

# HEAT PUMPS

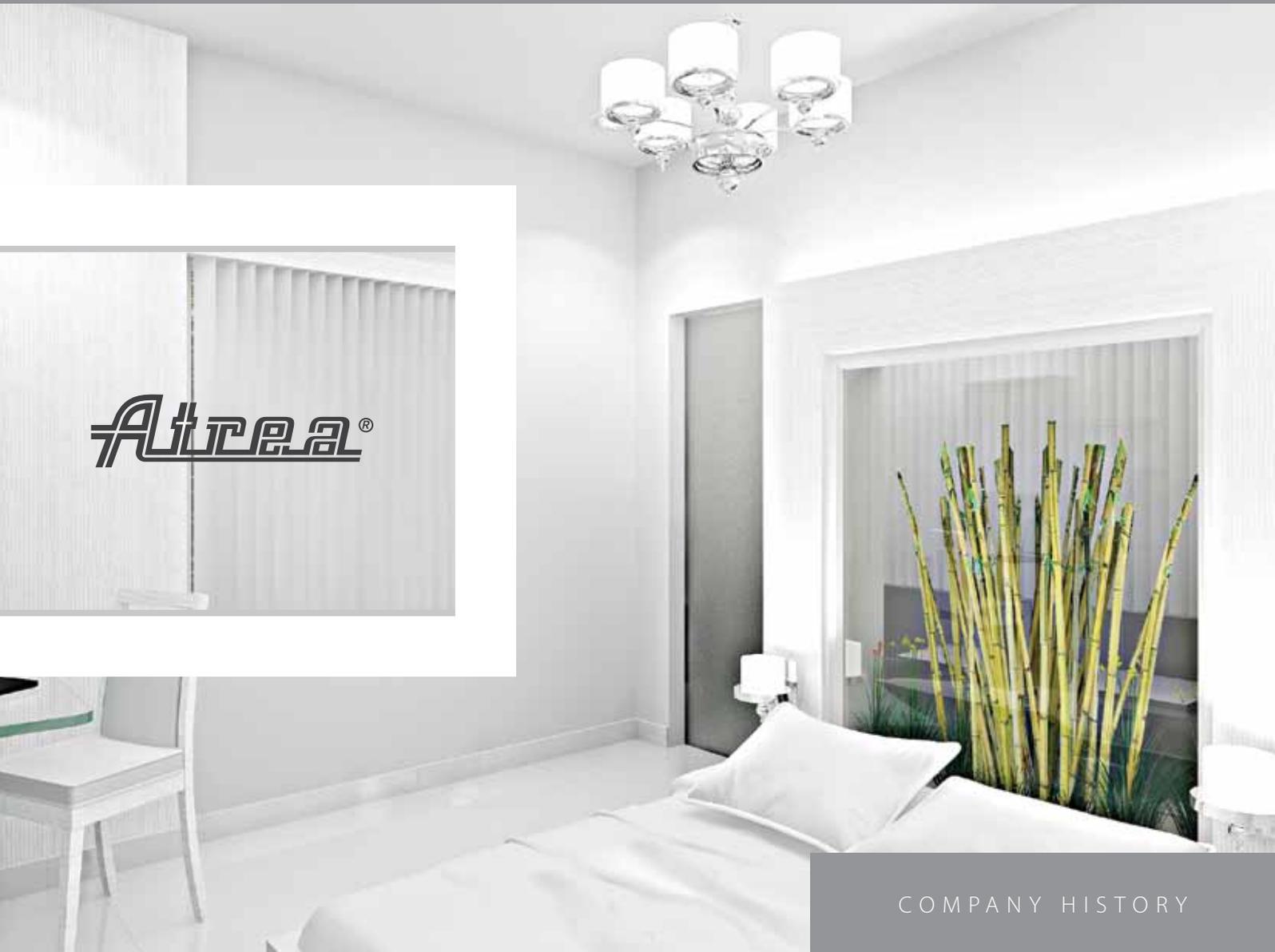


earth - water . air - water

**Aturala**<sup>®</sup>

# HEAT PUMPS

ATREA s.r.o. LEADING HVAC MANUFACTURER IN THE CZECH MARKET



## COMPANY HISTORY

**ATREA s.r.o.** was founded in 1990. Since its establishment it has been drawing on its experience of many years in the area of the micro climate of buildings and putting a lot of emphasis on the recovery and utilisation of heat from exhaust air (heat recovery).

**ATREA s.r.o.** is a leading manufacturer of hot air heating systems and heat recovery ventilation units and has achieved a substantial success in western European markets.

In the field of heating and production of heat pumps ATREA s.r.o. prefers a comprehensive and systematic approach, from the economical design of the building's energy concept to the development and production of related equipment to the installation and servicing of system solutions supplied.

A special emphasis is placed on installations in the upcoming generation of low-energy and passive houses ATREA s.r.o. has plenty of experience with.

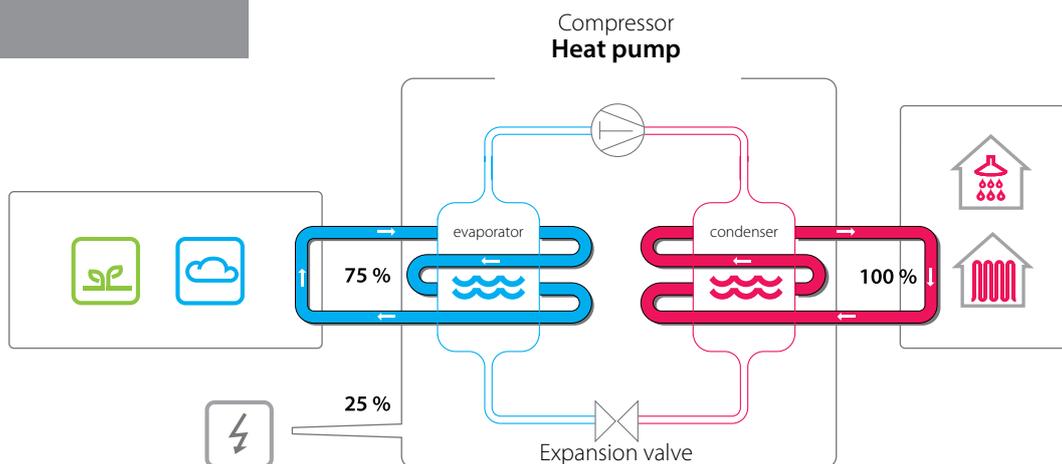


### Heat pump principle

A heat pump collects in a condenser heat thermal energy from the surrounding environment – air or earth. To this end a supercooled coolant is used to absorb this energy. The amount of such energy in our environment is practically inexhaustible, however, its temperature is not suitable. Therefore it must be increased to a value that may be utilised. This is done by a compressor that compresses the coolant. The hot coolant runs into the condenser where the energy is passed into water while the coolant is liquidized. The liquid coolant enters the expansion valve where its pressure and temperature are rapidly decreased and the supercooled coolant can subsequently collect more energy from the environment. The entire cycle is repeated.

Source = earth or air

Source = electricity



# TCA 3.1 H E A T P U M P „ e a r t h - w a t e r “



A TCA 3.1 heat pump acquires energy from a ground-based flat collector set 1.5 metre deep. This arrangement provides an advantageous replacement for expensive vertical wells and is adequate for smaller capacities. In connection with an IZT heat accumulator and a DUPLEX unit the TCA 3.1 provides monovalent or bivalent heating, hot water heating and the cooling of passive houses (the calculated heat loss of the building up to 2.5 kW).

s a v i n g . e c o l o g y . g u a r a n t e e . c e r t i f i c a t i o n . q u a l i t y . t r a d i t i o n

## What is COP (coefficient of performance)?

COP (coefficient of performance) is the ratio between the output and the supplied power. The higher the COP, the more efficiently is the heat pump working. For the operation of a heat pump it is only necessary to supply energy for the running of the compressor and possibly the antifreeze circulation pump (in „earth – water“ heat pumps) or the outdoor unit fan (in „air – water“ heat pumps). This energy contributes to the acquired output by only a 1/4 or a 1/3, while the remaining amount of energy is gathered from the surrounding environment. The COP value depends of many circumstances, the most significant being the dependence on the temperature of output heating water and the temperature of the source, i.e. the temperature of surrounding air or the temperature of the antifreeze.

The TCA 3.1 heat pump, developed by ATREA s.r.o. primarily for passive houses, is supplied as a compact aggregate with a built-in microprocessor equithermal control system.

The advantage of the TCA 3.1 is its stable performance and high coefficient of performance regardless of current outdoor temperature. The system, complete with an IZT accumulation heat accumulator and a DUPLEX R4 hot air heating and ventilation unit with heat recovery, also allows a highly economical mode of integrated cooling and IZT heat charging. In this mode the building is cooled via circulation cooling while DHW is heated inside the accumulator.

As standard a passive cooling mode using an antifreeze mixture is available in which the building is cooled and the ground-based flat collector is regenerated simultaneously.



**HEAT PUMP TCA 3.1**

Type / identification	TCA 3.1
heating performance (EN 14511) – B0/W35 [kW]	3,1
power input [kW]	0,73
coefficient of performance (EN 14511) – B0/W35 [-]	4,4
heating performance (EN 14511) – B0/W45 [kW]	2,9
power input [kW]	0,84
coefficient of performance (EN 14511) – B0/W45 [-]	3,6
heating performance (EN 14511) – B5/W35 [kW]	3,8
power input [kW]	0,76
coefficient of performance (EN 14511) – B5/W35 [-]	5,2
heating performance (EN 14511) – B5/W45 [kW]	3,4
power input [kW]	0,85
coefficient of performance (EN 14511) – B4/W45 [-]	4,2
nominal voltage / frequency [V / Hz]	230 / 50
coolant	R407C
dimensions (h x w x d) [mm]	1 000 x 450 x 475

**Ground-based flat collector**

For the flat collector of a TCA 3.1 an excavation area of approximately 30 m<sup>2</sup> is sufficient provided that the composition of soil is suitable. For faster regeneration of soil around the collector a sun-lit area is preferable. Avoid installing the collector under tarmaced surfaces that restrict the access of sunshine and rain water to the collector.

**What does B0/W35 or A2/W35 indication mean?**

In order for the user to be able to compare various products on the market the coefficient of performance is always stated in the same basic conditions. For „earth – water” heat pumps the basic parameter is B0/W35 – the temperature of the antifreeze mixture from earth 0 °C and the temperature of output heating water 35 °C. For „air – water” heat pumps the basic parameter is A2/W35 – the assumed temperature of outdoor air 2 °C and the temperature of output water 35 °C. However, these base values should always be supplemented with other parameters such as B5/W45 or A7/W45. Always request values measured according to the ČSN EN 14511 standard in a certified laboratory.

# TCV 4.8

H E A T P U M P „ a i r - w a t e r “

s a v i n g . e c o l o g y . g u a r a n t e e . c e r t i f i c a t i o n . q u a l i t y . t r a d i t i o n

The TCV 4.8 heat pump acquires energy from surrounding air. The major advantage is the option of all-year-round efficient operation. In winter the pump works up to a temperature of  $-15^{\circ}\text{C}$ , and in summer the COP increases dramatically. Summer cooling is available in selected types.



## Bivalent source

From the operation economy point of view it is not suitable to size a heat pump to cover the entire heat loss of the building. The performance of the pump is usually designed to cover approximately 60 % of the house's heat loss, which provides up to 90 % of required heat. The rest of energy on extremely freezing days is supplied by the so-called bivalent source such as electrical heating cartridges in an accumulation accumulator. This principle makes it possible to install a lower-performance heat pump that is cheaper, has lower running costs and is utilised more efficiently.



The TCV 4.8 has a „split“ design. The outdoor unit contains a compressor and a fan with speed control (inverter technology) that runs with minimum noise and power input under all circumstances. This applies in heating mode in winter, during summer cooling and during all-year-round heating of hot water.

The compact design saves space in the utility room and facilitates installation. The RG21 control system supplied can also control a bivalent source, a solar system or a fireplace with hot water insert. The control system also ensures automatic condenser defrosting.

The TCI version includes a plumbing mixing kit to control the temperature of heating water and optionally a solar or a second mixing kit.

A I R W A T E R



OUTDOOR UNIT



INDOOR UNIT

indoor unit type	HMT	HMT2	HMTC	HMTCI
heating function	yes	yes	yes	yes
2 heating water outlets	no	yes	no	no
cooling function	no	no	yes	yes
built-in plumbing kits	no	no	no	yes
heating perf. A2/W35 [kW]	4,8			
power input A2/W35 [kW]	1,3			
coefficient of perf. A2/W35 [-]	3,69			
heating perf. A2/W45 [kW]	4,5			
power input A2/W45 [kW]	1,5			
coefficient of perf. A2/W45 [-]	3,00			
heating perf. A7/W35 [kW]	5,7			
power input A7/W35 [kW]	1,3			
coefficient of perf. A7/W35 [-]	4,24			
heating perf. A7/W45 [kW]	5,28			
power input A7/W45 [kW]	1,6			
coefficient of perf. A7/W45 [-]	3,34			
rated voltage / frequency [V / Hz]	230 / 50			
coolant	R410A			
compressor	hermetical, inverter, rotational			
outdoor unit dim. (h.w.d) [mm]	578 x 790 x 300			
outdoor unit weight [kg]	39			
indoor unit dim. (v.š.x.h) [mm]	600 x 400 x 250	600 x 400 x 250	900 x 340 x 540	1450 x 450 x 610
outdoor unit weight incl. content [kg]	26	26,5	83	106 – 112

### What if servicing is required?

ATREA heat pumps are designed in such a way so that a possible failure would not cause inconvenience to the user and in such an event heating and hot water heating is provided by a bivalent source (IZT integrated heat accumulator).

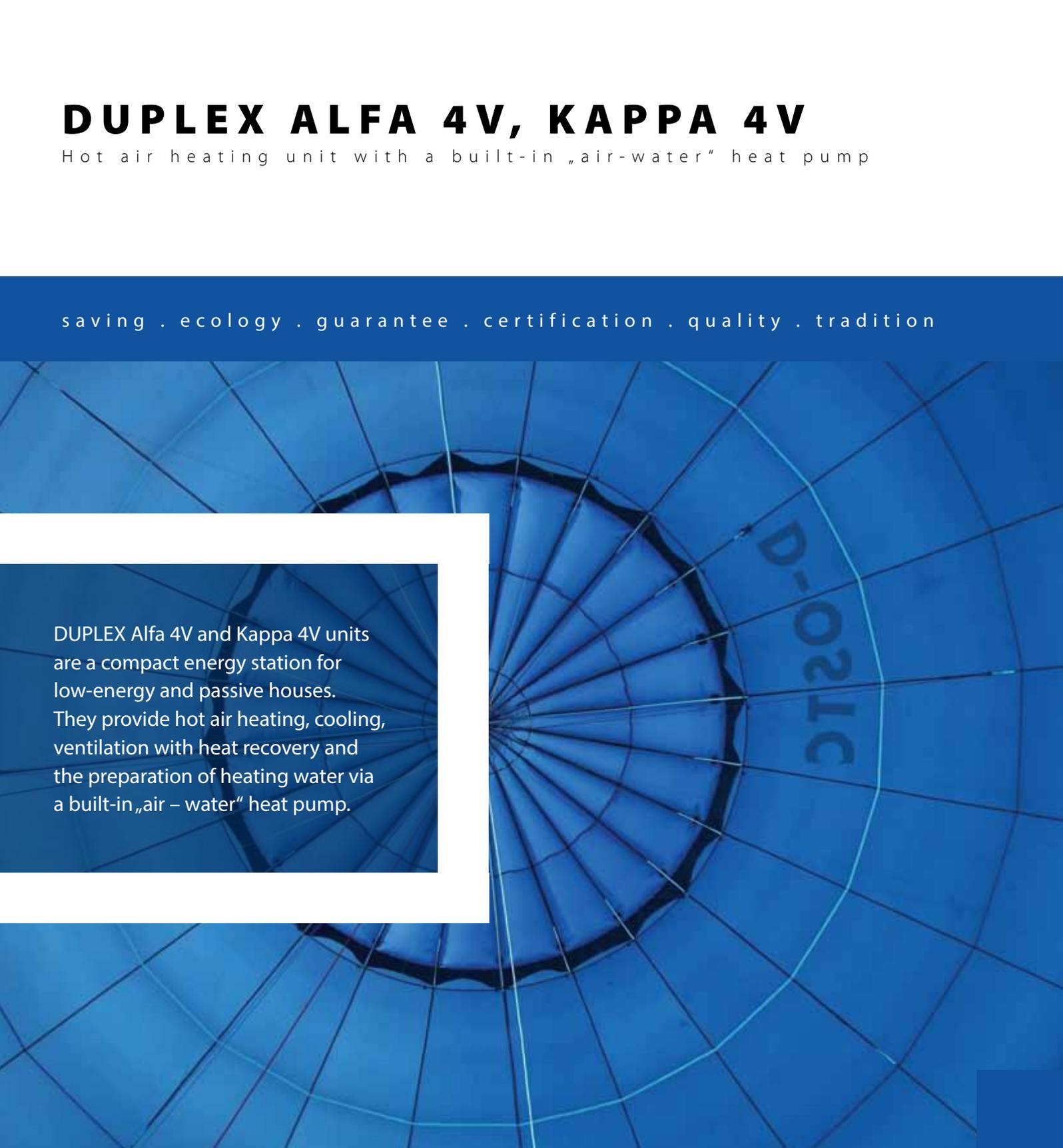
### Are heat pumps noisy?

The „earth-water“ heat pump has a spring mounted compressor and double acoustic insulation of the case. The total sound pressure level is 40.3 dB at a distance of 1 metre, which corresponds to the amount of noise made by a bigger refrigerator. With „air-water“ system heat pumps only their indoor units containing a circulation pump, inaudible in a closed case, are installed inside a house. The outdoor unit has a compressor and a fan with speed control, further reduced by software. When located appropriately at the site, there will be no noise nuisance for you or your neighbours.

# DUPLEX ALFA 4V, KAPPA 4V

Hot air heating unit with a built-in „air-water“ heat pump

saving . ecology . guarantee . certification . quality . tradition



DUPLEX Alfa 4V and Kappa 4V units are a compact energy station for low-energy and passive houses. They provide hot air heating, cooling, ventilation with heat recovery and the preparation of heating water via a built-in „air – water“ heat pump.

**Advantages of the compact solution?** Compared with a modular system the compact concept of DUPLEX Alfa 4V and Kappa 4V units has many advantages such as saving installation space in the utility room including saving space for additional plumbing components on the walls, easier connections resulting in lower mounting costs, an improved appearance of the installation, a reduction in heat loss and, last but not least, reduced chance of error during installation. Another advantage is an integrated source of heat / cold in a joint case with the hot air DUPLEX unit. By connecting to a combined IZT heat accumulator the DUPLEX Alfa 4V and Kappa 4V unit also heats hot water. The IZT accumulator acts as a bivalent heat source and allows to connect other sources – a fireplace, a solar system etc.



DUPLEX Alfa 4V and Kappa 4V units are intended for two-zone circulation hot air ventilation or cooling and comfort controlled ventilation with heat recovery. They also provide heating for hot and heating water. The fans and circulation pumps are fitted with EC technology to ensure low operating costs and reduced noise. They also contain a built-in „air – water“ heat pump in a split version (with a separate outdoor unit and controlled compressor speed) and a plumbing kit to control the temperature of heating water.

As standard the units are supplied with a full control system. Optionally a solar kit or a second mixing kit may be fitted. Ideally, they should be combined with IZT accumulators.

A I R W A T E R



OUTDOOR UNIT



INDOOR UNIT

DUPLEX	ALFA 4V	KAPPA 4V
<b>HVAC section</b>		
dimensions (h x w x d) [mm]	1 140 x 1 720 x 630	1 140 x 1 720 x 630
weight of internal section [kg]	170	183
circulation air – max. [m³/h]	600	1 200
exhaust air – max. [m³/h]	350	350
heat recovery efficiency – max. [%]	91	91
diameter of connecting ports [mm]	ø 160 (i <sub>1</sub> , i <sub>2</sub> ) ø 200 (e <sub>1</sub> , c <sub>1</sub> , c <sub>2</sub> )	ø 160 (i <sub>1</sub> , i <sub>2</sub> ) ø 250 (e <sub>1</sub> , c <sub>1</sub> , c <sub>2</sub> )
number of fans [pcs]	2 (with EC technology)	
power input / frequency [V / Hz]	230 / 50	
filter class	G4 (optional F7)	
condensate drain [mm]	1x ø 16	
heating performance – max. [kW]	4,5	7,0
cooling performance – max. [kW]	2,0	4,0
<b>Heat pump</b>		
heating performance A2/W35 [kW]	4,8	
power input A2/W35	1,3	
coefficient of performance A2/W35	3,69	
coolant	R410A	
outdoor unit dimensions [mm]	578 x 790 x 300	
outdoor unit height [kg]	39	

### Control system

DUPLEX Alfa 4V and Kappa 4V units are supplied with a full control system. HVAC modes and room temperature are controlled by a CP 18 RD controller using a programmable timer or manually. The control system of the HVAC part allows convenient activation of increased ventilation performance by an impulse from the toilet, bathroom or kitchen.

The control of the heat pump, back-up electric heating coils and possibly other sources (solar system, fireplace) is provided by an RG21 controller. It is installed directly on the IZT-U accumulator. The controller allows for example charging to various temperatures depending on the season of the year, alternating between IZT-U's top and bottom charging, controlling the equithermal underfloor heating circuit, charging a swimming pool via a heat pump and other functions.

# TCA 3.1

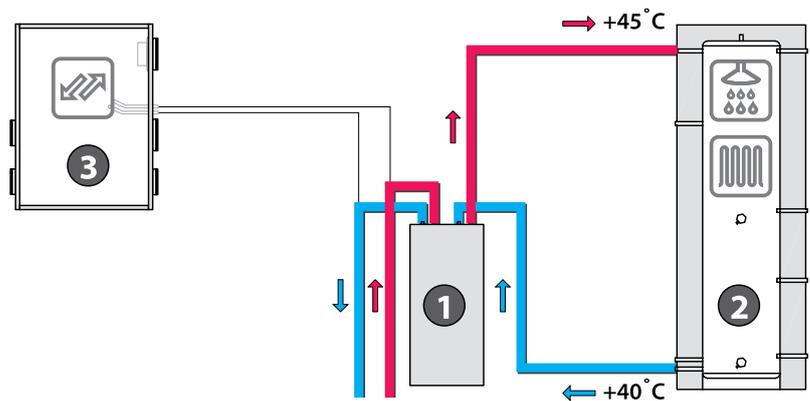
Integrated heating, ventilation, passive cooling and DHW heating system with a TCA 3.1 heat pump

## OPERATING MODES



- 1 **TCA 3.1 kW**  
Heat pump
- 2 **IZT-U-TS**  
Integrated heat accumulator
- 3 **DUPLEX R4**  
ATREA hot air unit

**Mode „A“** Charging ATREA – IZT heat accumulator



Flat ground-based heat exchanger  
(30 m<sup>2</sup> horizontal ground loop collector)



← +0°C

→ +3°C

### A combination of a heat pump system with other RER

When determining the concept of covering the requirements of hot water heating and the preparation of heating water the economic benefits of combining a HP with other RER\* must be verified. The most common combinations include those with a fireplace or wood pellet stove with a hot water exchanger or solar system. The COP of „earth – water“ heat pumps is almost constant all year round. The COP of „air-water“ heat pumps is at its highest in summer when also solar systems generate the best utilisation ratio. However, during this period energy is required only for heating HW, the two systems compete with each other and are not fully utilised. In winter solar systems contribute very little to the overall energy balance and gains from a solar system are reduced to minimum if a biomass source is installed. The combination of a heat pump with a natural gas boiler is not recommended at all, not only due to purchase costs but also because energy requirements are jointly covered by two sources with a subsequent reduction in the advantages of utilising the parameters of both of them.

\* RER - Renewable energy resources

2



**IZT-U-TS 400**

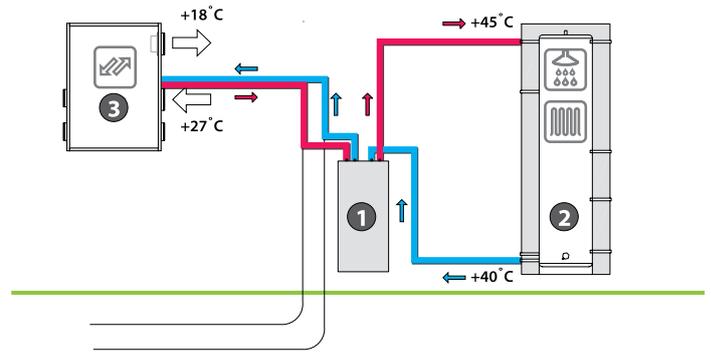
The IZT-U may be used with any type of heating system.

With a TCA 3.1 heat pump we recommend using accumulators with volumes between 350 and 650 litres in the TTSE version.

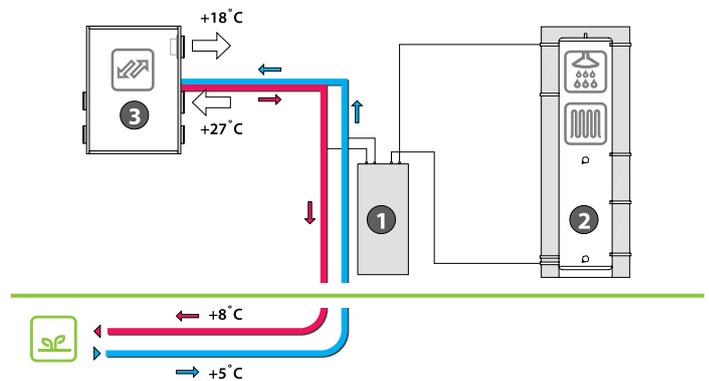
E A R T H W A T E R



**Mode „B“** Building cooling using energy for HW heating (summer operation)



**Mode „C“** Direct building cooling using cold from earth (summer operation)



**IZT-U – integrated heat accumulators**

IZT-U accumulators are designed for heat accumulation, heating water preparation and primarily for heating hot water (HW) in continuous stainless exchangers. As a result perfectly hygienic heating of HW is ensured, eliminating the Legionella bacterium. The separate preparation of CH and HW also eliminates the formation of sediment in accumulators. The self-contained range of accumulators also makes it possible to connect heat pumps, solar systems and fireplaces or wood pellet stoves.

**What type of heat pump to choose?**

For newly-built passive and low-energy houses, especially of a densely-built (e.g. terraced) type a TCA 3.1 „earth – water“ heat pump can be recommended provided that a horizontal loop collector can be installed at the site (approximately 30 m<sup>2</sup>) and the subsoil is of a suitable type. For renovation projects or when the subsoil is not suitable (e.g. rock, gravel) a TCV 4.8 „air – water“ heat pump is more suitable as it can be installed easily without the need of additional earthworks. An „air – water“ HP is also more suitable for newly-built houses with higher heat loss.

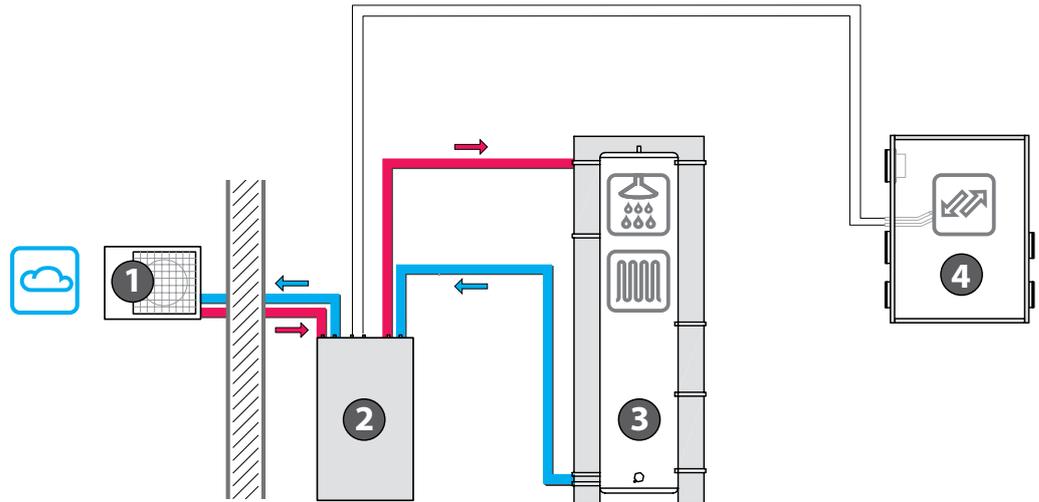
# TCV 4.8

A connection diagram of a TCV 4.8 into a heating, ventilation, active cooling and DHW heating system

## OPERATING MODES

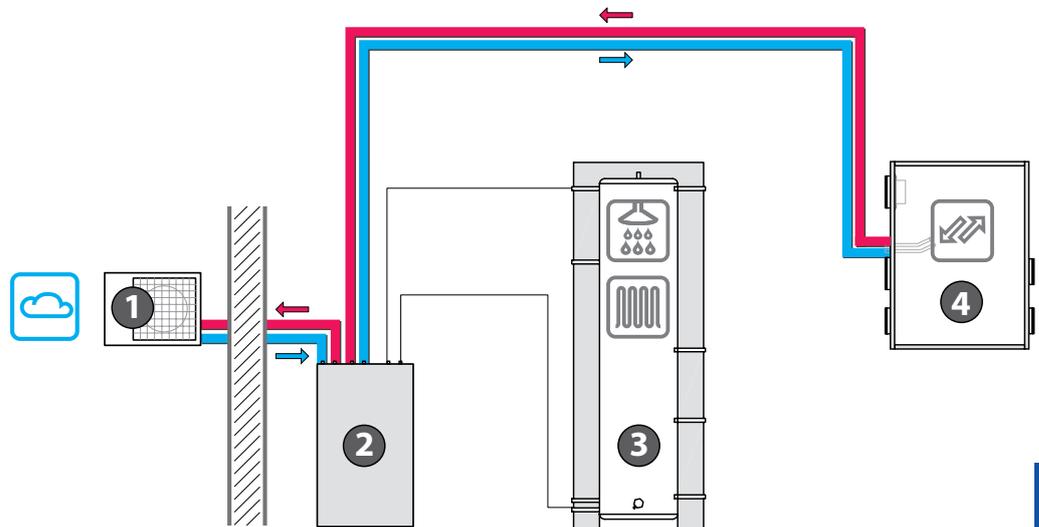
### Mode „A“

Charging the ATREA integrated heat accumulator IZT – winter operation.



### Mode „B“

Building cooling in summer – reverse HP operation.



### Economic viewpoints

When ATREA's TCA 3.1 and TCV 4.8 heat pumps are installed, the electricity supplier may grant a preferential power rate for the entire house in D56 tariff (i.e. 22 hours/day in low NT tariff).

Compared to direct electric heating and DHW heating annual cost saving on heating, DHW heating and running the household of up to 60 % may be expected.



V  
Z  
D  
U  
C  
H  
V  
O  
D  
A

3



**IZT-U-TTS 650**

An IZT-U can be used for all types of heating systems.

For a TCV 4.8 heat pump we recommend using accumulators with volumes between 350 and 650 litres in the TTSE version.

1

**FZ 14**  
outdoor unit

2

**TCV 4.8 kW**  
indoor unit

3

**IZT-U-TTS**  
Integrated heat accumulator

4

**DUPLEX R4**  
ATREA hot air unit

**Certification**

The TCA 3.1 heat pump was certified by the Engineering Test Institute in Brno.

The TCV 4.8 heat pump was certified by the Institute for testing and certification in Zlin.

**Placing the condensing unit**

The condensing unit must be placed with respect to the spreading of noise and vibrations, condensate drainage options and also with regard to protection from adverse weather conditions.

In terms of noise it is preferable to install it in a grassed area for better noise absorption. As far as vibrations are concerned, installing it on a concrete foundation rather than on wall bracket is recommended as vibrations might be transferred into the structure, particularly in wooden houses. A condensate drain line from the outdoor unit to a drainage system below the frost line must be always provided.

# SYSTEM

with a compact unit with a **built-in heat pump** (version A), with a **stand-alone heat pump** (version B, C)  
with **direct heat pump connection** (version D)

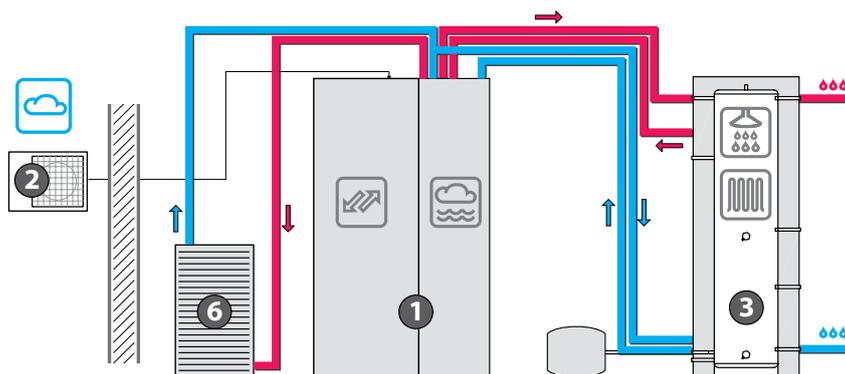
## WIRING DIAGRAM



### Connection arrangement „A“

with a compact unit

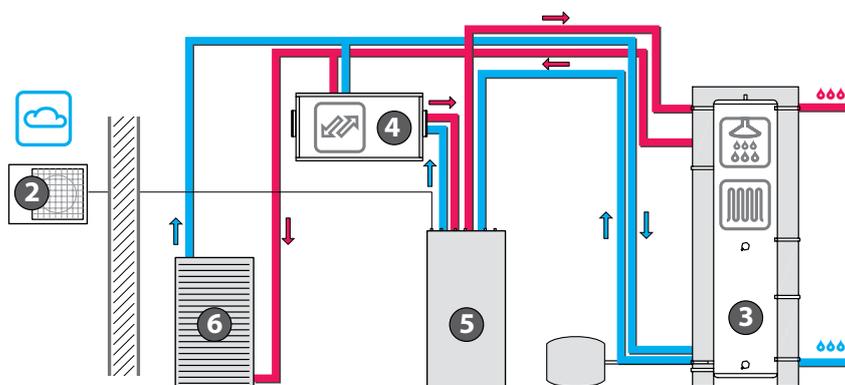
When a DUPLEX Alfa 4V or Kappa 4V compact hot air unit is used, it is not necessary to install a heat pump in a separate case. This substantially reduces the amount of ductwork in the utility room and improves the appearance of the installation. The unit is always equipped with cooling. This kind of arrangement is suitable for newly-built houses.



### Connection arrangement „B“

with a stand-alone heat pump

Using a stand-alone upright heat pump is suitable when an existing heating system is supplemented with an economical heat source or in new buildings with a DUPLEX RB4 hot air unit. This connection arrangements requires a more complex duct system and the installation of additional heating components on to the walls. Cooling is available only in selected heat pump models.



**1 DUPLEX Alfa 4V, Kappa 4V**  
Compact hot air unit with a heat pump (HP)



**2 OUTDOOR UNIT**  
of an air – water or air – air heat pump



**3 IZT-U**  
Integrated heat accumulator

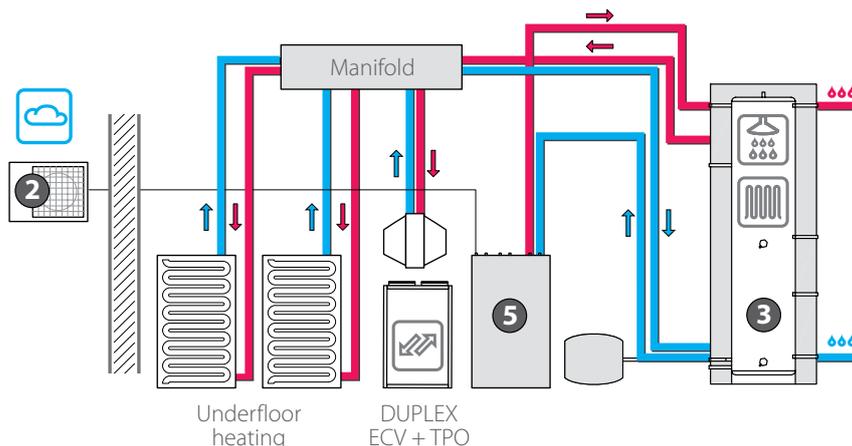




### Connection arrangement „C“

with a stand-alone heat pump and ventilation unit

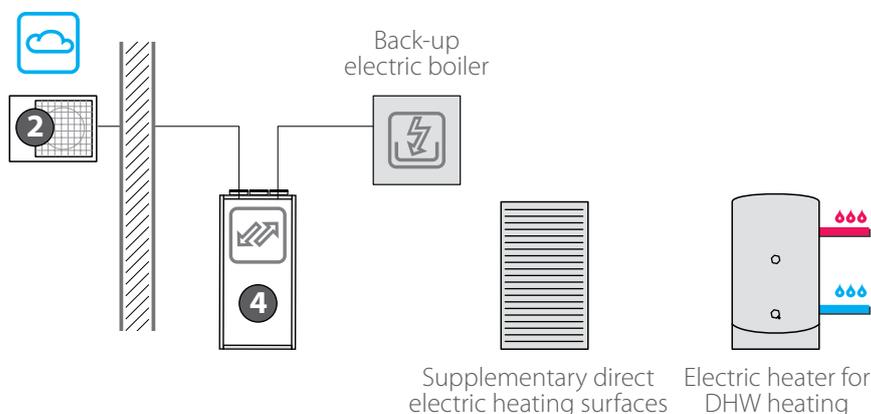
This type of connection is suitable when a heat pump is installed in a building using an equal pressure managed ventilation system with heat recovery with the possible reheating of supply air via a TPO duct hot air heating coil. Heating is provided by an independent heating system (e.g. underfloor heating). A cooling mode is not available in this type of connection arrangement.



### Connection arrangement „D“

DUPLEX R\_3 with direct evaporator

The connection arrangement with a direct evaporator in a DUPLEX R4 unit is suitable when cooling is a preferred option. Air heating via a heat pump in air – air mode is always supported by a back-up heat source (electric boiler) for periods with lower outdoor temperatures. The system does not allow heating water via a heat pump.



**4 DUPLEX R4**  
Stand-alone hot air unit



**5 TCV 4.8, TCA 3.1**  
Stand-alone heat pump air – water  
or earth – water  
(with ground flat collector)



**6 Supplementary heating surfaces**  
e.g. in bathrooms





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