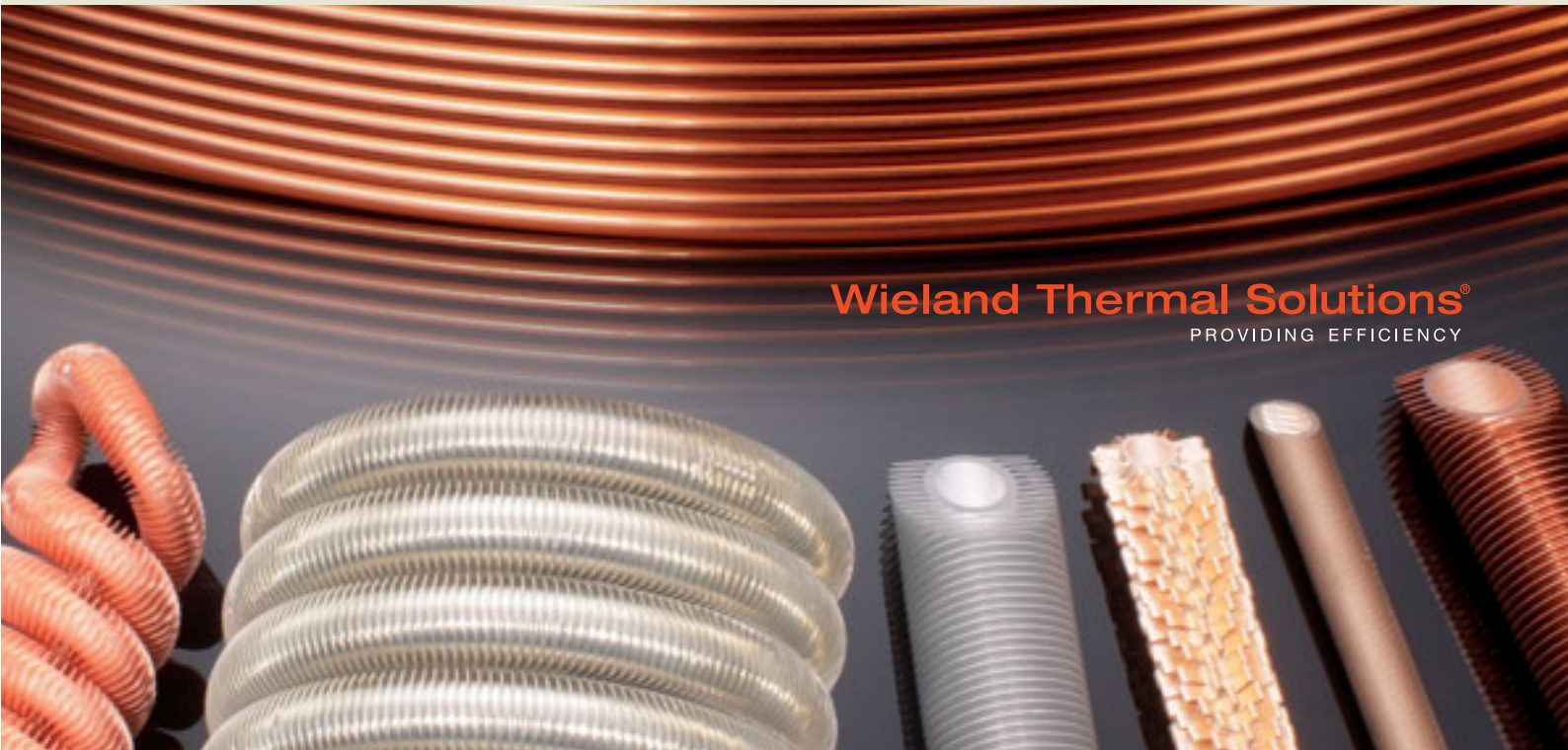


**Wieland**

Tubes and heat exchangers

**Wieland Thermal Solutions®**  
PROVIDING EFFICIENCY



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*Ulm plant with headquarters*



*Vöhringen plant*

## Production

In a modern casting shop, the copper grades are smelted down from pure base material with constant monitoring of the chemical composition, and converted into billets by continuous casting. Close tolerances regarding additives as well as the permissible impurities ensure uniform material properties independently of the individual heats.

The billets are cut to lengths suitable for the extrusion press, heated to red hot and extruded into tubes on a horizontal tube press (power approx. 35 MN).

On efficient break-down tube blocks which use forces of up to 166 kN, the extruded tube is drawn in several successive steps to a coiled tube of smaller diameter and thinner wall thickness. The uniform cold forming takes place in the drawing die with a so-called flying mandrel placed inside the tube. During both the initial draw, when the coils hang from an overhead conveyor, and the redraw, when they lie in large steel baskets, the coils are continuously fed back to the draw block by a power-and-free conveyor, without being handled manually, until the desired final dimension is reached.

The tubes to be supplied in straight lengths and in hard as drawn condition

are then straightened, eddy-current tested and cut to length.

An automatic saw cuts the tubes cleanly into shorter lengths, if required by the customer.

Level-wound tube coils are produced on high-performance coilers, in a similar manner to a cotton reel, turn next to turn and layer above layer. Simultaneously, they are eddy-current tested.

Spirally wound tube coils are made on winding machines while they are eddy-current tested and cut when the specified length is reached.

The recrystallized state of soft annealed industrial tubes is achieved by precisely monitored heat treatment in the bright annealing furnace. For industrial tubes requiring a defined hardness between soft and hard as drawn, for example half-hard or hard, the desired temper is obtained, after preliminary annealing, by means of cold work-hardening under carefully controlled conditions.

After testing and release by the Quality Assurance Department, which is independent of the production departments, the tubes are suitably packed and are thus ready for despatch.



# Materials and properties

Classification of Wieland pure copper grades		
Wieland designation	Designation according to DIN EN/UNS	Characteristic properties
Wieland-K10	Cu-OFE C10100	Oxygen-free, no deoxidants, electrical conductivity in soft annealed temper $\geq 58$ MS/m
Wieland-K12	Cu-HCP C10300	Oxygen-free, deoxidized, electrical conductivity in soft annealed temper $\geq 57$ MS/m
Wieland-K20/-K21	Cu-DHP C12200	Oxygen-free, deoxidized, K20/K21 no requirements regarding electrical conductivity
Wieland-K30	Cu-OF C11000	Oxygen-containing, electrical conductivity in soft annealed temper $\geq 57$ MS/m

The standardized values for mechanical properties are given in the relevant standards.

A distinction is drawn between oxygen-containing copper grades, oxygen-free, non-deoxidized copper grades and oxygen-free copper grades which have been deoxidized with phosphorus.

The permissible contents of residual oxygen or residual phosphorus as well as the minimum values required for electrical conductivity are established by standards. Wieland copper grades correspond to the requirements of the relevant standards. As a result of internal production standards, however, the tolerances for the permissible contents of additives and impurities in Wieland grades of copper are significantly stricter than official standards. This measure enables Wieland to supply copper tubes of a consistently high quality.

**Wieland-K20 and Wieland-K21** deoxidized grades of copper. They correspond to the material Cu-DHP, with a residual phosphorus content of between 0.015 and 0.040 %. Industrial tubes made from these materials can be produced economically and are extensively used wherever high resistance to corrosion and good forming properties are called for, but where no special requirements are made regarding electrical conductivity. The electrical conductivity in soft annealed temper is around 50 MS/m. In many cases it is of critical significance for industrial

tubes manufactured from Wieland-K20 or -K21 to possess a very high thermal conductivity (approx.  $320 \text{ W}/(\text{m} \cdot \text{K})$ ), to be easy to install and join by soldering or brazing to each other or to components of copper or other materials.

In Wieland-K21, the content of individual impurities is kept particularly low. The mechanical properties of tubes made from this material are specifically adjusted to the high demands with regard to the workability of these tubes when they are used for heat exchangers in refrigeration and air-conditioning equipment.

**Wieland-K10, -K12 and -K30**, on the other hand, are grades of copper characterized by high electrical conductivity and used almost exclusively in components for the electrical industry.

**Wieland-K10** (Cu-OFE) is an oxygen-free copper containing no deoxidants, characterized by its high degree of purity compared to other commercially available grades of copper: the content of permissible impurities is limited to a maximum of 74 ppm (1 ppm = 0.0001 %). Wieland-K10 does not contain any impurities with a high vapour pressure, so that parts made from it can be used in high vacuums, e.g. in transmitter tubes. The material therefore satisfies the highest demands regarding electrical and thermal

conductivity. The electrical conductivity in the soft annealed temper is at least 58 MS/m.

**Wieland-K12** (Cu-OF) is an oxygen-free copper grade which has been deoxidized by phosphorus. The copper content is at least 99.90 % by weight. Due to its very low level of residual phosphorus, the material possesses a very high electrical and thermal conductivity, the former being at least 57 MS/m in the soft annealed temper.

**Wieland-K30** (Cu-OF) is a copper grade also having an electrical conductivity in the soft annealed temper of at least 57 MS/m. Due to the residual oxygen content, tubes made from this copper grade are not suitable for soldering or welding in a reducing atmosphere.



## Plain tubes

Ranges of sizes				
Supplied as	Outside diameter in mm	Wall thickness in mm		
		soft	hard as drawn	half-hard
Straight lengths (up to max. 8 m)	6–8	0.40–1.00	0.30–1.00	
	8–10	0.40–1.50	0.35–1.50	
	10–13	0.40–1.50	0.35–1.50	0.60–1.25
	13–16	0.40–2.00	0.40–2.00	0.65–1.50
	16–19	0.50–2.00	0.50–2.00	0.75–1.50
	19–22	0.60–2.00	0.60–2.00	0.75–1.50
	22–25	0.85–1.75	0.85–1.75	1.00–1.25
	25–28	0.90–1.50	0.90–1.50	1.00–1.25
	28–30	0.90–3.00	0.90–3.00	0.90–1.65
	30–50	0.90–3.00	0.90–3.00	0.90–1.75
	50–54	0.90–3.00	0.90–3.00	1.20–2.00
	54–58	1.50–3.00	1.50–3.00	1.50–2.00
	58–64	2.00–2.50	2.00–2.50	
Spirally wound coils (pancakes)	6–8	0.45–1.00	0.30–1.00	
	8–13	0.45–1.00	0.35–1.50	
	13–16	0.50–1.75	0.40–1.75	
	16–18	0.60–2.00	0.50–2.00	
	18–20	0.75–1.75	0.75–1.75	
	20–23	0.75–1.25	0.75–1.25	
Level-wound coils	5–9.525	0.28–1.00		
	9.525–12.7	0.30–1.50		
	12.7–16	0.40–1.75		
	16–18	0.50–2.00		
	18–20	0.75–1.75		
	20–22	0.75–1.50		
	22–28	1.00–1.25		

Industrial tubes made of Wieland-K20/-K21 as well as of Wieland-K10, -K12 and -K30, are supplied in straight lengths or as spirally wound coils (pancakes) or level-wound coils. The table provides a summary of the ranges of sizes available.

Unless otherwise agreed, we supply tubes according to DIN EN 12449. Refrigeration tubes are specified in DIN EN 12735.

Spirally wound coils (pancakes)				
Outside diameter of tube in mm	Outside diameter of coil in mm	Inside diameter of coil in mm	Shape of coil	Usual coil lengths, max. coil weight
6–8	450+20	approx. 300	Single- and multi-layer spirals	15, 25, 30, 50, 100 and 150 m; depending on weight per meter up to approx. 80 kg max. coil weight
8–10	560+20	approx. 420		
10–16	560+20	approx. 370		
16–23	760+20	approx. 570		

# Plain tubes

## Details of level-wound coils without reel

	Details without reels	
Coil weight in kg	Height of standard coil in mm	Inside diameter of coil in mm
100, 150, 300	max. 380	600 + 10/-0

The coil height depends on the tube dimension and the specified outside diameter of coil.  
This table also applies to tubes with finned inner surface.

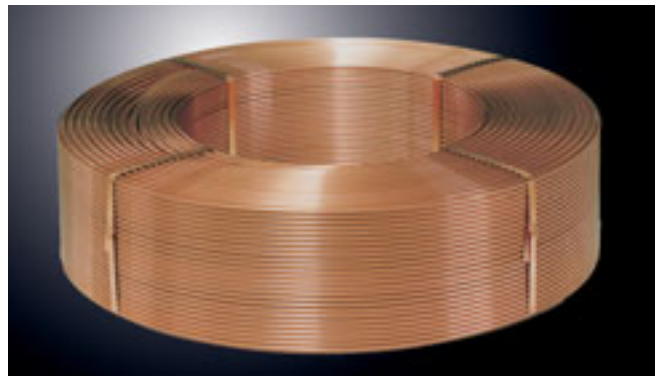
## Details of level-wound coils with reel

	Details of the reels	
Coil weight in kg	Distance between flanges in mm	Flange diameter in mm
100 and 150	160, 200, 240, 280, 320	1060 and 1150

Core diameter approx. 600 mm, diameter of the receiving hole 130 mm.  
This table also applies to tubes with finned inner surface.



Bundled tubes in straight lengths



Level-wound coils



Two-layer spirally wound tubes



Three-layer spirally wound tubes

## solarclean® – plain copper tubes with clean outer surface

In the manufacture of solar panels the welding of seamless copper tubes with copper or aluminium plates requires a special clean tube surface to ensure sufficient holding grip of sheet and copper tube. The surface quality offered by Wieland is referred to as solarclean.

# Refrigeration tubes

## cuprofrío® copper tube for refrigeration

cuprofrío, the seamless drawn Wieland refrigeration tube is used mainly for gases in refrigeration equipment, refrigeration and air conditioning units as well as heat exchangers. An outstanding property of this tube is its clean and dry inner surface.

cuprofrío tube meets the requirements of EN 12735-1 for copper tube used in refrigeration and air conditioning units.

Material: Cu-DHP (SF-Cu)  
Wieland-K20  
Tolerances: EN 1057  
Delivery conditions: EN 12735-1

Standard dimensions cuprofrío from stock				
Dimension mm	Weight kg/m	Permissible operating pressure in bar	Coils soft R220 m/box	Straight lengths hard as drawn R290 m/box
6 x 1	0.140	200	2 x 35	200
8 x 1	0.196	143	2 x 35	100
10 x 1	0.252	111	35	75
12 x 1	0.308	91	35	50
15 x 1	0.391	71	25	50
16 x 1	0.419	66	25	50
18 x 1	0.475	59	25	50
22 x 1	0.587	48	25	50
28 x 1	0.755	37	–	50
28 x 1.5	1.110	57	–	50
35 x 1.5	1.410	45	–	25
42 x 1.5	1.700	37	–	25
54 x 2	2.910	38	–	20
64 x 2	3.467	32	–	5 m*
76.1 x 2	4.144	27	–	5 m*
88.9 x 2	4.859	23	–	5 m*
108 x 2.5	7.374	24	–	5 m*

\* without box



cuprofrío in coils



cuprofrío/cuproMed in straight lengths

## cuproMed® copper tube for medical gas supply

The seamless drawn cuproMed copper tube is used for refrigeration/air conditioning as well as for medical gas supply units according to EN 793.

cuproMed tube meets the requirements according to EN 12735-1 and also according to EN 13348.

Material: Cu-DHP (SF-Cu)  
Wieland-K20  
Tolerances: EN 1057  
Delivery conditions: EN 12735-1 and EN 13348

Standard dimensions cuproMed from stock			
Dimension mm	Weight kg/m	Permissible operating pressure bar	Straight lengths hard as drawn R290 m/box
8 x 1	0.196	143	100
10 x 1	0.252	111	75
12 x 1	0.308	91	50
15 x 1	0.391	71	50
16 x 1	0.419	66	50
18 x 1	0.475	59	50
22 x 1	0.587	48	50
28 x 1	0.755	37	50
28 x 1.5	1.110	57	50
35 x 1.5	1.410	45	25
42 x 1.5	1.700	37	25
54 x 2	2.910	38	20
64 x 2	3.467	32	5 m*
76.1 x 2	4.144	27	5 m*
88.9 x 2	4.859	23	5 m*
108 x 2.5	7.374	24	5 m*

## cuproclima® tubes

cuproclima is a protected trade name for seamless tubes made of Cu-DHP for producing heat exchangers in refrigeration and air-conditioning systems. The tubes are supplied in level-wound coils, in annealed temper, with suitable packaging.

The cuproclima product specification was established with a view to the particular requirements imposed by further processing in the refrigeration and air-conditioning industry. It not only covers the most important national and international standards, but also exceeds these standards in many important aspects.

When using refrigerants, particular importance is attached to the inner tube surface being clean. The maximum permissible soluble residue on the inner surface of the tube is 25 mg/m<sup>2</sup>. On request, the tube ends are closed in order to avoid contamination of the inner surface. Furthermore, cuproclima tubes are available on request in a so-called "super clean" grade, with an extra high level of cleanliness on the inside.



The cuproclima specification supports the European Pressure Equipment Directive 97/23/EG.

After drawing, the tubes are wound into coils. In the process, the tube is 100 % checked for flaws using an integrated eddy-current testing instrument.

The coils can be supplied either on reels (usually cardboard) or without reels. The standard coil and reel dimensions correspond to those of the standard plain tubes in the tables on page 6.

To simplify the further processing of level-wound copper tubes without cardboard packaging, we offer our customers wooden decoiling adapters, together with adjustable lifting belts.

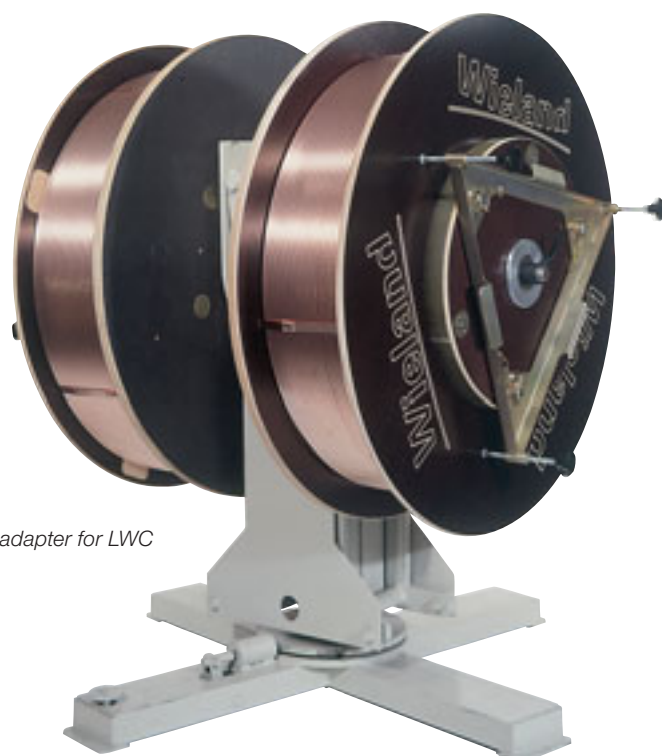
For further information on these tubes, please consult the appropriate data sheets.



*Level-wound coils with and without cardboard packaging*



*Lifting belt and cross-bar*



*Wooden decoiling adapter for LWC*

## cuprofin® tubes

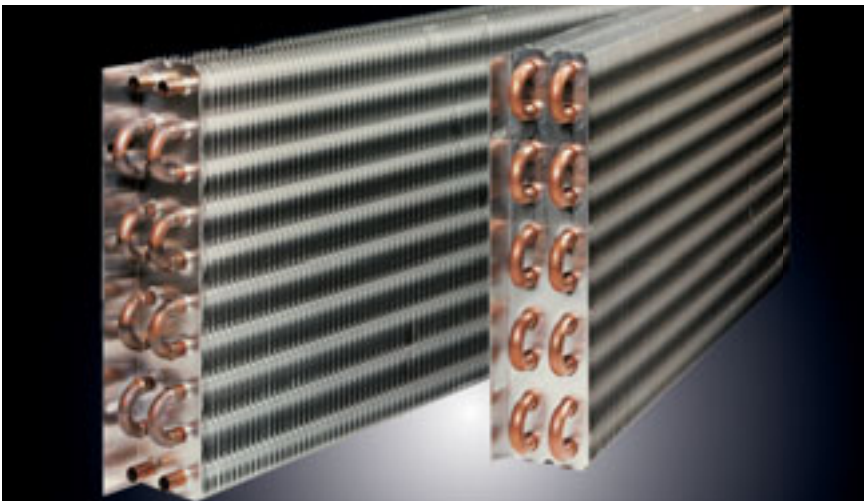
These tubes have a plain outer surface and a finned inner surface. cuprofin tubes are usually used in heat exchangers in which refrigerant evaporates or condenses in the tube.

The most common applications for cuprofin tubes are shell-and-tube dry-expansion evaporators and for fin coils and air-handling units fin coil evaporators and condensers.

The specially designed inner surface of the cuprofin tubes leads to significantly higher heat transfer than tubes with a plain inner surface.

Controlled development was required to achieve this. Wieland has developed suitable high-performance tubes which are adapted to the requirements and application areas:

- cuprofin-C for condensation in air coolers
- cuprofin-E for dry-expansion evaporation in air coolers
- cuprofin-EDX for dry-expansion evaporation in shell-and-tube heat exchangers.



Heat exchanger coils with cuprofin tubes



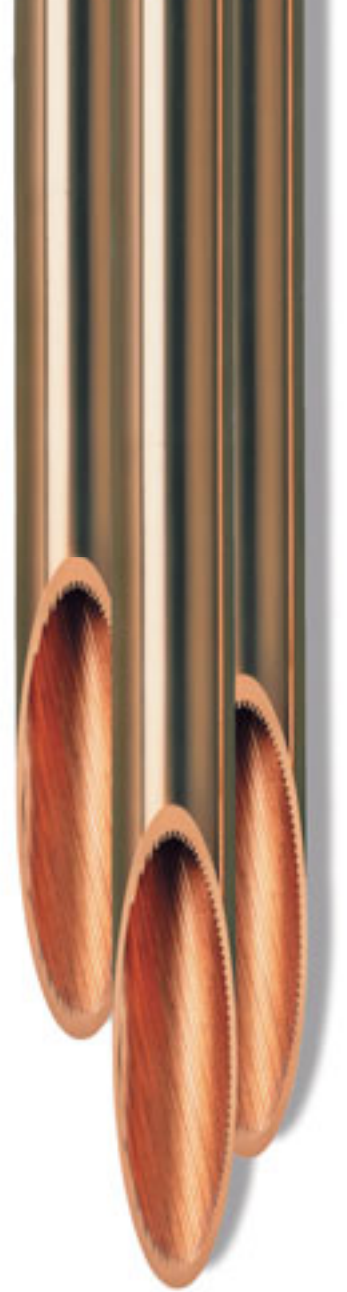
Test plant for tubes and heat exchangers

A well-equipped laboratory for carrying out thermal engineering measurements on individual tubes, but also on complete shell-and-tube heat exchangers, is available for determining performance characteristics.

After the fins have been formed, the cuprofin tubes are usually level wound and soft-annealed. They can also be supplied in lengths which are ready for installation and in the hard as finned temper.

The technical requirements and forms of delivery are similar to those of cuproclima. cuprofin tubes are also available on request in "super clean" quality.

For further information on dimensions and other technical details, please refer to the cuprofin data sheets.



## Finned tubes

Nowadays, Wieland produces and supplies finned tubes made from copper and copper alloys, aluminium, carbon steels, stainless steel and titanium. Wieland finned tubes are produced by a cold-forming process in which the fins are rolled out from the wall of a plain tube in a process which is similar to that of thread rolling.

Particularly with the filigree outer and inner structures of our high-performance finned tubes, this forming technique requires the use of ultra-modern machines, tools and testing equipment. Measurement devices which are linked to EDP-assisted data collection and assessment are now responsible for the dimensional testing which accompanies fabrication.

Further processing of finned tubes, for example the machining of the ends of high-finned tubes, is carried out in a completely automatic process on CNC machining centres. Final testing of rolled finned tubes takes place as laid down by national and international standards, in the form of eddy-current testing (DKI material test sheet 801, ASTM B-359, DIN EN 12452) or as an air under water pressure test or hydraulic test up to a pressure of 320 bar.

Group	Type	
Low-finned tubes (fin height up to 1.5 mm)	GEWA-K (Cu)	
	GEWA-K Ti, X-St	
	GEWA-KS	
	GEWA-PB	
	GEWA-C	
	GEWA-B	
Medium-high-finned tubes (fin height 1.5 to 4.5 mm)	GEWA-D	
	GEWA-DW	
High-finned tubes (fin height 4.5 to 15 mm)	GEWA-H	
	GEWA-HB	
Safety tubes (double wall)	GEWA-Safe	

Further details relating to the use of finned tubes are given in the corresponding data sheets.

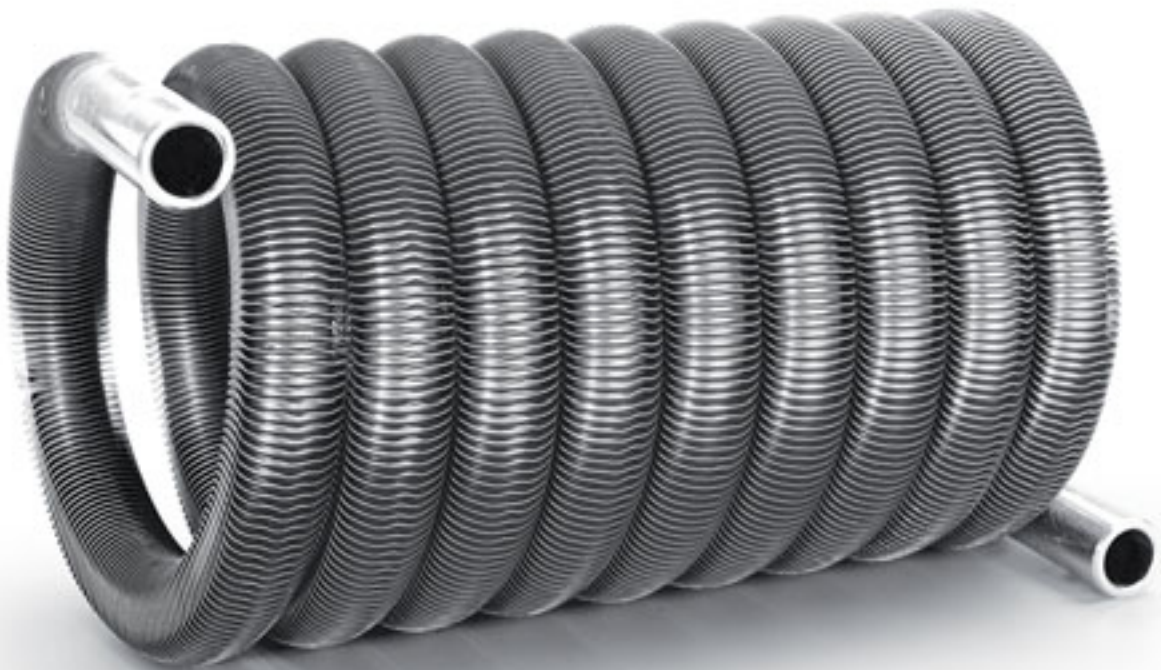
## Heat exchangers

Wieland's heat exchanger manufacturing sector processes industrial tubes and finned tubes to produce heat exchangers: Ultra-modern bending and winding machines, induction- and gas-soldering devices, as well as special pickling and cleaning units, are operated by highly qualified employees and form the basis for economic manufacture of high-quality heat exchangers.

Our Quality Assurance Department has precise and reliable testing equipment and CAQ systems at its disposal.

Solutions which satisfy the application and cost requirements are developed in close cooperation with the customer. Prototypes are produced in our own modelling department and can be tested in the thermal engineering laboratory.








These products are used primarily in the air-conditioning / refrigeration and heating industries, in the automotive industry and in mechanical engineering.



*Heat exchanger made of aluminium*



# Heat exchangers

Group	Designation	Series	
Standard designs (stock types)	Finned tube heat exchangers	WRW	
	Finned tube heat exchangers	WRW-W	
	Finned tube condensers	WRK	
	Finned tube (condensers with safety double wall tube)	WRKS	
	Coaxial condensers	WKC	
	Coaxial evaporators	WKE	
	Special designs	According to customer specifications, taking into account the particular installation situation	
Accessories	Insulating sets		

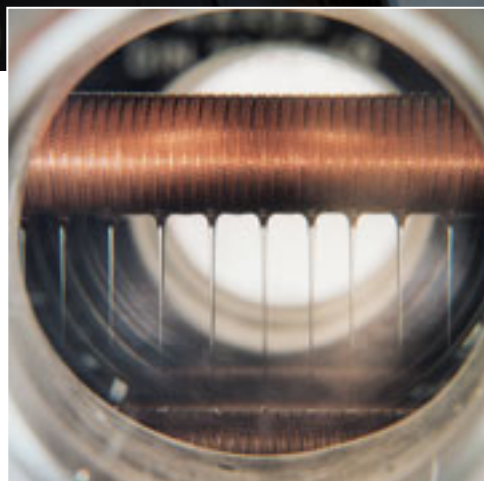
## Technical service

Quality begins with good advice: Experienced engineers in the Technical Marketing Department are available for consultation on materials engineering questions and for questions related to the optimum use of industrial tubes in customers' applications all the way through to active assistance in the development of customers' products.

Our Technical Service Department also encompasses:

- Materials testing in up-to-date laboratories
- Computer-aided thermal engineering calculations
- Application-oriented software
- Performance and pressure drop measurements carried out in our own thermal engineering laboratory

Our continuous development and invention of products and production processes allow us to satisfy the market requirements for components which are of an ever higher quality yet less expensive.



*Tests carried out on finned tubes for condensers*

## Forms of packing

The packing used for Wieland industrial copper tubes meets the demands of transportation, protects the semi-finished product, is selected for its economy, provides the customer with a clear picture of his stock and simplifies internal handling.

Sturdy folding corrugated cardboard boxes on wooden runners or wooden cases bound with steel straps are used as non-returnable packing for industrial tubes and finned tubes in manufactured lengths or cut lengths of up to 6 m. Maximum weight is approx. 500 kg. Tubes longer than 6 m are always packed in wooden cases. They may also be supplied in large cases with steel rails for ease of stacking. This returnable packing allows a maximum weight of approx. 1500 kg.

If wall thickness and strength are sufficient, industrial tubes in straight lengths are also supplied in bundles.

Coiled tubes can be supplied in folding corrugated cardboard boxes. They are

fitted with a wooden frame, fastened with steel straps onto non-returnable pallets and can be stacked two high. In case of a width of below 700 mm, two cardboard boxes are arranged next to one another on one pallet in order to provide sufficient space between runners for the fork-lift truck. Maximum weight is approx. 300 kg per box.

Coiled tubes are also despatched stacked in small containers or skeleton box pallets as well as packed in wooden cases.

Level-wound coils are supplied stacked on wooden pallets with layers of cardboard between them. The maximum number of stacked coils is 8. At the end, a carton with an insertion core is fitted. The stacked coils are then wrapped in plastic film and held taut in order to provide stability and protect against contamination and damage when force is applied. In addition, 4 cardboard strips are inserted beforehand in order to provide protection during transport and to make it easier to cut open the packaging film.

Copper refrigeration tubes and copper tubes for medical gases in standard dimensions available from stock are supplied in cardboard boxes, reliably protecting the tubes against damage and contamination. Straight lengths are packed in cardboard boxes 5 m long, pancake coils in square, flat cardboard boxes with a handle punched onto them in order to make the individual coil packs easier to carry.

Heat exchangers are usually supplied in cardboard boxes or in skeleton boxes.

On request we pack industrial tubes for overseas shipment.

Where economically viable, we take back wooden cases and pallets.



*Packing forms of tubes and heat exchangers*

# Quality assurance

Wieland has modern, high-performance, largely automated facilities and substantial know-how in the production of drawn copper tubes.

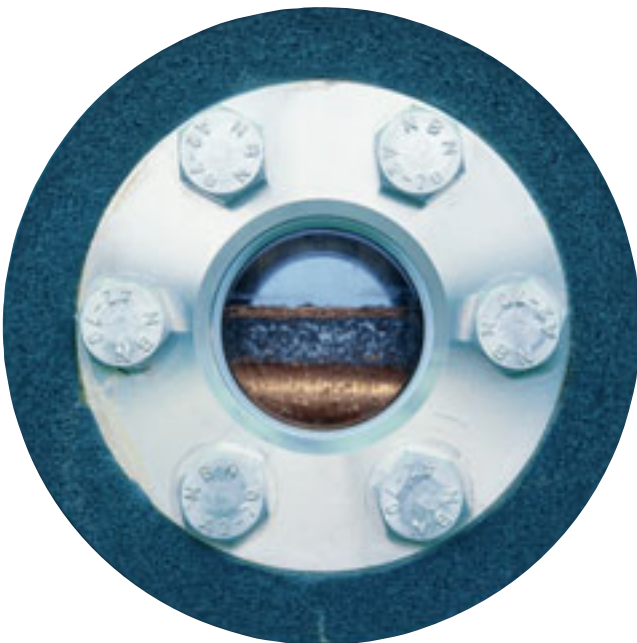
For many years, Wieland's worldwide customers have been able to rely on products made under the conditions of the Wieland quality assurance system. Careful monitoring of the manufacturing process from the arrival of material all the way through to despatch, by reliable and experienced employees, guarantees the high quality standard of Wieland products.

Employees in the Quality Assurance Department, which is independent of production departments, use precisely defined internal standards and test procedures to ensure that the specified quality features are maintained during all production steps. The finished product is only released for despatch by employees of the Quality Assurance Department when it complies with all points specified in the order confirmation.

Manufacturing schedules and test results are stored and can always be called up

if required – an important condition for a constantly high quality standard.

The Wieland-Werke AG Quality Management System (QMS) was set up as laid down by DIN EN ISO 9001 and was checked and certified by the independent Certification Association Kiwa International Cert GmbH. This system is used to maintain and ensure compliance with the requirements imposed on Wieland products.



Performance test of an evaporator tube



Automated alloy analysis



## Wieland-Werke AG

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[www.wieland-thermalsolutions.com](http://www.wieland-thermalsolutions.com)