

# Technical Data Manual

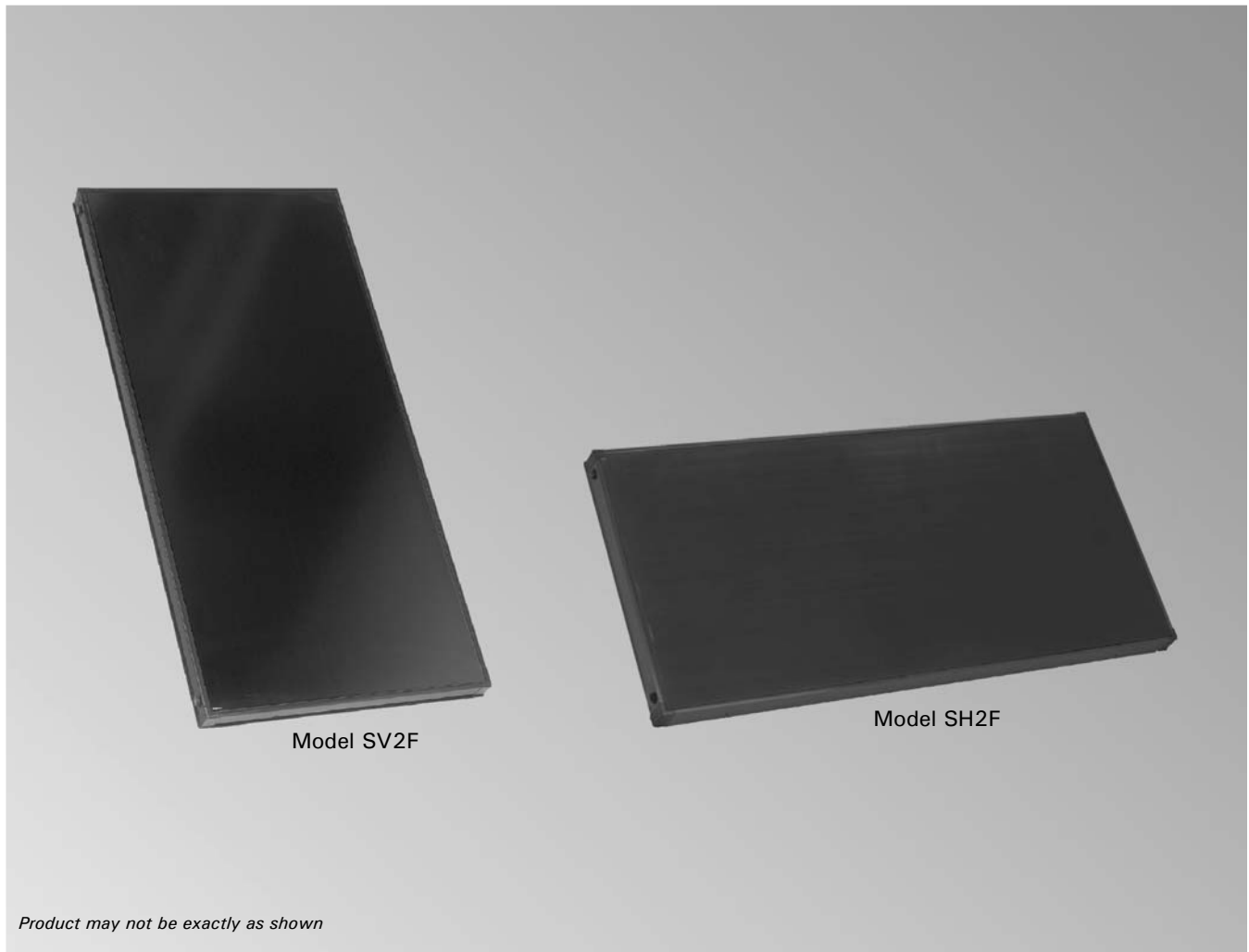
Model Nos. and pricing: see Price List

Flat plate solar collectors for the harnessing of solar energy  
Panels with 25 ft<sup>2</sup> (2.32 m<sup>2</sup>) absorber surface

# VIESSMANN®



## VITOSOL® 200-FM



### VITOSOL 200-FM Model SV2F and SH2F

#### Flat plate solar collectors

For vertical (model SV) or horizontal (model SH) installation on sloped and flat roofs. For integration on walls (model SH only).

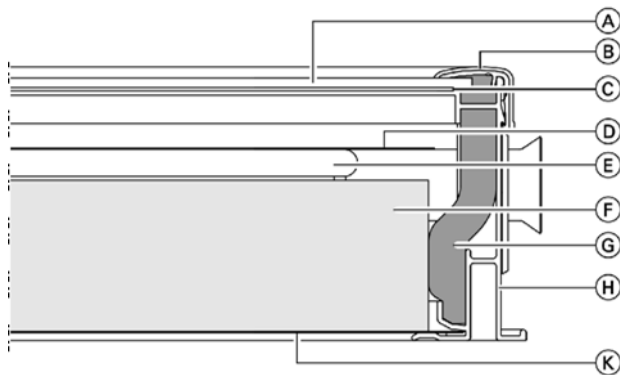
To produce domestic hot water, or to supplement low-temperature heating systems or swimming pools via a heat exchanger.



## Product Description

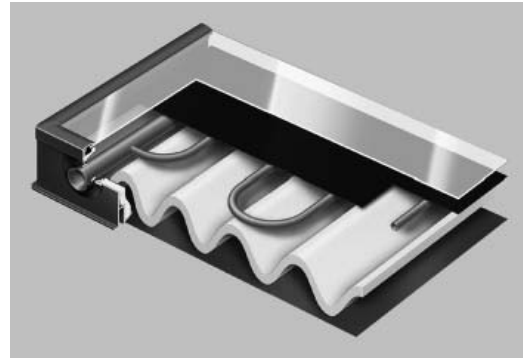
### Benefits

- **High performance**, premium version flat plate collector, thanks to unique frame design and highly efficient ThermProtect coated aluminum absorbers.
- **Suitable for many residential or commercial applications** with vertical or horizontal versions available. Suitable for DHW or pool heating, space heating applications.
- **Attractive appearance** with powder coated dark blue frame, endless glass seal and minimal space between collectors. No screws or rivets used in frame for clean, neat finish.
- **Rugged, high-quality construction** using impact-resistant low-iron solar glass, copper piping, aluminum absorber and frame and non-degrading thermal insulation.
- **Permanently sealed and high stability** through all-around folded aluminum frame and endless glass seal.
- **Universal application** on flat, sloped roofs or freestanding, vertical (model SV) or horizontal (model SH) orientation. Model SH is suitable for installations on walls. Connect up to 12 collectors in one array for commercial or residential systems.
- **Fast installation** with flexible connection pipes and quick-connect fittings. Prefabricated collector mounting hardware ensures easy connection to roofs.
- **Maximum system performance and reliability** with a full range of solar system components designed to integrate seamlessly.
- **Quality tested** to Solar Keymark testing requirements.
- **Certified** to the Solar Rating and Certification Corporation (SRCC) OG-100 Standard.



### Legend

- (A) Solar glass cover, 1/8 in. (3.2 mm) thick
- (B) Aluminum cover strip in dark blue
- (C) Continuous flexible seal for solar glass cover
- (D) Aluminum absorber sheet with ThermProtect coating
- (E) Meander-shaped copper pipe
- (F) Melamine resin foam insulation
- (G) Melamine resin foam insulation
- (H) Aluminum frame in dark blue
- (K) Aluminum-zinc coated sheet steel back panel



### Construction and function

The main component of the Vitosol 200-FM is the ThermProtect switching absorber. It ensures high absorption of solar radiation and low emission of thermal radiation. When the collector temperature becomes elevated  $> 167^{\circ}\text{F}$  ( $> 75^{\circ}\text{C}$ ) the absorber will switch or transition to a higher rate of thermal emission. The net result is that the collector will operate at a reduced temperature as the absorber will be rejecting excess thermal radiation. The ThermProtect switching absorber limits the maximum or stagnation temperature of the collector  $293^{\circ}\text{F}$  ( $145^{\circ}\text{C}$ ). A meander-shaped copper pipe, through which the heat transfer medium flows, is permanently embedded into the absorber.

The heat transfer medium channels the absorber heat through the copper pipe. The absorber is encased in a highly insulated collector housing, which minimizes collector heat losses. The high quality thermal insulation provides temperature stability and is free from gas emissions.

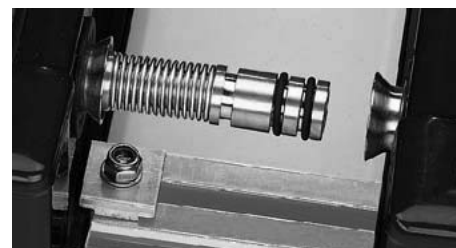
The cover consists of a solar glass panel with a very low iron content, thereby reducing reflection losses. The tempered solar glass is 1/8 in. (3.2 mm) thick, making it very resistant to weather influences.

The glass is set into the collector frame with a continuous profiled seal, preventing water from penetrating into the collector. This ensures a long and reliable service life for all internal components.

The collector housing consists of a one-piece powder-coated aluminum frame into which the solar glass is permanently sealed.

Up to twelve collectors can be joined quickly and easily to form a single collector array. For this, the standard equipment includes flexible connection pipes, sealed with O-rings (see picture below).

A connection kit with clamping ring fittings enables the collector array to be quickly connected to the pipes of the solar circuit. The collector temperature sensor is installed in the solar circuit flow using a sensor well set.



Flexible interconnection pipes

# Specification

Vitosol 200-FM		SV2F	SH2F
Gross area	ft <sup>2</sup> (m <sup>2</sup> )	27.0 (2.51)	27.0 (2.51)
Absorber area	ft <sup>2</sup> (m <sup>2</sup> )	25.0 (2.32)	25.0 (2.32)
Aperture area* 1	ft <sup>2</sup> (m <sup>2</sup> )	25.1 (2.33)	25.1 (2.33)
Spacing between collectors	in. (mm)	¾ (21)	¾ (21)
<b>Dimensions* 2</b>			
Width	in. (mm)	41 ¾ (1056)	93 ¾ (2380)
Height	in. (mm)	93 ¾ (2380)	41 ¾ (1056)
Depth	in. (mm)	3 ½ (90)	3 ½ (90)
<b>Optical efficiency* 3</b>	%	82.3	82.6
<b>Heat loss coefficient U1</b>	W/(m <sup>2</sup> · K)	4.421	4.380
<b>Heat loss coefficient U2</b>	W/(m <sup>2</sup> · K <sup>2</sup> )	0.0220	0.037
<b>Thermal capacity</b>	kJ/(m <sup>2</sup> · K)	4.89	5.96
<b>Weight (dry)</b>	lb (kg)	86 (39)	88 (40)
<b>Fluid capacity</b> (heat transfer medium)	USG (L)	0.48 (1.83)	0.63 (2.40)
<b>Maximum working pressure* 4</b>	psig (bar)	87 (6)	87 (6)
<b>Maximum stagnation temperature* 5</b>	°F (°C)	293 (145)	293 (145)
<b>Connection</b>	in. (mm)	¾ (22)	¾ (22)
<b>Requirements for installation surface and anchorage</b>	Roof construction with adequate load capacity for prevailing wind forces		
<b>Mechanical test load</b>			
Max. tested positive load	lb/ft <sup>2</sup> (Pa)	73.1 (3500)	73.1 (3500)
Max. tested negative load	lb/ft <sup>2</sup> (Pa)	62.7 (3000)	62.7 (3000)

\* 1 Important for system design considerations.

\* 2 Dimensions rounded to the nearest ¼ inch.

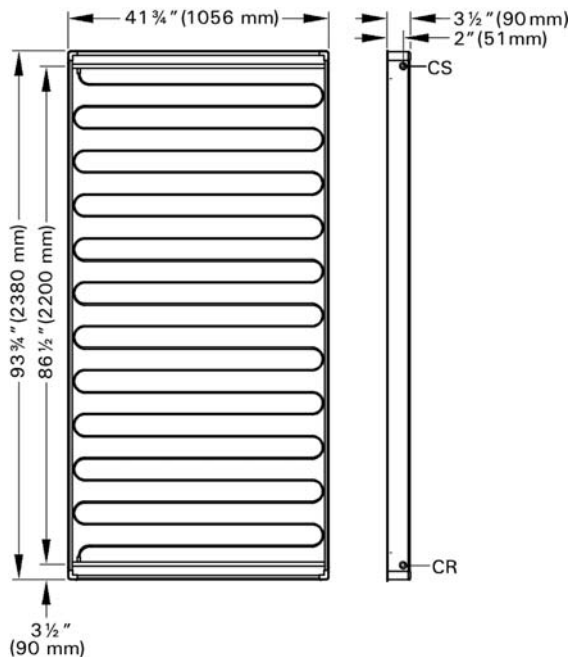
\* 3 Based on absorber area.

\* 4 In sealed systems, operating pressure of at least 44 psig + 0.45 psig x static head (ft.)

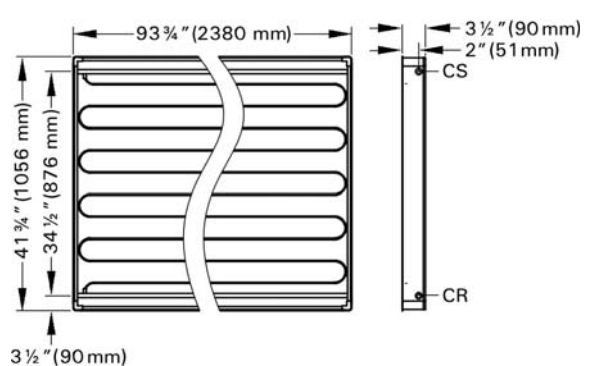
(3.0 bar + 0.1 bar x static head (m) must be present in the collectors in cold condition).

\* 5 The stagnation temperature is the temperature which applies to the hottest point of the collector at a global radiation intensity of 3412 Btuh (1000 W) when no heat is conducted by the heat transfer medium.

**Model SV2F (Vertical mounting)**



**Model SH2F (Horizontal mounting)**



**Legend**

- CR Collector return (inlet)
- CS Collector supply (outlet)

## Standard Equipment/Accessories

### Standard equipment

Vitosol 200-FM, Models SH2F and SV2F come fully assembled and are ready to be connected.

**Note:** Viessmann offers complete solar heating system combi packages, as well as comprehensive design support in order to facilitate the component selection process.

### Accessories

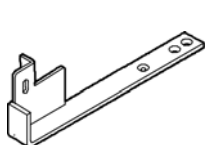
- Accessories (individually packed, depending on order):
- Mounting hardware with technical literature
  - Interconnection pipes with insulation
  - General connection set
  - Sensor well set
  - Solar-Divicon (pumping station for the collector circuit)
  - Electronic differential temperature control
  - Automatic air vent with air separator
  - Fast air vent valve with tee and shutoff valve
  - Solar hand pump
  - Solar expansion tank
  - Heat transfer medium

### Mounting hardware

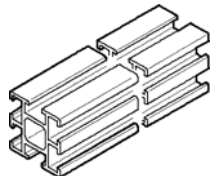
The mounting hardware consists of components required for the relevant method of installation, such as: Roof brackets, mounting plates, mounting rails, connecting elements for mounting rails, clamping bolts, screws and nuts.

### Sloped roof hardware

Required for mounting collector directly onto shingled roof. Raises collector 3 1/2 in. (88.9 mm) above the roof.



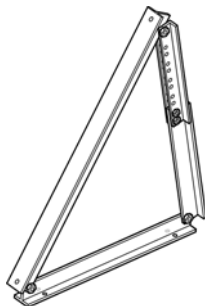
Roof bracket



Installation rail

### Flat roof hardware

Required for freestanding, flat roof installations.

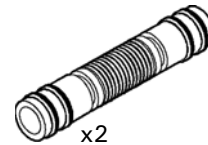


### General connection set

Required to connect solar collector to system piping. One set required per collector array - maximum 10 to 12 collectors per individual array.

### Pipe connection set

Required to connect multiple solar collectors.



x2

### SCU 124/224/345

Electronic differential temperature control for solar heating.



### Solar-Divicon

Pre-assembled pumping station for solar collector circuit (2 sizes available: DN20B & DN25B).

Includes: 3-speed pump, pressure gauge, 2 thermometers, 2 ball valves, pressure relief valve, flow meter, 2 flow check valves, air separator, system fill manifold, and foam insulation cover.



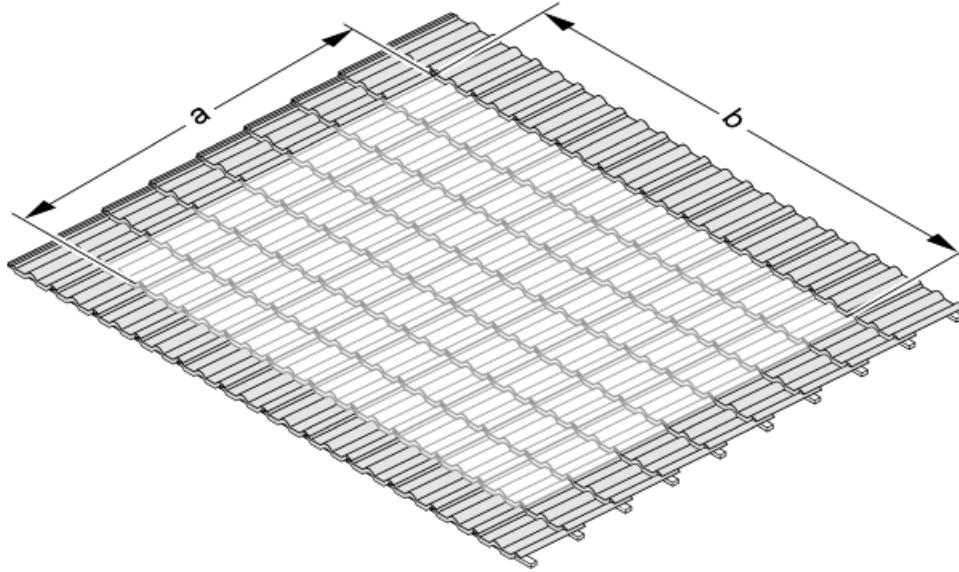
### Heat transfer medium

Tyfocor HTL non-toxic heating liquid for solar heating systems with active anti-corrosion and anti-ageing protection.

Frost protection:.....	-31°F (-35°C) to: ASTM D 1177
Water Content:.....	50% to: DIN 51777
Specific gravity at 68°F (20°C):...	1.032 to 1.035 g/cm <sup>3</sup> to: ASTM D 1122
Viscosity at 68°F (20°C):.....	6.5 to 8.0 mm <sup>2</sup> /s to: DIN 51562
pH value:.....	7.5 to 8.5 to: ASTM D 1287
Color:.....	transparent, blue-green
Container:.....	5.3 USG (20 L) in a disposable container

**Required Installation Area (Sloped Roofs) - Vitosol 200-FM, Type SV**

For vertical collectors installed between 10° - 80° degrees from the horizontal plane (ground)

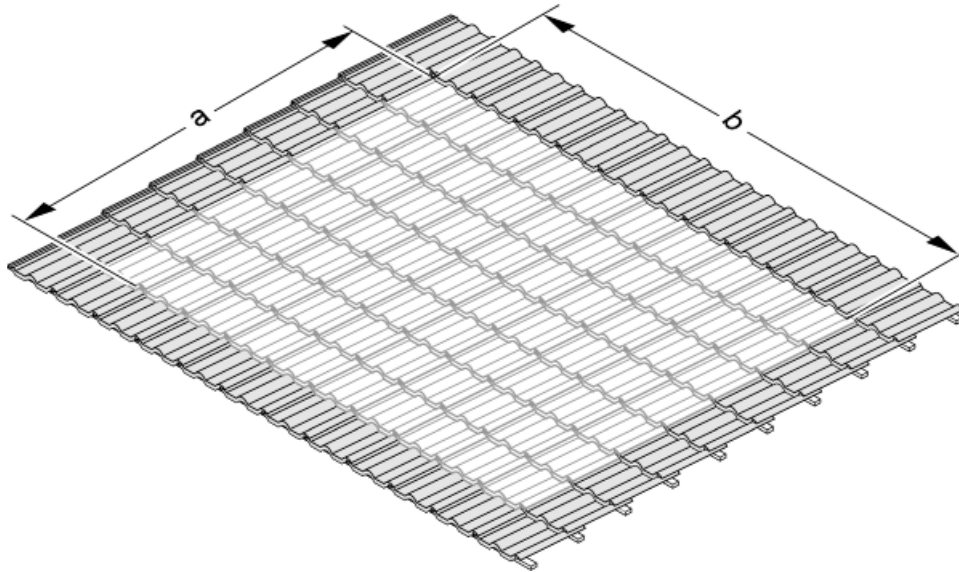


Number of Collectors	Vitosol 200-FM SV2F Array Dimensions				Slope Roof Installation Collector Array Weight (Collectors, racking, fittings & fluid)	
	Dimension "a"		Dimension "b"		lb.	(kg)
	in.	(mm)	in.	(mm)		
1 Collector	93¾	(2380)	43¼	(1098)	116	(53)
2 Collectors	93¾	(2380)	85¾	(2175)	222	(101)
3 Collectors	93¾	(2380)	128¾	(3273)	328	(149)
4 Collectors	93¾	(2380)	171¼	(4350)	434	(197)
5 Collectors	93¾	(2380)	214½	(5448)	542	(246)
6 Collectors	93¾	(2380)	257	(6525)	653	(296)
7 Collectors	93¾	(2380)	300	(7623)	757	(344)
8 Collectors	93¾	(2380)	342½	(8700)	869	(394)
9 Collectors	93¾	(2380)	385¾	(9798)	971	(440)
10 Collectors	93¾	(2380)	419½	(10654)	1083	(492)
11 Collectors	93¾	(2380)	471½	(11973)	1190	(540)
12 Collectors	93¾	(2380)	513¾	(13050)	1301	(590)

**Note:** It is recommended that a minimum service clearance of 12 in. (305 mm) should be added to each end of the collector array. This allows for ease of installation and servicing of the solar supply and return connections.

**Required Installation Area (Sloped Roofs) - Vitosol 200-FM, Type SH**

For horizontal collectors installed between 10° - 80° degrees from the horizontal plane (ground)

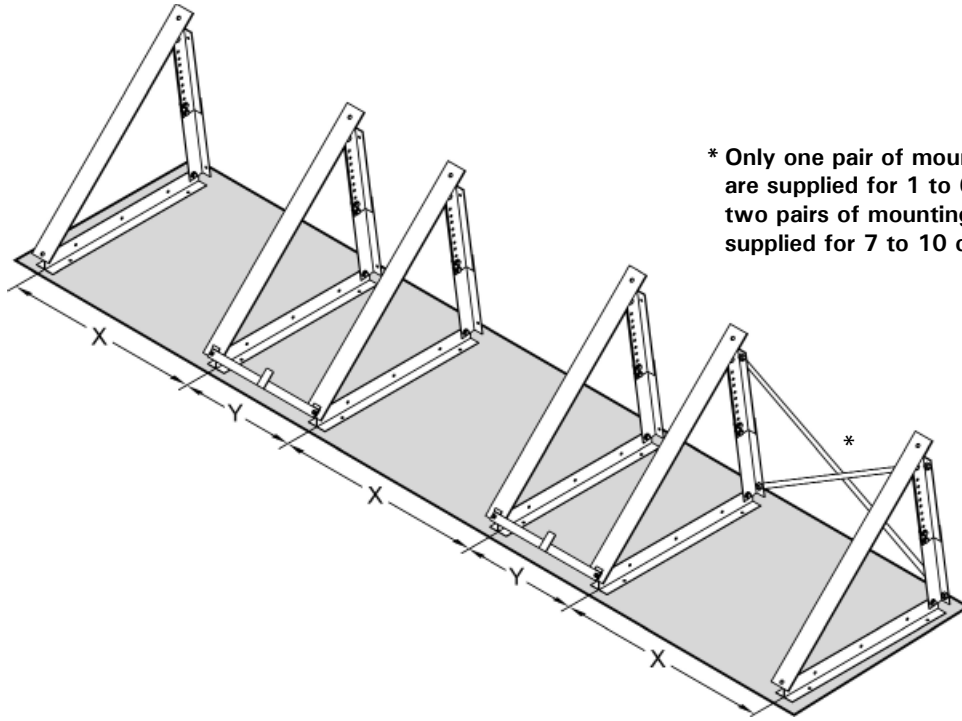


Number of Collectors	Vitosol 200-FM SH2F Array Dimensions				Slope Roof Installation Collector Array Weight (Collectors, racking, fittings & fluid)	
	Dimension "a"		Dimension "b"		lb.	(kg)
	in.	(mm)	in.	(mm)		
1 Collector	41 3/4	(1056)	95 1/4	(2422)	124	(56)
2 Collectors	41 3/4	(1056)	190 3/4	(4844)	240	(109)
3 Collectors	41 3/4	(1056)	286	(7266)	355	(161)
4 Collectors	41 3/4	(1056)	381 1/2	(9688)	471	(214)
5 Collectors	41 3/4	(1056)	476 3/4	(12110)	587	(266)
6 Collectors	41 3/4	(1056)	572 1/4	(14532)	702	(319)
7 Collectors	41 3/4	(1056)	667 1/2	(16954)	821	(373)
8 Collectors	41 3/4	(1056)	762 3/4	(19376)	935	(424)
9 Collectors	41 3/4	(1056)	858 1/4	(21798)	1054	(478)
10 Collectors	41 3/4	(1056)	953 1/2	(24220)	1166	(529)
11 Collectors	41 3/4	(1056)	1049	(26642)	1285	(583)
12 Collectors	41 3/4	(1056)	1144 1/4	(29064)	1400	(635)

**Note:** It is recommended that a minimum service clearance of 12 in. (305 mm) should be added to each end of the collector array. This allows for ease of installation and servicing of the solar supply and return connections.

**Required Installation Area (Flat Roofs) - Vitosol 200-FM, Type SV**

For vertical collectors installed between 25° - 60° degrees from the horizontal plane (ground)



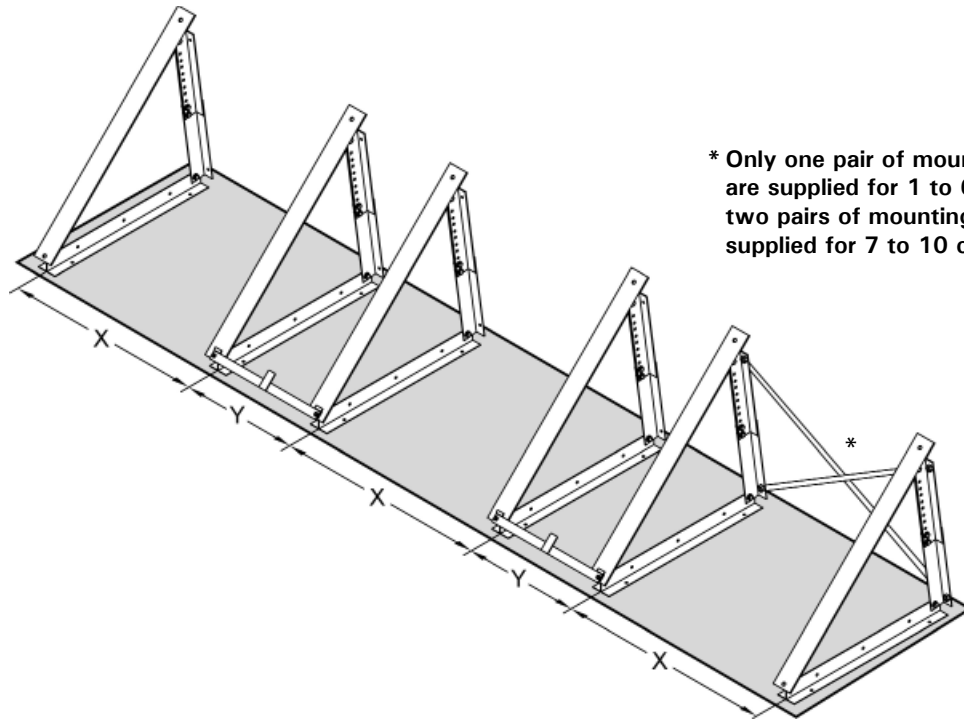
\* Only one pair of mounting crossbars are supplied for 1 to 6 collectors, two pairs of mounting crossbars are supplied for 7 to 10 collectors.

Number of Collectors	Vitosol 200-FM SV2F Array Dimensions		Flat Roof Installation Collector Array Weight (Collectors, racking, fittings & fluid)		
	Mounting Frame Spacing Dimensions "X" = 23½ in (595 mm) "Y" = 18 <sup>7</sup> / <sub>8</sub> in (481 mm)	Overall Length of Array When Collectors Installed		lb.	(kg)
		in.	(mm)		
1 Collector	1x "X"	42¼	(1071)	142	(65)
2 Collectors	2x "X" + 1x "Y"	84½	(2148)	278	(126)
3 Collectors	3x "X" + 2x "Y"	127	(3225)	414	(188)
4 Collectors	4x "X" + 3x "Y"	169¼	(4301)	549	(249)
5 Collectors	5x "X" + 4x "Y"	211¾	(5378)	685	(311)
6 Collectors	6x "X" + 5x "Y"	254¼	(6455)	820	(372)
7 Collectors	7x "X" + 6x "Y"	296½	(7532)	958	(435)
8 Collectors	8x "X" + 7x "Y"	339	(8609)	1094	(496)
9 Collectors	9x "X" + 8x "Y"	381¼	(9685)	1229	(558)
10 Collectors	10x "X" + 9x "Y"	423¾	(10762)	1365	(619)
11 Collectors	11x "X" + 10x "Y"	466	(11839)	1500	(681)
12 Collectors	12x "X" + 11x "Y"	508½	(12916)	1636	(742)

**Note:** It is recommended that a minimum service clearance of 12 in. (305 mm) should be added to each end of the collector array. This allows for ease of installation and servicing of the solar supply and return connections.

**Required Installation Area (Flat Roofs) - Vitosol 200-FM, Type SH**

For horizontal collectors installed between 25° - 80° degrees from the horizontal plane (ground)



\* Only one pair of mounting crossbars are supplied for 1 to 6 collectors, two pairs of mounting crossbars are supplied for 7 to 10 collectors.

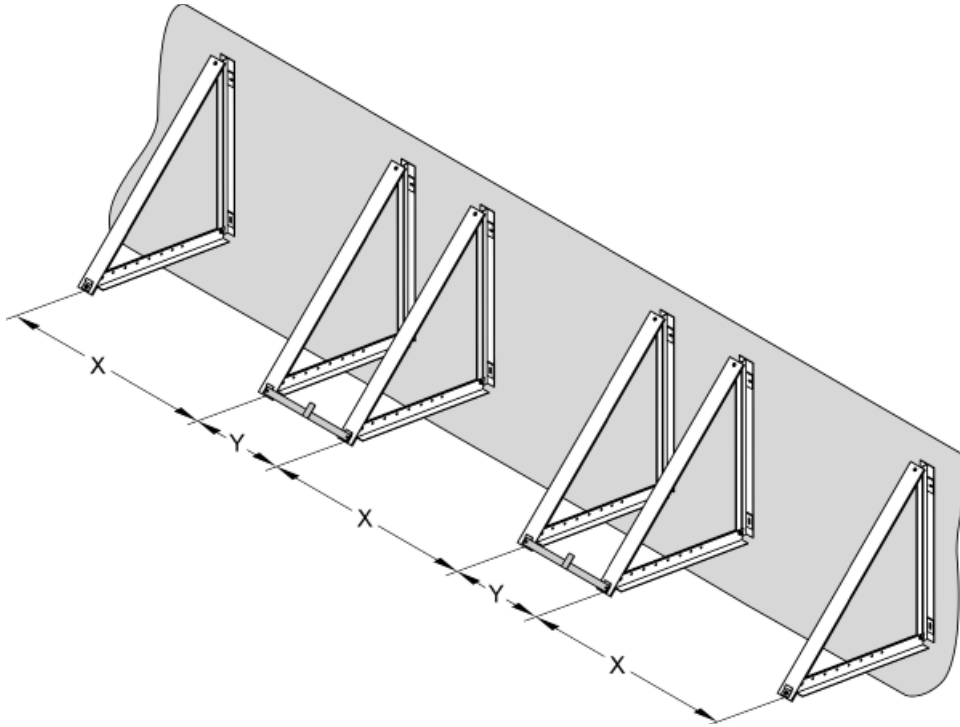
Number of Collectors	Vitosol 200-FM SH2F Array Dimensions		Flat Roof Installation Collector Array Weight (Collectors, racking, fittings & fluid)		
	Mounting Frame Spacing Dimensions "X" = 75 <sup>5</sup> / <sub>8</sub> in (1920 mm) "Y" = 18 <sup>7</sup> / <sub>8</sub> in (481 mm)	Overall Length of Array When Collectors Installed		lb.	(kg)
		in.	(mm)		
1 Collector	1x "X"	94 <sup>1</sup> / <sub>4</sub>	(2395)	125	(57)
2 Collectors	2x "X" + 1x "Y"	188 <sup>3</sup> / <sub>4</sub>	(4796)	243	(110)
3 Collectors	3x "X" + 2x "Y"	283 <sup>1</sup> / <sub>4</sub>	(7197)	361	(164)
4 Collectors	4x "X" + 3x "Y"	377 <sup>3</sup> / <sub>4</sub>	(9597)	479	(218)
5 Collectors	5x "X" + 4x "Y"	472 <sup>1</sup> / <sub>4</sub>	(11998)	597	(271)
6 Collectors	6x "X" + 5x "Y"	567	(14399)	715	(325)
7 Collectors	7x "X" + 6x "Y"	661 <sup>1</sup> / <sub>2</sub>	(16800)	836	(379)
8 Collectors	8x "X" + 7x "Y"	756	(19201)	954	(433)
9 Collectors	9x "X" + 8x "Y"	850 <sup>1</sup> / <sub>2</sub>	(21601)	1072	(486)
10 Collectors	10x "X" + 9x "Y"	945	(24002)	1190	(540)
11 Collectors	11x "X" + 10x "Y"	1039 <sup>1</sup> / <sub>2</sub>	(26403)	1308	(594)
12 Collectors	12x "X" + 11x "Y"	1134	(28804)	1426	(647)

**Note:** It is recommended that a minimum service clearance of 12 in. (305 mm) should be added to each end of the collector array. This allows for ease of installation and servicing of the solar supply and return connections.



## Required Installation Area (Walls) - Vitosol 200-FM, Type SH

For horizontal collectors installed between 45° - 80° degrees from the horizontal plane (ground)



Number of Collectors	Vitosol 200-FM SH2F Array Dimensions		Wall Installation Collector Array Weight (Collectors, racking, fittings & fluid)		
	Mounting Frame Spacing Dimensions	Overall Length of Array When Collectors Installed		lb.	(kg)
	"X" = 75 <sup>5</sup> / <sub>8</sub> in (1920 mm) "Y" = 18 <sup>7</sup> / <sub>8</sub> in (481 mm)	in.	(mm)		
1 Collector	1x "X"	94 <sup>1</sup> / <sub>4</sub>	(2395)	120	(55)
2 Collectors	2x "X" + 1x "Y"	188 <sup>3</sup> / <sub>4</sub>	(4796)	236	(107)
3 Collectors	3x "X" + 2x "Y"	283 <sup>1</sup> / <sub>4</sub>	(7197)	352	(160)
4 Collectors	4x "X" + 3x "Y"	377 <sup>3</sup> / <sub>4</sub>	(9597)	467	(212)
5 Collectors	5x "X" + 4x "Y"	472 <sup>1</sup> / <sub>4</sub>	(11998)	583	(265)
6 Collectors	6x "X" + 5x "Y"	567	(14399)	699	(317)
7 Collectors	7x "X" + 6x "Y"	661 <sup>1</sup> / <sub>2</sub>	(16800)	814	(370)
8 Collectors	8x "X" + 7x "Y"	756	(19201)	930	(422)
9 Collectors	9x "X" + 8x "Y"	850 <sup>1</sup> / <sub>2</sub>	(21601)	1046	(475)
10 Collectors	10x "X" + 9x "Y"	945	(24002)	1161	(527)
11 Collectors	11x "X" + 10x "Y"	1039 <sup>1</sup> / <sub>2</sub>	(26403)	1277	(579)
12 Collectors	12x "X" + 11x "Y"	1134	(28804)	1393	(632)

**Note:** It is recommended that a minimum service clearance of 12 in. (305 mm) should be added to each end of the collector array. This allows for ease of installation and servicing of the solar supply and return connections.

## Flow Rate in the Collector Array

All Vitosol collectors have a minimum required flow rate (low flow) and maximum flow rate (high flow). The collectors must operate within this range and the system designer must choose a flow rate based on the specific parameters of the system. At the same collector output, a higher flow rate means a lower  $\Delta t$  or temperature spread across the collector array. Inversely a lower flow rate will have a higher  $\Delta t$  or temperature spread across the collector array. When the  $\Delta t$  or temperature spread across the collector array becomes too large, the efficiency of the collectors will also decrease.

For larger solar installations, high flow is usually not recommended as this results in bigger pumps and larger pipe sizes. Typically low flow would be used as the decreased flow requirements result in smaller pumps which would use less energy, and small pipe sizes, reducing the overall installation and operating cost for the system.

Operating modes:

**Low flow operation**

Operation with flow rates between:  
0.010 - 0.012 USG/min/ft<sup>2</sup> (25 - 30 L/h/m<sup>2</sup>)

**High flow operation**

Operation with flow rates between:  
0.012 - 0.025 USG/min/ft<sup>2</sup> (30 - 60 L/h/m<sup>2</sup>)

### Specific Flow Rate

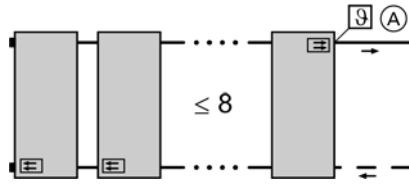
	Low Flow		High Flow					
	USG/min/ft <sup>2</sup>	0.0102	0.0123	0.0143	0.0164	0.0184	0.0205	0.0225
(L/h/m <sup>2</sup> )	(25)	(30)	(35)	(40)	(45)	(50)	(55)	(60)
USG/min	0.26	0.31	0.36	0.41	0.46	0.51	0.56	0.62
(L/min)	(1.0)	(1.2)	(1.4)	(1.6)	(1.7)	(1.9)	(2.1)	(2.3)

### Recommended flow rate for the number of collectors per individual array

Number of Collectors	USG/min (L/min)							
	1 Collector	0.26 (1.0)	0.31 (1.2)	0.36 (1.4)	0.41 (1.6)	0.46 (1.7)	0.51 (1.9)	0.56 (2.1)
2 Collectors	0.51 (1.9)	0.62 (2.3)	0.72 (2.7)	0.82 (3.1)	0.92 (3.5)	1.03 (3.9)	1.13 (4.3)	1.23 (4.7)
3 Collectors	0.77 (2.9)	0.92 (3.5)	1.08 (4.1)	1.23 (4.7)	1.39 (5.2)	1.54 (5.8)	1.69 (6.4)	1.85 (7.0)
4 Collectors	1.03 (3.9)	1.23 (4.7)	1.44 (5.4)	1.64 (6.2)	1.85 (7.0)	2.05 (7.8)	2.26 (8.5)	2.46 (9.3)
5 Collectors	1.28 (4.9)	1.54 (5.8)	1.80 (6.8)	2.05 (7.8)	2.31 (8.7)	2.56 (9.7)	2.82 (10.7)	3.08 (11.7)
6 Collectors	1.54 (5.8)	1.85 (7.0)	2.15 (8.2)	2.46 (9.3)	2.77 (10.5)	3.08 (11.7)	3.39 (12.8)	3.69 (14.0)
7 Collectors	1.80 (6.8)	2.15 (8.2)	2.51 (9.5)	2.87 (10.9)	3.23 (12.2)	3.59 (13.6)	3.95 (15.0)	4.31 (16.3)
8 Collectors	2.05 (7.8)	2.46 (9.3)	2.87 (10.9)	3.28 (12.4)	3.69 (14.0)	4.10 (15.5)	4.51 (17.1)	4.92 (18.6)
9 Collectors	2.31 (8.7)	2.77 (10.5)	3.23 (12.2)	3.69 (14.0)	4.16 (15.7)	4.62 (17.5)	5.08 (19.2)	5.54 (21.0)
10 Collectors	2.56 (9.7)	3.08 (11.7)	3.59 (13.6)	4.10 (15.5)	4.62 (17.5)	5.13 (19.4)	5.64 (21.4)	6.16 (23.3)
11 Collectors	2.82 (10.7)	3.39 (12.8)	3.95 (15.0)	4.51 (17.1)	5.08 (19.2)	5.64 (21.4)	6.21 (23.5)	6.77 (25.6)
12 Collectors	3.08 (11.7)	3.69 (14.0)	4.31 (16.3)	4.92 (18.6)	5.54 (21.0)	6.16 (23.3)	6.77 (25.6)	7.39 (28.0)

**Note:** Maximum of 10x Vitosol 200-FM can be connected in one array, having single-sided connections.  
Maximum of 12x Vitosol 200-FM can be connected in one array, having alternate side connections (reverse return).

**Vitosol 200-FM, Type SV and SH Low Flow Operation (single-sided connection)**

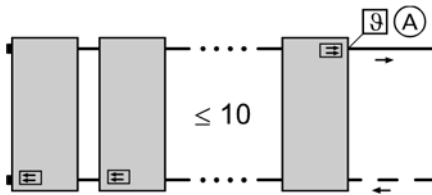


Single array less than or equal to (≤) 8x flat plate collectors

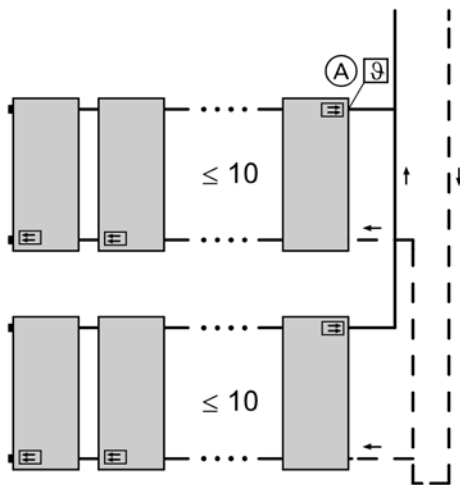
**Legend**

(A) Collector temperature sensor (field installed)

**Vitosol 200-FM, Type SV and SH High Flow Operation (single-sided connection)**



Single array less than or equal to (≤) 10x flat plate collectors

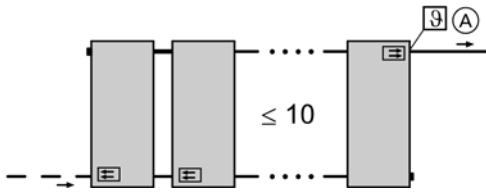


Multiple arrays less than or equal to (≤) 10x flat plate collectors per individual array

**Legend**

(A) Collector temperature sensor (field installed)

**Vitosol 200-FM, Type SV and SH Low Flow Operation (connection on alternate sides)**

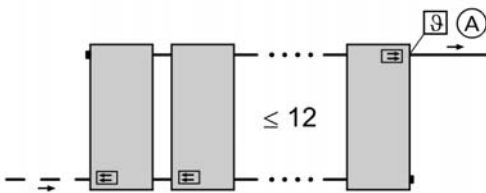


Single array less than or equal to ( $\leq$ ) 10x flat plate collectors

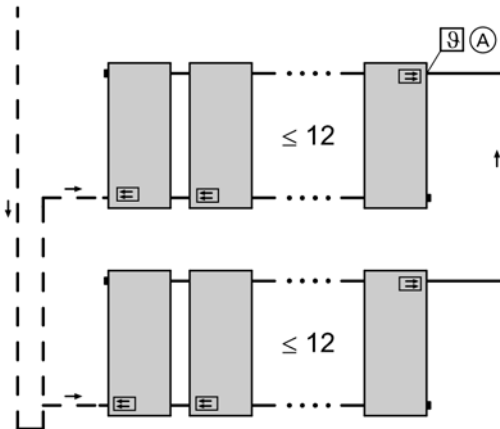
**Legend**

(A) Collector temperature sensor (field installed)

**Vitosol 200-FM, Type SV and SH High Flow Operation (connection on alternate sides)**



Single array less than or equal to ( $\leq$ ) 12x flat plate collectors



Multiple arrays less than or equal to ( $\leq$ ) 12x flat plate collectors per individual array

**Legend**

(A) Collector temperature sensor (field installed)

**Flow Velocity**

To minimize the pressure drop through the solar thermal system pipe work, the flow velocity in the pipe should not exceed 3.3 ft/s (1 m/s). We recommend flow velocities between 1.3 and 2.3 ft/s (0.4 and 0.7 m/s). At these flow velocities, an approximate pressure drop as indicated below can result:

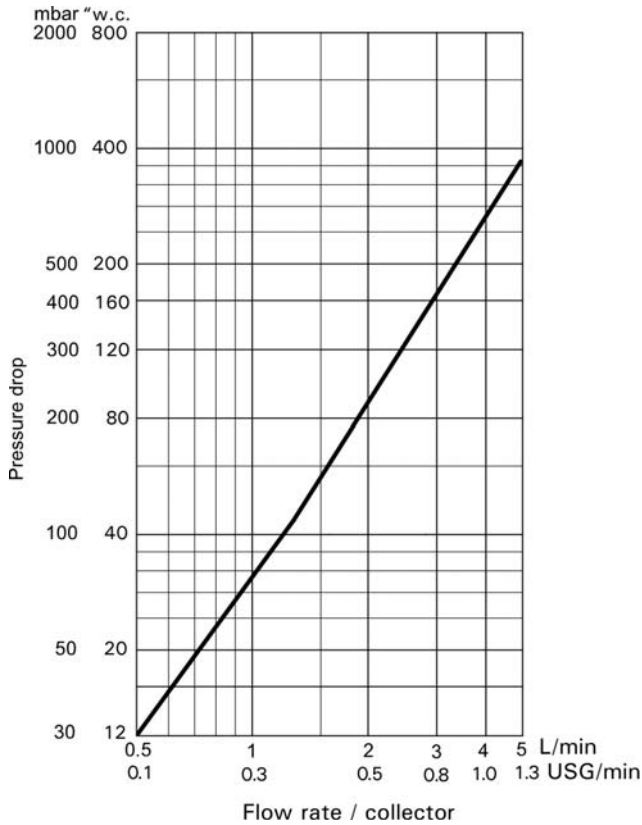
0.12 and 0.3 "w.c. per foot of pipe  
(1.0 and 2.5 mbar per meter of pipe)

For the installation of collectors, we recommend sizing the solar supply and return pipes as for a normal heating system according to flow rate and velocity.

**Note:** A higher flow velocity results in a higher pressure drop and potentially could erode the walls of the pipe work. If the flow velocity is too low, the system will not capture or move the air trapped in the system.

Any residual air that has collected at the collector must be routed downwards through the solar return line to the air vent in the Solar-Divicon. This will have to be manually vented.

## Pressure Drop of Vitosol 200-FM, Type SV and SH



Relative to water, corresponds to Tyfocor HTL at approximately 140°C (60°C).

**Note:** For multiple Vitosol 200-FM collector arrays, use the flow rate per individual collector to calculate the pressure drop.

### Specific Flow Rate

	Low Flow		High Flow					
	USG/min/ft <sup>2</sup>	0.0102	0.0123	0.0143	0.0164	0.0184	0.0205	0.0225
(L/h/m <sup>2</sup> )	(25)	(30)	(35)	(40)	(45)	(50)	(55)	(60)
USG/min	0.26	0.31	0.36	0.41	0.46	0.51	0.56	0.62
(L/min)	(1.0)	(1.2)	(1.4)	(1.6)	(1.7)	(1.9)	(2.1)	(2.3)

### Resulting Pressure Drop for Vitosol FM, Type SV and SH for collector arrays consisting of 1 to 12 collectors (connected in parallel)

"w.c.	29	39	49	60	72	86	100	116
ft/hd	2.4	3.2	4.1	5.0	6.0	7.1	8.3	9.6
(mbar)	(73)	(96)	(121)	(149)	(180)	(213)	(249)	(288)
(kPa)	(7)	(10)	(12)	(15)	(18)	(21)	(25)	(29)

**Note:** Maximum of 10x Vitosol 200-FM can be connected in one array, having single-sided connections.  
 Maximum of 12x Vitosol 200-FM can be connected in one array, having alternate side connections (reverse return).

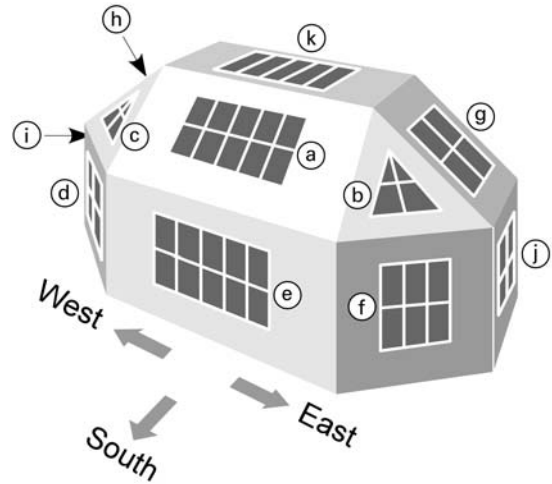
## Collector Location



Refer to the Solar System Design Guide, for detailed information on the optimum alignment and inclination of solar collectors.

### Optimum alignment and inclination

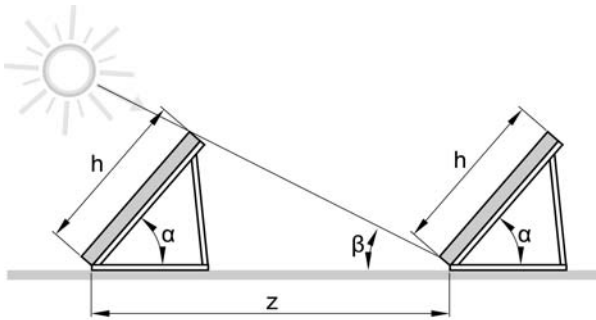
The solar collector provides the highest solar yield over an annual average when facing due south with an inclination of approximately, 30° to 45° from the horizontal plane. However, the installation of a solar heating system is still viable even when the installation deviates quite significantly from the above (South-Westerly to South-Easterly alignment or with an inclination of 25° to 55° from the horizontal plane).



Solar Energy Yield

(a)	100%	(d)	65%	(g)	80%	(j)	50%
(b)	95%	(e)	70%	(h)	80%	(k)	90%
(c)	95%	(f)	65%	(i)	50%		

## Determining the Collector Row Distance "z"



$$z = \frac{h \cdot \sin (180^\circ - (\alpha + \beta))}{\sin \beta}$$

### Legend

z = Collector row distance

h = Collector height

200-FM model SV = 93¾ in. (2380 mm)

200-FM model SH = 41¾ in. (1056 mm)

α = Collector angle of inclination

200-FM model SV = 25° - 60°

200-FM model SH = 25° - 80°

β = Solar angle

β = (90° - 23.5°) - Latitude

## IMPORTANT

When installing several collectors in series, maintain a distance of "z".

Example:

Vitosol 200-FM, Type SV (Vertical Collector)  
Toronto is located at approximately 43° latitude.

1. Determine the angle of the sun β. This should be chosen so that the midday sun December 21 falls on the second row of collectors without being obstructed by shadows.

Solar angle β:

β = (90° - 23.5°) - latitude

(23.5° should be accepted as constant value for northern latitudes)

β = (90° - 23.5°) - 43° = 23.5°

2. Calculating dimension "z":

h = 2380 mm

α = 45°

β = 23.5°

$$z = \frac{2380 \text{ mm} \cdot \sin (180^\circ - (45^\circ + 23.5^\circ))}{\sin 23.5^\circ}$$

$$z = \frac{2380 \text{ mm} \cdot \sin 111.5^\circ}{\sin 23.5^\circ}$$

z = 218.6 in. (5553 mm)

**Note:** Contact Viessmann Solar Tech Support for assistance with calculating distance "z".

## Solar System Design

When designing a solar thermal system, the engineer or installing contractor must carefully select system components to ensure efficient, trouble free operation. During the design phase it is recommended that the following details be addressed:

- Type of collector to be used and how it will be installed
- The recommended flow rate for each collector or collector array
- The supply/return pipe size, material and total length of run
- Recommended size of the solar storage/buffer tank

- The pressure drop of the solar collectors, piping, solar pumps, tanks, heat exchangers and other hydronic devices added to the system
- The size of the solar pump required based on flow and pressure drop of the system
- The size of the expansion tank required based on the height of the installation and the thermal expansion of the solar fluid. Since there is a potential for steam to be created, this will also need to be considered when sizing the expansion tank



Refer to the Installation, Operating and Service Instructions, for sizing information which is available online.

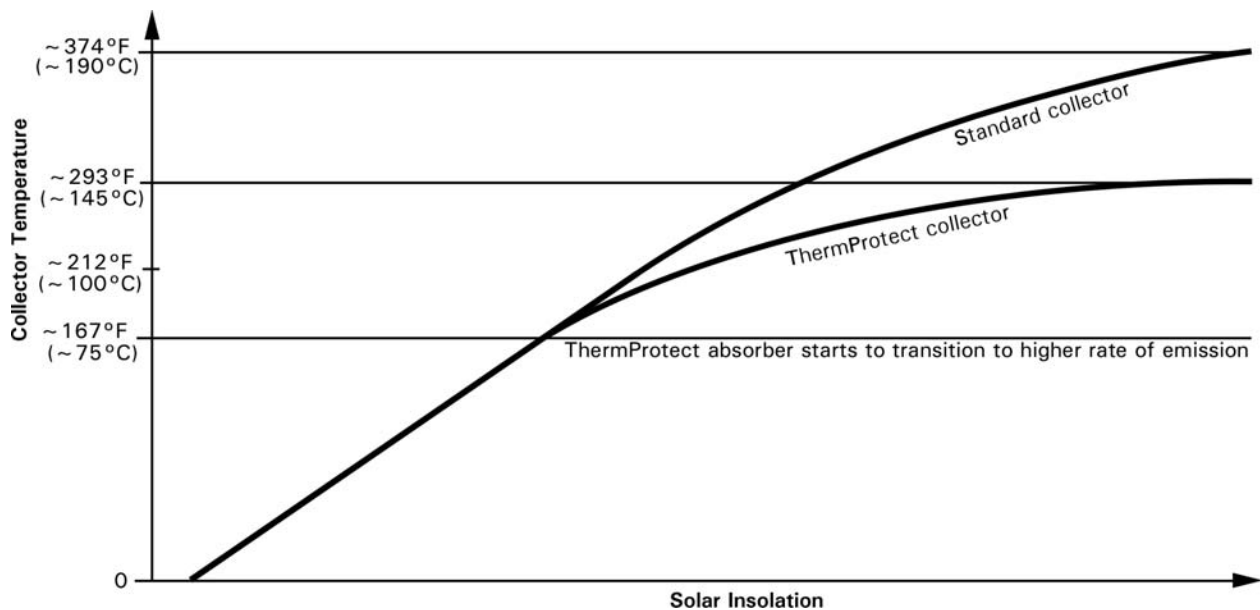
**Note:** Contact Viessmann Solar Tech Support for assistance with solar sizing.

## ThermProtect Absorber Coating

### ThermProtect temperature characteristics

Solar collector temperature	Solar tank operation	Emission $\epsilon$
up to 167°F (75°C)	Solar storage tank being heated	~ 5%
from 167°F to 293°F (75°C to 145°C)	Solar storage tank at max. temperature	~ 5% increases to ~ 40%

- The absorber selective coating (ThermProtect), optical characteristics changes depending on operating temperature
- The rate of absorption  $\alpha$  does not change
- The rate of emission  $\epsilon$  automatically adapts to the system



**Quick Reference**

°C	°F
-40	-40
-35	-31
-25	-13
-20	-4
-18	0
-16	+3
-14	+7
-12	+10
-10	+14
-9	+16
-8	+18
-7	+19
-6	+21
-5	+23
-4	+25
-3	+27
-2	+28
-1	+30
0	+32
+1	+34
+2	+36
+3	+37
+4	+39
+5	+41
+6	+43
+7	+45
+8	+46
+9	+48
+10	+50
+12	+54
+14	+57
+16	+61
+18	+64
+20	+68
+25	+77
+30	+86
+35	+95
+40	+104
+50	+122
+60	+140
+70	+158
+80	+176
+90	+194
+100	+212
+110	+230

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