify that the wind loads are acceptable for the collector and fixing system.

To minimise the effect of wind load on the collectors, it is recommended that collectors are not installed within 0.5m of the ridge or eaves.

The host roof structure, and any modifications necessary to accommodate the Clean Energy Ireland Solar Heating Systems, should be checked by a suitably qualified engineer in accordance with the Building Regulations 1997 to 2009. The installer of the system must ensure that this has been done prior to commencing installation, as per the Clean Energy Ireland Structural Verification Procedure.

3.2 IMPACT RESISTANCE

The Integra IDMK Collector was tested for impact resistance in accordance with EN 12975-2:2006, and met the pass criteria for impact resistance.

3.3 COLLECTOR EFFICIENCIES

The ability to convert solar energy into thermal energy is expressed by the optical efficiency, η_0, (zero-loss collector efficiency in SEAI DEAP software) of the system. The heat loss coefficient value, a_0, is also used in the DEAP software.

Table 3 shows the η_0 and a_0 values for the Clean Energy Ireland Solar Heating Systems obtained when tested to EN 12975-2:2006.

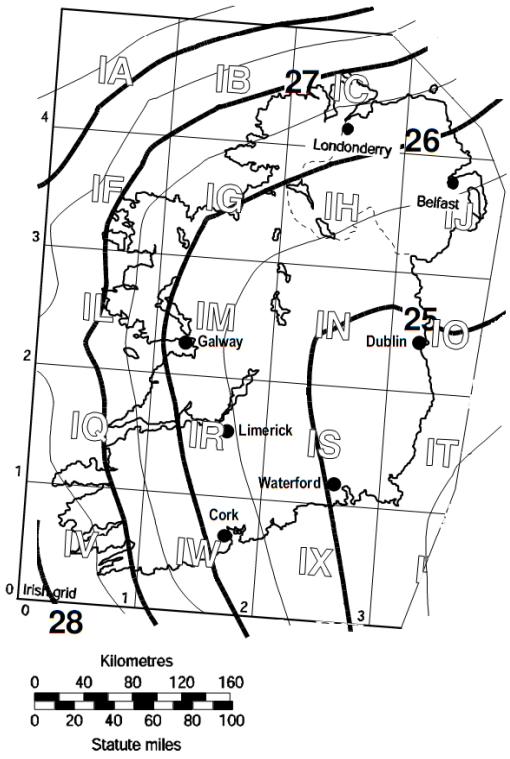


Figure 14: Basic Wind Velocity (ref. Irish National Annex to Eurocode 1)

At high levels of sunlight (1000 W/m^2), when the average system fluid temperature is slightly higher than ambient temperature (10K), for a solar heating system utilising the Clean Energy Ireland Solar Collector, each collector can transfer approximately 1.719 kW of energy to the building hot water store.
Test results of the performance of the collectors are shown in Tables 1 and 2.

Model	Aperture area	η_0	a_0
IDMK 25	2.32 m^2	0.781	3.796
IDMK 15	1.1 m^2	0.781	3.796

Table 3: Zero-Loss Collector Efficiency and Heat Loss Coefficient Values

3.4 RISK OF BACTERIAL GROWTH / LEGIONELLA

The installer of the Clean Energy Ireland Solar Heating System completes a Legionnaires Checklist as part of the initial risk assessment of the site during the pre-installation survey. If a risk of legionella is identified during this risk assessment a solar control panel with legionella controls must be installed (Deltasol BS Pro). Examples of areas where a risk of legionella may be identified include long periods of non-use of the hot water supply, infrequently used outlets such as showers and taps, and residents who are highly vulnerable to infection. In addition, a thorough review of all pipework is required in such situations with alterations incorporated as required to limit risks. Unused 'dead legs' shall be removed and recirculation pipework heavily insulated. Recirculation circuits should be timed on/off for no more than 8 hours per 24 hour period (for conservation of energy).

Information and guidance is provided to the homeowner by the installer on the correct operation of the solar heating system during normal operation and after periods of non-use, to help reduce the risk of legionella. For further guidance, refer to the HPSC (Health Protection Surveillance Centre) document *National Guidelines for the Control of Legionellosis in Ireland* and the NDSC (National Disease Surveillance Centre) document *The Management of Legionnaires' Disease in Ireland*.

The Clean Energy Ireland Deltasol BS Pro controller has an auxiliary heat activation function which enables a boiler to heat the cylinder to a set temperature and at a frequency set by a timer.

3.5 HIGH TEMPERATURE CONDITIONS

Continuous temperatures in excess of 170^{o}C will cause a degrading of the antifreeze solution and its inhibiting properties and may also cause damage to the collectors, pump station and expansion vessel in the system.

A thermostatic mixing valve should be installed to the hot water exiting the solar cylinder to prevent accidental scalding due to high temperatures. Clean Energy Ireland recommends and supplies the Tacanova MT52 mixing valve. Care should be taken to prevent any debris from entering the mixing valve and in open-vented systems the mixing valve shall not interfere with cylinder venting.
The Clean Energy Ireland control panel uses the following functions on the Deltasol BS Pro controller to prevent collector and cylinder overheating from occurring.

Anti-Stagnation
If the adjusted maximum store temperature is reached, the solar pump remains activated in order to avoid overheating of the collector. The temperature of the cylinder may continue to increase but only up to 95^{o}C (emergency shutdown of the store). In the evening the solar heating system continues running until the cylinder is cooled down to the adjusted maximum store temperature via collector and pipes. This function is not suitable where tube collectors are used due to the tube high heat retention properties.

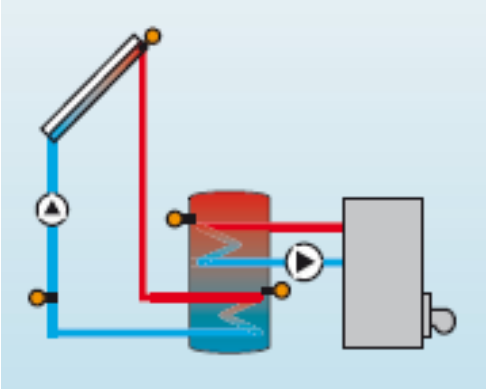


Figure 15: Auxiliary Heating Diagram

Heat Dumping
This function is typically enabled to send unwanted cylinder heat to a heat dump, such as a radiator. The heat dump function has a switch-on temperature differential and a switch-off temperature differential enabling the user to send even low temperature levels to a radiator during, for example, holiday periods or in a vacant holiday home.

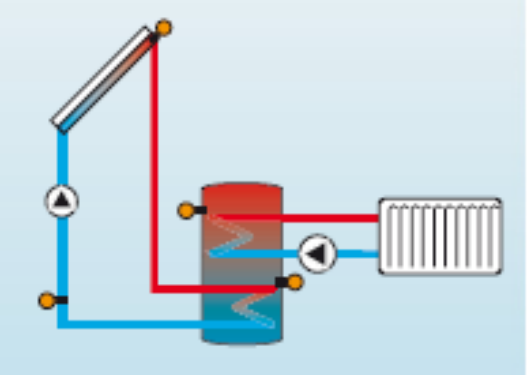


Figure 16: Heat Dumping Diagram

3.6 LIGHTNING PROTECTION

To limit potential damage to the systems from lightning, a lightning protection diode should be incorporated into the system. Clean Energy Ireland can supply a lightning protection kit for this purpose. The solar flow and return pipe work must be bonded as per the ETCI requirements to avoid electric potential differences.

In general, the risk of property damage due to lightning is relatively low in Ireland for domestic properties, and installation of Clean Energy Ireland Solar Heating Systems does not generally increase the level of risk as the collectors are placed below ridge level and not higher than the chimney. Where a building requires specific lightning protection, the collector should be connected to the lightning protection system.

4.1 BEHAVIOUR IN RELATION TO FIRE

The roof covering on which the collectors are installed must have an AA, AB or AC rating as stated in Table 4.4 of TGD to Part B of the Building Regulations 1997 to 2009.

When tested in accordance with BS 476-3:2004 *Fire tests on building materials and structures – Classification and method of test for external fire exposure to roofs*, the Integra IDMK Flat Plate Integrated Collector achieved an EXT.S.AA rating. The Integra IDMK Flat Plate Integrated Collector also achieved a B_{Roof}(T4) classification per IS EN 13501-5:2005, when evaluated against ENV 1187-4:2005 *Test methods for external fire exposure to roofs*.

Where pipes pass through fire-rated walls or cavity barriers, they must be adequately fire stopped, without compromising provision for thermal expansion.

Combustible materials should not be exposed to solar heating equipment having operating temperatures which can cause ignition.

4.2 WEATHERTIGHTNESS

The Clean Energy Ireland Solar Heating Systems when installed in completed roofs will provide adequate resistance to weather ingress, when installed in accordance with the Certificate holder's instructions. Particular attention must be paid to correct installation of the flashing components the grommets and areas where pipe work enters the building.

4.3 MAINTENANCE

Users should regularly check the temperatures which the solar control panel is recording. If the collector temperatures have been excessively high, i.e. over 170^{o}C, it is recommended that the antifreeze level be checked using a refractometer by an approved installer/qualified engineer. If the antifreeze has lost its antifreeze properties, the system should be refilled with fresh antifreeze fluid.

It is recommended that the solar heating system is serviced annually by a qualified engineer and immediately if the system shows evidence of having lost pressure or has discharged liquid at the pressure relief valve. Items checked on the annual service include the system pressure, flow rate, antifreeze level, pH reading, inspection of the collectors and inspection of the collectors and flashing components.

4.4 DURABILITY

In the opinion of NSAI Agrément, when installed in accordance with this Certificate and the manufacturer's instructions, and the recommended maintenance programme, the Clean Energy Ireland Solar Heating Systems will have a design life as solar collectors in the order of 20 years with regular inspection and maintenance.

The structural durability of the fixings, flashing etc. if maintained as per the Clean Energy Ireland maintenance schedule, has been assessed and will have a design life equivalent to that of the roof structure in which it is incorporated.

4.5 TESTS AND ASSESSMENTS WERE CARRIED OUT TO DETERMINE THE FOLLOWING

- Fire resistance
- Internal pressure of absorber
- High temperature resistance
- Exposure
- Determination of stagnation temperature
- External and internal thermal shock
- Rain penetration
- Mechanical load
- Impact resistance
- Thermal performance

4.6 OTHER INVESTIGATIONS

(i) Existing data on product properties in relation to fire, toxicity, environmental impact and the effect on mechanical strength/stability and durability were assessed.

(ii) The manufacturing process was examined including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

(iii) Site visits were conducted to assess the practicability of installation and the history of performance in use of the product.

5.1 National Standards Authority of Ireland ("NSAI") following consultation with NSAI Agrément has assessed the performance and method of installation of the product/process and the quality of the materials used in its manufacture and certifies the product/process to be fit for the use for which it is certified provided that it is manufactured, installed, used and maintained in accordance with the descriptions and specifications set out in this Certificate and in accordance with the manufacturer's instructions and usual trade practice. This Certificate shall remain valid for five years from date of issue so long as:

(a) the specification of the product is unchanged.

(b) the Building Regulations 1997 to 2007 and any other regulation or standard applicable to the product/process, its use or installation remains unchanged.

(c) the product continues to be assessed for the quality of its manufacture and marking by NSAI.

(d) no new information becomes available which in the opinion of the NSAI, would preclude the granting of the Certificate.

(e) the product or process continues to be manufactured, installed, used and maintained in accordance with the description, specifications and safety recommendations set out in this certificate.

(f) the registration and/or surveillance fees due to IAB are paid.

5.2 The NSAI Agrément mark and certification number may only be used on or in relation to product/processes in respect of which a valid Certificate exists. If the Certificate becomes invalid the Certificate holder must not use the NSAI Agrément mark and certification number and must remove them from the products already marked.

5.3 In granting Certification, the NSAI makes no representation as to;

(a) the absence or presence of patent rights subsisting in the product/process; or

(b) the legal right of the Certificate holder to market, install or maintain the product/process; or

(c) whether individual products have been manufactured or installed by the Certificate holder in accordance with the descriptions and specifications set out in this Certificate.

5.4 This Certificate does not comprise installation instructions and does not replace the manufacturer's directions or any professional or trade advice relating to use and installation which may be appropriate.

5.5 Any recommendations contained in this Certificate relating to the safe use of the certified product/process are preconditions to the validity of the Certificate. However the NSAI does not certify that the manufacture or installation of the certified product or process in accordance with the descriptions and specifications set out in this Certificate will satisfy the requirements of the Safety, Health and Welfare at Work Act 2005, or of any other current or future common law duty of care owed by the manufacturer or by the Certificate holder.

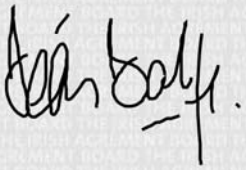
5.6 The NSAI is not responsible to any person or body for loss or damage including personal injury arising as a direct or indirect result of the use of this product or process.

5.7 Where reference is made in this Certificate to any Act of the Oireachtas, Regulation made thereunder, Statutory Instrument, Code of Practice, National Standards, manufacturer's instructions, or similar publication, it shall be construed as reference to such publication in the form in which it is in force at the date of this Certification.

NSAI Agrément

This Certificate No. **10/0352** is accordingly granted by the NSAI to **Clean Energy Ireland** on behalf of NSAI Agrément.

Date of Issue: **October 2010**

Signed 

Seán Balfe
Director of NSAI Agrément

Readers may check that the status of this Certificate has not changed by contacting NSAI Agrément , NSAI, 1 Swift Square, Northwood, Santry, Dublin 9, Ireland. Telephone: (01) 807 3800. Fax: (01) 807 3842. www.nsai.ie