

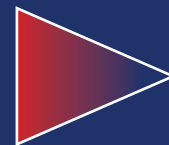
# Climate management for process air conditioning

## Process air conditioning devices



**WEISSHAAR**<sup>®</sup>  
industrial refrigeration

Perfect process conditioning. Order given. Job done.  
Made by Weisshaar.





## WEISSHAAR – Mission and philosophy.

“You can’t build a reputation on what you are going to do.” (Henry Ford)



**WEISSHAAR** – industrial process conditioning and cooling technology. In Bad Salzflen. In the middle of Germany. For over 40 years. Privately owned. Flexible. Responsive. Experienced. Reliable. Collaborative.

**WEISSHAAR** – the company that offers functional solutions in the field of correct process air conditioning. Manufactured in-house with high degree of vertical integration. Solutions with patents pending.

**WEISSHAAR** – the team of engineers, refrigeration specialists, service technicians. Services on your behalf that we channel completely into your project.

The vast majority of our customers in the field of process air control and process air conditioning are leading system manufacturers in the food industry, the chemical- and plastics processing industries, many of whom specify **WEISSHAAR** systems to meet their own factory standards.

Our process air chillers and dryers guarantee optimal conditioning in pressure and suction applications. We ensure that the correct dew point control is implemented for conveying hygroscopic, powdery materials with the correct process air conditioning or for extracting grinding heat. We offer you the optimum solution for such tasks.





## WEISSHAAR – Expertise.

The technical expertise and competence of our engineers, refrigeration and service technicians as well as our more than 40 years of experience together mean that: We develop the optimal solution for your air conditioning project for pneumatic conveyance or milling.

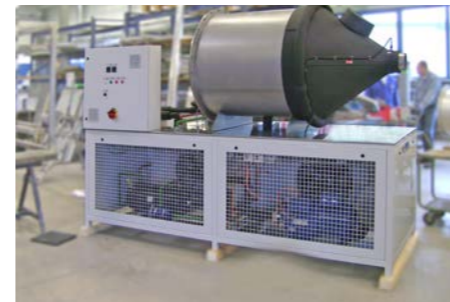
Nowadays powdery substances are very efficiently pneumatically conveyed in the chemical, plastics processing and especially in food chemistry industries. In order to meet hygienic requirements and promote the conveyability of hygroscopic media such as powdered sugar, whey powder or flour, as well as plastic granules and various chemical substances, the dew point of the conveying air must be reduced.

In addition, it is essential to ensure the dryness of conveying air in regions of high humidity, which is prevalent throughout much of Asia, for example, throughout the year. In addition to dry conveying air, many substances such as sugar, which caramelises at higher temperatures, require lowered or moderate conveying temperatures.

In the milling of powdered sugar, spices, cocoa or similar foods, the key issue is not so much the reduction of moisture, but rather the extraction of excess grinding heat. Especially under inert conditions, the devices of the LKTA series find a wide range of applications. Modified devices can also be used for humidification, which is useful, for example, in the conditioning of powdered sugar.

Our solutions are always informed by careful consideration of the overall cost effectiveness.

**We look forward to your next assignment for us.**





## WEISSHAAR – Units and systems for air conditioning and dew point control.

**LK.**  
**LKL.**  
**LKTA.**

With our air-conditioning systems, we can deal with virtually all air volumes as well as temperature and dew point ranges.

WEISSHAAR offers the right solutions for different tasks:

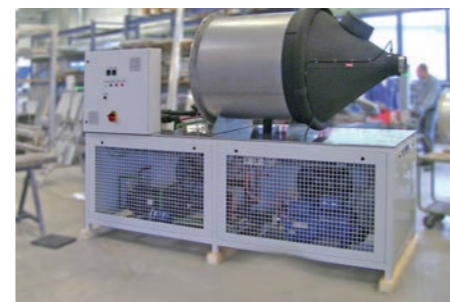
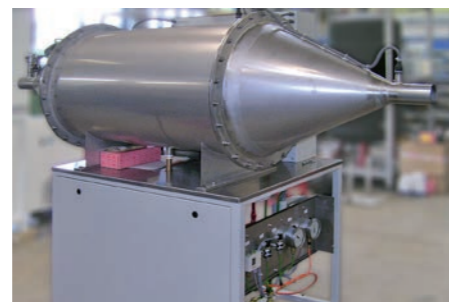
- Standardized WEISSHAAR devices in compact designs – the range of LK, LKTA or LKL process air coolers – cover a wide range of requirements.
- Customized WEISSHAAR devices are primarily used in the area of process air conditioning, wherever conventional technical building systems cannot provide satisfactory solutions. In addition to a wide performance range, these air-conditioning units can be adapted to meet customer-specific factory standards or specific hygiene requirements.
- For air conditioning in the low dew point range (<4°C), an additional drying step is required in addition to conventional cool drying. After the pre-drying stage, the process volume flow passes through an adsorption dryer, which is already integrated in the system.

### The WEISSHAAR quality features in air cooling and drying units.

Designed for permanent continuous operation and for the heaviest loading as well as the conditioning of all temperature ranges, our units and systems are built for absolute ease of maintenance and short service downtimes.

Our process air coolers (LK and LKTA) are characterized by very low pressure losses and are ideal for air cooling and air drying of pneumatic conveying air flows. Of course, other applications are also possible.

## WEISSHAAR – Desuperheating. Dehumidifying. Reheating.





## WEISSHAAR – The exploitation of physical laws for air conditioning.

The air conditioning systems of the WEISSHAAR series exploit the principle of dew point reduction in air dehumidification. This basic principle of dehumidification can be understood with the aid of a Mollier-h-x-diagram.

### 1. Desuperheating

For pressure-side applications, the hot process air after the blower is first cooled economically via an air/air heat exchanger (LKL). The discharge temperature of the process air is approx. 15°C higher than that of the ambient air.

### 2. Cooling to dew point – 100% relative air humidity

Air with any degree of saturation at any temperature is first cooled down on a cold surface until the relative humidity reaches 100%. This state is known as the dew point. If the temperature is now lowered further, the air can no longer completely absorb the moisture contained in it – moisture condenses on the cold surface.

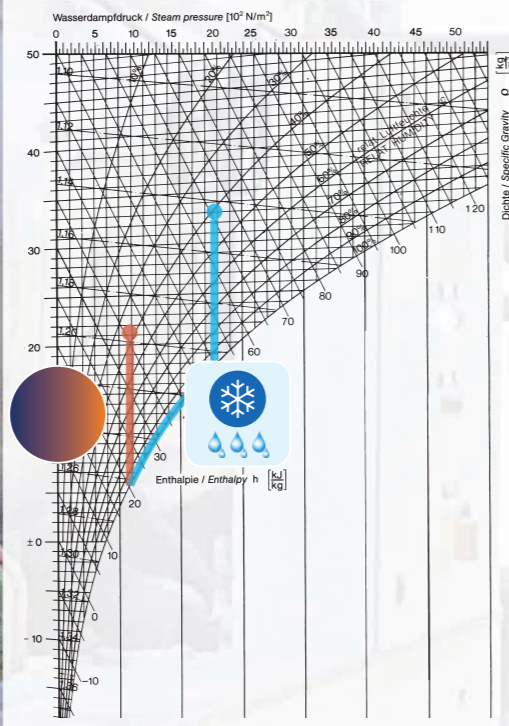
### 3. Cooling below the dew point – dehumidification along the saturation line

Further cooling of the air displaces the dew point. The absolute humidity measured in g/kg is now lowered. Water condenses out of the air. During this process, the air state “shifts” along the saturation line in the Mollier-h-x-diagram - the humidity remains 100%.

### 4. Reheating – Lowering the relative humidity

Downstream reheating now reduces the relative air humidity. In the diagram it can be seen that the air is “relatively” drier.

#### Suction-side configuration



#### Pressure-side configuration

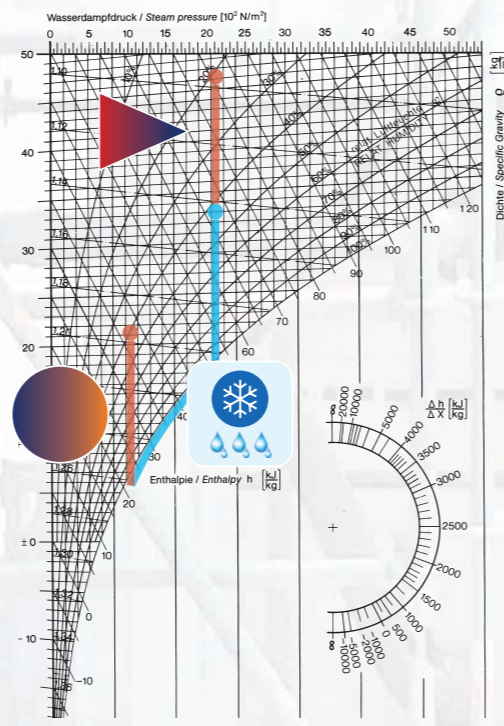


Illustration given as example, not drawn to scale



## WEISSHAAR – Differentiated system layout in air conditioning.

A basic distinction is made in the design of pneumatic conveyance systems between suction and pressure conveyance. In the case of suction conveyance, the blower (vacuum pump) is located at the system end, in the case of a pressure conveyance system, the blower (side channel compressor, Positive displacement blower) is located at the beginning of the conveyance line. The conveyed material is thus once “sucked” through the feed line and once “pressed”. The components of WEISSHAAR air conditioning system can be used in both cases.

### Suction-side system configuration

In a pressure feed system, the suction-side configuration is the most economical air conditioning option in which the reheating is carried out by the subsequent adiabatic compression (Fig. 1).

In the case of suction conveyance, the air conditioning takes place at the inlet to the feed line. Here, if necessary, the air is reheated after cooling and dehumidification to the desired dew point. This serves to control the relative humidity before the conveyed material is fed into the system, which in turn prevents moisture from being transferred from the air to the conveyed material if the latter is hygroscopic (Fig. 2).

### Pressure-side system configuration

The mounting of the cooler on the pressure side of the blower is advantageous if the conveyed product requires a correspondingly low conveying air temperature. With this configuration, the desired process air temperature is controlled and allows drying of the air. The usually considerable – adiabatic – compression of

the process air causes relatively high temperatures. This air is first “desuperheated” with low-energy ambient air before it is fed to the actual cooling unit (Fig. 3).

#### Suction-side configuration

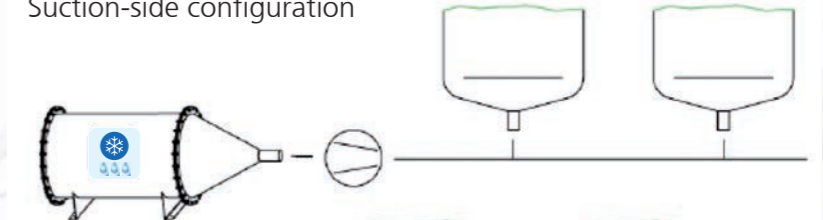


Fig. 1

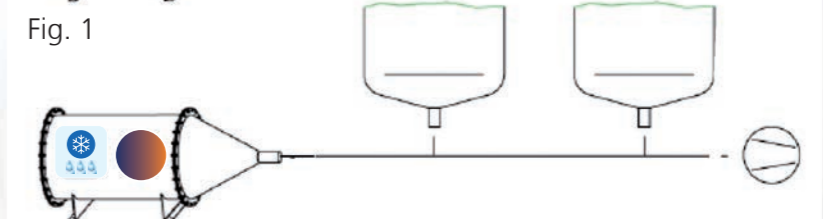


Fig. 2

#### Pressure-side configuration



Fig. 3





## WEISSHAAR – The components in the air conditioning system.



### The process air heat exchanger

The specially developed and patented heat exchanger design has extremely low pressure losses in the process air stream. These low pressure losses are a decisive criterion in the choice of the blower which is usually provided by the client.

Conventional heat exchangers with a shell and tube design or in the form of plate heat exchangers cause considerable pressure losses, which mean high operating costs for the blower but also higher initial purchase costs.

With a housing design that combines intelligence and simplicity, safe drip water drainage, a hygienic execution and appropriate cleaning are assured – a MUST in the food production!

The heat exchangers can be manufactured in a variety of material combinations. Depending on the application, efficient use is made of heat-conducting non-ferrous metals or specially coated surfaces, and in some cases the system is made entirely of stainless steel (1.4301 or 1.4571).

The round housing is generally made of stainless steel. The housing compactly accommodates, depending on the application, the pre-cooling ► main cooling ❄️ and reheating 🔴 modules .



Process air heat exchanger



Process air heat exchanger

## WEISSHAAR – The right module for each task.

### The LKL process air desuperheater

Our air-to-air cooler series (LKL) is primarily used for pre-cooling a compressed process air flow. The compression heat can be initially discharged to the outside air using an air-to-air cooler in an energy-efficient manner and without supplying expensive cooling medium. If additional cooling is required, a corresponding after-cooler is installed, whose load is, depending on the ambient temperature, efficiently reduced by the upstream air-to-air cooler.

### The LK / LKTA process air conditioner

The process air conditioners of the LK and LKTA series operate identically with regard to the process air. The difference between them lies mainly in the type of cooling. While the units of the LK-series are cooled by external cooling water or cold brine, the units of the LKTA-series have an integrated refrigeration system and operate autonomously from external refrigeration supplies. The choice of whether a device of the LK or one of the LKTA-series is used depends on the conditions and requirements of the end customer. If cooling water is available on site or if several lines are to be supplied via a central WEISSHAAR liquid chiller, a solution with devices of the LK-series can be used. If there is no on-site cooling supply at the required temperature, LKTA-series appliances are used.



LKL 90 to LKL 240

LK 120



LKTA 90 with preconnected LKL 90



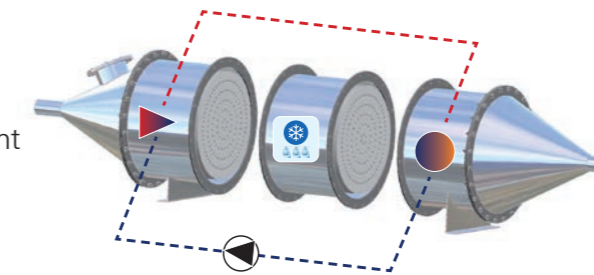
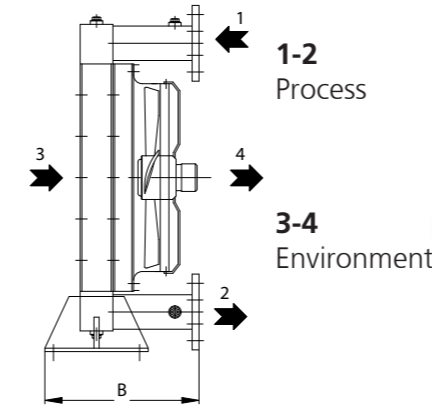
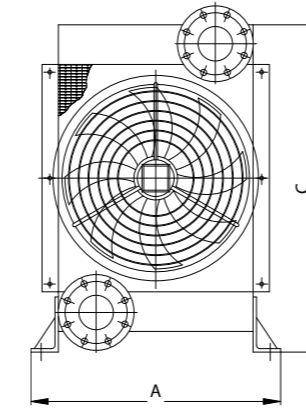
# Process air conditioning devices

LK.

LKL.

LKTA.

## WEISSHAAR – LKL pre-cooler / desuperheater.



### Precooling

“Desuperheating” = precooling of the process air relieves the main cooler. The WEISSHAAR precoolers of the LKL series are cross-flow heat exchangers with their own, optionally speed-controlled ventilation fan. They therefore ensure an efficient, highly precise temperature pre-cooling of the process air. The advantage: The pre-cooling relieves the main cooler, allowing smaller systems to be used – and saves money for the operator of the system.

As an alternative to the LKL, the “desuperheating” of the process air can be effected by the customer’s cold water supply. For this purpose, a WEISSHAAR pre-cooling module is connected to the LK process air cooler, which can be connected to the customer’s cooling media.

The advantage: The energy needed to reheat the process air is provided as a by-product of the pre-cooling – representing a meaningful contribution to environmental protection given dwindling energy resources.

### LK process air conditioner

with water cooled pre-cooler/heater and waste heat recycling for the reheating of process air

LKL pre-cooler / desuperheater series

LK	Nominal flow rate <sup>2)</sup>	Nominal flow rate <sup>2)</sup>	Max. operating pressure <sup>3)</sup>	Refrigeration capacity <sup>4)</sup>	Power draw <sup>5)</sup>	Waste heat air flow rate	Dimensions <sup>1)</sup> (mm)				Plug	Air connections <sup>6)</sup>
	Nm <sup>3</sup> /h	Nm <sup>3</sup> /min	bar (abs.)	kW	kW	m <sup>3</sup> /h	Width A	Depth B	Height C	Weight kg	Inches	DN
90	900	15	4	42	0,72	6000	725	465	950	86	3/4"	DN 100
180	1800	30	4	84	1,2	11000	1110	530	1295	170	3/4"	DN 125
240	2400	40	4	110	2,1	15000	1310	650	2100	290	3/4"	DN 150

1) detailed drawing on request, 2) based on the atmospheric standard state, 3) max. inlet temp. 220°C / higher pressures and temperatures on request, 4) cooling from + 190°C to + 45°C at ambient temp. +30°C, 5) 400V/ 3 Ph/ 50 Hz, other connection conditions on request, 6) flange connection according to DIN EN 1092-1 / others on request

## WEISSHAAR – LKTA compact system.



Compact system pressure-side



Compact system suction-side

The compact process air cooler units (LKTA) are always used wherever process volume flows are to be conditioned and no refrigerant (e.g. water-glycol), which is supplied by the customer, can be used. The coolant is integrated directly in the LKTA process air cooler and ensures stand-alone operation of the cooler. This takes place by means of economical direct evaporation. In this case, the waste heat of the refrigerant circuit can be recuperated for reheating the process air. All this is achieved without additional costs for a chiller and the associated installation work.

For this purpose, a compression refrigeration module that has proved itself a million times in practice is used, whereby the service option is supported even in remote areas of the world. Special factory or other standards can also be applied on request.

Depending on the conditions in the machinery room, we can offer our LKTA device as a split unit with an external air-cooled condenser. The condenser heat is then discharged outside the machinery room without adversely affecting the building's air-conditioning system.

Adaptable process air connection

Control cabinet as per customer requirements

Integrated cooling system

Cooling air extraction

Drip water connection



Air cooling and drying units LKTA series

LKTA	Nominal flow rate <sup>2)</sup>	Nominal flow rate <sup>2)</sup>	Nominal re- frigeration power <sup>3)</sup>	Power draw <sup>4)</sup>	Fuse <sup>4)</sup>	Waste heat air flow rate	Dimensions <sup>1)</sup> (mm)				Con- densate drainage	Air connec- tions <sup>6)</sup>
	Nm <sup>3</sup> /h	Nm <sup>3</sup> /min	kW	kW	A	m <sup>3</sup> /h	Width A <sup>5)</sup>	Depth B	Height C	Weight kg	Inches	DN
30	300	5	6	2,8	16	2500	1860	1010	1690	290	3/4"	85
60	600	10	11	5,2	20	4800	1860	1010	1740	340	3/4"	85
90	900	15	17	7,4	35	5500	1860	1210	1950	440	3/4"	125
120	1200	20	22	9,1	50	6500	1860	1210	2040	510	3/4"	125
150	1500	25	28	10,6	50	10000	1960	1410	2240	610	3/4"	125
180	1800	30	33	11,5	63	12500	2200	1610	2350	800	3/4"	200
240	2400	40	45	15,7	63	16000	2200	1610	2350	900	3/4"	200
320	3200	53	60	20,5	63	19000	2800	1610	2550	1040	3/4"	200
400	4000	67	74	23,8	80	28000	2800	1810	2750	1250	3/4"	250
480	4800	80	89	27,4	100	32000	2800	1810	2750	1300	3/4"	250

1) Detailed drawing on request

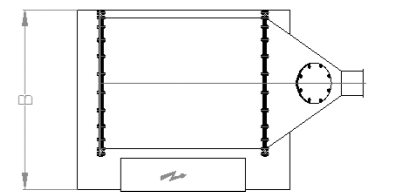
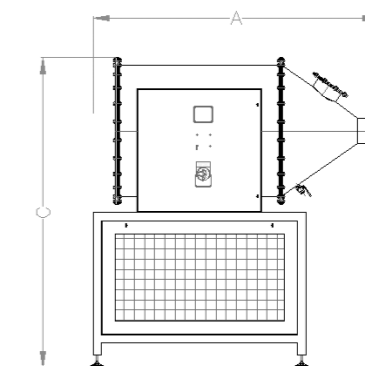
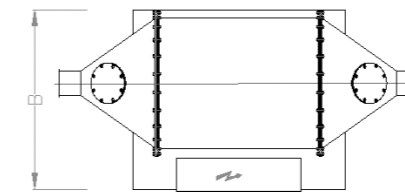
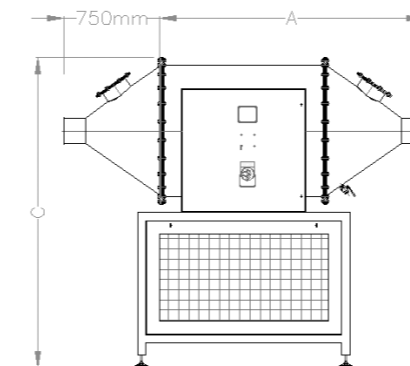
2) Based on the atmospheric standard state

3) Based on inlet air conditions of 32°C, 50% RH or 15g/kg

4) 400V/ 3 Ph/ 50 Hz, other connection conditions on request

5) Wide standard version, varies with the respective version

6) Connection is to be agreed





## WEISSHAAR – LK central refrigeration.

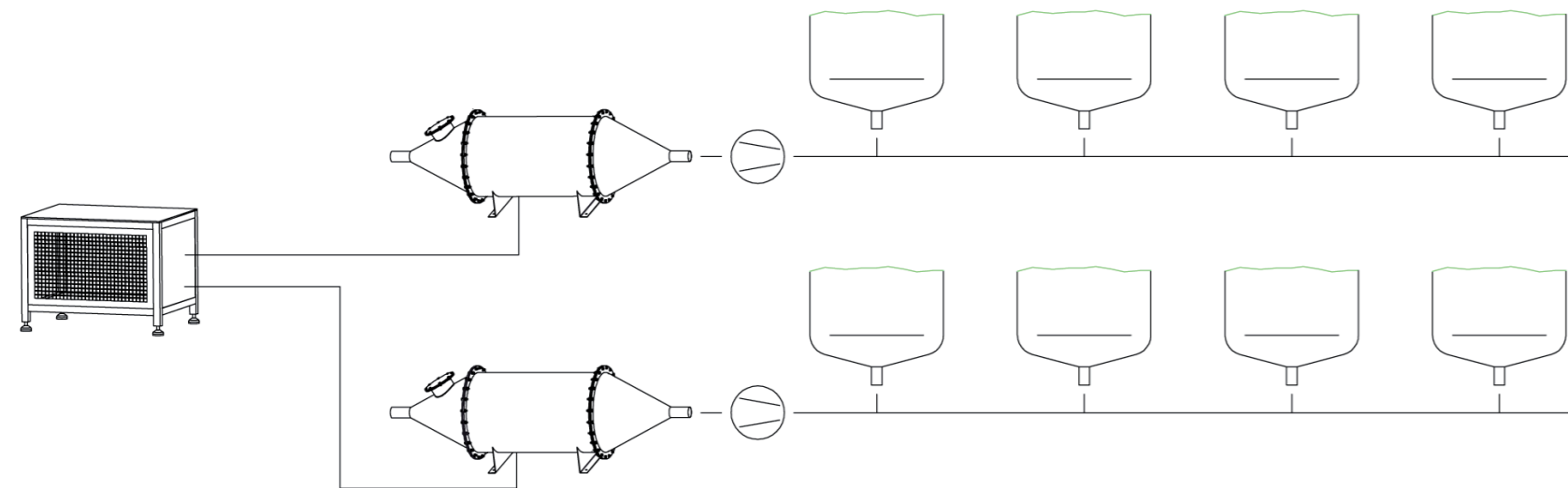
In the case of multi-circuit process air lines or when various consumers are connected, central cooling of the systems is recommended.

WEISSHAAR also supplies the proven heat exchangers of the LK-series for use with cooling medium such as ice water, glycol water mixture etc.

This solution is also suitable for cooling water supplied by the customer. If the temperature level is correct, the cost-effective cooling water available can be used to provide the required cooling capacity. This reduces investment costs for process air conditioning. This solution also creates no heat load at the installationside.

If no central cooling water is available for the application, we are able to offer you the right liquid cooler for your application.

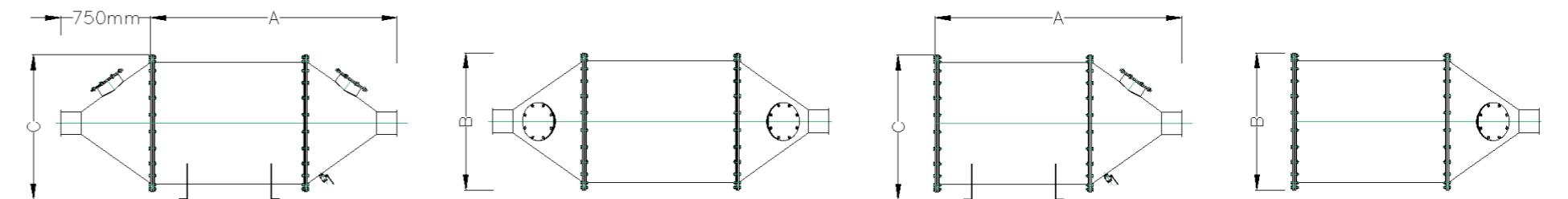
We will be pleased to advise you. We will find the technically and economically optimum solution for you.



Air cooling and drying units LK series – water cooled									
LK	Nominal flow rate <sup>2)</sup>	Nominal flow rate <sup>2)</sup>	Nominal refrigeration power <sup>3)</sup>	Dimensions <sup>1)</sup> (mm)				Condensate drainage	Air connections <sup>5)</sup>
	Nm <sup>3</sup> /h	Nm <sup>3</sup> /min	kW	Width A <sup>4)</sup>	Depth B	Height C	Weight kg	Inches	DN
30	300	5	6	1750	800	850	140	3/4"	85
60	600	10	11	1750	800	850	150	3/4"	85
90	900	15	17	1750	1000	1050	180	3/4"	125
120	1200	20	22	1750	1000	1050	190	3/4"	125
150	1500	25	28	1750	1200	1250	200	3/4"	125
180	1800	30	33	1750	1200	1250	210	3/4"	200
240	2400	40	45	1750	1200	1250	215	3/4"	200
320	3200	53	60	1750	1200	1250	235	3/4"	200
400	4000	67	74	1750	1400	1450	245	3/4"	250
480	4800	80	89	1750	1400	1450	280	3/4"	250

- 1) Detailed drawing on request, precise dimensions depend on the design
- 2) Based on the atmospheric standard state
- 3) Based on inlet air conditions of 32°C, 50% RH or 15g/kg

- 4) Wide standard version, varies with the respective version
- 5) Connection is to be agreed





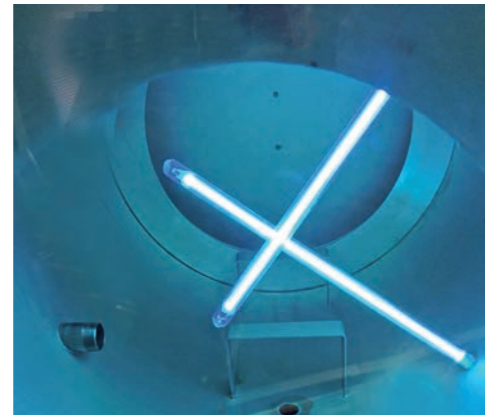
## WEISSHAAR – Air conditioning for every requirement.

Regardless of whether 50 m<sup>3</sup>/h or 50,000 m<sup>3</sup>/h, whether drying, heating, cooling, humidifying or dehumidifying, WEISSHAAR always offers the right solution for your application.

In our systems, we combine the necessary energy flows and technologies in such a way that your requirements are solved effectively and efficiently by bearing both the investment and the operating costs in mind.

The flexible combination of cool drying and adsorption drying enables the lowest dew points; by additional heating or cooling, we achieve every desired air condition for your process. But even if different air conditions are required within a process chain, we are always able to offer a tailor-made solution. Thus air may be needed in a first process step with high temperature and humidity, but then in a cool and dry state.

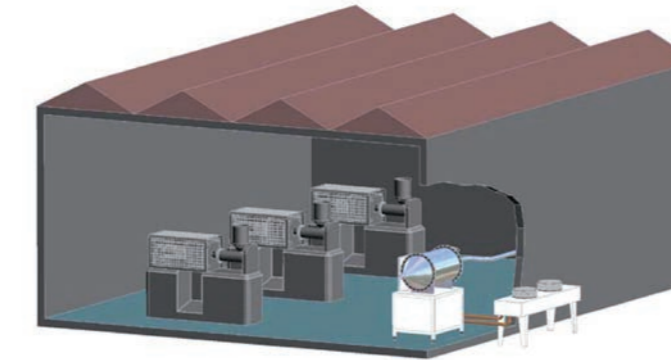
We use the energy flows that already exist in your production processes, such as electricity, steam, ice water or heating water or provide the necessary equipment for this. Simply talk to us and we'll make sure you get the required result.



## WEISSHAAR – Exhaust heat extraction and gas scrubbing.

### Exhaust heat extraction

Devices in compact versions generate the required cooling energy in a decentralized fashion. The waste heat from the process is dissipated to the environment at the location where it is generated, so ventilation of the place of installation must be ensured, especially for medium and large cooling capacities. Alternatively, a split solution can be applied, in which the heat-dissipating component, the condenser, is mounted outside the installation space.



### Gas scrubbing or gas cleaning

Due to temperatures falling below dew point for process-related reasons, not only the air humidity condenses, but in certain applications also unwanted by-products of the air/gas are deliberately precipitated. This procedure, known as a cold trap or gas scrubbing, is used in many process engineering applications and can be implemented with our technology.





# WEISSHAAR – Range.

Crane cab coolers and -systems  
KTG



Climate/conditioning chambers



Air cooling and drying units (air-/water cooled)  
LK, LKL, LKTA

Liquid chillers (air-/water-cooled)  
FKL



Ripening chambers  
RK



Grain cooling units and systems  
GKT



Refrigeration and air conditioning systems for industrial applications

## Design data

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### DESIGN DATA

Location / customer \_\_\_\_\_

Industrial applications  Plastic/cement  Food processing  \_\_\_\_\_

Application  Pneumatic conveyance  Grinding heat extraction  \_\_\_\_\_

Product \_\_\_\_\_

Process (e.g. "suction-side conveyance") \_\_\_\_\_

Air flow rate (standard m<sup>3</sup>/min) \_\_\_\_\_ Fluctuates between min. \_\_\_\_\_ and max. \_\_\_\_\_

Inlet pressure (bar abs.) \_\_\_\_\_ Inlet temperature (°C) \_\_\_\_\_ humidity (r.h. % / g/kg) \_\_\_\_\_

desired dew point (°C) \_\_\_\_\_ or desired outlet temperature / humidity (°C/ r.h.) \_\_\_\_\_

Climatic zone (e.g. Central Europe) \_\_\_\_\_ Outside temperature (°C) \_\_\_\_\_

Where is the unit to be erected (for example, machine room)? \_\_\_\_\_

In the case of erection outside: Is the device protected against rainfall? \_\_\_\_\_

What is the minimum temperature (° C) at which the device should operate? \_\_\_\_\_

Is cooling water available, which should be used? \_\_\_\_\_ At what temperature? \_\_\_\_\_ (°C)

Desire pre-filter class \_\_\_\_\_

Power supply (PH / V / Hz) \_\_\_\_\_

\_\_\_\_\_

Control voltage (V) \_\_\_\_\_

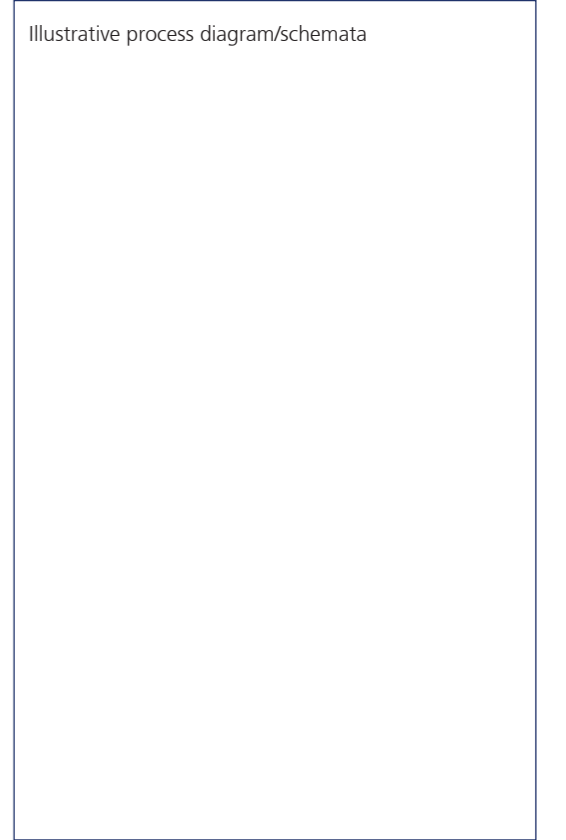
Are there special requirements in relation to materials? \_\_\_\_\_

Do special factory standards apply? \_\_\_\_\_

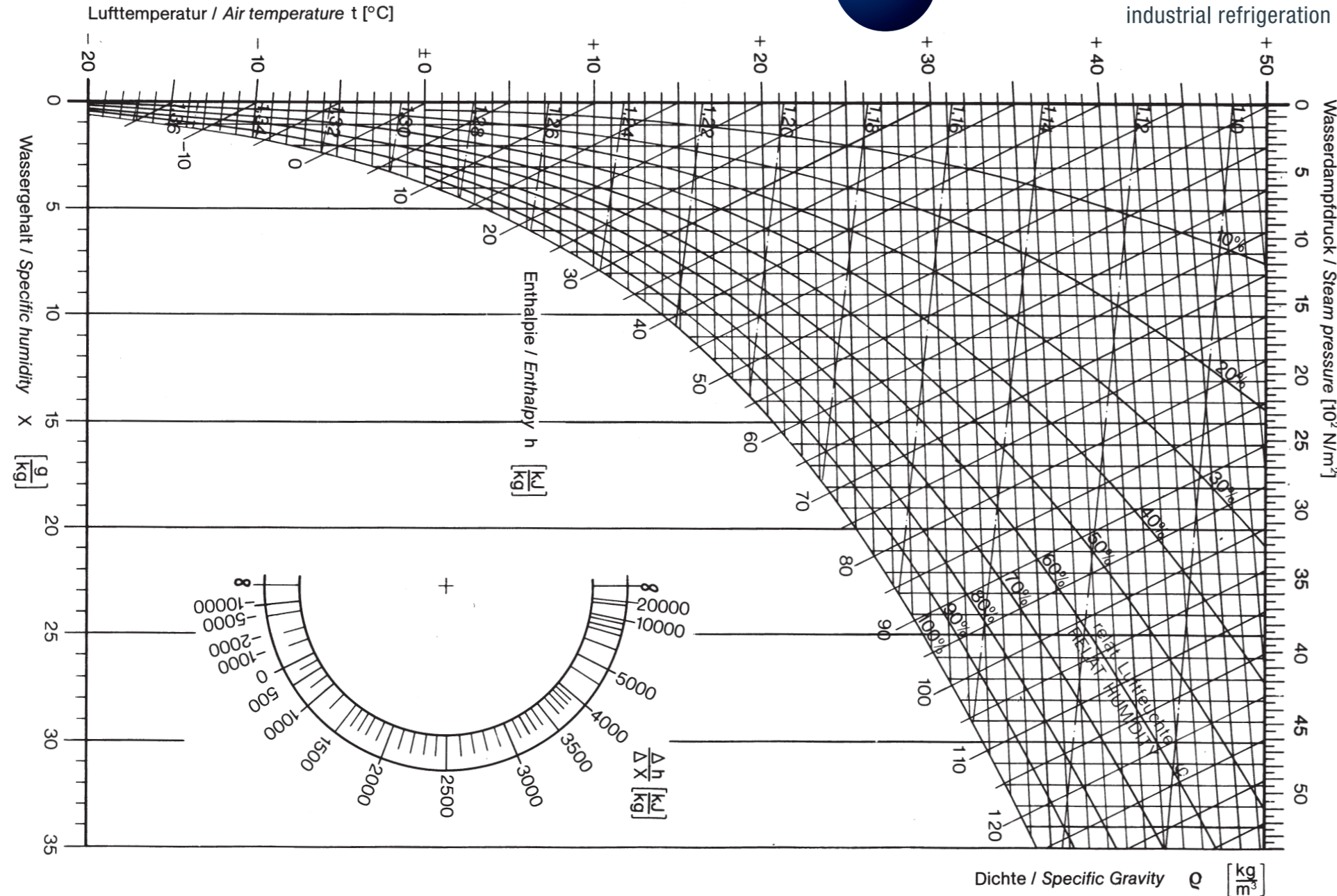
Special local conditions \_\_\_\_\_

ATEX zone allocation \_\_\_\_\_

Illustrative process diagram/schemata







## WEISSHAAR – Quality.



“Our name is on our products.  
That places us under obligation.” (Stefan Weißhaar)

All WEISSHAAR air cooling and drying units and the entire air conditioning systems are designed and built in Germany.

At WEISSHAAR, every employee vouches for the quality of his own work. So that you can be sure to always receive only a perfect product, we have established an extensive quality management system.

Every device that leaves our factory is subject to strict test criteria and undergoes a 100% final test and a test run before delivery. In addition, we offer you as a further service, an ex works FAT (Factory Acceptance Test), which will assure you directly of the quality of the custom production of your order.

### Because we know:

- The operational reliability of our customers' production processes depends, among other things, on the perfect air conditioning of the process air.

**We want to be better. Accordingly, our entire team of employees undergo regular, goal-oriented training and further education.**

### WEISSHAAR-Service:

For us more than just an empty phrase. Perfect service is an integral part of our corporate philosophy: 24 hours a day, worldwide, we are there for you to help you.

We will gladly look after your systems with our service team and thereby obtain the operational safety and optimal function over the lifetime of the device.







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industrial refrigeration

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