2025

SRP

Water Radiant Panel

New Generation Heating System
for Industrial Areas: “**Water Radiant Panel**”

srpradyant.com

NEOPLANT

SRP is a brand of Neoplant.

Contents

SRP
Water Radiant Panel

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New generation heating system for industrial areas "Water Radiant Panel"

2011
Neoplant Engineering was established.

2016
We committed the distributorship of Kotrbaty Radiant panel brand in Türkiye.

2017
We implemented the first radiant panel application.

2107-2018
We have completed the SRP Hacettepe Teknokent R&D project.

2018
We implemented the first Defense Industry application.

2018
We realized our first overseas project.

2019
We implemented our first sawdust boiler application.

2019
We have registered the SRP brand worldwide.

2020
We implemented our first steam exchanger heating application.

2020
We implemented our first waste heat economizer application.

2021
We have completed the SRP Tübitak Teydeb 1507 project.

2021
We have completed the production and certification of the SRP prototype.

2022
We have completed the EHP Adaptive Industrial Air Curtain R&D project.

2022
We started mass production of Türkiye's first domestic radiant panel.

2022
We have completed our first local SRP application.

2023
We started mass production of EHP Adaptive Industrial Air Curtains.

2023
We have been awarded the ISO 9001 ISO 14001 ISO 45001 certifications.

2024
We have completed corporate carbon footprint calculation and reporting (ISO 14064-1) studies.

SRP
Water Radiant Panel

About Us

Founded in 2011, Neoplant Engineering began its journey in industrial heating and energy efficiency by becoming the Turkey distributor of the Czech water-based radiant panel manufacturer Kotrbaty in 2016. Over the years, Neoplant Engineering has introduced high-efficiency heating systems to many clients, leading the adoption and implementation of water-based radiant panel technology in Turkey.

Recognizing the energy-saving potential of water-based radiant panels (which were not yet produced domestically), Neoplant Engineering launched an R&D initiative in 2017 to develop Turkey's first local water-based radiant panel system. By 2021, after completing its TUBITAK project, the company successfully began producing SRP Water-Based Radiant Panels.

By 2025, both Kotrbaty and SRP water-based radiant heating systems had been successfully applied in dozens of projects, achieving a combined installed power of over 153.5 MBtu/h.

Continuing its mission to improve industrial energy efficiency, Neoplant Engineering expanded into the production of adaptive industrial air curtains in 2023, following the completion of an R&D project in 2022.

To ensure operational excellence, the company implemented an Integrated Management System in 2023 and obtained ISO 9001, ISO 14001, and ISO 45001 certifications from TÜV AUSTRIA.

What is Radiant Heating?

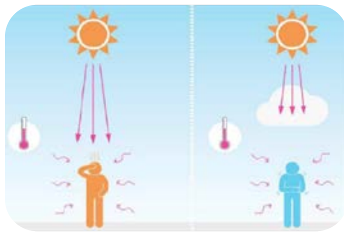
Radiant heating refers to the transfer of heat through electromagnetic wave energy from a warm object to another object at a lower temperature. This process is based on thermal radiation, which is one of the three modes of heat transfer. Infrared radiation moves easily through air and space, only producing heat upon contact with surfaces such as floors or walls. When these waves hit an object, the affected molecules begin to oscillate, generating a sensation of warmth.

The maximum amount of radiation that a surface can emit depends on its absolute temperature and is determined by the Stefan-Boltzmann law. The amount of heat transfer through radiation is influenced by emissivity, surface area, and the fourth power of surface temperature.

$$Q = \varepsilon \times \sigma \times S \times Ts^4$$

- Q = Heat Flow (W)
- ε = Emissivity (Emissivity of the Surface)
- σ = 5,67 . 10^{8} Stefan Boltzman Constant (W/m^2K^4)
- S = Heat Transfer Surface (m^2)
- Ts = Surface Temperature (K)

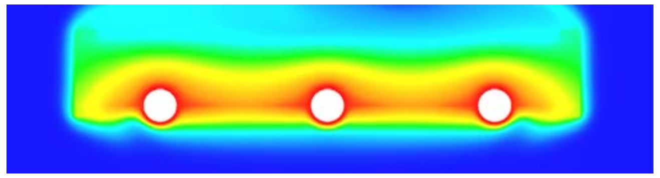
Thermal comfort is a combination of air temperature and surface temperature. Therefore, when entering an environment heated by radiation, the first sensation is comfort. As a practical example, when moving from a shaded area to a sunny area, even though the air temperature remains the same, a higher temperature is felt. The reason for this is that the sensation of temperature comes not only from the air temperature but also from the surface temperatures. Due to exposure to direct sunlight, the surface temperature increases, which also raises the perceived temperature.



Water-based Radiant Heating Systems work by circulating hot water through pipes embedded in radiant panels. These panels then transfer heat to people and objects in the environment via radiation. The energy first warms objects and people, and subsequently heats the air in the space. The hot water required for circulation can be supplied by boilers using various fuels, heat pumps, or waste heat sources. Once the hot water transfers heat to the panels, it returns to the heat source.

Water-based radiant panels are modular in structure, meaning they can be combined in different quantities to achieve the required heating surface area. These panels not only provide an effective heating solution but also act as distribution piping, reducing additional installation costs. This system ensures that floor temperatures remain slightly higher than ambient air temperatures, enhancing comfort.

Compared to other heating systems, water-based radiant panels can reduce energy consumption by over 40%, particularly in industrial facilities, warehouses, sports halls, train maintenance stations, aircraft hangars, amphitheaters, farms, and greenhouses. These panels are especially suitable for buildings with high ceilings or high fire risk due to their efficiency and safety.



SRP Advantages

COMFORTABLE!
- Provides homogeneous temperature distribution
- Does not create any air movement
- Operates silently
- Enhances comfort with high radiant effect
- Provides optimum comfort thanks to the high floor temperatures

ENVIRONMENTALLY FRIENDLY!
- Minimizes NOx and CO2 emissions due to high efficiency
- Compatible with renewable energy sources and waste heat recovery

ECONOMICAL!
- No maintenance or service costs
- Can operate with renewable and waste energy sources
- High Energy Efficiency (up to 79% radiant efficiency)
- No obligation to use natural gas (compatible with electricity, coal, wood chips, pellets, etc.)
- Panels in unused areas can be shut off via motorized valve

SAFE!
- No fire hazard
- No risk of explosion
- No risk of flue or natural gas leakage in the area

PRACTICAL!
- Quick and easy installation
- Minimal startup time
- Can be adapted to any ceiling height (9.8 ft-131.2 ft)
- No need for chimneys or additional ventilation
- Requires minimal piping

HEALTHY!
- No combustion gases released into the air
- No dust or particle circulation due to the absence of air movement

COMPACT, ADAPTABLE, AND AESTHETIC!
- Can be installed at any height, width, or length
- Saves space as it is mounted on the ceiling
- Can be used for both heating and cooling
- Has a sleek and modern appearance
- Can be produced in any RAL color for aesthetic integratio

Application Areas

Water radiant panel heating systems provide the highest possible energy efficiency for heating buildings with high ceilings. This makes them ideal for factories, warehouses, sports halls, amphitheaters, and similar large spaces. Additionally, in facilities with high fire risk, water radiant panels offer a safe and effective heating solution without fire hazards.

Moreover, renovation projects, waste heat applications, and the wood & furniture industry can benefit significantly from water radiant panel systems.

Renovation Projects

Radiant heating, unlike convection-based systems, allows heating specific areas rather than the entire air volume with very low air stratification. This prevents excessive heat accumulation in ceiling spaces where most energy losses occur, reducing unnecessary heat waste. As a result, significant fuel savings are achieved along with a considerable increase in comfort in the heated areas.

Especially when replacing hot water-based convection systems with water radiant panels, existing boiler rooms, pumps, expansion tanks, and pipelines can often be reused with minor modifications. This significantly reduces initial investment costs. Furthermore, fuel, electricity, and maintenance savings can lower annual operational costs by up to 40%. In many cases, the return on investment (ROI) for transitioning to a water radiant heating system is between 1 to 4 years, depending on operational conditions.

Waste Heat Applications

A key aspect of energy efficiency is the recovery of waste heat generated by industrial processes. Many industrial facilities release excess heat from flue gases of boilers and furnaces, compressors, and other sources. This heat can be captured and reused for space heating, eliminating waste and improving sustainability.

Unlike convection-based systems, which are inefficient for high-ceiling buildings, water radiant panels offer an optimal heating solution. Apart from water radiant panels, there is no other radiant heating system that can operate with waste heat.

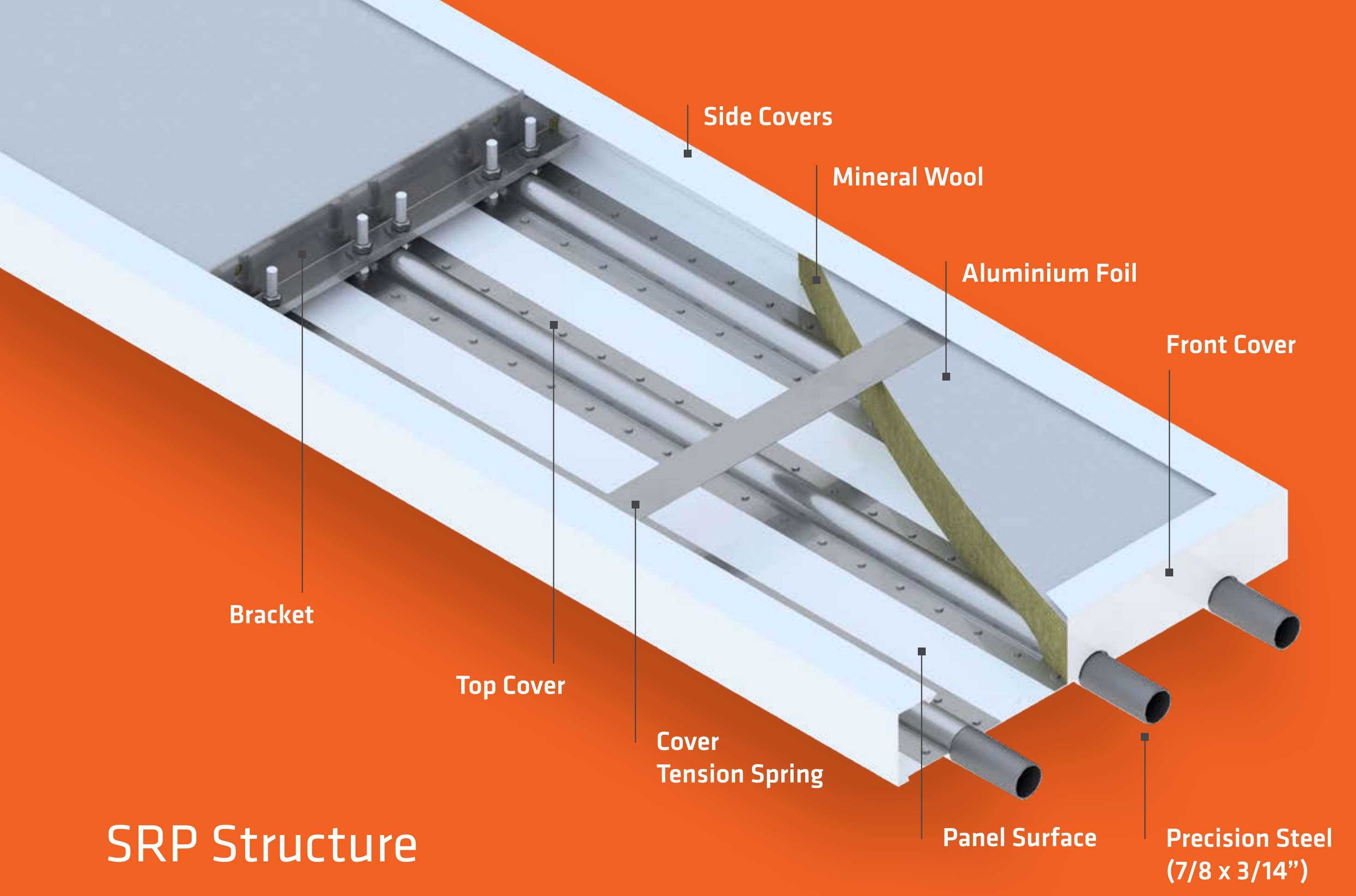
Waste heat can be transferred to water through heat exchangers, allowing it to circulate through radiant panels. This eliminates the need for additional heating sources, making the system nearly 100% fuel-free. However, if the capacity of the waste heat source is insufficient, the water radiant panels can be supplemented with an additional heat generator (such as a boiler). In some cases, energy costs for removing or cooling the waste heat generated by the process can also be reduced.

Wood & Furniture Industry Applications

Water radiant panels are particularly suitable for wood processing and furniture production facilities, where fire risk is high and airborne dust must be minimized. These facilities require stable indoor temperatures and rapid responses to sudden temperature fluctuations.

In addition to being the most effective and accurate solution for the wood and furniture industry, the water radiant panel system allows the use of waste sawdust generated from processes as an energy source through sawdust boilers, which can lead to savings of up to 100% on fuel costs.

Another advantage is that sawdust boilers and water radiant panels allow facilities to operate without relying on natural gas, LPG, or LNG, eliminating the need for additional energy investments.

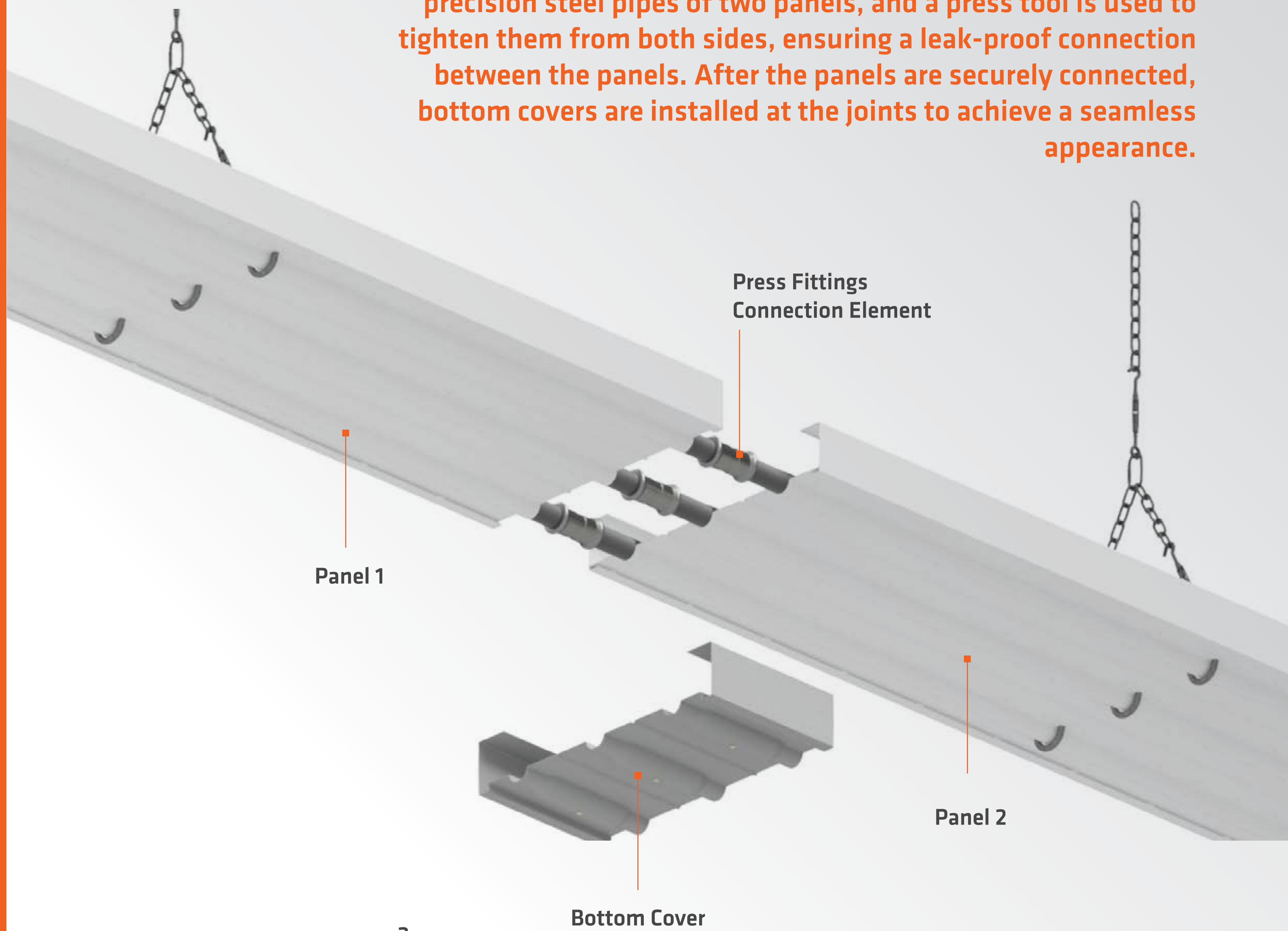


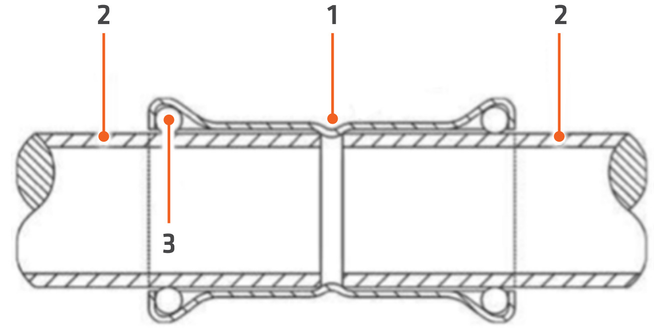
SRP Structure

SRP water-based radiant panels consist of precision steel pipes, a specially coated sheet metal panel surface, aluminum foil-coated mineral wool insulation, suspension brackets, and covers. The hot/overheated water circulated within the panel pipes heats the panel surface, and the heated coated panel transfers its heat via radiation to the people and objects in the environment.

Panel	12" modular galvanized sheet metal with special coating
Pipes	Ø ⅞" precision steel pipes
Side Covers	Specially coated steel sheet
Insulation	1.6" mineral wool with aluminum foil coating
Width	n x 12" (min: 12", max: 48")
Length	6.6ft, 9.8ft, 19.7ft
Panel Connection	⅞" press fittings
Fluid	Water with temperatures between 104 - 248 °F
Hydraulic Connection Options	Parallel, Series, Series + Parallel
Capacity Control	Flow control, Temperature control
Pressure Class	PN10

The connection of the panels is made using press fittings connection elements. The press fittings are placed between the precision steel pipes of two panels, and a press tool is used to tighten them from both sides, ensuring a leak-proof connection between the panels. After the panels are securely connected, bottom covers are installed at the joints to achieve a seamless appearance.





1. Press Fittings Connection Element
2. SRP Pipes
3. Sealing Element
4. Press Tool

SRP Working Principle

The SRP system provides radiant heating by generating the necessary hot water through alternative energy sources. The system consists of the following components: radiant panel, thermometer, pump group, and control unit.

- Water Radiant Panel
- Thermometer

- Pump Group
- Control Unit

Natural Gas

Coal

Pellet

Condensing Cascade Boiler

Heat Pump

Steam Boiler

Waste Heat Economizer

Hot/Superheated Water Boiler

References

With each passing day, we produce solutions for heating of more factories and facilities.

Heating Solution in 702,229 m² Area | of 65 Brands | in 5 Countries | Since 2016

[yatas]	EVINE	DAL HEAVY INDUSTRIES	FNSS	DALGAKIRAN
INTECRO	RAYON	Tüpraş	tyco Fire Protection Products	ODTU
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TÜRK HAVACILIK UZAY SANAYİİ	SALOGLU	VitrA ARTEMA	boracelik	sinerji
arçelik	zebrand	kmk paper	ADY	DE TASARIM
MODEL AMBALAJ	METYX telateks	Gökrail	KEY HOLDING	NORM CIVATA
NORM SALIHLI	NORM COATING	sarıprofil	MVD	ASO SEM
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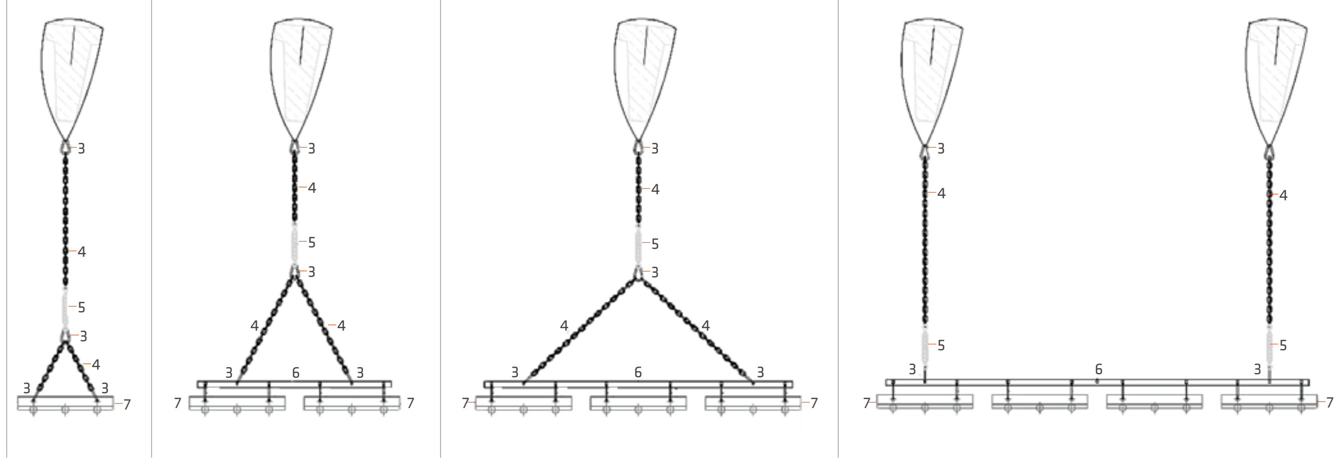
İTÜ	İZOCAM	nit set	ORGANİK KİMYA	Unuvar Tekstil

Installation & Application

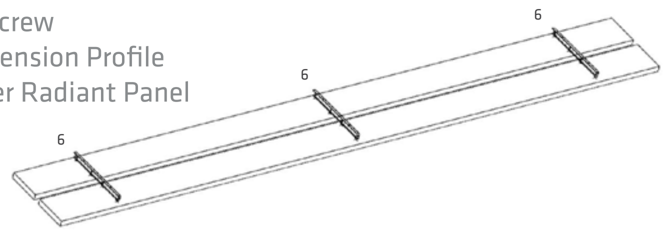
SRP water radiant panels can be used as monoblock units in models SRP 300, SRP 600, SRP 900, and SRP 1200. Additionally, two, three, or four SRP 300 models can be combined using suspension profiles. In such cases, the models are classified as SRP I, SRP II, SRP III, and SRP IV.

The panels are suspended using ceiling-compatible support equipments (such as beam clamps, suspension belts, steel anchors, etc.), carabiners, chains, and tension screws. Each suspension bracket of a panel or a suspension profile of a panel group can be connected to the ceiling at a single point (single suspension system) or at two points (double suspension system).

SRP I Single Suspension | SRP II Single Suspension | SRP III Single Suspension | SRP IV Double Suspension

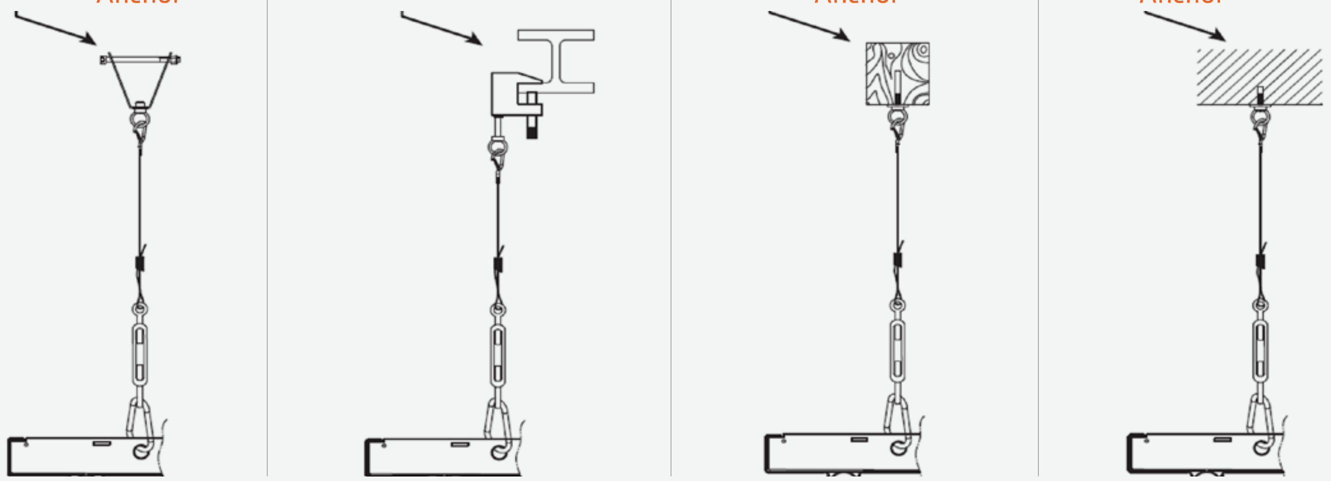


1. Reinforced Concrete Ceiling Anchor
2. Steel Suspension Belt
3. Carabiner
4. Chain
5. Tension Screw
6. SRP Suspension Profile
7. SRP Water Radiant Panel

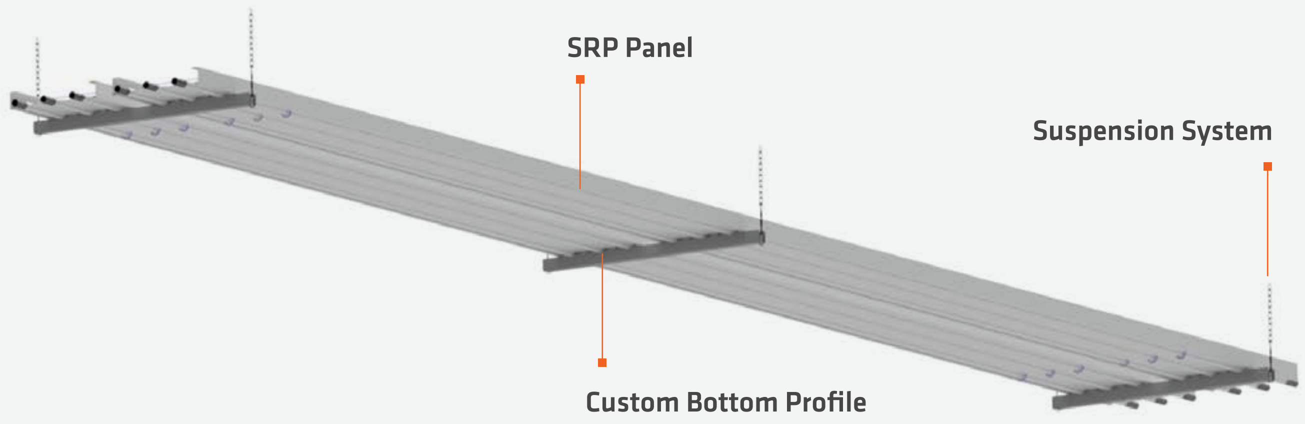


Different Roof Types & Suspension Equipment

Trapezoidal Sheet Anchor | Beam Clamp | Wooden Dowel Anchor | Steel Concrete Anchor



When standard suspension points are not available, or when panel alignment requires a specific arrangement, custom bottom profiles can be used for suspension.



Pipe Connection Collectors

For panel strip connections, collectors are used at the start and end points to facilitate panel-to-system integration.

Pipe connections use ⅞" press fittings.
Connection points are available in NPS 1 or NPS 1 1/4 threaded connections.

Dimensions

SRP 300 – 600 – 900 – 1200 DIMENSIONS

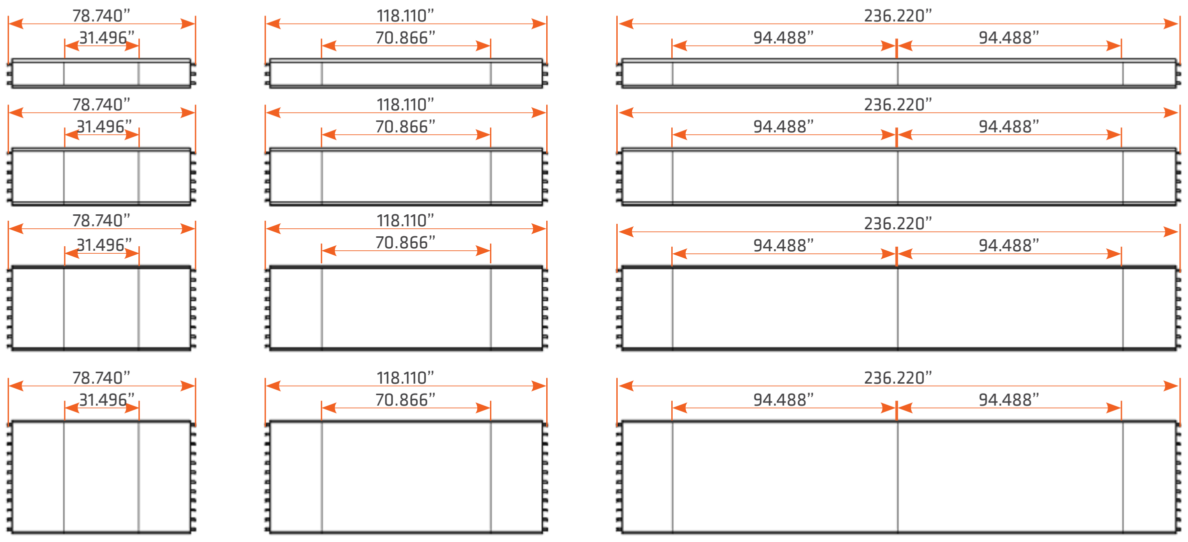
6,6 ft | 9,8 ft | 19,7 ft

SRP 300

SRP 600

SRP 900

SRP 1200



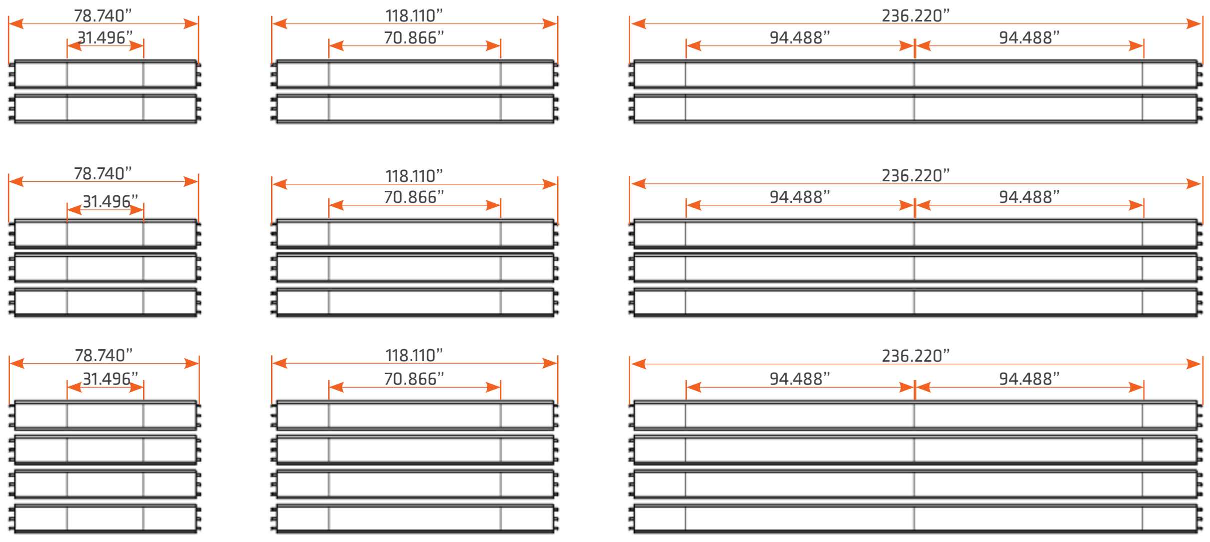
SRP I- II - III - IV DIMENSIONS

6.6 ft | 9,8 ft | 19,7 ft

SRP II

SRP III

SRP IV

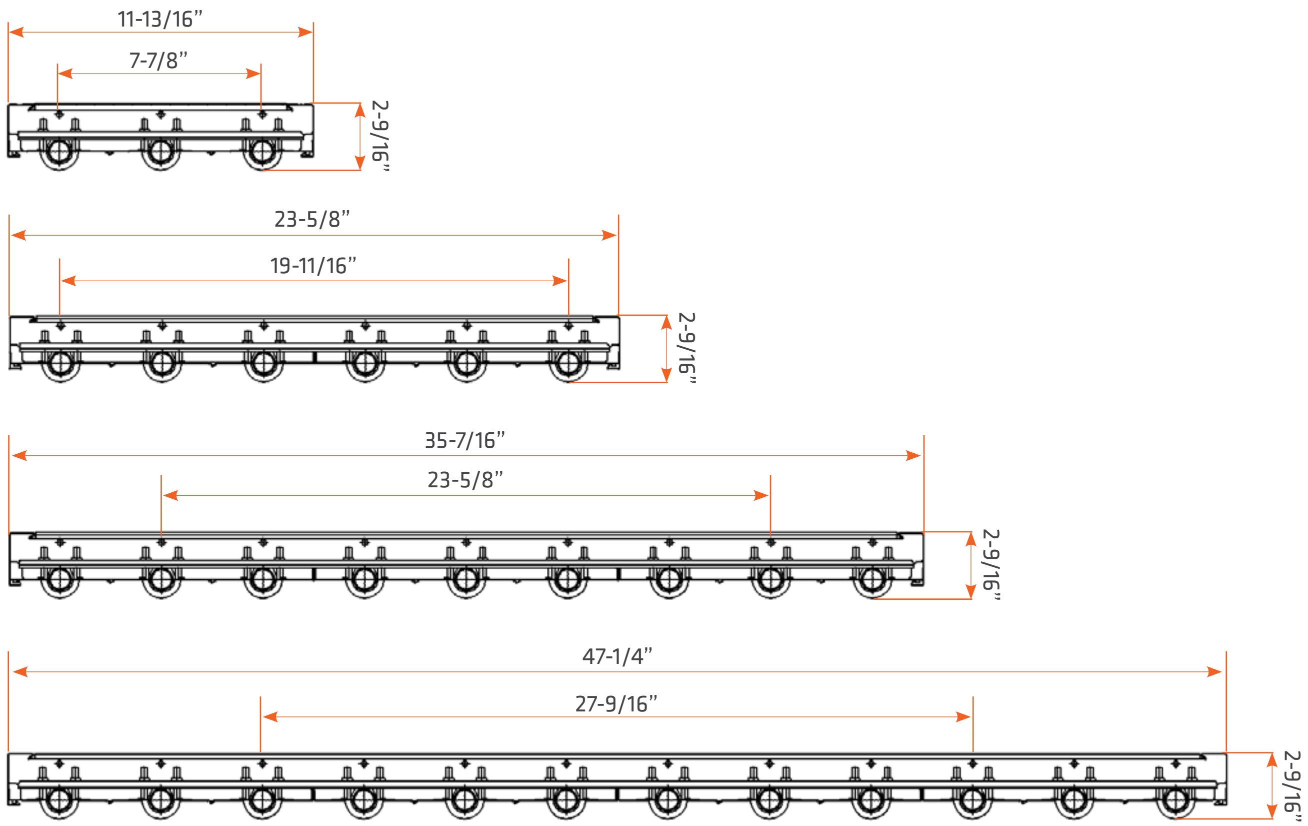


SRP 300

SRP 600

SRP 900

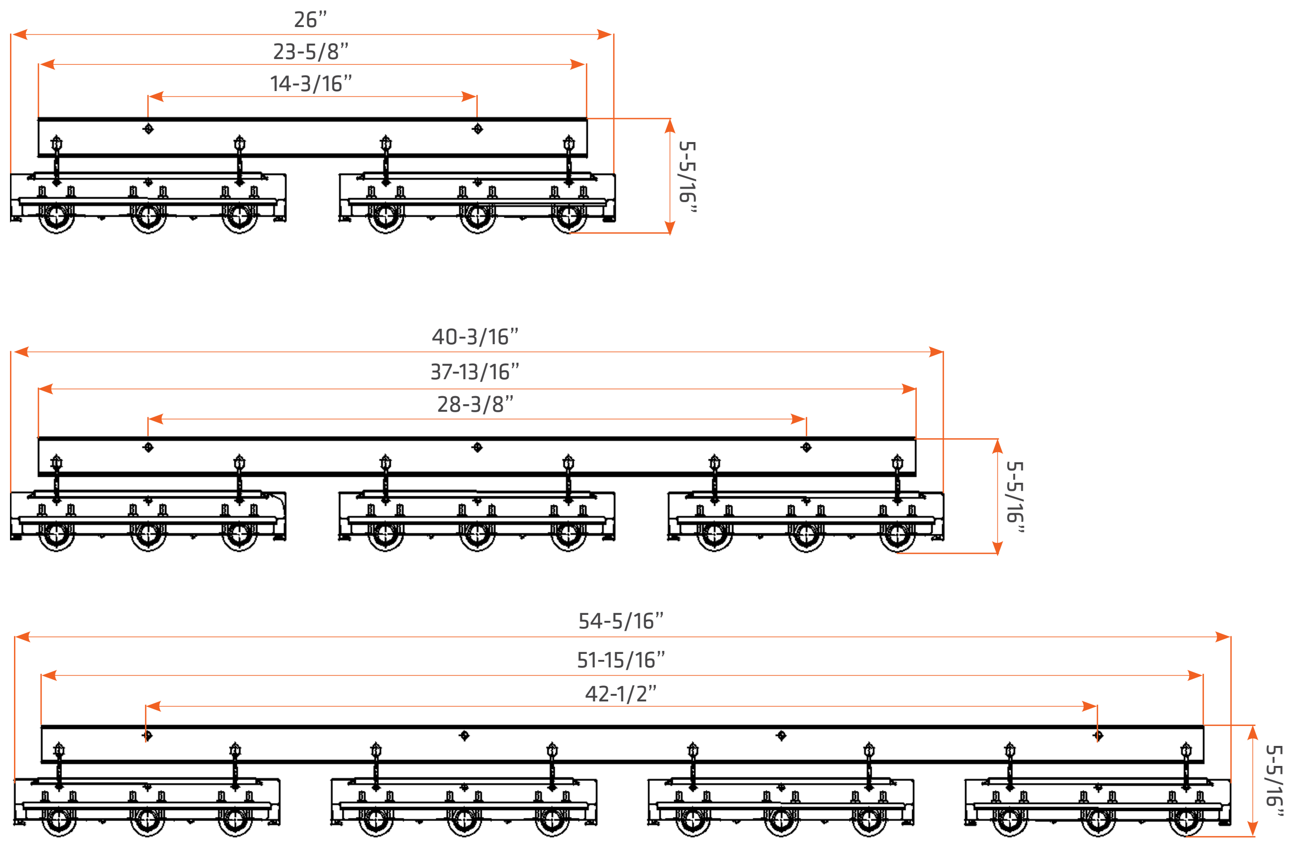
SRP 1200



SRP II

SRP III

SRP IV



Weight & Capacity Tables

SRP 300-600-900-1200 WEIGHT TABLE

Number Of Modules	Type of panel	Weight (lb)					
		Panel L = 6.6'		Panel L =9.8'		Panel L =19.7'	
		With Water	Empty	With Water	Empty	With Water	Empty
1	SRP 300	25.1	21.2	37.9	32.0	75.6	63.7
2	SRP 600	47.0	38.8	71.2	59.1	141.5	117.7
3	SRP 900	68.8	56.7	104.3	86.2	207.5	171.5
4	SRP 1200	90.6	74.5	137.3	113.3	241.4	225.5

SRP I-II-III-IV WEIGHT TABLE

Number Of Mod-ules	Type of panel	Weight (lb)					
		Panel L = 6.6'		Panel L =9.8'		Panel L =19.7'	
		With Water	Empty	With Water	Empty	With Water	Empty
1	SRP I	25.1	21.2	37.9	32.0	75.6	63.7
2	SRP II	52.2	44.3	78.0	66.1	154.5	130.5
3	SRP III	78.7	66.6	117.3	99.4	232.1	196.2
4	SRP IV	105.2	89.1	156.7	132.9	278.0	262.1

SRP 300-600-900-1200 CAPACITY TABLE

ΔT [˚F]	PANEL THERMAL CAPACITY [(BTU/H)/FT] / HEADER COUPLE [BTU/H]							
	PANEL MODEL							
	SRP 300 [(BTU/H)/FT]	Header Couple BTU/H	SRP 600 [(BTU/H)/FT]	Header Couple BTU/H	SRP 900 [(BTU/H)/FT]	Header Couple BTU/H	SRP 1200 [(BTU/H)/FT]	Header Couple BTU/H
54	93.48	90.29	168.96	161.21	235.97	249.89	303.13	338.24
63	112.04	109.82	202.85	195.77	283.12	303.73	363.46	411.49
72	131.06	130.12	237.65	231.65	331.51	359.66	425.34	487.64
81	150.50	151.12	273.27	268.72	381.02	417.48	488.62	566.43
90	170.32	172.76	309.64	306.88	431.54	477.05	553.15	647.64
99	190.49	194.99	346.69	346.05	482.99	538.21	618.85	731.09
108	210.98	217.77	384.37	386.15	535.29	600.88	685.61	816.63
117	231.77	241.07	422.64	427.14	588.40	664.95	753.38	904.12
126	252.84	264.87	461.46	468.95	642.25	730.35	822.07	993.47
135	274.18	289.12	500.80	511.55	696.81	797.00	891.64	1084.57
144	295.77	313.82	540.63	554.90	752.03	864.84	962.04	1177.33
153	317.59	338.94	580.93	598.96	807.89	933.82	1033.22	1271.69
162	339.64	364.46	621.67	643.70	864.34	1003.88	1105.15	1367.56

ΔT = ((Flow Water Temperature + Return Water Temperature) / 2) – Indoor Temperature

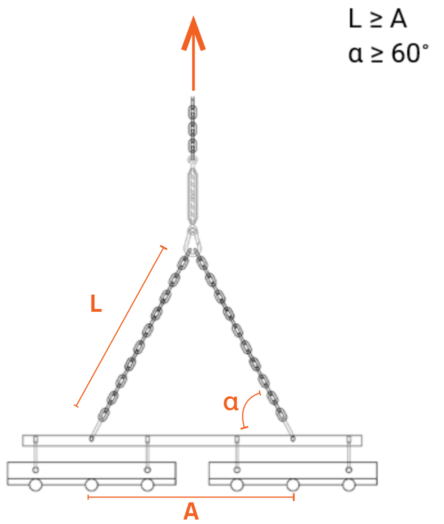
SRP I-II-III-IV CAPACITY TABLE

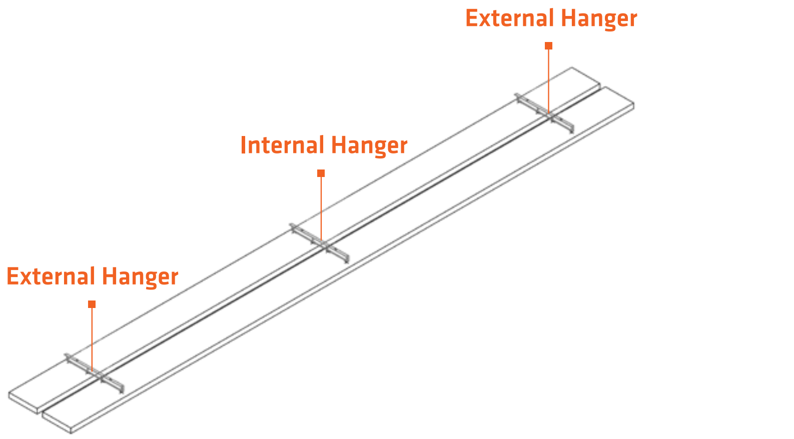
ΔT [˚F]	PANEL THERMAL CAPACITY [(BTU/H)/FT] / HEADER COUPLE [BTU/H]							
	PANEL MODEL							
	SRP I [(BTU/H)/FT]	Header Couple BTU/H	SRP II [(BTU/H)/FT]	Header Couple BTU/H	SRP III [(BTU/H)/FT]	Header Couple BTU/H	SRP IV [(BTU/H)/FT]	Header Couple BTU/H
54	93.48	90.29	186.97	180.59	280.45	270.88	373.94	361.18
63	112.04	109.82	224.07	219.64	336.11	329.47	448.14	439.29
72	131.06	130.12	262.11	260.24	393.17	390.36	524.22	520.48
81	150.50	151.12	300.99	302.24	451.49	453.35	601.98	604.47
90	170.32	172.76	340.63	345.51	510.95	518.27	681.26	691.02
99	190.49	194.99	380.97	389.97	571.46	584.94	761.94	779.95
108	210.98	217.77	421.96	435.54	632.93	653.31	843.91	871.08
117	231.77	241.07	463.54	482.15	695.31	723.22	927.08	964.30
126	252.84	264.87	505.69	529.74	758.53	794.60	1011.38	1059.47
135	274.18	289.12	548.36	578.25	822.55	867.37	1096.73	1156.50
144	295.77	313.82	591.54	627.65	887.31	941.47	1183.08	1255.29
153	317.59	338.94	635.19	677.88	952.78	1016.82	1270.37	1355.77
162	339.64	364.46	679.28	728.93	1018.93	1093.39	1358.57	1457.85

ΔT = ((Flow Water Temperature + Return Water Temperature) / 2) – Indoor Temperature

Load and Angle on Suspension Points

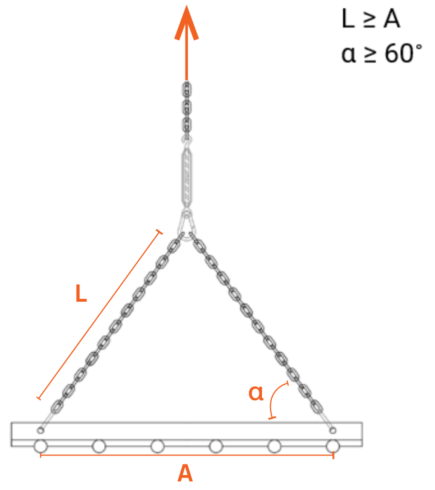
SRP I-II-III-IV SUSPENSION LOAD (SINGLE SUSPENSION SYSTEM)

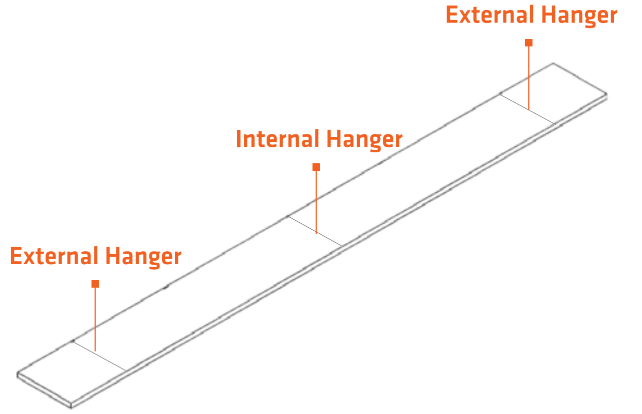




Number Of Modules	Weight Force (lbf)					
	Panel L = 6.6'		Panel L =9.8'		Panel L =19.7'	
	External Hanger	Internal Hanger	External Hanger	Internal Hanger	External Hanger	Internal Hanger
SRP I	12.5	-	19.0	-	22.7	30.3
SRP II	26.1	-	39.1	-	46.4	61.8
SRP III	39.3	-	58.7	-	69.6	92.9
SRP IV	52.6	-	78.4	-	83.4	111.2

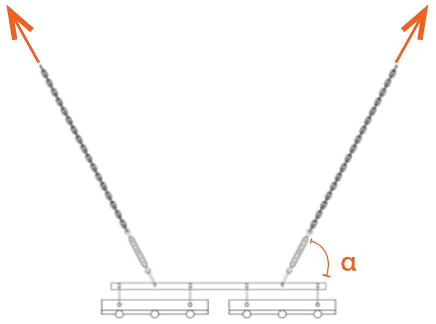
SRP 300-600-900-1200 SUSPENSION LOAD (SINGLE SUSPENSION SYSTEM)



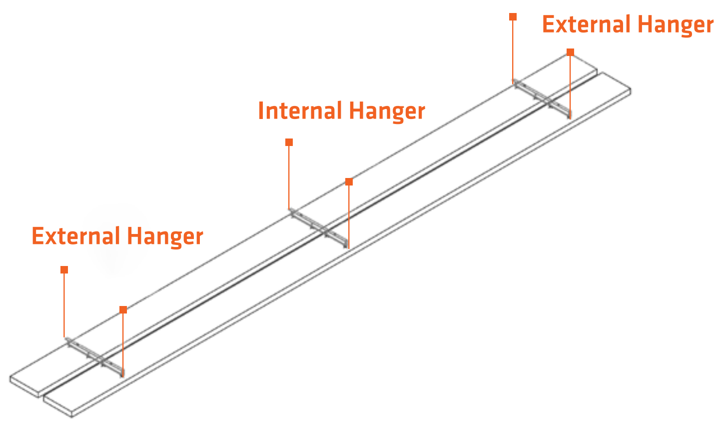


Number Of Modules	Weight Force (lbf)					
	Panel L = 6.6'		Panel L =9.8'		Panel L =19.7'	
	External Hanger	Internal Hanger	External Hanger	Internal Hanger	External Hanger	Internal Hanger
SRP 300	12.5	-	19.0	-	22.7	30.3
SRP 600	23.5	-	35.6	-	42.5	56.6
SRP 900	34.4	-	52.1	-	62.2	83.0
SRP 1200	45.3	-	68.7	-	72.4	96.6

SRP I-II-III-IV SUSPENSION LOAD (DOUBLE SUSPENSION SYSTEM)

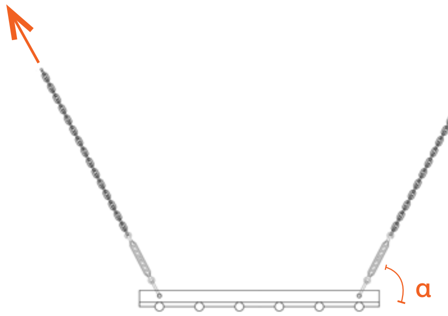


90˚ ≥ α ≥ 60˚

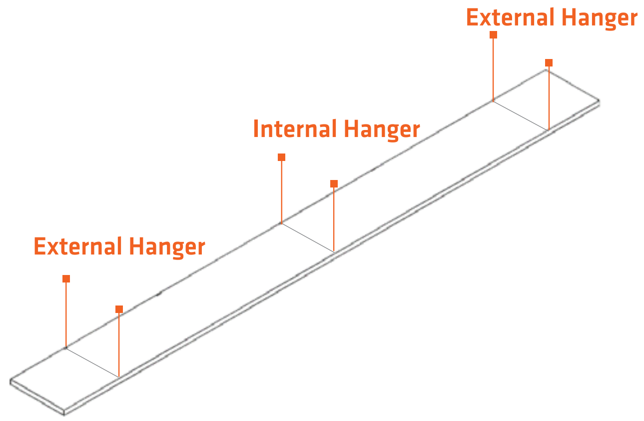


Number Of Modules	Weight Force (lbf)					
	Panel L = 6.6'		Panel L =9.8'		Panel L =19.7'	
	External Hanger	Internal Hanger	External Hanger	Internal Hanger	External Hanger	Internal Hanger
SRP I	6.3	-	9.5	-	11.4	15.1
SRP II	13.1	-	19.5	-	23.2	30.9
SRP III	19.7	-	29.3	-	34.8	46.4
SRP IV	26.3	-	39.2	-	41.7	55.6

SRP 300-600-900-1200 SUSPENSION LOAD (DOUBLE SUSPENSION SYSTEM)



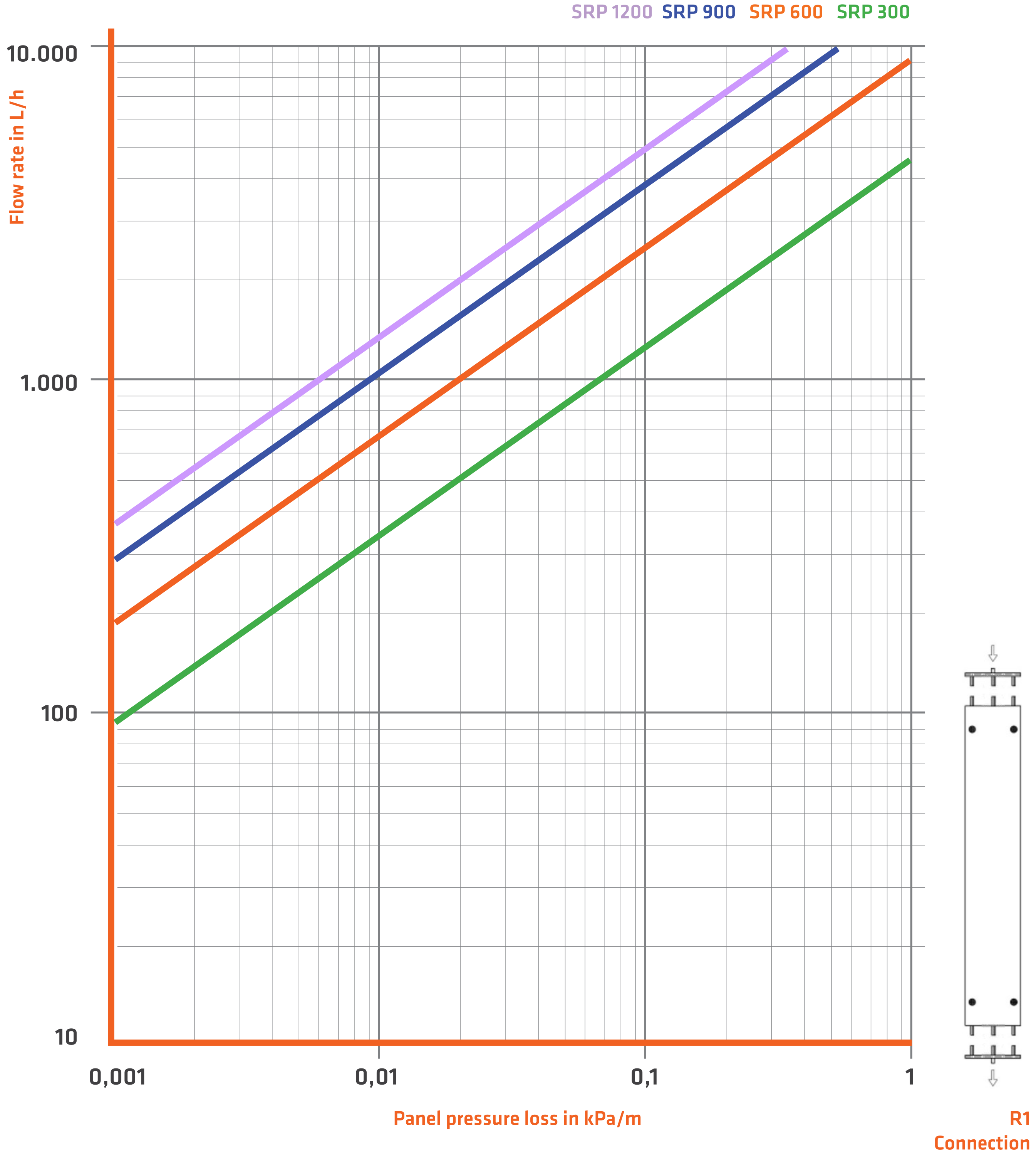
90˚ ≥ α ≥ 60˚



Number Of Modules	Weight Force (lbf)					
	Panel L = 6.6'		Panel L =9.8'		Panel L =19.7'	
	External Hanger	Internal Hanger	External Hanger	Internal Hanger	External Hanger	Internal Hanger
SRP 300	6.3	-	9.5	-	11.4	15.1
SRP 600	11.7	-	17.8	-	21.2	28.3
SRP 900	17.2	-	26.1	-	31.1	41.5
SRP 1200	22.6	-	34.3	-	36.2	48.3

Pressure Loss

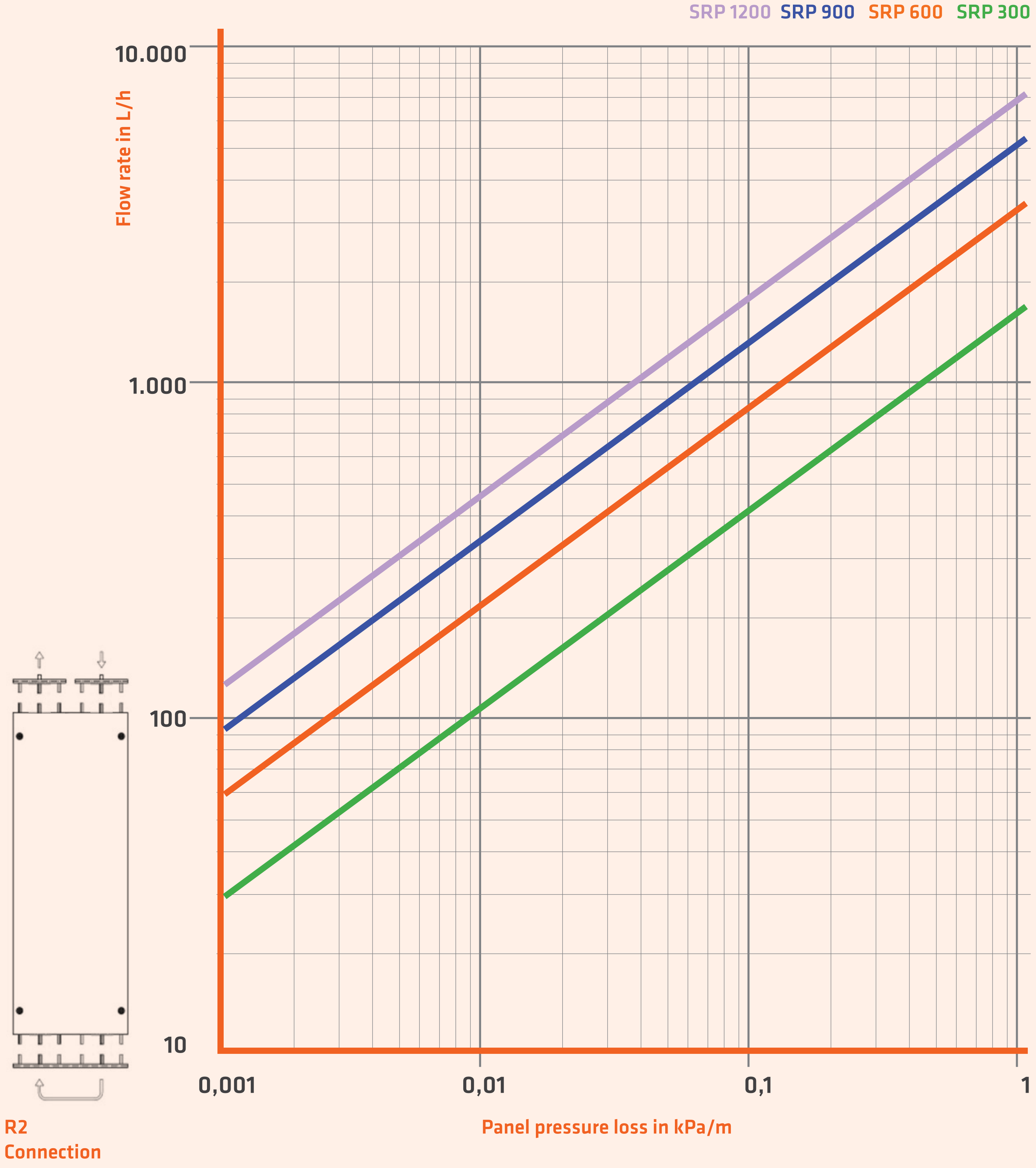
SRP PRESSURE LOSS CURVES – **R1 CONNECTION**



NOTE: The pressure loss values shown in the graph are calculated for an average water temperature of 176°F. The following correction factors should be applied for different water temperatures:

Mean Water Temperature T [°F]	140	176	212	248
Correction Coefficient	1.08	1	0.95	0.9

SRP PRESSURE LOSS CURVES – **R2 CONNECTION**

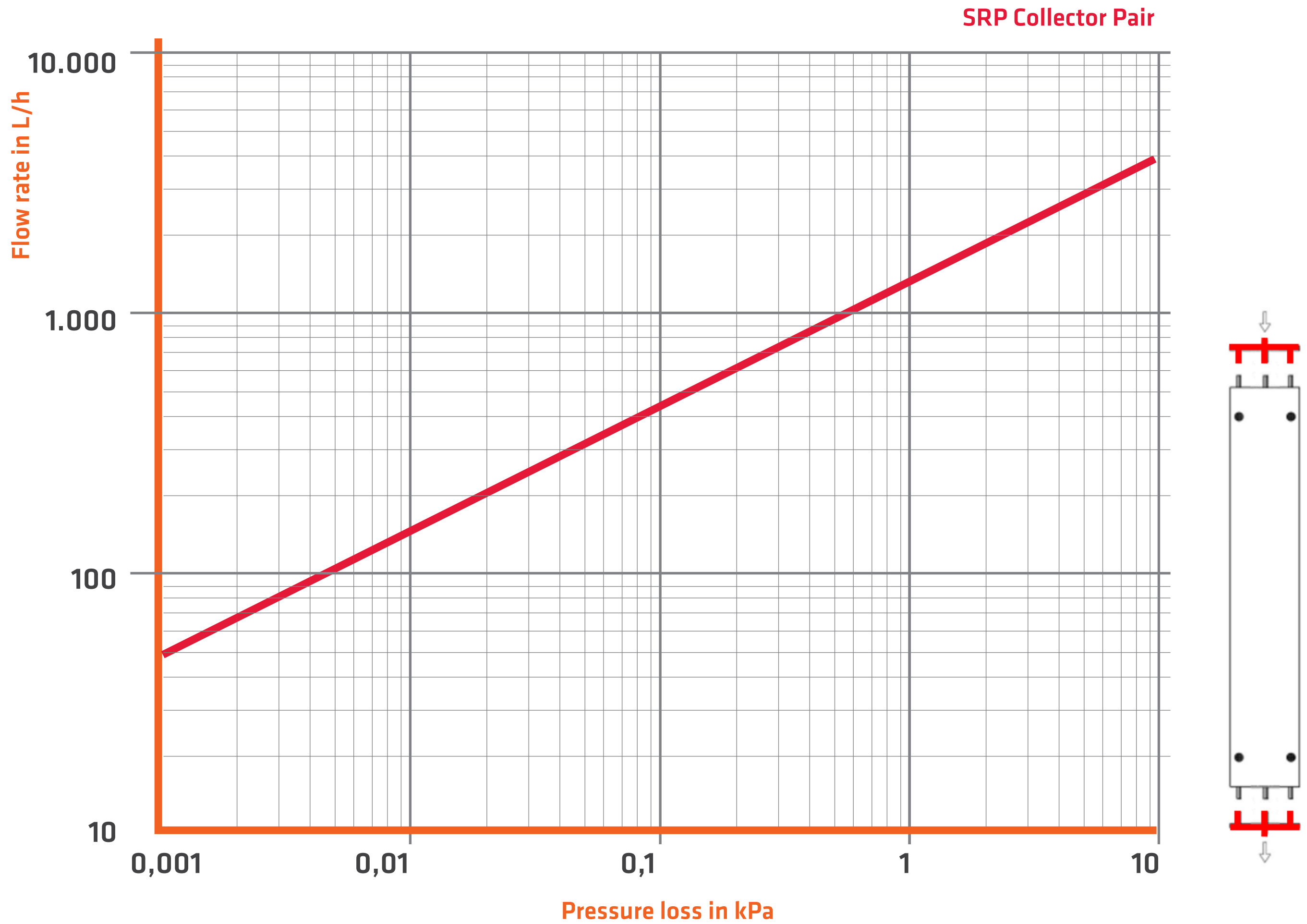


NOTE: The pressure loss values in the graph are calculated for an average water temperature of 176°F The following correction factors should be applied for different temperatures.

Mean Water Temperature T [°F]	140	176	212	248
Correction Coefficient	1.08	1	0.95	0.9

Pressure Loss

SRP COLLECTOR **PRESSURE LOSS CURVE**



NOTE: *The pressure loss values in the graph are calculated for an average water temperature of 176°F The following correction factors should be applied for different temperatures:*

Mean Water Temperature T [°F]	140	176	212	248
Correction Coefficient	1.08	1	0.95	0.9

HLK STUTTGART

HLK Certification and EN 14037

The EN 14037 European standard defines the performance criteria for water-based radiant panels, setting quality requirements for these systems. The standard also specifies the testing methods used to determine the thermal capacity of the panels.
These tests measure the average water temperature's impact on thermal output and allow the calculation of both total and radiant thermal capacity.
SRP water-based radiant panels have been certified and tested at HLK Stuttgart Laboratories according to the EN 14037 standard. The technical tables in this catalog are based on test reports, ensuring accurate data on total capacity, radiant efficiency, and performance.

MINIMUM WATER VELOCITY AND FLOW RATE LIMITS

For the SRP water-based radiant panels to achieve the specified capacity values, the flow inside the panel pipes must be turbulent. Otherwise, there can be a loss of up to 15% in the panel capacity values.

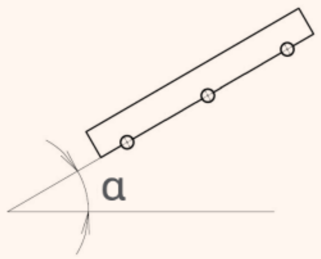
To ensure that the flow inside the SRP panels is turbulent, the water speed in each pipe within the panel must be at least 0.5 Ft/s (Feet per second), and the water flow rate must be at least 353 lb/h (Pound per hour). Therefore, when designing a water-based radiant system and determining the connection layout of the radiant panel lines, this criterion must be carefully considered.

INSTALLATION HEIGHT & MOUNTING ANGLE

Minimum Installation Heights: For a comfortable heating operation, the radiant energy intensity at a person's head level under radiant influence should not exceed. (63.4 (Btu/h)/ft²).

Mean Water Temperature T [°F]	PANEL MODEL / MINUMUM INSTALLATION HEIGHTS [FT]							
	SRP 300	SRP 600	SRP 900	SRP 1200	SRP I	SRP II	SRP III	SRP IV
104	7.9	7.9	8.2	8.2	7.9	8.2	**8.5**	**8.9**
122	8.5	8.9	8.9	8.9	8.5	8.6	**9.2**	**9.5**
140	9.8	9.8	9.8	9.8	9.8	10.2	**10.2**	**10.5**
158	10.2	10.5	10.8	10.8	10.2	10.5	10.8	11.2
176	10.8	11.5	11.5	11.5	10.8	11.5	11.8	12.1
194	11.5	11.8	12.1	12.5	11.5	12.1	12.5	12.8
212	12.1	12.5	13.1	13.1	12.1	12.8	13.8	14.1

In addition to this criterion, factors such as the ratio of ceiling area to water-based radiant panel area and the density ratio of cold surfaces (such as external walls) can also affect the suspension height. The table provides recommendations regarding the minimum suspension heights for SRP water-based radiant panels; however, different minimum height values may be used depending on the specific project requirements.



Mounting Angle: The SRP heating capacity values provided in the capacity tables are valid for the case where the panels are mounted parallel to the floor. If the panels are mounted at an angle, an adjustment should be made to the design heating capacities based on the mounting angle.

For 30° mounting angle, a 1.10 correction factor should be applied.
For 45° mounting angle, a 1.15 correction factor should be applied.

High Ceiling Installation: In cases where the panel mounting height exceeds 19.7 ft, an adjustment should be made to the design heating capacity due to the reduction of radiant energy reaching the working area, caused by the transfer of energy to the surrounding air. The adjustment factors based on height are provided in the table below.

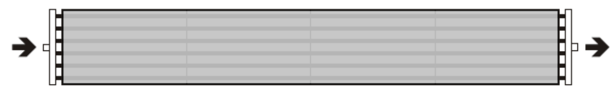
Panel Mounting Heights [ft]	19.7	26.2	32.8	39.4	49.2	65.6
Correction Coefficient	1.00	1.08	1.12	1.18	1.25	1.30

High Ceiling - Low Panel Installation: If the panel mounting height is more than 3.3 ft lower than the ceiling height, the radiant energy will have a greater impact on the working area, and losses to the surrounding air will be reduced. Therefore, a reduction should be applied to the design heating capacity based on the distance between the ceiling and the panel installation height. The reduction factors are provided in the table below.

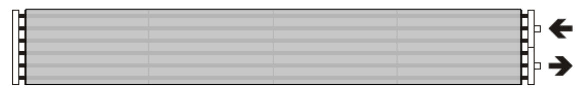
Distance Between Panel and Ceiling [ft]	3.28	6.56	9.84	13.1	16.4	19.7	23.0	26.2	29.5	32.8	36.1	39.4
Correction Coefficient	1.00	0.96	0.94	0.93	0.91	0.89	0.88	0.86	0.85	0.83	0.82	0.8

SRP STRIP CONNECTION TYPES

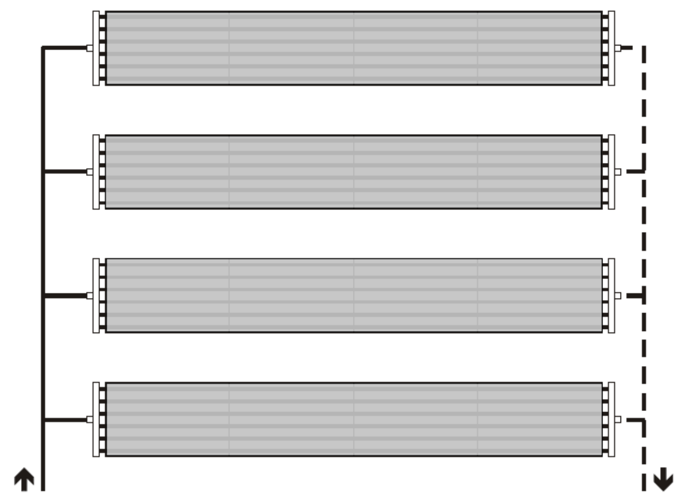
R1 Series Connection – Single Panel Strip



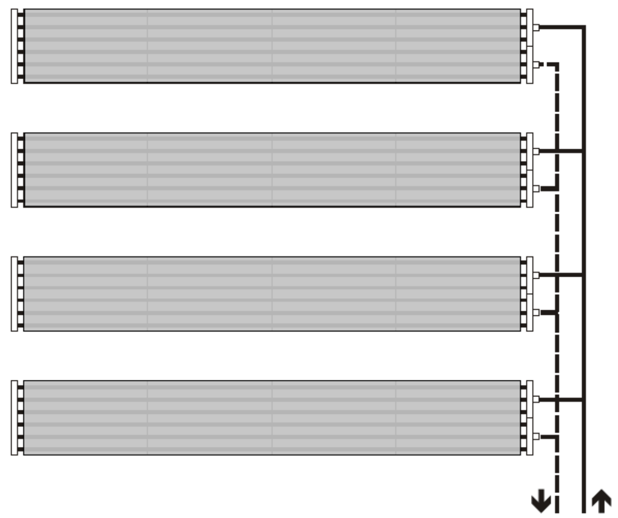
R2 Parallel Connection – Single Panel Strip



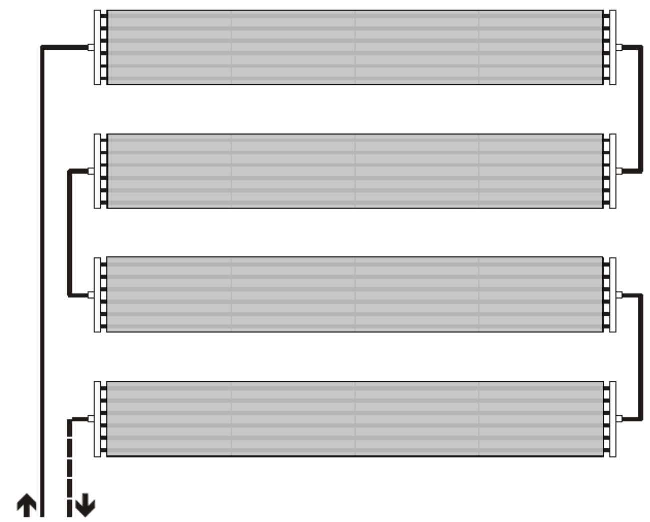
R1 Parallel Connection – 4-Panel Strip Group



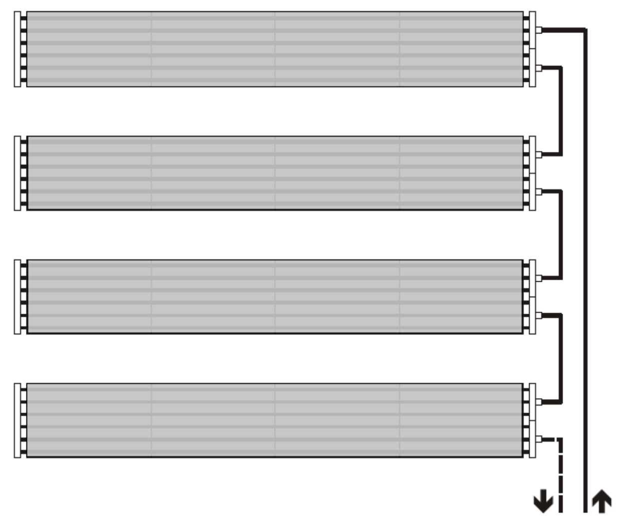
R2 Parallel Connection – 4-Panel Strip Group



R1 Series Connection – 4-Panel Strip Group



R2 Series Connection – 4-Panel Strip Group



Flexible connection hoses and shut-off valves suitable for the strip length should be used at the pipe connection points.

To achieve hydraulic balance in water-based radiant panel strips, the Tichelmann piping method can be applied. However, due to the fact that this method is costly and difficult to implement in many cases, it is recommended to use balancing valves on the return lines for hydraulic balancing.

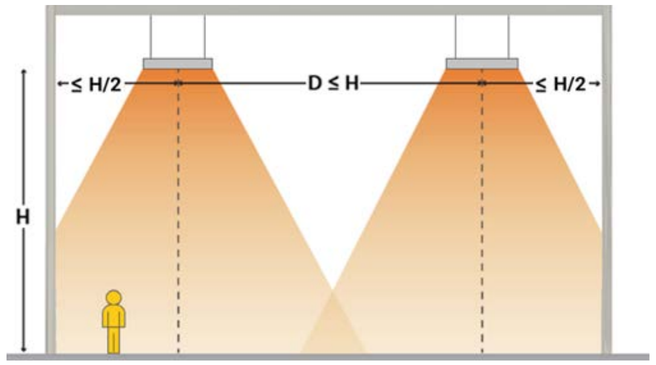
In addition to hydraulic balancing, zone temperature control can also be achieved through motorized combined balancing valves and room thermostats.

System Design

PANEL TO PANEL AND PANEL TO WALL DISTANCES

For an efficient water-based radiant panel heating system, it is essential to ensure homogeneous heat distribution by properly spacing the panels relative to each other and the walls.
- If the panel mounting height is H, then the maximum allowable distance (D) between panels should be equal to H.
- The maximum distance between the panels and external walls should be H/2 to minimize the cold radiation effect.

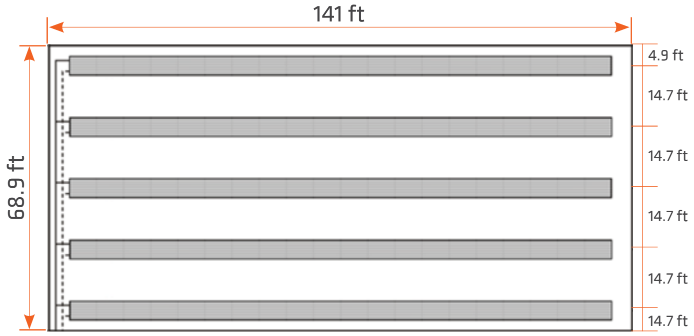
By following these spacing rules, uniform heat distribution can be achieved, ensuring optimal thermal comfort.



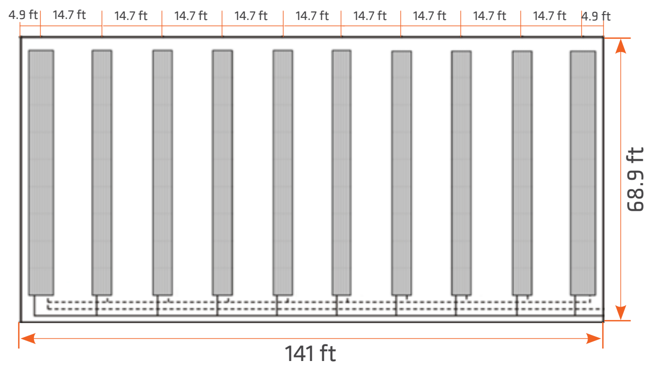
ORIENTATION AND LINE LENGTHS

Depending on structural requirements, machinery layout, and rack arrangement, radiant panel heating strips should be arranged parallel to the longest side of the area whenever possible.
By placing the panels parallel to the longer side, the number of panel strips can be reduced, which in turn:
- Minimizes installation complexity,
- Reduces piping and system costs.

In the example below, two water-based radiant system designs with different orientations for the same space can be examined. The structure is a concrete truss building with a height of 18.0 ft, and the trusses are parallel to the long side.



Parallel Radiant Panel System Layout



Perpendicular Radiant Panel System Layout

With the design criteria in mind, in the parallel truss design, 5 rows of 131.2 ft SRP 600 panels were used, while in the perpendicular truss design, 8 rows of 59.4 ft SRP 600 panels and 2 rows of 59.4 ft SRP 900 panels were used. As can be seen from the example drawing, in the perpendicular truss design, the number of lines, piping, and connection equipment requirements are higher. Additionally, since suspension in the truss direction is not possible, a special suspension application is required. Therefore, in the perpendicular truss design, the costs for piping, equipment, and suspension are higher.

When calculating the maximum length of the panel strips, the pressure loss value for each pipe should not exceed 0.01105 psi/ft.

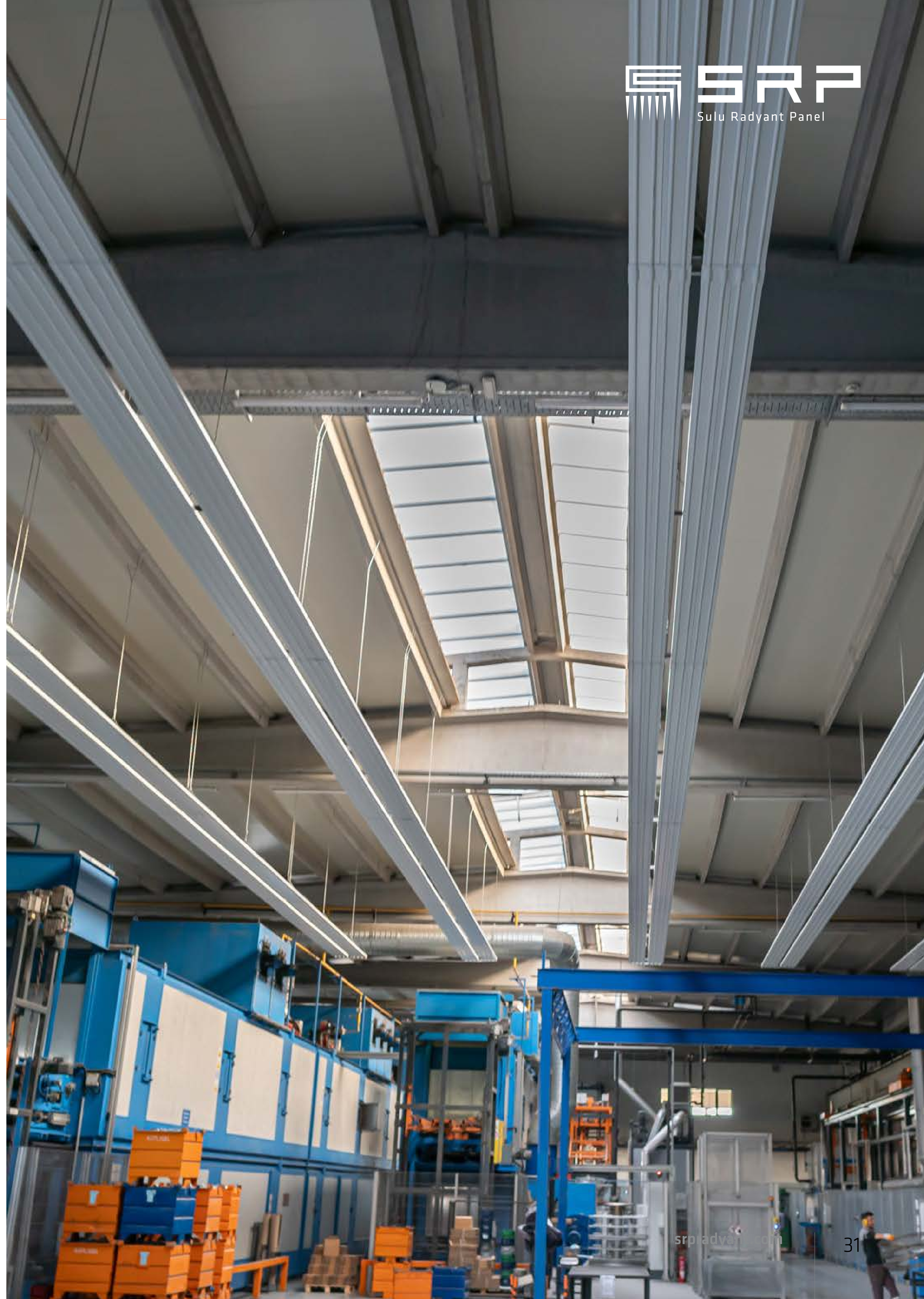
With this criterion in mind, the recommended maximum length of SRP strips for R2 parallel connection and R1 series 2 panel stirp group connections are shown in the table below.

For R1 parallel connection, the table length values should be multiplied by 2. For R2 series connection, the table values should be checked with the "unit strip length * number of series-connected strips" value.

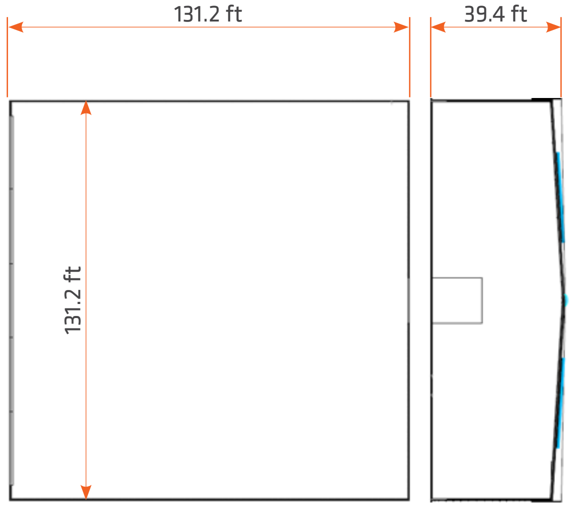
ΔT °F	95	104	113	122	131	140	149	158	167	176	185	Tg-Td
Max. Strip Lenght	557.7 ft	475.7 ft	426.5 ft	377.3 ft	328.1 ft	295.3 ft	262.5 ft	246.1 ft	229.7 ft	213.3 ft	196.9 ft	36 F

Correction Factor for Tg-Td = 10 K: 0.50
Correction Factor for Tg-Td = 5 K: 0.25

Tg-Td: Supply water temperature - Return water temperature
ΔT [°F]: (Supply temperature + Return temperature) / 2 - Indoor temperature



SRP SYSTEM DESIGN FOR A SAMPLE PROJECT



1- PROJECT INFORMATION

BUILDING TYPE	: FACTORY
LENGTH	: 131.2 FT
WIDTH	: 131.2 FT
HEIGHT	: 39,4 FT (AVERAGE)
CEILING TYPE	: TRUSS - I PROFILE
HEAT DEMAND	: 204,729 BTU/H
INDOOR TEMPERATURE:59 °F	
HEAT SOURCE	: CONDENSING NATURAL GAS BOILER
HEATING WATER TEMPERATURE	: 176/140°F (SUPPLY/RETURN)

2- DETERMINATION OF MOUNTING HEIGHT, NUMBER OF STRIPS, ORIENTATION, AND PANEL LENGTH

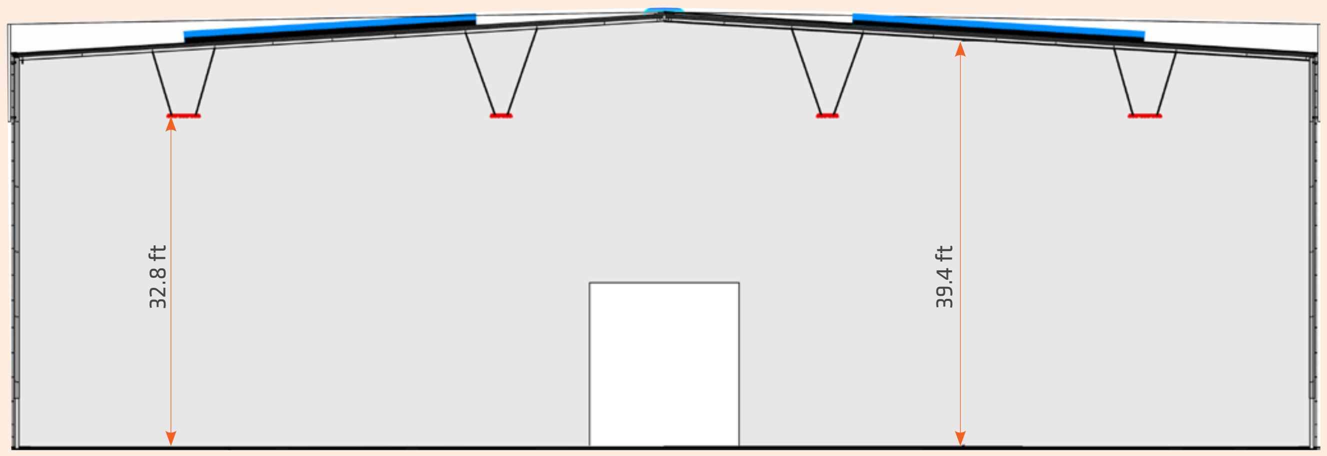
In the project, considering the placement of machinery and equipment (such as lighting, ducts, sprinklers, etc.), it has been found suitable for the panel mounting height to be 32.8 ft, with the direction of the strips aligned with the ceiling trusses.
The distance between the panels and the walls should be ≤ 16.4 ft (H/2), the distance between the panels should be ≤ 32.8 ft (H), and since the building width is 131.2 ft, the minimum number of lines can be calculated as:
Minimum number of strips = 131.2/32.8= 4
When checking the trusses to be used for suspension, it was confirmed that the truss spacing is suitable for 4 rows, so the number of strips has been set to 4.
When determining the strip lengths, a minimum of 4.9 ft of space should be left at the ends of the strips to allow for easy pipe and collector connections. For the specific project, it is anticipated that 6.6 ft of space will be left at the strip ends. Therefore, for a building length of 131.2 ft the strip lengths have been set to 118.1 ft.

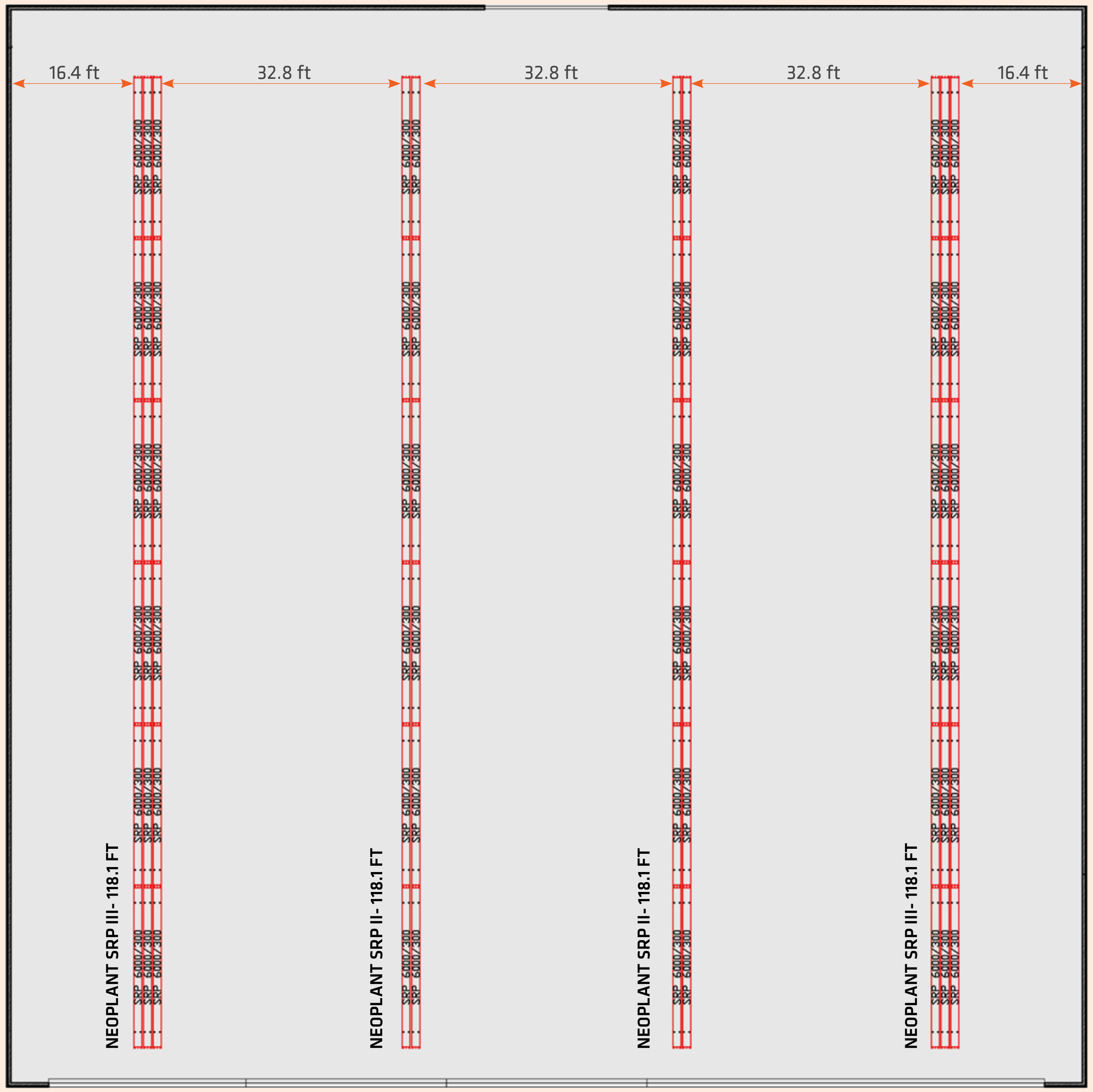
3- DETERMINATION OF SRP SYSTEM CAPACITY

For a panel mounting height of 16.4 ft the adjustment factor is 1.12.
For the distance between the panel and the ceiling of 6.6 ft (39.4 – 32.8), the reduction factor is 0.96.
The SRP system capacity is calculated as:
SRP system capacity = 204,729 Btu/h (building heat loss) × 1.12 × 0.96 = 220,125 Btu/h

4- SELECTION OF SRP PANEL TYPES

The system can be designed using SRP 300-600-900-1200 models, SRP I-II-III-IV models, or a combination of these models. However, since there is no distinguishing preference in this project, it has been decided to design using the SRP I-II-III-IV models.
ΔT = ((Supply Water Temp. + Return Water Temp.) / 2) – Indoor Temp. = ((176 + 140) / 2) – 59 = 99 ˚ F
From the table, for a ΔT of 99 ˚ F, the SRP I panel capacity is 190.49 (Btu/h)/ft.
For a 118.1-ft strip, the strip capacity is:
118.1 ft×190.49 (Btu/h)/ft=22,497 Btu/h
The total required capacity is 220,125 Btu/h so the number of SRP I strips is calculated as:
220,125 Btu/h / 22,497 Btu/h = 9.79
The number of strips was previously set to 4. If 2 of these 4 strips are SRP II and 2 are SRP III, a total capacity equal to the capacity of 10 SRP I strips will be achieved. (3 x SRP I thermal capacity = SRP III thermal capacity ; 2 x SRP I thermal capacity = SRP II thermal capacity)
Since heat loss and cold radiation effects are higher near the exterior walls, it has been decided to use 2 SRP III strips near the exterior walls and 2 SRP II strips in the interior areas.
Based on the criteria determined so far, appropriate trusses and suspension methods have been selected, and the panel layout has been incorporated into the project.





5- DETERMINATION OF CONNECTION TYPE

The most important criterion to be considered when deciding on the strip connection method is the water velocity criterion. Along with this criterion, specific needs related to control, as well as the pipe system of the installation, are also taken into account when determining the strip connection method.

If we consider the R2 Parallel Connection for the SRP III – 118.1 FT strips, the calculations are as follows:
Line Heating Capacity: (571.47 (Btu/h)/ft × 118.1 ft) panel + (584.94 Btu/h) collector pair = 68,075 Btu/h
Flow Rate: (68,075 Btu/h) / (36 °F* 1 btu / lb°F) = 1,891 lb/h

There are 3x3=9 pipes in the SRP III panels. In the R2 parallel connection, these 9 pipes can be split as 6/3 or 5/4 for supply/return. For the given project, it is planned to use 5 pipes for the supply line and 4 pipes for the return line.

The flow per pipe is calculated as: 1,891 lb/h / 5 = 378.2 lb/h

If we consider the R2 Parallel Connection for the SRP II – 118.1 FT strips, the calculations are as follows:
Line Heating Capacity: (381 (Btu/h)/ft × 118.1 ft) panel + (389.97 Btu / h) collector pair = 45,386 Btu/h
Flow Rate: (45,386 Btu/h) / (36 °F* 1 Btu / lb°F) = 1,261 lb/h

There are 2x3=6 pipes in the SRP II panels. In the R2 parallel connection, these 6 pipes are used with 3 for the supply and 3 for the return.

The flow per pipe is calculated as: 1,261 lb/h / 3 = 420.3 lb/h

Since the flow per pipe is 420.3 lb/h, which is greater than the minimum required flow of 353.3 lb/h, the minimum required water velocity of 0.5 ft/s is exceeded, and the condition for turbulent flow is met.
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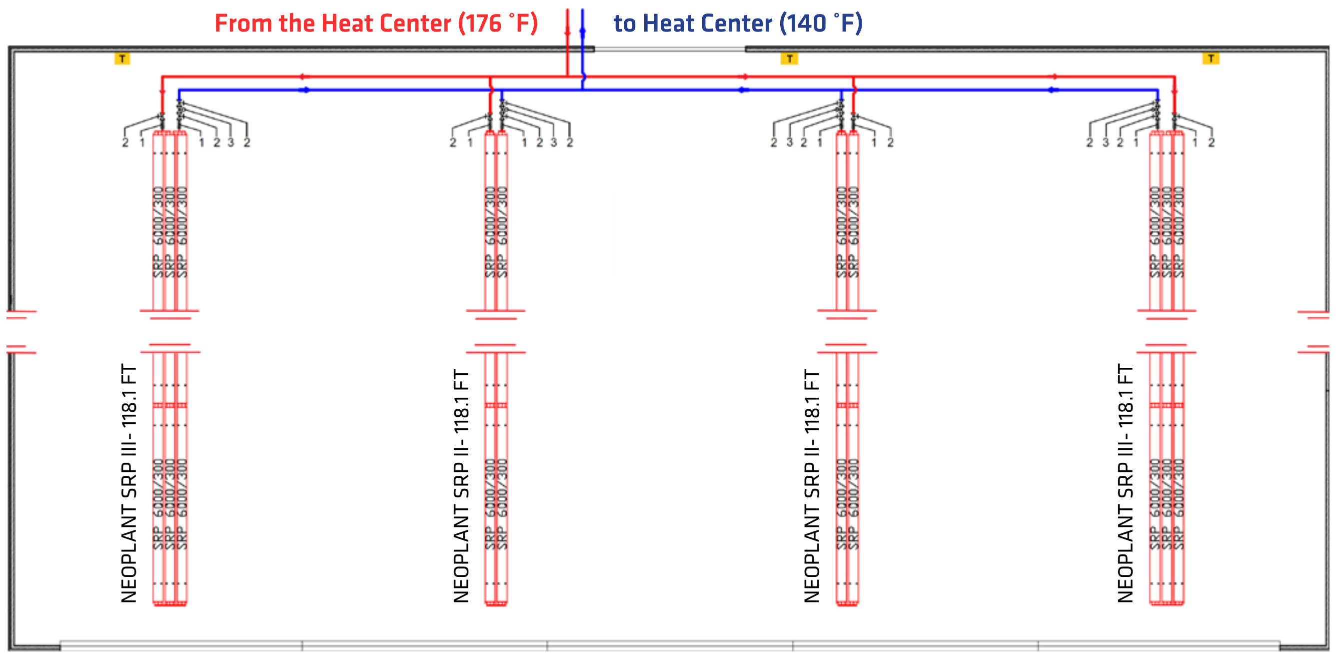
6 - DETERMINATION OF PIPING ROUTE

The pipe routes are determined by considering the selected connection type, the location of the heat center, and the conditions of the area to be heated. Based on the line capacities, the appropriate pipe diameters are selected.



7- CONNECTION EQUIPMENT AND CONTROL

To compensate for expansion and contraction at pipe inlets and outlets, flexible connection hoses (1) are used. Additionally, shut-off valves (2) are installed to allow manual intervention when needed.
To limit flow rates and control temperature, pressure-independent control valves (3) are used at the panel outlet. These valves are adjusted according to flow rate requirements.
The motorized actuators of these pressure-independent control valves are controlled via room thermostats. Each motorized valve can be controlled by a dedicated thermostat or grouped under a single thermostat. If zoning is required in the space, a thermostat is used for each zone, and the motorized valves are grouped according to the zones. Thermostats are positioned in the areas of the space where temperature control is most critical, or if there is no such specific need, they are placed in the parts of the space or zone that are expected to be the coldest.
In our project, since the system is intended to be controlled in three zones, three room thermostats (T) have been used. The motors of the strips located near the walls are controlled by individual thermostats, while the motors of the two strips in the middle are controlled by a single thermostat.

8 - DETERMINATION OF PRESSURE LOSS

The pressure loss in the panels is calculated from the flow rate passing through the strip and the connection type, using the pressure loss tables.
For SRP III – 118.1 FT strips, the flow rate is 1,891 lb/h = 3.78 GPM; the pressure loss is calculated as:
0.00442 psi/ft * 118.1 ft = 0.522 psi
For SRP II – 118.1 FT strips, the flow rate is 1,261 lb/h = 2.52 GPM; the pressure loss is calculated as:
0.00199 psi /ft * 118.1 =0.235 psi

The collector pressure loss is also calculated based on the flow rate using the collector pressure loss table.
For SRP III – 118.1 FT strips, the flow rate is 1,891 lb/h = 3.78 GPM; the collector pair pressure loss is 0.058 psi.
For SRP II – 118.1 FT strips, the flow rate is 1,261 lb/h = 2.52 GPM; the collector pair pressure loss is 0.0261 psi.

The pressure loss tables are prepared based on an average water temperature of 176°F. Since the design is done at 176/140°F and the average water temperature is 158°F, correction factors should be applied to the pressure loss values.

Mean Water Temperature T [°F]	140	176	212	248
Correction Coefficient	1.08	1	0.95	0.9

The correction factor for 158°F is considered to be 1.04. The total pressure loss values are calculated as follows:
For SRP III – 118.1 FT: Total Pressure Loss = 0.522 psi + 0.058 psi = 0.58 psi
Corrected Pressure Loss = 0.58 * 1.04 = 0.603 psi
For SRP II – 118.1 FT: Total Pressure Loss =0.235 psi + 0.0261 psi =0.261 psi
Corrected Pressure Loss = 0.261 psi * 1.04 = 0.272 psi

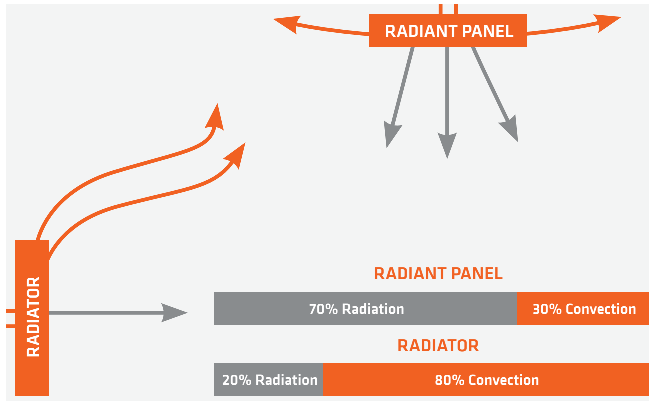
The pressure loss values for the strips have been calculated. The total pressure losses for each strip are determined by adding the boiler room pressure losses, connection equipment pressure losses, and pipe pressure losses. The critical strip is then identified,and the circulation pump's head is selected based on the critical strip's pressure loss value.

The circulation pump flow rate is then selected to meet the total flow rates of the strips.
Total Hydronic Radiant Panel System Flow Rate: (2 x 3.78 GPM) + (2 × 2.52 GPM) = 12.6 GPM

Frequently Asked Questions

1. Is water-based radiant heating a new system? Will it cause any issues?

Water-based radiant heating is not a new technology. In fact, it has been in use for over 60 years. However, due to its high efficiency and comfort, its use is increasing in modern building designs. While this system may not be widely used in our country yet, in regions where it has been implemented, it has provided significant energy savings and high customer satisfaction. Therefore, no major problems are expected.



2. Radiators look similar, aren't they the same?

Radiators transfer 80% of their heat through convection and only 20% through radiation. In contrast, radiant heating panels primarily operate on radiation, making them more efficient. Radiant panels ensure even heating without air circulation, eliminating dust movement and providing a more comfortable environment.

3. Does heating the environment with devices that heat by blowing air, such as fan coils or unit heaters, provide more comfort than radiant heating, which heats the objects it encounters??

For comfortable heating, it is not necessary to heat the large air mass in which people or objects are located. On the contrary, radiant heating, being a small simulation of the sun's heating, creates a more natural heating sensation. Additionally, heating the air can lead to increased energy consumption and discomfort in many cases. In buildings with high ceilings, due to thermal stratification, unwanted areas (such as the space under the ceiling) reach higher temperatures, while the desired heating area (working zone) remains at lower temperatures. This situation not only creates discomfort in heating but also increases heat losses as the temperatures in unwanted areas are excessively raised, leading to energy waste.

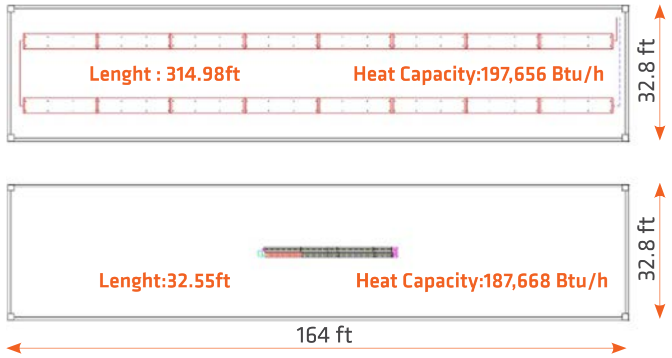
Another disadvantage of air heating is that due to the density difference of the heated air, it tends to accumulate at leakage points within the space (such as doors, windows, etc.), creating a non-homogeneous heat distribution. This also leads to discomfort and additional energy consumption. In forced air systems, there is a constant air movement and noise in the environment. The air movement, especially, causes the movement of particles and dust, which degrades the air quality and may create an unhealthy environment. Moreover, in air heating systems, if the supply air temperature drops below a certain value, even if the air temperature is above room temperature, it may create a cooling sensation instead of a heating one. This leads to the fact that the temperature of the heat generator's outlet water cannot be reduced below a certain level, resulting in low efficiency and high energy consumption. None of these disadvantages apply to radiant panels.

4. Since heating with radiant panels is done from the ceiling, is there a possibility of our heads overheating, causing discomfort?

If the design and installation of the radiant panel system are done correctly, such a situation will not occur. The system design is made by considering the effect area, required thermal capacity, and water temperature values, based on the mounting height of the panels. Unlike radiant tube heaters or ceramic radiant heaters, the surface temperatures of radiant panels can be controlled according to the water temperature, and due to their large surface area, the effect area per unit thermal capacity is much higher. Therefore, if the system is designed correctly, the possibility of discomfort due to overheating is eliminated.

The installation of a radiant panel system operating at 176/140°F water temperatures Equivalent U-Tube Radiant Installation -1187.668 Btu/h

The installation of a radiant panel system operating at 176/140°F water temperatures



Equivalent U-Tube Radiant Installation - 187,668 Btu/h

Water Radiant Panel

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SRP is a brand of Neoplant.