
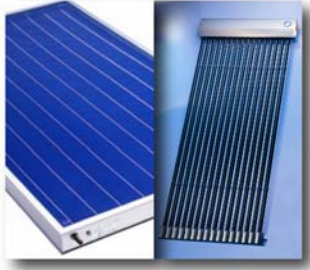





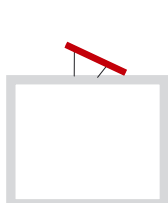

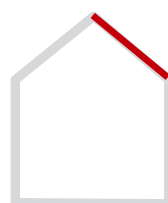
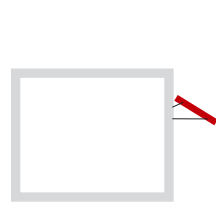
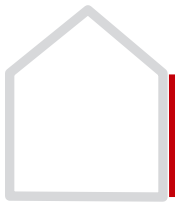
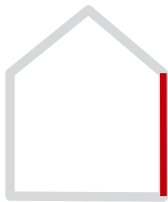
Choice of collectors 

Standard collector 1.5–2 m ²	Large collector 5–10 m ²	Solar Roof 15–30 m ²
		
needed number for 100 m²		
50	15	4
mounting time in m² per person and day		
20	50	100

Photos: Ambiente Italia, Wagner & Co / ESTIF, SCHOTT-Rohrglas / ESTIF

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Installation possibilities for collectors 

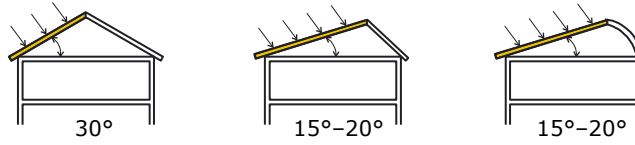
Roof			
Facade			
	flat roof / facade mounting systems	roof-mounted installation / curtain wall	integrated

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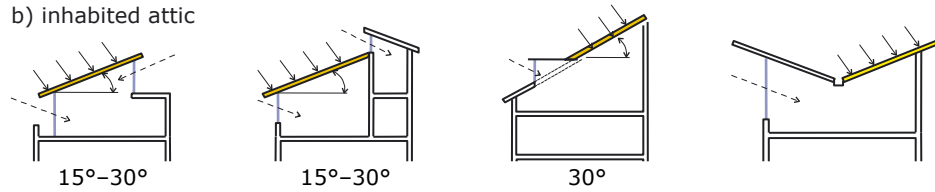
Positioning of the collectors on the roof



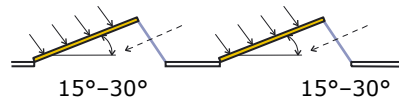
a) uninhabited attic



b) inhabited attic



c) Sports hall / industrial building



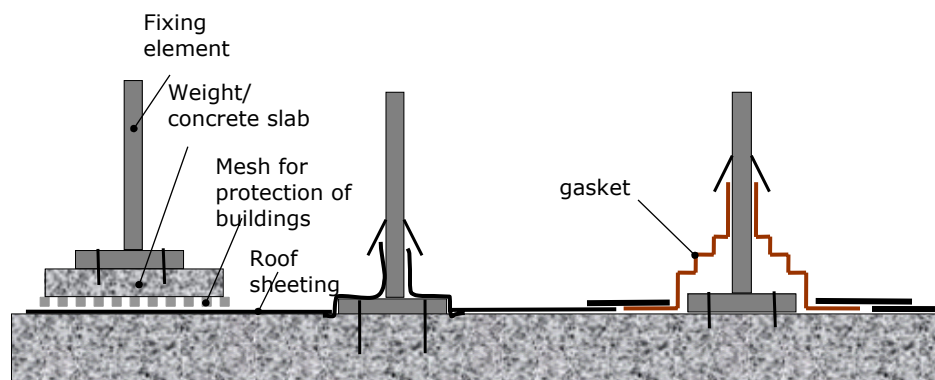
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Source: ITW

3

Flat roof: Fixing elements and professional sealing

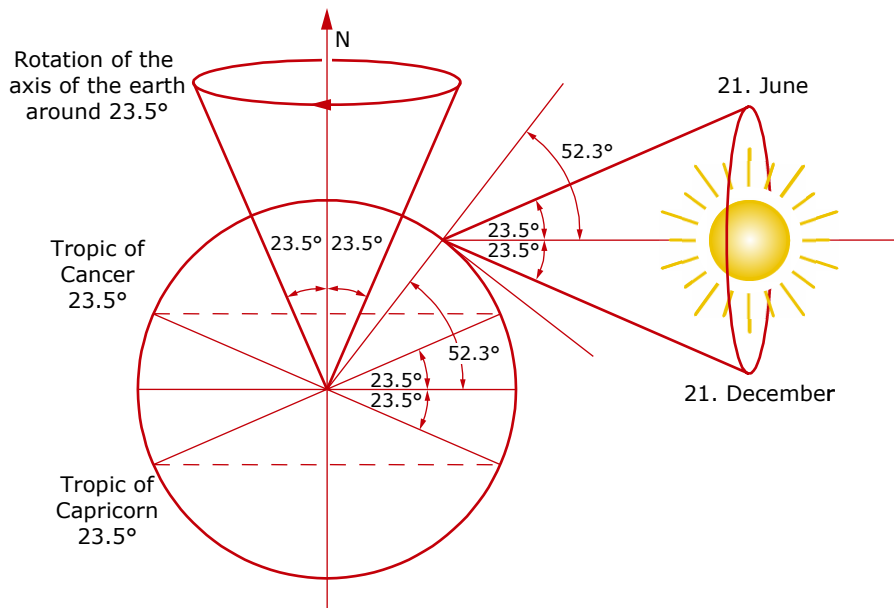


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4

Geometry of the sun's position



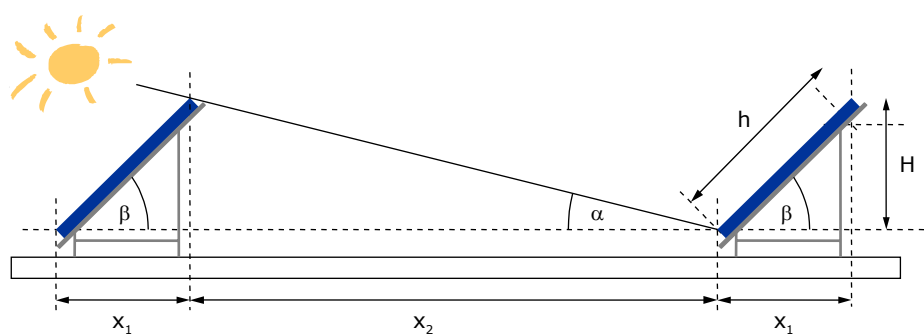
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Source: M. Schnauss

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Calculation of the distance between collectors



Height of construction $H = h \cdot \sin \beta$

Base surface $x_1 = h \cdot \cos \beta$

$$\tan \alpha = H / x_2 \quad \rightarrow \quad x_2 = H / \tan \alpha$$

$$\alpha_{\min.} (\text{Berlin}) = 14^\circ \quad \rightarrow \quad x_2 \approx 4 \cdot H$$

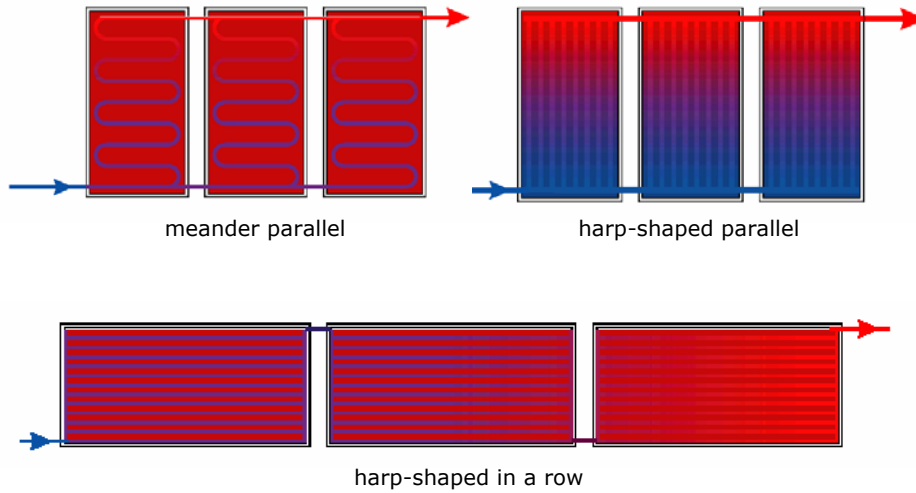
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Source: target

6

Collector types and their possible interconnection



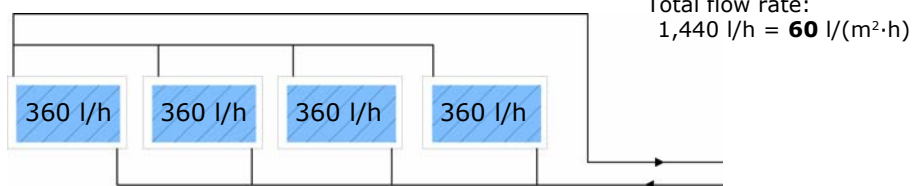
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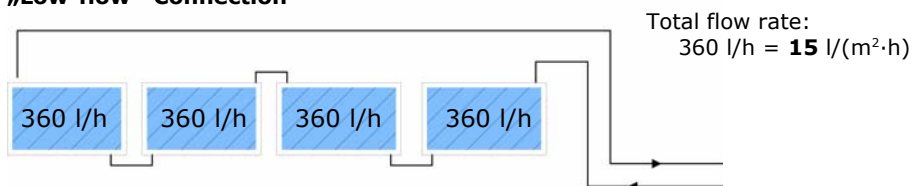
Collector hydraulic – High-flow / Low-flow



Traditional interconnection („High-flow“)



„Low-flow“-Connection



Surface per module: 6 m^2 , necessary flow per module: $360 \text{ l/h} = 60 \text{ l}/(\text{m}^2 \cdot \text{h})$

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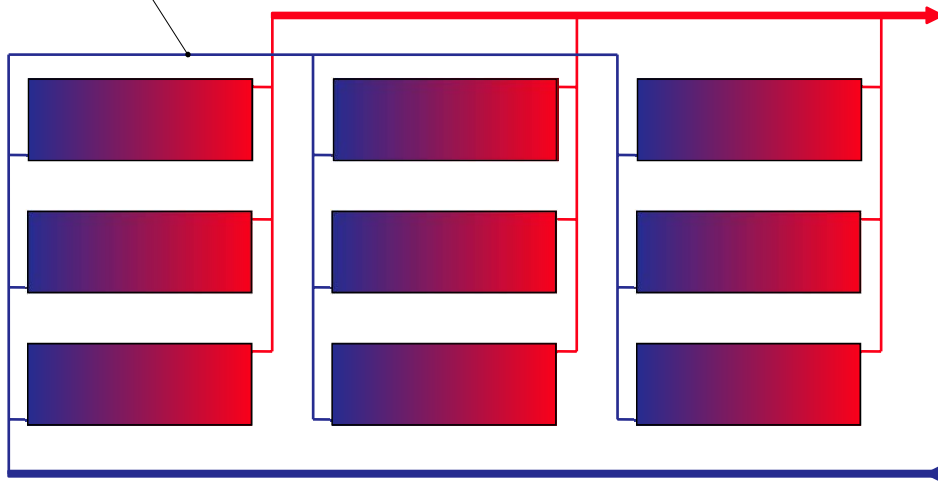
Source: according to AEE

8

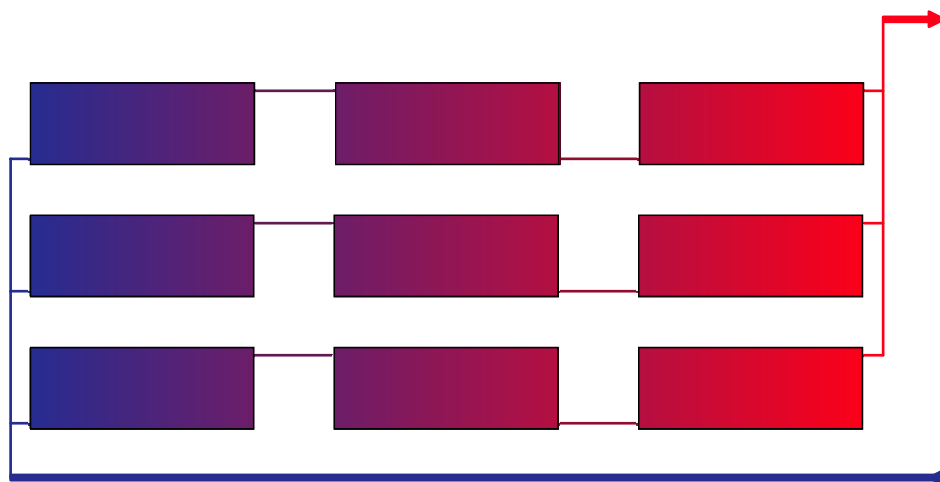
Collector hydraulic – interconnection according to Tichelmann



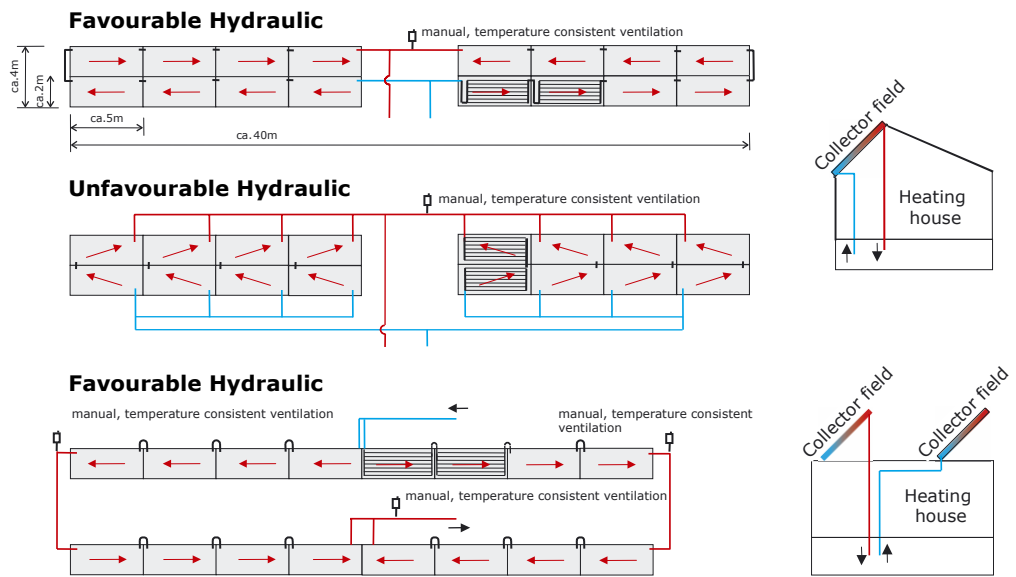
Tichelmann-loop



Collector hydraulic – series connection



Collector hydraulic – optimisation



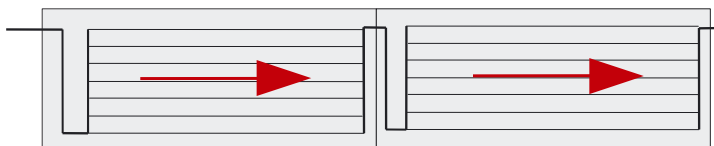
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Source: AEE 11

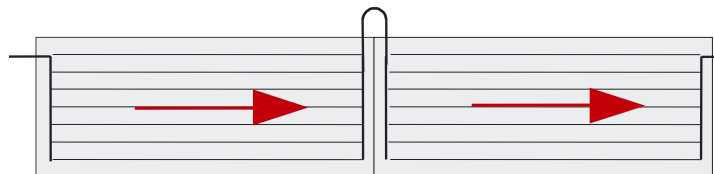
Compensation of the heat expansion



Stretching loop inside the collector



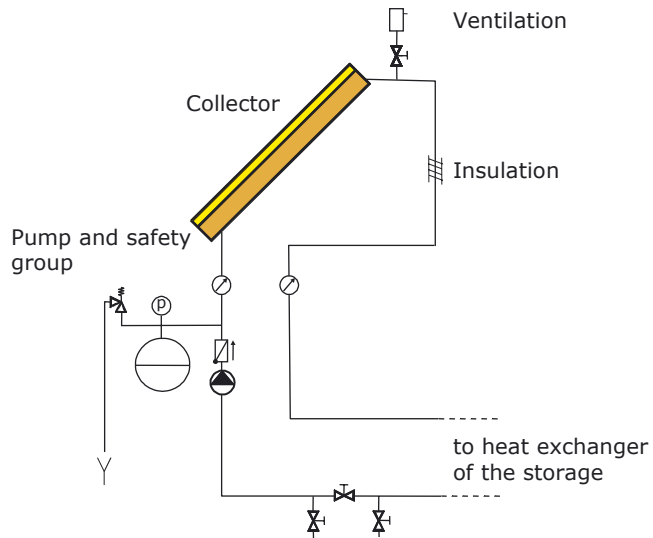
External stretching loop with flexible pipes



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Source: AEE 12

Safety in the stagnation phase (I)



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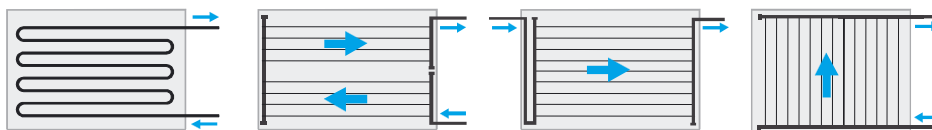
Source: Ambiente Italia

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Safety in the stagnation phase (II)



Good emptying behaviour



Bad emptying behaviour



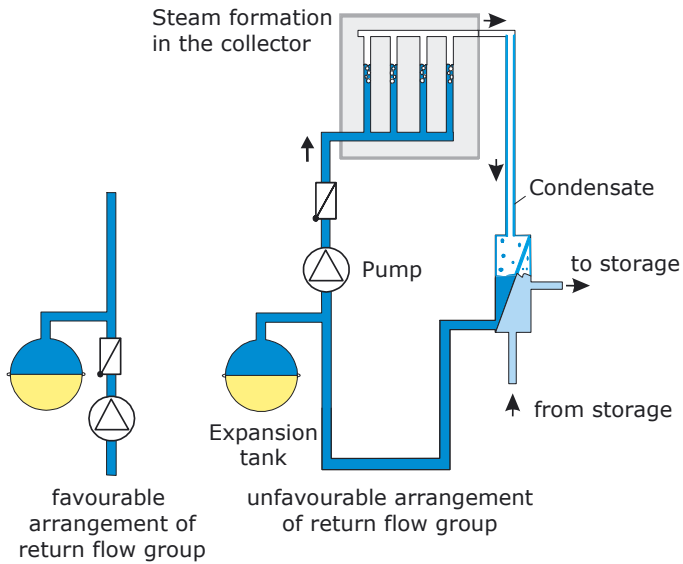
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Source: AEE

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Safety in the stagnation phase (III)



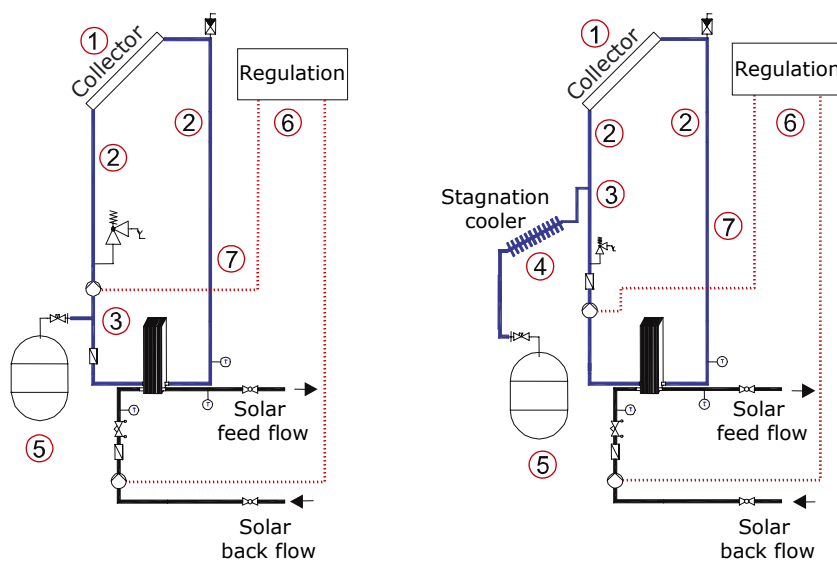
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VI Collector field

Source: according to AEE

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Safety in the stagnation phase (IV)



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Source: AEE

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Safety instructions for stagnation phase



- It should be easily possible to empty collectors and pipes.
- Pipes with inclination
- Check valve and expansion tank in return flow (possibly pre-vessel)
- Precise dimensioning of the expansion tank
- Control system with all necessary functions
- Suitable fluids (e.g. Tyfocor L up to 160 °C, Tyfocor LS up to 200 °C)