

CATALOG

INDUSTRIAL FURNACES FOR ADDITIVE MANUFACTURING



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COMPANY PROFILE

LAC, s.r.o. has been a successful manufacturer and seller of industrial furnaces, dryers and refractory castable shapes for three decades. It operates both on domestic and foreign markets. Since its foundation in 1992, the company has developed into a leading global manufacturer and has delivered as many as 20,000 furnaces and dryers. The products are used in many technological processes of heat treatment, especially:

- heat treatment of ferrous and non-ferrous metals
- alloy technologies for non-ferrous metals
- heat treatment and chemical- heat treatment metal processing
- low-temperature applications
- laboratory technologies
- production of industrial and hobby ceramics



The LAC manufacturing program includes the manufacture of a complete standard range of furnace and dryer lines, and also accommodates the individual requirements of the customer through the design and manufacture of customized furnaces tailor-made to meet customer specifications. The LAC development and design office works in tandem with a team of service technicians to ensure quality service to customers and pave the way for future company growth. Progress in technological development is proven by orders for the automotive, aerospace and defense industries that meet the demanding standards of AMS 2750 E, NADCAP, CQI-9. In 2018, the construction of new LAC complex in Židlochovice worth CZK 220 million was completed. Investments in the form of a new furnace and dryer production hall and office space allow us to streamline the production process and produce even higher quality products for our customers.

A significant part of the LAC business is the manufacture of refractory castable shapes, the bulk of which are used in the manufacture of industrial furnaces. Refractory castable shapes are also used by metallurgy companies and manufacturers of boilers for burning wood, pellets, and biomass. The investments in the extension of the premises for production of refractory castable shapes at Hrušovany nad Jevišovkou have reached a total of CZK 67 million.

The company also supplies heating elements, refractory and insulation materials, regulating elements, and reconstruction of furnaces, heating systems and switchboards to its customers.



6 custom projects
per month



Almost 20,000 furnaces
manufactured



We deliver to 35 countries
worldwide

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INSTRUCTIONS FOR USE OF THE CATALOGUE:

You can find the demanded furnace using the table on page 14.

1. Look up for a material type.
2. Look up for a type of material heat treatment.
3. The last column contains a type of a suitable furnace together with page number.
4. After turning to the page with the required furnace type, select the dimensions of your platform from the table and you will see the recommended furnace size.
5. Contact the LAC sales representative who will prepare a quotation for the furnace and other accessories for you.

Subject to technical changes.

The values indicated in the catalogue are only of an informative character.

Edition 9/2023.

Additive Manufacturing (AM)

Additive Manufacturing represents a huge potential. It brings about higher efficiency and reduces costs at production, testing and introducing new products. This technology allows production of 3D products even with a very complicated shape. Objects or products are created on the basis of digital 3D models or other electronic data sources. Application possibilities of 3D printing seem to be unlimited when taking into consideration progressive development of this technology.

WHAT IS THE ADDITIVE MANUFACTURING?

Additive Manufacturing designates the process at which a product is created by progressive applying thin layers of material on each other (plastic, metal, concrete, ceramic, tissue ...). Additive Manufacturing is basically the same as 3D printing, however, there is a substantial difference in that the term Additive Manufacturing means a process at which a final product is created rather than a prototype.

(source: Encyklopedie 3D tisku, www.3D-tisk.cz)

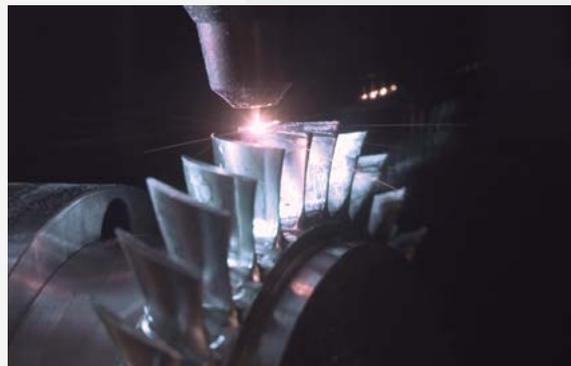
ADDITIVE MANUFACTURING TECHNOLOGY

Additive Manufacturing is a general designation of all various methods of 3D printing. E.g. by plastic fibre melting, sintering plastic or metallic powder materials, etc.

Examples of the types of 3D printing technologies:

- FFF (or FDM) – printing of functional models with molten plastic
- SLA (or DLP) – photosensitive resin curing
- SLS – plastic powder laser sintering
- DMLS – metallic powder sintering
- Solidscape – wax model printing
- ProJet – printing of fragile full-colour models from powder
- Mcor – printing of fragile full-colour models from paper

Our furnaces are designated for all the technologies listed below, for metal processing – melting or sintering of metallic powders or fibres which do not contain additional binders.



DMLS – direct metal laser sintering

MLS – micro laser sintering

SLM – selective laser melting

DMLM – direct metal laser melting

LMD – laser metal deposition

LMF – laser metal fusion

up to 650 °C



up to 850 °C



up to 1300 °C



up to 950 °C



Furnaces are designed for heat treatment after previous additive types of charge production. If you use another type of 3D printing or if your technology is not listed above, contact the LAC sales department where they will recommend you the corresponding equipment.

PP chamber furnace

up to 650 °C

The chamber furnace for heat treatment of 3D components produced by additive manufacturing technology which will ensure a process for correct metallurgical properties of metallic alloy. The furnace with ideal temperature distribution and forced air circulation offers suitable conditions for annealing, soft annealing, hardening, tempering and artificial ageing.

Processed material type:

Aluminium

ALUMINIUM COMPONENTS

Aluminium components produced by the AM technology are processed at a temperature between 150 °C and 650 °C.

The PP chamber furnaces up to 650 °C with forced air circulation and ideal temperature distribution are suitable for pre-heating, artificial ageing, annealing and internal stress relieving.

Examples of platform max. dimensions (mm)	Furnace type
100x100	PP 20/65
250x250	PP 40/65
300x300	PP 70/65
400x400	PP 140/65
550x550	PP 270/65
650x650	PP 540/65



PP 140 furnace

Technical specification:

Furnace type	T _{max}	T _{max} for long-term operation	Volume	External dimensions (w×h×d)	Internal dimensions (w×h×d)	Number of shelves	Input*	Weight	Protection**	Voltage	Max. floor load
	°C	°C	l	mm	mm	pcs	kW	kg		V	kg
PP 20/65	650	600	20	800×650×1000	300×200×350	-	3,0	130	16/1	230	30
PP 40/65	650	600	35	850×1450×1050	300×300×400	2	6,0	180	16/3	400	50
PP 70/65	650	600	70	850×1550×1150	350×400×500	2	8,0	200	20/3	400	80
PP 140/65	650	600	135	950×1650×1300	450×500×600	2	12,0	250	20/3	400	150
PP 270/65	650	600	270	1200×1750×1450	600×600×750	2	20,0	580	40/3	400	240
PP 540/65	650	600	540	1300×1950×1750	750×800×900	2	24,0	850	50/3	400	500

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

Subject to technical changes.

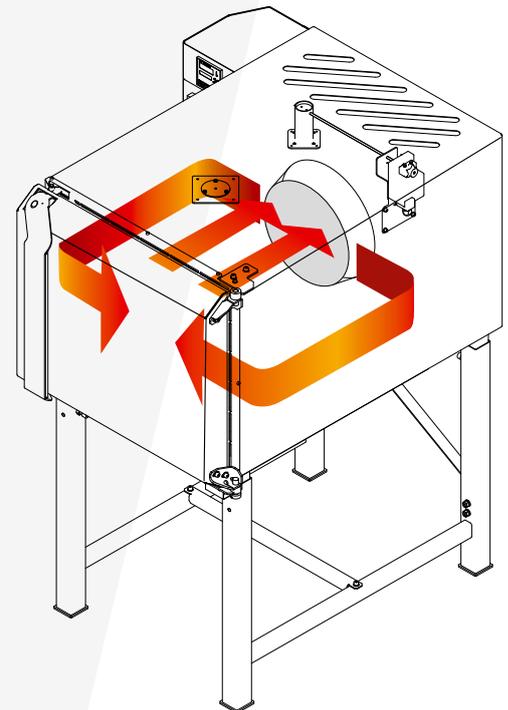
**Protection may vary according to the optional accessories selected.

STANDARD FURNACE EQUIPMENT

- Ht205 controller
- Stainless steel muffle
- Stainless steel circulation insert with long service life
- Horizontal internal atmosphere circulation
- Heating elements located outside the furnace space
- 2 stainless steel shelves (except for the PP 20)
- Manually controlled ventilation flap for cooling the furnace's operational space
- "K" type thermocouple
- Contactless switching relay for noise-free operation
- Limit switch for safe opening of the furnace
- Door manually opened towards the side
- Tabletop (PP 20) or free-standing variant (other types)

OPTIONAL ACCESSORIES AVAILABLE FOR AN EXTRA CHARGE

- Intake of protective atmosphere (manually or automatically controlled gas intake)
- Semi-gastight furnace variant (with a special ventilation chimney)
- Digital temperature recorder (controller and recorder are located in custom control panel on side of furnace)
- Automatic ventilation flap for cooling the furnace's operational space
- Optimisation of the temperature field for DIN 17052-1 ΔT 10 °C in the internal usable space (in an empty furnace at T_{max})
- Measuring loop calibration
- RS-485 or LAN interfaces including software and cabling
- HtMonit EV set (include furnace monitoring software + interface)
- Custom stand
- Door opening to the left or right (hydraulic sliding, pneumatically controlled)
- Additional shelves
- One-handed opening (for models PP 20 through PP 140 inclusive, this is standard equipment)
- Controlled or uncontrolled forced cooling (cannot be combined with the semi-gastight furnace version)



3D model of inner atmosphere circulation



PP 140 furnace

PP chamber furnace

up to 850 °C

The chamber furnace for heat treatment of 3D components produced by additive manufacturing technology which will ensure a process for correct metallurgical properties of metallic alloy. The furnace with ideal temperature distribution and forced air circulation offers suitable conditions for annealing, soft annealing, hardening, tempering and artificial ageing.

Processed material type:

Aluminium

High-strength Steel

Stainless Steel

Cobalt-Chromium

STEEL COMPONENTS AND COBALT-CHROMIUM ALLOYS

Steel components and nickel and cobalt-chromium alloys produced using the AM technology are processed in protective atmosphere at max. temperature 850 °C.

PP furnaces up to 850 °C are suitable for thermal processing of metals such as annealing, solution annealing, soft annealing, tempering and hardening. It is possible to change a standard furnace into the variant with protective atmosphere intake by using a protective gas box.

Examples of platform max. dimensions (mm)	Furnace type
100x100	PP 40/85
200x200	PP 70/85
280x280	PP 140/85
400x400	PP 270/85
550x550	PP 540/85



PP 140 furnace with protective gas box

Technical specification:

Furnace type	Tmax	Tmax for long-term operation	Volume	External dimensions (w×h×d)	Internal dimensions (w×h×d)	Gas box internal dimensions (w×h×d)	Input*	Weight	Protection**	Voltage	Max. floor load
	°C	°C	l	mm	mm	mm	kW	kg		V	kg
PP 40/85	850	800	35	850×1450×1050	300×300×400	220×160×250	7,0	200	20/3	400	50
PP 70/85	850	800	70	900×1550×1150	350×400×500	270×260×350	9,0	250	20/3	400	80
PP 140/85	850	800	135	1000×1650×1250	450×500×600	320×340×400	14,0	350	25/3	400	150
PP 270/85	850	800	270	1200×1750×1650	600×600×750	470×460×550	20,0	580	40/3	400	240
PP 540/85	850	800	540	1350×1950×1800	750×800×900	620×610×700	30,0	850	50/3	400	500

* Fan motor power of the PP 20 is 0,25 kW. For PP 40-140, all temperatures, and PP 270/65 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.

STANDARD FURNACE EQUIPMENT

- Gas box with protective atmosphere automatic intake
- Ht205 controller
- HtMonit set (include furnace monitoring software + interface)
- Automatically controlled protective atmosphere intake for single type of gas (one flow meter)
- “K” type control thermocouple + Ht40B displaying unit
- “K” type charge thermocouple + Ht40B displaying unit
- Furnace control switching between the control and charge thermocouples
- Door controlled manually opening towards the right-hand side
- One shelf (for PP / 650 °C)
- Manually controlled ventilation chimney
- Free-standing variant
- Stainless steel muffle
- Stainless steel circulation insert with long service life
- Limit switch for safe opening of the furnace

OPTIONAL ACCESSORIES AVAILABLE FOR AN EXTRA CHARGE

- HtMonit EV set (include furnace monitoring software + interface)
- Three- or four-colour beacon
- Automatic intake and exhaust flap (recommended)
- Manual intake and exhaust flap
- Controlled/uncontrolled vacuum forced cooling
- Circulation fan adjustable speed
- Door manual opening upwards
- Automatic door opening (pneumatic)
- Door opening towards the left
- Door electric lock
- Switchboard cooling
- Roller track
- Optimisation of the temperature field for DIN 17052-1 ΔT 20 °C in the internal usable space (in an empty furnace at Tmax)
- Digital temperature recorder (controller and recorder are located in custom control panel on side of furnace)
- Pulling out hook with length of 750 mm or 1000 mm
- Protective atmosphere automatic intake for two different quantities of gas (two flow meters) – it is recommended
- Charging trolley
- Cooling table



Protective atmosphere automatic intake



Ht 205 and Ht40B PID



Ventilation chimney, automatic flap

K chamber furnace

up to 1300 °C

The chamber furnace for heat treatment of 3D components produced by additive manufacturing technology which ensures a process for correct metallurgical properties of metallic alloy. We design the chamber furnaces as very durable equipment for hardening, annealing, solution annealing or internal stress relieving under protective atmosphere. Heating from five sides, meanwhile, is a guarantee of even heat distribution within the operating area.

Processed material type:

Stainless steel

Nickel alloys

Cobalt-Chromium alloys

STEEL COMPONENTS, NICKEL AND COBALT-CHROMIUM ALLOYS

Steel components, nickel and cobalt-chromium alloys produced using the AM technology are processed in protective atmosphere at a temperature up to 1100 °C or up to 1300 °C without a box with protective atmosphere intake.

The K furnaces are suitable for heat treatment of metals such as e.g. annealing, solution annealing, soft annealing, tempering, curing and internal stress relieving. It is possible to change a standard furnace into the variant with protective atmosphere intake by using a protective box.

Examples of platform max. dimensions (mm)	Furnace type
100x100	K 40/13
250x250	K 120/13
400x400	K 216/13
420x520	K 500/13
400x800	K 715/13



K 120 furnace

Technical specification:

Furnace type	Tmax	Tmax with gas box	Volume	External dimensions (w×h×d)	Internal dimensions (w×h×d)	Gas box internal dimensions (w×h×d)	Input	Weight	Protection	Voltage	Max. floor load
	°C	°C	l	mm	mm	mm	kW	kg		V	kg
K 40/13	1300	1100	40	945×1470×1020	350×350×350	170×170×170	9	170	16/3	400	50
K 120/13	1300	1100	120	1080×1480×1120	500×500×500	350×350×350	15	350	25/3	400	80
K 216/13	1300	1100	216	1250×1600×1250	600×600×600	450×400×450	20	400	40/3	400	120
K 500/13	1300	1100	490	1460×1825×1460	650×1000×750	500×750×600	40	770	80/3	400	300
K 715/13	1300	1100	715	1460×1825×1950	650×1000×1100	500×750×950	60	990	100/3	400	400

Subject to technical changes.

STANDARD FURNACE EQUIPMENT

- Gas box with protective atmosphere automatic intake
- Ht205 controller
- HtMonit EV set (include furnace monitoring software + interface)
- Automatically controlled protective atmosphere intake for single type of gas (one flow meter)
- “K” type control thermocouple + Ht40B displaying unit
- “K” type charge thermocouple + Ht40B displaying unit
- Furnace control switching between the control and charge thermocouples
- Door controlled manually opening towards the right-hand side
- Manually controlled ventilation chimney
- Free-standing variant



Protective gas box

OPTIONAL ACCESSORIES AVAILABLE FOR AN EXTRA CHARGE

- Three- or four-colour beacon
- Automatic intake and exhaust flap (recommended)
- Manual intake and exhaust flap
- Controlled/uncontrolled vacuum forced cooling
- Door automatic opening towards the top (pneumatically)
- Door electric lock
- Door opening towards the left
- Switchboard cooling
- Optimisation of the temperature field for DIN 17052-1 ΔT 20 °C in the internal usable space (in an empty furnace at Tmax)
- Digital temperature recorder (controller and recorder are located in custom control panel on side of furnace)
- Pull out hook with length of 750 mm or 1000 mm
- Protective atmosphere automatic intake for two different quantities of gas (two flow meters) – it is recommended
- Charging trolley
- Cooling table



Programmable PID Ht205



Ventilation flap

PKRC gastight chamber furnace

up to 950 °C

Gastight furnaces with internal atmosphere circulation for precise temperature distribution. They are used especially for heat treatment of materials in the defined protective atmosphere (argon, nitrogen, moulding gas etc.) even with low consumption of protective gas up to max. temperature of 950 °C. Above all annealing, tempering, curing, internal stress relieving, etc. are included.

Processed material type:

Titanium

Nickel alloys

TITANIUM AND NICKEL ALLOYS

Titanium parts manufactured by AM technology, which are processed in a protective atmosphere at temperatures up to 800 °C. AM nickel alloys processed to relieve stress at 890 °C.

PKRC furnaces are equipped with a hot-wall retort, protective atmosphere inlet and vacuum pump. They are suitable for heat treatment of metals and due to the circulation of the inner atmosphere they are characterized by excellent temperature distribution.

Examples of platform max. dimensions (mm)	Furnace type
200x200	PKRC 55/95
300x300	PKRC 180/95
300x500	PKRC 350/95
400x400	PKRC 350/95
400x800	PKRC 350/95



PKRC 55 gastight chamber furnace

Technical specification:

Furnace type	Tmax	Tmax for long-term operation	Volume	External dimensions (w×h×d)	Internal dimensions (ød×h)	Retort operational dim. with a shelf** (w×h×d)	Input	Weight	Protection*	Voltage	Max. floor load
	°C	°C	l	mm	mm	mm	kW	kg		V	kg
PKRC 55/95	950	900	24	1400×1830×1450	267×410	225×135×410	13	600	25/3	400	150
PKRC 180/95	950	900	83	1700×1960×1670	412×620	325×245×620	29	1100	50/3	400	200
PKRC 350/95	950	900	225	1915×2080×2005	544×900	450×290×900	50	1380	80/3	400	300

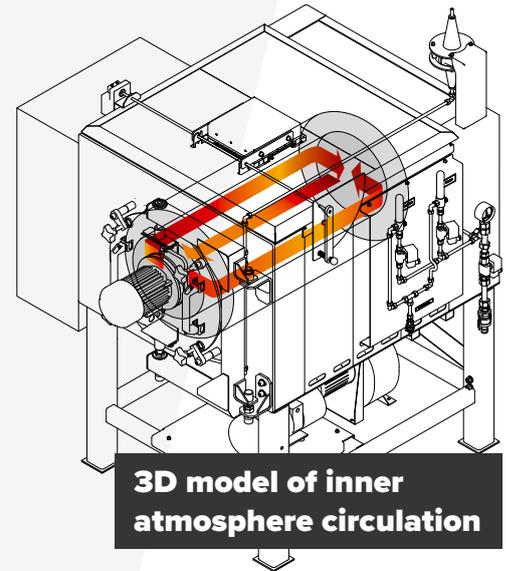
* Protection may vary according to the optional accessories selected.

** These dimensions are variable with respect to a retort circular cross section.

Subject to technical changes.

STANDARD FURNACE EQUIPMENT

- Ht205 controller
- HtMonit EV set (include furnace monitoring software + interface)
- Heating spirals on ceramic tubes outside the furnace's operational space
- Door sealing
- Manually controlled ventilation and suction flaps for cooling space outside of the retort
- Door manually opened towards the side
- Limit unit
- Automatically controlled intake of protective atmosphere for one type of gas (one flow meter)
- Manovacuumeter for checking overpressure in the retort
- Vacuum pump for atmosphere exhaustion from the retort in cold conditions
- Adapter for connecting a G ½" rubber hose to the cooling of the collar
- Thermistor for checking the temperature of the flange and detection of coolant presence in the collar of the retort
- Overpressure safety valve for releasing protective gas from the retort with an overpressure of 4–6 mbar
- Ammeters for checking the state of the heating elements (numbers based on number of phases connected to the heating)
- "K" type control thermocouple + Ht40B displaying unit
- "K" type charge thermocouple + Ht40B displaying unit
- Furnace control switching between the control and charge thermocouples
- Contactless switching relay for noise-free operation
- Limit switch for safe opening of the furnace
- Free-standing variant



OPTIONAL ACCESSORIES AVAILABLE FOR AN EXTRA CHARGE

- Replacement retort made of refractory stainless steel
- Controlled forced cooling (cooling along a selected cooling curve)
- Automatic intake and exhaust flap (recommended)
- Optimisation of the temperature field for DIN 17052-1 ΔT 20 °C in the internal usable space (in an empty furnace at Tmax)
- Digital temperature recorder (controller and recorder are located in custom control panel on side of furnace)
- Second gas automatic supply
- Three-colour beacon
- Four-colour beacon with siren

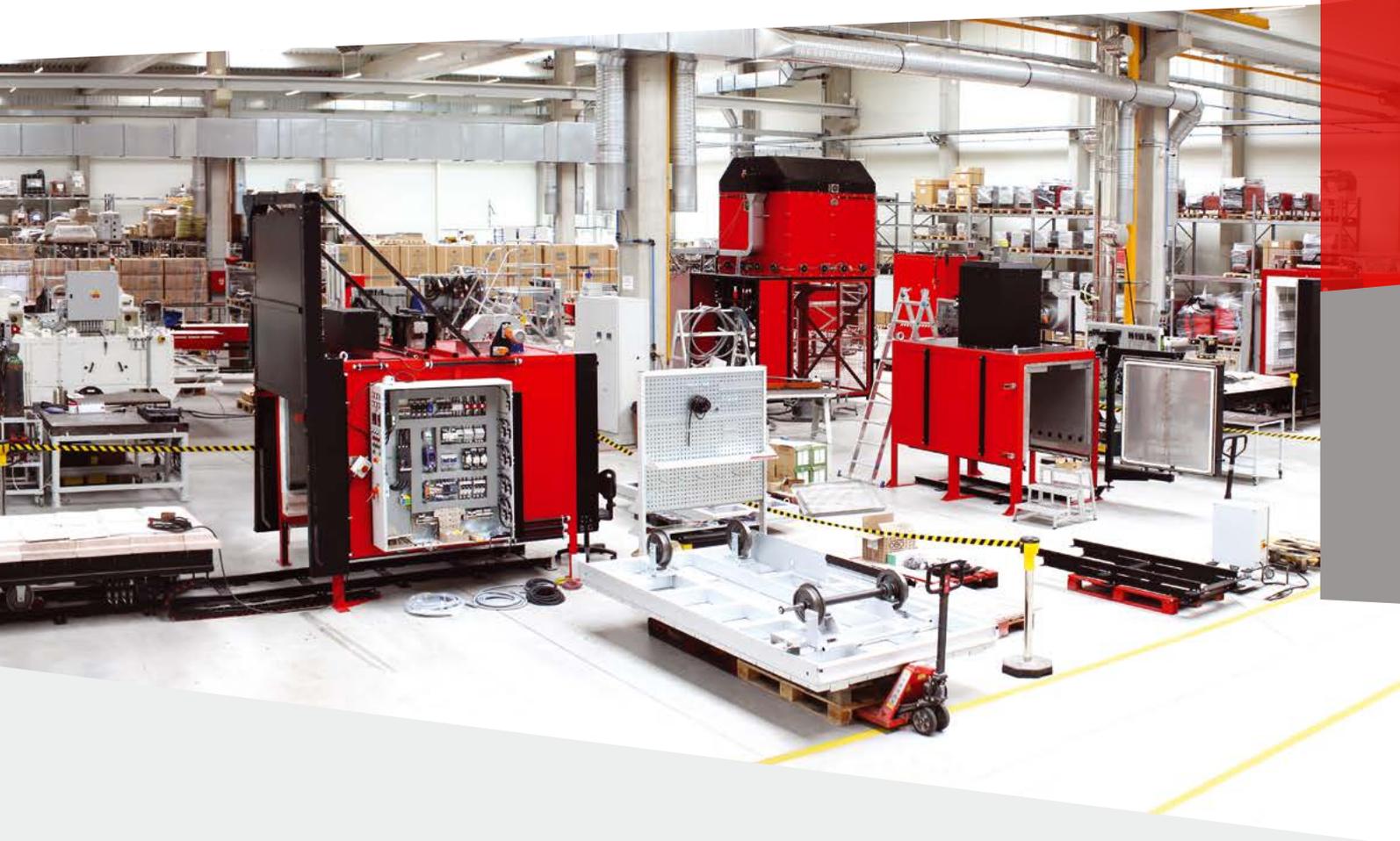


RECOMMENDED FURNACE SELECTION FOR METALLIC MATERIALS USED AT MANUFACTURING USING THIS TECHNOLOGY

Material	MATERIAL TYPE	Type of heat treatment	Recommended furnaces and accessories
Tool Steel	18 Mar 300 / 1.2709	Artificial ageing 490 °C 6 h, air circulation	PP furnace with forced air circulation, protective gas box p. 8
	Stainless steel 17-4 / 1.4542	Relieving of internal stress 650 °C 1 h	PP furnace with forced air circulation, protective gas box, N2 supply p. 8
1. Solution annealing 1040 °C 30 min, cooling with air below 32 °C		K furnace, protective gas box, Ar supply, cooling table p. 10	
Stainless Steel	Hardenable stainless steel 15-5 / 1.4540	2. Artificial ageing 460 °C 1 h, cooling with air below 32 °C	PP furnace with forced air circulation p. 8
		Hardening 525 °C 4 h	PP furnace with forced air circulation, protective gas box, N2 supply p. 8
Stainless Steel	1.4404 / UNS S31673	Relieving of internal stress 650 °C 1 h	PP furnace with forced air circulation, protective gas box, N2 supply p. 8
	1.44.4 / UNS S31673	Relieving of internal stress	PP furnace with forced air circulation, protective gas box, N2 supply p. 8
Stainless Steel	Tooling grade steel	Solution annealing 850 °C 30 min, N2, cooling with air	PP furnace with forced air circulation, protective gas box, N2 or Ar supply, cooling table p. 8
		Artificial ageing 525-600 °C 4 h, N2	
Stainless Steel	Stainless steel 17-4PH / 1.4542 / X5CrNiCuNb17-4 ASTM F899-12b	Relieving of internal stress 650 °C 1 h	PP furnace with forced air circulation, protective gas box, N2 supply p. 8
		1. Solution annealing 1040 °C 30 min, cooling with air below 32 °C	K furnace, protective gas box, Ar supply, cooling table p. 10
Stainless Steel	Stainless steel 17-4PH / 1.4542 / X5CrNiCuNb17-4 ASTM F899-12b	2. Artificial ageing 460 °C 1 h, cooling with air below 32 °C	PP furnace with forced air circulation p. 8
Nickel Alloys	Inconel™ 718, UNS N07718, AMS 5662, mat. # 2.4668	Solution annealing 980 °C 1 h, Ar, cooling with air	K furnace, protective gas box, Ar supply, cooling table p. 10
		Artificial ageing 720 °C 8 h, Ar cooling to 620 °C within 2 h, holding for 8 h, Ar	K furnace, protective gas box, Ar supply, cooling table p. 10
Nickel Alloys	Inconel™ 625, UNS N06625, AMS 5666F, mat. # 2.4856 etc.	Relieving of internal stress 890 °C air circulation	PKRC retort furnace with hot wall p. 12
		Solution annealing 1090-1200 °C cooling	K furnace, cooling table p. 10
Nickel Alloys	UNS N06002	Annealing 950-1000 °C cooling	K furnace, cooling table p. 10
		Solution annealing 1177 °C 1 h, air quick cooling with air under 60 °C	K furnace p. 10
Cobalt-Chromium	CoCrMo super alloys, UNS R31538, ASTM F75	Relieving of internal stress 1150 °C 6 h, Ar	K furnace, protective gas box, Ar supply p. 10
	CoCrMo super alloys	Relieving of internal stress 750 °C 1 h, Ar	PP furnace with forced air circulation, protective gas box, Ar supply p. 8
Cobalt-Chromium	CoCrMo super alloys	Relieving of internal stress 750 °C 1 h, Ar	PP furnace with forced air circulation, protective gas box, Ar supply p. 8
	Ti64 Ti6Al4V light metal	Relieving of internal stress 800 °C 2-4 h, Ar	PKRC retort furnace with hot wall, Ar supply, vacuum pump p. 12
Titanium	Ti6Al4V ELI	Relieving of internal stress 800 °C 2-4 h, Ar	PKRC retort furnace with hot wall, Ar supply, vacuum pump p. 12
	TiCP Grade 2, 3.7035, ASTM F67 (UNS R50400), (ISO5832-2)	Relieving of internal stress 800 °C 2-4 h, Ar	PKRC retort furnace with hot wall, Ar supply, vacuum pump p. 12
Aluminium	AlSi10Mg light metal	Relieving of internal stress 300 °C 2 h	PP furnace with forced air circulation p. 6
	AlSi7Mg0,6 light metal	Relieving of internal stress 300 °C 2 h	PP furnace with forced air circulation p. 6
Refractory Metals	Pure tungsten	Austenitization annealing, annealing, hardening	Consult the LAC representative
	Cr-C tool steel	Austenitization annealing, annealing, hardening	Consult the LAC representative



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