

Internal coupling for finned heat exchangers

Software CCSX

In 1987 Cert.-Eng. Marin Zeller TU, VDI, the owner of the company <u>www.zcs.ch</u>, invented this circuit. As of 2022, the software he developed for finned heat exchangers in heat recovery systems has been on the market for more than 25 years and has been accepted by the majority of manufacturers.

Its characteristic was the achievement of a maximum of cross-counterflow, taking into account the venting and draining in the installation position. We support in line and staggered tube arrangements.



However, it remained open as of 2022 - and also for 25 years! - an internal circuit software for all other types of finned heat exchangers such as air heaters, air coolers, condensers and evaporators. There are some applications on the market for this, but they were never able to cover the requirements. It was switched up and down freshly and happily, without taking into account the necessary venting and draining, and the individual couplings sometimes did not have the same number of tubes, with the flimsy justification of wanting to prevent blind tubes. Under these circumstances, the manufactureers of finned heat exchangers had no choice but to create databases of hydraulic circuits that had already been manufactured and laboriously generate new circuits. We were therefore approached with a request to develop software that would eliminate all these shortcomings.

Software SIC

In September 2022, after an intensive development phase by 3 engineers over a period of 1 year, we are now able to offer an application for this as well

Get supported:

Air direction Tube arrangement Tubes on depth Tubes on height Max. blind tubes horizontal in line and staggered 2 to 12 pieces 6 to 60 pieces 2 pieces or maximal 2%



Until the end of August 2022, we offered companies that supported us in the development a discount of 25%, which unfortunately only 1 manufacturer of finned heat exchangers took advantage of. That's the way it is, unfortunately, many are crying out for a solution and few support it.

Since both applications can now be downloaded from our FTP server on request, installed and tested as trial versions for 3 days with a maximum of 6 executions, we are offering interested companies who would like to purchase both applications a discount of 25% until end of October 2022.

CCSX & SIC, 1 Single-License each, EUR 11'784 less 25% = EUR 8'838 until end of October 2022

Using the example of cooling hot air in summer from 32°C to 18°C with cold water at various temperature levels, two problems become apparent.

The closer the cold water inlet is to the hot air outlet (blue field), the more multiple cross-counterflow is required.

If the cold water leaving temperature is higher than the hot air leaving temperature (yellow field), the more multiple cross-counterflow is required.



Cooling of hot air from 32°C to 18°C Efficiency of the mean logarithmic temperature difference (%)



How much multiple cross-counterflow is required is shown by not losing more than 10% of mean logarithmic temperature difference compared to pure counterflow (green field).

This is still possible with 2-fold crosscountercurrent with cold water of 14/20°C, but no longer with 1-fold cross-countercurrent.

In line or staggered tube rows?

The pictures on the right and the following pages show that in this example the 8 tube rows in line have significantly more cross-countercurrent packages than the 8 staggered tube rows.

In addition, you can get by with the standard coupling, offered by the SIC software, and you don't have to switch to the special coupling, offered by the CCSX software.

However, this would change abruptly if the cold water spread was greater than just the usual 6K! 8 in line tube rows

8 staggered tube rows





Using the example of cooling hot air in summer from 32°C to 18°C with cold water at various temperature levels, two problems become apparent.

The closer the cold water inlet is to the hot air outlet (blue field), the more multiple cross-counterflow is required.

If the cold water leaving temperature is higher than the hot air leaving temperature (yellow field), the more multiple cross-counterflow is required.



Cooling of hot air from 32°C to 18°C Efficiency of the mean logarithmic temperature difference (%)



How much multiple cross-counterflow is required is shown by not losing more than 10% of mean logarithmic temperature difference compared to pure counterflow (green field).

This is still possible with 5-fold crosscountercurrent with cold water of 14/28°C, but no longer with 3-fold or 4fold cross-countercurrent.

In line or staggered tube rows?

The pictures on the right and the following pages show, that in this example the 14 in line tube rows have the same cross-countercurrent packages like the 14 staggered tube rows.

In addition, you need the special circuit offered by the CCSX software and you can no longer use the standard circuit offered by the SIC software.

14 in line tube rows

14 staggered tube rows



| Cooler: 35/35/12-8R-20T-992A-2 | 2A-2.8PA-16C-Cu/AI/AISI 304 | | Software by www.zcs.ch | | | | |
|---------------------------------|-----------------------------|---------------|------------------------|---------------------------------|--|--------------------------------|----------------|
| Capacity | | kW | 25.205 | sensible: | 23.849 | | 0 |
| Surface reserve | | % | 1.941 | latent: | 1.356 | | |
| Present surface | | m2 | 130.930 | frost | 0.000 | Company | |
| Required surface | | m2 | 128.437 | | | Branch | |
| k-coeff. | W/r | m2K | 28.886 | | | Street | |
| Average temp. diff. (93.30 %) | | ĸ | 6.794 | | | Country / ZIP / | City |
| Air humid / # 0 00005 01000 | 1 | | 1.1.4 | | Definiti | Dhanas | ~~~~ |
| Height over sea level |) | m | Inlet | Outlet | | Fax: xxxxxx | XXX |
| Pressure | | ni hP≏ | | | 1013 250 | F_Mail | |
| Temp | | a ℃ | 33 000 | 18 000 | 20 000 | Homenage | 3 |
| Rel, humidity | | % | 32.000 40.000 | 80 567 | 20.000 <u>40.000</u> | nomepage | - |
| Abs. humidity | | a/ka | -11 860 | 11 541 | 5 78/ | City 25 9 20 | 22 |
| Density humid | ko | שיייש ז∕m? | 1 1/1 | 1 20/ | 1 200 | With the complim | |
| Enthalov humid | r(v | J/kn | 62 560 | 47 355 | 34 805 | | |
| Volume flow humid | к г | n3/h | 5255 023 | 5011 407 | 5000 000 | Representati | ive |
| Mass flow drv | I | ka/h | 5963 904 | 5963 904 | 5963 904 | Direct dialin | ıg |
| Condensate flow | | kg/h | 2200.004 | 1,907 | 2000.007 | XXXXXXXXXXXX | (|
| Surface temperature | | °C | 23.328 | 15.109 | | 2230000 | |
| Velocity | | m/s | 2.102 | 2.005 | 2.000 | Plant | |
| Pressure drop (dry 45 Pa) | | Pa | | 46.003 | | Object | |
| W | | | | — | | Position | |
| Water (ff = 0.00005 m2K/W) | | <u>،</u> | 14.000 | Temp. (°C) | | | |
| Temp Outlet | | °C | 14.000 | ~ | | | |
| Temp. Selection | | °C | 20.000 16 100 | 30 | | ┱ <u>┝</u> ╞┝╞┝┝┝┝┝┝┝┝ | |
| Density | le o | 1/m3 | 00.190 008 020 | 25 | | | |
| Spec, heat | K(| /kaK | <u>لا 184</u> | | | ▏▋▐ ▋ ▖ ▏▕▕▕─▎┤ | |
| Heat cond | κJ, \Λ/ | //mK | 4.104 N 507 | 20 0 | | \₿₿₿₿₿ ₽₽₽ | |
| Viscosity | vv | Pas | 1.103F-03 | 15 | → → ↓↓ | \ | |
| Volume flow | r | n3/h | 3 618 | 10 | | ********* | ∎∎₽₽₽ |
| Velocity | I | m/s | 0.594 | | | | |
| Reynolds | | | 6244.182 | 5 | | | |
| Pressure drop (T/C = 9.114) | | kPa | 7.919 | 0 | | | |
| Technical data | | | | | | | |
| | | lieco | 460 | | Tubaa | | ^ |
| Tubes Iolank | ۲ م | iece | 160 | | Tubes: | | CU emooth |
| Int yent /draine | ۲ ۲ | iece | U | | Tubes: | | SHIOOTN |
| Tube rows on the depth | ۲ ۲ | iece | U | | Tubes: | | in line |
| Tube rows on the beight | ۲ م | jece | ठ 20 | | Collectore | 0 49 m/c | Gircular Cu |
| Tube coupling in series | ۲ م | iece | 20 10 | | Connections: | 0.40 m/s | Do7 |
| Number of circuits (NC) | г D | 'iece | 10 | | Fine | ס/וון טד.ט | λ1 Δ1 |
| Volume | r | 1 | 23 | | Fine: | | Smooth |
| Weight | | ka | 23 86 | | Circulations: | 1 | Default |
| Connections | G | g | 2" | | Frame: | 2.0 mm | AISI 304 |
| Frame height | RH | mm | 780 | | Protection | | without |
| Frame width | BT | mm | 1170 | | Protection | | |
| Frame depth | RT | mm | 330 | Air | flow direction: | | horizontal |
| Finned height | LH | mm | 700 | | | | |
| Finned width | LB | mm | 992 | <mark>⊧ ⊧</mark> AD | | | 2 |
| Finned depth | LF | mm | 280 | | <u> </u> | ¥>< | ; |
| Frame on top | RO | mm | 40 | | └───────────────────────────────────── | | |
| Frame on bottom | RU | mm | 40 | | 91191° - E E | | |
| Frame in front | RV | mm | 30 | ØK | ╙ <u>_</u> ∥∟т ║∣= | 티티 | |
| Frame on back (~53mm) | RN | mm | 53 | ບ | ╷╶─┑┍──┐╷║║║╎╴ | | |
| Collector-Diameter | К | mm | 54 | ┉╪╦╤╡╨┝═┽╎ | | <u>↓</u> ↓ ₩{>□ | \$₩ ║ |
| Collector covering | AD | mm | 125 | | RV | | |
| Collector distance | KA | mm | 245 | | <mark>⊭`</mark> BT ∣ ⁱ | | |
| Fin spacing | LT | mm | 2.800 | ' ₄ | > | <mark>⊨ ⊢</mark> Ľ RT F | |
| Fin thickness | LD | mm | 0.200 | | | r∎ → L | |
| | DA | mm | 12.400 | Delivery: | | | 5-6 weeks |
| Tube diameter | aa | mm | 12.400 | Validity: | | | 12 weeks |
| Tube interval on the balance | ୧1 | uim mm | 0.400 | Condit.: | | net, preț | 30 dours |
| Tube interval on the height | 51 52 | uill) mm | 35.000 | Price petr | | EUD | JU uays net |
| rube interval on the depth | 32 | 11111 | 30.000 | Price net: | | EUK | 1302.00 |

| Cooler: 35/30/12-8R-20T-992A-3 | A-3.0PA-16C-Cu/Al/AISI 304 | | Software by www.zcs.ch | | | |
|---------------------------------|----------------------------|---|---|--|--|-------------|
| Capacity | k\/ | √ 25.193 | sensible: | 23.850 | | |
| Surface reserve | 0 | 6 2.305 | latent: | 1.343 | | |
| Present surface | m | 2 105.248 | frost: | 0.000 | Company | |
| Required surface | m | 2 102.877 | | | Branch | |
| k-coeff. | W/m2l | < 36.149 | | | Street | |
| Average temp. diff. (93.03 %) | | ۲ 6.774 | | | Country / ZIP / City | |
| Air humid (ff = 0.00005 m2K/W |) | Inlet | Outlet | Definition | Phone: xxxxxxxxxxx | |
| Height over sea level | r | n | | 0.000 | Fax: xxxxxxxxxxx | |
| Pressure | hP | а | | 1013.250 | E-Mail | |
| Temp. | °(| 32.000 | 18.000 | 20.000 | Homepage | |
| Rel. humidity | 0 | ⁶ 40.000 | 89.590 | 40.000 | | |
| Abs. humidity | g/k | g 11.860 | 11.544 | 5.784 | City, 25.9.2022 | , |
| Density humid | kg/m | 3 1.148 | 1.204 | 1.200 | With the compliments o | t |
| Enthalpy humid | kJ/k | g 62.569 | 47.362 | 34.805 | Department | |
| volume flow humid | m3/ | n 5255.023 | 5011.430 | 5000.000 | Representative | |
| wass now dry | kg/ | n 5963.904 | 5963.904 | აყ 63.904 | | |
| Condensate flow | kg/ | | 1.889 | | XXXXXXXXXX | |
| Sunace temperature | ° | 23.353 | 15.118 | 2 000 | Plant | |
| Pressure drop (dry 56 Do) | m/ | а 2.102 а | 2.000 56 664 | ∠.000 | | |
| | Р | | 00.004 | | Position | |
| Water (ff = 0.00005 m2K/W) | | 11000 | Temp. (°C) | | | I |
| Temp. Outlot | °I | 14.000 | ³⁵ C | | | |
| Temp. Oullet | °(| 20.000 2 46.400 | 30 | - ├ ──┤ │ ∎└─ | | |
| nemp. Selection Density | / | 3 000 000 | 25 | ∥ ∥∎ | ¹ <mark>┏</mark> ╡╡╡╡╡╡╡╡╡╡ | |
| Spec, heat | אמ/m ור ו/ורים | ی ع ام عام کار کار کار کار کار کار کار کار کار کار | | | ╫ ┫╎╗╎_┓╎╶╎╶╎╶╎╶╎╶╎╶┤╶┤ | |
| Heat cond | KJ/KG \//ml | 4.104 ζ Ω ΕΩ2 | 20 0 | ─~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | ▝▐▋▐▋▏▋▏▖ | |
| Viscositv | vv/111. Pa | s 1.103E-03 | 15 | Ă Ⅲ | ▝▋▋▋▋▋▋∎⋼₋₋п | |
| Volume flow | ים m٦/ | h 3.616 | 10 | ĭ | ▝▋▋▋▋₿₿₿₿₿₿₿₿ | |
| Velocity | m/ | s 0.594 | | | | |
| Reynolds | | - 6241.082 | 5 | | | |
| Pressure drop (T/C = 9.114) | kP | a 7.912 | 0 | | | |
| Technical data | | | | | | |
| Tubes total | Picc | 9 160 | | Tubes: | | <u>Cu</u> |
| Tubes blank | Piec | e 0 | | Tubes: | en | nooth |
| Int. vent./drains | Piec | e 0 | | Tubes: | stan | gered |
| Tube rows on the depth | Piec | e 8 | | Tubes: | ci | rcular |
| Tube rows on the height | Piec | e 20 | С | ollectors: | 0.49 m/s | Cu |
| Tube coupling in series | Piec | e 10 | Con | nections: | 0.49 m/s | Rg7 |
| Number of circuits (NC) | Piec | e 16 | | Fins: | | AI |
| Volume | | I 23 | | Fins: | sr | nooth |
| Weight | k | g 77 | Circ | culations: | 1 D- | efault |
| Connections | G | - 2" | | Frame: | 2.0 mm AIS | SI 304 |
| Frame height | RH mr | n 780 | Pi | rotection: | w | rithout |
| Frame width | BT mr | n 1170 | Pi | rotection: | | |
| Frame depth | RT mr | n 300 | Air flow | direction: | horiz | zontal |
| Finned height | LH mr | n 700 | , AD | LB RN | | 1 |
| Finned width | LB mr | n 992 | ► • • - • • - • • • | | | |
| Finned depth | LF mr | n 242 | | | | |
| Frame on top | κu mr | n 40 | | ŗ _] _† | <†♥ ₪ ₪ | ₽ ₽> |
| Frame on bottom | KU Mr | 11 40 | øк = '' | $ _{1+} _{-} _{-}$ | <u>_</u> | |
| | | 11 30 | | ة ∸ ^{⊥_} ⊧ | $\overline{\mathbf{x}}$ | |
| Collector-Diameter | ארא Mr גי או | n 53 | | | | |
| Collector covering | | 54 1 105 | | <u> </u> | | Ψ |
| Collector distance | KA mr | I∠⊃ 1 ²¹² | | | | |
| Fin spacing | LT mr | ∠າວ ງ <mark>ເ</mark> | | BT | | |
| Fin thickness | LD mr | n 0.200 | - | | | [4]∛ |
| Tube diameter | DA mr | n 12.400 | Delivery: | | 5-6 v | veeks |
| Tube diameter | da mr | n 12.400 | Validity: | | 12 v | veeks |
| Tube thickness | S mr | n 0.400 | Condit.: | | net, prepaid ad | dress |
| Tube interval on the height | S1 mr | n 35.000 | Payment: | | 30 day | √s net |
| Tube interval on the depth | S2 mr | n <u>30.311</u> | Price net: | | EUR 12 | 97.00 |

| Cooler: 35/35/12-14R-20T-1000 | 0T-1000A-2.7PA-7C-Cu/Al/AISI 304 | | Software by www.zcs.ch | | | |
|--------------------------------------|----------------------------------|--------------------|-----------------------------------|------------------------|-------------------------|----------------|
| | | | | 00.07- | | |
| Capacity | kW | 24.499 | sensible: | 23.857 | LAAA | |
| Surface reserve | % | 1.688 | latent: | 0.642 | | 9 |
| Present surface | m2 | 239.127 | frost: | 0.000 | Company | |
| rtequirea surrace | m² | 235.156 | | | Branch | |
| | vv/m2k | 28.296 | | | | |
| Average temp. and. (92.05 %) | K | 3.682 | | | Country / ZIP / City | |
| Air humid (ff = 0.00005 m2K/W | () | Inlet | Outlet | Definition | Phone: xxxxxxxxxx | |
| Height over sea level | m | 1 | | 0.000 | Fax: xxxxxxxxxxx | |
| Pressure | hPa | ı | | 1013.250 | E-Mail | |
| Temp. | °C | 32.000 | 18.000 | 20.000 | Homepage | |
| Rel. humidity | % | 40.000 | 90.849 | 40.000 | | |
| ADS. NUMIAITY | g/kg | 11.860 | 11.709 | 5.784 | UITY, 25.9.2022 | ; |
| Density numid | kg/m: | a 1.148 | 1.204 | 1.200 34 90F | with the compliments of | |
| Linnaipy numid Volume flow burnid | KJ/K(| 5255 022 | 4/./01 | 500.000 | Representative | |
| Mass flow dry | 1113/1 ka/h | 5200.023 | 5963 904 | 5963 904 | Direct dialing | |
| Condensate flow | ka/h | . 0000.004 | 0.903 | 0000.004 | XXXXXXXXXXX | |
| Surface temperature | °C | 29.124 | 15.124 | | | |
| Velocity | m/s | 2.085 | 1.989 | 1.984 | Plant | |
| Pressure drop (dry 80 Pa) | Pa | 1 | 80.414 | | Object | |
| · · · · | | | | | Position | |
| Water (ff = 0.00005 m2K/W) | | | Temp. (°C) | | | _ |
| remp. Inlet | °C | 14.000 | 35 | | | |
| Temp. Outlet | °C | 28.000 | 30 | | | |
| nemp. Selection | ٽ د مارس | 19.110 | 25 | | | |
| Spec, heat | kg/ma | × 390.389 | | <u>↓</u> ∎ ∎ | | |
| Heat cond. | N//mk | 4.102 0 507 | 20 | \ 📗 | | |
| Viscosity | Pas | 1.024F-03 | 15 | | | |
| Volume flow | m3/h | 1.509 | 10 | ĭ | | |
| Velocity | m/s | 0.567 | 5 | | ▝▋▋▋▋₿₿₿₿₿₿₿₿₿ | |
| Reynolds | | 6407.427 | 3 | | | |
| Pressure drop ($T/C = 10.201$) | kPa | 28.497 | 0 | | | |
| Technical data | | | | | | |
| Tubes total | Piece | 280 | | Tubes: | | Сп |
| Tubes blank | Piece | • 0 | | Tubes: | sm | nooth |
| Int. vent./drains | Piece | • 6 | | Tubes: | i | n line |
| Tube rows on the depth | Piece | · 14 | | Tubes: | cir | cular |
| Tube rows on the height | Piece | . 20 | C | ollectors: | 0.85 m/s | Cu |
| Tube coupling in series | Piece | . 40 | Con | nections: | 0.85 m/s | Rg7 |
| Number of circuits (NC) | Piece | • 7 | | Fins: | | AI |
| Volume | | I 34 | | Fins: | sn | nooth |
| Weight | kg | 1 139 | Circ | culations: | 1 De | efault |
| | G | - 1" | | ⊢rame: | 2.0 mm AIS | 1 304 |
| Frame neight | KH MM DT | 780 | Pi - | rotection: | wi | nout |
| Frame depth | | 1170 | Pi Al- diate | direction: | L.2 | |
| Finned height | | 510 700 | AIT TIOW - | ດແ ບ ບເປປາ. | noriz | Jung |
| Finned width | | | | | <u> </u> [1] [2] | |
| Finned depth | LF mm | | | Q | | |
| Frame on top | RO mm | 40 | | i ``` ‡ | | |
| Frame on bottom | RU mm | 40 | | | | T |
| Frame in front | RV mm | ı 30 | ØK '' | | 윤 | |
| Frame on back (~53mm) | RN mm | 53 | v∣ ∥⊫ → | ┉┈╷╢╢║╶┙ | - | |
| Collector-Diameter | K mm | . 28 | ┉╪╦╤╡╨┢╡└ | | ·│ │╙ ₩<≈<>₩ │ | Ψ |
| Collector covering | AD mm | n 117 | | | | _ |
| Collector distance | KA mm | 455 | | BT | | |
| Fin spacing | LT mm | 2.700 | k | ► | | 4 |
| | DA mm | 0.200 | Delivery | | | v |
| Tube diameter | da mm | . 1∠.400 12.400 | Validity: | | 0-C 10 v | ieeks ieeks |
| Tube thickness | S mm | 1 <u>Λ</u> ΔΟΟ | Condit.: | | net, prepaid ad | dress |
| Tube interval on the height | S1 mm | 35.000 | Payment: | | 30 dav | 's net |
| Tube interval on the depth | S2 mm | 35.000 | Price net: | | EUR 232 | 22.00 |

| Cooler: 35/30/12-14R-20T-1000 | A-2.9PA-7C-Cu | /AI/AISI 304 | Software by | y www.zcs.ch | | |
|----------------------------------|---------------|-----------------|-------------|--|---------------|----------------|
| | | | | | | |
| Capacity | k٧ | V 24.495 | sensible: | 23.857 | LV | JV |
| Surface reserve | c | 6 1.998 | latent: | 0.639 | | |
| Present surface | m | 2 191.696 | frost: | 0.000 | Compa | iny |
| Required surface | m | 2 187.941 | | | Branc | h |
| k-coeff. | W/m2 | K 35.390 | | | Stree | |
| Average temp. diff. (92.07%) | | K 3.683 | | | Country / ZI | P / City |
| Air humid (ff = 0.00005 m2K/W | ') | Inlet | Outlet | Definition | Phone: xxx | xxxxxx |
| Height over sea level | , r | n | | 0.000 | Fax: xxxxx | XXXXX |
| Pressure | hP | а | | 1013.250 | E-Ma | il |
| Temp. | 0 | C 32.000 | 18.000 | 20.000 | Homepa | age |
| Rel. humidity | c | 6 40.000 | 90.856 | 40.000 | | |
| Abs. humidity | g/k | g 11.860 | 11.710 | 5.784 | City, 25.9 | .2022 |
| Density humid | kg/m | 3 1.148 | 1.204 | 1.200 | With the comp | liments of |
| Enthalpy humid | kJ/k | g 62.569 | 47.783 | 34.805 | | |
| Volume flow humid | m3/ | h 5255.023 | 5012.744 | 5000.000 | Represen | tative |
| Mass flow dry | kg/ | h 5963.904 | 5963.904 | 5963.904 | Direct dia | aling |
| Condensate flow | kg/ | h | 0.898 | | XXXXXXX | XXX |
| Surface temperature | 0 | C 29.128 | 15.128 | | | |
| Velocity | m/ | s 2.085 | 1.989 | 1.984 | Plant | t |
| Pressure drop (dry 97 Pa) | Р | а | 97.886 | | Objec | ct op |
| Water (ff = 0.00005 m2K/W) | | | Temp. (°C) | | 1 03110 | |
| Temp. Inlet | 0 | C 14.000 | 35 | | | |
| Temp. Outlet | 0 | C 28.000 | | | | |
| Temp. Selection | 0 | C 19.110 | 30 | _ | | |
| Density | kg/m | 3 998.389 | 25 | | | |
| Spec. heat | kJ/kg | K 4.182 | 20 | | | |
| Heat cond. | W/m | K 0.597 | | Ý | | |
| Viscosity | Pa | s 1.024E-03 | 15 | Ý | | |
| Volume flow | m3/ | h 1.509 | 10 | | | |
| Velocity | m/ | s 0.567 | 5 | | | |
| Reynolds | - | - 6406.499 | | | | |
| Pressure drop ($T/C = 10.201$) | kP | a 28.490 | 0 | | | |
| Technical data | | | | | | |
| Tubes total | Piec | e 280 | | Tubes: | | Cu |
| Tubes blank | Piec | e 0 | | Tubes: | | smooth |
| Int. vent./drains | Piec | e 6 | | Tubes: | | staggered |
| Tube rows on the depth | Piec | e 14 | | Tubes: | | circular |
| Tube rows on the height | Piec | e 20 | | Collectors: | 0.85 m/s | Cu |
| Tube coupling in series | Piec | e 40 | | Connections: | 0.85 m/s | Rg7 |
| Number of circuits (NC) | Piec | e 7 | | Fins: | | AI |
| Volume | | I 34 | | Fins: | | smooth |
| Weight | k | g 123 | | Circulations: | 1 | Default |
| Connections | G - | 1" | | Frame: | 2.0 mm | AISI 304 |
| Frame height | RH mr | n 780 | | Protection: | | without |
| Frame width | BT mr | n 1170 | | Protection: | | |
| Frame depth | RT mr | n 450 | Air | flow direction: | | horizontal |
| Finned height | LH mr | n 700 | AD | LB F | RN 1 | |
| Finned Width | LB mr | n 1000 | | | | >< |
| Finned depth | | n 424 | | | | |
| Frame on top | RU III | n 40 | | | Î <†¶ ∏ | |
| Frame on bollom | RU III | n 40 | øк | $\ \ ^{\mu'} \ _{L^{\infty}} = \ \ _{2}$ | | |
| Frame on back (~53mm) | RN mr | n 53 | | ╵ ╶┥╡╸╹ ╷╢║║═ | | |
| Collector-Diameter | K mr | n 28 | | ا اااالى ا | | |
| Collector covering | AD mr | n 117 | | | ╪┙┖┈╺╹ | |
| Collector distance | KA mr | n 395 | | | | |
| Fin spacing | LT mr | n 2.900 | _ | BT | | |
| Fin thickness | LD mr | n 0.200 | | | KI ▲ KI | 3∥ 4∛ |
| Tube diameter | DA mr | n 12.400 | Delivery: | | | 5-6 weeks |
| Tube diameter | da mr | n 12.400 | Validity: | | | 12 weeks |
| Tube thickness | S mr | n 0.400 | Condit.: | | net, p | repaid address |
| Tube interval on the height | S1 mr | n 35.000 | Payment: | | | 30 days net |
| Tube interval on the depth | S2 mr | n <u>30.311</u> | Price net: | | EUR | 2200.00 |