

EXTENDED DATA INPUT FOR BALANCED VENTILATION

Planning ventilation systems with multiple ventilation units

Building: Primary School 8 "Sveti Sveti Kiril I Metodi" - Section B

Ventilation unit / Heat recovery efficiency design
In Ventilation worksheet (standard design)
In Additional Vent (this worksheet)

	(Ventilation worksheet)
x	(Additional vent)

Treated Floor Area A_{TFA}

m² 4630 (Areas worksheet)

Room Height h

m 2,50 (Worksheet Annual heating)

Room air volume for ventilation (A_{TFA}·h) = V_V

m³ 11576 (Worksheet Annual heating)

Number of Occupants

P 680,0 (Ventilation worksheet)

Room temperature

°C 20 (Worksheet Annual heating)

Average external temp. heating period

°C 4,5 (Ventilation worksheet)

Average ground temp.

°C 11,4 (Ground worksheet)

Ventilation type

Balanced PH-Ventilation with HR (Ventilation worksheet)

Results of ventilation design and unit selection:

Ventilation Unit no.	Description of the unit	Design		Average value / yr.		Air ch.rt.
		V _{SUP} m³/h	V _{ETA} m³/h	V _{SUP} m³/h	V _{ETA} m³/h	
1	Parter	1500	1500	223	223	---
2	First floor	1500	1500	223	223	---
3	Second floor	1500	1500	223	223	---
4	Floor -1	1750	1750	183	183	---
5	Sector A 1 floor	470	470	52	52	---
6	Sector A 2 floor	300	300	38	38	---
7	Floor -1	550	550	82	82	---
8	Parter	1350	1250	201	186	---
9	Floor 1	5400	5500	803	818	---
10						---

Result for overall vent. syst.

14320	14320	2028	2028	0,18
-------	-------	------	------	------

Effective heat recovery efficiency	Energy recovery value	spec. Input power	Heat recov. efficiency SHX	Cross check
81%	0%	0,40	0%	
81%	0%	0,40	0%	
82%	0%	0,40	0%	
81%	0%	0,40	0%	
81%	0%	0,40	0%	
75%	0%	0,40	0%	
78%	0%	0,40	0%	
80%	0%	0,40	0%	Supply and extract air should be the same!
81%	0%	0,40	0%	Supply and extract air should be the same!

81%	0%	0,40	0%
-----	----	------	----

Recommendations for dimensioning air quantities

Use of low odour and low-emission building materials/ furnishings:

It is strongly recommended to use building materials that cause no or only little pollution instead of increasing the outdoor air volume flow in order to reduce preventable pollution. This holds true independently from the chosen approach for the air quality determination; emissions of all sources in the room should be considered, e.g. furniture, carpets and ventilation or air-conditioning unit.

Assessment of volume flow rates according to the number of persons

Also in non-residential buildings, the number of persons is fundamentally important for assessing the volume air flow rates. For good indoor air quality the amounts of 20 to 30 m³/h/person are completely sufficient. Higher outdoor air amounts may lead to excessively dry indoor air in winter. The air flow rates are specified by classification according to EN 13779. The classification must be agreed with the client in advance. IDA 3 is adequate for office buildings. IDA 4 has proven satisfactory for school buildings as purge ventilation is carried out during breaks anyway. For typical external air CO₂ concentrations of around 400-500 ppm, it is possible to comply even with 1500 ppm. Exceeding this figure temporarily is permissible.

Fresh air flow rates per person:

- Recommended for residential buildings: around 30 m³/(h person)
- Recommended for offices and similar uses: around 30 m³/(h person) (AMEV: 28 m³/(h person); EN 13779 / IDA 3: at least 24 m³/(h person))
- Recommended for schools and day care centres: 15 to 20 m³/(h person) (Source: Guidelines for energy-efficient educational buildings, Passive House Institute, 2010)
- Recommendation for sport halls: 60 m³/(h person) (DIN 18032-1)

Purging phase for intermittent ventilation operation

Due to the purge ventilation phase, the ventilation operation period is extended accordingly (utilisation time + purge ventilation phase). Please consider this for the ventilation design. Emissions have to be removed. Flushing the building prolongs the utilization time of the ventilation system (utilization time + flushing phase). Please consider this at design stage.

Design of air quantities

When designing the air quantities, please consider the design recommendations given above.
The ventilation operation period can be determined on the basis of the daily utilisation hours including purging phase if applicable. In addition, time periods with reduced ventilation requirements (operation modes) can be taken into account by means of reduction factors.

Room Nr.	Amount	Room name	Assignment to ventilation unit	Area A m²	Clear height h m	Room vol. A x h m³	Volume flow per room			Air change rate per room n 1/h	Utilisation times			Reduction Red.1	Operation Red. 1	Reduction Red.2	Operation Red.2	Reduction Red.3	Operation Red. 3	Cross check		Average volume flows			Average air change rate	
							V _{SUP} m³/h	V _{ETA} m³/h	V _{TRANS} m³/h		h/d	d/week	weeks/yr								V _{SUP} m³/h	V _{ETA} m³/h	V _{TRANS} m³/h			
1	5	Classroom	1	53	3,30	175	300			1,72	14	5	32	100%	30%	60%	0%	40%	70%			223			0,26	
2	1	Corridors	1	122	3,30	403		1000	500	2,48	14	5	32	100%	30%	60%	0%	40%	70%				149	74		0,37
3	1	Lobbies	1	69	3,30	228		500		2,20	14	5	32	100%	30%	60%	0%	40%	70%				74			0,33
4	5	Classroom	2	53	3,30	175	300			1,72	14	5	32	100%	30%	60%	0%	40%	70%			223			0,26	
5	1	Corridors	2	122	3,30	403		1000	500	2,48	14	5	32	100%	30%	60%	0%	40%	70%				149	74		0,37
6	1	Lobbies	2	69	3,30	228		500		2,20	14	5	32	100%	30%	60%	0%	40%	70%				74			0,33
7	5	Classroom	3	53	3,30	175	300			1,72	14	5	32	100%	30%	60%	0%	40%	70%			223			0,26	
8	1	Corridors	3	122	3,30	403		1000	500	2,48	14	5	32	100%	30%	60%	0%	40%	70%				149	74		0,37
9	1	Lobbies	3	69	3,30	228		500		2,20	14	5	32	100%	30%	60%	0%	40%	70%				74			0,33
10	1	Lobbie -1	4	69	3,30	228	100			0,44	10	5	32	100%	30%	50%	30%	30%	40%		10					0,05
11	1	Corridor -1	4	18	3,30	59		150		2,53	10	5	32	100%	30%	50%	30%	30%	40%			16				0,26
12	1	Canteen	4	176	3,30	581	1550		50	2,67	10	5	32	100%	30%	50%	30%	30%	40%			162		5		0,28
13	1	Kitchen	4	68	3,30	224		1600	50	7,13	10	5	32	100%	30%	50%	30%	30%	40%				167	5		0,74
14	1	Room behind kitchen	4	79	3,30	262	100			0,38	10	5	32	100%	30%	50%	30%	30%	40%		10					0,04
15	1	Computer classroom	5	51	3,30	168	300			1,79	14	5	32	100%	10%	70%	30%	20%	60%		33					0,20
16	1	Bookstore	5	16	3,30	52	50			0,96	14	5	32	100%	10%	70%	30%	20%	60%		6					0,11
17	1	Canteen	5	51	3,30	168	120	140		0,83	14	5	32	100%	10%	70%	30%	20%	60%		13	15				0,09
18	1	WC	5	8	3,30	26		80		3,06	14	5	32	100%	10%	70%	30%	20%	60%			9				0,34
19	1	Corridor	5	41	3,30	136		250	80	1,84	14	5	32	100%	10%	70%	30%	20%	60%			28	9			0,20
20	1	Corridor 2	5	8	3,30	26			80	3,03	14	5	32	100%	10%	70%	30%	20%	60%				9			0,33
21	1	Teachers room	6	17	3,30	56	30			0,53	14	5	50	100%	0%	50%	40%	20%	60%		4					0,07
22	1	Teachers room	6	33	3,30	109	90			0,82	14	5	50	100%	0%	50%	40%	20%	60%		12					0,11
23	1	Teachers room	6	16	3,30	52	30			0,58	14	5	50	100%	0%	50%	40%	20%	60%		4					0,07
24	1	Teachers room	6	51	3,30	169	150			0,89	14	5	50	100%	0%	50%	40%	20%	60%		19					0,11
25	1	WC	6	8	3,30	26		80		3,06	14	5	50	100%	0%	50%	40%	20%	60%			10				0,39
26	1	Corridor	6	41	3,30	136		220		1,62	14	5	50	100%	0%	50%	40%	20%	60%			28				0,21
27	1	Corridor 2	6	8	3,30	26			80	3,03	14	5	50	100%	0%	50%	40%	20%	60%				10			0,39
28	1	Fitness	7	96	3,30	317	250			0,79	14	5	32	100%	30%	60%	0%	40%	70%		37					0,12
29	1	Classroom	7	143	3,30	472	300			0,64	14	5	32	100%	30%	60%	0%	40%	70%		45					0,09
30	1	Corridor	7	120	3,30	396			550	1,39	14	5	32	100%	30%	60%	0%	40%	70%				82			0,21
31	1	Mechanical	7	256	4,40	1126		350		0,31	14	5	32	100%	30%	60%	0%	40%	70%				52			0,05
32	1	WC	7	11	3,30	36		100		2,75	14	5	32	100%	30%	60%	0%	40%	70%			15				0,41
33	1	Others	7	67	3,30	221		100		0,45	14	5	32	100%	30%	60%	0%	40%	70%			15				0,07
34	2	Classroom	8	64	3,30	211	300			1,42	14	5	32	100%	30%	60%	0%	40%	70%		89					0,21
35	1	Classroom	8	51	3,30	167	300			1,80	14	5	32	100%	30%	60%	0%	40%	70%		45					0,27
36	1	Classroom	8	67	3,30	221	300			1,36	14	5	32	100%	30%	60%	0%	40%	70%		45					0,20
37	1	Entrance room	8	53	3,30	175	150			0,86	14	5	32	100%	30%	60%	0%	40%	70%		22					0,13
38	6	Storages	8	16	3,30	53		100		1,89	14	5	32	100%	30%	60%	0%	40%	70%			89				0,28
39	1	Corridor	8	202	3,30	667		450	700	1,05	14	5	32	100%	30%	60%	0%	40%	70%			67	104			0,16
40	1	WC	8	39	3,30	129		200		1,55	14	5	32	100%	30%	60%	0%	40%	70%			30				0,23
41	1	Others entrance	9	55	3,30	182		100		0,55	14	5	32	100%	30%	60%	0%	40%	70%			15				0,08
42	1	Classroom	9	58	3,30	191	300			1,57	14	5	32	100%	30%	60%	0%	40%	70%		45					0,23
43	1	Classroom	9	76	3,30	251	300			1,20	14	5	32	100%	30%	60%	0%	40%	70%		45					0,18
44	5	Storages	9	16	3,30	53		100		1,89	14	5	32	100%	30%	60%	0%	40%	70%				74			0,28
45	2	Classroom	9	67	3,30	221	300			1,36	14	5	32	100%	30%	60%	0%	40%	70%		89					0,20
46	2	Classroom	9	51	3,30	168	300			1,78	14	5	32	100%	30%	60%	0%	40%	70%		89					0,27
47	1	Corridor	9	204	3,30	673		1100	500	1,63	14	5	32	100%	30%	60%	0%	40%	70%			164	74			0,24
48	1	WC	9	39	3,30	129		200		1,55	14	5	32	100%	30%	60%	0%	40%	70%			30				0,23
49	1	Classroom	9	58	3,30	191	300			1,57	14	5	32	100%	30%	60%	0%	40%	70%		45					0,23
50	1	Classroom	9	76	3,30	251	300			1,20	14	5	32	100%	30%	60%	0%	40%	70%		45					0,18
51	5	Storages	9	16	3,30	53		100		1,89	14	5	32	100%	30%	60%	0%	40%	70%				74			0,28
52	2	Classroom	9	67	3,30	221	300			1,36	14	5	32	100%	30%	60%	0%	40%	70%		89					0,20
53	2	Classroom	9	51	3,30	168	300			1,78	14	5	32	100%	30%	60%	0%	40%	70%		89					0,27
54	1	Corridor	9	204	3,30	673		1100	500	1,63	14	5	32	100%	30%	60%	0%	40%	70%				164	74		0,24
55	1	WC	9	39	3,30	129		200		1,55	14	5	32	100%	30%	60%	0%	40%	70%			30				0,23
56	1	Classroom	9	58	3,30	191	300			1,57	14	5	32	100%	30%	60%	0%	40%	70%		45					0,23
57	1	Classroom	9	76	3,30	251	300			1,20	14	5	32	100%	30%	60%	0%	40%	70%		45					0,18
58	5	Storages	9	16	3,30	53		100		1,89	14	5	32	100%	30%	60%	0%	40%	7							

Ventilation unit selection

Up to 10 different ventilation units are considered. By changing the amount, identical units can be considered. The data from PHI certified ventilation units as well as the entry data lines for user data for other ventilation units can also be found in the worksheet "Components". When choosing to use a compact unit the standard design in the Ventilation worksheet has to be used.

Ventilation Unit no.	Quantity	Description Ventilation units	Selection Unit type	Design vol. flow per unit m³/h	Entry area for volume flow rate from to m²/h	Electrical efficiency Wh/m³	Pressure loss calculation			Entry area		Cross check ----- Pressure loss assessment duct network	Interior location (x)	Exterior location (x)	Heat recovery efficiency		Energy recovery value [-]	Frost protection necessary	Subsoil HX		U noise level < 35dB(A)	Noise protection adapter Supply air db(A)
							ODA-SUP ΔP _{duct} Pa	ETA-EHA ΔP _{duct} Pa	Additional ΔP _{system} Pa	per line ΔP _{external} Pa	Subtraction ΔP _{internal} Pa				Unit [-]	effective [-]			Effectiveness degree	Efficiency of heat recovery		

Change sorting type																						
1	1	Parter	06ud Tangra ventilation unit EVB 16 HI	1500	800	1600	0,40	55	55	65	-	-	ok	x		0,82	81%	0%	yes	0%	n.a.	68
2	1	First floor	06ud Tangra ventilation unit EVB 16 HI	1500	800	1600	0,40	55	55	65	-	-	ok	x		0,82	81%	0%	yes	0%	n.a.	68
3	1	Second floor	06ud Tangra ventilation unit EVB 16 HI	1500	800	1600	0,40	55	55	65	-	-	ok	x		0,82	82%	0%	yes	0%	n.a.	68
4	1	Floor -1	07ud Tangra ventilation unit EVB 20 HI	1750	1000	2000	0,40	55	105	90	-	-	ok	x		0,82	81%	0%	yes	0%	n.a.	68
5	1	ector A 1 floor	02ud Tangra ventilation unit EVB 06 HI	470	250	600	0,40	45	45		100	-	ok	x		0,82	81%	0%	yes	0%	n.a.	61
6	1	ector A 2 floor	01ud Tangra ventilation unit EVB 04 HI	300	150	400	0,40	45	45		100	-	ok	x		0,82	75%	0%	yes	0%	n.a.	57
7	1	Floor -1	02ud Tangra ventilation unit EVB 06 HI	550	250	600	0,40	55	50		100	-	ok	x		0,82	78%	0%	yes	0%	n.a.	61
8	1	Parter	06ud Tangra ventilation unit EVB 16 HI	1350	800	1600	0,40	65	55	60	-	-	ok	x		0,82	80%	0%	yes	0%	n.a.	68
9	1	Floor 1	07ud Tangra ventilation unit EVB 20 HI	5400	1000	2000	0,40	70	55	70	-	-	ok	x		0,82	81%	0%	yes	0%	n.a.	68
10																						

Data entries for duct sections between the ventilation unit and the thermal envelope

The duct sections between the ventilation unit and the thermal envelope should be as short as possible and should be well insulated, both for interior as for exterior location of the ventilation unit. These duct sections can be entered here. The heat losses of the overlying duct section will be considered for the effective heat recovery efficiency. An entered duct section can also be used for multiple ventilation units. If in the section "Ventilation unit - selection" in one line a ventilation unit is selected as multiple units (amount larger than 1 for identical units), then the corresponding duct sections may simply be entered (duct sections for one ventilation unit).

Temperature of the location of installation: <div>20,0</div> (only enter when at least one unit is installed outside of the thermal envelope)																									
Quantity	Cross check	Round duct ins. diameter mm	Rectangular duct		Insulation Thickness mm	Thermal conductivity W/(m K)	Reflective insulation duct (x)	Transmittance duct W/(m K)	Length of Supply air m	Ambient or Extract air Duct (t)	Exhaust or flow Duct (t)	Duct type	Design Volume rate	Vent. Unit 1	Vent. Unit 2	Allocation to ventilation units (when central unit applicable enter "1")									
			Width mm	Height mm												Vent. Unit 3	Vent. Unit 4	Vent. Unit 5	Vent. Unit 6	Vent. Unit 7	Vent. Unit 8	Vent. Unit 9	Vent. Unit 10		
1		315			150	0,033		0,291	2	1		Supply air	1500	1											
1		315			150	0,033		0,291	11		1	Abluft	1500	1											
1		315			150	0,033		0,293	2	1		Ambient air	1500		1										
1		315			150	0,033		0,293	7,5		1	Fortluft	1500		1										
1		315			150	0,033		0,293	2	1		Ambient air	1500			1									
1		315			150	0,033		0,293	4		1	Fortluft	1500			1									
1		315			150	0,033		0,294	2	1		Ambient air	1750				1								
1		315			150	0,033		0,294	14,5		1	Fortluft	1750				1								
1		200			150	0,033		0,212	2	1		Ambient air	470					1							
1		200			100	0,033		0,272	3		1	Fortluft	470					1							
1		200			150	0,033		0,205	5,5	1		Ambient air	300						1						
1		200			100	0,033		0,261	6,5		1	Fortluft	300						1						
1		160			150	0,033		0,187	6	1		Ambient air	550							1					
1		160			100	0,033		0,239	18		1	Fortluft	550							1					
1		315			150	0,033		0,293	3,5	1		Ambient air	1350								1				
1		315			150	0,033		0,293	14,5		1	Fortluft	1350								1				
3		315			150	0,033		0,298	3,5	1		Ambient air	5400									1			
3		315			150	0,033		0,298	11		1	Fortluft	5400									1			
													0												
													0												

Additional lines: Please mark complete lines above, copy and paste multiple times