TANGRA®

AIR HANDLING UNITS WITH HEAT PUMP INCORPORATED

TANGRA AHU - DEX

www.tuv.com
TÜVRheinland®
ID:9105068985

Description

The microclimate in buildings is one of the most important factors for comfort of the occupants. In the premises with high level of humidity like indoor swimming pools and SPA centers the maintaining of proper temperature and precise humidity is highly significant. An advantage of the air conditioning and ventilation systems is that they not only provide comfort and fresh air, but also prevent condensation on the inner surfaces and thereby preserve buildings structure and furnishing for long time.

Traditionally air conditioning and ventilation systems for swimming pools are big consumers of energy. Air handling units with heat pump are the most energy efficient solution due to the two step heat recovery. The first is the plate or rotary heat exchanger and the second is the heat pump, thus the total COP of the unit is more than 9 (COP* > 9)

TANGRA company has rich experience in the design and production of HVAC units and systems. Production, Research and Development Department and HVAC Laboratorie are situated at more than 8000 sq.m. Well educated professionals are responsible to satisfy every specific HVAC need. Machines with extremely high precision and efficiency assure the high quality of the production.

Air handling units TANGRA AHU DEX M and TANGRA AHU DEX S are designed to work in clean and non-explosive environment.

Air handling units with heat pump module are used in the following ventilation and air conditioning installations:

- Commercial buildings
- Office and business buildings
- Indoor swimming pools
- Thermal and mineral baths
- Private swimming pools
- SPA centers
- Sanatoriums

Certificate
of conformity

Certificate Register No: 2013 – BSP _P02/P03-0030.3-Z

TUV Rheinland- Bulgaria EOOD
Herewith certifies that the company

Certificate Holder: „TANGRA-AV" OOD
BG – 1331, Sofia
174, Evropa Blvd.
Bulgaria

Manufactures the product
AIR HANDLING UNIT
TANGRA AHU-DEX
Type: with heat recovery and heat pump module,
Model: AHU-DEX, Serial No. AHU-DEX 20XX-XXX

In conformity with following documents:
Directive 2006/42/EC on machinary,
Low Voltage Directive (LVD) 2006/95/EC

and are applying following standards:
БДС EN ISO 12100:2012; БДС EN 60204-1:2006; БДС EN 60335-1:2003;
БДС EN 60335-2-40:2003; БДС EN 60335-2-80; БДС EN 13053:2006+A1:2011;

This certificate is based on the examinations referred to in Report No. № 2012-BSP_P02/P03-0030.1-R/25.09.2013 and Test protocols № 13.0039/02.057/20.09.2013 and № 13.0039/02.058/ 20.09.2013. Copies of the them are available in TUV Rheinland Bulgaria EOOD.
It is an obligation of the manufacturer to affix the conformity marking on the product under strict observation of all valid requirements related to the product.

Validity: The year of first certification: 2013

Dipl. Eng. K. FILIPOV

Sofia, 26.09.2013

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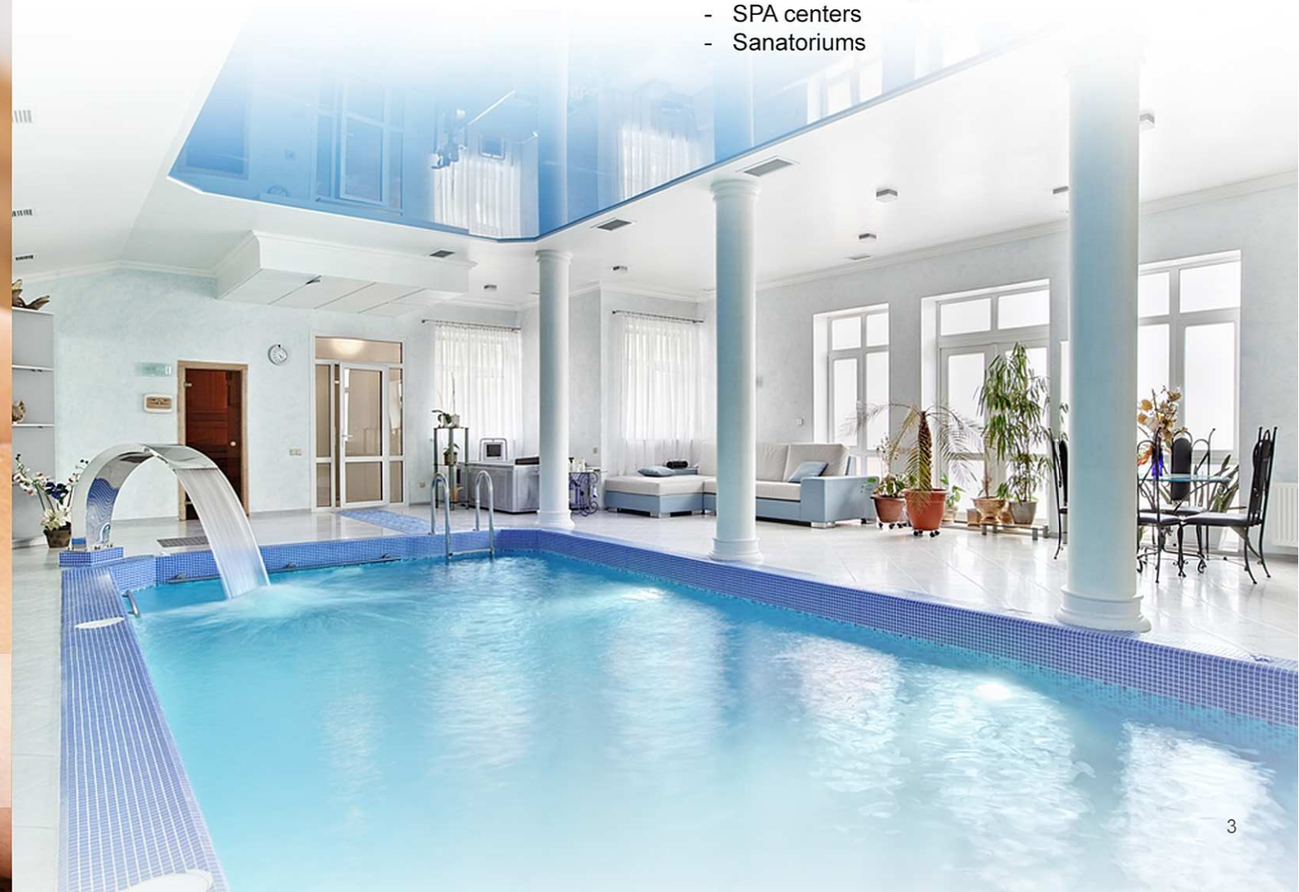
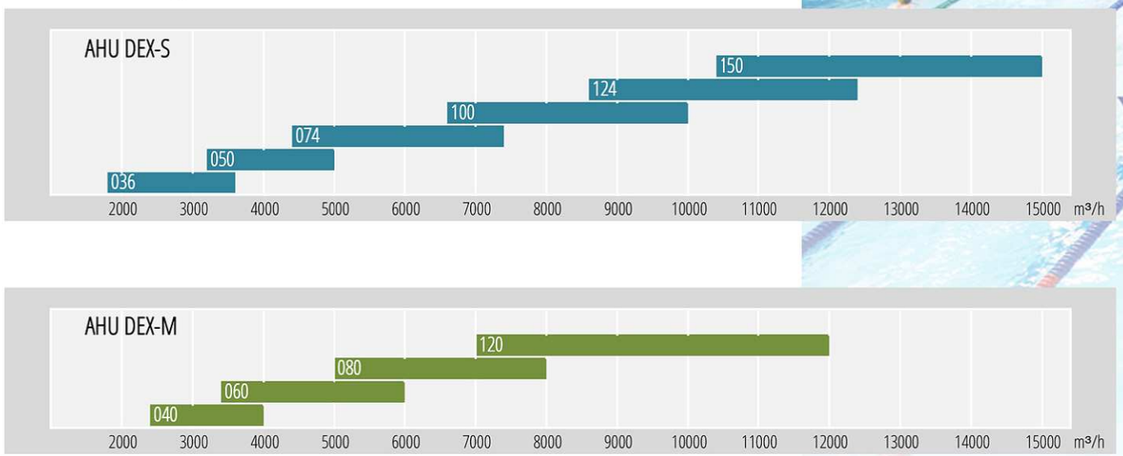
TÜVRheinland®
Precisely Right.

Characteristics proved by TÜV Rheinland in accordance with DIN EN 1886



Construction

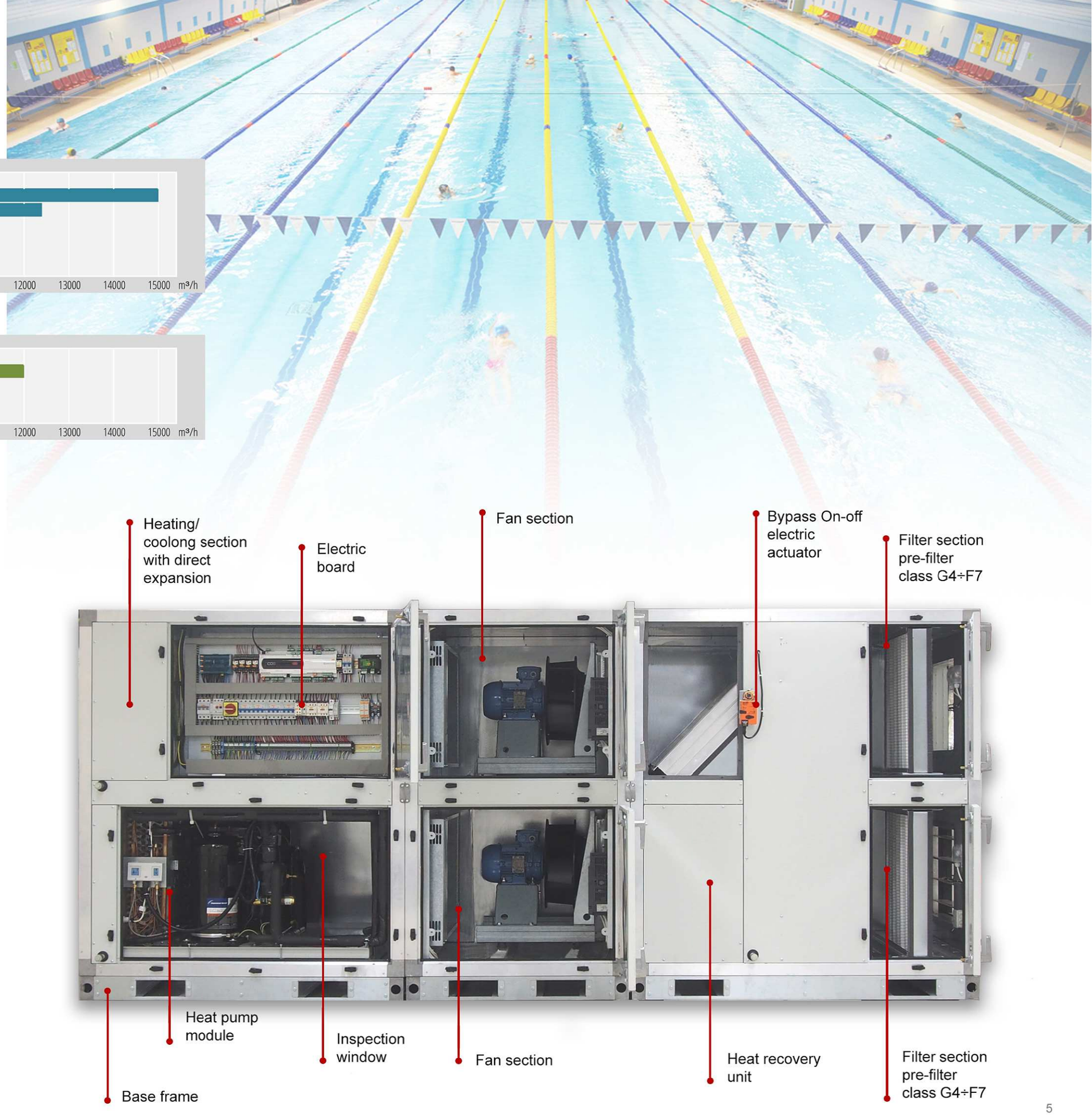
Product range



TANGRA AHU-DEX air handling units are manufactured in modules allowing easy assembly, installation and commissioning.
TANGRA DEX-S with incorporated indoor and external outdoor heat pump unit, with air flow from 1800 up to 15000m3/h.
TANGRA DEX-M with incorporated indoor and outdoor unit (air flow from 2500 to 12000m3/h).

Technical characteristics in accordance with DIN EN 1886:
- Casing deflection - Class D1
- Thermal transmittance - Class T2 (M)
- Thermal brifging - TB2 (M)
- Casing leakage - Class L2 (M)
- Filter leakage - Class F9 (M)

Advantages:
- High efficient two-stage heat recovery from the exhaust air.
- Three models of heaat exchanger units with efficiency from 35% up to 65%.
- Heat pump module with variable capacity compressor from 10% up to 100% - Copeland Scroll Digital.
- Total efficiency higher than 90%.
- IE2 and IE3 fans with EC and AC motors for lower energy consumption.
- All in 1 - the unit is easy for transportation and installation and all the modules are joined by fast connections.
- Easy and precise control by programmable controller.
- Plug and play

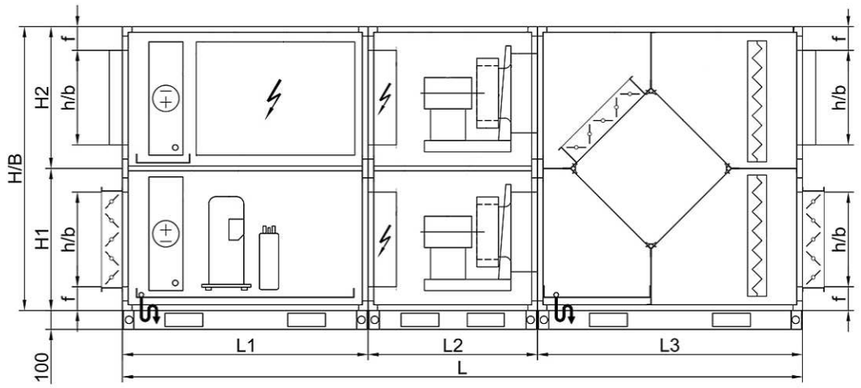


Technical data

AHU DEX-M _ _

040 060 080 120

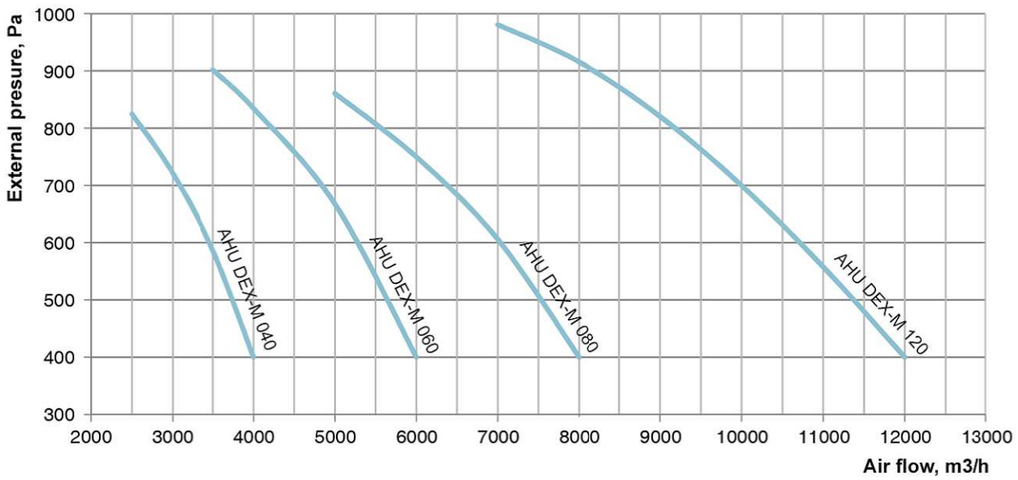
Monoblock type



Overall and joined dimensions

Model	Air flow	B	H	L	H1	H2	L1	L2	L3	b	h	f
	m³/h	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
AHU DEX-M 040	2500÷4000	1160	1500	3600	750	750	1300	900	1400	700	500	125
AHU DEX-M 060	3500÷6000	1600	1500	3600	750	750	1300	900	1400	1000	500	125
AHU DEX-M 080	5000÷8000	1500	2100	4850	1050	1050	1600	1000	2250	1000	700	175
AHU DEX-M 120	7000÷12000	2100	2100	5050	1050	1050	1600	1200	2250	1400	700	175

Aerodynamic characteristics



We reserve the right to introduce alternations both in design and technical data without prior notice, due to continued product development.

		DEX-M 040	DEX-M 060	DEX-M 080	DEX-M 120
Maximum air flow	m³/h	4000	6000	8000	12000
Minimum air flow	m³/h	2500	3500	5000	7000
External pressure at maximum air flow	Pa	450	420	450	400
Nominal fan capacity	kW	2x1,5	2x2,2	2x3,0	2x4,0
Nominal capacity of the compressor(s)	kW	3,70	5,50	2x3,70	2x5,50
Nominal capacity of the electric heaters	kW	2x7,5	2x11,25	2x15,0	2x18,75
Total capacity	kW	21,70	32,40	43,40	56,50
Power supply	ph/V/Hz	3+N / 400 / 50			
Room air temperature 22°C / relative humidity 30%; External air temperature -15°C / relative humidity 90%					
Temperature of supply air	°C	22	22	22	22
Efficiency of a plate heat recovery unit “air-air” (REC)	%	56,9	57,0	55,4	55,0
Recovered energy from REC	kW	29,00	43,50	56,30	83,80
Heating capacity of heat pump	kW	16,20	25,40	32,50	51,20
Total heating capacity (supply air)	kW	49,63	74,45	99,26	148,89
Electric capacity	kW	17,16	24,60	32,69	48,56
COP [(1)] at maximum air flow		**2,90**	**3,03**	**3,04**	**3,07**
COP [(2)] at maximum air flow, without fans		**3,46**	**3,62**	**3,64**	**3,64**
Room air temperature 22°C / relative humidity 30%; External air temperature -5°C / relative humidity 90%					
Temperature of supply air	°C	22,7	23,3	22,8	23,4
Efficiency of a plate heat recovery unit “air-air” (REC)	%	57,3	57,4	55,6	55,3
Recovered energy from REC	kW	21,10	31,70	41,00	61,10
Heating capacity of heat pump	kW	16,20	25,50	32,60	51,20
Total heating capacity (supply air)	kW	37,30	57,20	73,60	112,30
Electric capacity	kW	6,21	9,17	12,22	17,94
COP [(1)] at maximum air flow		**6,01**	**6,24**	**6,03**	**6,26**
COP [(2)] at maximum air flow, without fans		**10,94**	**11,07**	**10,80**	**10,87**
Room air temperature 27°C / relative humidity 47%; External air temperature 35°C / relative humidity 40%					
Temperature of supply air	°C	23,8	23,5	23,8	23,5
Efficiency of a plate heat recovery unit “air-air” (REC)	%	57,6	57,5	55,9	55,5
Recovered energy from REC	kW	5,7	8,7	11,3	17,1
Cooling capacity of heat pump	kW	13,6	21,6	27	43
Total cooling capacity (supply air)	kW	19,3	30,3	38,3	60,1
Electric capacity	kW	6,8	10,2	13,3	20,2
EER [(3)] at maximum air flow		**2,86**	**2,98**	**2,88**	**2,98**
EER [(4)] at maximum air flow, without fans		**4,89**	**4,89**	**4,85**	**4,77**

Q_{max} energy needed for heating the fresh air at maximum air flow
N_{fan} max power consumption of the fans at maximum air flow
N_{comp} max power consumption of the compressors at maximum air flow
$N_{el.heat.}$ power consumption of the electric heaters at maximum air flow
$Q_{max\ cool}$ energy needed for cooling the fresh air at maximum air flow

$$(1)\ COP = \frac{Q_{max}}{N_{fan} + N_{comp.} + N_{el.heat.}} \qquad (2)\ COP = \frac{Q_{max}}{N_{comp.} + N_{el.heat.}}$$

$$(3)\ EER = \frac{Q_{max\ cool}}{N_{fan} + N_{comp.}} \qquad (4)\ EER = \frac{Q_{max\ cool}}{N_{comp.}}$$

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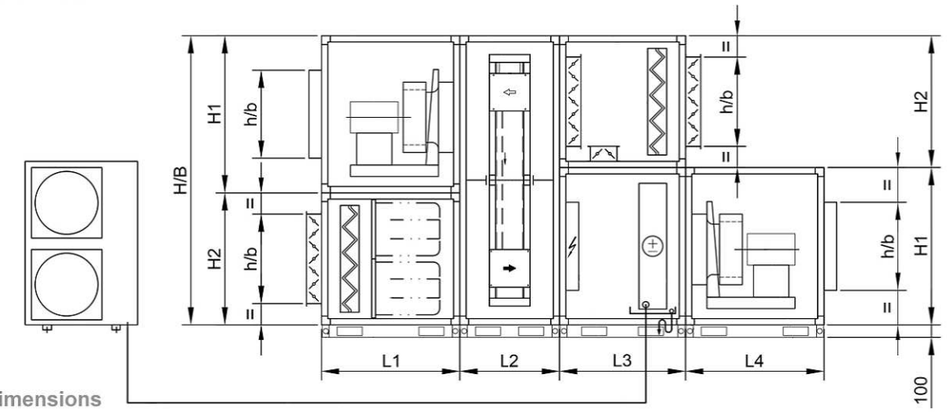
Technical data

AHU DEX-S _ _

036 050 074 100 124 150

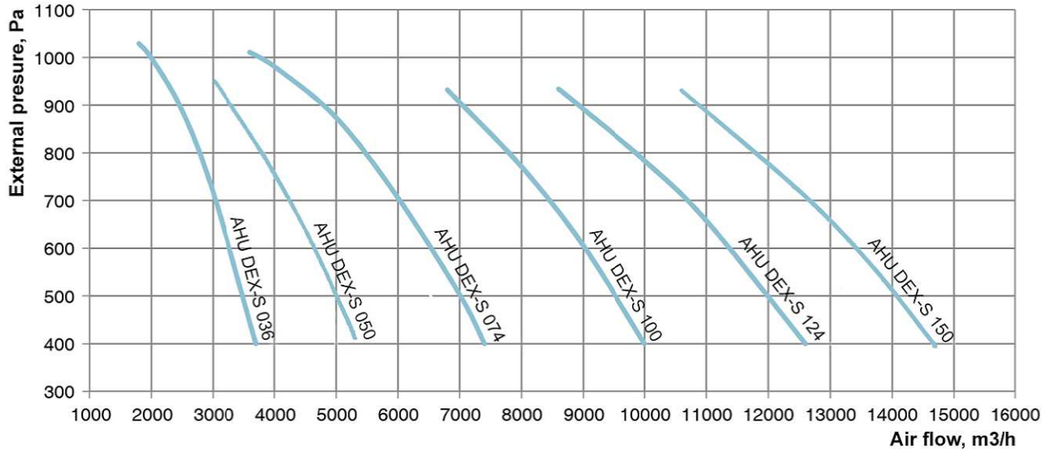
Split type



Overall and joined dimensions

Model	Air flow	B	H	L	H1	H2	L1	L2	L3	L4	b	h
	m³/h	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
AHU DEX-S 036	1800÷3700	1100	1400	3200	700	700	900	600	900	800	700	500
AHU DEX-S 050	3300÷5000	1400	1500	3300	800	700	900	600	900	900	1000	500
AHU DEX-S 074	3600÷7400	1600	1800	3500	900	900	1000	600	900	1000	1000	700
AHU DEX-S 100	6800÷10000	1850	2000	4000	1000	1000	1100	800	1100	1000	1400	700
AHU DEX-S 124	8600÷12600	2200	2300	4200	1250	1050	1150	800	1100	1150	1400	800
AHU DEX-S 150	10400÷15000	2200	2300	4400	1250	1050	1250	800	1100	1250	1600	800

Aerodynamic characteristics



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		DEX-S 036	DEX-S 050	DEX-S 074	DEX-S 0100	DEX-S 124	DEX-S 150
Maximum air flow	[m³/h]	3700	5000	7400	10000	12600	15000
Minimum air flow	[m³/h]	1800	3300	3600	6800	8600	10400
External pressure at maximum air flow	[Pa]	400	400	400	400	400	400
Nominal fan capacity	[kW]	1,5+1,1	2,2+1,5	3,0+2,2	4,0+3,0	5,5+4,0	7,5+5,5
Nominal capacity of the outdoor unit	[kW]	5,10	7,70	2x5,1	2x7,7	3x6,1	3x7,7
Nominal capacity of the electric heaters	[kW]	6,25	6,25	10,00	11,25	15,00	22,50
Nominal capacity of the ROT motors	[kW]	0,09	0,09	0,09	0,18	0,18	0,18
Total capacity	[kW]	14,04	17,74	25,49	33,83	42,98	58,78
Power supply	[ph/V/Hz]	3+N / 400 / 50					
Room air temperature 22°C / relative humidity 30%; External air temperature -15°C / relative humidity 90%							
Temperature of supply air	[°C]	22,8	24,6	22,8	24,6	24,1	24,6
Efficiency of a plate heat recovery unit “air-air” (ROT)	[%]	68,6	71,9	71,8	71,4	72,5	69,3
Recovered energy from ROT	[kW]	37,70	53,30	79,00	105,90	134,40	154,10
Heating capacity of heat pump (VRF)	[kW]	9,00	14,90	18,00	29,80	35,60	44,70
Total heating capacity (supply air)	[kW]	52,20	73,70	105,20	147,42	183,10	220,20
Electric capacity	[kW]	11,28	14,70	19,87	30,12	35,03	49,58
COP [(1)] at maximum air flow		**4,63**	**5,01**	**5,29**	**4,89**	**5,23**	**4,44**
COP [(2)] at maximum air flow, without fans		**5,83**	**6,44**	**7,00**	**6,25**	**6,72**	**5,63**
Room air temperature 22°C / relative humidity 30%; External air temperature -5°C / relative humidity 90%							
Temperature of supply air	[°C]	25,8	28,2	25,8	28,2	27,5	28,2
Efficiency of a plate heat recovery unit “air-air” (ROT)	[%]	68,8	72,1	72,0	71,6	72,7	69,5
Recovered energy from ROT	[kW]	25,20	35,50	52,60	70,60	89,60	102,70
Heating capacity of heat pump (VRF)	[kW]	12,40	20,50	24,80	41,00	49,00	61,50
Total heating capacity (supply air)	[kW]	37,60	56,00	77,40	111,60	138,60	164,20
Electric capacity	[kW]	6,26	10,02	12,63	20,04	23,91	30,64
COP [(1)] at maximum air flow		**6,01**	**5,59**	**6,13**	**5,57**	**5,80**	**5,36**
COP [(2)] at maximum air flow, without fans		**9,54**	**8,28**	**9,94**	**8,25**	**8,59**	**8,13**
Room air temperature 27°C / relative humidity 47%; External air temperature 35°C / relative humidity 40%							
Temperature of supply air	[°C]	21,6	19,8	21,6	19,8	19,8	19,8
Efficiency of a plate heat recovery unit “air-air” (ROT)	[%]	69,7	72,9	72,8	72,4	73,5	70,4
Recovered energy from ROT	[kW]	7,10	10,00	14,80	19,80	25,10	28,80
Cooling capacity of heat pump (VRF)	[kW]	16,00	27,00	32,00	54,00	67,20	81,00
Total cooling capacity (supply air)	[kW]	23,10	37,00	46,80	73,80	92,30	109,80
Electric capacity	[kW]	7,54	12,10	15,19	24,20	29,55	36,88
EER [(3)] at maximum air flow		**3,06**	**3,06**	**3,08**	**3,05**	**3,12**	**2,98**
EER [(4)] at maximum air flow, without fans		**4,43**	**4,19**	**4,52**	**4,17**	**4,24**	**4,15**

Q_{max} energy needed for heating the fresh air at maximum air flow
N_{fan} max power consumption of the fans at maximum air flow
$N_{comp.}$ max power consumption of the compressors at maximum air flow
$N_{el.heat}$ power consumption of the electric heaters at maximum air flow
N_{ROT} power consumption of the rotary heat exchanger ROT
$Q_{max\ cool}$ energy needed for cooling the fresh air at maximum air flow

(1) $COP = \frac{Q_{max}}{N_{fan} + N_{comp.} + N_{el.heat.} + N_{ROT}}$

(2) $COP = \frac{Q_{max}}{N_{comp.} + N_{el.heat.} + N_{ROT}}$

(3) $EER = \frac{Q_{max\ cool}}{N_{fan} + N_{comp.} + N_{ROT}}$

(4) $EER = \frac{Q_{max\ cool}}{N_{comp.} + N_{ROT}}$

We reserve the right to introduce alternations both in design and technical data without prior notice, due to continued product development.

Components

CONSTRUCTION

The basic construction of the unit consists of special aluminium profiles and aluminium corners. The panels are of the “sandwich”type, consisting of an outer and inner cover with an integrated inner thermal and sound insulation. The covers are made of galvanized sheet steel with powder coating.

The thickness of the panels is 25 and 50 mm. TANGRA AHU DEX meet DIN EN 1886 requirements for class T3 and T2 thermal transmittance.

MULTIPLE LEAF DAMPER

The leaf damper can be operated manually or automatically througn the use of an actuator directly connected to the temperature sensor. This way the water section is safe from potential freezing.

FILTER SECTION

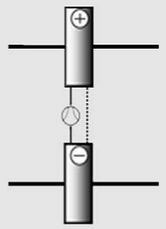
The unit is manufactured with cassette filter, class G4. According to customer’s request, the filter may be cassette or bag type with filtration class G4 up to F9. The filters are mounted by conducting guides and locking mechanism, which allows their easy removal if necessary.

HEAT RECOVERY SECTION

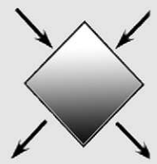
➤ Heat exchanger system with intermediate heat transfer
Two heat exchangers "water-air" are placed in the flow of fresh and exhaust air. The heat exchangers are connected with pipe system and circulating pump transport continuously water / propylene glycol between them.
This type of heat exchange is used when both streams have to be completely isolated from each other or due to special installation requirements. Heat exchangers are made of copper pipes and aluminum lamellas.

➤ Plate heat exchanger
Compact unit that allows heating/cooling of the fresh air by using energy of the exhaust air. Both air flows are fully separated.
The plate heat exchangers used in hygiene air handling units TANGRA are with aluminum lamellas and pans of stainless steel. Bypass is also available for defrost of the heat exchanger in the winter and to allow "free cooling".

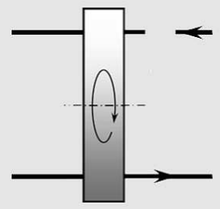
➤ Rotary regenerative heat exchanger
The heat exchanger rotates, thereby ensuring heat transfer between the flows of hot exhaust air and cold fresh air.
There is a possibility of a partial return of moisture from discharged air.



E = 35 ÷ 50 %



E = 50 ÷ 65 %



E = 65 ÷ 80 %

Components

HEAT PUMP SECTION

(Direct expansion section)

Heat pump modules in two modifications with indoor and outdoor units incorporated (DEX-M), or with indoor unit incorporated and external outdoor unit (DEX-S).

The heat pump units allow easy heating and cooling of the incoming air without the need of additional external energy source.

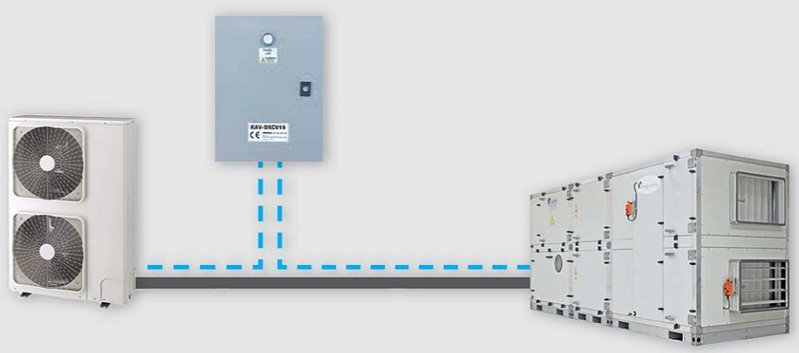
AHU DEX-M series is compact, with whole heat pump unit incorporated in the AHU's body. Refrigeration modules are with one or two Copeland Digital Scroll compressors. Integrated electric thermostatic valve ensures the smooth operation of the system. The second compressor works in "on-off' mode. The section is fully equipped with automation and ready to use.

AHU DEX-S systems use external VRF heat pump module, installed beside the air handling unit. Indoor unit (condenser or evaporator, depending on the working mode) is incorporated in the AHU.

The section, as well as the whole unit is managed by freely programmable controller (see p.14)

AHU DEX-M

Main scheme - AHU DEX-S



FAN SECTION

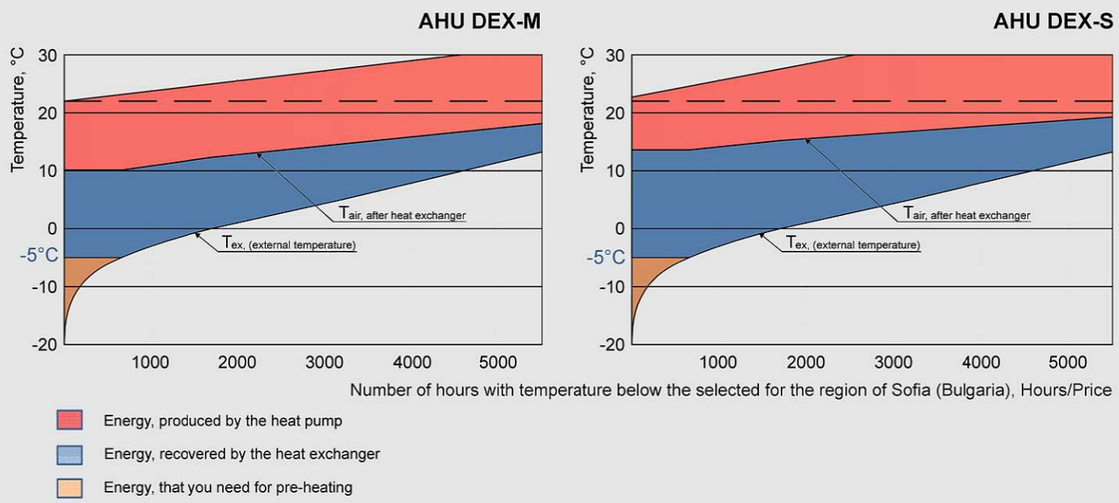
All fans are statically and dynamically balanced.
Power supply: 400V / 50Hz.
Two types of fans are used:

➤ Centrifugal plug fan:
- High efficiency
- Smooth regulation of flow and pressure through the inverter control;
- Mounted on the vibration-absorbing frame.
- Good acoustic performance.

➤ Centrifugal fan with double inlet and backward curved impellers.
- High efficiency;
- Mounted on the vibration-absorbing frame.
- Attached to the structure with a joint.

Note: There is a safety guard grille built-in the fan section.

ANNUAL DIVISION OF ENERGY COSTS



Control

Air-conditioning and ventilation installations are rarely used to the maximum of their capacity. Optimization of energy costs can be achieved by changing the volume of treated air according to the needs of buildings each moment. This can be realized through the use of frequency inverter and programmable controllers.

Frequency Inverter

Frequency inverter enables smooth speed control of rpm of three-phase motors.
This gives the possibility to reduce operating costs by 25%.
Protection class of the frequency inverter can be IP20 or IP66, and the control power of motors varies between 0.37 and 22 kW.
Easy for installation and use.

Freely Programmable Controller

Freely programmable controller gives the opportunity to adjust and control various parameters of the fresh and exhaust air. Control of temperature, humidity and pressure of each air handling unit, as well as maintenance calendar can be organized through the remote control.

Remote control can be done with:
- LCD Display,
- Touch screen Display,
- Internet - remote access from any PC, allowing real time monitoring and control,
- BMS – Building Management System.

This type of controllers allows the modeling of timetables in real time according to the needs of each building. Simplified and easy to understand graphics are displayed to help user control. Ability to program the controller with different access levels is also available – for the personnel, service and manufacturer.

Programmable controller

LCD display

Safety during servicing and cleaning is ensured through mounting of manual switches on the air handling unit.
Degree of contamination of the primary and final filters is monitored by a precision differential pressure switches.

Important standards and recommendations relating to ventilation systems in hospitals:

EPBD - Energy Performance Building Directive - European directive aimed at energy saving and achieving the program Europe 2020.
EN 13779 - Ventilation for non-residential buildings.
EN 13053 - Assessing the ventilation air handling units, Rating and performance of components and sections.
DIN EN 1886 - Mechanical performance and measurements of ventilation and air conditioning air handling units.
EN 15251 - Ventilation and microclimate parameters for design and evaluating the energy efficiency of buildings.
VDI 2089 - Building systems for swimming facilities - indoor pools.
VDI 6022 - Hygienic requirements for ventilation and air-conditioning systems and air handling units.
VDI 3803 - Air conditioning systems - construction and technical requirements.

Made in Bulgaria

Since 2003 TANGRA has implemented quality management system ISO 9001 for design, production, installation and service of ventilation, air-conditioning and heating equipment, wholesale and retail of ventilation, air-conditioning and heating equipment.

TANGRA is an associated suporter of the Federation of European Heating, Ventilation and Air-conditioning Associations REHVA and member of the Bulgarian Chamber of Machine Building..

The company won a gold medal on the International Trade Fair in Plovdiv (Bulgaria) with its series of plate heat exchangers.

In 2014 TANGRA was awarded by the German-Bulgarian Chamber of Commerce and Industry for its range of high efficiency heat recovery ventilation.

Rev 02/2014

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