



AMP

Heat Treatment Technologies

www.amphtt.com

AMP Sp. z o.o. is an innovative company created upon a solid framework of experienced engineering and sales personnel. Since its establishment the company has been focused on manufacturing equipment for heat and surface treatment of metals as well as PVD and CVD technologies. In our proposals we employ the best engineering and technological solutions available while at the same time supporting them with long-standing professional experience of our employees and the ingenuity of our engineers. Our knowledge and experience are supported with Autodesk Inventor Professional software which permits 3D parametric designs as well as FEM analysis.



Our product range incorporates furnaces and equipment for the following applications:

- vacuum furnaces
- atmospheric furnaces
- atmosphere generators
- furnaces for thermo-chemical treatment
- industrial washers using eco-friendly washing agents.

We are a reliable supplier of metal heat treatment equipment. We ensure well-proven technical solutions based on components of recognized manufacturers and compliant with the latest global trends and standards. All equipment supplied to aircraft manufacturers is made in adherence to the regulations AMS2750 and BAC while the procedures effected through that equipment are NADCAP approved.

Our equipment can be applied in the following technologies:

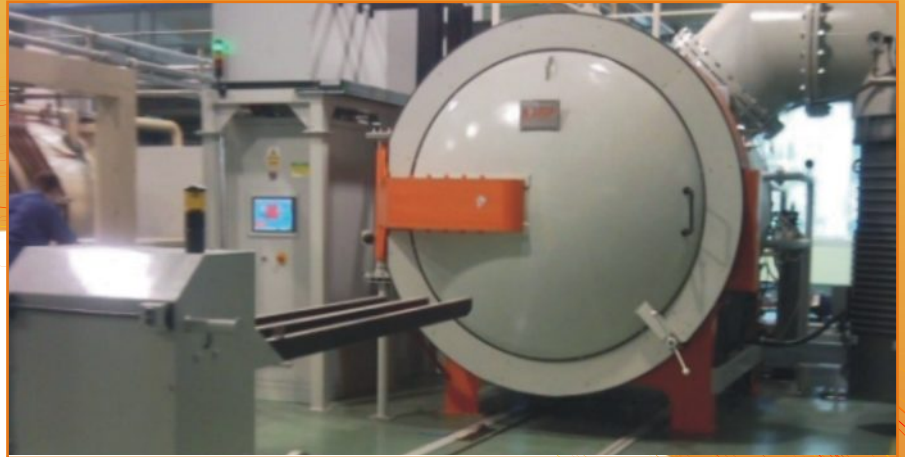
- vacuum quenching
- sintering
- toughening
- hardening
- tempering
- annealing
- degassing and dehydrogenation
- washing and degreasing.



Horizontal Vacuum Furnace series HVF



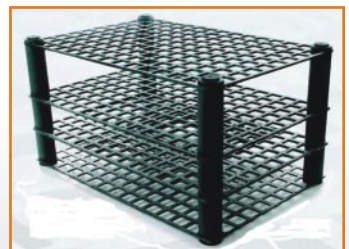
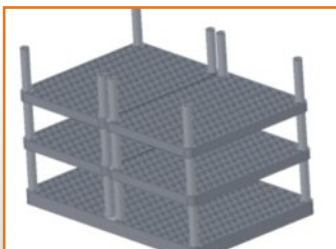
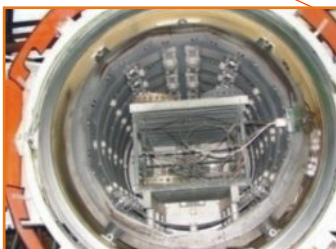
The series of horizontal vacuum furnaces is adjusted to suit the standards of aircraft, automotive and tool industries. Optionally, your furnace may be equipped with a high vacuum system, convection heating and cooling in 0.5, 6, 10, 12, 16 to 20 bar cooling gas overpressure of nitrogen, argon, hydrogen, helium atmospheres or mixtures thereof. An adequately selected set of pumps ensures a vacuum level from 5×10^{-1} mbar to 5×10^{-8} mbar. Heat treatment temperatures range up to 3000°C .



Horizontal vacuum furnace series

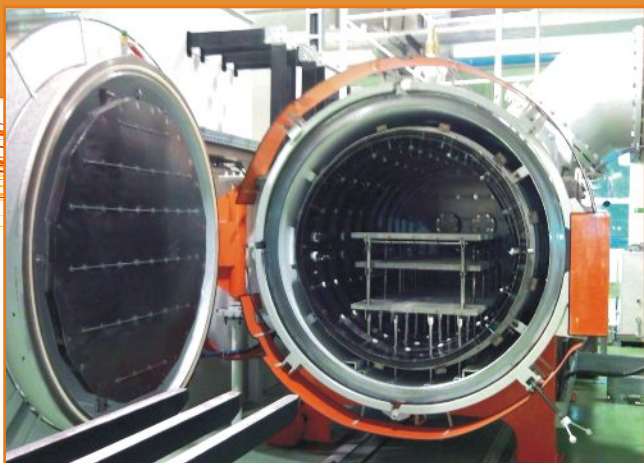
Model	Useful area W x H x L [mm]	Workload weight [kg]
HVF 30/30/60	300 x 300 x 600	150
HVF 45/45/60	450 x 450 x 600	250
HVF 60/60/90	600 x 600 x 900	600
HVF 90/90/125	900 x 900 x 1250	1500
HVF 90/90/155	900 x 900 x 1550	1800
HVF 90/90/185	900 x 900 x 1850	2000
HVF 120/120/155	1200 x 1200 x 1550	2500
HVF 120/120/185	1200 x 1200 x 1850	3000
HVF 140/140/185	1400 x 1400 x 1850	3500
HVF 140/140/280	1400 x 1400 x 2800	5000

AMP may deliver a furnace for customer-specified workload dimensions.



Graphite heating chamber

Here at AMP we have developed graphite insulation of heating chamber based on a monocyliner made of graphite felt and graphite foil. The combination of those two materials created a new insulating composite which surpasses the traditional insulating packs based on polygonal construction. AMP solution permits energy saving and guarantees temperature uniformity from $\pm 2^{\circ}\text{C}$. The heating element is made of light bent graphite strips. Large radiation surface ensures high dynamics of heating and proper temperature distribution.



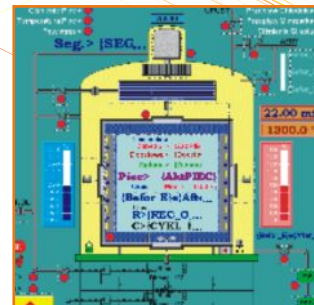
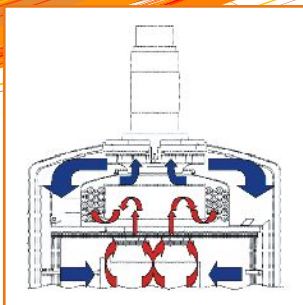
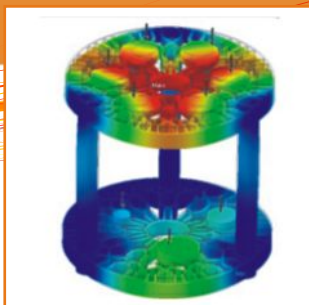
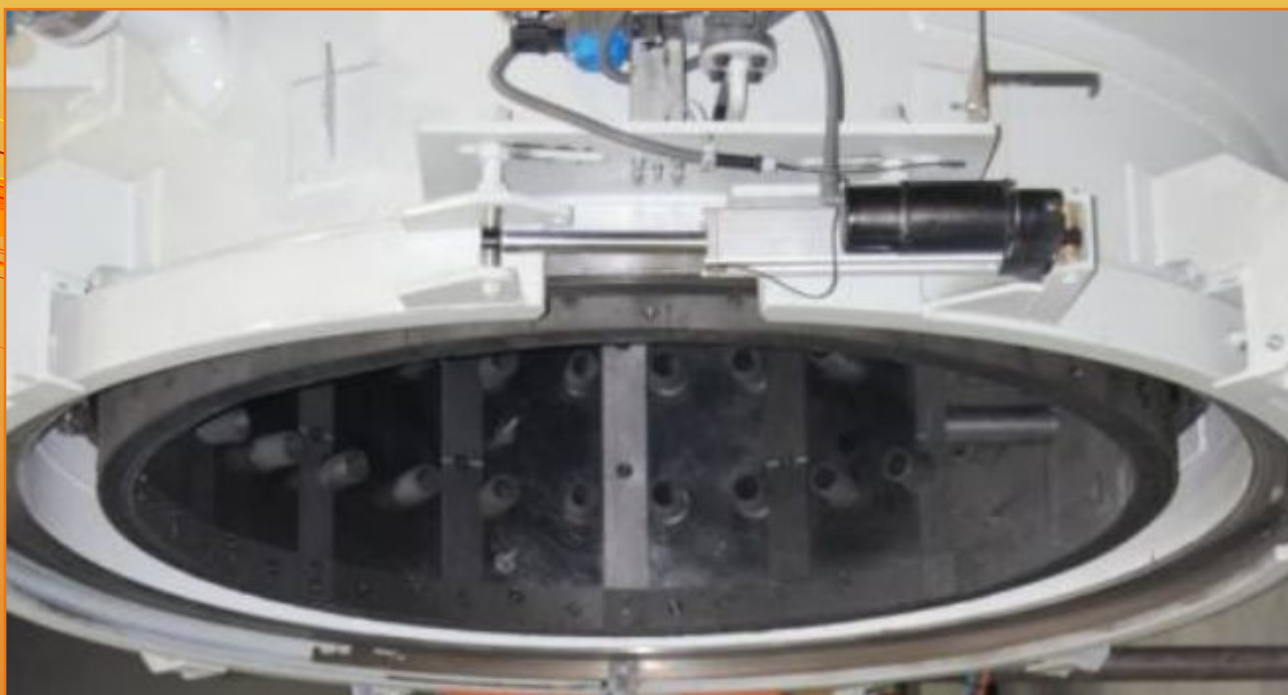
Molybdenum heating chamber

A molybdenum heating chamber is used where high purity of treatment is required as well as in applications with high and ultra high vacuum. The insulation pack consists of a few layers of thin sheets of extended resistance to temperature and 2 – 3 layers of molybdenum sheets. For certain applications the sheets feature an addition of Lanthal. In order to increase their life-span they are lined with a 1 mm thick layer of graphite foil. The heating element is made of molybdenum of increased recrystallization resistance (alloy addition of La). Lengthwise fluting is provided in order to stiffen each heating element.



Vertical Vacuum Furnace series VVF

The series of vertical vacuum furnaces is adjusted to suit the standards of aircraft, automotive and tool industries. Optionally, your furnace may be equipped with a high vacuum system, convection heating and cooling in 0.5, 6, 10, 12, 16 and even 20 bar cooling gas overpressure of nitrogen, argon, hydrogen, helium atmospheres or mixtures thereof. An adequately selected set of pumps ensures a vacuum level from 5×10^{-1} mbar to 5×10^{-8} mbar. Working heat treatment temperature ranges from 120°C up to 3000 °C.



Vertical vacuum furnace series

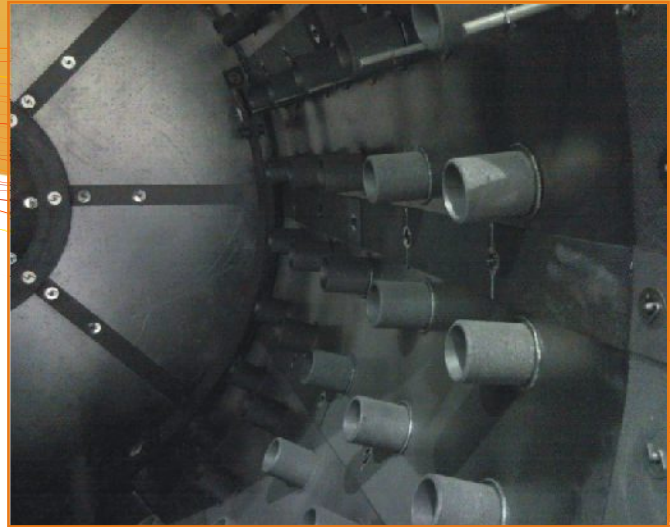
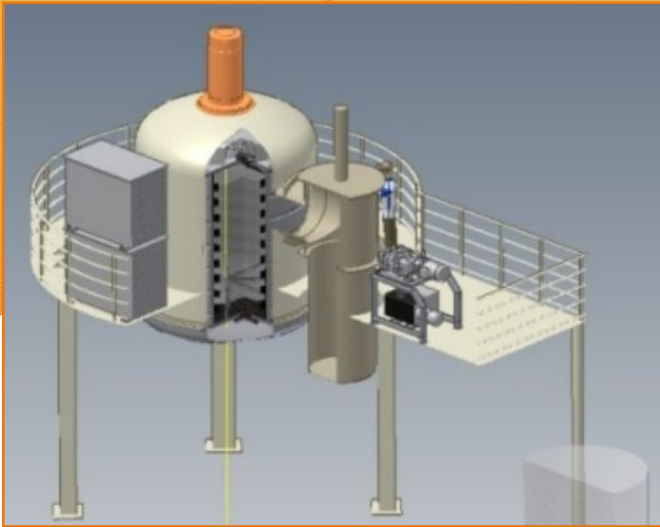
Model	Useful area Ø x H [mm]	Workload weight [kg]
VVF 30/60	300 x 600	100
VVF 60/90	600 x 900	600
VVF 90/125	900 x 1250	1200
VVF 90/150	900 x 1500	1500
VVF 125/125	1250 x 1250	2000
VVF 125/150	1250 x 1500	2300
VVF 125/185	1250 x 1850	2800
VVF 150/150	1500 x 1500	3000
VVF 150/185	1500 x 1850	3500
VVF 220/220	2200 x 2200	4000



Vertical Vacuum Furnace series VVF

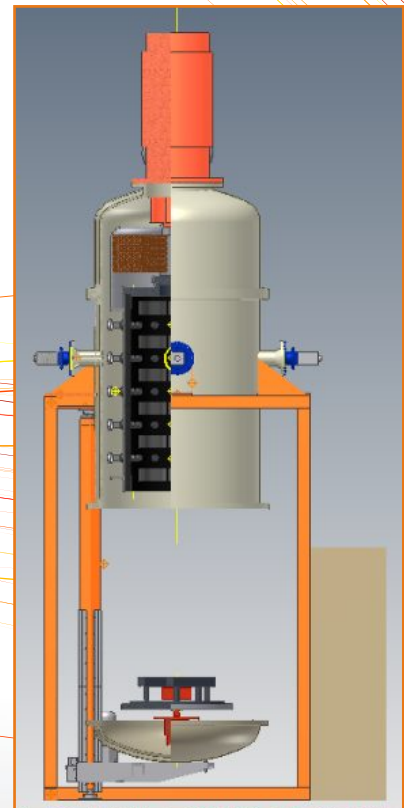
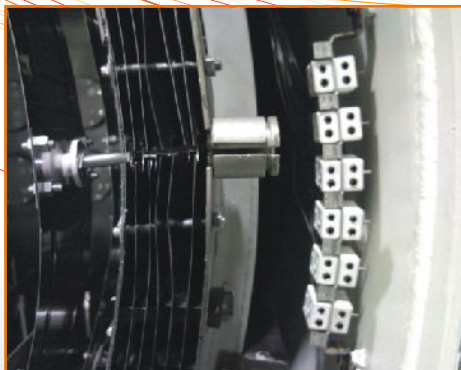
Graphite heating chamber

In an attempt to meet the requirements of contemporary heat treating technology, here at AMP we have developed graphite insulation of heating chamber based on a monocylinder made of graphite felt and graphite foil. The combination of those two materials resulted in a new insulating composite which surpasses the traditional insulating packs based on polygonal construction. Our solution permits energy saving and guarantees temperature uniformity from $\pm 2^\circ\text{C}$. The heating element is made of light bent graphite strips while large radiation surface ensures high dynamics of heating and proper temperature distribution.



Molybdenum heating chamber

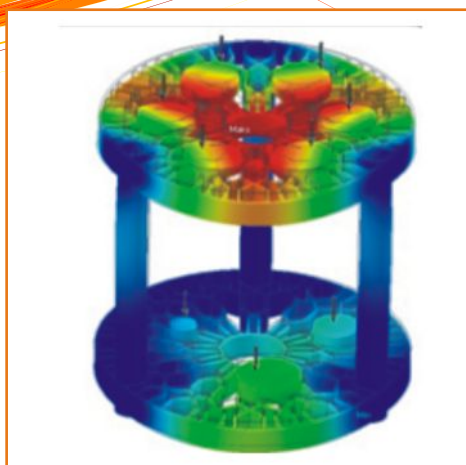
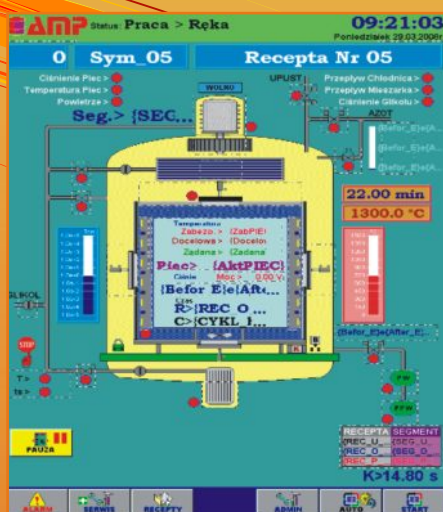
A molybdenum heating chamber is used where high purity of treatment is required as well as in applications with high and ultra high vacuum. The insulation pack consists of a few layers of thin sheets of increased resistance to temperature and two or three layers of molybdenum sheets. For certain applications the sheets feature an addition of Lanthanum. In order to increase their life-span they are lined with a 1 mm thick layer of graphite foil. The heating element is made of molybdenum of increased recrystallization resistance (alloy addition of La). Lengthwise fluting is provided in order to stiffen each heating element.



Process control system.

Our process control system is based on a high class logic controller integrated with an operator's touch panel designed for industrial working conditions. The control systems features a few access levels, which enables an arbitrary configuration of treatments. Visualization of events and alarms permits a hands-free operation. The AMP systems has a provision for remote control and maintenance of the equipment from any computer logged on to the Internet, Ethernet or likewise network.

AMP designs and manufactures their equipment in compliance with the standards specified by the customer. These standards include: PN/EN, NEMA, NFPA, BAC5621, SAE AMS 2750D, SAE AMS 2769, BAC 5617, GAMPS 5101, P.S. 15000, MMC282 and others. All equipment made to aviation industry standards are ready to handle treatments in accordance with the requirements of NADCAP.



Workload fixtures

Every AMP furnace may be equipped with workload fixtures on as required basis. Workload trays or hearth may be made of CFC composite, heat resistant steel or molybdenum. All fixtures are selected to suit individual requirements of the customers and their strength is optimized through the design and calculation system MES.



Horizontal Atmosphere Furnaces series EF, HAF

Our series of horizontal atmosphere furnaces is available in a few types which differ in their design and application, i.e.:

- Chamber furnaces with protective or carburizing atmosphere or without atmosphere
- Car-bottom hearth furnaces with or without protective atmosphere
- Horizontal atmosphere furnaces with forced convection heating.

Working temperature depends on a the requirements of a particular heat treatment i.e.:

- quenching, carburizing: 750 .°C to 1300 .°C
- tempering, nitriding: 150 .°C to 750 °C.

There is a choice of electric or gas heating available for horizontal atmosphere furnaces.





Horizontal atmosphere furnace series

Model	Useful area W x H x L [mm]	Workload weight [kg]
*EF..**HAF 30/30/60	300 x 300 x 600	150
*EF..**HAF 45/45/60	450 x 450 x 600	250
*EF..**HAF 60/60/90	600 x 600 x 900	600
*EF..**HAF 90/90/125	900 x 900 x 1250	1500
*EF..**HAF 90/90/155	900 x 900 x 1550	1800
*EF..**HAF 90/90/185	900 x 900 x 1850	2000
*EF..**HAF 120/120/155	1200 x 1200 x 1550	2500
*EF..**HAF 120/120/185	1200 x 1200 x 1850	3000
*EF..**HAF 140/140/185	1400 x 1400 x 1850	3500
*EF..**HAF 140/140/280	1400 x 1400 x 2800	5000

AMP may deliver a furnace for customer-specified workload dimensions.

*EF – furnace with car-bottom hearth, **HAF – horizontal chamber furnace.



Vertical Atmosphere Furnaces series VAF

Our series of vertical atmosphere furnaces is available in a few types which differ in their design and application, i.e.:

- Retort furnaces with protective or carburizing atmosphere or without atmosphere
- Furnaces without a retort, with or without protective atmosphere
- Vertical atmosphere furnaces with forced convection heating.

Working temperature depends on the requirements of a particular heat treatment i.e.:

- quenching, carburizing: 750 °C to 1300 °C
- tempering, nitriding: 150 °C to 750 °C
- retort furnaces may feature vacuum purging.

Vertical atmosphere furnace series

Model	Useful area Ø x H [mm]	Workload weight [kg]
VAF 30/60	300 x 600	100
VAF 60/90	600 x 900	600
VAF 90/125	900 x 1250	1200
VAF 90/150	900 x 1500	1500
VAF 125/125	1250 x 1250	2000
VAF 125/150	1250 x 1500	2300
VAF 125/185	1250 x 1850	2800
VAF 150/150	1500 x 1500	3000
VAF 150/185	1500 x 1850	3500
VAF 220/220	2200 x 2200	4000

AMP may deliver a furnace for customer-specified workload dimensions.



Pyrolysis, PVD and CVD technologies

AMP makes every effort to meet the expectations of the market. Furthermore, we look way ahead into the future by implementing new technologies and equipment. One of such items of equipment is an industrial furnace for manufacturing of pyrolytic graphite (PG and HOPG) and PG coats. This is a vacuum furnace of working temperature 3000 °C and working pressure 3×10^{-3} mbar. Its cylindrically shaped heating chamber has a single graphite hot zone. Insulation is also made of graphite. The furnace may operate in hydrogen and argon atmosphere. Both the equipment and related technology were entirely developed by AMP.



The main characteristics of pyrolytic graphite are: chemically inert, high purity (99.999 %); durable up to 500 °C in air, up to 2500 °C in 0.1 torr vacuum, up to 3500 °C in atmosphere (Ar, He, N); impermeable; non-dusting; resistant to thermal shock; easily machined.

Pyrolytic graphite is widely applied in electronics, biomedicine, chemical industry, nuclear industry, rocket jet nozzles, nanotechnology, precision heating technology, semi-products such as plates and tubes, coatings (10-100 µm) on ceramic, graphite or metal base.



SINTER and SINTER – HIP Technologies

Vacuum furnaces designated for sintering provide an option of running three technologies within one cycle. In the first stage the workpieces are dewaxed, then sintered in high temperature. In order to improve mechanical properties of the sinters, they can be isostatically compacted in high pressure while the high temperature of treatment is maintained.

Distinctive features of sintering furnaces:

Pressure: 0-150 bar
Vacuum: 10-2 mbar
Temperature: 1500 °C to 2200 °C
Useful area: customized
Workload position: horizontal or vertical.



Heating chamber:

A standard heating chamber is made of graphite felt lined with 5 mm thick graphite foil. The chamber contains a graphite cylinder which holds the main treatment. Graphite heaters are placed between the graphite foil and the cylinder. Process gas is deflected in such a way as to penetrate the interior of the cylinder behind the workload.



Process gases:

The AMP system permits application of various process gases from partial pressure to furnace maximum working pressure. AMP allows such gases as: nitrogen, argon, hydrogen, methane and other hydrocarbons. Mixing and proportioning of these gases may be controlled with rotameters or mass valves.

Pre-treatment workload washing technologies

Following the EC Directive 1999/13/EC, whose objective was to limit emissions of volatile organic compounds, and due to being highly detrimental to ozone layer as well as due to its period of retention in the earthly atmosphere, the 1,1,1-trichloroethane (commonly known as TRI) has been totally withdrawn from use.

TRI was widely used in industrial washing procedures, while its feature of complete and traceless evaporation from the workpieces being washed earned it an opinion of a very good chemical used in washing workloads before heat treatment.

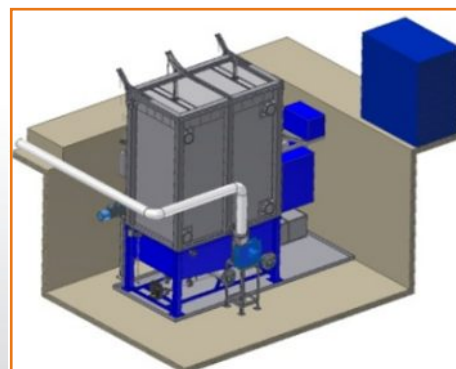
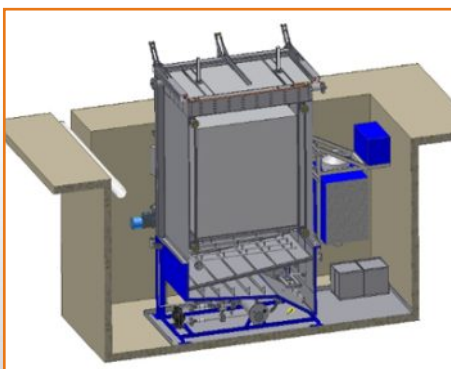
In an attempt to meet market demand AMP designed and manufactured an industrial washer in which n-Propyl Bromide, available under commercial name of EnSolv, is used as a cleaning agent. This is the most common industrial substitute for the withdrawn TRI i TRI-derivative solvents.



Pre-treatment workload washing technology – washer EVC-100/200/200

Steam washer EVC-100/200/200 is vertically loaded. Its main components include:

- control cabinet
- washer's casing with allocated working space
- container for liquid washing agent
- heating elements
- safety barrier (separating liquid section from working section)
- vapour condenser in working section
- cover lid
- ice-water generator
- ENSOLVE vapours sensor
- liquid level gauge
- water separator
- filtering system
- anti-contamination tank
- vacuum distillation system
- circulating pumps
- ventilation system.





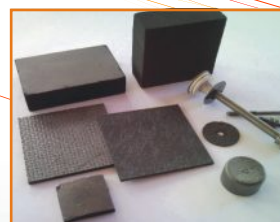
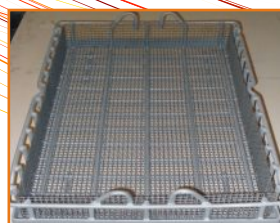
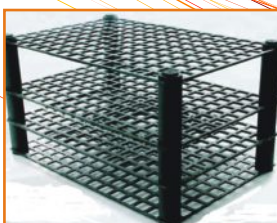
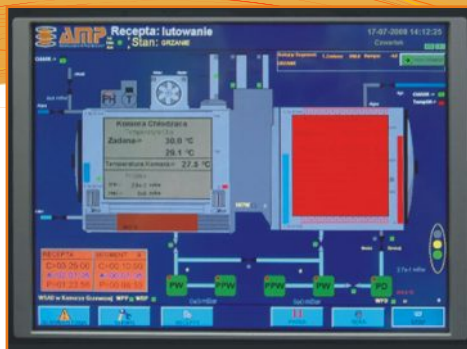
Service, Overhauls, Modernization, Spare Parts

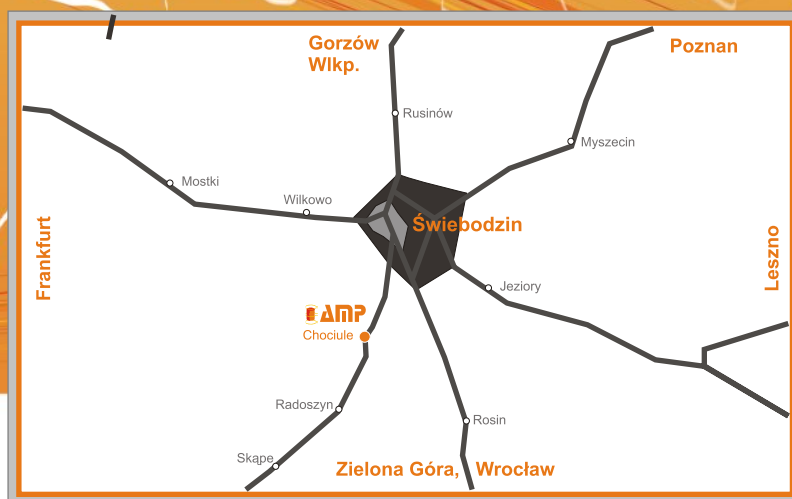
Service, Overhauls, Modernization, Spare Parts

Extensive overhauls and modernization of metal heat treatment equipment.

AMP offers a wide range of spare parts for heat treatment and thermochemical treatment equipment. The spare parts offered are manufactured of top quality materials and are characterised by long life span. The high quality of materials combined with competitive prices guarantee full satisfaction of our Customers.

Should you require any spare parts for the equipment you operate, please do not hesitate to contact our company.





AMP Sp.z o.o.
Chociule 36D, 66-200 Świebodzin
Poland

tel. +48 68 382 26 44, +48 68 382 26 48
fax +48 68 382 26 40
TIN: PL 927-183-92-80
e-mail: info@amphtt.com
www.amphtt.com

Representative