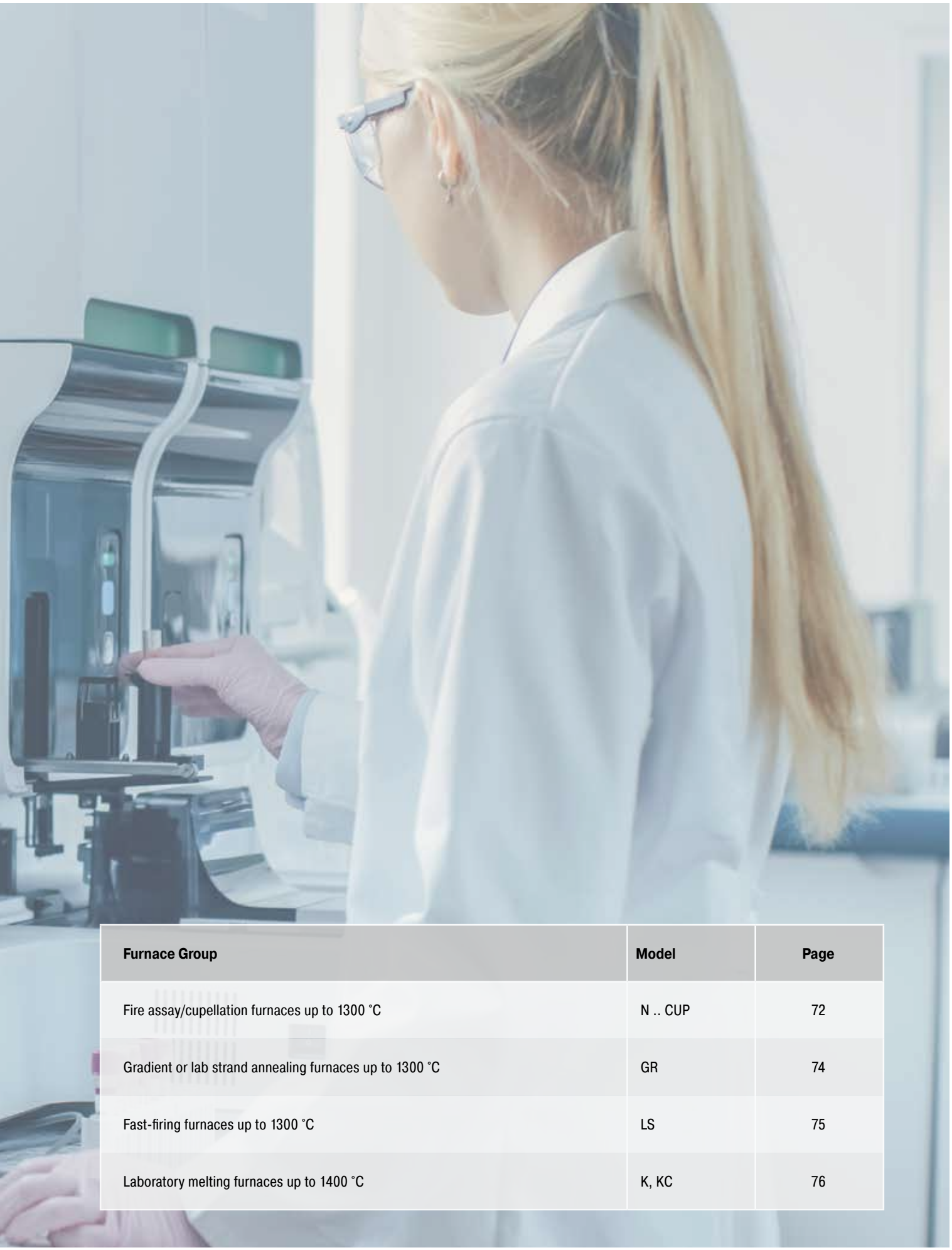
Furnaces for Special Applications

- Dual shell ventilated housing made of textured stainless steel sheets for low surface temperature and high stability
- Exclusive use of insulation materials without categorization according to EC Regulation No 1272/2008 (CLP). This explicitly means that alumino silicate wool, also known as “refractory ceramic fiber” (RCF), which is classified and possibly carcinogenic, is not used.
- NTLog Basic for Nabertherm controller: recording of process data with USB-flash drive
- Defined application within the constraints of the operating instructions
- As additional equipment: Process control and documentation via VCD software package for monitoring, documentation and control



Furnace Group	Model	Page
Fire assay/cupellation furnaces up to 1300 °C	N .. CUP	72
Gradient or lab strand annealing furnaces up to 1300 °C	GR	74
Fast-firing furnaces up to 1300 °C	LS	75
Laboratory melting furnaces up to 1400 °C	K, KC	76

Fire Assay/Cupellation Furnaces up to 1300 °C

Cupellation is a process to separate precious metals, such as gold or silver, from alloys with base metals. During the process, aggressive gases that attack the insulation and the heating are released. Cupellation furnaces N ../13 CUP are especially designed for the very demanding process requirements.

The furnace chamber consists of a ceramic muffle, which offers very good protection for the heating elements and insulation against the vapors. A special fresh-air and exhaust air system guides exhaust gases directly into the exhaust hood of the cupellation furnace. At the same time, fresh air is lead into the furnace atmosphere. The integrated exhaust hood on top of the furnace and above the door is the interface to the customer's required exhaust air system. The design is very-maintenance friendly; all wear and tear parts on the furnace, which are f.i. the ceramic muffle and the heating elements, can be replaced easily.

Cupellation furnaces N 4/13 CUP as a tabletop model and N 10/13 CUP are designed especially for cupellation. Due of its high chamber design, model N 30/13 CUP can also be used for crucible melting. Pit-type furnace S 73/HS is especially designed for crucible melting.

Cupellation furnace N 4/13 CUP as a tabletop model

Cupellation furnace N 10/13 CUP with closing brick and base on castors

Standard Equipment of Cupellation Furnace N 4/13 CUP

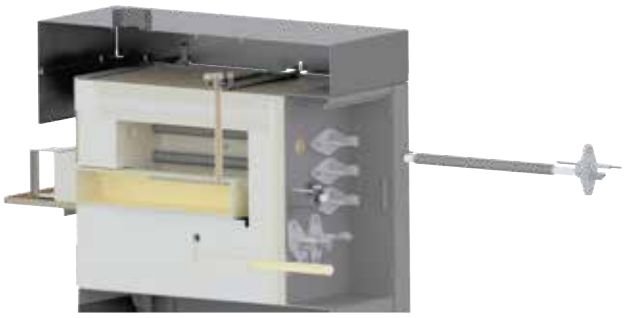
- Compact tabletop model
- Ceramic muffle to protect the heating elements and insulation
- Furnace chamber is heated from three sides (floor and sides) with heating elements on support tubes
- Extraction system with integrated exhaust hood on top of the furnace and above the door to connect to the customer's exhaust air system
- Manual lift door

Additional Equipment for Cupellation Furnace N 4/13 CUP

- Over-temperature limiter with adjustable cutout temperature as temperature limiter to protect the furnace and load

Standard Equipment of Cupellation Furnaces N 10/13 CUP and N 30/13 CUP

- Ceramic muffle to protect the heating elements and insulation
- Furnace chamber is heated from 4 sides with heating elements on support tubes
- The heating elements can be easily replaced as one unit
- Furnace chamber ventilated as additional protection for the heating elements
- Precise temperature control with control thermocouple directly in the muffle
- Closing brick for the muffle with handle for N 10/13 CUP
- Electro-mechanic lift door for N 30/13 CUP
- Bench/surface in front of muffle
- Special fresh-air and exhaust air system for the ceramic muffle. Exhaust gases are directly guided into the exhaust hood via a ceramic tube at the back of the muffle. The air exchange rate is adjustable.
- Extraction system with integrated exhaust hood on top of the furnace and above the door to connect to the customer's exhaust air system
- Over-temperature limiter with adjustable cutout temperature as temperature limiter to protect the furnace and load



Compact heating element, easy to replace (cupellation furnaces N 10/13 CUP and N 30/13 CUP)

Additional Equipment for Cupellation Furnaces N 10/13 CUP and N 30/13 CUP

- Electro-mechanic lift door for N 10/13 CUP
- Swiveling inspection window as heat protection
- Timer to program switching on and off times (preset temperature)
- Base mounted on castors

Pit-type furnace S 73/HS with split lid

Standard Equipment of Pit-Type Furnace S 73/HS

- Compact pit-type furnace for crucible melting
- Split lid, opened manually by swiveling
- Heating from four sides
- Heating elements and floor protected against friction and aggressive substances with silicon carbide tiles
- Furnace chamber ventilated as additional protection for the heating elements
- Exhaust air box with insulated tube to the rear. Facilities for connection to customer's necessary extraction system.

Additional Equipment for Pit-Type Furnace S 73/HS

- Manual rolling lid
- Pneumatic rolling lid
- Over-temperature limiter with adjustable cutout temperature as temperature limiter to protect the furnace and load
- Timer to program switching on and off times (preset temperature)

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions[1] in mm			Connected	Electrical	Weight
	°C	w	d	h	in l	W	D	H	load kW	connection*	in kg
N 4/13 CUP	1280	185	250	80	3.7	800	750	750	3	1-phase	105
N 10/13 CUP	1300	250	540	95	8.0	800	1300	1850	15	3-phase	450
N 30/13 CUP	1300	250	500	250	25.0	1050	1300	2150	15	3-phase	480
S 73/HS	1300	530	380	360	73.0	1050	1530	900	26	3-phase	890

[1]External dimensions vary when furnace is equipped with additional equipment. Dimensions on request.

*Please see page 84 for more information about supply voltage

Pit-type furnace S 73/HS with rolling lid

Sides and floor lined with silicon carbide tiles as protection for pit-type furnace S 73/HS

N 10/13 CUP with optional electromotoric lift door

Gradient or Lab Strand Annealing Furnaces up to 1300 °C

The furnace chamber of the gradient furnace GR 1300/13 is divided in six control zones of equal length. The temperature in each of the six heating zones is separately controlled. The gradient furnace is usually charged from the side through the parallel swivel door. A maximum temperature gradient of 400 °C can then be stabilized over the heated length of 1300 mm. On request the furnace also is designed as a lab strand annealing furnace with a second door on the opposite side. If the included fiber separator are used charging is carried-out from the top.

Gradient furnace GR 1300/13S

Standard Equipment

- Tmax 1300 °C
- Heated length: 1300 mm
- Heating elements on support tubes providing for free heat radiation in the kiln chamber
- Charging from the top or through the right side door
- Gas damper suspension of the lid
- Separate control of heating zones (each 160 mm long)
- Temperature gradient of 400 °C over the entire length of the kiln chamber, each zone can individually be controlled
- Fiber separators dividing the chamber in six equally sized chambers
- Controller H1700, alternative controllers see page 84

Additional Equipment

- Up to ten control zones
- Second parallel swing door for use as lab strand annealing furnace
- Vertical instead of horizontal strand furnace
- 1400 °C model

Model	Tmax	Inner dimensions in mm			Outer dimensions[1] in mm			Connected	Electrical	Weight
	°C	w	d	h	W	D	H	load kW	connection*	in kg
GR 1300/13	1300	1300	100	60	1790	1020	1350	18	3-phase	400

[1]External dimensions vary when furnace is equipped with additional equipment. Dimensions on request.

*Please see page 84 for more information about supply voltage

Parallel front swing door

Gradient furnace GR 1300/13S

Furnace chamber of gradient furnace GR 1300/13 with second door as additional equipment

Fast-Firing Furnaces up to 1300 °C

These fast-firing furnaces are ideal for simulation of typical fast-firing processes up to a maximum firing temperature of 1300 °C. The combination of high performance, low thermal mass and powerful cooling fans provides for cycle times from cold to cold up to 35 minutes with an opening temperature of approx. 300 °C.

Fast-firing furnace LS 25/13

Standard Equipment

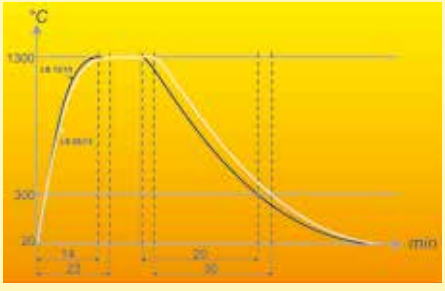
- Tmax 1300 °C
- Ceramic grid tubes as charge support
- Floor and lid heating, two-zone control
- Special arrangement of the heating elements for optimum temperature uniformity
- Rapid switching cycles result in precise temperature control
- Integrated cooling fans, programmable to speed up charge cooling including housing cooling
- Programmable lid opening of approximately 60 mm for faster cooling without activating the fan
- Thermocouple type S for top and bottom zone
- Castors for easy furnace moving
- Controller with touch operation P570 (50 programs with each 40 segments), alternative controllers see page 84

Model	Tmax	Inner dimensions in mm			Volume	Outer dimensions[2] in mm			Connected	Electrical	Weight
	°C	w	d	h	in l	W	D	H	load kW	connection*	in kg
LS 12/13	1300	350	350	40	12	750	880	1090	15	3-phase[1]	150
LS 25/13	1300	500	500	100	25	900	1030	1150	22	3-phase[1]	160

[1]Heating only between two phases
[2]External dimensions vary when furnace is equipped with additional equipment. Dimensions on request.

*Please see page 84 for more information about supply voltage

Fast-firing furnace LS 25/13



Firing curves of fast-firing furnaces LS 12/13 and LS 25/13

Floor and lid heating, two-zone control

Laboratory Melting Furnaces up to 1400 °C

These compact melting furnaces for the melting of non-ferrous metals and alloys are one of a kind and have a number of technical advantages. Designed as tabletop models, they can be used for many laboratory applications. The practical counter balanced hinge with shock absorbers and the spout (not for KC 4/14) on the front of the furnace make exact dosing easy when pouring the melt. The melting furnaces are available for furnace chamber temperatures of 1000 °C, 1300 °C, or 1400 °C.

Melting furnace KC 4/14

Standard Equipment

- Tmax 1000 °C, 1300 °C, or 1400 °C
- Crucible sizes of 0.75, 1.5 or 3 liters
- Crucible with integrated pouring spout of clay-graphite included with delivery
- Additional spout (not for KC 4/14), mounted at the furnace for exact pouring
- Compact bench-top design, simple emptying of crucible by tiltiing system with gas damper
- Crucible for heating up of melting furnace insulated with a hinged lid, lid opened when pouring
- Controller R7 (resp. 3508 for KC), alternative controllers see page 84

Additional Equipment

- Other crucible types available, e.g. steel
- Design as bale-out furnace without tilting device, e.g. for lead melting
- Over-temperature limiter for the furnace chamber with automatic reset to protect against overtemperature. The limit controller switches off the heating when the pre-set limit temperature has been reached and does not switch it on again until the temperature falls below the setting again.
- Observation hole for melt

Model	Tmax furnace	Tmax melt bath	Crucible	Capacity in kg		Volume	Outer dimensions[3] in mm			Connected load	Weight
	°C	°C		Al	Cu	in l	W	D	H	kW	in kg
K 1/10	1000	850	A6	1.5	-	0.75	600	710	670	3.0	85
K 2/10	1000	850	A10	3.0	-	1.50	600	710	670	3.0	90
K 4/10	1000	850	A25	7.0	-	3.00	670	800	710	3.5	110
K 1/13[1]	1300	1150	A6	1.5	6.0	0.75	600	710	670	3.0	85
K 2/13[1]	1300	1150	A10	3.0	10.0	1.50	600	710	670	3.0	90
K 4/13[1]	1300	1150	A25	7.0	25.0	3.00	670	800	710	5.5	110
KC 1/14[2]	1400	1250	A6	-	6.0	0.75	570	630	580	11.0	90
KC 2/14[2]	1400	1250	A10	-	10.0	1.50	570	630	580	11.0	95
KC 4/14[2]	1400	1250	A25	-	25.0	3.00	670	870	590	22.0	110

[1]Outer dimensions of furnace, transformer in separate housing (500 x 570 x 300 mm)
[2]Switchgear and controller mounted in a floor standing cabinet
[3]External dimensions vary when furnace is equipped with additional equipment. Dimensions on request.

Tilting-aid with dampers

Furnace K 4/10 with steel crucible, e.g. for tin melting

Melting furnace KC 1/14

Temperature Uniformity and System Accuracy

Temperature uniformity is defined as the maximum temperature deviation in the work space of the furnace. There is a general difference between the furnace chamber and the work space. The furnace chamber is the total volume available in the furnace. The work space is smaller than the furnace chamber and describes the volume which can be used for charging.

Holding frame for measurement of temperature uniformity

Specification of Temperature Uniformity in +/− K in the Standard Furnace

In the standard design the temperature uniformity is specified in +/− K at a defined set-temperature with the work space of the empty furnace during the dwell time. In order to make a temperature uniformity survey the furnace should be calibrated accordingly. As standard our furnaces are not calibrated upon delivery.

Calibration of the Temperature Uniformity in +/− K

If an absolute temperature uniformity at a reference temperature or at a defined reference temperature range is required, the furnace must be calibrated appropriately. If, for example, a temperature uniformity of +/− 5 K at a set temperature of 750 °C is required, it means that measured temperatures may range from a minimum of 745 °C to a maximum of 755 °C in the empty work space.

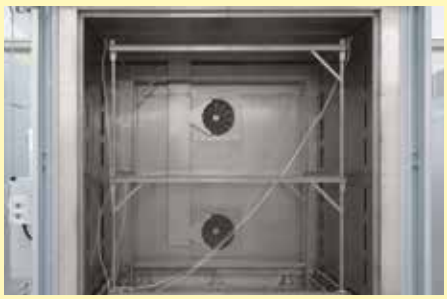
System Accuracy

Tolerances may occur not only in the work space, they also exist with respect to the thermocouple and in the controls. If an absolute temperature uniformity in +/− K at a defined set temperature or within a defined reference working temperature range is required, the following measures have to be taken:

- Measurement of total temperature deviation of the measurement line from the controls to the thermocouple
- Measurement of temperature uniformity within the work space at the reference temperature or within the reference temperature range
- If necessary, an offset is set at the controls to adjust the displayed temperature at the controller to the real temperature in the furnace
- Documentation of the measurement results in a protocol

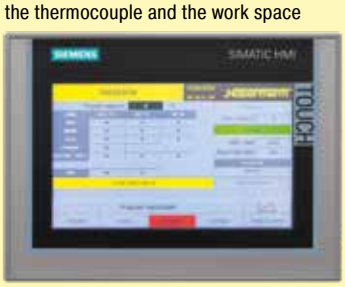
Temperature Uniformity in the Work Space incl. Protocol

In standard furnaces, temperature uniformity is guaranteed as +/− K without measurement of temperature uniformity. However, as an additional feature, a temperature uniformity measurement at a target temperature in the work space compliant with DIN 17052-1 can be ordered. Depending on the furnace model, a holding frame which is equivalent in size to the work space is inserted into the furnace. This frame holds thermocouples at up to 11 defined measurement positions. The measurement of the temperature uniformity is performed at a target temperature specified by the customer after a static condition has been reached. If necessary, different target temperatures or a defined target working temperature range can also be calibrated.



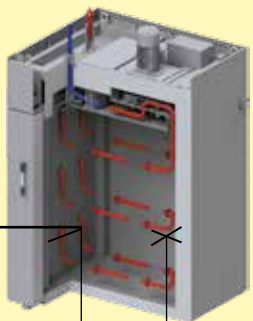
Pluggable frame for measurement for forced convection chamber furnace N 7920/45 HAS

The system accuracy is defined by adding the tolerances of the controls, the thermocouple and the work space



Precision of the controls, e. g. +/− 1 K

Deviation of thermocouple, e. g. +/− 1.5 K



Deviation from measuring point to the average temperature in the work space e. g. +/−3 K