FINNED TUBES HEAT EXCHANGERS
WRW, WRW-W
APPLICATIONS

WRW finned tube heat exchangers are mainly used for the heating of drinking or heating water and as tankless water heaters. They are also suitable for heating or cooling of other liquids (suitability of material to be checked on a case-by-case basis).

WRW-W finned tube heat exchanger are primarily used for safety heat exchangers in solid-fuel boilers. For the type WRW-W a GEWA-DW finned tube with integral fins is used. Due to the integral fins the pressure drop is approximately 1.8–1.9 times higher compared to the type WRW.

MANUFACTURING AND PROCESSING

WRW and WRW-W is a spiral heat exchanger consisting of a seamless copper tube having integral fins (GEWA-D) and brazed fittings. It is pressure tested at 28 bar according to the „air under water“ method.

The risk of corrosion of galvanized steel tubes connected downstream can be reduced by tin plating the outside surface of the finned tube heat exchanger. WRW and WRW-W heat exchangers with tin plated surface are available from stock; inside plating upon request only.

BENEFITS

- Option of compact design through high thermal conductivity of copper in combination with optimised heat transfer surface
- Proven corrosion resistance of copper materials for drinking water, particularly chloride-containing water
- Copper – a hygienic and antimicrobial material for use in drinking water storage
- Exchangeable because of compact coil design
- Standard WRW heat exchangers available from stock
- Can be adapted to your individual requirements if necessary

OPERATION

<table>
<thead>
<tr>
<th>Fluids</th>
<th>heating water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Superheated vapour</td>
</tr>
<tr>
<td></td>
<td>Antifrogen N, PKL 90</td>
</tr>
<tr>
<td></td>
<td>Others upon enquiry</td>
</tr>
</tbody>
</table>

| Max. operating temperature for EPDM-Sealing element* | Up to +130 °C; up to +170 °C for a short time |
| Max. operating gauge pressure | 28 bar |

QUALITY ASSURANCE

To ensure consistent product quality, Wieland-Werke AG has a sophisticated quality control system according to DIN EN ISO 9001 which has been verified and certified by an independent certification company. Our test laboratories in the Central Laboratory and Development Services have been accredited to DIN EN ISO/IEC 17025 and DIN EN ISO 9001 as test and certification laboratories.

TECHNICAL SERVICE

Our Technical Marketing experts are available at any time as contact partners to work together with your experts from the very early product planning stages in order to obtain optimum results for the manufacturing stage and for your application. The only way to find the best, most economical solution is by means of comprehensive technical consultation based on computerised thermal engineering rating.

MATERIALS

<table>
<thead>
<tr>
<th>Part</th>
<th>Material designation</th>
<th>Composition as per</th>
<th>Wieland symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finned tube</td>
<td>Cu-DHP</td>
<td>EN 12451 K21</td>
<td></td>
</tr>
<tr>
<td>Fitting</td>
<td>CuZn40Pb2</td>
<td>EN 12164 Z48</td>
<td></td>
</tr>
<tr>
<td>Hard solder</td>
<td>AG106</td>
<td>EN 1044</td>
<td></td>
</tr>
<tr>
<td>Sealing element</td>
<td>EPDM</td>
<td>DIN ISO 1629</td>
<td></td>
</tr>
<tr>
<td>Hollow disk</td>
<td>CuZn40Pb2</td>
<td>EN 12164 Z48</td>
<td></td>
</tr>
<tr>
<td>Hexagon nut</td>
<td>CuZn40Pb2</td>
<td>EN 12164 Z48</td>
<td></td>
</tr>
</tbody>
</table>

*Do not use lubricants which contain mineral oil!
DIMENSIONS AND WEIGHTS

<table>
<thead>
<tr>
<th>Model</th>
<th>Tube No.</th>
<th>Dimensions (mm)</th>
<th>Dimensions (m)</th>
<th>approx. weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRW 10</td>
<td>D-1135.12100-00</td>
<td>5,210</td>
<td>1.0</td>
<td>0.78</td>
</tr>
<tr>
<td>WRW 13</td>
<td>D-1135.14100-00</td>
<td>5,780</td>
<td>1.3</td>
<td>1.13</td>
</tr>
<tr>
<td>WRW 18</td>
<td>D-1135.18100-00</td>
<td>6,590</td>
<td>1.8</td>
<td>2.13</td>
</tr>
<tr>
<td>WRW 23</td>
<td>D-1135.18100-00</td>
<td>8,380</td>
<td>2.3</td>
<td>2.13</td>
</tr>
<tr>
<td>WRW 26</td>
<td>D-1135.18100-00</td>
<td>9,300</td>
<td>2.6</td>
<td>2.13</td>
</tr>
<tr>
<td>WRW 26-2</td>
<td>D-1135.18100-00</td>
<td>9,300</td>
<td>3.0</td>
<td>2.47</td>
</tr>
<tr>
<td>WRW 31-2</td>
<td>D-1135.18100-00</td>
<td>11,000</td>
<td>3.1</td>
<td>4.26</td>
</tr>
<tr>
<td>WRW 36-2</td>
<td>D-1135.18100-00</td>
<td>13,900</td>
<td>3.6</td>
<td>4.26</td>
</tr>
<tr>
<td>WRW 45-2</td>
<td>D-1135.18100-00</td>
<td>16,880</td>
<td>4.5</td>
<td>4.26</td>
</tr>
</tbody>
</table>

*approximate dimensions

CAPACITY AND PRESSURE DROP

The diagrams on the following pages will be helpful when choosing a heat exchanger to heat up a water tank by using water of a heating circuit. The diagrams are based on our own tests with heating water and unforced convection in the tank.

Symbols:
- $Q$ (W) Capacity to be transferred
- $q$ (W/K) Capacity per K of temperature difference ($t_1 - t_s$)
- $t_1$ (°C) Heating water temperature at inlet
- $t_2$ (°C) Heating water temperature at outlet
- $t_s$ (°C) Mean temperature of tank water surrounding the heat exchanger
- $V$ (m³/h) Heating water volume flow
- $w$ (m/s) Heating water velocity (limit 2.5 m/s)
- $\Delta p$ (bar) Pressure drop on heating water side
- $f_1$ (-) Correction factor for lower capacity when using other heating fluids
- $f_2$ (-) Correction factor for pressure drop increase when using other heating fluids
- Index $G$ Other heating fluid (mixture)

With water as heating fluid, the capacity to be transferred is:

$$Q = q (t_1 - t_s)$$

The pressure drop in the heat exchanger is given in the diagram on page 4.

With heating fluids (mixtures) as used in solar power units, the capacity drops by the factor $f_1$ and the pressure drop rises by the factor $f_2$:

$$Q_G = f_1 \cdot q (t_1 - t_s)$$

$$\Delta p_G = f_2 \cdot \Delta p$$

Factors of a few commercial heating fluids (mixtures):

<table>
<thead>
<tr>
<th>Index $G$</th>
<th>$f_1$</th>
<th>$f_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifrogen N (concentration 20 %)</td>
<td>0.95</td>
<td>1.15</td>
</tr>
<tr>
<td>Antifrogen N (concentration 40 %)</td>
<td>0.85</td>
<td>1.35</td>
</tr>
<tr>
<td>PKL 90 (concentration 100 %)</td>
<td>0.55</td>
<td>1.45</td>
</tr>
</tbody>
</table>
A 300 l water tank is to be reheated through a solar power system filled with a 40 % Antifrogen N water mixture. The heating fluid enters the tank at 50 °C to reheat the 15 °C tank water. The volume flow is 1.0 m³/h and the maximum pressure drop in the heat exchanger is 0.3 bar.

**a)** What is the capacity a specific heat exchanger can transfer to the tank water?

**Solution a)**

Maximum pressure drop for a 40 % Antifrogen N solution:

\[ p_{\text{max.}} = \frac{0.3}{1.35} = 0.22 \text{ bar} \]

Refer to pressure drop diagram:

\[ \Delta p_{\text{max.}} = 0.22 \text{ bar} \text{ and } V \cdot 1.0 \text{ m}^3/\text{h}, \text{ hence WRW 23 or WRW 26.} \]

Refer to diagrams WRW 23 and WRW 26:

\[ V \cdot 1.0 \text{ m}^3/\text{h}, t_1 = 50 \degree C, \text{ hence } \]

WRW 23: \( \dot{q} = 410 \text{ W/K} \)

WRW 26: \( \dot{q} = 440 \text{ W/K} \)

Capacity: \( \dot{Q}_G = f_1 \cdot \dot{q} (t_1 - t_3) \):

WRW 23: \( \dot{Q}_G = 0.85 \cdot 410 (50 - 15) = \text{approx. } 12 \text{ kW} \)

WRW 26: \( \dot{Q}_G = 0.85 \cdot 440 (50 - 15) = \text{approx. } 13 \text{ kW} \)

**b)** What is the pressure drop to be kept in mind when selecting the circulation pump?

**Solution b)**

\[ \Delta p_G = f_2 \cdot \Delta p; \text{ (see } \Delta p \text{ diagram)} \]

WRW 23: \( \Delta p_G = 1.35 \cdot 0.16 = 0.22 \text{ bar} \)

WRW 26: \( \Delta p_G = 1.35 \cdot 0.19 = 0.26 \text{ bar} \)

c) What is the return temperature of the heating fluid?

**Solution c)**

In the heat exchanger, the heating fluid cools off by

\[ \Delta t = \frac{Q_G}{V \cdot p \cdot C_p} \]

Physical properties for the 40 % Antifrogen N heating fluid:

\( \sigma = 1.055 \text{ kg/m}^3; C_p = 0.986 \text{ Wh/kgK} \)

WRW 23: \( \Delta t = \frac{12,000}{1.0 \cdot 1.055 \cdot 0.986} = 11.5 \text{ K} \)

Return temperature \( t_2 = 50 - 11.5 = 38.5 \degree C \)

WRW 26: \( \Delta t = \frac{13,000}{1.0 \cdot 1.055 \cdot 0.986} = 12.5 \text{ K} \)

Return temperature \( t_2 = 50 - 12.5 = 37.5 \degree C \)

d) What capacity can be transferred when the temperature of the water surrounding the heat exchanger is 45 °C?

**Solution d)**

The water temperature around the heat exchanger is 45 °C, the capacity is only \( \dot{Q}_G = f_1 \cdot \dot{q} (t_1 - t_3) \):

WRW 23: \( \dot{Q}_G = 0.85 \cdot 410 (50 - 45) = \text{approx. } 1.75 \text{ kW} \)

WRW 26: \( \dot{Q}_G = 0.85 \cdot 440 (50 - 45) = \text{approx. } 1.9 \text{ kW} \)
### DESIGN

The suitable heat exchanger is chosen according to the required outside surface which is calculated as follows:

\[
A = \frac{\dot{Q}}{k \cdot \Delta t_m}
\]

- \( A \) (m\(^2\)) Outside surface of the heat exchanger
- \( \dot{Q} \) (W) Capacity to be transferred
- \( k \) (W/m\(^2\)K) Heat transfer coefficient referred to outside surface of the heat exchanger (empirical value: 800–1,000 W/m\(^2\)K)
- \( \Delta t_m \) (K) Mean logarithmic temperature difference (assumed water temperature at outlet of 35–40 °C).

### DIMENSIONS AND WEIGHTS WRW-W

<table>
<thead>
<tr>
<th>Model</th>
<th>Tube No.</th>
<th>Tube length (mm)</th>
<th>Outer surface area (m(^2))</th>
<th>Free-space sectional area (cm(^2))</th>
<th>( D_{\text{max}} ) (mm)</th>
<th>( a_{\text{max}} ) (mm)</th>
<th>Dimensions (mm)</th>
<th>SW</th>
<th>G</th>
<th>m</th>
<th>Approx. weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRW-10W</td>
<td>D-1145.12100-16</td>
<td>3,800</td>
<td>1.0</td>
<td>0.70</td>
<td>140</td>
<td>350</td>
<td>320</td>
<td>46</td>
<td>30</td>
<td>½</td>
<td>8</td>
</tr>
<tr>
<td>WRW-13W</td>
<td>D-1145.14100-16</td>
<td>3,950</td>
<td>1.1</td>
<td>1.05</td>
<td>147</td>
<td>410</td>
<td>375</td>
<td>52</td>
<td>36</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>WRW-18W</td>
<td>D-1145.18100-16</td>
<td>4,430</td>
<td>1.6</td>
<td>1.90</td>
<td>170</td>
<td>440</td>
<td>390</td>
<td>52</td>
<td>36</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>WRW-23W</td>
<td>D-1145.18100-16</td>
<td>5,830</td>
<td>2.0</td>
<td>1.90</td>
<td>170</td>
<td>540</td>
<td>490</td>
<td>52</td>
<td>36</td>
<td>¾</td>
<td>10</td>
</tr>
<tr>
<td>WRW-26W*</td>
<td>D-1145.18100-16</td>
<td>6,750</td>
<td>2.4</td>
<td>1.90</td>
<td>170</td>
<td>595</td>
<td>545</td>
<td>52</td>
<td>36</td>
<td>¾</td>
<td>10</td>
</tr>
</tbody>
</table>

*approximate size; **available in stock

![Diagram of a heat exchanger](image)

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**WRW-10W – WRW-26W**

[Image of a heat exchanger diagram]
MOUNTING OF THE HEAT EXCHANGER

WRW heat exchangers are mostly mounted into hot water tanks. They are mounted into the (cold) bottom part of the tank if heat is to be added and into the (hot) upper part of the tank if heat is to be withdrawn from the tank water. Its position may be either horizontal (Fig. 1) or vertical (Fig. 2). The seal is generally placed on the outside of the tank (Fig. 3), in some cases on the inside (Fig. 4). If the flange is less than 8 mm in thickness, a spacer (not supplied by Wieland) must be added between hollow disk and nut (Fig. 5). When fixing the nut, it is imperative to counterhold at the fitting flats.

For the EPDM-sealing element lubricants which contain mineral oil should not be used.

The WRW heat exchanger must be supported in the tank for transportation as well as operation to avoid mechanical damage of the heat exchanger.

ACCESSORIES

Defective coating of the tank may lead to corrosion of the tank if there is no electric insulation between tank, piping and heat exchanger. For this purpose, we are offering various sets of insulating elements available upon request.
For details, please refer to a special leaflet available upon request.
INNOVATIVE SPIRIT. OUTSTANDING RESULTS.

For further information please contact

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