



Cost-effective and advanced systems

CONTROLLED VENTILATION WITH HEAT RECOVERY

For low-energy and passive residences



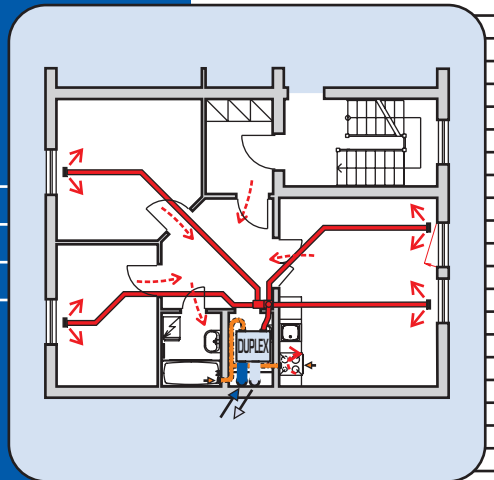
Unit ventilators with heat recovery
DUPLEX 230 EC, 330 EC, 500 EC
DUPLEX 220 BP, 360 BP, 550 BP



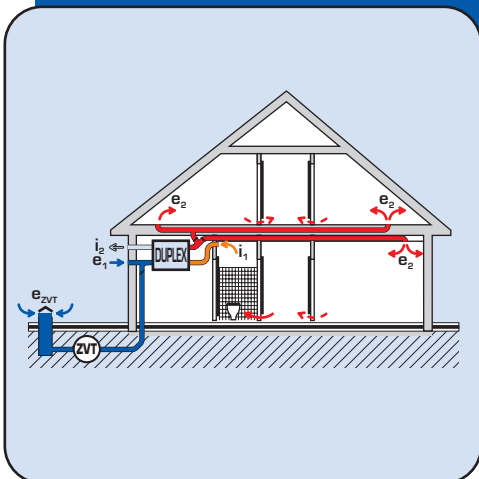
Unit ventilators with heat recovery
DUPLEX 220, 360



Ventilation units with heat recovery
DUPLEX 250 ECV, 380 ECV
DUPLEX 540 ECV



Residential floor air distribution layout



Family house ventilation system layout



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INDOOR ENVIRONMENTAL QUALITY

IMPORTANCE OF BUILDING VENTILATION

Building indoor environment may be evaluated by the following criteria:

Temperature-humidity environment is the most important part to ensure healthy indoor environment.

The recommended value of higher air RH (50 to 70 %) that prevents dryness of mucous membranes, commonly causes mold formation (e.g. the Alternaria or Aspergillus family), mainly in cool and poorly ventilated room corners, heads and linings. This results in increasing resident sickness figures, frequent nausea, allergies, bronchitis etc.

Those phenomena gain strength when inappropriately weatherstripping windows without an appropriate air intake compensation. In addition, with higher RH value (above 60 %) percentage of surviving organisms doubles (e.g. Staphylococcus, Streptococcus) in respect to RH value of 30 to 40 %. With decrease of the RH value number of mites in textiles and resulting allergies (asthma) dramatically decreases.

To the major humidity sources in buildings belong mainly human metabolism (produces 50 to 250 g of water vapor/h/1, based on activity), bathrooms (produce 700 to 2600 g of water vapor/h), kitchens (produce 600 to 1500 g of water vapor/h) and laundry drying (produce 200 to 500 g of water vapor/h/5 kg). In many rich counties it is recommended for keeping the optimum RH value (between 35 to 45%) that a forced ventilation of apartments with ACH value of $n = 0,3$ až $0,5$ (h^{-1}) be applied.

Microbial environment is created by microorganisms of bacteria, viruses, fungi, spores and pollens. Allergic syndroms from spores of different types of fungi and pollen particles become very serious problem these days.

Aerosol environment – aerosols occur in air in form of solid particles (dust) or fluid particles (mist).

Building dust, mainly particles smaller than 1 mikrometer, is other main cause of asthma.

Odour environment – next to a common odours (smoke, food preparation) styrenes, formaldehydes and paint vapors, substances not known before, occur in today's interior. In general, concentration of 0,10 % CO_2 (Pettenkofer kriterium max. 1 000 ppm) is stated as a comparative and exact measured value.

Quality of odour building environment can only be affected basically a sufficient intake of fresh air. Basic and worldwide recognized value of ventilation intensity for removal of common body odours (for not adapted persons) is 25 m^3 /hour of fresh outdoor air per person.

Toxic environment is created by toxic gasses with pathological effects. The most unhealthy gas in buildings' interior is CO. Poorly ventilated kitchens with gas stoves have NO_x occurrence up to 50 micrograms/ m^3 which has evidently cancerogenic effect.

COMPARISON OF VENT. SYSTEM PARAMETERS

Accomplishing Parameter	window infiltration	tight windows	bathroom air exhaust	equal-press. heat recover.
Thermal comfort	●	●	○	●
Room ventilation	●	-	○	●
Occasional ventilation	-	-	-	●
Bathroom exhaust	-	-	○	●
Ventilation efficiency	○	-	-	○
Heat recovery	-	-	-	●
In. & ext. gain use	-	-	-	○
Air filtration	-	-	-	●
Night precooling	-	-	-	○

● completely ○ partially - does not accomplish

VENTILATION REQUIREMENT FOR KITCHEN & BATHROOM

standard	kitchen (m^3h^{-1})	bathroom (m^3h^{-1})	WC (m^3h^{-1})
DIN 18017/3		40 - 60	20 - 30
DIN 1946/6	40 - 60	40 - 60	20 - 30
ECE Compendium	36 - 180	36 - 180	
BSF 1998:38	36 - 54	36 - 108	36
CR	100 - 150	60	25

PRINCIPLES OF LOW-ENERGY BUILDINGS

New version of the CSN 730540 - 2 (2007) „Thermal insulation of buildings“ uses, in accord with the EU, significantly tougher values of heat transfer coefficient of all perimeter structures compared with the previous requirements. Also, new indoor-air-quality requirements for building airtightness, controlled ventilation with heat recovery and tightness (leakage) are specified based on the CSN EN 13829 (Blower - door test).

Purpose of these significant changes is mainly to decrease building operation energy use as well as to improve building indoor air quality.

The future will definitely belong to the low-energy (and energy-passive) home construction where calculated space heating heat source consumption does not exceed 50 [15] kWh/m^2 a year, and for which following main principles may be defined:

1. Proper lot orientation to the world coordinates
2. Room orientation to south to utilize passive solar energy
3. Compact building shape (A : V ration) and optimum glazing size
4. Avoiding thermal bridges
5. Very low heat transfer coefficient of all perimeter structures: perimeter walls: $U < 0,15$ W/m^2K ; roof: $U < 0,12$ W/m^2K ; windows: $U < 1,0$ W/m^2K
6. Low production energy use of building materials (e.g. suitability of wood)
7. Perfect building (measured by the „Blower door test“ according to the EN 13829, i.e. $n < 0,9$ (h^{-1}) at $\Delta p = 50$ Pa)
8. Installing controlled ventilation with heat recovery, preferably in combination with flexible warm-air heating and utilization of indoor heat gains
9. installing bivalent (supplementary) biomass-based heating supply (fireplace insert, stove)
10. Installing solar systems to support space and portable water heating with low-temperature storage
11. Using energy-saving appliances

COMPARISON OF BUILDING ENERGY PARAMETERS

Parameter	unit	old family houses	low - energy houses (NERD)	energy passive houses (EPD)
Heat energy use for heating & ventilation *)	$kWh/year$	to 25 000	to 9 800	< 2 100
Specific design heat energy input for heating & ventilation	W/m^2	> 110	20 - 40	< 10
Specific heat use - for space heating and ventilation	$kWh/m^2/a$	170 - 220	30 - 70	= 15
Specific heat use - for portable water	$kWh/m^2/a$	35	< 20	10 - 15
Specific electric energy use in a household (EI)	$kWh/m^2/a$	30	< 20	10 - 15
Total specific energy use (heating+ventilation+portable water+ EI)	$kWh/m^2/a$	235 - 285	70 - 110	35 - 45
Total use of primary fuel	$kWh/m^2/a$	-	-	< 120
Min. required heat transfer coefficient through walls	$W/m^2/K$	-	< 0,20	< 0,12
Min. required heat transfer coefficient through windows	$W/m^2/K$	-	< 1,0	< 0,8

*/ an average family house wit 140 m^2 of used area

**/ for EPH indoor gains cover up to 35 % of total heat energy for space heating, solar gains up to 30 %, remaining use is approx. 35 %

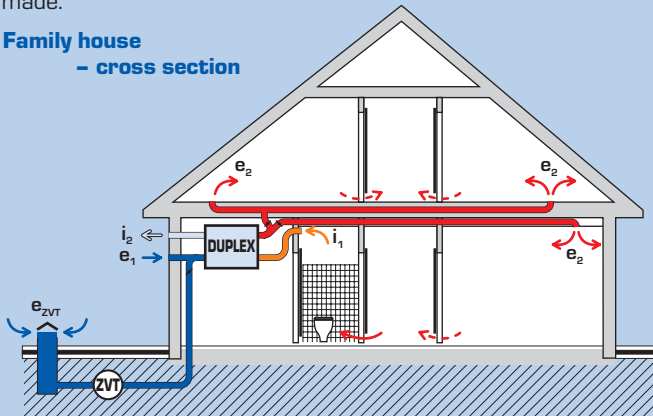
***/It is preferable in the central-european climate to use internal gains

ATREA AIR-HANDLING SYSTEM FOR LOW-ENERGY AND PASSIVE HOUSES

Ventilating system enables controlled equal-pressure ventilation with heat recovery of family houses and high-rise apartment buildings, including reheat and summer precooling of supply air, with effective utilization of all internal and external energy gains. The system provides filtered fresh air supply to each room and kitchen as well as exhaust of stale air from bathrooms and kitchen. For low-energy buildings it supplements the ventilation system with a heating system (radiators, floor heating, etc.). In low energy houses, the ventilation system complements the basic heating system (central heating radiators, underfloor heating etc.).

For passive buildings we recommend warm-air circulation heating and heating with heat recovery to maintain optimum humidity in dwelling spaces through air circulation. Connection to fireplace inserts or other bivalent sources can also be easily made.

Family house - cross section



- e_1 fresh air from facade
- e_{zvt} fresh air intake from a ground heat-exchanger (optional)
- e_2 fresh air supply to rooms
- i_1 stale return air from bathrooms and kitchen
- i_2 exhaust air outlet after heat recovery

DUPLEX unit ventilator with heat recovery

ZVT ground heat-exchanger (optional), of PVC (PP, PE) pipes

Ground heat-exchanger is designed for ventilating air preheating in heating season and precooling in summer. Also, it protects a heat recovery core against freezing.

The ground exchanger consists of piping in ground of 20 to 25 m of length, inlet shaft and shaft cover with filter located above ground. The winter outdoor air at -15°C preheats in ground heat-exchanger to $+2$ to $+5^{\circ}\text{C}$.

The summer outdoor air precools from $+32^{\circ}\text{C}$ down to $+18^{\circ}\text{C}$.

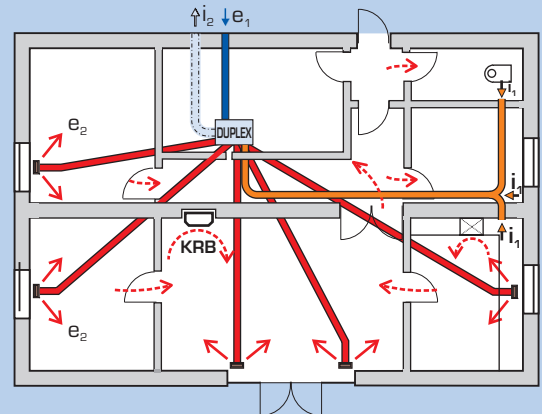
During off season the ventilating air intake is via louvers on building's facade and T-shaped duct with dampers and an actuator. An outdoor air temperature sensor located on north wall of a building controls a switchover between the intake via the louvers or the ground heat-exchanger.

Technical solutions and functions of the ATREA system

- The DUPLEX / DUPLEX EC unit ventilator can be located below ceiling of a bathroom, technical room, etc. Also, it is possible to install the unit in a loft or on a wall in a technical room, closet, etc.
- fresh air distribution ductwork is installed based on building type:
 - a) Ductwork of galvanized sheet metal of 160 x 40 mm size, laid in floor insulation layer, with floor outlets with controls. This system is designed for new buildings. Branch-based air distribution from a central floor shaft avoids crosstalk between rooms.
 - b) Air distribution below false ceiling of round duct (galvanized, PVC), with round diffusers. This system is designed for new buildings with false ceiling.
 - c) Air distribution below ceiling of round duct (galvanized, PVC, sound attenuators), covered by drywall (SDK, Fermacell, etc.), with jet air outlets below ceiling (Coanda effect). This system is designed for additional installations and for renovation of concrete-panel apartment buildings.

All supply ductwork cleaning is ensured in all system options.

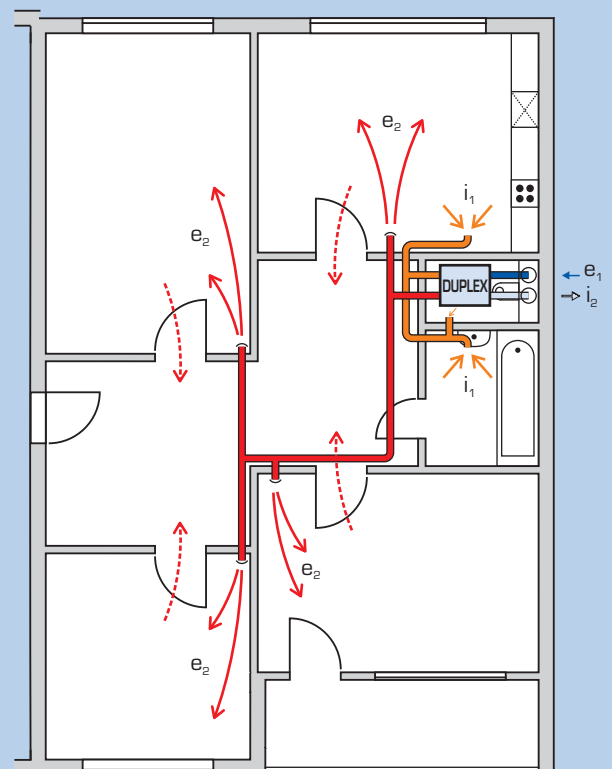
Family house - floor air distribution



- stale air from bathrooms is exhausted via round duct of $\varnothing 100 - 160$ mm below ceiling or below false ceiling with round air inlet with controls
- air from rooms is exhausted via slots below doors (6 to 8 mm) to a corridor and drawn below doors to a bathroom
- kitchen hoods above stoves are always of circulation type with carbon filters to trap odors, with adjustable volume flow of 150 to 450 m^3/h
- fresh air inlet and stale air outlet is usually accomplished by rain louvers on building facade, or to central shaft via shutoff- and fire dampers for high-rise buildings.
- fresh air supply to rooms is sized at 30 to 45 m^3/h (based on supposed occupation), bathroom air exhaust according to DIN 1946/6 with air volume flow: bathroom 40 to 60 m^3/h ; lavatory only 20 to 30 m^3/h ; kitchen 40 to 60 m^3/h (exhaust of vapor only, which is not trapped by the circulation hood).




Observe the ČSN 730872 „Protection of buildings against fire propagation via air-handling system” (distances, dampers) when designing air distribution ductwork and shafts for high-rise buildings.

Family house - ceiling air distribution









ATREA MODULAR AIR-HANDLING SYSTEM



DUPLEX EC (UNIT WITH ELECTRONICALLY CONTROLLED FANS)

	DUPLEX 230 EC	or. no. A160200	Unit ventilator with a counterflow heat recovery core, automatic by-pass including actuator; electronically controlled EC motors, built-in digital control module, G4 filters, operation and maintenance manual
	DUPLEX 330 EC	or. no. A160201	
	DUPLEX 500 EC	or. no. A160207	
	DUPLEX 250 ECV/O	or. no. A160250	A ventilation unit with a counter-flow heat recovery exchanger; automatic by-pass including a servo drive, electrically-powered EC motors, a built-in digital control module, G4 class filters and an operation and maintenance manual
	DUPLEX 250 ECV/1	or. no. A160251	
	DUPLEX 380 ECV/O	or. no. A160260	
	DUPLEX 380 ECV/1	or. no. A160261	
	DUPLEX 540 ECV/O	or. no. A160270	
	Regulátor CP 08 RD - white	or. no. A170280	A controller for units with a built-in digital module - a digital version with a display and a built-in ambient temperature sensor to allow comfortable control of the entire system in automatic mode with a wide range of parameter settings
	Regulátor CP 08 RD - ivory	or. no. A170281	




OPTIONAL ACCESSORIES - CONTROLLERS, SENSORS, FILTERS

	HYG 6001	or. no. A141303	Room humidistat - RH sensor to switch the unit based on set RH value
	PS 1000	or. no. A141306	Room movement switch - to switch the unit based on occupancy
	QPA 84	or. no. A141301	Room IAQ (indoor air quality) sensor - to switch selected fan speed based on increased concentration (reacts mainly to cigarette smoke)
	AS CO2-P	or. no. A142308	Room sensor with continuous control of output ventilation based on actual CO ₂ value
	FT G4	or. no. dep. type	Spare filter cloth with basic filtration class G4 (package of 10 peices - 10 replacements)
	FT F7	or. no. dep. type	Spare filter cloth with higher filtration class F7 (package of 10 pieces - 10 replacements)
	FK G4	or. no. dep. type	Spare filter cassette with basic filtration class G4
	FK F7	or. no. dep. type	Spare filter cassette with higher filtration class F7

OPTIONAL ACCESSORIES - HEATING COILS







	EPO-V 125/0,8 EC	or. no. A150101	Electric heating coil to be fitted into the duct; it has coils with heating capacities of 0.9 kW (1.5 or 2.1 kW), non-interference switches, operating and safety thermostats and an installation, operation and maintenance manual. Duct sensor ADS !@) must be installed.
	EPO-V 160/1,4 EC	or. no. A150102	
	EPO-V 200/2,1 EC	or. no. A150103	
	TPO 125 EC	or. no. A160204	Hot-water coil to be built in duct comprises heating coil, capillary freeze protection thermostat, electrically controlled shutoff valve, thermostatic control valve with capillary duct sensor; operation, installation and maintenance manual
	TPO 160 EC	or. no. A160203	
	TPO 200 EC	or. no. A160209	

DUPLEX (UNITS WITH STANDARD FANS)

	DUPLEX 220	or. no. A160300	Unit ventilator with a counterflow heat recovery core, without a by-pass, with a G4 filters, operation and maintenance manual"
	DUPLEX 360	or. no. A160301	
	DUPLEX 220 BP	or. no. A160350	Unit ventilator with a counterflow heat recovery core, by-pass with an actuator, G4 filters, operation and maintenance manual"
	DUPLEX 360 BP	or. no. A160351	
	DUPLEX 550 BP	or. no. A160352	
	GHE damper control	or. no. A160210	Thermostat for controlling the ground heat exchanger damper

HEAT SOURCE, DUCTWORK, VALVES

ATREA s. r. o. offers a complete air distribution system for DUPLEX units including fittings and terminal elements. For detailed specifications see the „[System of warm-air heating and ventilation of family houses with heat recovery – Designed data, product catalog](#)“.

	Floor ducts	160 x 40 mm air distribution ducts for floor system; 200 x 50 mm including distribution shafts, transitions and complete accessories
	Round ducts	Complete range of sturdy and flexible ducts, with acoustic and thermal insulation, sound attenuators - see the "Atrea catalog"
	Air distribution	Complete range of fitting, facade louvers, transitions, etc. - se the "Atrea catalog"
	Floor grilles	Adjustable grilles for floor supply air outlet to rooms
	Wall diffuser	Special air outlet ø 100, ø 125 mm for jet air supply from wall under ceiling
	Round diffusers	Wall and ceiling diffusers with lock for supply and return air - see „Atrea catalog“

More information at www.atrea.cz