

## **Annex P5.4**

# **Hydraulic Designation Code**

SKN\_N0872R0\_ / Edition 2025-12-10

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## 1. Introduction

Details about the hydraulic system of a collector are important for the design of a collector field. However also in other cases it would be helpful to have this information. Examples are - to decide whether two collectors can be considered as “the same collector” within a collector family

- as a simple check whether a collector is distributed as tested.

Furthermore the hydraulic system is important with respect to the drainability of a system.

Professional planning software such as Polysun are using the hydraulic information to simulate the hydraulic behaviour of collector fields, to estimate the overall pressure drop and to provide proper dimensioning of the pumps. The proposed HDC can be used (decoded) automatically by simulation software.

The information about the hydraulic system of a collector is usually not easily available, especially it is not included in the public Solar Keymark information (i.e. data sheet). The hydraulic designation code presented in this document was developed to make this important information easily available in an unambiguous way and in an encoded form allowing also software tools to use it. The hydraulic designation code which includes the following parameters is a proposal for an encoding to make available this information in an unambiguous way:

- Hydraulic Configuration / Flow Scheme
- Length and inner diameter(s) of the absorber tube(s)
- Length and inner Diameter Collector tube(s)
- Drainability

The code was elaborated in the frame of a partly SCF funded project (SCF 7C10). It can be assumed that this code covers >>95% of all collectors on the market. There are of course innovative collector designs where the code may fail or is not applicable. In this case some or all required information is marked with an “X” to indicate that encoding is not possible or not clear, i.e. the manufacturer should be contacted to understand the hydraulic concept of a collector.

In Chapter 2 the code is explained and the individual designators are defined.

In Chapter 3 examples of most of the common collector designs are presented with a short explanation.

## 2. The Code Definition {F}-{O}-{CL}-{A:Ø,L}-{C:Ø,L}-{D}

### 2.1 General

The HDC consists of several fields providing encoded information. These fields are mandatory and must be given in the correct order. For the definition in this chapter, the code includes brackets {}, these brackets are omitted later. It is important to keep in mind, that the HDC is only describing the hydraulic design of a collector but not the absorber design itself. Collectors having different absorber designs (e.g. materials, fin or full plate, etc.) can have the same HDC.

### 2.2 {F} Hydraulic Flow Scheme Code

{F} Flow scheme: Number of Absorber elements

N = N parallel tubes ( $N \geq 1$ )

1= Serpentine (usually)

12=Harp with 12 tubes

3,4,6 = Serial bundles of 3, 4 and 6 parallel tubes

X = Any other flow scheme

{F} is mandatory

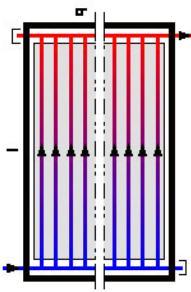
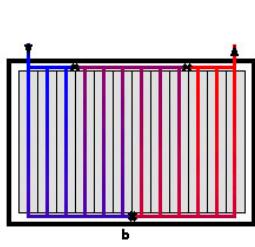
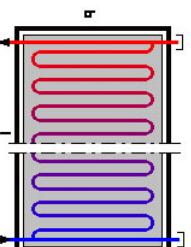
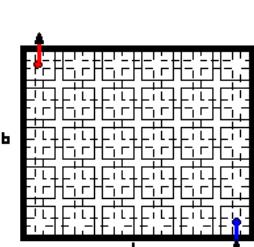
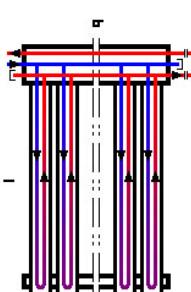
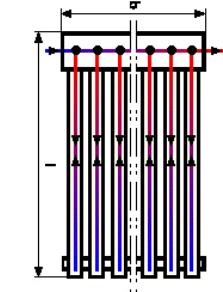
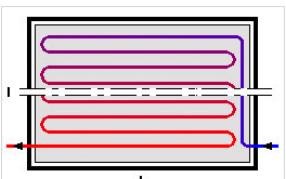
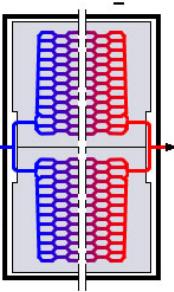
			
{F} = 10 (any number)	{F} = 3,3,3,3 (any numbers)	{F} = 1	{F} = X
			
Heatpipe			
{F} = 12 (any number)	{F} = 1	{F} = 1	{F} = X

Figure 1: Examples of {F}

### 2.3 {O} Orientation

{O} Orientation of the main flow elements (as tested):

V = Vertical

H = Horizontal

VH = Tested as V, can be installed H as well

HV = Tested as H, can be installed V as well

X = Cannot be described as V or H

Remark: The HDC is only dealing with the flows in connection with the hydraulic system of the heating system, e.g. heat pipes of evacuated tube collectors are not considered in the HDC.

The option to operate at 90° is not only depending on the hydraulics, but often by the collector design itself. Therefore, the first letter always indicates "HOW IT WAS TESTED". The second letter – if available – must be given by the manufacturer: Is it allowed to install if rotated by 90°? If unclear, indicate only orientation as tested.

{O} is mandatory

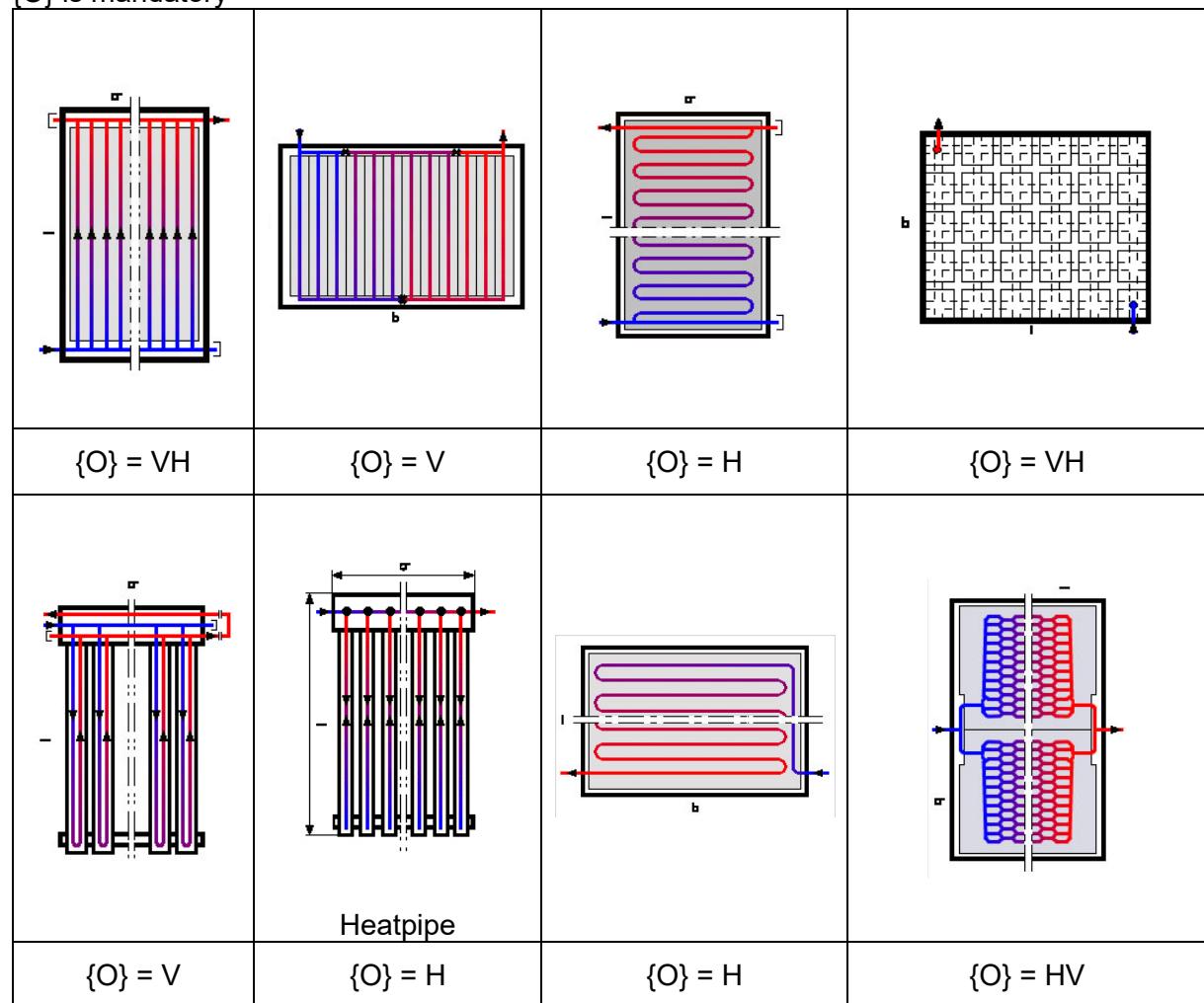


Figure 2: Examples of {O}

## 2.4 {CL} Connectors location and direction

{CL} Connector is combination of location and direction

Location:

1,2,3,4      Corner number (Definition see graph)  
T,B,L,R      If not in the corner but on the sides

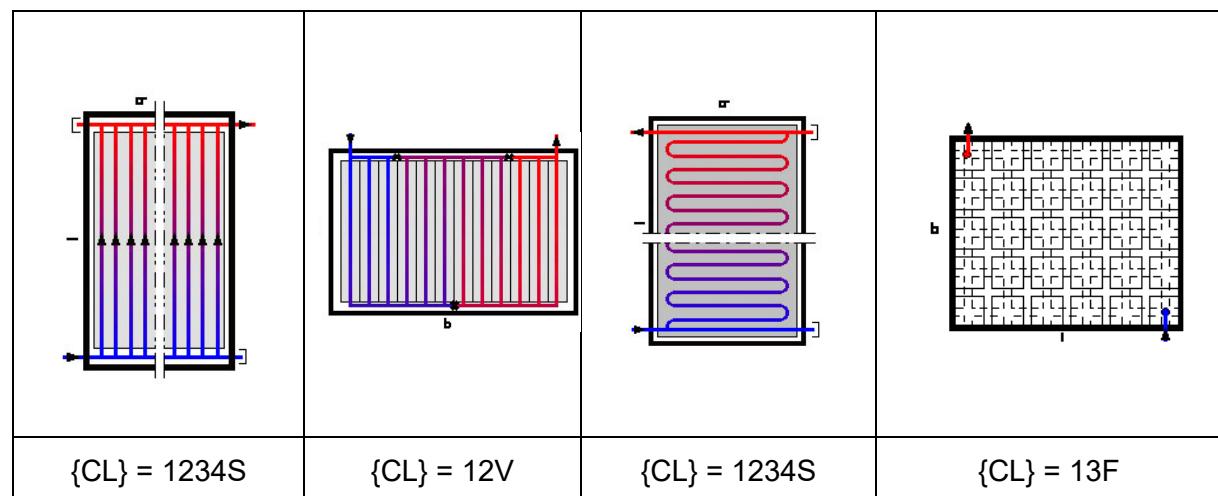
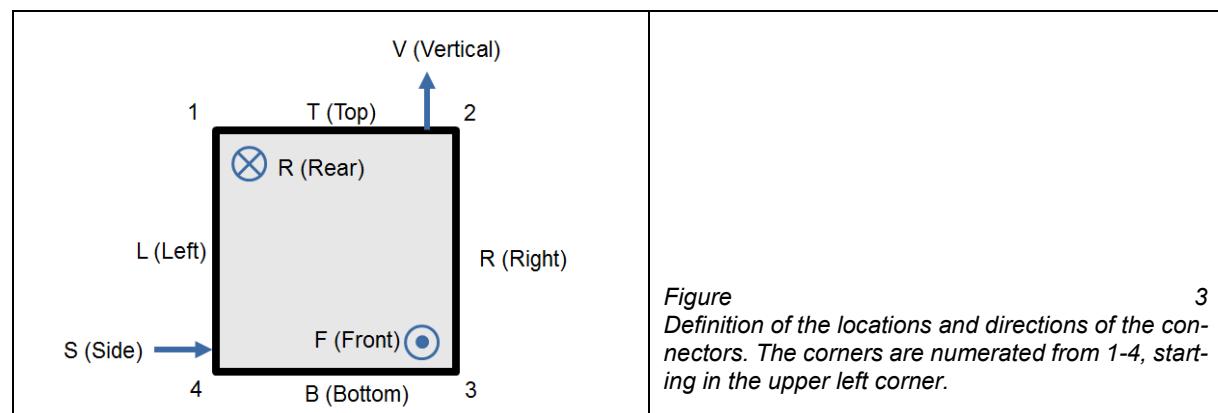
Direction

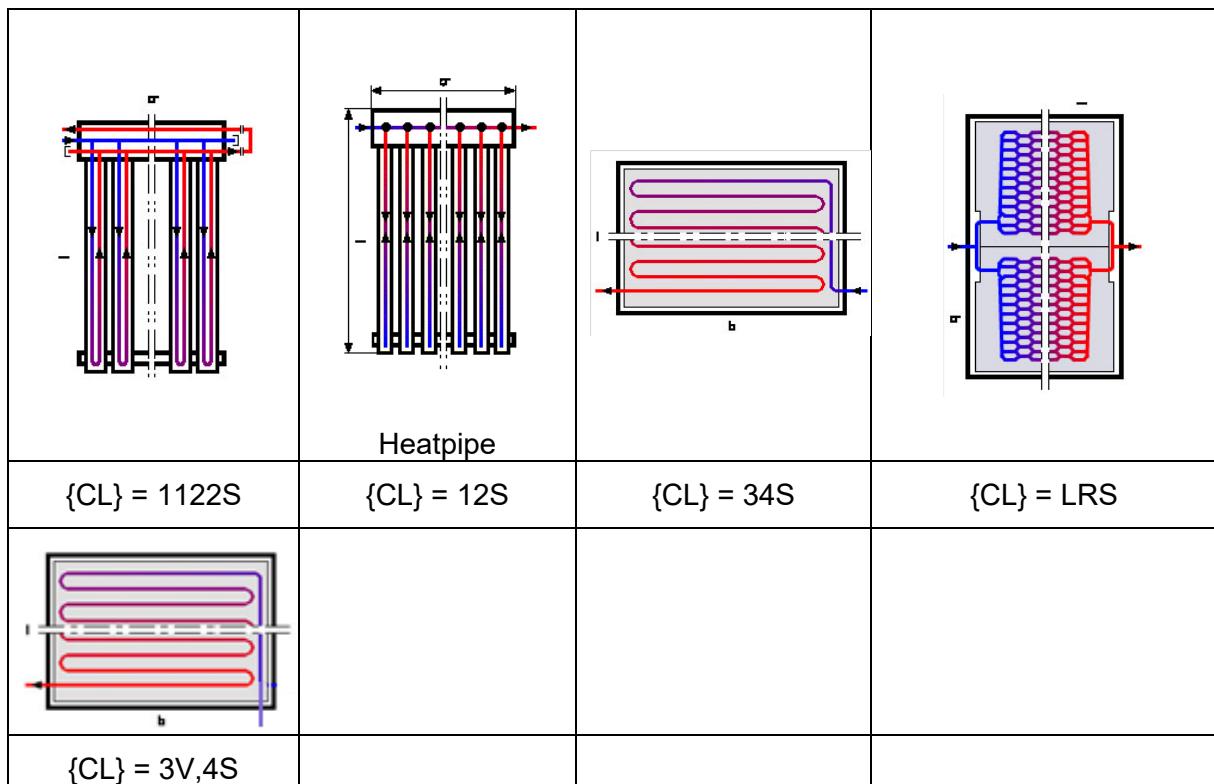
S,R,V,F      Side, Rear, Vertical, Front

{CL} is minimum is 3 letters: 2-4 for location and the last one for direction.

In general the direction is the same for all connectors, then the last letter applies for all connectors. In the few cases of different directions: separate by commas Example: {CL} = 1F,3R = upper left corner flow in from front side and lower right corner flow out on the rear side.

{CL} is mandatory



Figure 4: Examples of  $\{CL\}$ 

## 2.5 $\{A:\emptyset,L\}$ Absorber Element Details

The absorber element is the tube where the fluid is heated up

$\{A:\emptyset,L\}$  Inner diameter [mm] and length of the main single absorber element(s) [mm]

8,23000: 8 mm inner diameter, length of 23 m

10,1900: 10 mm inner diameter, length of 1.9 m

It is assumed that this statement is valid for each of all tubes indicated in  $\{F\}$ .

If variable diameters: Indicate minimum diameter

If not round tube: Equivalent diameter giving the same area

If different lengths: Average value

If not clear what to write: Indicate A:X

Some collector have no  $\{A:\emptyset,L\}$  statement (e.g. heat pipe collectors)

## 2.6 $\{C:\emptyset,L\}$ Collector Element Details

Collector is where the absorber elements are collected

$\{C:\emptyset,L\}$  inner diameter [mm] and length of the collector element(s) [mm]

8,23000: 8 mm inner diameter, length of 23 m

10,1900: 10 mm inner diameter, length of 1.9 m

If variable diameter: Minimum diameter

If not round tube: Equivalent diameter

If different lengths: Average value

If not clear what to write: Indicate C:X

## 2.7 {D} Drainability

If a collector is draining (orientation as tested), then indicate D at the end of the HDC. If it is not draining or if it is not clear, do not indicate D (X is not allowed and not needed).

D Draining

No D Not draining OR not clear.

The drainability of a collector field is of course depending on the field and not only on the collector. Nevertheless the drainability of an individual collector is an important information that is given here.

## 2.8 Orthographic Rules

No Spaces in the whole code allowed

No {} and no spaces allowed

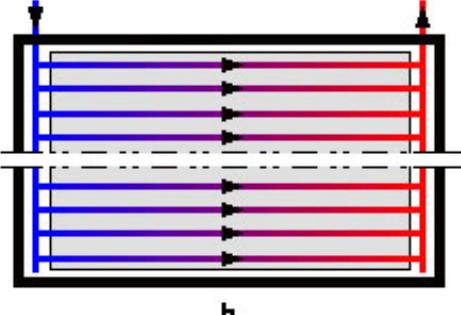
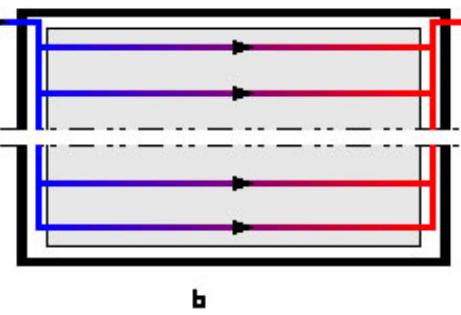
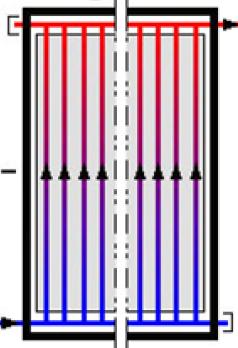
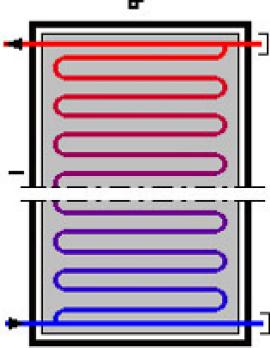
Between all indicators a dash ‘-’ is required.

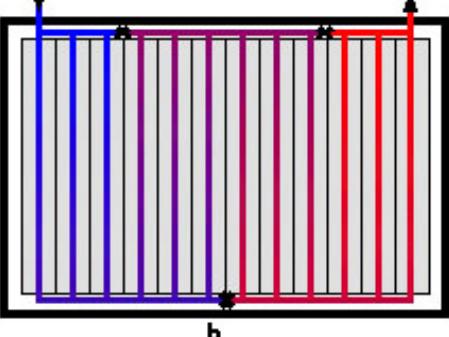
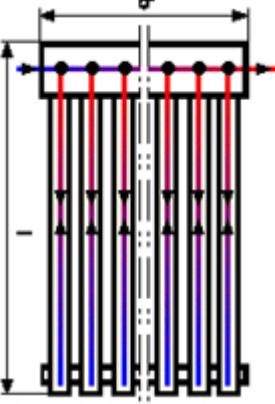
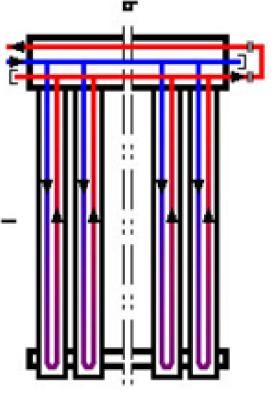
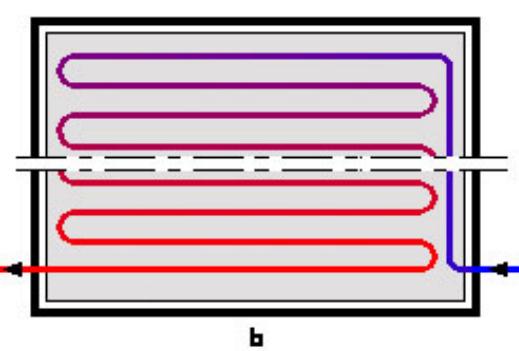
If different absorber/collector tubes: Several statements are possible such as C:22,900-C:22,3000 using a “-“ between. However this should be avoided, in general this would probably better be “X”.

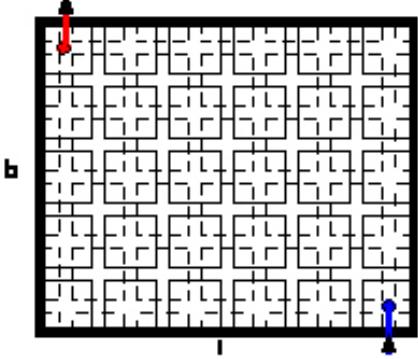
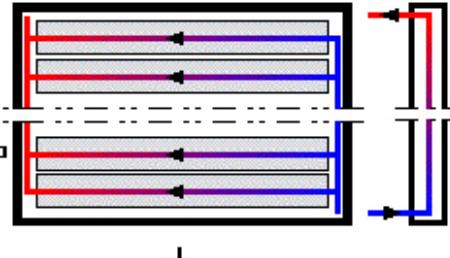
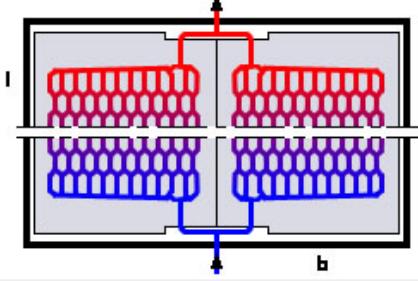
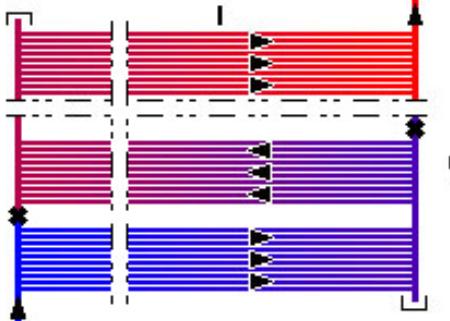
Either {A:Ø,L} or {C:Ø,L} must be indicated (or both). If {A:Ø,L} = {C:Ø,L} then indicate one {AC:Ø,L}

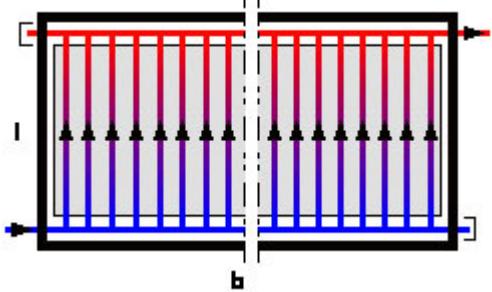
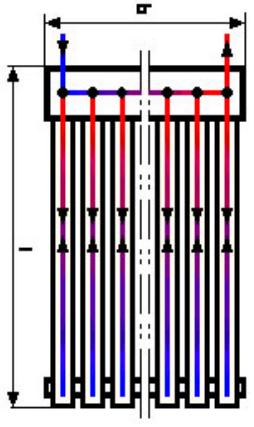
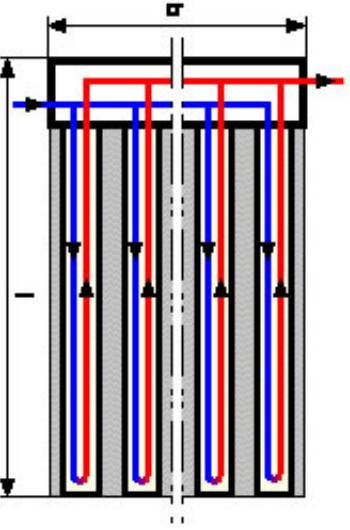
### 3. Full examples

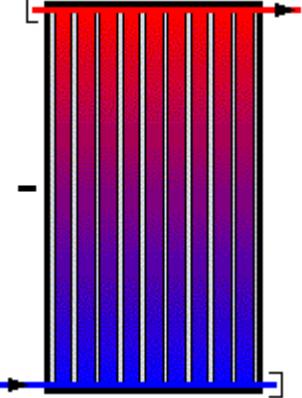
In this section examples are presented for illustration and training.

	<p><b>HDC=12-H-12V-A:8,1900-C:18,1000</b></p> <p>12 Number of absorber tubes H Tested Horizontal, shall not be operated vertical 12V Connectors in the upper corners, vertical out Absorber tube inner Ø 8 mm Absorber tube length 1900 mm Collector tube inner Ø 18 mm Collector tube length 1000 mm D missing: Not draining</p>
	<p><b>HDC=22-H-12S-A:8,5000-C:28,1900</b></p> <p>22 Number of absorber tubes H Tested Horizontal, shall not be operated vertical 12S Connectors in the upper corners, side out Absorber tube inner Ø 8 mm Absorber tube length 5000 mm Collector tube inner Ø 28 mm Collector tube length 1900 mm D missing: Not draining</p>
	<p><b>HDC=10-VH-1234S-A:10,1800-C:22,1000-D</b></p> <p>10 Number of absorber tubes VH Tested vertical, can be operated horizontal 1234S Connectors in the four corners, side out Absorber tube inner Ø 10 mm Absorber tube length 1800 mm Collector tube inner Ø 22 mm Collector tube length 1000 mm D Draining as tested</p>
	<p><b>HDC=1-H-1234S-A:10,1800-C:22,1000-D</b></p> <p>1 Number of absorber tubes H Tested horizontal, cannot be operated vertical 1234S Connectors in the four corners, side out Absorber tube inner Ø 10 mm Absorber tube length 1800 mm Collector tube inner Ø 22 mm Collector tube length 1000 mm D Draining as tested</p>

	<p><b>HDC=3,3,3,3-V-12V-A:8,1200-C:22,3000</b></p> <p>3,3,3,3 Number of absorber tubes, 4 sections a 3 tubes</p> <p>V Tested vertical, cannot be operated horizontal</p> <p>12V Connectors in the upper corners, vertical out</p> <p>Absorber tube inner Ø 8 mm</p> <p>Absorber tube length 1200 mm</p> <p>Collector tube inner Ø 22 mm</p> <p>Collector tube length 3000 mm</p> <p>D missing: Not draining</p>
	<p><b>HDC=1-H-12S-C:17,800-D</b></p> <p>1 One tube</p> <p>H Tested horizontal, cannot be operated V</p> <p>12S Connectors in the upper corners, side out</p> <p>Absorber tube inner Ø n.a.</p> <p>Absorber tube length n.a.</p> <p>Collector tube inner Ø 17 mm (minimum diameter)</p> <p>Collector tube length 3000 mm</p> <p>D: Draining</p> <p><b>Standard Heat pipe collector with sleeves in the collector tube for the heat pipe condensers</b></p>
	<p><b>HDC=10-VH-1122S-A:8,2200-C:20,1000</b></p> <p>10: 10 U-tubes</p> <p>VH Tested vertical, can be operated H</p> <p>1122S Connectors in the upper corners, side out*</p> <p>Absorber tube inner Ø 8 mm</p> <p>Absorber tube length 2200 mm **</p> <p>Collector tube inner Ø 20 mm (minimum diameter)</p> <p>Collector tube length 1000 mm</p> <p>D missing Not draining (as tested)</p> <p>* Third pipe is dummy, hydraulic function</p> <p>** Sum of down und up</p>
	<p><b>HDC=1-H-34S-A:8,22000-D</b></p> <p>1: 1 Tube</p> <p>H Tested H, shall not be operated V</p> <p>34S Connectors in the lower corners, side out</p> <p>Absorber tube inner Ø 8 mm</p> <p>Absorber tube length 22000 mm (one very long tube)</p> <p>Collector tube inner Ø NA</p> <p>Collector tube length NA</p> <p>D: Draining (as tested)</p>

	<p><b>HDC=X-VH-13F-AC:X</b></p> <p>X Does not fit into the designation scheme*</p> <p>VH Can be used in both directions</p> <p>13F Connectors in 1,3 corners, front out</p> <p>AC:X Absorber and Connector: Cannot be described by this scheme*</p> <p>D missingNot draining</p> <p>* The information cannot be described by the designation code: Special designs -&gt; Ask manufacturer.</p>
	<p><b>HDC=8-HV-13B-A:10,2000-C:22,1000-D</b></p> <p>8: 8 tubes</p> <p>HV Tested H can be installed V</p> <p>13B Connectors in 1,3 corners, back out</p> <p>Absorber tube inner Ø 10 mm</p> <p>Absorber tube length 2000 mm</p> <p>Collector tube inner Ø 22 mm</p> <p>Collector tube length 1000 mm</p> <p>D: Draining</p>
	<p><b>HDC=X-VH-13F-AC:X</b></p> <p>X Does not fit into the designation scheme*</p> <p>VH Can be used in both directions</p> <p>13F Connectors in 1,3 corners, front out</p> <p>AC:X Absorber and Connector: Cannot be described by this scheme*</p> <p>D missing: Not draining</p> <p>* The information cannot be described by the designation code: Special designs -&gt; Ask manufacturer.</p>
	<p><b>HDC=10,10,10-HV-1234V-A:4,2000-C:20:1200-D</b></p> <p>10,10,10: 3 times 10 parallel tubes in packages</p> <p>HV Can be used in both directions</p> <p>1234V Connectors in all corners, vertical out</p> <p>A:X Absorber and Connector: Cannot be described by this scheme*</p> <p>D Draining</p> <p>* The information cannot be described by the designation code: Special designs -&gt; Ask manufacturer.</p>

	<p><b>HDC=20-V-1234S-A:8,1800-C:22,1000-D</b></p> <p>20: Number of absorber tubes</p> <p>V: Tested horizontal, cannot be operated vertical</p> <p>1234S Connectors in the four corners, side out</p> <p>Absorber tube inner Ø 8 mm</p> <p>Absorber tube length 1800 mm</p> <p>Collector tube inner Ø 22 mm</p> <p>Collector tube length 1000 mm</p> <p>D: Draining in tested orientation</p>
	<p><b>HDC=1-H-12V-C:20,1000</b></p> <p>1: One tube</p> <p>H Tested horizontal, cannot be operated V</p> <p>12V Connectors in the upper corners, vertical out</p> <p>Absorber tube inner Ø n.a.</p> <p>Absorber tube length n.a.</p> <p>Collector tube inner Ø 20 mm (minimum diameter)</p> <p>Collector tube length 1000 mm</p> <p>No D: Not Draining</p> <p><b>Standard Heat pipe collector with sleeves in the collector tube for the heat pipe condensers</b></p>
	<p><b>HDC=4-V-12S-A:8,3600-C:20,800</b></p> <p>4. 4 tubes</p> <p>H Tested vertical, cannot be operated H</p> <p>12S Connectors in the upper corners, side out</p> <p>Absorber tube inner Ø 8 mm</p> <p>Absorber tube length 3600 mm (2 x 1800 mm).</p> <p>Collector tube inner Ø 20 mm (minimum diameter)</p> <p>Collector tube length 800 mm</p> <p>No D: Not Draining</p> <p><b>U tube or coaxial tube</b></p>

	<p><b>HDC=4-VH-1234S-AC:X-D</b></p> <p>4: 4 tubes</p> <p>V: Tested vertical, can be operated H</p> <p>1234S Connectors in all corner, side out</p> <p>Absorber tube inner Ø ?</p> <p>Absorber tube length ?</p> <p>Collector tube inner Ø ?</p> <p>Collector tube length ?</p> <p>D: Draining</p> <p>e.g. Swimming pool collector with unclear hydraulic setup</p>
	<p><b>HDC=1-H-LRS-AC:20,12000</b></p> <p>1: 1 tube</p> <p>H Tested H, cannot be operated V</p> <p>LRS Connectors left and right, side out</p> <p>Absorber tube inner Ø 20 mm</p> <p>Absorber tube length 12 m</p> <p>Collector tube inner Ø A=C?</p> <p>Collector tube length A=C</p> <p>D missing: Draining not clear</p>