



AIR CYCLE ATT HVAC SYSTEMS

Free air energy





TRADITIONS OF ENGINEERING

The UPEC Industrial Group is one of Ukraine's largest private industrial companies, occupying a leading position in several product segments and in production of components for the largest OEMs in the CIS, uniting a number of leading manufacturing companies and engineering centres with more than a half of century history.

The company develops as a customer-focused engineering industrial group, which includes the largest Ukrainian bearing manufacturer HARP (Kharkov Bearing Plant), the leading manufacturer of heavy roll and cylindrical CNC- grinding machines - HARVERST (Kharkov Machine-Tool Plant), the largest in Ukraine and the CIS forging mechanical plant - LKMZ (Lozova Forging-Mechanical Plant), the manufacturer of electric motors and pumps - HELZ (Kharkov Electro-Technical Plant) and the steel and iron casting company ULK (Ukrainian Casting Company).

The UPEC develops and manufactures bearing units, electric motors, pumps and electric compressors, air-cycle HVAC systems, transmissions and chassis, agricultural machinery, as well as other machinery, equipment, units and components for the railway, automotive, agricultural, general, energy, defense and metallurgical industries.

The UPEC has a unique corporate system for concentration and implementation of engineering knowledge and innovations, which includes:

- the Joint Engineering R&D Centre;
- certification and research test centre and specialized laboratories;
- software environment for integrated automation of new development products (KSA);
- system of technology transfer, outsourcing and joint product development with R&D centres of the leading European engineering corporations;
- Specialized Engineering Centres for:
 - bearing industry (UKTBPP);
 - electrical engineering (SKB Ukrelectromash);
 - machine-tool industry (OKBShS);
 - transmissions and chassis (UKBTSh).

INNOVATIVE DEVELOPMENTS FOR SAVING OF THE EARTH RESOURCES



AIR TURBO TECHNOLOGY ENGINEERING CENTRE

Ecological problems, such as destruction of the ozone layer of the Earth and depletion of natural resources and continuous growth of energy costs, caused development of the new generation HVAC systems – energy efficient and environmentally friendly, operating on safe natural refrigerants such as air. In comparison with freon (and its analogues), air as a refrigerant has a lot of benefits: available, non-toxic, fire- and flame-proof, potentially applicable for direct cooling and heating of premises, no restrictions of its physical properties within the operating temperature range for all climate zones. Air in respect to ecological safety is fully correspond to all necessary requirements of the Montreal and Kyoto Protocols, and absolutely free of charge.

Know-how in the field of Air Cycle HVAC equipment and refrigerating machines is generated in the UPEC Air Turbo Technology Engineering Centre (ATT) under the leadership of Dr. Vartan Petrosyants, Laureate of the State Award of Ukraine in Science and Technology, Designer-in-chief.

Today the UPEC Industrial Group has completed the development and launches mass production of a completely new generation of ATT HVAC systems in the field of renewable energy, using air thermodynamic cycle instead of freon and other conventional refrigerants. This new product line:

- air cycle conditioners;
- air-to-air cycle heat pumps;
- combined reversable Air Cycle HVAC systems for air conditioning in summer and heating in winter, combined with ventilation;
- refrigerating machines for direct deep air cooling in the temperature range +15...-100°C.

New generation HVAC ATT technologies is based on fundamental thermodynamic principles and sophisticated mathematical simulations, combination of some ATT cycle know-how, unique technologies, and comprises of the most advanced components from several high-tech segments:

- highly efficient compressors;
- highly efficient turbines;
- high speed electric motors;
- air dynamic bearings;
- highly efficient air-to-air heat exchangers of a unique design;
- automatic control systems.

Ambient air is a perfect, environmentally friendly, renewable, and above all, free of charge energy source.

The combined ATT HVAC system is a fully variable reversible machine, which operates as an air conditioner in summer ($t = +27...+50^{\circ}\text{C}$) and as an air source heat pump in winter ($t = -50...+7^{\circ}\text{C}$). In both cases it is combined with ventilation and provides inflow up to 100% of fresh air. Besides, ATT Air Cycle HVAC system can be connected to water heating system and in this case it will provide air heating and hot water as well.

Green energy

What makes the technology developed at the UPEC unique is the usage of air as a refrigerant. This makes it possible to apply highly efficient open and combined cycles, within which air being cooled or heated after thermodynamic cycle inflows directly into premises providing simultaneous ventilation. All other systems provide cooling or heating of premises with application of an "external" refrigerant (freon, water, ammonia, CO_2 , etc.), which operates in the closed cycle and transfers energy through the heat exchanger walls. Only air is 100% environmentally friendly, 100% available and also 100% free of charge. Furthermore, due to the application of air bearings, there are no oils or greases in the system, which definitely positions the unit as an environmentally safe HVAC unit of "green energy".

Revolution in the HVAC technology

Another very important feature of ATT HVAC system, with air as a refrigerant, is its capability to operate within the ambient temperature range: $-50...+50^{\circ}\text{C}$, unlike conventional air source heat pumps and air conditioners, which have a significantly narrower temperature range and strictly limited capability to supply fresh air at an acceptable efficiency both in summer and winter. Depending on the ambient temperature, the ATT HVAC system heating efficiency (COP) is 2.8...4.2 and the cooling efficiency is 1.3...1.7 (with respect to humidity and ambient temperature), with fresh air supplied by ATT unit into premises (ventilation) up to 100% of fresh air! Moreover, the ATT HVAC system conversion and heating / cooling efficiency increase with a reduction of ambient temperature, while the same features of conventional units deteriorate significantly.



HI-TECH

All machines of ATT HVAC product line are based on fundamental thermodynamic principles and high precision mathematical simulations, as well as application of original air cycle and unique technologies, and involve advanced components from several hi-tech fields: high efficiency and high speed compressors and turbines, high speed electric motors, air bearings, high efficiency air-to-air heat exchangers of the original unique design, automatic control systems.

High energy performance of the ATT HVAC systems is ensured by high efficiency of the main components (compressors, turbines, motors), the unique gas-dynamic systems, design optimization of each component in harmonized operating for every mode (AC, AS HP, etc), low aerodynamic resistance of the air piping (air ducts, pipes, valves).

For example, the turbo compressor with adiabatic efficiency of 86% and the turbine with internal efficiency of 87% are used for the ATT 30/60. The turbo compressor rotor contains a built-in high-speed motor with efficiency of 92%, which charges from the frequency inverter with efficiency of 97...98%. Air bearings with mechanical efficiency of over 99% serve as rotor supports. Heat efficiency of the heat exchanger reaches 95% at resistance of up to 500 Pa.

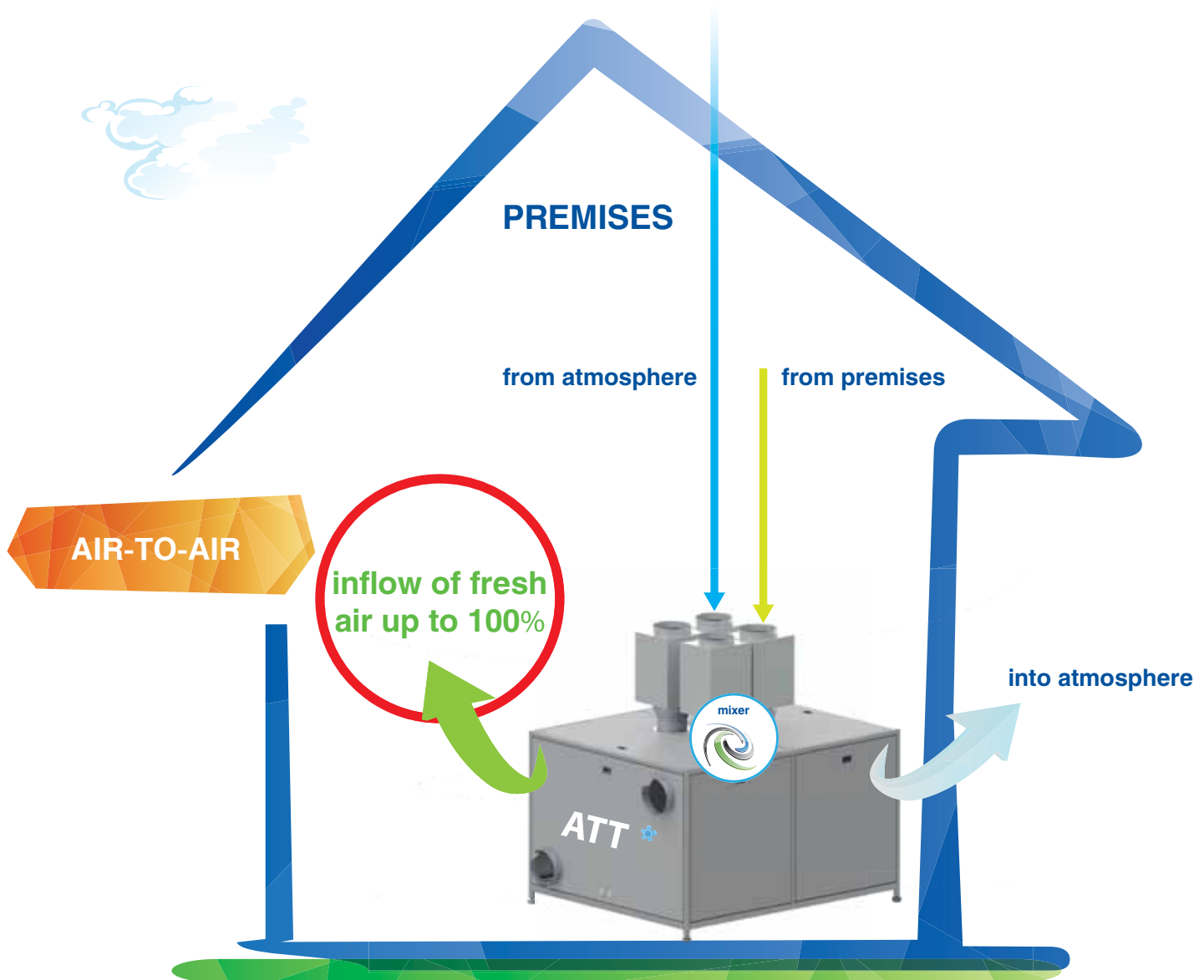


Additional high energy and economic benefits of the ATT HVAC system AC mode in summer are based on the second heat recovery circuit in a unified system of cooling, heating and water heating (e.g. water heating for pools or domestic needs). Moreover, total efficiency of power use in this case reaches 4.0.



OPERATING PRINCIPLE OF THE AIR CYCLE HVAC ATT SYSTEM

The air cycle HVAC ATT system can be supplied in two options: "air-to-air" and "air-to-water-air"



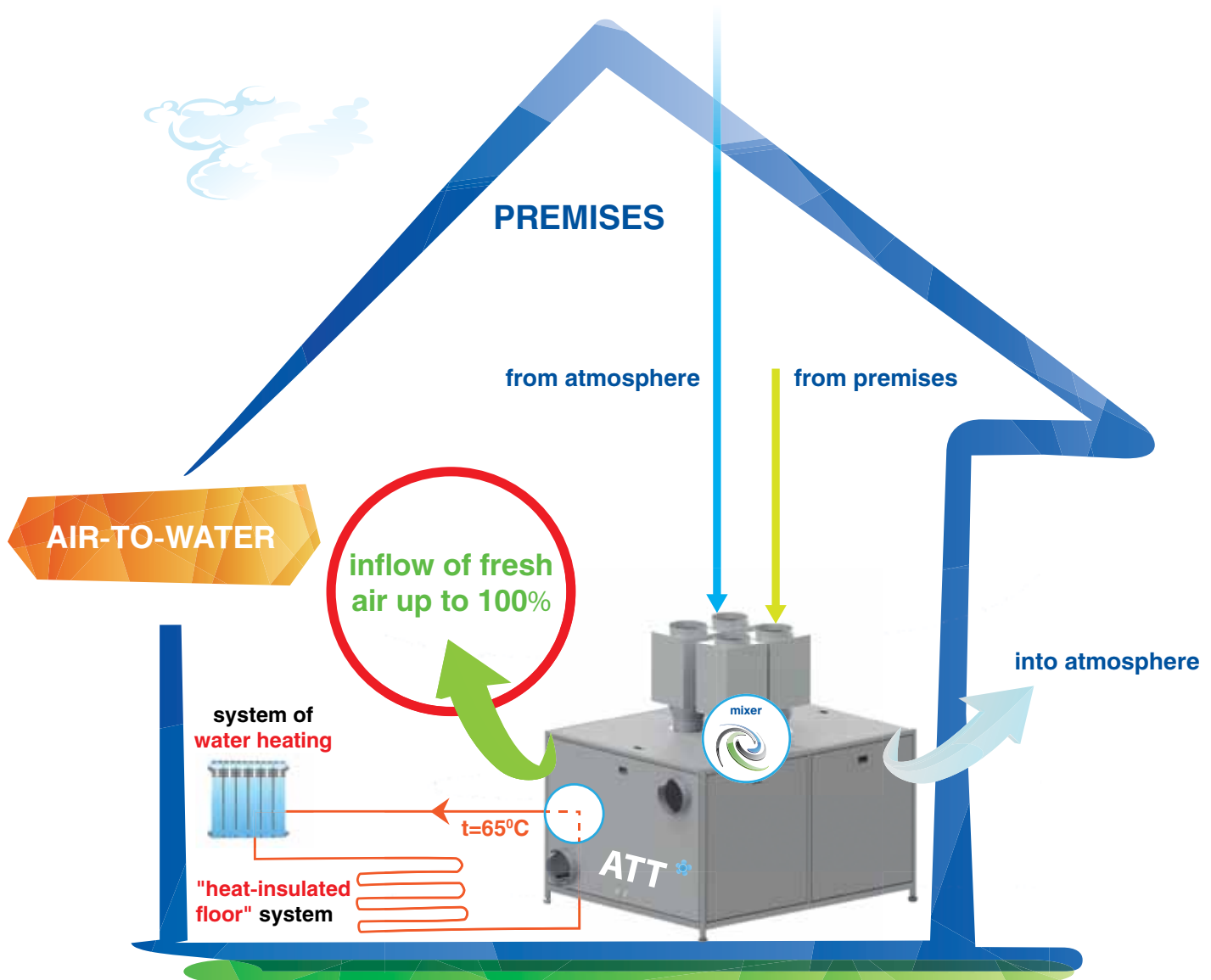
In summer a compressed air is cooled in a heat exchanger. Cooled air is expanded in turbine, which reduces its temperature down to +5...+10 °C. This cooled air is supplied into premises (directly or pre-mixed). Hot air after passing through heat exchanger is discharged into the atmosphere or into additional utilization circuit (water heating, e.g., etc.).

In winter warm air is transferred from heat exchanger into the premises, while supercooled air is discharged into atmosphere.

With the benefit of the ATT's know-how, efficient usage of air and condensate from operational circle provides high energy performance of the unit and simultaneously - high quality of supplied air.

WATER HEATING BY THE AIR CYCLE HVAC ATT SYSTEM

This model of air cycle HVAC ATT system provides stable simultaneous flow of heat air and hot water to the premises.



If required, the air cycle HVAC ATT system can be easily connected to available water heating system (including heat-insulated floor system) and / or hot water supply, replacing conventional gas or electric heating boiler. Both models of ATT HVAC system includes full system of ventilation with heating of incoming air to the temperature of premises without usage of any additional coils.

The air cycle HVAC ATT system can be installed directly indoors and outdoors (under shelter). The operating ATT HVAC system has no sensible vibration. There is no need in additional basement and groundwork, the ATT HVAC system can be mounted in any part of the building.

APPLICATIONS

UPEC developed two product lines of ATT HVAC systems: for transport applications and stationary units (residential and commercial). The ATT HVAC stationary units are designed for air conditioning and air source heating of the administrative, commercial and public premises, sports centres, shopping malls, catering, medical and industrial facilities, warehouses and garages, farm buildings, greenhouses and other facilities, which require air conditioning, heating and ventilation.



Motor vehicles and railway rolling stock.

There is a demand for operating cost reduction, seasonal heating, cooling and ventilation, high requirements for the air quality.

ATT passenger rail car HVAC system ventilates, conditions and heats a railway car in all weather conditions: from -50 to +50°C. Water heating system of the car (in case it exists as e.g. in CIS) can be completely excluded due to high heating efficiency of the air cycle ATT HVAC system, resulting in car weight reduction (minimum by 3 t; 25 cars – reduction by 75 t), annual electricity consumption decrease to 30...40%, operating cost reduction, as there is no need in refrigerant recharge reversible air cycle HVAC system for passenger railway cars was presented at InnoTrans trade fair in Berlin as "World Premier" and met high interest from leaders of HVAC railway segment.

Shopping and entertainment centres, retail centres, cinemas, restaurants.

There is an all-season demand for air conditioning and ventilation, in winter – for heating. High requirements for the air quality. Strong interest in equipment operating efficiency, as well as in Life Cycle Costs minimization.

The air cycle ATT HVAC system provides up to 100% fresh air supply, while removable excess heat can be applied in water heating for sanitary and commercial needs. The air ATT HVAC system minimizes capital and life cycle costs, as there is no need to be connected to any other energy sources except electricity, and also reduces air conditioning and ventilation costs by 2-3 times.



Industrial premises, warehouses, print shops, etc.

There is an all-season demand for air conditioning, in winter – for reliable and budget-friendly heating. High demand for ventilation. Water heating for technological and social needs.

The ATT HVAC unit efficiently ventilates, conditions and heats industrial premises in any weather conditions: at ambient temperature in summer up to +50°C and in winter down up -50°C, providing energy saving by 2-3 times (in comparison with conventional units). Due to high heating efficiency of the air cycle ATT HVAC unit in winter time (Air Source Heat Pump mode), the water heating system can be completely excluded (if it existed in industrial premise together with conventional boiler), resulting in significant capital and operating costs reduction. In summer time, second heat circuit of the air conditioning cycle in the ATT HVAC system can be applied in water heating for technological and social needs.

One of the ATT HVAC reversible units is successfully operating more than three years in the Bearing International Test Center providing all-seasons permanent temperature in premises with 3 powerful test rigs installed. During summertime ATT unit successfully compensates not only ambient heat transfer but also the additional heat generation caused by test rigs. In winter time because of the same reasons and highly efficient air source heat pump mode ATT unit mostly operates even on partial capacity.



Cottages and dwellings

There is a seasonal demand for air conditioning and heating, all-season demand for ventilation, hot water supply, high requirements for the air quality, space saving, noise level.

The air climate control system applies excess heat in summer, which is removed from the premises, for the simultaneous water heating in shower, kitchen and/or pool. In winter, the air climate control system reduces heating costs by 2-3 times and completely eliminates application of other energy sources: gas, solid or liquid fuel. Furthermore, the air climate control system ensures fast temperature change, which is very convenient for country houses, when it is necessary to quickly heat/cool the rooms on arrival of the dwellers on weekends and public holidays.

Sports centres

There is an all-season demand for the air conditioning, ventilation, hot water supply, high requirements for the air quality, temperature change speed in premises over different operating periods after shutoff (at night, on weekends, with no people indoors).

In summer, except conditioning, air control system allows to use excess heat, which is removed from premises, for free of charge water heating and hot water supply as well as pool heating. In winter, the air climate control system uses cool air for ventilation of such premises as, for instance, training facilities requiring all-year cooling. Fast temperature change in premises ensures climate control cost reduction by 3-4 times.

Agricultural buildings, greenhouses, livestock facilities, grain storage.

There is a seasonal demand for air conditioning and heating, all-season demand for ventilation, period or all-season demand for hot water supply, need to precisely maintain the required temperature (e.g. poultry complexes, greenhouses).

The air climate control system ensures precise temperature maintenance with fresh air supply of up to 100%, in summer it uses excess heat, which is removed from the premises, for free of charge water heating and hot water supply. In winter, the air climate control system uses ambient air to cool down such premises as, for instance, shops for poultry butchering, etc.

The air climate control system completely eliminates application of other energy sources: gas, solid or liquid fuel, which significantly reduces capital costs.



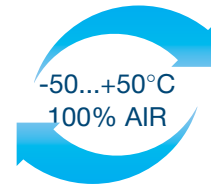
An average person at the age of 70 has been in the closed premises for about 45-55 years, including at least 30-35 years in domestic premises. Controlling and maintaining of high hygienic air quality in domestic premises is an important social and medical problem, which can be perfectly solved with air cycle ATT HVAC system developed and manufactured by UPEC. 50-100% guaranteed fresh air supply (from 50% up to 100%) + cleaning with additional filters.

CARE AND COMFORT

Fully environmentally friendly (no freon, no refrigerant besides air, no oil).

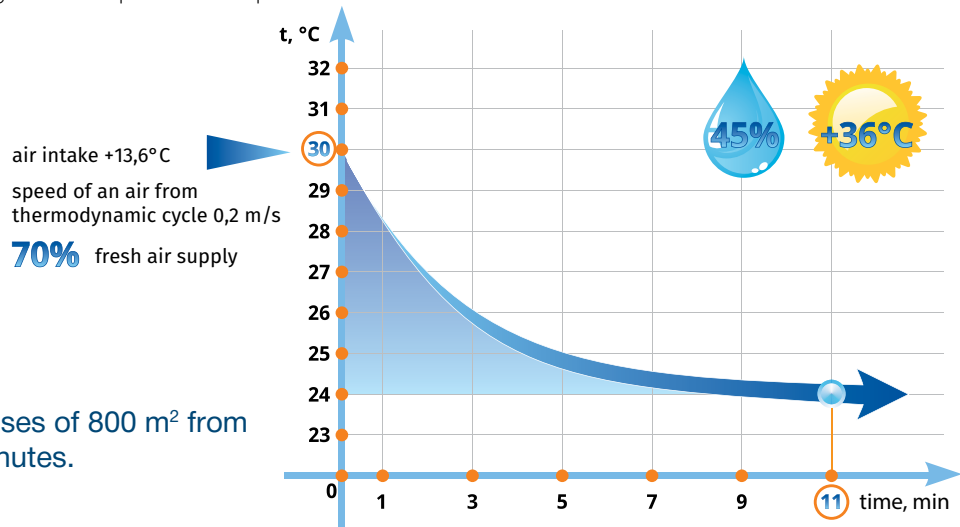


Fully variable operation in any season and any weather conditions.

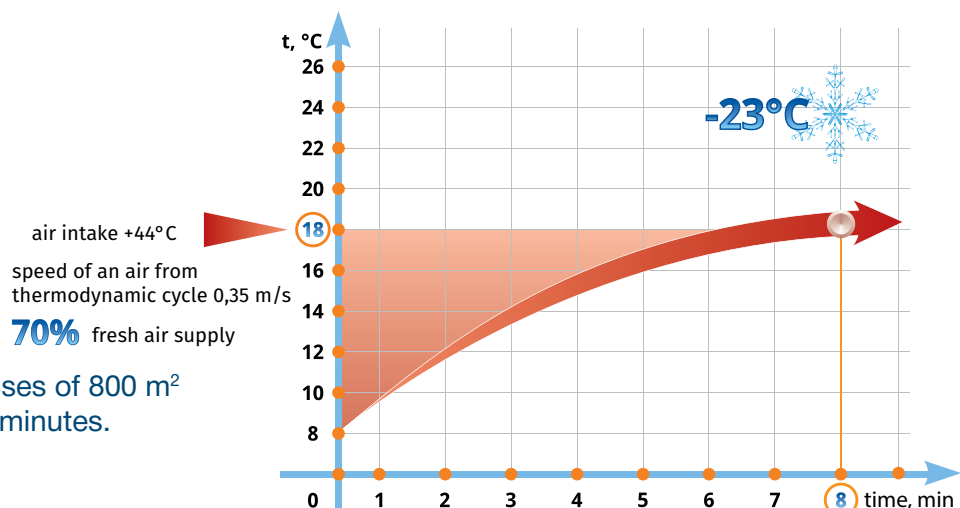


High air quality in cooled (heated) premises (with temperature +20...+24°C and fresh air supply of 50...100%; in summer time with relative humidity 40...60%). In premises (800 m²) the air changes completely within 4-5 minutes!

Fast reaching of the target air temperature in premises.



Cooling time for premises of 800 m² from +30 to +24°C is 11 minutes.



Heating time for premises of 800 m² from +8 to +18°C is 8 minutes.

ECONOMY AND EFFICIENCY

High energy efficiency with low re-circulation (up to 0), which means large percentage of fresh air (up to 100%).

In cold seasons, the heating rate is 2...4.5 in the temperature range -50...+7°C; in warm seasons, the cooling rate is 1.3...1.7 in the temperature range +25...+50°C with fresh air supply of up to 100%.

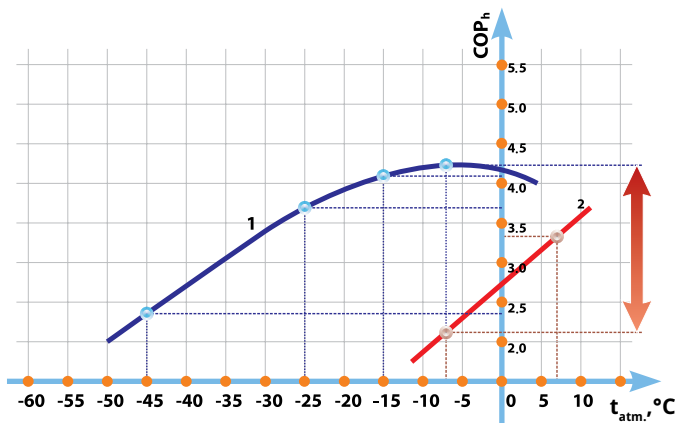


Fig. 1. Comparison of the air cycle ATT HVAC system (1) in the heating mode with a conventional air source heat pump (2).

If these rates draw together at positive temperatures, then at negative temperatures with an increasing heating demand the air cycle ATT HVAC system has high performance even in the modes, when most of conventional heat pumps do not operate and therefore tubular electric heaters are traditionally applied for heating.

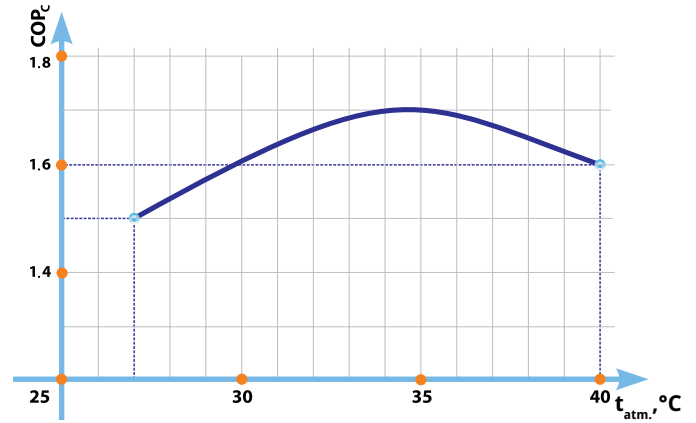


Fig. 2. The air cycle ATT HVAC system performance in the air-conditioning mode with fresh air supply of up to 100%.

It can not be compared with conventional air conditioners, as a fresh air supply in such a volumes is not inherent to most of them or even virtually impossible with the same high performance.

Energy saving.

High heating rates mean electric energy saving by 3...4.5 times in comparison with conventional electric heaters; thus 1 kW of heat generated by the air cycle ATT HVAC system is 2.3...2.7 times cheaper than 1 kW of heat generated by gas burning boiler.

Easy serviceability and low operating and life cycle costs due to natural availability of air as a thermodynamic refrigerant and electric energy as the only charged source. No need to charge a refrigerant, oil, etc.



SIMPLICITY AND CONVENIENCE

Low specific weight and dimensions

are ensured with an innovative original design of turbo compressor and heat exchanger.

The shortest time of mounting: there is no need to place heat exchangers deep underground as in case of most known heat pumps of "ground-air" type, and thus no need in expensive construction and installation works, any special works besides air ducting and power supply (no other connections are needed, except the cases when a system has a "water heating" option).

The control system of the ATT machine is automated, intuitively clear and provides simplest, effective and safe operation.

The system maintains the set indoors temperature, using the minimum quantity of electric power due to inverter control of a turbo compressor. Meanwhile, if the criterion of the optimal control will be to minimize the time to target temperature, the control system will provide this by automatic mode re-adjustment and correspondent logic of software.



The control system monitors all vital parameters of the unit: EC motor temperature, contamination of filters, power consumption and other parameters. If handling becomes required (e.g. filters need to be replaced), - the corresponding message will appear on the screen.

Usually, the air cycle HVAC system does not require other maintenance (besides filters replacement), but if it happens, the control system will inform you about the failure. Recorded diagnostic information will help support service to eliminate this failure as soon as possible.

User interface of ATT control system is extremely simple and clear. It is required only to switch on the unit and set the temperature. Manual control is also provided - it is possible to set operating mode AC or AS HP manually, to adjust the timers, to monitor unit operation parameters, indoor and outdoor temperature and many other parameters (if you want).

The system can be operated both from the screen on the main control cabinet and from the external panel, which can be supplied and connected as an option and from remote control as well. Informational content and functionality of the external panel for special applications are set under specific requirements of the customer.

BASIC TECHNICAL PARAMETERS

The product line of ATT HVAC systems unites a number of models differing by applications, combination of modes, capacity, but usually designed in monoblock

	ATT 30/60	ATT 15/30
Heating mode:		
Guaranteed range of outside temperature, °C	-50... +20	
Rated heating productivity, kW	60	30
Air supply to premises (including 50...100% of fresh air), m ³ /h	2000...4500	500...1800
Temperature of air supplied to premises, °C	+20...+50	
Rated electric motor power, kW	17	15
Power consumption (for "fast heating" option), kW	5...18.5 (38.5)	3...13 (18)
COP transformer rate	2.0...4.5	2.0...4.5
Time to target temperature (from +8 to +18°C with ambient temperature -20°C), min	8	16

Cooling mode:		
Guaranteed range of outside temperature, °C	+15...+50	
Rated cooling productivity, kW	30	15
Air supply to premises (including 50...100% of fresh air), m ³ /h	1000...3500	500...1800
Temperature of air supplied to premises, °C	≥10	
Power consumption, kW	5...25	3...13
COP transformer rate	1.3-1.7	1.3-1.7
Energy efficiency category	A	A
Time to target temperature (from +30 to +24°C with outside temperature +30°C), min	22	22

General information:		
Air duct diameter, mm	315	250
Number and type of compressors	1 Turbo	1 Turbo
Number and type of fans	1 CF	1 CF
Maximum cycle pressure, bar	1.7	1.7
Compressor adiabatic efficiency	0.86	0.86
Turbine internal efficiency	0.87	0.87
Type of control	stepless (inverter)	stepless (inverter)
Maximum static head, Pa	300	300
Power supply: current type / voltage / frequency	~3ph / 380V / 50Hz	~3ph / 380V / 50Hz
Noise level (according to the operating mode), dB	40...50	40...50
Unit dimensions, mm	2380 x 2000 x 1470	2100 x 1400 x 1230
Weight, kg	1200	700

- Warranty period – up to 2 years
- Life time – up to 10 years
- Refrigerant – air
- In-service refrigerant recharge – no need
- Additional options – water heating in summer time

WHAT ARE THE MAIN COMPONENTS OF THE AIR CYCLE ATT HVAC SYSTEM?

Air cycle ATT HVAC system is a monoblock with the following main components:



Turbo compressor — ATT/UPEC-engineered high speed and high efficiency turbo compressor with a unique optimal design for the reversible air cycle HVAC system. Compressor and turbine stages for every turbo compressor type and dimension / unit capacity are designed as 3D shape optimization in harmonized operating conditions for each ATT unit mode (AC, AS HP, etc).

Heat exchanger — ATT/UPEC-engineered highly-efficient super-compact air-to-air heat exchanger. Temperature efficiency in the design mode is up to 95%.

Controller — control system is operating with a Kinco controller, the unit is fitted with a colour touch display and a user-friendly interface.

Fans — energy-efficient centrifugal Green tech fans with an EC-motor manufactured by the world leader in this area – German company “Ebmpapst”, which save from 30 to 80% of consumed energy in comparison with conventional AC-fans.

Frequency inverter — highly efficient and reliable, manufactured by the world leading company Schneider.

Air ducts, valves, flaps, silencers with minimum aerodynamic drags.

The ATT unit needs to be connected to the air duct lines of premises and environment, as well as power supply. No other connections are needed, except the cases when a system has a “water heating” option.

There are spaces for air duct and power supply connections on the outer surface of the frame.

APPLICATION EXAMPLES

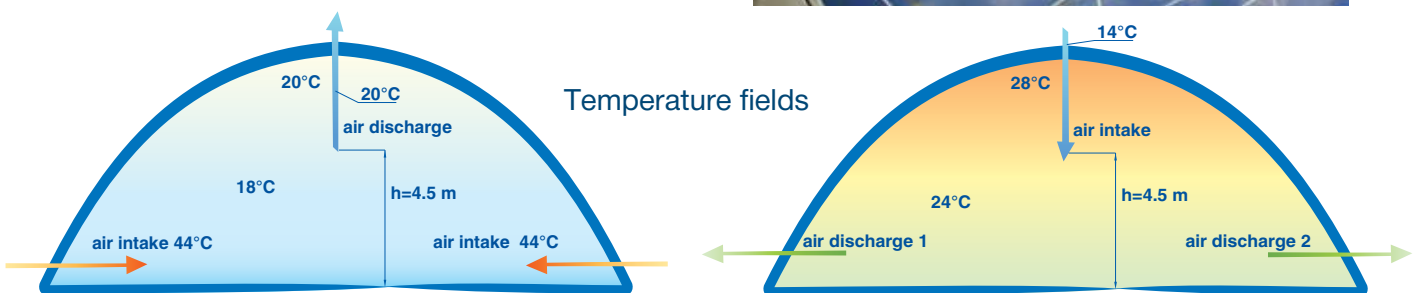
Premises space - 9000 m³

Window area, single glazing - 100 m²

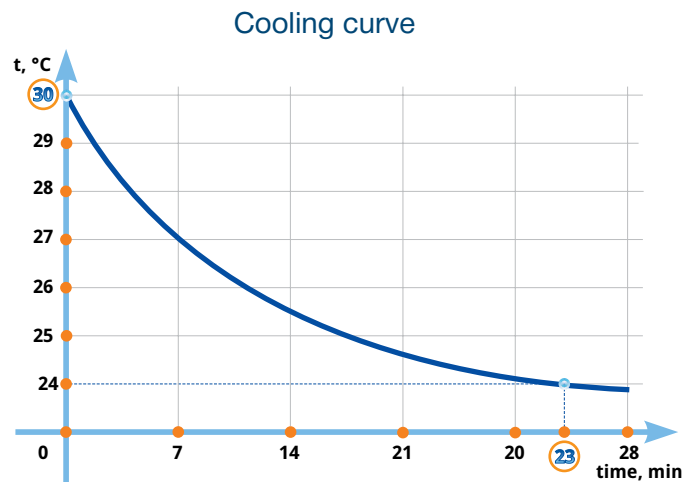
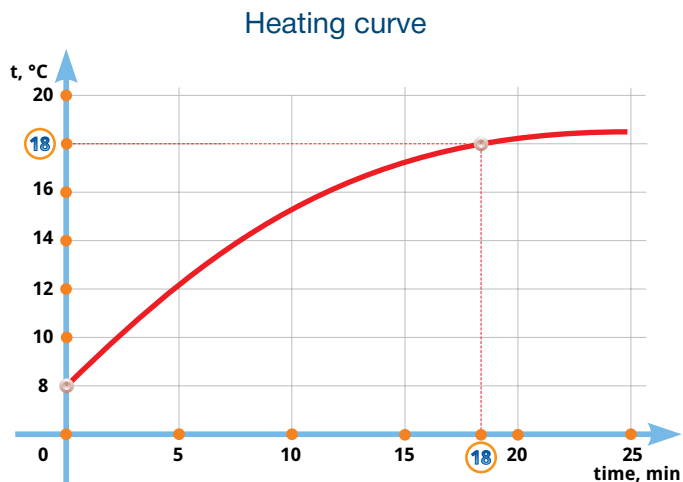
Estimated number of sportsmen - 60 people

Estimated number of the required ATT-30/60 - 3 units

Premises dimensions for the air cycle ATT HVAC system mounting: LxWxH: 9.0x5.0x4.2



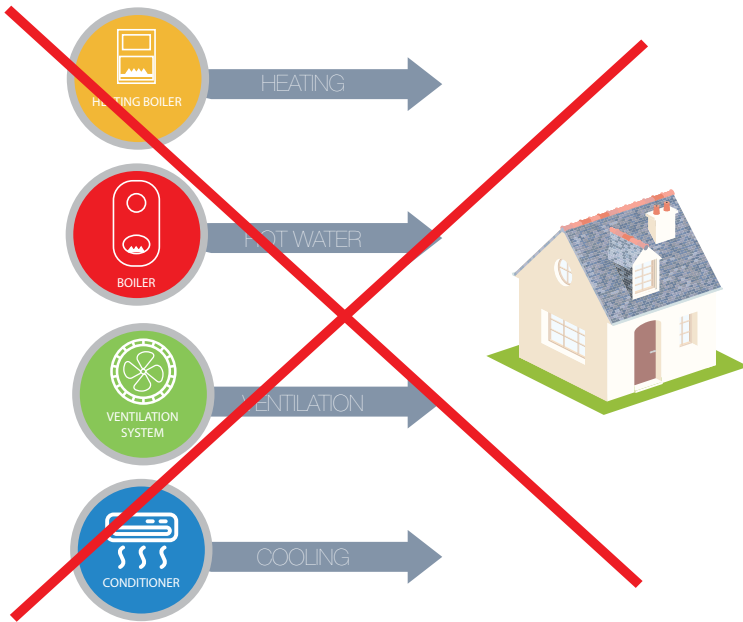
Parameter	Winter	Summer
Ambient air temperature, °C	-23	+36
Relative ambient air humidity, %	70	45
Temperature of air supplied to premises, °C	+44	+13.6
Average temperature in premises, °C	+18	+24
Fresh air volume, m ³ /h**	4800	
Average speed of air after air cycle into premises area, m/s	0.35	0.2
Temperature in premises when ATT starts, °C	+8	+30
Time to heat/cool premises from +8 to +18°C / from +30 to +24°C, min.	18	23



APPLICATION EXAMPLES

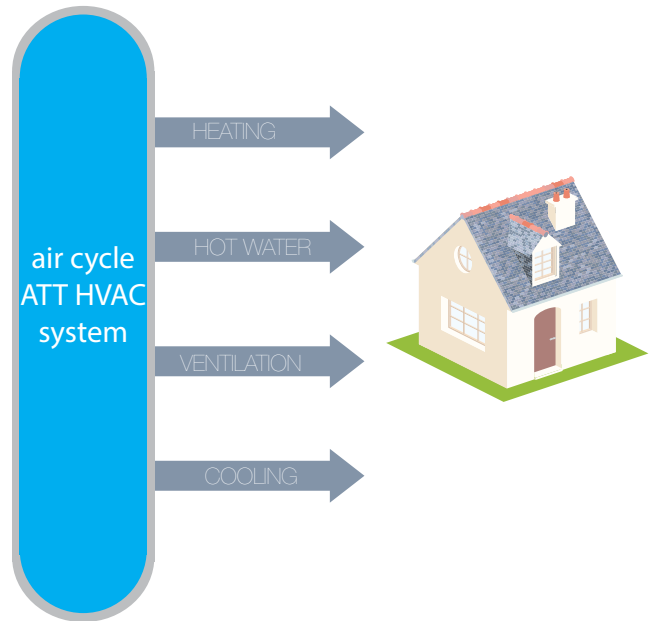
Traditional system

The climatization is provided by separate different devices



Innovative air cycle ATT HVAC system

The climatization is provided by one ATT device



Application examples

Expenses	System based on pellet boiler	Air cycle ATT HVAC system
Expenses on heating by pellets	\$3.549	—
Expenses on input-exhaust ventilation with air pre-heating	\$3.136	—
Expenses on power supply	\$948	\$4.345
Total	\$7.633	\$4.345

You can save 42% of your expenses if you use the air cycle ATT HVAC system

The air cycle ATT HVAC system additionally saves money due to decrease of energy consumption during transition to the "stand-by mode", at night, during week-end and holidays.

ENERGY EFFICIENCY OF THE AIR CYCLE ATT HVAC SYSTEM IN THE HEAT PUMP MODE COMPARED TO COMMERCIAL HEATING AND VENTILATION SYSTEMS (SAMPLE)

Premises area: **850 m²**

Required temperature in the premises: **in winter + 16° C**

Outdoor temperature - **10 °C**

Heat losses through the enclosure - **Q1 = 15 kW**

Rate of ventilation per 1 person is **15 m³/h** of fresh air heat rate for the ventilation for **190** persons total in the premises
Q2 = 25 kW

Total amount of heat that is needed to deliver into premises including heating and ventilation modes:
Qsum = Q1 + Q2 = 40 kW



	Air cycle ATT HVAC system	Electric coils without recuperation system	Electric coils with commercial heat exchanger - recuperator	Natural gas boiler
	Heating coefficient of performance - COPh = 3.5	Efficiency of electric coils Efft = 85%	Efficiency of electric coils Efft = 85% Coefficient of recuperation for commercial heat exchanger-recuperator, Kr = 1.3	Efficiency of the natural gas-fired boiler Eff = 91%
Electricity consumption, kW•h	11,43	50,05	43,25	1,5
Natural Gas consumption, m ³ per hour	-	-	-	5,5
Expenses per hour in USD (see Ukrainian Rates)	\$0.69	\$3	\$2.6	0.09 + 2.26 = \$2.35

Rates in USD: Kilowatt-hour rate - 6 cents per 1 kWh, Natural Gas rate - 41 cents per 1 m³

Conclusion:

The benefit of the air climate control system in Air Source Heat Pump mode in winter time will be

- **435%** if to compare with electric coils without recuperation system;
- **377%** if to compare with electric coils with conventional commercial heat exchanger (recuperator);
- **341%** if to compare with natural gas boiler.



RECUPERATOR

The most efficient heat recovery of internal (compartment) heat is realized inside the thermodynamic cycle of ATT climate control system. Meanwhile in some cases (when high heating or cooling capacity is not in demand; or on the contrary, when additional inflow of fresh air is required; or for removal of its humidity excess) - only recovery function is enough. For such a cases, ATT Centre developed highly efficient heat recuperator as a separate UPEC HVAC product.

The recuperator ensures forced extraction of "used" air from premises and inflow of fresh air into the premises by two separate flows, providing simultaneous passive heating or cooling of incoming air (depending on season) by means of highly efficient heat exchanger.

The Construct

The recuperator is a monoblock comprising of the following main components:

ATT-engineered high-efficient super-compact air-to-air heat exchanger.

Controller with a user-friendly intuitively clear interface, color touch display and remote control panel.

Energy-efficient centrifugal "Green tech" ebm-papst fans with the EC-motor (save 30 ... 80% of consumed energy in comparison with conventional AC-fans)



- high-efficient heat exchanger
- wide range of ambient temperatures
- silent operation
- easy operational control
- easy mounting
- high reliability
- short payback period

Applications

Recuperators can be installed in administrative, commercial, industrial buildings, private houses and cottages to cut expenses during ventilation of premises.






Product line of ATT- commercial recuperators includes the models for manufacturing shop of the production building, office centers or public buildings (school, kindergarten, shops).

Product line of ATT- residential recuperators includes the models for cottages, cottage pools, baths, greenhouses and winter gardens, as well as recuperators for apartments.



Also ATT/UPEC-engineered recuperators can be built-in in the available ventilation duct system that provides reduction of the costs of the electric power for inflow air heating more than by 5 times, without additional investments.



-  Central ventilation system
-  Heating in winter
-  Cooling in summer
-  Air filtration
-  Easy assembling

Key parameters of recuperators	
Air consumption	From 10 to 4000 m ³ /h in one module
Losses of pressure	150 ... 200 Pas (depends on model)
Ambient temperature	Above - 40 C ^o
Air temperature in premises	+10...+35
Recovery coefficient (efficiency of utilization of heat)	75...82% (depends on model)
Noise level (depending on an operating mode), dBA	20...30
Power supply	220 or 380 V / 50 Hz (depends on model)

- Warranty period – 2 years
- Life time – 15 years
- Service – replacement of filters is required, if necessary.



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