Dualsun

Instructions for installation, use and maintenance Dualsun SPRING DUO/MAX/BOOST

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1. Introduction

1.1. General safety instructions

Please read this installation manual thoroughly and in detail in order to be able to fully exploit the functionality of the product. DualSun disclaims all liability for defetcs and damages that would result from non-compliance with the installation instructions (improper use, incorrect installation, handling error, etc.).

IMPORTANT

- It is important to follow these instructions for personal safety. Improper mounting may cause serious injury. The end user must keep these safety instructions.
- The installation, control, commissioning, maintenance and repair of the installation must only be carried out by qualified personnel.
- The correct functioning of the installation is only guaranteed if the installation and assembly have been carried out in accordance with the rules of the art.

CAUTION

- The entire solar installation must be installed and operated in accordance with recognized technical rules.
- All electrical work must be done according to local guidelines.
- The installation must not be used if it shows signs of damage.

DANGER

- For installations on roofs, it is necessary to comply with personal safety standards, relating to roofing and waterproofing work and relating to scaffolding work with safety net by mounting the respective devices before starting work . Refer to the recommendation published by the national risk prevention organization.
- Gloves are compulsory when handling the panels to avoid any risk of injury or burns.
- Disconnect all connection cables from the power supply before working on the installation.

1.2. General standards to be observed

To ensure safe, ecological and economical operation, all applicable regional and national standards, rules and directives must be observed, particularly the international standards mentioned below:

1.2.1. Photovoltaic solar standards

- IEC / EN 61215 1 and 2: Design qualification and approval of crystalline silicon photovoltaic (PV) modules for terrestrial application.
- IEC / EN 61730 1 and 2: Photovoltaic (PV) module safety qualification - part 1: Requirements for construction and part 2: requirements for tests.

1.2.2. Solar thermal standards

- EN 12975 1 and 2: General requirements and control method for solar thermal collectors.
- EN 12976 1 and 2: General requirements and process for testing prefabricated solar thermal installations.

1.2.3. Standard and DTU (french standard) to be respected - Plumbing and heating systems

- DTU 65.10: implementation of pressurized hot/cold water pipes as well as wastewater and rainwater pipes inside buildings
- NF EN 15316-4-2: Energy performance of buildings - Method for calculating energy needs and system efficiencies - Part 4-2: space heating generation systems, heat pump systems module M3-8-2, M8-8-2
- NF P 52-612: Heating systems in buildings - Method for calculating low heat losses
- NF EN 12977: Solar thermal installations and their components - Custom assembled installations - Part 1: general requirements for solar water heaters and combined solar installations
- DTU 65.14: execution of hot water heated floors
- DTU 65.16: heat pump installations

The installation instructions and safety instructions must be met.

Observe the regulations on the prevention of industrial accidents prescribed by professional associations, in particular those relating to work carried out on the roof.

1.3. End of life of panels

DualSun panels should be recycled



2. General description

DualSun SPRING DUO/MAX/BOOST is a new-generation hybrid solar panel that produces both electricity (photovoltaic) via its front face and heat via its rear face thanks to a finned aluminum heat exchanger.



Protected by several patents, the panel SPRING DUO/MAX/BOOST produces 4 times more energy than a photovoltaic panel of the same surface. This innovative technology allows your panel to be used:

- as the cold source of a glycoled water/water heat pump,
- to regenerate or recharge geothermal probes.
- to heat your domestic hot water

This panel makes it possible to avoid the use of an air/water heat pump and its outdoor unit (air heater), which are noisy and less efficient than a glycoled water / water heat pump.

2.1. Technical characteristics of the panel SPRING DUO/MAX/ BOOST

When in the instructions we refer to SPRING DUO/MAX/BOOST, we are referring to the following models:

Commercial name	Technical reference
SPRING MAX (SPRING with fins)	DSTFXXX-108M10TB-03 (xxx = 420 - 425 with a step of 5) DSTFxxx-108M10RTB-03 (xxx = 440) DSTFxxx-96G12RTB-03 (xxx = 455)

Commercial name	Technical reference
SPRING DUO (SPRING Insulated)	DSTIXXX-108M10TB-03 (xxx = 420 - 425 with a step of 5) DSTIxxx-108M10RTB-03 (xxx = 440) DSTIxxx-96G12RTB-03 (xxx = 455)
SPRING BOOST (SPRING Non-insulated)	DSTNXXX-108M10TB-03 (xxx = 420 - 425 with a step of 5) DSTNxxx-108M10RTB-03 (xxx = 440) DSTNxxx-96G12RTB-03 (xxx = 455)

Details of the physical, photovoltaic and thermal characteristics of the panel SPRING DUO/MAX/ BOOST are to be consulted in the technical sheet published in our online library.

The hydraulic pressure drops, the thermal behavior and the thermal power of the panel can be consulted on technical sheets of our panels as well as in appendix [44].

Specificities of the heat exchanger SPRING DUO/MAX/BOOST

SPRING DUO/MAX/BOOST heat exchanger is in Aluminium, an alloy specially dedicated to heat transfer.

We have selected this material because it allows to have a constant operating pressure in the system, and an optimal thermal exchange with the external environment of the panel which allows a better performance in case of a coupling with the heat pump evaporator.

2.1.1. Hail resistance

The panel SPRING DUO/MAX/BOOST has hail resistance level RG3.

2.1.2. Operating temperatures:

Product model	Operating temperature	Stagnation temperature
SPRING MAX	-40°C / 85°C	70°C
SPRING DUO	-40°C / 85°C	80°C
SPRING BOOST	-40°C / 85°C	70°C

2.1.3. Climate class

For the homologation of the panel we obtained grade A following the EN ISO 9806 standard.

2.1.4. Recommended hydraulic flows for the panel SPRING DUO/MAX/BOOST

Nominal average operating flow rates:

In case of direct coupling to a glycoled water/water heat pump, the flow in the panels is controlled by the heat pump to ensure the most optimal temperature delta at all times. In general, the flow rate per panel that can be observed in operation is between 20 and 200L/h/panel.

In case of recharging geothermal probes, the flow that can be observed in operation will be approximately 60L/h/panel.

Maximum recommended filling rate:

- Portrait mode panel: 60 L/h/panel

Maximum allowable flow rate:

- 500 L/h/panel

WARNING

The choice of flow rate directly impacts the hydraulic pressure

When filling the hydraulic circuit, a flow rate increase implies a pressure increase.

2.1.5. Maximum pressures allowed for DualSun panels SPRING DUO/MAX/ BOOST

CAUTION

It is imperative never to exceed 6 bar in the panels SPRING DUO/MAX/BOOST:

When measuring pressure in the technical room, always take into account the static pressure corresponding to the height H (m) between the technical room and the panels to know the exact pressure in the panels.

$$P_{panel} = P_{measured}\text{-}H/10 \text{ [bar]}$$

IMPORTANT

At the start of hydraulic filling, so as to avoid thermal shock at the panel level with the flow of the first liters of heat transfer fluid, **it is important to limit the flow to 60 L/min/panel until reaching a temperature in the panels between 30°C and 10°C.**

In this temperature range, it is then possible to reach the pressures indicated above.

2.1.6. Heat transfer fluid

Type of heat transfer fluid to be used:

In order to have good protection against freeze we recommend using a **glycol heat transfer fluid** with the following characteristics:

- Ready to use: already mixed with the correct concentration of glycol depending on the geographic area of the installation
- Anti-corrosion effect
- Lowest possible viscosity in negative temperatures

Here are the glycol references already validated with the aluminum panel exchanger SPRING DUO/MAX/BOOST :

- Antifrogen® SOL HT (Clariant International Ltd)
- Coracon Sol 5 et Coracon Sol 5F (Aqua Concept GmbH)
- ®PEKASOLar 30-50% (pro KÜHLSOLE GmbH)
- Solarliquid L (Staub & Co Chemiehandels GmbH)
- Tyfocor® L (Tyforop GmbH)
- Greenway Neo N (Climalife)



NOTE
non-exhaustive list and subject to change



NOTE
The specifications of each glycol, such as the minimum temperature according to the concentration rate, should be checked on the manufacturer's documentation.

2.2. General recommendations

2.2.1. Protection against fire / explosion

Do not install the DualSun modules in the vicinity of highly flammable gases, vapours, or dust (e.g., next to a gas station or containers). The national and local fire prevention standards and regulations must be respected during installation. For installations located on a roof, the modules must be mounted on a fire-resistant roofing cover adapted to the application.

The photovoltaic (PV) module, component of the module (PVT) has a class C fire resistance according to CEI/EN 61730-2.

However, the resistance to external fire sources of the PVT module SPRING DUO/MAX/BOOST (photo-voltaic module + heat exchanger) has not yet been evaluated.

2.2.2. Handling

DualSun modules should be handled like any glass product. To avoid accidents, injuries, or damage to the module during work, the following precautions must always be observed:

- Do not step on the modules.
- Do not drop anything on the modules.
- Protect the modules from possible scratches on the front and rear sides
- Do not exert mechanical tension on the connectors.
- Always lift and transport the modules with both hands and never use the junction box as a carrying handle.

- Never press on the exchanger part of the panel, you would damage it.

CAUTION
Never use the exchanger manifolds to transport the panel so as not to damage it and risk leaks. Always use the aluminum frame of the panel to handle it.

2.2.3. Transport

In order not to risk damaging the modules during transport, the following instructions must be observed:

- Transport the stacked modules vertically, with a separator supported by the frame of each module.
- Do not remove the original packaging until the time of installation.
- Do not apply mechanical pressure to the modules (for example, do not fasten the modules with a strap, or else do not place any object on the surface of the modules).

2.2.4. Storage

During storage, to avoid any accident or damage to the modules, the following instructions must be observed:

- Store the modules vertically.
- Do not store modules on the edges, on a corner, or on an uneven surface.
- Do not place any object on the surface of the modules.
- When choosing a suitable storage location, make sure that:
  - The location is dry and cool,
  - No object can fall on the module and thus damage it.

WARNING
If a DualSun module is damaged or broken, it must be replaced. Never install a damaged module.

2.3. Cleaning the surface of the modules

The greater the degree of contamination of the surface of the PV system, the less the cells are able to absorb the energy contained in the incident sunlight.

By tilting the panels slightly in relation to the horizontal, rain and snow can clean the surface, and thus temporarily protect them from additional contamination. However, after a while, dust, leaves or bird droppings will dirty the glass on the front panel and thereby reduce the output power.

In case of persistent soiling, the panels should be washed with cold water and a soft sponge.

To clean greasy stains such as fingerprints (especially just after installation) you can use isopropyl alcohol.

CAUTION

Never use solvents or a pressure washer, and never scrape the panel surface. Cleaning operations must be carried out by qualified professionals.

DANGER

Work at height: Refer to the recommendation published by the national risk prevention body.

3. Mechanical installation

CAUTION

The management and installation of DualSun panels and the equipment making up the complete installation must be carried out by trained and qualified personnel. The system must be assembled and operated in accordance with the instructions provided, in accordance with the local and national health and safety, and risk prevention regulations.

During assembly and operation of the system, no unauthorized person may be on the roof or around the installation.

3.1. System location

The overall yield of the photovoltaic system in series is always impacted by the module delivering the lowest power. Different factors can influence the performance of a module (shading, different orientations, fouling ...) and these impact the entire system.

Therefore, it is necessary to study the layout to avoid a shading effect on the modules in series.

In addition, all panels must be mounted with the same orientation. It is advisable to align all the modules to the solar noon, to obtain optimal performance.

DualSun suggests installing the modules in areas where **temperatures are between -20°C and +40°C,** which corresponds to the minimum and maximum monthly average temperatures, **in accordance with IEC 60364-5-51**. The extreme operating temperatures of the modules are between -40°C and +85°C.

In regions with a lot of snow and exposed to strong winds, the modules must be assembled in such a way as to ensure sufficient nominal strength and in accordance with local regulations.

Certain operating environments are not recommended for DualSun modules, and **are excluded from the DualSun Limited Warranty**:

- No panel should be mounted on a site where it may be exposed to direct contact with :
  - salt water
  - acid rain
  - active chemical vapors or any other aggressive environment
- DualSun modules must not be installed near flammable liquids, gases, hazardous materials or on any type of vehicle.
- It is recommended to install the photovoltaic modules at altitudes below 2000 m

3.2. Angle of inclination

The optimal mounting position of the DualSun solar panels corresponds to an angle of incidence of the sun's rays of 90 ° relative to the surface of the panels (i.e. perpendicular to the panels). To optimize the output of the installation, the panels must be installed with the optimal orientation and angle of inclination. These positioning angles depend on the geographic location of the installation and can be calculated by a qualified solar installer. Wherever possible, the panels of a group must have the same orientation and the same inclination in order to avoid any underperformance of the system due to inconsistent productions.

DualSun recommends a minimum tilt angle of 5 ° from the horizontal to reduce the clogging effect.

The cleaning frequency should be increased for modules installed with a very low angle of inclination from the horizontal.

3.3. Static roofing requirements

The solar installer must ensure that the roof structure can carry the additional weight of the hybrid system.

3.4. Installing DualSun modules

The panels SPRING DUO/MAX/BOOST **can only be installed in portrait.**

DualSun does not provide the module fixing system: for proper installation, refer to the installation instructions for the chosen fixing system.



NOTE

The list of mounting systems compatible with DualSun modules is available in the "Mounting systems compatibility" document in our online library



CAUTION

Even when solar radiation is low, the photovoltaic system produces direct current (DC). This DC current flows from the module to the inverter, do not handle the module or connections without protection.

The modules are qualified for use in class II and comply with standards IEC / EN 61215-2 and IEC / EN 61730-1. These standards concern PV modules for use on buildings, or on ground structures.

Artificially concentrated solar radiation must not be directed onto the module.

The frame thickness and the dimensions of the SPRING panel are identical to photovoltaic panels. It adapts easily to photovoltaic mounting systems; however, it is necessary to ensure the positioning of the hoses in relation to the mounting system frame and to the roof covering surface.

The mounting system must have a flat surface for mounting the panel and must not cause twisting or stress on the panel, even in case of thermal expansion.

We also remind that the waterproofing of the roof is not ensured by the panels but by the panels mounting system and that the drainage must be provided.

It is necessary to provide a space between the frame of the panels and the structure or the floor to avoid damage to the cables and hydraulic fittings.

The panel mounting systems must be installed only on buildings that have been formally validated for structural integrity, and which have been considered capable of supporting the additional weight of the panels and mounting systems, by a certified building specialist or engineer.

The supplier of the mounting system must take into account the galvanic corrosion which may appear between the aluminium frame of the panels and the mounting system or the grounding parts if they are made of different metals.

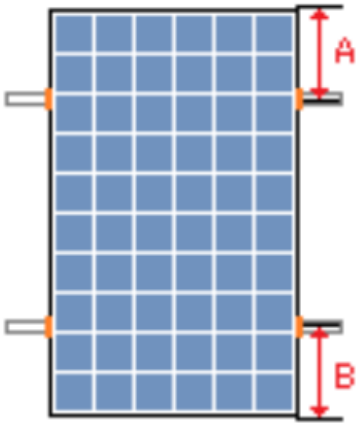
The module is only certified when its original frame is completely intact. Do not remove or modify the module frame in any way. Drilling additional mounting holes is likely to damage the module and reduce the strength of the frame, and thus is not allowed.

The use of flanges and fasteners with additional grounding bolts or grounding connectors shall be in accordance with this safety and installation instruction manual and according to the conditions of Grounding and lightning protection [25].

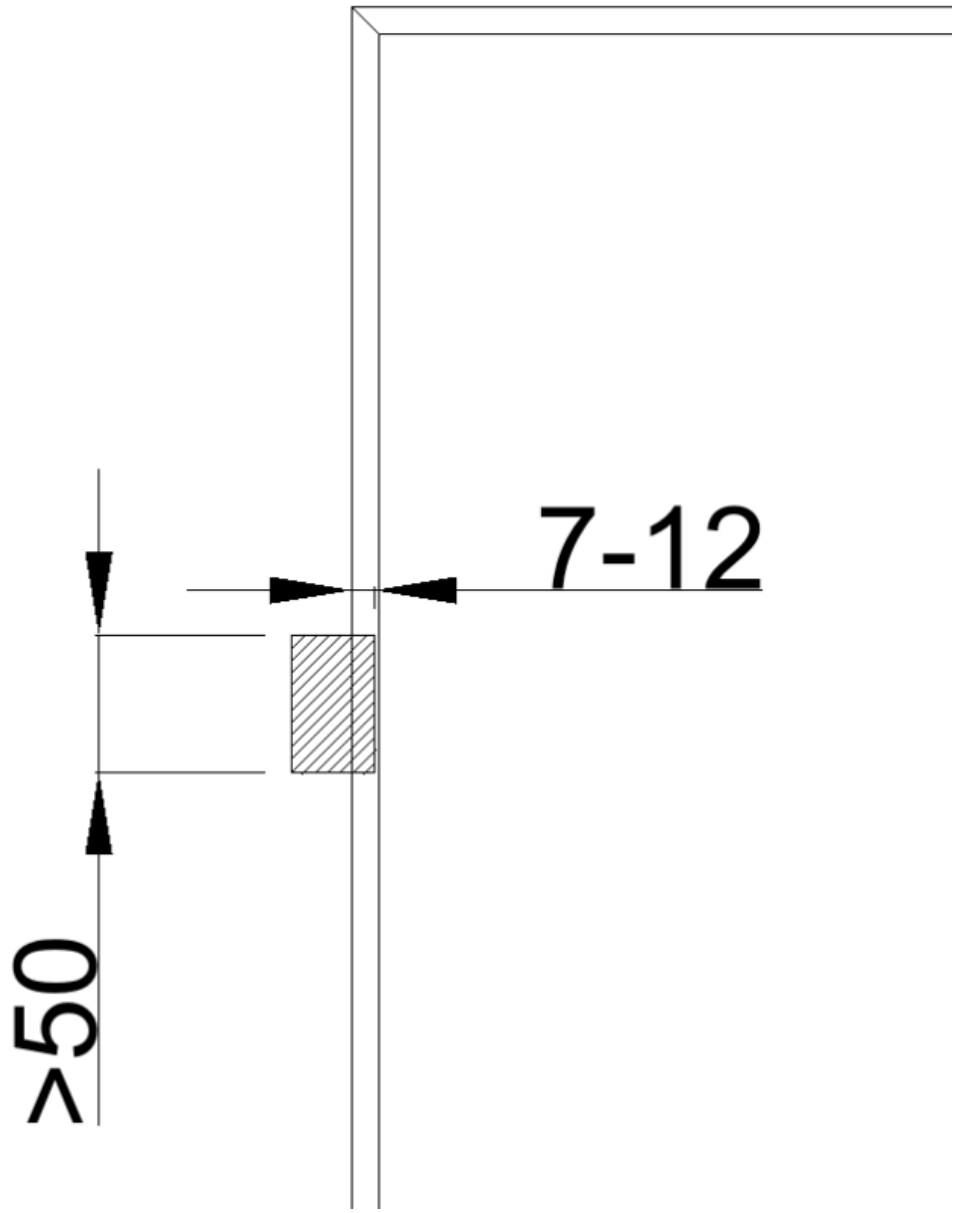
The modules can be installed according to the following methods:

1. **Frame holes:** Attach the module to the structure using the factory-made mounting holes. It is recommended to use four M8x16 mm stainless steel screws with bolts, washers and lock washers for each module. The maximum tightening torque of the bolts is 24 N.m. This method has not been tested as part of the certification.
2. **Brackets or clamps** : the clamps can be mounted on the longitudinal (longest side) or lateral (shortest side) side of the module. The areas allocated to these clamps are specified in Installation areas on the rails of the mounting system.

> **NOTE**
> When certifying panels SPRING DUO/MAX/BOOST, only the configuration with clamps mounted on the longitudinal side (longest side) was tested, with a position of the clamps according to the diagram below with A=B=322mm.



3. When installing the clamps, please consider the following measures:
   - Do not bend the frame of the module.
   - Do not touch the glass or cast shadows on the front glass.
   - Overlap in depth of the clamps on the frame: between 7mm and 12 mm
   - Minimum clamps width: 50mm.
   -Maximum clamps spacing: 31mm
   -Minimum clamps width: 50mm.
   - Minimum thickness of the clamps: 3mm
   Installers must ensure that the strength of the clamps is sufficient given the maximum pressure to which the module can be exposed. The clamps are not supplied by DualSun



IMPORTANT
It is important to make sure that the clamps do not distort the top of the aluminium frame of the DualSun panel, this may weaken or even break the glass.

CAUTION
The tightening torque of the clamps must not exceed 24 N.m.

WARNING
The compatibility of the mounting system with the modules must be assessed before any installation, especially when the system does not use brackets or clamps.

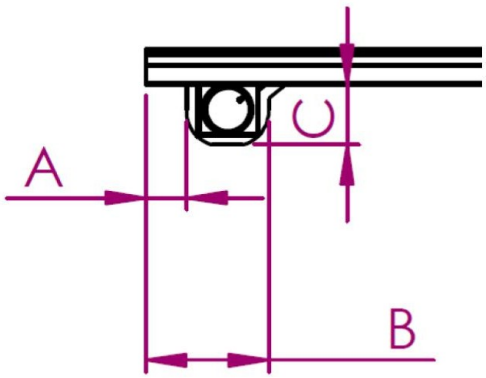
IMPORTANT
To allow the positioning of the inlet outlet fittings between two hydraulic lines, the end and start of the line panels must be spaced apart by 80 mm in a plug versus elbow fitting configuration.

3.5. Over-raising the panels SPRING DUO/MAX/BOOST compared to the roof

It is necessary to ensure that the size of the hydraulic connections corresponds to the distance allocated by the laying system, between the surface of the roof and the lower edge of the module frame, which will be in contact with the mounting system.

See dimensions in the table below (dimensions given in mm):

Technical reference	A	B	C
DSTFXXX-108M10TB-03	43	93	42
DSTNXXX-108M10TB-03	43	93	42
DSTIXXX-108M10TB-03	33	115	50
DSTFXXX-108M10RTB-03	63	113	42
DSTNXXX-108M10RTB-03	63	113	42
DSTIXXX-108M10RTB-03	53	135	50
DSTFxxx-96G12RTB-03	63	113	42
DSTNxxx-96G12RTB-03	63	113	42
DSTIxxx-96G12RTB-03	53	135	50



CAUTION
The size of the manifolds on the rear face of the panels SPRING DUO/MAX/BOOST must be carefully considered to avoid contact between the fittings and the surface of the roof covering.

NOTE
To ensure good air circulation between the panel and the roof, a distance of 30mm must be ensured between the roof and the panel.

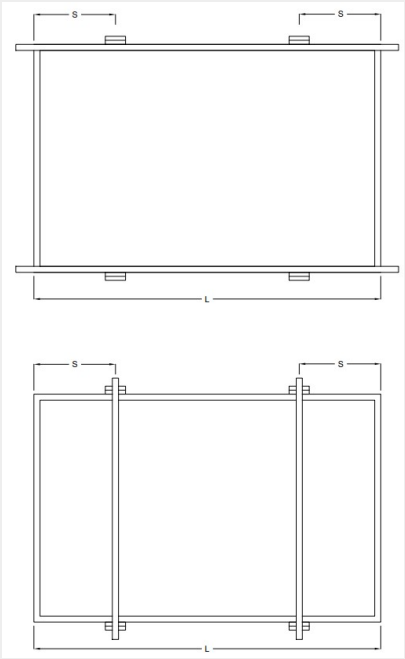
3.6. Installation areas on the rails of the mounting system

Dualsun panels SPRING DUO/MAX/BOOST are **certified in mechanical test load according to the IEC standard** in a **standard configuration with four clamps along the long side** :

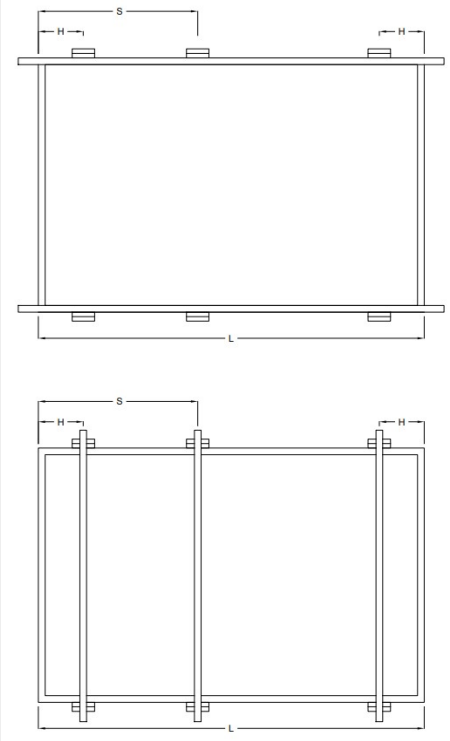
- 6600 Pa positive (pressure) and -3600 Pa negative (depression) for the DSTF/N/Ixxx-108M10RTB-03, DSTF/N/Ixxx-108M10RTB-03 and DSTF/N/Ixxx-96G12RTB-03 versions (maximum design load of 4400Pa/-2400Pa (safety factor of 1.5)).
- 5400 Pa positive (pressure) and -2400 Pa negative (negative pressure) for the DSTF/N/Ixxx-108M10TB-03 version (maximum design load of 3600Pa/-1600Pa (safety factor of 1.5)). Note: This version has however undergone an additional test without certification (R&D test, excluded from the scope of IEC 61215/61730) which allows it to claim a mechanical resistance of +6600/-3600Pa (TUV Rheinland - test report n°DE23R5E4 001)

All dimensions specified in this table are in mm.

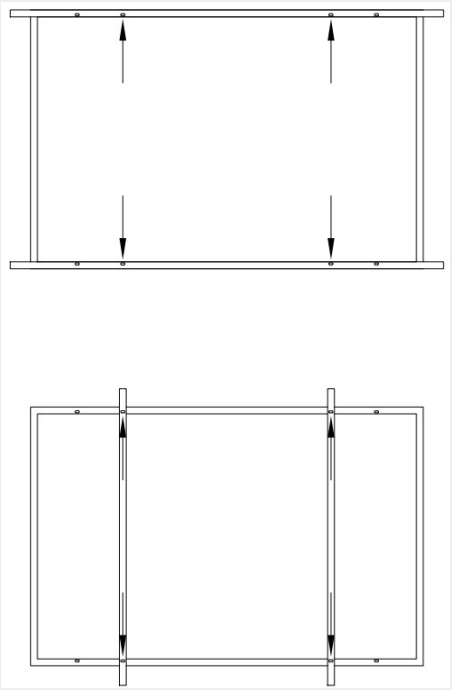
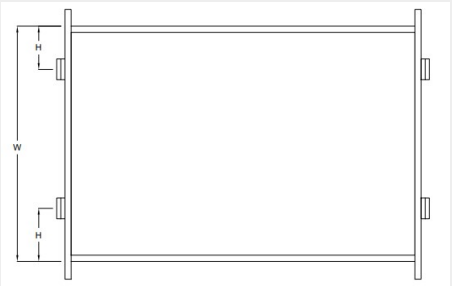
DSTFxxx-108M10TB-03 ; DSTNxxx-108M10TB-03 ; DSTIxxx-108M10TB-03 **DSTFxxx-108M10RTB-03 ; DSTNxxx-108M10RTB-03 ; DSTIxxx-108M10RTB-03** **DSTFxxx-96G12RTB-03 , DSTNxxx-96G12RTB-03 ; DSTIxxx-96G12RTB-03**	
Installation method	4 clamps on the long side (certified)

DSTFxxx-108M10TB-03 ; DSTNxxx-108M10TB-03 ; DSTIxxx-108M10TB-03 **DSTFxxx-108M10RTB-03 ; DSTNxxx-108M10RTB-03 ; DSTIxxx-108M10RTB-03** **DSTFxxx-96G12RTB-03 , DSTNxxx-96G12RTB-03 ; DSTIxxx-96G12RTB-03**	
Installation	
Position of clamps	(1/5*L-50) < S < (1/5*L+50)
Maximum test load	6600Pa positive, 3600Pa negative (for DSTF/N/Ixxx-108M10RTB-03 and DSTF/N/Ixxx-96G12RTB-03) 5400Pa positive, 2400Pa negative (for DSTF/N/Ixxx-108M10TB-03)
Maximum design load	4400Pa positive, 2400Pa negative (for DSTF/N/Ixxx-108M10RTB-03 and DSTF/N/Ixxx-96G12RTB-03) 3600Pa positive, 1600Pa negative (for DSTF/N/Ixxx-108M10TB-03)

DSTFxxx-108M10TB-03 ; DSTNxxx-108M10TB-03 ; DSTIxxx-108M10TB-03 **DSTFxxx-108M10RTB-03 ; DSTNxxx-108M10RTB-03 ; DSTIxxx-108M10RTB-03** **DSTFxxx-96G12RTB-03 , DSTNxxx-96G12RTB-03 ; DSTIxxx-96G12RTB-03**		
Installation method	6 clamps on the long side (excluding certification)	

DSTFxxx-108M10TB-03 ; DSTNxxx-108M10TB-03 ; DSTIxxx-108M10TB-03 **DSTFxxx-108M10RTB-03 ; DSTNxxx-108M10RTB-03 ; DSTIxxx-108M10RTB-03** **DSTFxxx-96G12RTB-03 , DSTNxxx-96G12RTB-03 ; DSTIxxx-96G12RTB-03**		
Installation		
Position of clamps	(1/2L-80) < S < (1/2L-30) ; (1/6L-50) < H < (1/6L+50)	
Maximum test load	6600Pa positive, 3600Pa negative	
Maximum design load	4400Pa positive, 2400Pa negative	

DSTFxxx-108M10TB-03 ; DSTNxxx-108M10TB-03 ; DSTIxxx-108M10TB-03 **DSTFxxx-108M10RTB-03 ; DSTNxxx-108M10RTB-03 ; DSTIxxx-108M10RTB-03** **DSTFxxx-96G12RTB-03 , DSTNxxx-96G12RTB-03 ; DSTIxxx-96G12RTB-03**		
Installation method	4 bolts in the mounting holes on the long side (excluding certification)	4 clamps on the short side (excluding certification)

DSTFxxx-108M10TB-03 ; DSTNxxx-108M10TB-03 ; DSTIxxx-108M10TB-03 **DSTFxxx-108M10RTB-03 ; DSTNxxx-108M10RTB-03 ; DSTIxxx-108M10RTB-03** **DSTFxxx-96G12RTB-03 , DSTNxxx-96G12RTB-03 ; DSTIxxx-96G12RTB-03**		
Installation		
Position of clamps		0 < H < 1/4*W
Maximum test load	6600Pa positive, 3600Pa negative (for DSTF/N/Ixxx-108M10RTB-03 and DSTF/N/Ixxx-96G12RTB-03)	2400Pa positive, 1600Pa negative
Maximum design load	4400Pa positive, 200Pa negative	1600Pa positive, 1066Pa negative

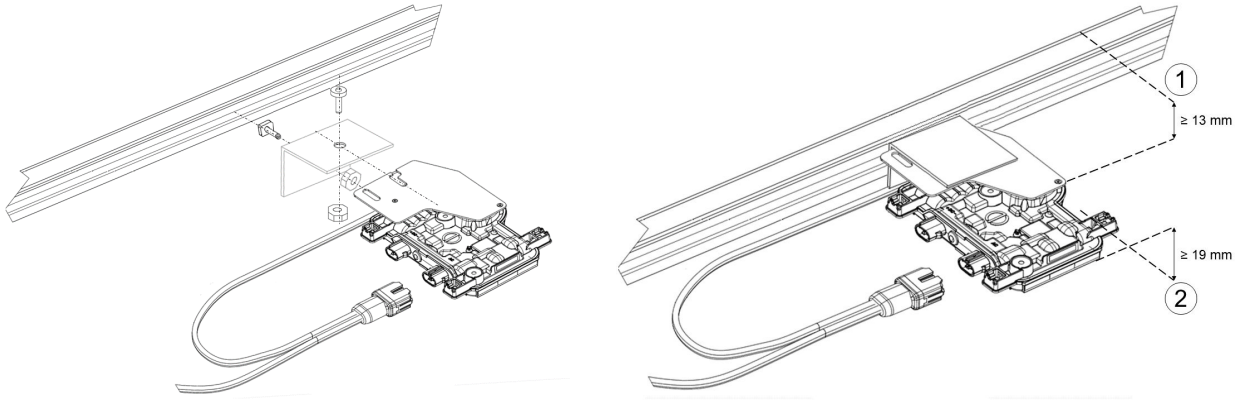
3.7. Microinverter position

CAUTION
Do not interface the rails of the laying system with the hydraulic connections, the areas of which are delimited in the plan above.

WARNING

No element fixed on the rails can be in contact with the rear face of the panel. For example micro-inverter or optimizer.

Use a mechanical mounting element adapted to the rails of the installation system to fix the microinverter or optimizer in such a way as to ensure a minimum distance of 19 mm between the roof and the microinverter or optimizer and 13 mm between the back of the modules SPRING DUO/MAX/BOOSTand the upper part of the microinverter or optimizer. See assembly example below:



1. Panel bottom frame edge SPRING DUO/MAX/BOOST
2. Roof area

4. Electrical Installation

Electrical connection [22]

Electrical fittings, cables and diodes [24]

Grounding and lightning protection [25]

Indirect lightning strike [26]

4.1. Electrical connection

The nominal electrical parameters Isc, Voc and Pmax of the modules are determined under standard STC (Standard Test Condition) test conditions: illumination of 1000 W/m² with a spectrum of 1.5 AM and a cell temperature of 25° C.

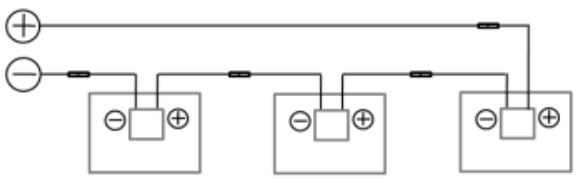
These values may vary according to the tolerances defined in the table below:

Tolerances under Standard Test Conditions (STC)	DSTF/I/ Nxxx-108M10TB-03	DSTF/I/ Nxxx-108M10RTB-03	DSTF/I/ Nxxx-96G12RTB-03
Pmpp	0/+3%	±3%	0/±3%
Isc	±4%	±4%	±4%
Voc	±4%	±3%	±3%

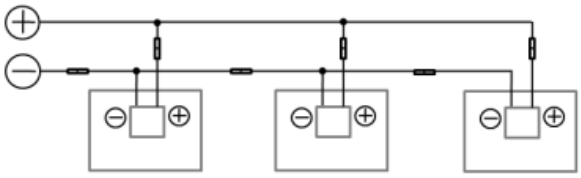
NOTE

Under normal conditions, a photovoltaic module is likely to be exposed to conditions which produce more current and / or voltage than what is measured under standard test conditions. Therefore, **the maximum values of I_{SC} and V_{OC} noted on the module should be multiplied by 1.25 when determining the rated voltage of the components**, the nominal current of the conductors, the size of the fuses, and the size of the control tools connected to the PV output

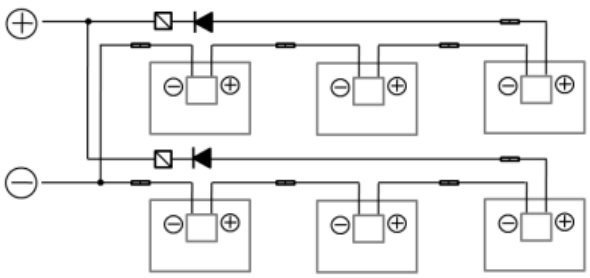
Wiring in series



Wiring in parallel



Serial / parallel wiring



Diode Overcurrent protection Connector

1. **Wiring in series**

To wire modules in series, the maximum number of connectable modules must be determined. For this it is necessary to determine the maximum voltage of the string. This is calculated by adding the open circuit voltage (V_{OC}) of each module when the ambient temperature is at its minimum value. Apply the temperature coefficient to know the V_{OC} value at the temperature considered.

The maximum open circuit voltage of the string should never exceed the maximum system voltage. See module data sheet.

Determination of the maximum number of modules that can be connected in series:

N = Maximum_system_voltage/(1.2 * Voc)

Where:

- N = Maximum number of modules in series
- V_{OC} = open circuit voltage of each module, when the ambient temperature is at its minimum value (refer to the product technical sheet)

WARNING

If additional PV modules must be installed in string with DualSun modules, their power and current must be equal to those of DualSun panels within the limits of manufacturers' tolerances

2. **Wiring in parallel**

For DualSun modules connected in parallel, a corresponding overcurrent protection must be used. To this end, a DC voltage fuse must be used to avoid reverse current. Refer to the maximum reverse current value in the product data sheet to determine the protection value. In addition, the operating conditions and design rules of the inverter manufacturer must be observed.

In case no string circuit breaker is used, the maximum number of authorized strings in parrallel is limited to 2. For 3 strings in parrallel or above, string circuit breakers correctly sized have to be used. In this case, the maximum number of strings in parrallel is limited by the combiner box or inverter electrical caracteristics and the system designer has to check these components technical datasheet to correctly define the number of strings in parrallel.

CAUTION

Refer to the instructions of the inverter used

WARNING
For modules connected in parallel, only modules with the same nominal voltages will be used

The electrical installation must be carried out by qualified personnel and in accordance with current safety standards and IEC / EN 61730.
Refer to the grid operator requirements when installing the system.
The installation must be equipped with a circuit breaker to isolate at the same time all the cables that are not grounded by a minimum spacing of 3 mm at the contact level.

4.2. Electrical fittings, cables and diodes

The DualSun solar modules are supplied with cables, connectors, and a pre-equipped junction box. Before installation, check that the plugs and connections are not damaged.

Connect the positive plug of a module to the negative plug of the next module; see identification of the polarity of the EVO2 (manufacturer : Stäubli) connectors below:



To connect the modules, special solar cables with a minimum diameter of 4 mm^2 should be used. Only identical connectors (same brand and model) should be used. We therefore recommend the use of Stäubli Electrical type EVO2 connectors which are those present on the panels. These cables must be UV and wear resistant. Avoid leaving cables exposed to the elements or place them in a protective sheath.

Respect a minimum bending radius of 40 mm.

When connecting the connectors, it is important to ensure that they are connected in a watertight manner (minimum IP67).

When handling these cables, make sure that the tools used are dry.

All modules are supplied with pre-installed bypass diodes to minimize hot spots and module current losses in the event of (partial) shading.

CAUTION
Never connect or disconnect a live circuit

CAUTION
Never open the junction box

The junction box of the DualSun module contains bypass diodes which are in parallel connection with the cell wires. If a hot spot occurs locally on one or more cells, the diode will enter into service to prevent the main current from flowing through the hot cells in order to limit overheating and loss of performance of the module. However, the bypass diode is not the overcurrent protection device.

If the LED appears to be out of order, the installer or system service agent should contact DualSun.

The maximum rating of a fuse connected in series with a cell chain is generally 15A, but the specific rating of the module can be found on the product label and in the product data sheet.

The diodes which are used as blocking diodes must have:

- Maximum average value tolerable by the junction [IF (AV)] above the maximum system current at the highest operating temperature of the module.
- Maximum repetitive peak value tolerable by the junction [VRRM] above the maximum system voltage at the lowest module operating temperature.

4.3. Grounding and lightning protection

CAUTION
The evaluation and design of the bonding and lightning protection system of PV installations must be carried out by trained and qualified personnel. It is imperative to refer to the local regulations in force to comply with specific requirements

DualSun modules must be grounded with prongs, lugs or other suitable means.

Grounding can be done through the holes made for this purpose as part of each module. These holes allow the earth cable to be attached and connected to the equipotential bonding.

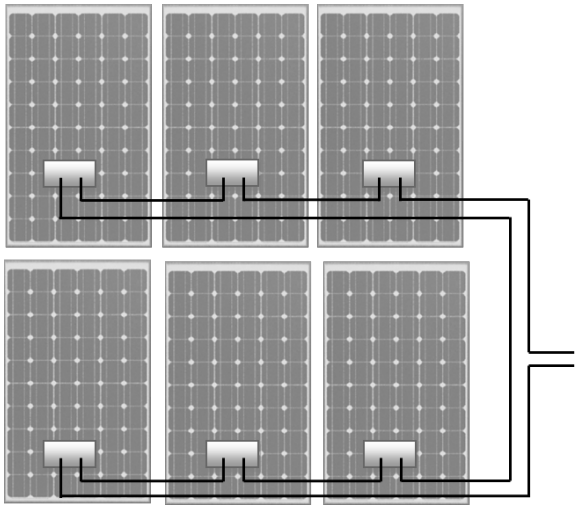
The frame of the panels is delivered with two grounding holes at each corner of the frame.

NOTE
Make sure that the grounding is carried out with the appropriate connections (**stainless steel**), to avoid anodizing or oxidation of the module frame at the hole provided for grounding. The grounding device must be in good contact with the aluminum frame of the module.

Avoid direct contact between aluminum and copper by using an intermediate metal such as stainless steel or tin.

4.4. Indirect lightning strike

The installation must also be protected from indirect lightning strikes. Indeed, the drivers of the system can become inductive if a lightning strike erupts in the vicinity of the installation. To prevent this phenomenon, the electrical cable loops must be avoided and the surface between the cables must be as small as possible, as can be seen in the graph below:



4.5. Capacitor effect

All photovoltaic panels act like a capacitor between the cells and any surrounding conductive surface.

The panel field, through its electrical capacity, then generates an alternating voltage. This creates a current that flows to earth called leakage current.

This leakage current is added to the fault current to create the residual differential current. It is this current that is detected by the installation's differential and can trigger it.

Only the fault current, created by an electrical insulation fault, is dangerous for people.

So, as long as the panels are properly earthed, this leakage current is not dangerous for people but can trip a differential circuit breaker.

The SPRING DUO/MAX/BOOST has a higher capacity than a FLASH panel due to the presence of the electrically conducting exchanger near the cells. Its average measured capacity is 18nF

It is therefore all the more recommended to pay attention to this subject in an installation containing SPRING DUO/MAX/BOOST.

4.6. Prepare your installation well to avoid an untimely disconnection

Today, choosing the right equipment helps prevent these problems from appearing:

If the installation has an inverter with transformer, the galvanic isolation between the panels and the AC circuit allows them to be decoupled and prevents the appearance of leakage currents.

In case the inverter does not have a transformer, it is recommended to install a 300mA RCD (residual current device). The latter accepts much higher residual currents than the usual 30mA.

The latter has been authorized since amendment A5 of standard NF C 15-100 provided that the earth connection is less than or equal to 167 ohms and that no power connection is implemented on the AC side of the PV IP.

5. Hydraulic installation

Hydraulic installation of solar panels SPRING DUO/MAX/BOOST on a line is broken down into the following steps:

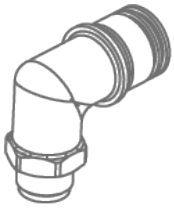
1. Inserting and locking the inlet-outlet fitting on the **first panel of the line** (respecting the direction of circulation of the heat transfer fluid)
   Hydraulic connection of the inlets-outlets to the panels [29]
2. Hydraulic connection of the inputs/outputs to the transfer circuit: Hydraulic connection of the inlets-outlets to the transfer circuit [30]
3. Inserting and locking the cap on the **first panel** of the line (respecting the direction of circulation of the heat transfer fluid)
   connecting the plugs [28]
4. Installation of the first panel [31]
5. Installation of line panels
   Inter-panel hydraulic connection [31]
6. Repeat steps 4 and 5 until the penultimate panel is installed
7. Inserting and locking the inlet-outlet fitting on the **last panel of the line** (respecting the direction of circulation of the heat transfer fluid)
8. Inserting and locking the cap on the **last panel of the line** (respecting the direction of circulation of the heat transfer fluid
9. Installation and fixing of the last panel

NOTE
The panels SPRING DUO/MAX/BOOST can only be installed in portrait mode.

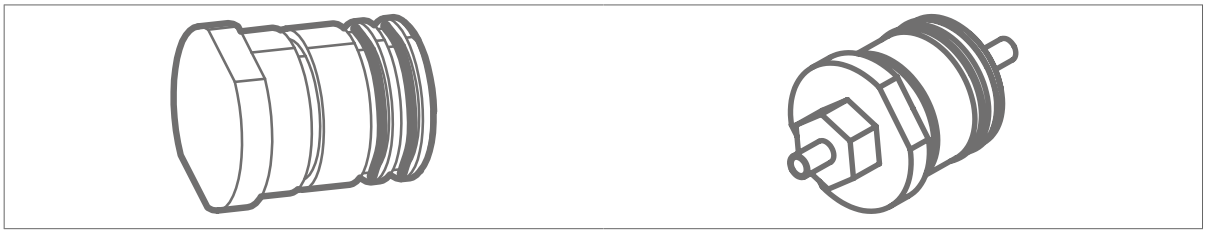
5.1. Inlet-Outlet Kit

Inlet-Outlet Kit
The Inlet-Outlet kit consists of the following elements:

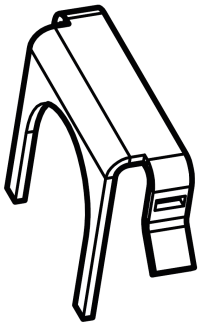
- Elbow fittings (with dielectric fitting)



- Plugs (with OR without steam trap)



- Blocker



5.1.1. Hydraulic connection of the inlets-outlets to the panels

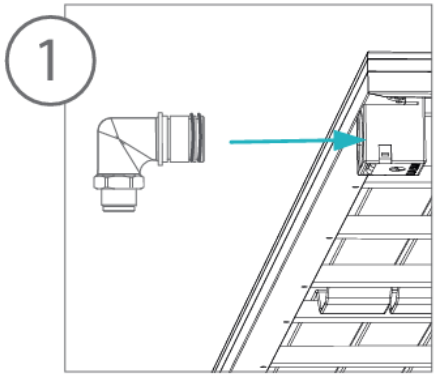
In order to connect the kits to the circuit it is important to take into account the size of our fittings: 1"1/4 or 3/4" depending on the kit chosen

Necessary material :

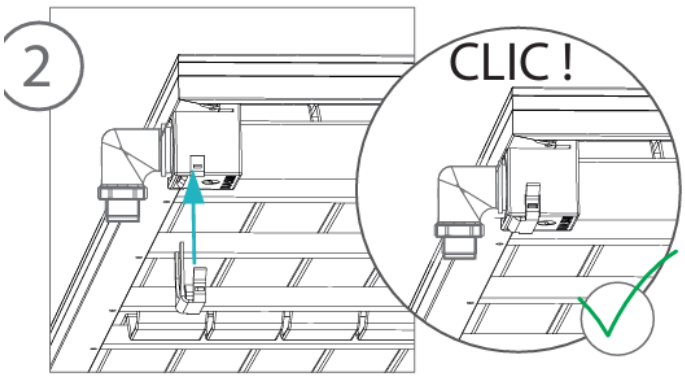
- Elbow fittings (with dielectric fitting)
- Blocker
- Grease

Assembly steps:

- Insert the greased elbow fitting into the manifold



- Locking the fitting with the blocker



GREASE HANDLING

Be careful when handling grease not to put any inside the fitting. If by mistake you put some in, it is imperative to remove it with a wipe.

5.1.2. Hydraulic connection of the inlets-outlets to the transfer circuit

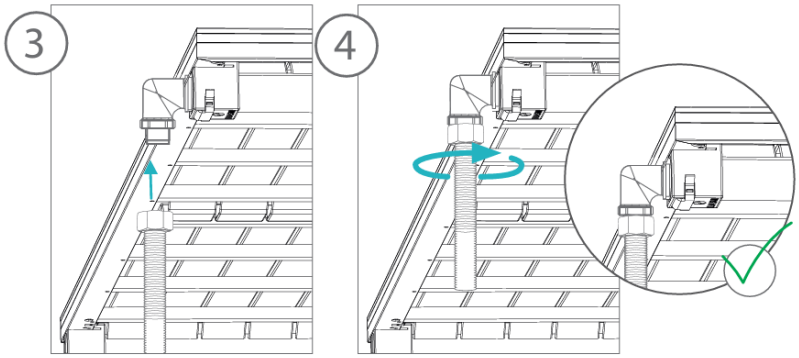
In order to connect the kits to the circuits it is important to take into account the size of our connections: 1"1/4

Necessary material :

- female connector (not supplied)
- joint (not supplied)
- Mounting tools (not included)

Assembly steps:

- Insert joint into fitting
- Screw the female fitting to the elbow fitting provided in the kit



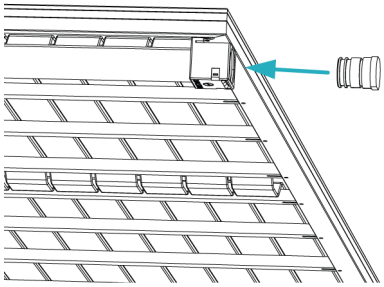
5.1.3. Adding plugs

Necessary material :

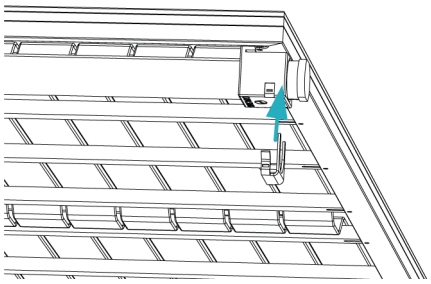
- Plug
- Blocker
- Grease

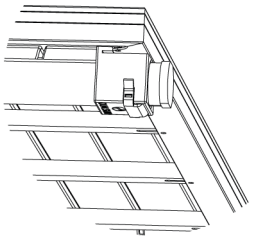
Assembly steps:

- Inserting the greased plug into the manifold



- Locking the cap with the blocker





GREASE HANDLING

Be careful when handling grease not to put any inside the fitting. If by mistake you put some in, it is imperative to remove it with a wipe.

5.2. Installation of the first panel

The first panel is placed at the start of the line like a standard photovoltaic panel using the installation system you have chosen before. Be careful not to interfere with the manifold and the installation rails and carefully take into account the recommendations in the chapter: Installation of DualSun modules [17].

For reasons of space management, it is important to first insert and fix the inlet-outlet connector and the plug on the panel.

CAUTION

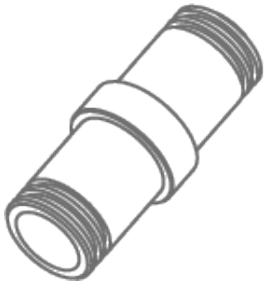
Do not interfere with the manifold with the installation rails and take into account the recommendations in the chapter: installation of modules [13]

5.3. Inter-panel hydraulic connection

The panelSPRING DUO/MAX/BOOST are designed to be simply assembled via stainless steel inter-panel connections.

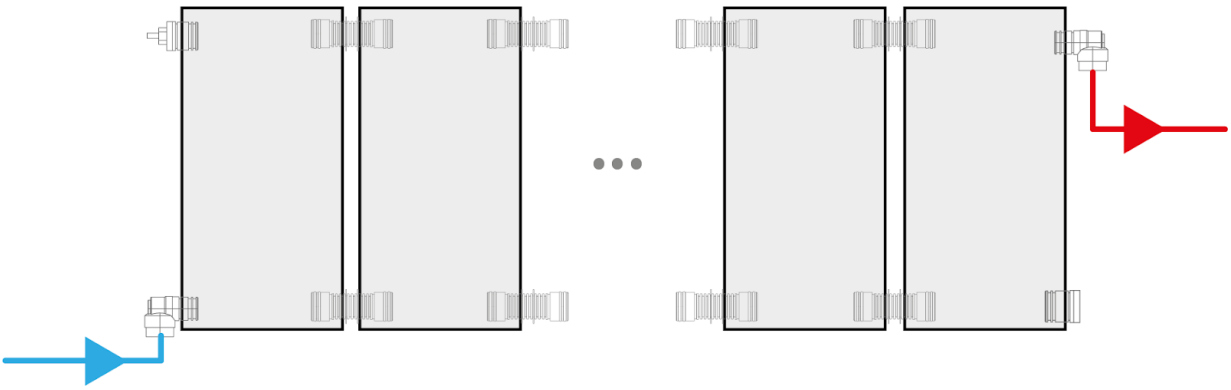
Necessary material :

- 2 inter-panel links per connection

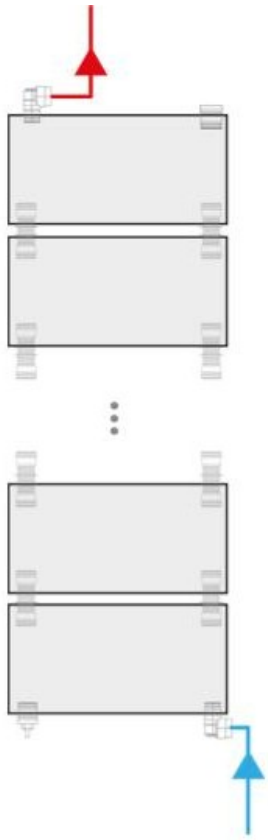


- grease

The Dualsun panel SPRING DUO/MAX/BOOST is designed to be installed and connected in portrait mode:



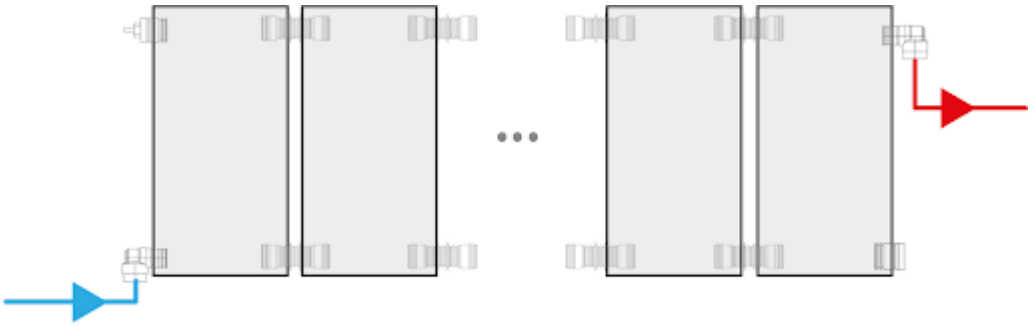
A landscape pose with a portrait connection is possible:



WARNING
Landscape mode installation with landscape connection is not possible.

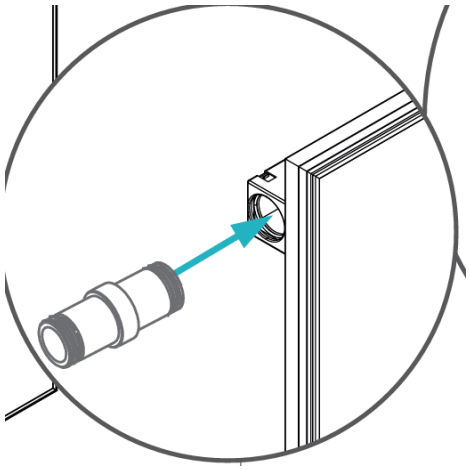
WARNING
For good heat exchange and good air flow, the finned SPRING4 /MAX can only be installed in portrait mode

All hydraulic connection directions can work with the panels SPRING DUO/MAX/BOOST. On the other hand, to optimize thermal production we recommend a so-called Z connection: input at the bottom of the panel and output at the top on the opposite side

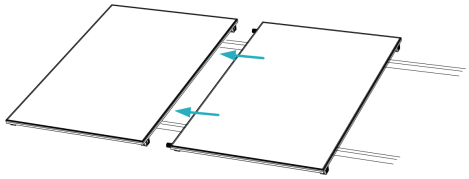


Assembly steps:

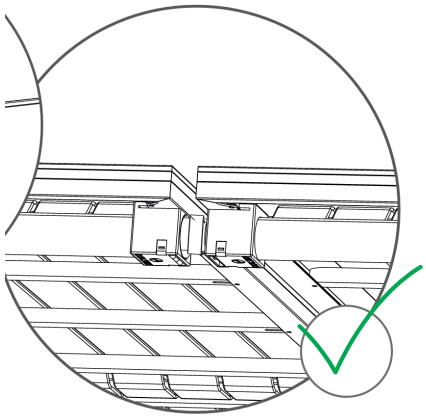
1. installation of the first module on the structure
2. Securing the module with the brackets
3. lubrication of inter-panel connections
4. Insertion of the 2 greased inter-panel connectors in the manifold at the top and bottom of the side of the fixed panel on the roof



5. Installation of the panel by inserting the connectors into the fixed panel



6. Securing the module with the brackets

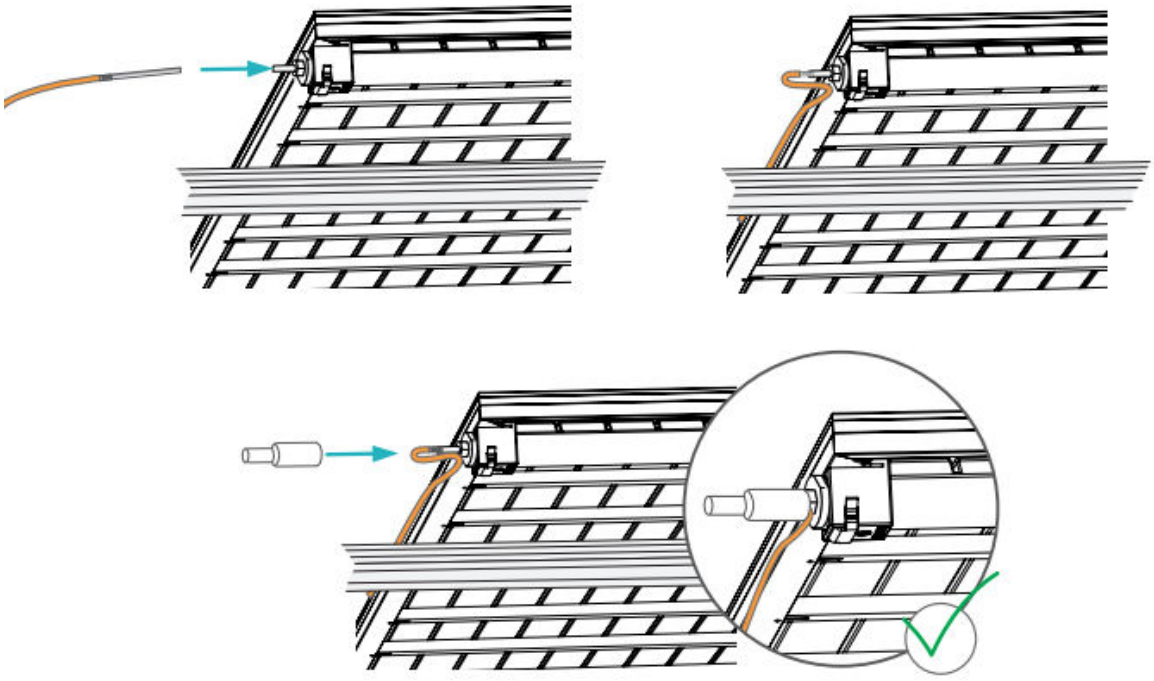


7. Repeat step 3 for each panel added

GREASE HANDLING
Be careful when handling grease not to put any inside the fitting. If by mistake you put some in, it is imperative to remove it with a wipe.

5.4. Panel temperature probe

The probe is inserted into the sensor fitting present on the cap of the inlet/outlet kit



For applications that require control linked to the panel temperature, or for monitoring, it is possible to insert a temperature probe into the elbow fitting at the panel inlet and/or outlet.

NOTE
Place the panel temperature probe and wind its cable properly before placing the panel on the mounting system.

IMPORTANT
It is important to include the installation of the panel temperature probe cable in the routing of the transfer lines. It is necessary to route a probe wire to the roof to connect the panel temperature probe to the solar regulation

For this, use a cable with at least two conductors with a diameter greater than 0.5mm^2 (2G0.5)

NOTE
The probe must then be connected to the solar controller

Refer to the instructions for the solar controller used.

5.5. Hydraulic balancing of panel fields

In the case of panel fields, the panel lines can be connected in parallel. To ensure proper thermal operation, the heat transfer fluid must circulate at the same speed in each panel. It is therefore important to ensure hydraulic balancing when several lines of panels are connected to the same hydraulic circuit.

Hydraulic balancing of panel fields for DualSun pressurized system [37]

Hydraulic balancing of panel fields for DualSun solar swimming pool heating system

5.5.1. Selection of transfer lines

The choice of transfer lines must be considered in order to:

- optimize ease and cost of installation
- limit linear pressure losses

Indeed, the flow of the heat transfer fluid passing through the transfer lines is a function of the number of panels. This determines the diameter of the pipes to limit the linear pressure losses. The choice of pipe diameter can change the choice of pipe material according to technical and economic criteria.

Selection of transfer lines - Pressurized system

Selection of transfer pipes for DualSun solar swimming pool heating system

5.5.2. Selection of transfer lines - Pressurized system

1. **Selection of material for transfer lines**
   For the connection of the solar station to the fields of panels, three types of pipes can be used:
   For the connection between the technical room and the field of panels, it is necessary to use a material compatible with the operating temperatures and pressure of the panel:

- -20°C to +80°C
- 6 bar maximum

Types of pipes that can be used:

- Copper pipes
- Stainless steel pipes
- PEX-Al-PEX multilayer pipes
- Aquatherm type polypropylene pipes

It is possible to choose PEX-Al-PEX multilayer transfer pipes due to the limited temperatures (<80°C) and pressures (<< 6 bar) in the solar circuit with DualSun hybrid solar panels SPRING DUO/MAX/BOOST.

Note :

- The hydraulic circuit must be designed taking into account the rate of thermal expansion of the pipes
- The hydraulic lines must resist UV rays, corrosion due to external agents and wildlife (rodents, birds) for parts exposed to the outdoors
- Hydraulic lines and fittings must be of compatible materials

2. **Selection of the diameter of the transfer lines**

The choice of the diameter of the transfer lines limits the pressure losses in the solar circuit and guarantees a good hydraulic filling when commissioning the system. As an indication, the following charts have been defined according to the recommended flow rate for each application.

The flow rates per application are recommended to optimize heat exchange.

a. **Nominal flow = 60 L/h/panel**

i. **Polypropylene (Aquatherm type)**

Number of panels	1 → 9	10 → 16	17 → 30	31 → 54	55 → 102
Pipe diameter	DN20	DN26	DN32	DN40	DN50

ii. **Corrugated stainless steel**

Number of panels	1 → 8	9 → 14	15 → 24	25 → 44	45 → 76
Pipe diameter	DN16	DN20	DN25	DN32	DN40

b. **Nominal flow = 100L/H/panel**

i. **Polypropylene (Aquatherm type)**

Number of panels	1 → 12	13 → 24	25 → 44	45 → 80
Pipe diameter	DN26	DN32	DN40	DN50

ii. **Corrugated stainless steel**

Number of panels	1 → 8	9 → 14	15 → 26	27 → 46
Pipe diameter	DN20	DN25	DN32	DN40

5.5.3. Hydraulic balancing of panel fields for DualSun pressurized system

IMPORTANT

The installation of isolation valves is necessary for:

1. Improve the bleeding of the air contained in the hydraulic circuit during filling while commissioning: Fill line by line in order to purge the air contained in the circuit more quickly and ensure the proper bleeding of each line
2. Carry out targeted maintenance operations: In the event of a fault on a hydraulic line, locking out the defective line makes it possible to intervene without stopping the installation. Only the faulty line can therefore be drained for maintenance. The filling of the hydraulic line on which the maintenance was carried out must then be carried out by isolating all the other hydraulic lines to avoid injecting air into the general circuit.

Be careful when isolating a hydraulic line, it is important to take into account that it will be isolated from the expansion tank. It is therefore important to limit the isolation duration or to ensure that the line is purged to avoid overpressure.

NOTE

Optimization for note 2 above:

In the case of an installation on a flat roof or on the ground, with the possibility of handling and supplying energy to a mobile filling pump, it is recommended to install a hydraulic tee fitting with shut-off valve at the inlet and outlet of each hydraulic line. Elements marked (8) in the diagrams below.

The installation of hydraulic T-fittings with shut-off valve thus allows filling only a hydraulic line on which intervention may be necessary, without isolating the rest of the installation.

This solution also allows direct hydraulic filling adjustments to optimize the air purge of the panels.

WARNING

It is recommended to install an automatic air vent fitted with a shut-off valve at each high point of the installation.

It is recommended to close the shut-off valve of each air vent a few weeks after the hydraulic commissioning.

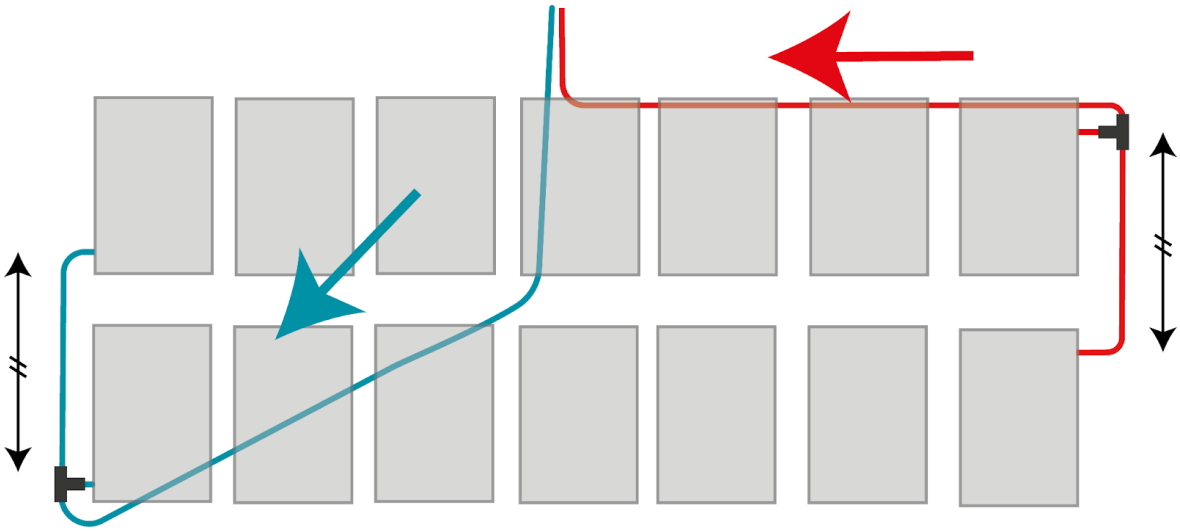
Symbols used in diagrams



1. Hydraulic inlet
2. Hydraulic outlet
3. Shut-off valve
4. Balancing valve
5. Filling valve

1. **Homogeneous lines**
   Hydraulic balancing by the Tichelmann loop principle can be adopted when the panel fields are identical with the same number of panels, placed in the same direction. The lines entering and leaving the panel field must be the same length.

> **NOTE**
> To limit heat loss, it is preferable to extend the cold inlet pipes



2. **Non-homogeneous lines**
   When hydraulic balancing by Tichelmann loop is not feasible or the panel fields are not homogeneous, number of panels per field different and / or panels placed in different directions (portrait /

landscape), the installation of balancing valves is recommended. The dimensioning of the balancing valves depends on the number of panels per line and the recommended nominal flow rate, see Recommended hydraulic flows for the panel SPRING DUO/MAX/BOOST [7].

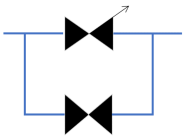
IMPORTANT

In the case of automatic balancing valves:

Provide for the installation of bypass / isolation valves in parallel with the automatic balancing valves for commissioning filling (higher flow rate).

In the case of manual balancing valves:

Fully open the balancing valves during commissioning filling



5.6. Maximum number of panels per hydraulic line

IMPORTANT

To ensure correct filling of the panels during commissioning, **the maximum recommended number of online modules is 7 portrait or landscape**

- **7 in portrait**



5.7. Insulation and protection of piping

For applications where the temperature of the tank to be heated is higher than 30 ° C, the hydraulic transfer lines must be insulated. The thermal insulation must resist UV rays

For the SPRING DUO/MAX/BOOST with heat pump coupling, the external pipes must not be insulated. Pipes inside the building can be insulated to limit condensation.

In the case of pre-insulated hydraulic pipes, the insulation can be cut to facilitate the passage of partitions.

For all other applications, the hydraulic transfer pipes do not require thermal insulation.

6. Maintenance

CAUTION
Maintenance operations and interventions on the solar system must be carried out by a competent and authorized specialist. We recommend an interval of 2 years between each operation.

Hydraulic maintenance

Heat pumps can indicate to you in the error messages the defaults originating from the cold source (pressure drop, loss of transfer liquid, etc.). We invite you to check every 3 months on the monitor of your heat pump that no alert message is present.

It is important to regularly check that no traces of leaks are visible at the panel connections (inlet/outlet connections and inter-panel connections) and that the interior and exterior piping as well as the valves are in good condition and that There are no visible signs of corrosion. If in doubt, draining the hydraulic circuit to check that the transfer fluid is not damaged is necessary.

Electrical maintenance

It is necessary to check that the earth is still well connected to the frame of the panel and that the various electrical cables are not detached under the panels. If you have a monitoring system you can regularly check that the production of your panels is still efficient

7. Decommissioning of the installation

Before any intervention on the device / installation, cut off the power supply and injection (via the appropriate fuse or a general switch, for example) and prevent any recommissioning.

For any intervention involving dismantling of the controllers, make sure that the internal components are not likely to cause a discharge of static electricity.

Removing a module [42]

Decommissioning of the installation [42]

7.1. Removing a module

If it is necessary to dismantle a module, the following procedure must be followed:

- Cut the electrical circuit upstream and downstream of the inverter.
- Risk of electric shock. For this, refer to the manufacturer's manual for the inverter / microinverter. For this it may be necessary to use a particular disconnection tool. Separate the module from its support.
- Disconnect the electrical connectors.
- Disconnect the module grounding.

7.2. Hydraulic disconnection

For SPRING modules, once the installation has been emptied, the DualQuickfit quick couplings can be dismantled using a special pliers, supplied in the essential kit.

7.3. Waste treatment

When handling waste from a used DualSun system, the applicable regional and national regulations must be observed.

DualSun is a PV Cycle member.

8. Responsibilities

DualSun	Installer	User
DualSun products are produced in compliance with the requirements of the various applicable European directives.	The installation and the first commissioning must be carried out in the rules of the art in accordance with: • The information in the installation instructions, • Legislation and standards in force. The installer must inform the user of the need for regular maintenance.	The user must call on qualified professionals: • To carry out the installation and carry out the initial commissioning, • To have regular maintenance performed on the installation. The user must keep the installation documents near the system components.

8.1. Guarantee conditions

See the document “DualSun Contractual Guarantee” for DualSun products.

For the other components of the installation, see the warranty conditions of the various manufacturers.

8.2. Disclaimer

DualSun cannot be held liable in the following cases:

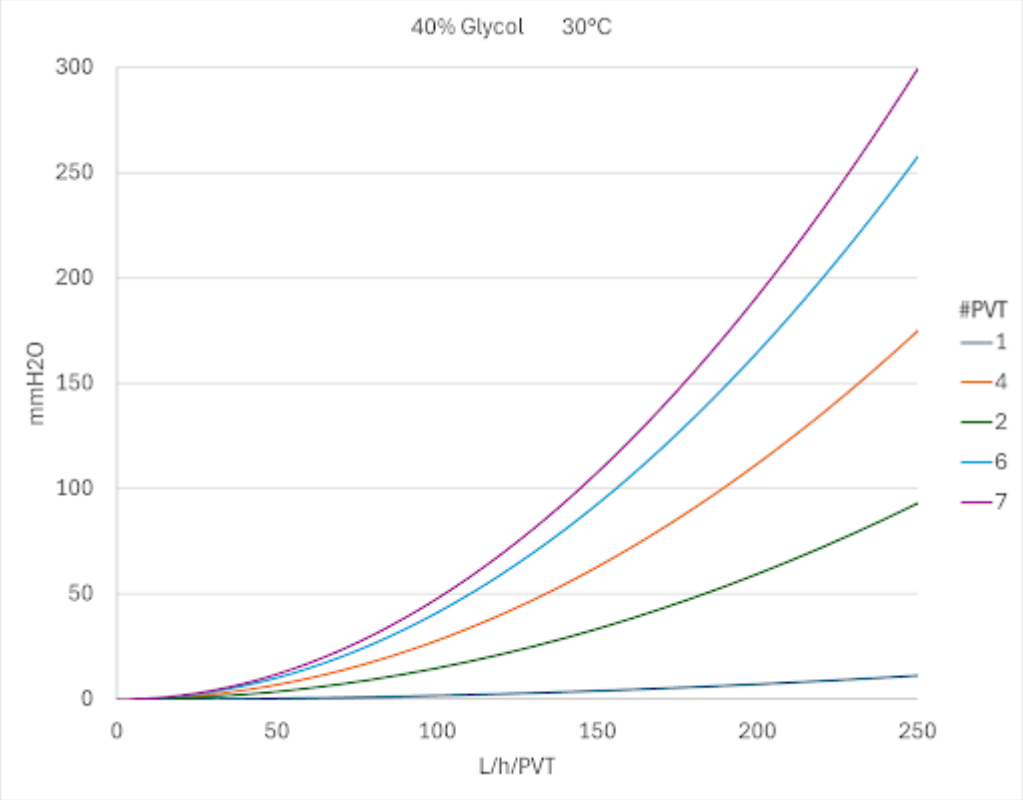
- Failure to comply with the instructions contained in the Notice concerning the installation, use, operation and maintenance of the installation.
- Non-compliance with the safety rules defined in the recommendation published by the national risk prevention organization

9. Technical appendices

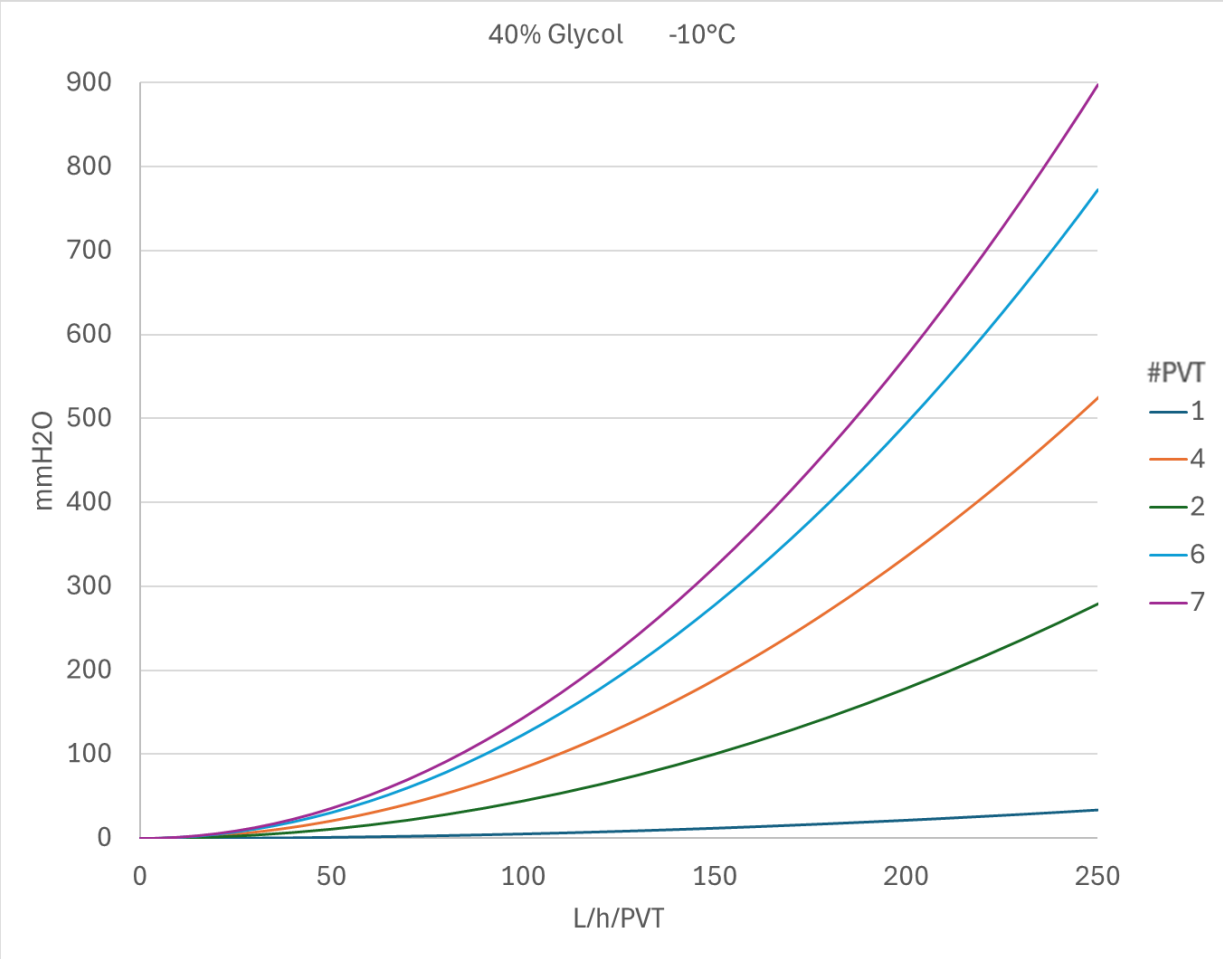
9.1. Hydraulic pressure losses SPRING DUO/MAX/BOOST

Z configuration

Hydraulic pressure loss SPRING DUO/MAX/BOOST in kPa from 1 to 8 panels depending on the flow rate in L/h for a temperature of 30°C, -10°Cand a glycol percentage of 28%



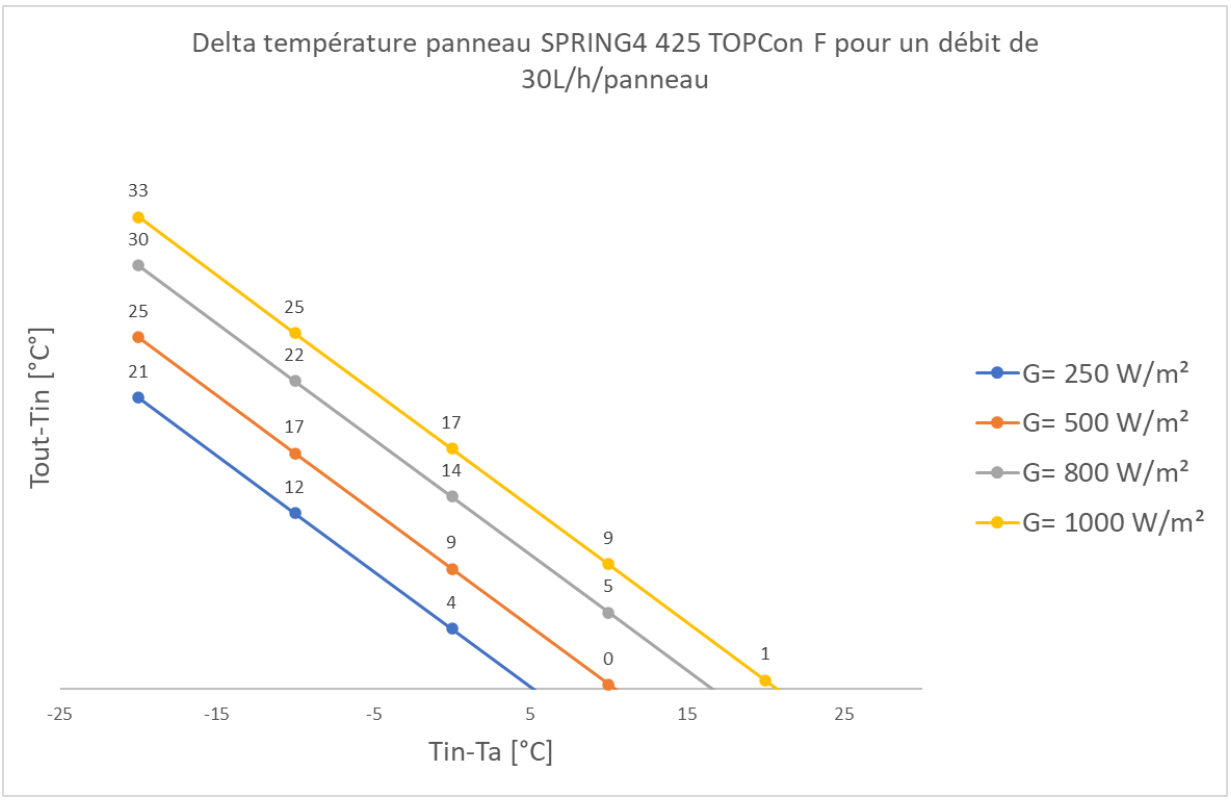
40% Glycol 30°C mmH2O					
L/h/PVT	1 PVT	2 PVT	4 PVT	6 PVT	7 PVT
30	0	1	3	4	4
100	2	15	28	41	48
200	7	60	112	165	191
250	11	93	175	258	299

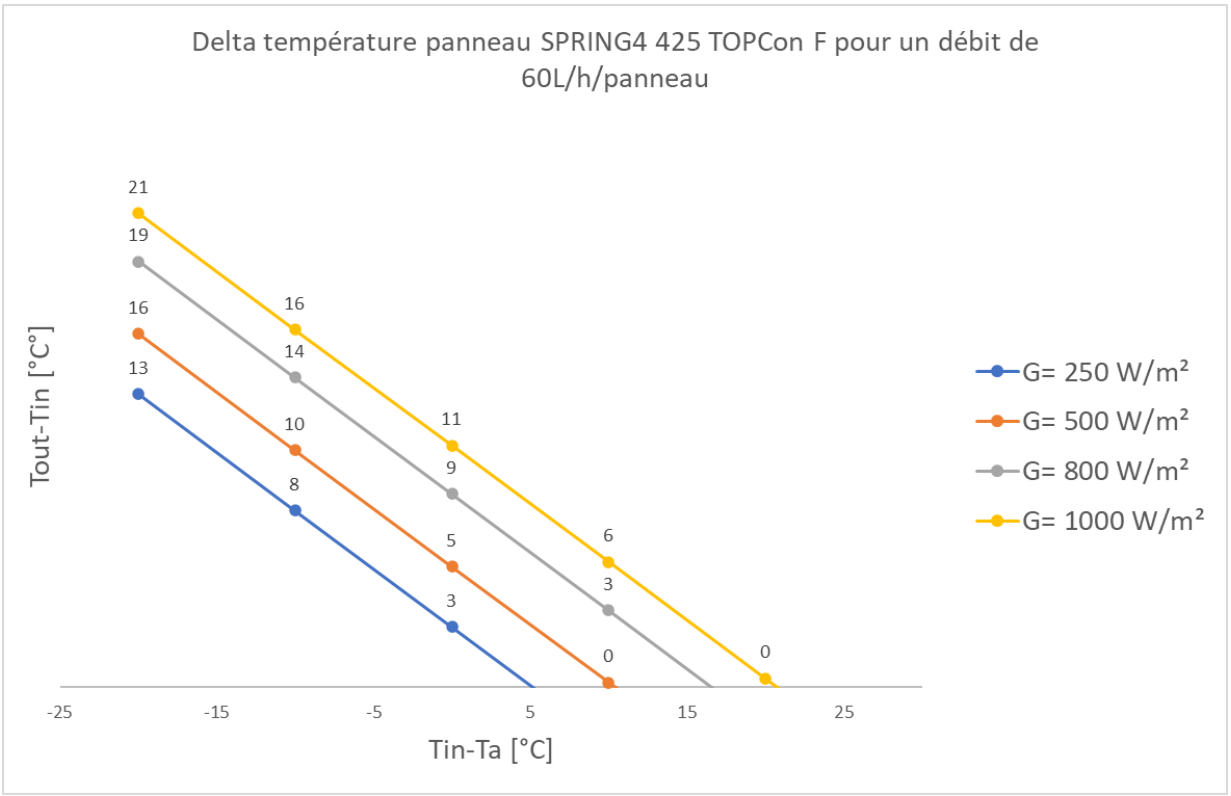


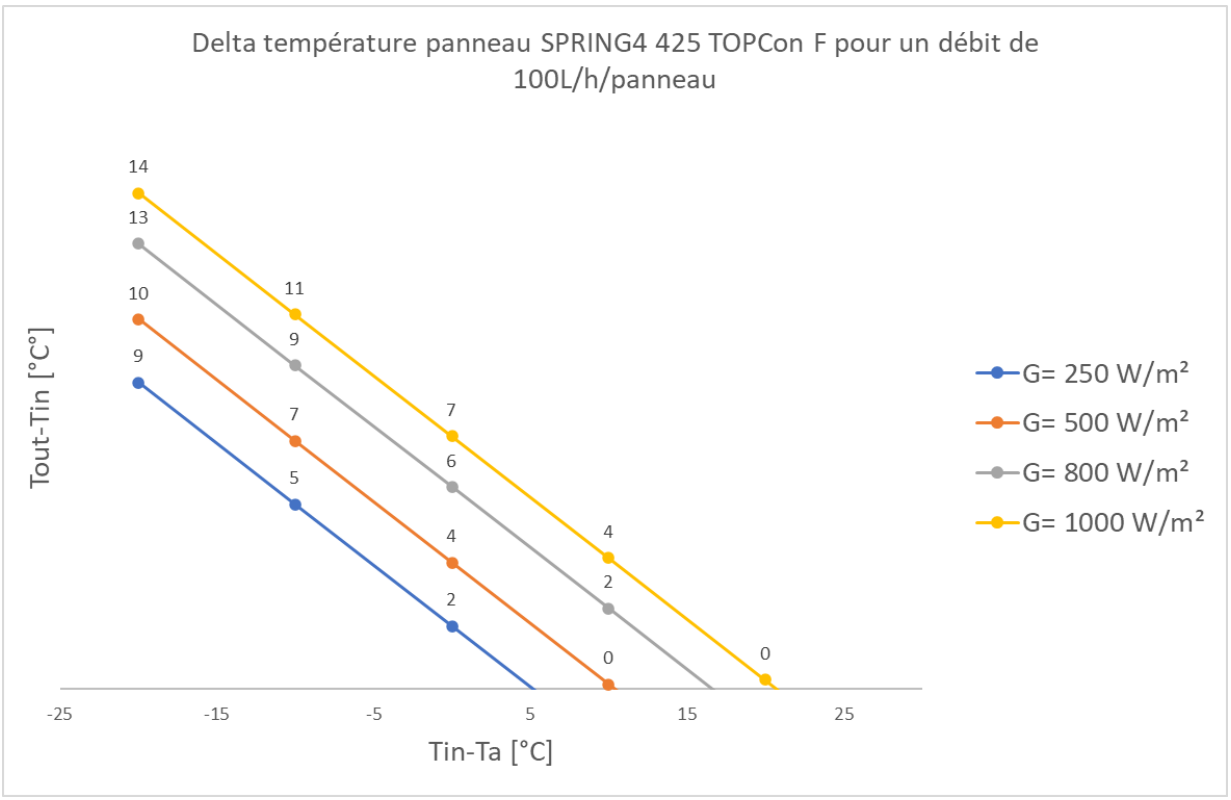
40% Glycol -10°C mmH2O					
L/h/PVT	1 PVT	2 PVT	4 PVT	6 PVT	7 PVT
30	0	4	8	11	13
100	5	45	84	124	144
200	22	179	336	495	574
250	34	279	524	773	897

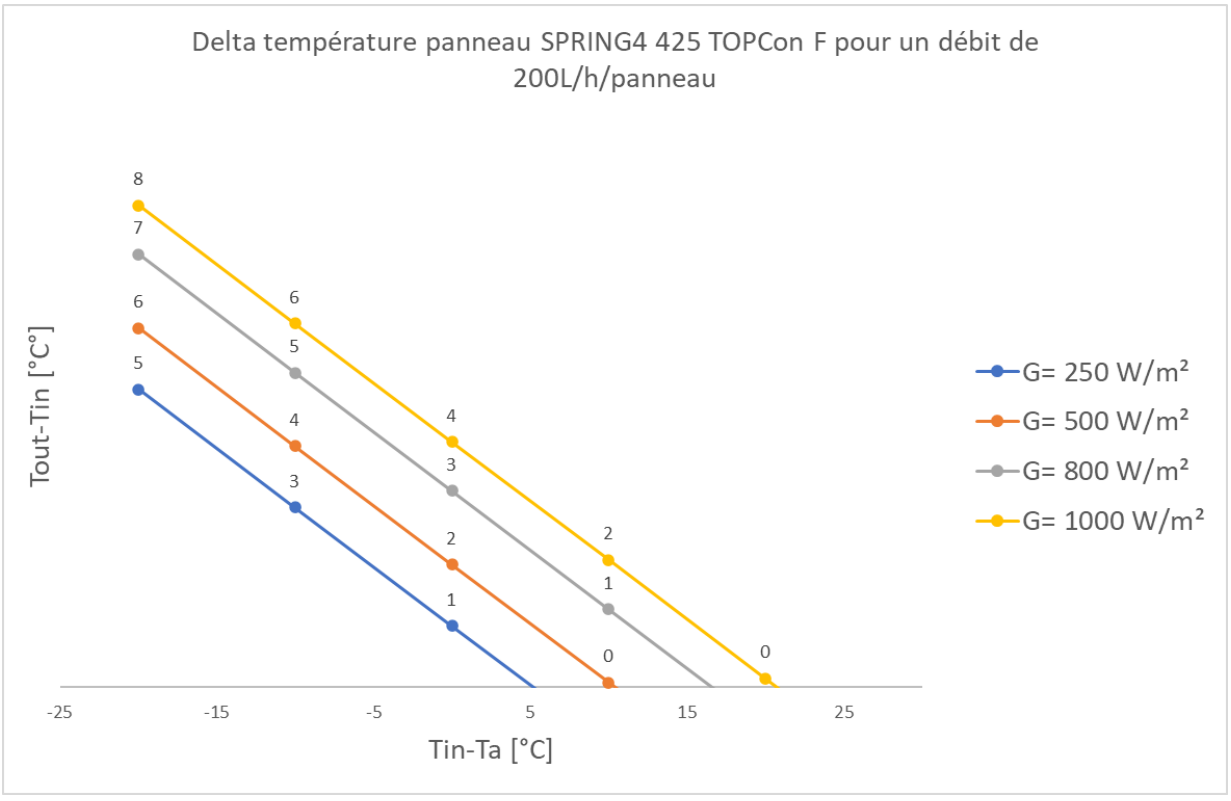
9.2. Delta T

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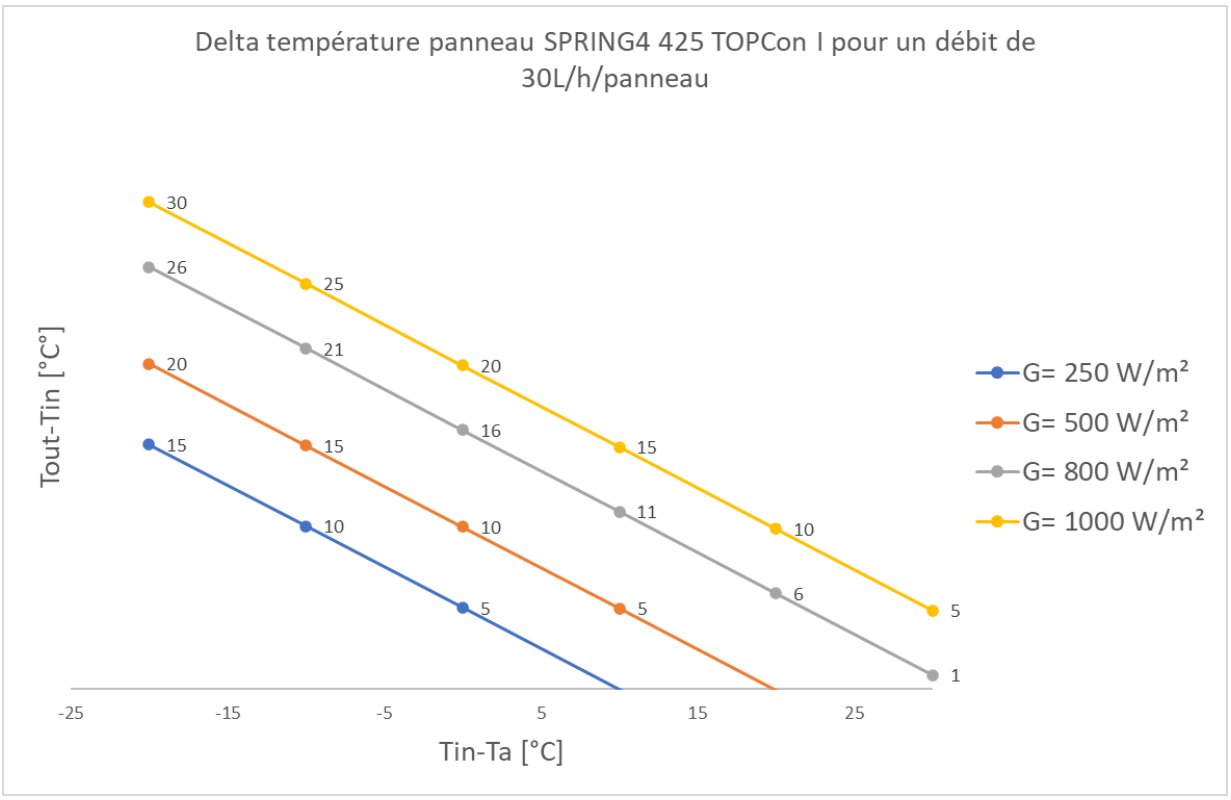

Delta température panneau SPRING4 425 TOPCon F pour un débit de 30L/h/panneau
Tout-Tin [°C]
Tin-Ta [°C]
-25
-15
-5
5
15
25
33
30
25
21
25
22
17
12
17
14
9
4
9
5
0
1
G= 250 W/m²
G= 500 W/m²
G= 800 W/m²
G= 1000 W/m²

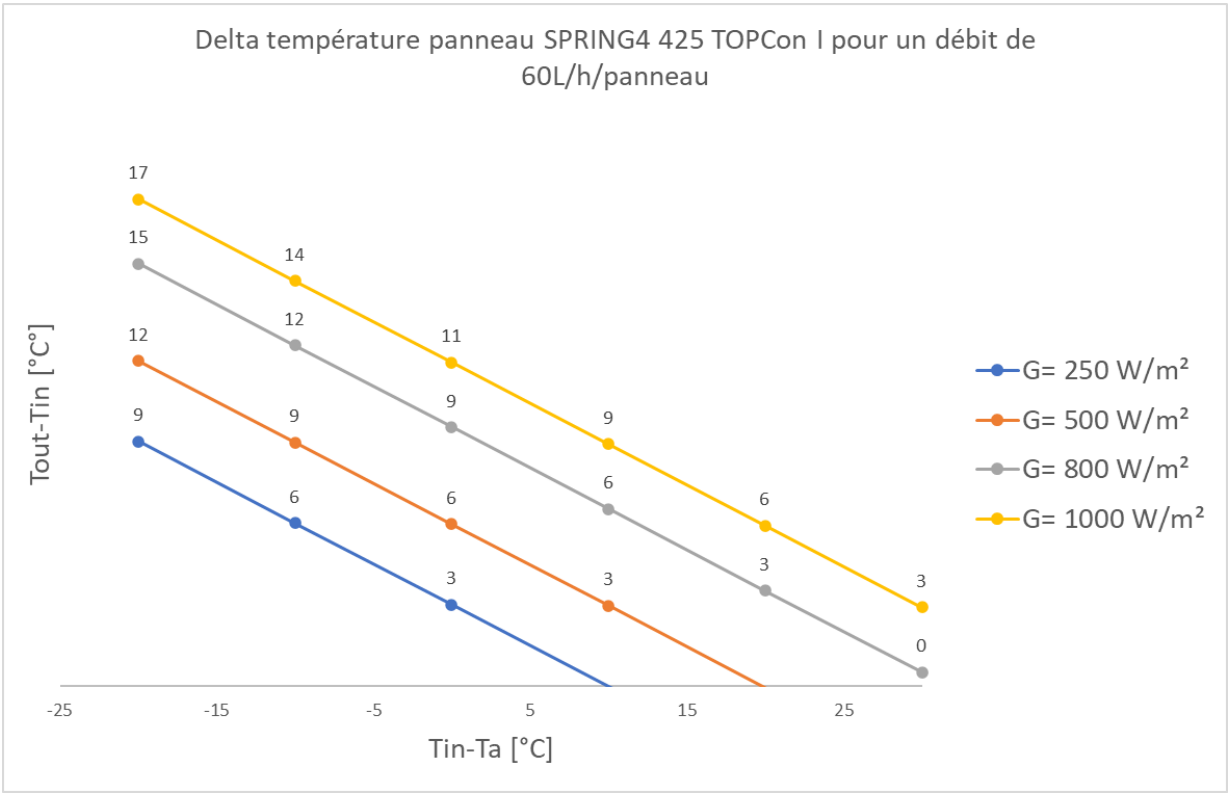

Delta température panneau SPRING4 425 TOPCon F pour un débit de 60L/h/panneau
Tout-Tin [°C]
Tin-Ta [°C]
-25
-15
-5
5
15
25
21
19
16
13
16
14
10
8
11
9
5
3
6
3
0
0
G= 250 W/m²
G= 500 W/m²
G= 800 W/m²
G= 1000 W/m²

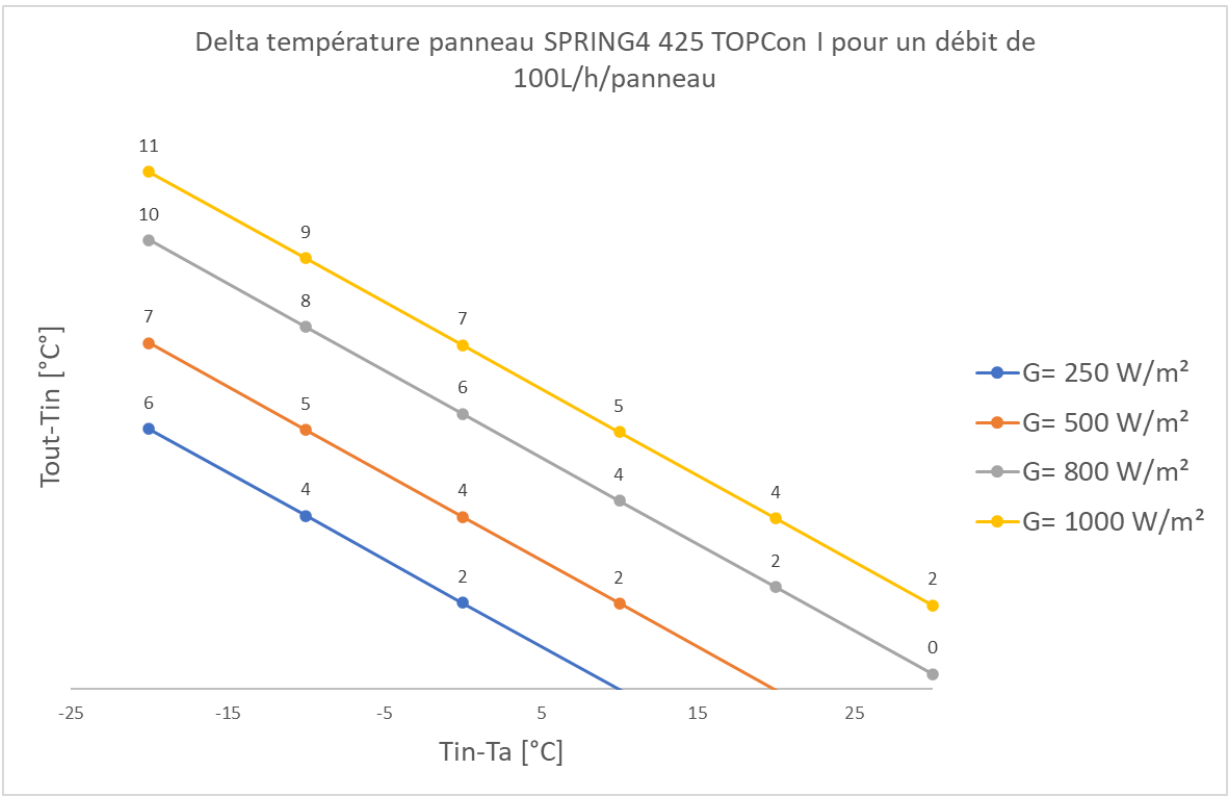


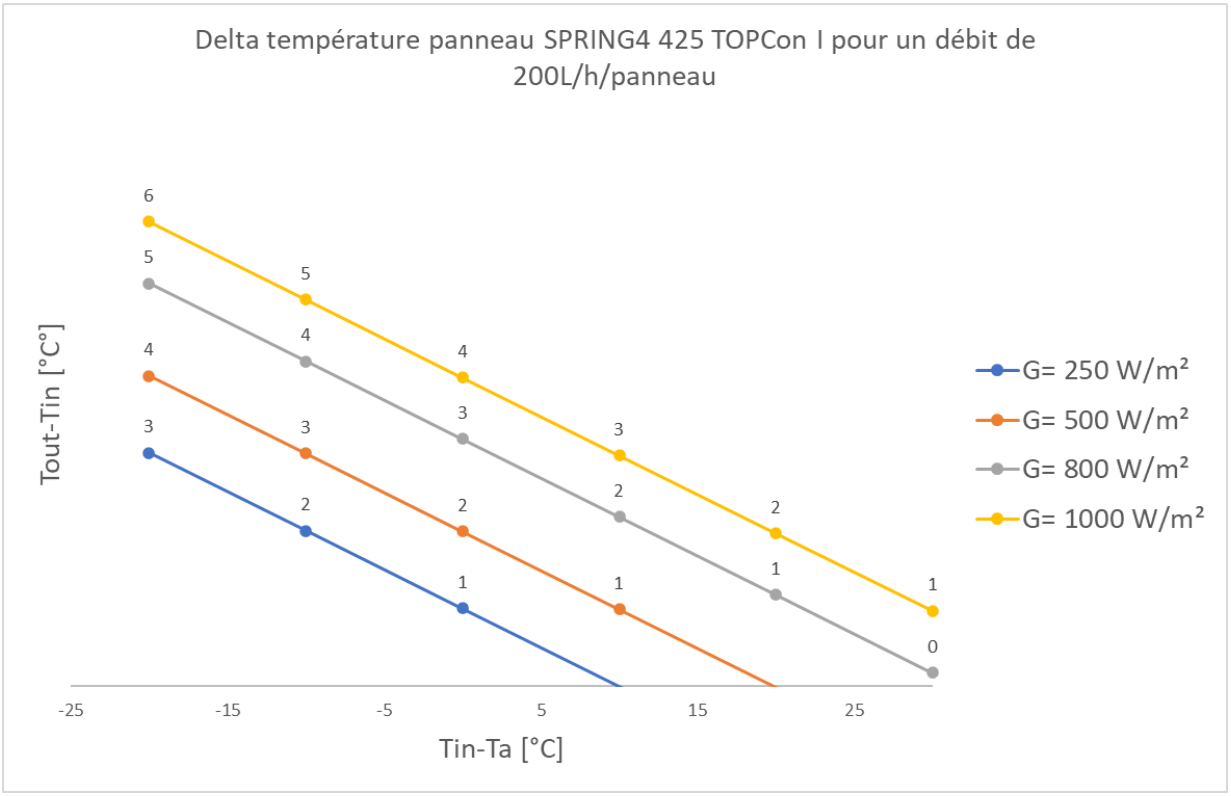


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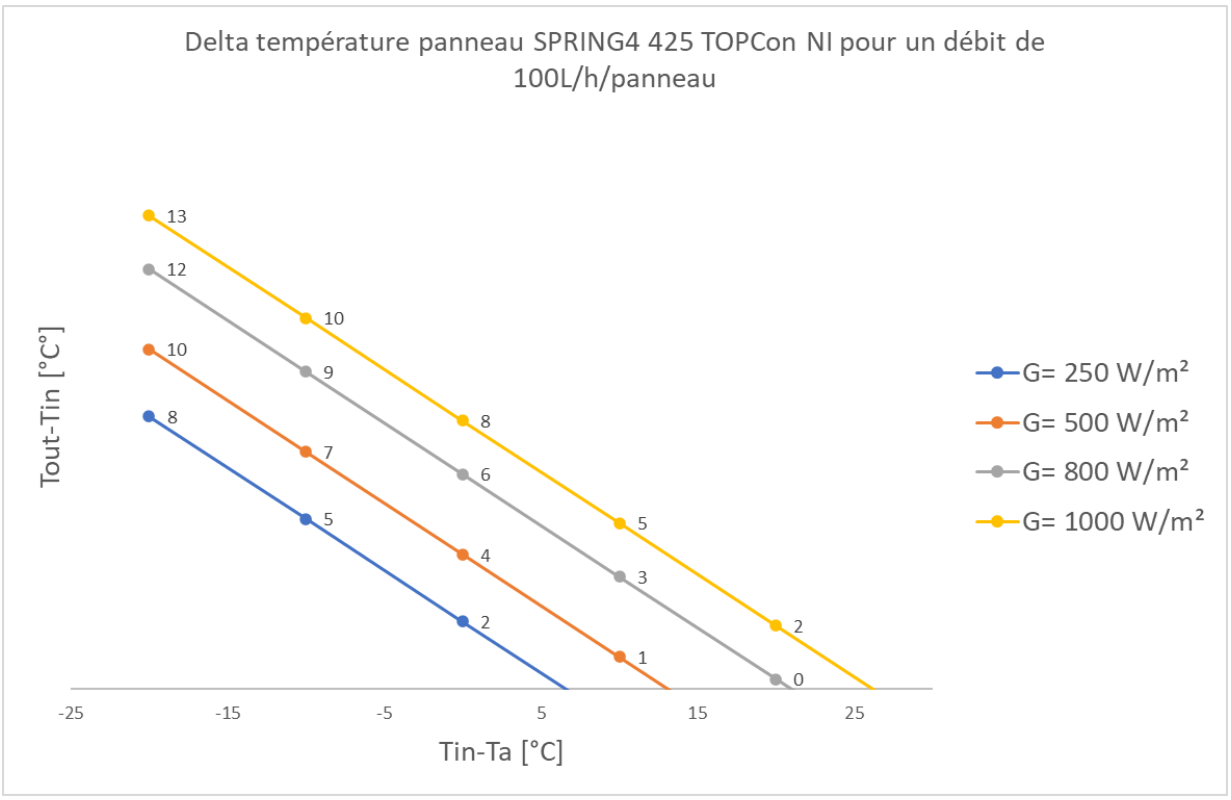

Delta température panneau SPRING4 425 TOPCon I pour un débit de 30L/h/panneau
Tout-Tin [°C°]
Tin-Ta [°C]
-25
-15
-5
5
15
25
30
25
20
15
26
21
16
11
6
1
20
15
10
5
15
10
5
10
5
G= 250 W/m²
G= 500 W/m²
G= 800 W/m²
G= 1000 W/m²

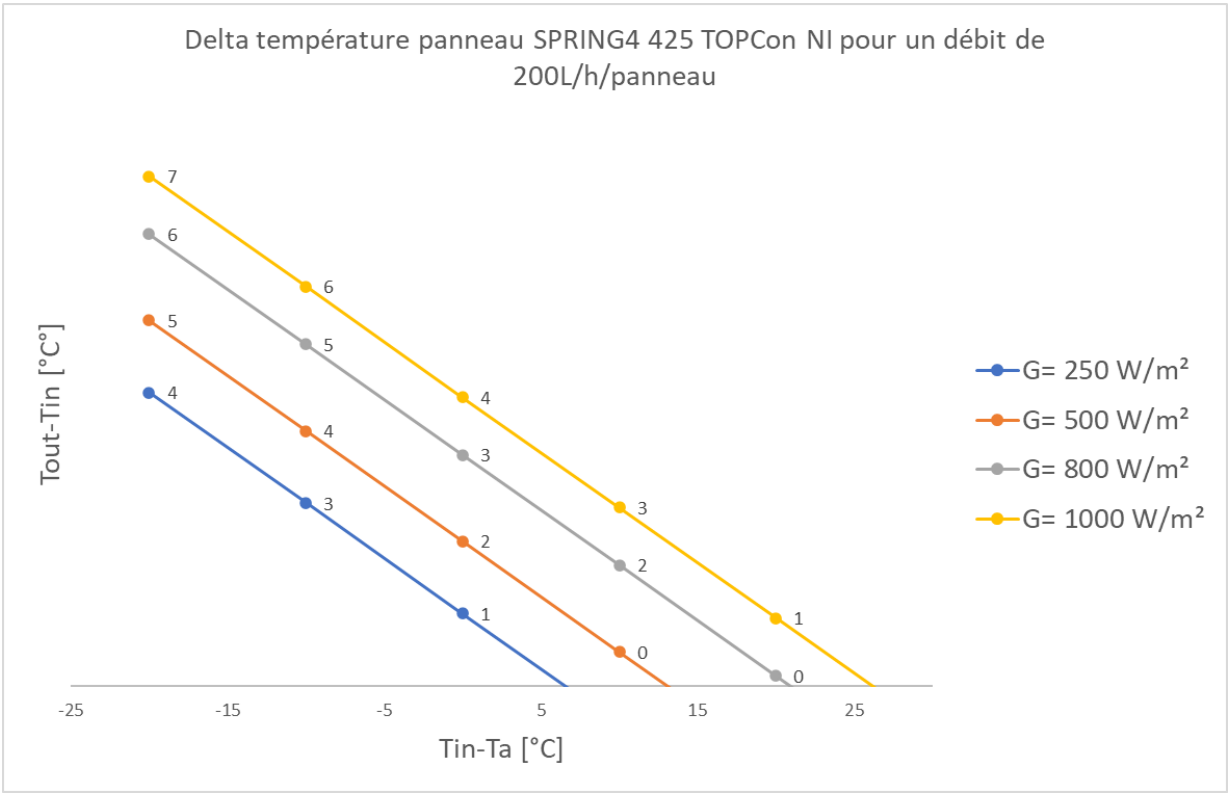

Delta température panneau SPRING4 425 TOPCon I pour un débit de 60L/h/panneau
Tout-Tin [°C°]
Tin-Ta [°C]
-25
-15
-5
5
15
25
17
14
11
9
6
3
15
12
9
6
3
0
12
9
6
3
9
6
3
6
3
G= 250 W/m²
G= 500 W/m²
G= 800 W/m²
G= 1000 W/m²





DSTNXXX-108M10TB-03


Delta température panneau SPRING4 425 TOPCon NI pour un débit de 100L/h/panneau
Tout-Tin [°C°]
Tin-Ta [°C]
-25
-15
-5
5
15
25
13
12
10
8
10
9
8
7
6
5
5
4
3
2
2
1
0
G= 250 W/m²
G= 500 W/m²
G= 800 W/m²
G= 1000 W/m²


Delta température panneau SPRING4 425 TOPCon NI pour un débit de 200L/h/panneau
Tout-Tin [°C°]
Tin-Ta [°C]
-25
-15
-5
5
15
25
7
6
5
4
6
5
4
3
3
2
2
1
1
0
0
G= 250 W/m²
G= 500 W/m²
G= 800 W/m²
G= 1000 W/m²

9.3. Thermal performance

Figure 1. Thermal power of the finned version in Watt as a function of (T_{water} -T_{air}) for G=0 and G=1000W/m²

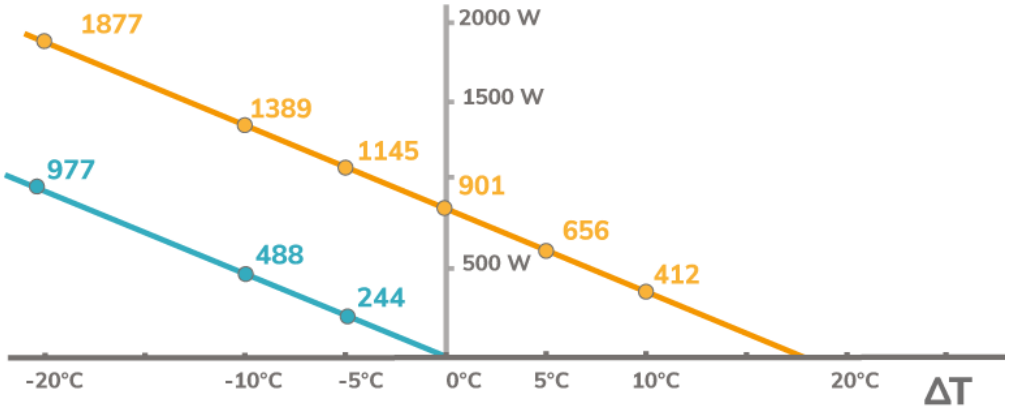


Figure 2.
Thermal power of the insulated version in Watt as a function of (T_{water} -T_{air}) for G=800 and G=1000W/m²

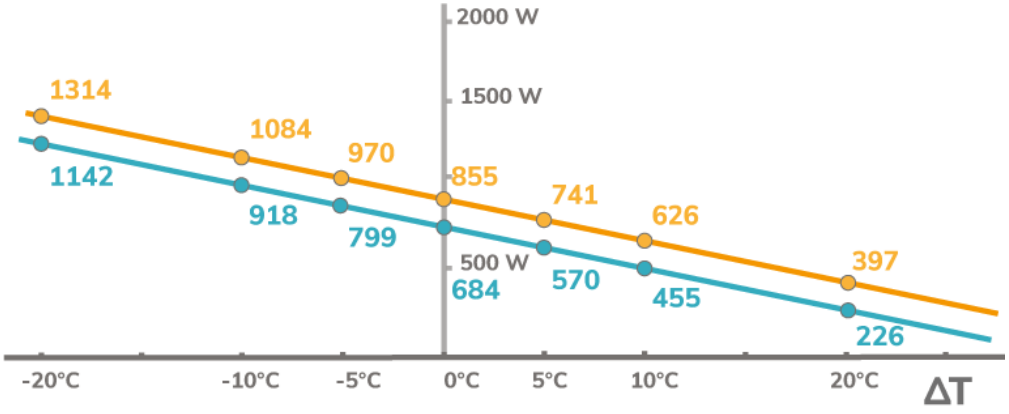


Figure 3.
Thermal power of the non-insulated version in Watt as a function of (T_{water} -T_{air}) for G=0 and G=1000W/m²

