



CATALOG



# Laboratory furnaces and dryers



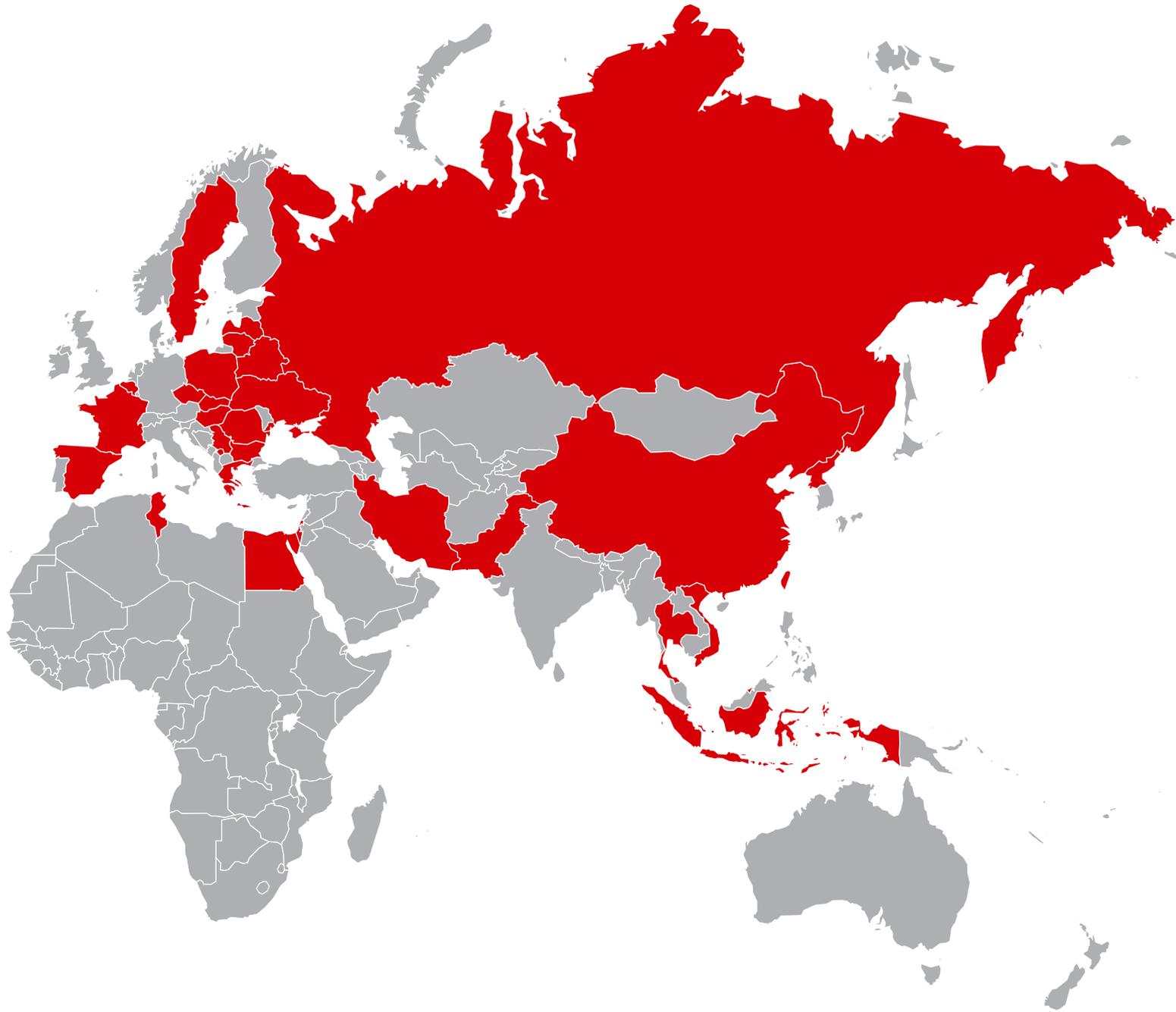
ART OF  
HEATING



*Art of heating*

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## LAC – Who We Are

We have over 240 employees and have produced more than 13,000 furnaces and dryers. We have exported to over 35 countries worldwide, with some of the farthest afield being to Mexico, Vietnam, Kazakhstan, Canada, Malaysia and even Hong Kong. Most of our furnaces, however, are delivered to European countries; Czech Republic, Poland, Germany, Great Britain and also into Scandinavian countries, like Sweden.

## Prize-Winning Products

We have won many prestigious awards. In 2012 at the MSV International Engineering Fair, our energy-saving PTE MK.II furnace was awarded Honorable Mention in the Most Innovative Exhibit category as the Most Energy-Efficient Commercial Product.

In 2015, LAC was again recognized, this time as one of the top Czech companies of the year 2015.

## Wide distributor network

We have more than 60 business partners in 34 countries in the laboratory segment.

## Simple installation and operation

Our laboratory furnaces are plug-and-play. All that's needed is to plug in the furnace and set the controller. LAC Ht controllers are user-friendly and easy to set up, no special knowledge needed.

## Custom adjustments

We understand that some users need products that go beyond the range of our standard line. For this reason, we are able to make atypical adjustments to fulfil specific requirements and applications.

## Furnaces in stock

We keep most of our standard lab furnaces in stock, meaning we are able to dispatch in as little as 2 days. In addition, we are planning to further expand our stock to include additional furnace types. We follow market trends and customer needs and keep our inventory updated accordingly. Ask us for confirmation of current delivery times for the furnaces you need.

## Silent operation

Our furnaces are equipped with contactless solid state relays. The relays guarantee smooth and silent operation of the equipment, allowing you to work undisturbed while testing your batch in the furnace. Unless your furnace is equipped with contactors or air circulation, you will barely even know it's running.

## Extended warranty

Of course there is a two-year warranty. In addition, we give an additional 12-month warranty on select furnaces. We can afford it, we are confident of our quality.

## Prompt and professional technical support

We provide you, our business partners, with unique technical support by making available documents, photos, videos, and training materials. You can contact us at any time and we will do our best to advise and assist you as quickly as possible.

We provide you, our end customers, with a wide network of high-quality well-trained business partners who are able to advise and assist you. And if there is anything else you need, you are always welcome to contact us directly at [labfurnace@lac.cz](mailto:labfurnace@lac.cz).

## Testing of samples for customers worldwide

No need to buy a pig in a poke. You can send us a batch sample for heat treatment. We will test your sample to make sure that the furnace is working as it should and the charge reaction is according to your expectations.

## 1. Think about which temperature you need

The temperature at which you plan to work is a critical point to consider when choosing a furnace, and keep in mind that for long-term operation, the maximum useable temperature should be 100 °C lower than the furnace maximum temperature. In general, furnaces for less than 600 °C will need inner air circulation. High-temperature furnaces are designed for use at high temperatures, and thus should not be used at temperatures less than 1200 °C. At temperatures lower than this, the furnace will not be as precise, and long-term use at lower temperatures will result in damage to the heating elements.

## 2. Consider the type of materials you plan to work with

As there is the possibility of fumes, or even aggressive or volatile elements that could be released during heat treatment, it is important to choose a furnace that is designed with the proper ventilation and made using the proper materials for use with such elements. Furnaces can be categorized according to chemical resistance. It is also necessary to take into account the quantity of emissions released during heat treatment and select a furnace type accordingly.



### Maximum resistance

The S and PP dryers and furnaces are equipped with a stainless inner muffle and heating bodies. This combination ensures high chemical resistance. Firing of paints, epoxies and oils, etc. can also be done using the appropriate optional extraction accessories for extra charge that are on offer for S dryers. LMH and LMV furnaces with a ceramic muffle also offer high resistance and can handle the effect of chemical processes much better than furnaces with exposed insulation.



### Partial resistance

Furnaces which have the heating elements built into the panels (L, PKE, LZ) or encased in quartz tubes (LE) provide partial protection. When using laboratory furnaces, it is necessary to ensure adequate ventilation of the workspace so that any fumes are directed safely out of the furnace chamber and cannot attack heating elements, insulation or the furnace lining.



### No resistance

Furnaces with exposed heating elements provide the lowest level of chemical resistance and will not withstand the effects of fumes or any type of aggressive emission.

## 3. Do you need fresh air or can you manage without?



### Adjustable air supply

Some furnaces are equipped with adjustable ventilation that can be used for drying (S) or for firing (LE, LZ).



### Ventilation chimney

All other laboratory furnaces come with a ventilation chimney flue as standard that can be then equipped with an exhaust fan and draft diverter to provide suction of the atmosphere from the furnace.



### No air supply

This third furnace category doesn't have any type of air supply and thus is not suitable for charges which release moisture or fumes.

## 4. Do you need the heating bodies protected from mechanical damage, or is it unnecessary for you?

Different types of heating elements have varying degrees of mechanical resistance.



### High resistance

Furnaces with a stainless steel chamber (S, PP, PKR, PKRC) or those with a ceramic muffle where the heating elements are not located in the furnace chamber (LMH, LMV) offer the highest level of mechanical resistance.



### Good resistance

Furnaces which have the heating elements fully encased in the heating panels provide good mechanical resistance (L, PKE, LG, LZ).



### Partial resistance

Furnaces with partial resistance are those with the heating elements set into grooves (LSP, LH) or encased in quartz tubes (LE).



### No resistance

Furnaces with fully exposed heating elements are perfect for the close proximity of heat to the charge, but have the disadvantage of being damaged easily by careless handling or complex charge manipulation.

### 5. Do you need to work in a defined protective atmosphere?

Some applications and heat treatment processes may require work in protective atmosphere so that unwanted chemical processes do not interfere or suppress the desired effect.

#### Gastight furnaces

We offer furnaces that are specifically designed for work in a fully protective or active atmosphere (PKR, PKRC).

#### With protective atmosphere

Furnaces with a muffle or ceramic tube for which it is possible, for an additional fee, to add on an adjustment for work in protective atmosphere.

#### Partially gastight furnaces

The PP furnace may also be ordered in its 'partially gastight' version which minimizes the escape of protective gas.

#### No protective atmosphere

Other types of furnaces may be equipped with a gas inlet which is sufficient for many applications done with small laboratory furnaces.

### 6. You should also consider what size charge you will be treating and how you will insert it into the furnace

A tube furnace is suitable for very small charges, chamber furnaces are good for larger ones. The simplest and cheapest furnaces have a hinged door. Furnaces with doors opening upwards or to the side (like the VP) are more convenient and also safer for the furnace user, as the hot insulation is facing away from the operator. Furnaces that are loaded from the top are ideal for loading a crucible or for charges that need to be loaded from the top. Top-loading furnaces also have the advantage of allowing the operator to simply open the furnace and look in for an optical check of the condition of the charge. Loading from the top also allows easy adjustment of the position of the charge, or its removal, with a minimum of heat loss. Furnaces with a door tilting downwards allow for placement of the charge onto the door itself while handling.

### 7. Ask our technical sales team if you can't find exactly what you are looking for

We also supply lab furnaces with atypical adjustments, as well as custom solutions for your specific application.

Furnace type	Tmax °C	Chemical resistance	Air inlet	Mechanical resistance	Protective atmosphere
S	200/300				
PP	450/650/850				
PKR	950/1100				
PKRC	950/1100				
LG	1200				
LZ	1100				
LE	1100				
L	1200				
LMH	1200				
LMV	1200				
PKE	1280				
LT	1300				 *
LSP	1300				
LH	1340				
LHS	1400/1500				
VP	1600/1700/1800				

\*With additional adjustments the furnace becomes gas-tight.

If you know the treatment process you require for your charge, this chart will serve as a handy guide to choosing the right furnace. We have included the most common processes, as well as a few special applications. If you can't find what you are looking for, please contact us, we'll be happy to help.

	S	PP	PKR	PKRC	LG	LZ	LE	L	LMH	LMV	PKE	LT
<b>Tmax °C</b>	200/300	450/650 850	950/1100	950/1100	1200	1100	1100	1200	1200	1200	1280	1300
<b>Ashing, combustion, annealing loss</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Enamel firing</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Sintering</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Preheating</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Pyrolysis</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥*
<b>Heat treatment of metals</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Melting metals</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Fusing glass</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Materials testing</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Tensile testing</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Annealing, stress relieving</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Heating and drying</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Calcination</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥
<b>Activating molecular sieves</b>	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥	🔥

# CHOOSING A FURNACE ACCORDING TO BATCH PROCESSING TECHNOLOGY

	LSP	LH	LHS	VP	SKM	CHTZ	LT 90 atyp	LH 30 atyp	L 09 atyp	LT 150 LT 300 atyp	LT 50 atyp	PKE 25 atyp	
	1300	1340	1400/1500	1600/1700 1800	1340	650/850 950	1100	1200	1200	450	1300	1200	Tmax °C
	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	Ashing, combustion, annealing loss
	🔥	🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	Enamel firing
	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Sintering
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Preheating
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Pyrolysis
	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	Heat treatment of metals
	🔥🔥	🔥🔥	🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Melting metals
	🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Fusing glass
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Materials testing
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Tensile testing
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Annealing, stress relieving
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Heating and drying
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	Calcination
	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥🔥	🔥	🔥🔥	🔥🔥	Activating molecular sieves

- 🔥🔥 suitable
- 🔥 partially suitable
- 🔥\* partially suitable with adjustments
- 🔥🔥 unsuitable

## S DRYERS

When 300 °C is plenty

S Dryers devices are designed for drying, vulcanization, preheating, curing and other low-temperature applications for treatment of various materials. The dryer is equipped with a chemically and mechanically-resistant stainless steel muffle to ensure long furnace life, and also boasts horizontal circulation of the internal atmosphere to provide uniform temperature distribution.

Lowest temperature

Uniform temperature distribution

Mechanical resistance

Chemical resistance



Simple installation and operation



Custom adjustment



Dispatch in as little as 6 weeks



Silent operation



24-month warranty



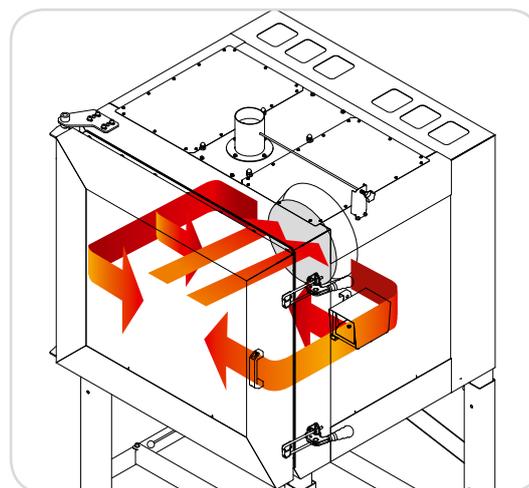
Prompt customer support



S 400/03

**Standard furnace equipped with:**

- Ht40AL controller (1 program: 2x ramp, 2x soak)
- stainless muffle
- high-resistance stainless steel circulation insert liner
- horizontal circulation of the internal atmosphere
- heating elements outside the working area of the furnace
- mineral fiber insulation mats
- braided rope door seal
- thermostat
- sliding lever in the furnace base for controlling air supply
- manually controlled ventilation flap for cooling the working area of the furnace
- height-adjustable shelves made of perforated metal
- type 'K' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening to the side
- desktop and freestanding designs available (loading sill height 700 mm)



3D model of inner atmosphere circulation in dryers S

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- automatically controlled ventilation flap for cooling the working area of the furnace
- graphic temperature recorder
- exhaust fan for the extraction of fumes
- wheels
- door opening to the right
- additional shelves
- electro-hydraulic door opening upwards
- pneumatic door opening upwards (pantograph)
- manual door opening upwards (pantograph)
- relative humidity measurement
- METREX gas analyzer
- unregulated or regulated forced cooling
- peephole in the door and illuminated inner chamber
- single-handed door closing
- optimization of the temperature field to meet DIN 17052-1  $\Delta T_{10}$  °C norms in the inner useable furnace (in empty furnace at T<sub>max</sub>)
- calibration of the measurement loop
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)



S 400/03

Note: Always consult with our technical office when combining optional accessories.

Model	T <sub>max</sub>	T <sub>max</sub> for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Shelves	Weight	Ventilator	Input	Protection*	Voltage	Max. floor load
	°C	°C	l	mm	mm	pcs	kg	ks	kW		V	kg
S 60/02	200	200	60	1050x1350x950	450x300x450	1	60	1	2.0	16/1	230	40
S 100/02	200	200	100	1050x1550x1000	450x500x450	1	180	2	3.0	16/1	230	50
S 250/02	200	200	240	1400x1550x1200	800x500x600	1	250	1	4.0	16/3	400	70
S 400/02	200	200	380	1400x1750x1200	800x800x600	1	350	1	4.0	16/3	400	70
S 60/03	300	300	60	1050x1350x950	450x300x450	1	60	1	3.0	16/1	230	40
S 100/03	300	300	100	1050x1550x1000	450x500x450	1	180	2	3.0	16/1	230	50
S 250/03	300	300	240	1400x1550x1200	800x500x600	1	250	1	4.0	16/3	400	70
S 400/03	300	300	380	1400x1850x1200	800x800x600	1	350	1	6.0	16/3	400	70

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## TEMPERING FURNACE PP

The smallest furnace with air circulation, suitable for temperatures even below 600 °C

One of the greatest advantages of the PP tempering furnace is its horizontal air circulation of the inner atmosphere to ensure even heating of the batch. Uniform temperature distribution, precise regulation of temperature increase and decrease, and controlled cooling (for an additional fee) give the operator complete control of the process inside the furnace chamber. The PP furnace is robust and built to last for use in industry, but its compact space-saving size makes it also ideal for laboratory use. Treated with just a little care, your LAC PP furnace will serve you well for many years to come. An industrial furnace is tough enough for any lab.

Excellent heat transmission  
into the charge

Uniform temperature distribution

Mechanical resistance

Chemical resistance

Robust industrial design



Simple installation and operation



Custom adjustment



Dispatch in as little as 6 weeks



Silent operation



24-month warranty



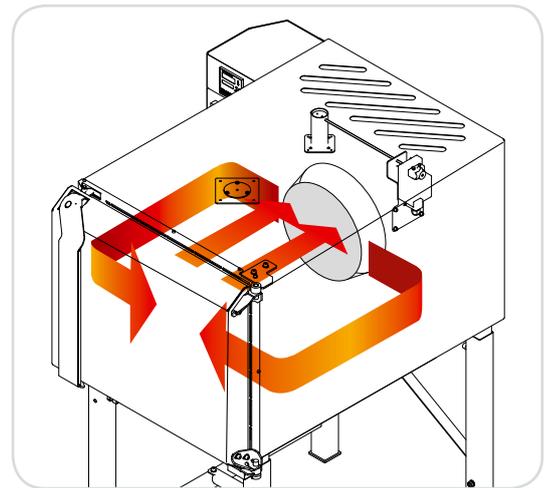
Prompt customer support



PP 140/65

**Standard furnace equipped with:**

- Ht40AL controller for PP 450 °C (1 program: 2x ramp, 2x soak)
- HtIndustry controller / Ht205 for PP 650 °C and 850 °C (30 programs of 15 steps each)
- stainless muffle
- high-resistance stainless steel circulation insert liner
- horizontal circulation of the internal atmosphere
- heating elements outside the working area of the furnace
- heating coils in ceramic panels for PP 850 °C
- mineral fiber insulation mats (PP 450 °C and 650 °C)
- brick insulation on furnace floor for PP 850 °C
- 2 stainless shelves (except PP 20)
- manually controlled ventilation flap for cooling the working area of the furnace
- type 'K' or type 'N' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening to the side
- desktop (PP 20) or freestanding versions available



3D model of inner atmosphere circulation in PP furnaces

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each) for PP 450 °C
- protective atmosphere inlet (manually or automatically controlled gas supply)
- semi-gastight furnace design (only possible with special ventilation chimney)
- graphic temperature recorder (regulator and recorder located in special control panel on the side of the furnace)
- automatically controlled ventilation flap for cooling the working area of the furnace
- optimization of the temperature field to meet DIN 17052-1  $\Delta T_{10}$  °C norms in the inner useable furnace (in empty furnace at Tmax)
- calibration of the measurement loop
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)
- custom stand
- door opening to the left or upwards (hydraulically powered, pneumatically powered)
- additional shelves
- one-handed door opening (already standard for models PP 20 - PP 140)
- unregulated or regulated forced cooling (cannot be combined with semi-gastight version of furnace)



PP 140/65

Note: Always consult with our technical office when combining optional accessories.

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Shelves	Input*	Weight	Protection**	Voltage	Max. floor load
	°C	°C	l	mm	mm	ks	kW	kg		V	kg
PP 20/45	450	450	20	800x650x1000	300x200x350	-	3.0	115	16/1	230	30
PP 40/45	450	450	35	850x1450x1050	300x300x400	2	6.0	160	16/3	400	50
PP 70/45	450	450	70	850x1550x1150	350x400x500	2	8.0	190	20/3	400	80
PP 140/45	450	450	135	950x1650x1300	450x500x600	2	12.0	300	20/3	400	150
PP 270/45	450	450	270	1200x1750x1450	600x600x750	2	20.0	580	40/3	400	200
PP 540/45	450	450	540	1300x1950x1750	750x800x900	2	24.0	750	50/3	400	250
PP 20/65	650	600	20	800x650x1000	300x200x350	-	3.0	130	16/1	230	30
PP 40/65	650	600	35	850x1450x1050	300x300x400	2	6.0	200	16/3	400	50
PP 70/65	650	600	70	850x1550x1150	350x400x500	2	8.0	250	20/3	400	80
PP 140/65	650	600	135	950x1650x1300	450x500x600	2	12.0	350	20/3	400	150
PP 270/65	650	600	270	1200x1750x1450	600x600x750	2	20.0	580	40/3	400	200
PP 540/65	650	600	540	1300x1950x1750	750x800x900	2	24.0	850	50/3	400	250
PP 20/85	850	800	20	850x700x1050	300x200x350	-	3.0	130	16/1	230	30
PP 40/85	850	800	35	850x1450x1050	300x300x400	2	7.0	200	20/3	400	50
PP 70/85	850	800	70	900x1550x1150	350x400x500	2	9.0	250	20/3	400	80
PP 140/85	850	800	135	1000x1650x1250	450x500x600	2	14.0	350	25/3	400	150
PP 270/85	850	800	270	1200x1750x1650	600x600x750	2	20.0	580	40/3	400	200
PP 540/85	850	800	540	1350x1950x1800	750x800x900	2	30.0	850	50/3	400	250

\* Fan motor power of the PP 20 is 0,25 kW. For PP 40-140, all temperatures, and PP 270/45, 65 it is 0,37 kW and for model PP 270/85 and PP 540, all temperatures, it is 1,1 kW.

\*\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## GAS-TIGHT CHAMBER FURNACE PKR

Simply set your program and heat treatment in protective atmosphere can begin

Precisely defined atmosphere protection to protect the surface of the charge from unwanted alteration and to ensure that the surface changes on the processed material are exactly as you require and nothing else. This furnace boasts low gas consumption; a great advantage when working with expensive gases like Argon, and of course the PKR can be set up for other standard gases such as nitrogen, forming gas, etc. If you would like to work at higher temperatures, an Inconel retort is available for an additional fee. The standard PKR refractory stainless retort can be used at temperatures up to 950 °C, the Inconel retort allows the furnace to be used at up to 150 °C more.

Protective atmosphere

Mechanical resistance

Chemical resistance

Robust industrial design



On-site installation possible upon request



Custom adjustment



Dispatch in as little as 9 weeks



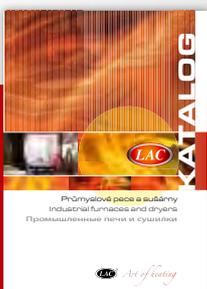
Silent operation



24-month warranty



Prompt customer support



You can find more information about this device in the industrial furnaces and dryers catalogue.

PKR 55/95

**Standard furnace equipped with:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- heating coils wound on ceramic tubes outside the working area of the furnace
- door sealing
- manually controlled ventilation flap for cooling the inner retort
- manual door opening to the side
- limit unit
- automatically controlled protective atmosphere inlet for one gas type (without vacuum pump)
- vacuum pressure gauge for vacuum control in the retort
- vacuum pump connection inlet
- G½" adapter for connecting cooling collar rubber hose
- thermistor for temperature control flange, signaling the presence of coolant in the retort collar
- overpressure valve at the retort gas input point with pressure 4–6 mbar
- ammeters to check the status of the heating elements (number depends on the number of stages involved in heating)
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- freestanding design

**Optional accessories for additional charge:**

- spare retort of refractory stainless steel
- pump for extraction of the atmosphere after processing
- automatically controlled ventilation flap for cooling outside of the retort
- charge thermocouple and Ht40 temperature display unit
- controlled forced cooling (according to input cooling curve)
- automatically regulated suction cooling with ventilation flaps (no fan)
- graphic temperature recorder
- optimization of the temperature field to meet DIN 17052-1  $\Delta T_{20}$  °C norms in the inner useable furnace (in empty furnace at Tmax)
- calibration of the measurement loop
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)
- Inconel retort
- custom gas setup (increased emissions, flow etc.)
- custom stand

Note: Always consult with our technical office when combining optional accessories.



Retort of PKR furnace

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions retort (dxw)	Input	Weight	Protection *	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
PKR 35/95	950	850	24	1400x1450x1300	250x490	11	400	20/3	400	75
PKR 55/95	950	850	28	1450x1450x1300	272x485	13	570	25/3	400	150
PKR 130/95	950	850	77	1450x1450x1550	372x715	21	950	40/3	400	200
PKR 180/95	950	850	94	1650x1650x1550	412x710	29	1050	50/3	400	200
PKR 350/95	950	850	242	1800x1750x1850	542x1050	50	1350	80/3	400	300

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## GAS-TIGHT CHAMBER FURNACE WITH AIR CIRCULATION PKRC

A better PKR. With circulation of the inner atmosphere for precise temperature distribution

The same applies to this furnace as to the PKR, it features precisely defined atmosphere protection to protect the surface of the charge from unwanted effects, low gas consumption, options for argon, nitrogen, forming gas, etc. In addition, the PKRC's circulation of the inner atmosphere gives it even better temperature distribution properties than the PKR. An Inconel retort is also available for the PKRC for an additional fee. A retort of this material allows the furnace to work at temperatures up to 150 °C higher than a standard stainless retort. The PKRC can also be adjusted to work as a nitriding furnace upon request.

Uniform temperature distribution

Mechanical resistance

Chemical resistance

Robust industrial design



On-site installation possible upon request



Custom adjustment



Dispatch in as little as 9 weeks



Silent operation



24-month warranty



Prompt customer support



PKRC 55/95



You can find more information about this device in the industrial furnaces and dryers catalogue.

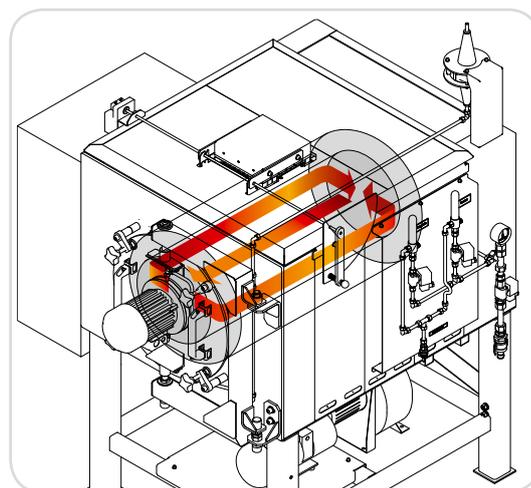
**Standard furnace equipped with:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- heating coils wound on ceramic tubes outside the working area of the furnace
- door sealing
- manually controlled ventilation flap for cooling the inner retort
- manual door opening to the side
- limit unit
- automatically controlled protective atmosphere inlet for one gas type (without vacuum pump)
- vacuum pressure gauge for vacuum control in the retort
- vacuum pump connection inlet
- 6½" adapter for connecting cooling collar rubber hose
- thermistor for temperature control flange, signalling the presence of coolant in the retort collar
- overpressure valve at the retort gas input point with pressure 4-6 mbar
- ammeters to check the status of the heating elements (number depends on the number of stages involved in heating)
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- freestanding design

**Optional accessories for additional charge:**

- spare retort of refractory stainless steel
- pump for extraction of the atmosphere after processing
- automatically controlled ventilation flap for cooling outside of the retort
- charge thermocouple and Ht 40 temperature display unit
- controlled forced cooling (according to input cooling curve)
- automatically regulated suction cooling with ventilation flaps (no fan)
- graphic temperature recorder
- Inconel retort
- custom gas setup according to customer specification (increased emissions, flow etc.)
- custom stand
- cast-iron propeller
- optimization of the temperature field to meet DIN 17052-1  $\Delta T_{20}$  °C norms in the inner useable furnace (in empty furnace at T<sub>max</sub>)
- calibration of the measurement loop
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



3D model of inner atmosphere circulation in PKRC furnaces



Retort of PKRC furnace



Automatic protective atmosphere inlet

Model	T <sub>max</sub>	T <sub>max</sub> for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimension retort (dxw)	Input	Weight	Protection *	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
PKRC 55/95	950**	850***	24	1450x1450x1450	272x410	13	600	25/3	400	150
PKRC 130/95	950**	850***	69	1450x1450x1950	372x635	21	980	40/3	400	200
PKRC 180/95	950**	850***	83	1650x1650x2050	412x620	29	1100	50/3	400	200
PKRC 350/95	950**	850***	225	1800x1750x2350	542x975	50	1380	80/3	400	300

\*Protection may vary according to the optional accessories selected.

\*\* In case of using retort from Inconel material and cast-iron propeller up to 1100 °C.

\*\*\* In case of using retort from Inconel material and cast-iron propeller up to 1000 °C.

Subject to technical changes.

## ASHING FURNACE LZ

Especially designed for ashing in the laboratory

The LZ furnace ideal for the oxidation of samples and for testing to determine ash quantity. It is also suitable for any applications in which ample fresh air and also exhaust from the furnace atmosphere are required. Air is circulated throughout the internal furnace chamber and exchanged from six to twelve times per minute, depending upon the furnace temperature. The oxidation process is supported by the strong flow of oxygen. Air is preheated before it enters the LZ furnace chamber, thus allowing uniform distribution of heat even at high-temperature operation.

6 to 12-time air circulation/60 s

Preheated air

Exhaust chimney



On-site installation possible upon request



Custom adjustment



Dispatch in as little as 3 weeks



Silent operation



24-month warranty



Prompt customer support



LZ 03/11

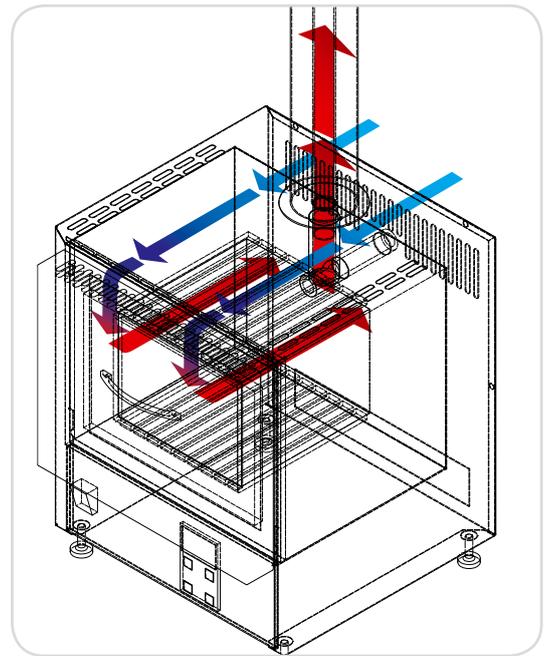
**Standard furnace equipped with:**

- Ht40AL controller (1 program: 2x ramp, 2x soak)
- heating elements in ceramic panels
- mineral fiber insulation panels
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening downwards
- desktop design

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- protective floor plate
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



3D model of inner atmosphere circulation in LZ furnaces

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions* (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection **	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
LZ 03/12	1200	1100	3	380x940x400	180x100x140	1.2	20	16/1	230	4
LZ 05/12	1200	1100	5	430x970x430	230x130x170	2.4	26	16/1	230	6
LZ 09/12	1200	1100	9	430x1005x500	230x170x240	3.0	30	16/1	230	6
LZ 15/12	1200	1100	15	450x1005x600	250x170x340	3.5	40	16/1	230	6

\*Listed furnace height includes chimney.

\*\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## ECONOMY LABORATORY FURNACE LE

A more economical version of our classic L furnace designed for shorter periods of use.

The LE lab furnace may not be quite as robust as the L furnace, but it can definitely boast an impressive price/performance ratio. The LE will serve you just as well as the L furnace in testing, trials and treatment. Just don't expect it to run 24/7; if you need that, the L furnace will be a better choice.

Rapid achievement of Tmax

Adjustable air supply

Great price



On-site installation possible upon request



Custom adjustment



Dispatch in as little as 2 days



Silent operation



24-month warranty



Prompt customer support



LE 09/11

**Standard furnace equipped with:**

- Ht60B controller (regulation to a constant value)
- heating elements encased in quartz tubes
- mineral fiber insulation panels
- ventilation chimney for ventilation of the furnace chamber
- sliding lever in door for controlling air supply
- type 'K' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening downwards
- desktop design

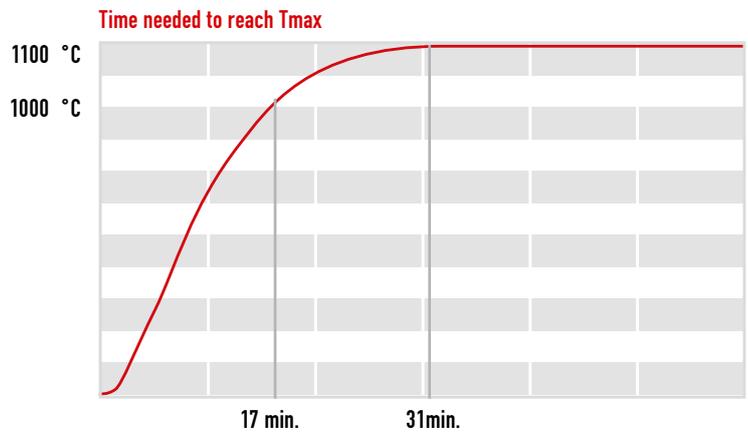
**Optional accessories for additional charge:**

- Ht40P controller (10 programs, 15 steps)
- injector with exhaust fan and draft diverter for fume extraction (only with controller Ht40P)
- protective atmosphere inlet (manually or automatically controlled gas supply)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



LE 09/11



Sliding lever in the door controlling air supply



Heating elements in glass tubes

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions* (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection **	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
LE 05/11	1100	1000	5	470x310x455	170x130x230	1.8	20	16/1	230	6
LE 09/11	1100	1000	9.4	490x350x515	190x170x290	2.3	24	16/1	230	6
LE 15/11	1100	1000	14.4	550x350x565	250x170x340	3.0	28	16/1	230	6

\* Outer dimensions calculated with closed door.

\*\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## UNIVERSAL LABORATORY FURNACE L

Universal laboratory assistant, capable of handling even the most demanding tasks

Laboratories of all types appreciate the versatility of this furnace. Its heating elements are encased in ceramic panels, giving it extra protection from mechanical and chemical damage. L furnaces have a ventilation chimney flue for the extraction of fumes, but note that they are not suitable for pyrolysis. The design quality and materials used in the construction of the L furnace guarantee that it can handle even the most demanding tasks.

Rapid achievement of T<sub>max</sub>

Even temperature distribution

Universal usage



Simple installation and operation



Custom adjustment



Dispatch in as little as 2 days



Silent operation



24-month warranty



Prompt customer support



You can find custom-made devices for special applications based on this furnace in this catalogue on page 45.

L 03/12

**Standard furnace equipped with:**

- Ht40AL controller (1 program: 2x ramp, 2x soak)
- heating elements built into ceramic panels
- mineral fiber insulation panels
- ventilation chimney for ventilation of the furnace chamber
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening downwards
- desktop design

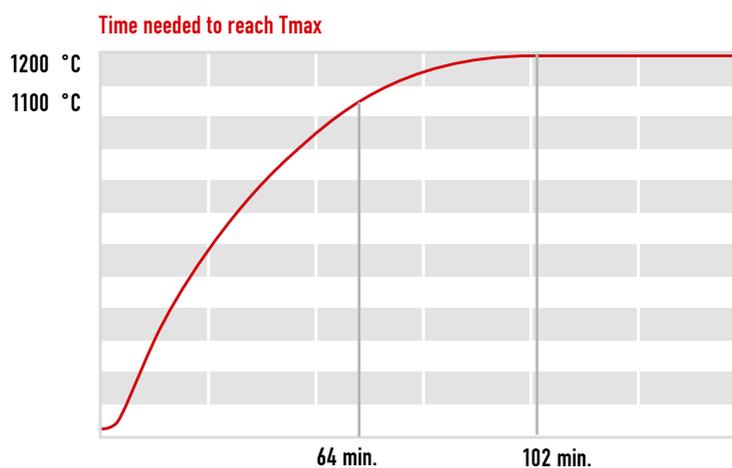
**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- injector with exhaust fan and draft diverter for fume extraction (only with controller HtIndustry / Ht205)
- protective floor plate
- protective atmosphere inlet (manually or automatically controlled gas supply)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)



L 03/12

Note: Always consult with our technical office when combining optional accessories.



Thermocouple in furnace chamber and ventilation chimney



Ventilation chimney for extraction of fumes from the furnace chamber

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection*	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
L 03/12	1200	1100	3	380x440x400	180x100x410	1.2	20	16/1	230	4
L 05/12	1200	1100	5	430x470x430	230x130x170	2.4	26	16/1	230	6
L 09/12	1200	1100	9	430x505x500	230x170x240	3.0	30	16/1	230	6
L 15/12	1200	1100	15	450x505x600	250x170x340	3.5	40	16/1	230	6

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## HORIZONTAL MUFFLE FURNACE LMH

Specially designed for the testing of aggressive materials

The heating coils are located outside of the furnace chamber; away from aggressive fumes and protected by a tough ceramic muffle. The LMH is further equipped with ventilation to protect from condensation during firing.

Rapid achievement of Tmax

Uniform temperature distribution

Mechanical resistance

Chemical resistance



Simple installation and operation



Custom adjustment



Dispatch in as little as 2 days



Silent operation



36-month warranty



Prompt customer support



LMH 07/12

**Standard furnace equipped with:**

- Ht40AL controller (1 program: 2x ramp, 2x soak)
- heating coils wound around the muffle, outside of the furnace chamber
- muffle insulated with mineral fiber insulation mat
- door portal made of refractory bricks
- ventilation chimney for ventilation of the furnace chamber
- peephole with protective glass in the door
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening upwards
- desktop design

**Optional accessories for additional charge:**

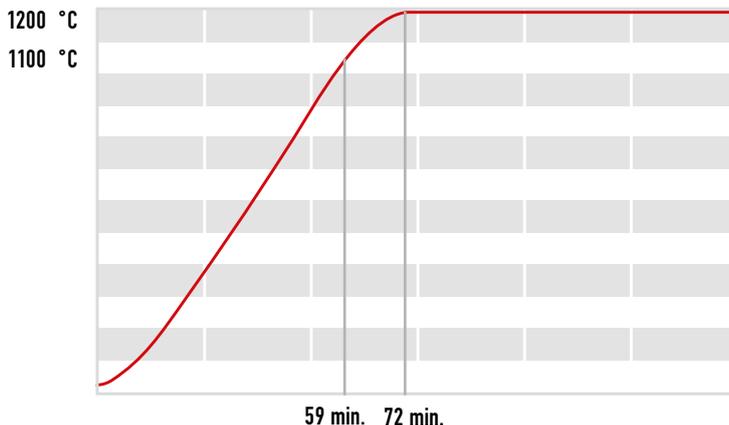
- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- injector with exhaust fan and draft diverter for fume extraction (only with controller HtIndustry / Ht205)
- protective atmosphere inlet (manually or automatically controlled gas supply)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



LMH 07/12

Time needed to reach Tmax



Chimney for the ventilation of the inner furnace chamber



Thermocouple and ventilation chimney in the furnace chamber



The door insulation with the peephole for batch control

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection *	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
LMH 04/12	1200	1100	4	490x570x680	170x90x275	3.0	42	16/1	230	10
LMH 07/12	1200	1100	7	490x570x680	170x170x275	3.0	48	16/1	230	10
LMH 11/12	1200	1100	11	580x570x680	255x165x255	3.5	52	16/1	230	15

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

# VERTICAL MUFFLE FURNACE LMV

Top-loading furnace for the testing aggressive materials

This variation on the standard muffle furnace is for those who need to lower the charge into the furnace from the top. The heating coils are located outside of the furnace chamber where aggressive fumes cannot penetrate, and are protected by a tough ceramic muffle. The LMV furnace is also equipped with ventilation to protect from condensation during firing.

Uniform temperature distribution

Mechanical resistance

Chemical resistance



Simple installation and operation



Custom adjustment



Dispatch in as little as 5 weeks



Silent operation



36-month warranty



Prompt customer support



LMV 2/12

**Standard furnace equipped with:**

- Ht40AL controller (1 program: 2x ramp, 2x soak)
- heating coils wound around the muffle, outside of the furnace chamber
- muffle insulated with mineral fiber insulation mat
- loading opening lid lined with mineral fiber insulation
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- removable lid with handle
- desktop design

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- injector with exhaust fan and draft diverter for fume extraction (only with controller HtIndustry / Ht205)
- protective atmosphere inlet (manually or automatically controlled gas supply)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



Manually-opened furnace lid with handle

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection *	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
LMV 2/12	1200	1100	2	290x520x290	110x160	1.8	30	16/1	230	5
LMV 5/12	1200	1100	5	346x530x346	170x230	2.6	40	16/1	230	5

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## GRAVIMETRIC FURNACE LG

Chamber furnace for measuring the weight loss of a charge

The LG gravimetric furnace is a combination laboratory furnace, precision laboratory scale and software for the identification and evaluation of decreases in the charge weight. Measurements are output as a thermogravimetric curve documenting weight loss of samples as correlating to temperature and time. The LG furnace can test different biomass as well as certain types of waste such as RDF, plastics and paper etc.

Comprehensive measurement output

Measurement of weight decrease

Weighing precision: 0.01 grams



Simple installation and operation



Custom adjustment



Dispatch in as little as 3 weeks



Silent operation



24-month warranty



Prompt customer support



LG 09/12

**Standard furnace equipped with:**

- Ht40P controller (10 programs of 15 steps each)
- digital scale with precision 0,01 g
- weighing capacity 2/5/10 kg
- manual door opening downwards
- heating elements in ceramic panels
- mineral fiber insulation panels
- ventilation chimney for ventilation of the furnace chamber
- sliding lever in door for controlling air supply
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- injector with an exhaust fan and draft diverter for the extraction of fumes (only with HtIndustry / Ht205 controller)
- protective atmosphere inlet (manually or automatically controlled gas supply)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



LG 09/12



Bowl for batch placement on scale



Sliding lever for controlling air supply



Digital scale placed under the furnace

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection *	Voltage
	°C	°C	l	mm	mm	kW	kg		V
LG 09/12	1200	1100	9.4	490x720x515	190x170x290	2.8	34	16/1	230

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## HARDENING CHAMBER FURNACE PKE

Industrial strength and larger volumes for the laboratory

This hardening chamber furnace is right for you if you need to work at higher temperatures with higher volume batches. The PKE boasts speed and good heating accumulation into the brick lining, allowing you to open the furnace and check your charge more often.

The furnace comes in desktop or freestanding designs, but don't let that fool you. The PKE is a tough furnace that brings industrial strength into your lab.

Uniform temperature distribution

Larger volumes

Robust industrial design



Simple installation and operation



Custom adjustment



Dispatch in as little as 5 weeks



Silent operation



24-month warranty



Prompt customer support



You can find custom-made devices for special applications based on this furnace on page 46 of this catalogue.

PKE 25/12

**Standard furnace equipped with:**

- Ht40P controller (10 programs of 15 steps each)
- heating elements built into ceramic panels on the furnace sides
- heating elements in the refractory fittings are covered by a heat-proof protective ceramic plate
- mineral fiber insulation panels
- ventilation chimney for ventilation of the furnace chamber
- type 'S' thermocouple
- manual door opening downwards
- contactor
- limit end-switch for safe opening of the furnace
- desktop (PKE 12, PKE 18) and freestanding designs available (loading sill height 900 mm)

**Optional accessories for additional charge:**

- injector with exhaust fan and draft diverter for fume extraction (only with controller HtIndustry / Ht205)
- protective atmosphere inlet (manually or automatically controlled gas supply; note that it is not possible to have this furnace in semi-gaslight version)
- graphic temperature recorder
- metal floor plate only up to 1000 °C
- optimization of the temperature field to meet DIN 17052-1  $\Delta T_{20}$  °C norms in the inner useable furnace (in empty furnace at T<sub>max</sub>)
- large hardening table for PKE 25/12 – PKE 90/12, including hardening containers and ventilator
- small hardening table for PKE 12/12 and PKE 18/12 (R) s including hardening containers and ventilator and PP 20
- unregulated or regulated forced cooling
- custom stand
- hardening container for heat treatment in protective atmosphere (refractory stainless up to 950 °C, Inconel up to 1100 °C)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



PKE 25/12



Manual door opening downwards



Furnace chamber with thermocouple and ventilation chimney

Model	T <sub>max</sub>	T <sub>max</sub> for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection*	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
PKE 12/12	1280	1180	12,2	700x650x850	250x200x250	3,0	95	16/1	230	20
PKE 18/12	1280	1180	17,5	700x650x900	250x200x350	3,5	101	16/1	230	30
PKE 18/12R	1280	1180	17,5	700x650x900	250x200x350	5,5	101	16/3	400	30
PKE 25/12	1280	1180	25	700x1300**x1100	250x200x500	7,0	132	16/3	400	50
PKE 45/12	1280	1180	44	800x1350**x1100	350x250x500	13,0	160	25/3	400	100
PKE 65/12	1280	1180	65	800x1350**x1300	350x250x750	16,0	195	32/3	400	130
PKE 90/12	1280	1180	87	800x1350**x1550	350x250x1000	18,0	225	32/3	400	150

\*Protection may vary according to the optional accessories selected.

\*\*Height of furnace includes stand

Subject to technical changes.

## TUBE FURNACE LT

Ideal for research and small batch testing

The constant temperature in the ceramic tube makes this furnace a researcher's best friend for trials and testing of various types of small samples. The charge can also be manipulated during testing without a major decline in temperature.

The greatest advantage of the LT furnace is that the tube ends can be sealed with metal plugs. The plugs give the furnace gaslight properties so that you can work with the charge in protective atmosphere.

Small batch options

Chemical resistance

Mechanical resistance

Semi-gastight design option



Simple installation and operation



Custom adjustment



Dispatch in as little as 8 weeks



Silent operation



36-month warranty



Prompt customer support



You can find custom-made devices for special applications based on this furnace in this catalogue on page 47.

LT 50/500/13

**Simple operation and installation**

- Custom adjustments
- Dispatch in as little as 8 weeks
- Silent operation
- 36-month warranty
- Prompt customer support
- Standard furnace equipped with:
  - Ht40AL controller (1 program: 2x ramp, 2x soak)
  - heating elements in insulation grooves outside of the furnace chamber
  - mineral fiber insulation mats
  - wiring located in a separate control cabinet
  - type 'S' thermocouple
  - contactless solid state relays for silent operation
  - limit end-switch for safe opening of the furnace
  - handle opens the top part of the furnace upwards
- desktop design

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- injector with exhaust fan and draft diverter for fume extraction (only with controller HtIndustry / Ht205)
- stand for vertical furnace positioning
- protective atmosphere inlet (manually or automatically controlled gas supply)
- mineral fiber sealing plugs
- metal sealing caps for gas-tight design
- 3-zone heating system for models with tube length 750 mm
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



LT 50/500/13

Model	Tmax	Tmax for long-term operation	Inner tube Ø	Outer dimensions (wxhxd)	Heating zone length	Tube length	Input	Weight	Protection*	Voltage
	°C	°C	mm	mm	mm	mm	kW	kg		V
LT 50/300/13	1300	1200	50	520x310x510	300	660	3.2	75	16/1	230
LT 50/500/13	1300	1200	50	805x310x510	500	900	5.0	85	16/3	400
LT 50/750/13	1300	1200	50	1125x310x510	750	1220	8.0	95	25/3	400
LT 75/500/13	1300	1200	75	805x310x510	500	900	6.5	85	20/3	400
LT 75/750/13	1300	1200	75	1125x310x510	750	1220	10.0	95	32/3	400
LT 100/500/13	1300	1200	100	810x450x650	500	900	7.0	85	25/3	400
LT 100/750/13	1300	1200	100	1125x310x543	750	1220	11.5	95	32/3	400

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

# FIVE-ZONE GRADIENT FURNACE LSP

Test fast, at up to five temperature zones at once

Don't expect to save space or some kind of special design, but if you need to test different samples and scan the temperature of each all at the same time, then this furnace is definitely the right one for you.

The LSP gradient furnace means you don't need five different furnaces, and you don't even have to keep changing your furnace settings. You just choose the temperature for the first zone, and the furnace will automatically set the proportional temperature in the other zones. Though you cannot regulate the temperature in the remaining zones, the temperatures are continuously scanned. If the temperature ratio in the individual zones is not as you would like, it can be adjusted upon request. The LSP gradient furnace is perfect for long-term sample testing as its firebrick lining has very good temperature accumulation properties.



Simple installation and operation



Custom adjustment



Dispatch in as little as 12 weeks



Silent operation



24-month warranty



Prompt customer support



LSP 30/13

**Standard furnace equipped with:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- heating coils in grooves in the lining along the full length of the sides of the furnace
- lid insulated with mineral fiber mats
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- handle opens the top part of the furnace upwards
- freestanding design

**Optional accessories for additional charge:**

- multi-channel controller Ht100 for scanning of temperatures at up to 10 points
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Loading opening internal dimension (wxd)	Input	Weight	Protection *	Voltage
	°C	°C	l	mm	mm	kW	kg		V
LSP 30/13	1300	1200	30	1700x1200x500	1400x140	7.0	240	20/3	400

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## LH - LABORATORY FURNACE

Universal equipment for higher temperatures and quick heating of samples

The LH is a flexible furnace with a wide range of uses in the lab. This is the furnace you get when you need to test materials at higher working temperatures. The heating elements built into grooves in the furnace lining ensure very quick heat transmission. However, the LH is not suitable for treatment of aggressive materials as fumes can attack the unprotected heating coils or the firebrick lining.

High temperatures

Excellent heat transmission into the charge

Universal application



Simple installation and operation



Custom adjustment



Dispatch in as little as 2 days



Silent operation



36-month warranty



Prompt customer support



You can find custom-made devices for special applications based on this furnace in this catalogue on page 44.

LH 15/13

**Standard furnace equipped with:**

- Ht40AL controller (1 program: 2x ramp, 2x soak)
- manual door opening upwards
- heating elements in grooves built into the lining
- refractory brick lining
- ventilation chimney for ventilation of the furnace chamber
- type 'S' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- desktop design

**Optional accessories for additional charge:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- injector with exhaust fan and draft diverter for fume extraction (only with controller HtIndustry / Ht205)
- protective atmosphere inlet (manually or automatically controlled gas supply)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



LH 15/13



Heating coils in grooves built into the lining



Ventilation chimney

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection*	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
LH 06/13	1340	1240	6	610x600x700	200x150x230	1.5	72	16/1	230	10
LH 09/13	1340	1240	9	610x600x700	230x170x230	2.0	73	16/1	230	10
LH 15/13	1340	1240	15	630x650x700	250x250x250	2.4	82	16/1	230	15
LH 30/13	1340	1240	30	690x770x760	310x310x310	3.2	105	16/1	230	25

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

## LABORATORY FURNACE WITH SILIT RODS LHS

Furnace for medium temperature applications, something between the VP and the LH

Silit rods are an inexpensive way to reach higher working temperatures. They boast lower maintenance, a longer life, and are more resistant to temperature shock than the MoSi2 heating elements that are used in the VP furnace.

The high-density silit rod construction of the LHS furnace allows it very rapid temperature increase. It can reach 1400 °C in 40 minutes. The LHS is also lighter and less bulky than the VP furnace.

Medium temperature range

Silit rods resistant to thermal shock

Lower purchase price compared with furnaces VP



Simple installation and operation



Custom adjustment



Dispatch in as little as 5 weeks



Silent operation



24-month warranty



Prompt customer support



LHS 08/15

**Standard furnace equipped with:**

- HtIndustry / Ht205 controller (30 programs of 15 steps each)
- silit rods on the furnace sides
- mineral fiber insulation panels
- forced jacket cooling
- type 'B' thermocouple
- contactless solid state relays for silent operation
- limit end-switch for safe opening of the furnace
- manual door opening upwards
- desktop design

**Optional accessories for additional charge:**

- protective atmosphere inlet (manually or automatically controlled gas supply)
- protective floor plate
- injector with exhaust fan and draft diverter for fume extraction (only with controller Ht40P)
- calibration of controller input measurement
- interface RS232 or EIA485 (including cable and software)
- HtMonit set (software and interface)

Note: Always consult with our technical office when combining optional accessories.



LHS 08/15



Pull out drawer with electro components for easy service access

Model	Tmax	Tmax for long-term operation	Volume	Outer dimensions (wxhxd)	Inner dimensions (wxhxd)	Input	Weight	Protection *	Voltage	Max. floor load
	°C	°C	l	mm	mm	kW	kg		V	kg
LHS 03/14	1400	1350	5	440x565x600	120x120x210	4,5	50	16/3	400	2
LHS 08/14	1400	1350	8,4	490x615x680	170x170x290	8,0	60	16/3	400	5
LHS 15/14	1400	1350	14,4	550x670x710	220x220x310	10,5	100	16/3	400	8
LHS 03/15	1500	1450	5	440x565x600	120x120x210	4,5	50	16/3	400	2
LHS 08/15	1500	1450	8,4	490x615x680	170x170x290	8,0	60	16/3	400	5
LHS 15/15	1500	1450	14,4	550x670x710	220x220x310	10,5	100	16/3	400	8

\*Protection may vary according to the optional accessories selected.

Subject to technical changes.

# HARDENING WORKPLACE – SKM LABORATORY TABLE

up to 1340 °C

Compact and practical laboratory hardening equipment set

No need to say more. You can choose the furnaces included in the set according to your own individual needs.

Up to 1340 °C

Air, water and oil cooling

Everything you need conveniently at hand



Installation and operator training needed



Custom adjustment



24-month warranty



Prompt customer support

### The workplace consists of:

- small laboratory hardening table
- one of these furnaces on the top; LH or PKE 12/12 or PKE 18/12
- one of these furnaces on the bottom; PP 20/45, PP 20/65, L 03 – L 15

### Standard design:

- table frame welded from steel sections
- hardening grate for hardening in air stream built into the tabletop
- fan below the hardening grate
- quenching water tank (volume 50 l)
- quenching oil container (volume 50 l)
- vessels with handles and lids
- perforated sheet metal baskets in the containers

### Optional accessories for additional charge:

- refractory shaped pieces around the hardening grid
- thermostatically controlled heating of the hardening medium



SKM – LH 15/13 + PP 20/65

## LH 30/12 ATYP

1200 °C

Calcining laboratory furnace

Our engineers have designed this modification of the LH 30/12 furnace especially for laboratory calcination of titanium dioxide (TiO<sub>2</sub>). The furnace features a rotating quartz glass retort into which the charge is placed and then loaded into the furnace. The quartz retort, retort loader, and table are included with the furnace.



Skleněná rotační retorta

LH 30/12

## L 09/12 ATYP

1200 °C

Bottom loading furnace for testing the thermal conductivity of samples

This special version of the L laboratory furnace tests the thermal conductivity of samples at a Czech university. This is a bell furnace that features table-top bottom loading and has a 900mm high loading sill. The furnace chamber can be manually adjusted to tilt up to 300 mm. All the furnace walls are heated-up.



L 09/12

**PKE 25/12 ATYP****1200 °C**

Hardening furnace for testing properties of high-strength steels

This industrial research center furnace tests innovative high-strength steel and manufacturing technologies for the production of rail vehicles. It is primarily tasked with the heating of samples and temperature monitoring. Its components include a protective gas supply container with a thermocouple to enable batch processing in a protective atmosphere of argon, nitrogen or forming gas.



PKE 25/12

**LT 50/500/13 ATYP**

**1200 °C**

Tube furnace LT with programmable servo-drive

This furnace was designed especially for testing in the aerospace industry. It features three zones; 800 °C, 1200 °C and cooling. The servo-drive is fully automatic, works according to a set temperature, and serves to move the charge from zone to zone. We also custom-designed and produced special refractory concrete spoons for loading the charge.

The system is regulated with a PLC Simatic controller and software. Up to four programs regulate the movement of the loading spoons, allowing the user to set various times and the frequency of each cycle.

**LT 150/400/45 ATYP a LT 300/800/45 ATYP 450 °C**

Activating tube furnace with glass retort LT

This one is a special tube furnace with a glass retort that our engineers designed especially for the activation of large quantities of molecular sieves which are capable of absorbing certain gases. The furnace was constructed for the analysis of gases, and production of filters and gas analyzers. However, they can be used for the heat treatment of almost any charge up to 450° C.

We manufactured a complete series of this portable vertical tube furnace and equipped it with HtIndustry controllers for simple yet comprehensive regulation of the heat treatment process.



LT 150/400/45



LT 300/800/45

**LT 90/30/11 ATYP**

**1100 °C**

Vertical tube furnace LT for mechanical testing of materials

This vertical tube furnace was especially designed for use in blasting test equipment. The test sample is clamped into the jaws of the blasting machine, and the portion of the sample being tested is placed in the heating chamber of the tube furnace. The sample is heated to the desired temperature and is then subjected to the mechanical test itself. And it's all automatic and hands-free, so you can focus on your notes and observations.



LT 90/30/11

## HT40AL

Simple programmable PID with dual ramp function



- 1 program: 2x ramp, 2x soak
- 1 measuring input
- 0 digital output
- 3 outputs (control, auxiliary, alarm)
- 1 communication line
- monitoring with the HtMonit system possible

### Program start:

- using keyboard
- via HtMonit system

### Additional functions:

- delayed program start
- program run indicator on front panel
- run indicator, output relay program end
- auto-set of regulating parameters
- device settings lock to prevent unqualified intervention

## HT60B

Simple PID/ two-step controller



- regulation at constant values
- 1 measuring input
- 0 digital output
- 2 outputs (control, alarm/signalling)
- 1 communication line
- monitoring with the HtMonit system possible

### Additional functions:

- auto-set of regulating parameters
- ramping function (after switching on, gradual ramp to temperature, speed of temperature increase set using °C/hour)
- manual regime for setting required performance manually, i.e. when probe is defective
- device settings lock to prevent unqualified intervention

## HT40P

Inexpensive single-loop PID controller



- 10 programs with 15 steps each
- 1 measuring input
- 0 digital output
- 3 outputs (control, auxiliary, alarm)
- 1 communication line
- monitoring with the HtMonit system possible
- datalogger to record up to 500 measurements

### Program start:

- using keyboard
- using real-time clock
- via communication links

### Additional functions:

- auto-set of regulating parameters
- device settings lock to prevent unqualified intervention

## HT100

Multichannel measurement



- 10 galvanically isolated inputs
- thermocouple inputs
- voltage inputs 0-5 V, 1-5 V, 0-10 V
- current inputs 0-20 mA, 4-20 mA
- 2 digital inputs
- 2 alarm outputs
- 1 communication line
- datalogger to record up to 2000 measurements

## HT205

Program PID / two-position / three-position controller for industrial applications



- 30 programs of 15 steps each
- 1 measuring input
- 2 digital inputs
- 7 outputs (control, alarm, auxiliary)
- LAN interface
- 2 communication lines
- datalogger of measured values; 500 entries
- datalogger reporting on device operation; 200 records
- Ambient temperature log; 500 entries

### Program start:

- using keyboard
- digital input
- via communication lines

### Other Features:

- program changes can be made while running
- front panel program status indicator
- system "Master - Slave", cascade control
- automatic parameter adjustment
- device settings lock to prevent unqualified intervention

## HTINDUSTRY

Programmable industrial PID controller



- 30 programs with 15 steps each
- 1 measuring input
- 2 digital outputs
- 2 regulating outputs (heating, cooling)
- 1 alarm output
- 4 configurable auxiliary inputs
- 2 communication lines (PC, Master - Slave)
- datalogger to record up to 4000 measurements

### Program start:

- using keyboard
- using real-time clock
- via HtMonit system

### Additional functions:

- program changes can be made while running
- system "Master - Slave", cascade control
- auto-set of regulating parameters
- device settings lock to prevent unqualified intervention

## HTMONIT

Universal monitoring software



This program is design to monitor from 1 to 4 Ht devices or electrical power consumption meters.

### It enables:

- monitoring of connected devices
- recording of all values in the database
- showing measured values on a graph
- searching within a graph
- printing charts and tables
- programming HtIndustry controller profiles, starting or stopping programs

It is capable of showing the current status of all types of devices on the display, and showing progress in graph format, recording into the database, printing graphs, and more. In addition it is able to create and record profiles directly into programmable controllers, as well as start or end programs. When monitoring electrical consumption, it can be set to monitor various parameters, etc.

## Furnace design

### Metal floor plate

Metal plate with a protective frame to protect the floor of the furnace from damage caused while manipulating a heavy charge in the furnace chamber.

### Illuminated peephole in the door

Double-glazed glass peephole and illumination of the furnace inner chamber for visual inspection of the charge in the furnace.

### Protective floor plate

The protective floor plate covers the floor of the furnace and protects the heating elements and the floor insulation from damage. The plate prevents the charge from being in direct contact with the heating elements.

### Adapter for connecting cooling collar rubber hose

Furnaces with a retort (PKR, PKRC) are equipped with a water cooling collar on the retort that is fitted with hose adapters for connection to a cooling water source.

### Inner atmosphere circulation

Furnaces and dryers that operate at temperatures up to approximately 850 °C require inner air circulation throughout the furnace chamber in order to ensure precise temperature uniformity between the heating elements and the charge. The circulation fan pulls air from the furnace chamber and that air is then blown back. The direction of the fan determines if the air is circulated horizontally (from the front to the back or from left to right) or vertically (from the floor to the ceiling). The heating elements heating the circulating air can be located in front of the ventilating fan, or at its output. Both the ventilating power and the air circulation direction have a significant effect on the temperature uniformity in the furnace chamber.

### Furnace muffle

The term muffle is used for the case that separates the furnace working chamber from the insulation. A muffle may be made of sheet steel, (aluminized structural steel or stainless steel) as in the case of large industrial furnaces, or from ceramic material (laboratory furnaces LMH and LMV). The use of a muffle ensures mechanical and even partial chemical resistance for the protection of the furnace insulation.

### Door portal

What is referred to as the furnace portal is the main point of entry into the furnace. In many cases it is made of high-resistance material in order to protect the insulation and the inner furnace equipment (such as the heating elements). Industrial furnace portals are often made of castable shapes of refractory concrete, while laboratory furnaces have portals of high-resistance refractory bricks.

### Cast-iron propeller

This propeller type is used in furnaces with inner atmosphere circulation in which it is necessary to work at high temperatures (above approx. 850 °C). Standard refractory materials are weakened and become markedly more ductile at such high temperatures and as in the case of the ventilation fan, can become permanently deformed and cause the entire circulation unit to become dysfunctional. The cast-iron propeller has a special design with markedly higher heat resistance and can handle the additional pressure of long-term use at high temperatures.

### MoSi2 heating elements

These resistance heating elements are made of a MoSi2 base, a dense ceramic material with a thin protective layer of silicon crystals on the surface which suppress oxidation at high temperatures. The operating temperature of these heating elements is up to a maximum of 1850° C, depending on the furnace type. The protective layer restores itself when at higher temperatures, and for this reason use of these elements at temperatures below approx. 1200° C is not suitable. At low temperatures, these heating elements are very fragile, therefore caution should be exercised in charge handling so as not to damage them. At temperatures above 1200° C, the material becomes ductile. As electric currents pass through them there can be deformation of the heating elements, but this does not affect the elements' life or performance.

### Silit rods

Silit rods are silicon carbide (SiC) resistance heating elements. The operating temperature of these heating elements is up to a maximum of 1600° C, depending on the furnace type. Unlike MoSi2 heating elements, silit rods do not lose their hardness at high temperatures, and there is no bending of the elements due to the electromagnetic forces of the electric current.

## Special adjustments only for tube furnaces

### Stand for vertical furnace positioning

Only for LT furnaces. This stand allows the furnace to be moved to a vertical tube position.

### Mineral fiber sealing plugs

Only for LT tube furnaces. This molded plug closes off each tube end. It is used to limit ventilation in the inner tube space and to improve temperature uniformity within the tube.

### Metal sealing caps

Only for LT furnaces. This shaped metal plug with graphite seal is designed to seal-lock each tube end. It is used when heat treating the charge in an inlet of protective atmosphere. The relatively small working space of the tube allows for achievement of high purity protective atmosphere with a minimum residual oxygen content. There is a plug adapter for connecting a gas hose on one side of the tube, and the plug on the other side has a small hole for discharging excess atmosphere.

## Cooling and ventilating of furnace

### Forced jacket cooling

Some lab furnaces (like the VP, for example) are equipped with a cooling fan to reduce furnace shell temperature. The fan is fully automatic and is activated as needed during furnace operation.

### Cooling of semi-gastight furnaces

The use of any type of ventilation chimney, flaps or suction valves on a furnace with semi-gaslight design greatly increases the escape of protective atmosphere from the furnace, and brings with it a major increase in gas consumption. This set-up could affect the operating conditions so significantly that the protective atmosphere concentration is no longer sufficient for the given process.

### Ventilation chimney

This chimney is used mainly in laboratory furnaces and provides ventilation of the furnace interior. As there is no regulation of the air flow, plugs of insulating material are available upon request.

### Sliding lever in door for controlling air supply

Located in the lower part of the door or on the furnace floor, these valves allow air feed into the interior of the furnace. Air intake can be manually controlled by closing the slider mechanism.

### Manual ventilation flaps

The flaps are usually located on the furnace ceiling and serve to ventilate the furnace interior. Opening and closing the flaps is done manually. These manual ventilation flaps cool the inner furnace outside the retort, but not the inner working chamber of the furnace itself.

### Automatic ventilation flaps

The flaps are usually located on the furnace ceiling and serve to ventilate the furnace interior. Opening and closing the flaps is powered by a servomotor and regulated by a program on the controller. This option is only possible in combination with the HtIndustry or one of the Ht200 controller series. The flap position may be set independently for each program step.

### Injector with exhaust fan and draft diverter

Stainless steel injection method exhaust chimney fan to improve exhaust extraction from the furnace. Combined with the draft diverter, the injector reduces the temperature of exhaust fumes and particles. This accessory is particularly suited to laboratory furnaces for the removal of corrosive exhaust. It may only be used in combination with the HtIndustry or Ht205 controller.

### Exhaust fan

The exhaust fan is connected to an automatic ventilating flap and served for forced extraction of fumes from the furnace. It can be used to extract fumes from the furnace directly at temperatures up to approx. 500 °C. For higher temperatures, it is necessary to first mix cool air into the hot fumes before extraction. This solution is suitable for industrial furnaces, but note that it may only be used in combination with the HtIndustry or one of the Ht200 controller series. The chimney draft and dimension must be set to a suitable size so as to ensure the flue is not blocked and fume extraction is not slowed. Connecting a draft diverter to the chimney is recommended.

### Unregulated forced cooling

Active cooling of the charge. Cool air is sucked into the lower part of the furnace by the ventilator and pulled through the automatic ventilating valves into the furnace chamber. The controller is used to open the flap and turn the ventilator on, but cooling speed cannot be regulated. The chimney draft and dimension must be set to a suitable size for proper operation of the cooling system, and to ensure the flue is not blocked and fume extraction is not slowed. Connecting a draft diverter to the chimney is recommended.

### Regulated forced cooling

Active cooling of the charge. Cool air is sucked into the lower part of the furnace by the ventilator and pulled through the automatic ventilating valves into the furnace chamber. The flap and ventilator are regulated by the controller and set according to the required furnace cooling speed. This option may only be used in combination with the HtIndustry controller or one of the Ht200 controller series. The chimney draft and dimension must be set to a suitable size for proper operation of the cooling system, and to ensure the flue is not blocked and fume extraction is not slowed. Connecting a draft diverter to the chimney is recommended.

## Adjustments of furnaces for working in protective atmosphere

### Protective atmosphere inlet (manually controlled gas supply)

Preparation of the furnace for a supply of protective atmosphere into the furnace chamber with hose input on the side of the furnace. In smaller furnaces, e.g. 550 liters volume, a bottle reducing valve with a flow meter is included.

### Automatically controlled gas supply

The protective atmosphere inlet can be supplemented with an automatically regulated solenoid valve controlling gas input into the furnace (on/off). The operator then sets the controller with the required values for each step. This option may only be used in combination with the HtIndustry controller or one of the Ht200 controller series.

### Semi-gastight furnace design

The furnace design is adjusted to ensure the best possible gas-tightness of the furnace chamber. Note that this adjustment does not replace a fully gas-tight design, and the furnace is not suitable for heat treatment under a defined protective atmosphere, as the residual oxygen content in the furnace chamber cannot be guaranteed. This design is only useful for less demanding applications, such as heat treatment with oxidation reduction requirements.

#### Hardening container for heat treatment in protective atmosphere

This is a removable closed case made of heat-resistant material with a protective atmosphere inlet. The charge is placed into the container before being inserted into the furnace. The container can be used for preventing oxidation or for the decarburization of steel parts during the heat treatment process.

#### Vacuum pump connection inlet

Furnaces with a retort (PKR, PKRC) are equipped with a separate terminal for connection of the vacuum pump. The pump itself can be supplied with the furnace, or the customer can install the vacuum pump later via the connection inlet. The vacuum pump is used for pulling air from the cold furnace after loading the charge so that the furnace can then be filled with process gas. The vacuum process can be repeated as necessary and will significantly reduce the residual oxygen level in the furnace retort.

#### Vacuum pump for PKR, PKR – for furnaces with retort

The pump sucks cold air from the retort to significantly reduce the amount of excess air in the retort. This improves the conditions for the subsequent purging of the retort before the heat treatment process begins. The set includes the pump, a solenoid valve, and accessories to connect all components. Pump activation is regulated by the controller.

## Electrical components

#### Contactors

This device is for switching on and off the electrical connection. In electric furnaces, the contactor is used to switch on or off the heating elements. It is a simple and robust mechanism that is a bit noisy, especially if the regulator often needs to turn on and off the heating in order to maintain the required temperature.

#### Contact free solid-state relay – SSR

Switching devices which contain no moving parts that can make noise or that can be worn out by frequent switching are used to control furnace operations.

#### Protection and furnace connections

Single phase (230 V / 50 Hz) furnaces are each provided with a power cord and plug. Three phase (400 V / 50 Hz) furnaces with protection of less than 32 A are also equipped with a power cord and plug. Furnaces with three phase power above 32 A require that the customer connect the power cord to the switchboard and secure the cable connection to the terminals in the furnace panel.

## Measurement, thermocouples etc.

#### Relative humidity measurement

This is a sensor that measures the humidity in the furnace interior. The measurement is displayed on the switchboard or on the control panel. The relative humidity value shown serves as an informative (approximate) value for the user, or it may be a relative humidity value that is factored into the controller program (only possible in combination with a programmable PLC).

#### Charge thermocouple

Charge thermocouples can be used for temperature monitoring in the furnace, or for temperature regulation. Charge thermocouples can also be attached directly onto the charge. The thermocouple used is designed to meet user specifications and can even have a diameter as small as 1.5 mm to allow attachment to the furnace door (for example when manipulation of the charge during heat treatment is required).

#### Graphic temperature recorder

This device is located in the control panel of the furnace and provides a paper print-out recording of the temperature in the furnace at any given time.

#### Thermocouples

Thermocouples are temperature sensors that work based on the principle of the thermoelectric effect of two different metals joined together to form two junctions with one end in the furnace chamber and the other end in the regulator. The thermocouple type designation is based on the type of metals used.

The Type K thermocouple uses two nickel alloys, Chromel and Alumel, and measures a temperature range from less than 0 °C to about 1100 °C. LAC uses K thermocouples that are fitted with a metal casing.

The Type N thermocouple uses a similar pair of nickel alloys, Nicrosil and Nisil, to define a temperature range from less than 0 °C to about 1200 °C. LAC uses N thermocouples that are fitted with a metal casing.

The Type S thermocouple uses the noble metals Platinum-Rhodium and Platinum which measure a temperature range from about 10 °C to about 1400 °C. LAC uses S thermocouples that are fitted with a ceramic casing.

The Type B thermocouple uses two different ratios of the precious metal Platinum-Rhodium to define a temperature range of about 300 °C to about 1700 °C. Temperatures lower than 300 °C do not display correctly with this thermocouple and temperatures shown can be far from the real temperature. LAC uses type B thermocouples that are fitted with a ceramic casing.

#### Gas analyzer METREX

This gas analyzer monitors the concentration of dangerous vapors during drying or batch firing. Its output is connected to an automatic ventilation flap or other devices (exhaust fan, siren, etc.) to ensure safe operation. Upon identifying increasing concentrations of dangerous gases (over 10% flammable mixture), the gas analyzer instructs the regulating system to take appropriate action to reduce this concentration.

## Vacuum pressure gauge for vacuum control in the retort

Analog pressure sensor which allows measurement of both positive pressure and vacuum. It is used in furnaces type PKR and PKRC for displaying the pressure in the furnace retort at any given time.

## Interface RS232 or EIA485 (including cable and software)

RS232 and EIA485 serve as a communication link between a PC and an external electronic device. RS232 can connect one PC with one device, EIA485 can connect up to 30 devices, and by using repeaters this number can be further increased. The interface is connected to the furnace regulator and routed to the electrical connector located on an accessible place on the furnace.

## Safety features

### Thermistor for temperature control flange and signaling the presence of coolant in the retort collar

This is used in furnaces with a retort (PKR, PKRC) and ensures that the collar temperature is monitored. The thermistor protects the furnace from damage if there is insufficient cooling or in the case of a total failure of the cooling system.

### Overpressure valve for PKR, PKRC – for furnaces with retort

Overpressure valve is a standard part of these furnaces and maintains the pressure in the retort at 4–6 mbar.

### System controlling optimal pressure in retort for PKR, PKRC – furnaces with retort

The system monitors the optimal retort pressure in the PKR and PKRC – furnaces with retort. It serves as automatic retort pressure regulation to keep the pressure in the retort at its optimal level between 2–4 mbar (200–400 Pa). The advantage of this system is the reduced consumption of process gas and maintenance of a stable pressure rate between 2–4 mbar. This means that high temperatures can be maintained at lower pressure, thus increasing retort life.

### Ammeters for checking the condition of heating elements'

Ammeters monitor incoming current to check the status of heating elements. Three ammeters are usually connected (according to the number of connected phases), but an ammeter can also be connected to each heating element separately for an additional fee. In monitoring the current measurements, the furnace operator is able to simply and accurately identify which of the heating circuits is damaged and take appropriate action.

### Thermostat

There is a thermostat in some furnaces with working temperature of up to 250 °C that is used to protect the furnace from overheating in the event of failure of the main regulating loop.

### Limit unit

The limit unit serves to protect the furnace from overheating in the event of failure of the main regulating loop. The limit unit has its own independent control loop consisting of the thermocouple and the controller. Upon request, the furnace may also be equipped with an additional thermocouple placed in the furnace chamber to protect the charge.

### Limit end-switch

All doors and service openings in furnaces are each equipped with a limit switch to monitor the position of the door when closed. When the door is opened, the limit switch automatically disconnects the furnace heating. The mechanism of the door limit switch is always designed so that without tools it is impossible for accidental or deliberate movement of the switch to simulate a closed door. Safety first.

## Calibration and optimization

### Calibration of controller input measurement

Issue of a calibration certificate defining the deviation between the temperature values displayed by the controller and the theoretical thermocouple input to the controller.

### Calibration of the measurement loop

Issue of a calibration certificate defining the deviation between the temperature values displayed by the controller and the theoretical thermocouple value that is input to the controller, thus reflecting the deviation of all elements used in the measuring loop.

### Optimization of the temperature field to meet DIN 17052-1 $\Delta T_{xx}$ °C norms in the inner useable furnace (in empty furnace at $T_{max}$ )

Adjustment of the internal airflow or adjustment of the furnace heating system according to the information detected by furnace measuring equipment. These adjustments provide optimization of furnace temperature uniformity in the empty furnace at  $T_{max}$  for the purpose of meeting requirements of maximum temperature uniformity deviation. In some cases, it is possible to optimize temperature uniformity in the furnace with its charge. Measurement is done according to DIN 17052-1 standards.



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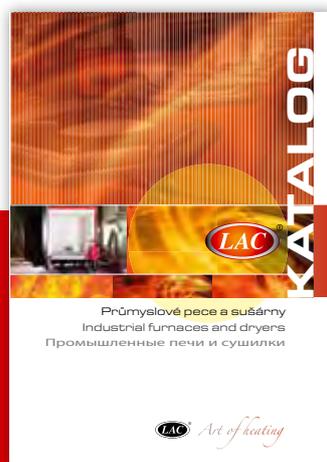
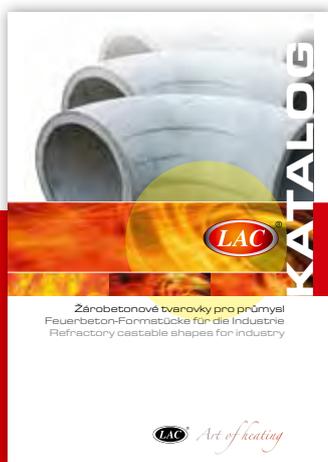
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*Art of heating*



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