

# Passive House Verifikācija

Attēls

Ēka:	Jelgavas 2 intonatpamatskola		
Vieta un klimats:		LAT_Riga_Kra	
Iela:	Filozofu iela 50,		
Pasta indekss/pilsēta:	Jelgava		
Valsts:	Latvija		
Ēkas tips:			
Ēkas īpašnieks(i) / Pasūtītājs(i):	Jelgavas novada dome		
Iela:	Pasta iela 37, Jelgava,		
Pasta indekss/pilsēta:	LV-3001		
Arhitekts:	SIA BALTEX GROUP		
Iela:	Rīga, Dīķa iela 44,		
Pasta indekss/pilsēta:	LV-1004		
Mehāniskās sistēmas/AVK:	SIA BALTEX GROUP		
Iela:	Rīga, Dīķa iela 44,		
Pasta indekss/pilsēta:	LV-1004		
Būvniecības gads	2015		
Mājokļu skaits:	1		
Ietvertais apjoms $V_e$ :	6198,3	m <sup>3</sup>	
Lietotāju skaits:	150,0		
		Telpu temperatūra:	18,0 °C
		Iekšējie siltuma ieguvumi:	2,8 W/m <sup>2</sup>

Īpatnējās prasības ar atsuci uz aplūkojamo grīdas platību			
Aplūkojamā grīdas platība	1179,9	m <sup>2</sup>	
Pielietots:	Monthly Method	PH Sertifikāts:	Izpildījums?
<b>Īpatnējais siltumenerģijas pieprasījums:</b>	<b>13,98</b>	<b>kWh/(m<sup>2</sup>a)</b>	<b>15 kWh/(m<sup>2</sup>a)</b> <b>Yes</b>
<b>Spiediena testa rezultāti:</b>	<b>0,50</b>	<b>st<sup>-1</sup></b>	<b>0,6 h<sup>-1</sup></b> <b>No</b>
<b>Īpatnējais primārās enerģijas pieprasījums</b> (MSŪ, Apkure, Dzesēšana, Palīg un māsasaimniecības elektrība):	<b>149</b>	<b>kWh/(m<sup>2</sup>a)</b>	<b>120 kWh/(m<sup>2</sup>a)</b>
<b>Īpatnējais primārās enerģijas pieprasījums</b> (MKŪ, Apkure, Palīga elektrība):	<b>127</b>	<b>kWh/(m<sup>2</sup>a)</b>	
<b>Īpatnējais primārās enerģijas pieprasījums</b> Enerģijas ietaupījums ar saules elektrību:		<b>kWh/(m<sup>2</sup>a)</b>	
<b>Apkures slodze:</b>	<b>14</b>	<b>W/m<sup>2</sup></b>	
<b>Pārkaršanas biežums:</b>		<b>%</b>	
<b>Īpatnējais lietojamasi dzesēšanas enerģijas pieprasījums:</b>	<b>0</b>	<b>kWh/(m<sup>2</sup>a)</b>	<b>15 kWh/(m<sup>2</sup>a)</b>
<b>Dzesēšanas slodze:</b>	<b>4</b>	<b>W/m<sup>2</sup></b>	
		virs	25 °C

Mēs apstiprinām, ka vērtības, kas dotas šeit ir noteikt pēc PHPP metodikas un pamatojoties uz ēkas raksturojošiem lielumiem. Aprēķini ar PHPP ir pievienoti šim pieteikumam.

Izsniedza:

Sertificēts Andrejs Nikolajevs, EA3-energoauditors: 0010

Paraksts:

01.10.2014.

# Passive House Verification

Photo or Drawing

Building:	Jelgavas 2 intenatpamatskola		
Location and Climate:		LAT_Riga_Kra	
Street:	Filozofu iela 50,		
Postcode/City:	Jelgava		
Country:	Latvija		
Building Type:	Sporta zales ēka		
Home Owner(s) / Client(s):	Jelgavas novada dome		
Street:	Pasta iela 37, Jelgava,		
Postcode/City:	LV-3001		
Architect:	SIA BALTEX GROUP		
Street:	Rīga, Dīķa iela 44,		
Postcode/City:	LV-1004		
Mechanical System:	SIA BALTEX GROUP		
Street:	Rīga, Dīķa iela 44,		
Postcode/City:	LV-1004		
Year of Construction:	2015		
Number of Dwelling Units:	1	Interior Temperature:	18,0 °C
Enclosed Volume $V_e$ :	6198,3 m <sup>3</sup>	Internal Heat Gains:	2,8 W/m <sup>2</sup>
Number of Occupants:	150,0		

Specific Demands with Reference to the Treated Floor Area				
Treated Floor Area:	1179,9	m <sup>2</sup>		
Applied:	Monthly Method	PH Certificate:		Fulfilled?
<b>Specific Space Heat Demand:</b>	<b>13,98</b>	<b>kWh/(m<sup>2</sup>a)</b>	<b>15 kWh/(m<sup>2</sup>a)</b>	<b>Yes</b>
<b>Pressurization Test Result:</b>	<b>0,50</b>	<b>h<sup>-1</sup></b>	0,6 h <sup>-1</sup>	<b>Yes</b>
<b>Specific Primary Energy Demand</b> (DHW, Heating, Cooling, Auxiliary and Household Electricity):	<b>149</b>	<b>kWh/(m<sup>2</sup>a)</b>	120 kWh/(m <sup>2</sup> a)	<b>No</b>
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	127	kWh/(m <sup>2</sup> a)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kWh/(m <sup>2</sup> a)		
Heating Load:	14	W/m <sup>2</sup>		
Frequency of Overheating:		%	over 25 °C	
Specific Useful Cooling Energy Demand:	0	kWh/(m <sup>2</sup> a)	15 kWh/(m <sup>2</sup> a)	<b>Yes</b>
Cooling Load:	4	W/m <sup>2</sup>		

We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

Issued on:

Sertificēts Andrejs Nikolajevs,  
energoauditors: EA3-0010

signed:

01.10.2014.

# Passive House Planning

## AREAS DETERMINATION

Building:  Heat Demand:  [W/m²]

Summary						Building Element Overview	Average U-Value [W/(m²K)]
Group Nr.	Area Group	Temp Zone	Area	Unit	Comments		
1	Treated Floor Area		1179,90	m²	Living area or useful area within the thermal envelope		
2	North Windows	A	0,00	m²	Results are from the Windows worksheet.	North Windows	
3	East Windows	A	56,50	m²		East Windows	0,798
4	South Windows	A	21,06	m²		South Windows	0,663
5	West Windows	A	6,82	m²		West Windows	0,773
6	Horizontal Windows	A	0,00	m²		Horizontal Windows	
7	Exterior Door	A	50,28	m²	Please subtract area of door from respective building element	Exterior Door	0,900
8	Exterior Wall - Ambient	A	890,55	m²	Window areas are subtracted from the individual areas specified in the "Windows" worksheet.	Exterior Wall - Ambient	0,056
9	Exterior Wall - Ground	B	49,96	m²	Temperature Zone "A" is ambient air.	Exterior Wall - Ground	0,116
10	Roof/Ceiling - Ambient	A	1183,62	m²	Temperature zone "B" is the ground.	Roof/Ceiling - Ambient	0,047
11	Floor Slab	B	1183,62	m²		Floor Slab	0,060
12			0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"		
13			0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"		
14		X	0,00	m²	Temperature zone "X". Please provide user-defined reduction factor ( 0 < f <sub>r</sub> < 1):	Factor for X	75 %
						Thermal Bridge Overview	▼ [W/(mK)]
15	Thermal Bridges Ambient	A	183,25	m	Units in m	Thermal Bridges Ambient	-0,010
16	Perimeter Thermal Bridges	P	167,74	m	Units in m; temperature zone "P" is perimeter (see Ground worksheet).	Perimeter Thermal Bridges	0,047
17	Thermal Bridges Floor Slab	B	0,00	m	Units in m	Thermal Bridges Floor Slab	
18	Partition Wall to Neighbour	I	0,00	m²	No heat losses, only considered for the heat load calculation.	Partition Wall to Neighbour	
Total Thermal Envelope						Average Therm. Envelope	0,086

Area Input																Selection of the Corresponding Building Element Assembly	Nr.	U-Value [W/(m²K)]
Area Nr.	Building Element Description	Group Nr.	Assigned to Group	Quantity	x (	a [m]	x	b [m]	+	User-Deter- mined [m²]	-	User Sub- traction [m²]	-	Subtraction Window Areas [m²]	) =			
	Treated Floor Area	1	Treated Floor Area	1	x (		x		+	1179,90	-					1179,9	From Windows sheet From Windows sheet	

# Passive House Planning

## AREAS DETERMINATION

Building:  Heat Demand:  [W/m²]

Summary						Building Element Overview	Average U-Value [W/(m²K)]
Group Nr.	Area Group	Temp Zone	Area	Unit	Comments		
1	Treated Floor Area		1179,90	m²	Living area or useful area within the thermal envelope		
2	North Windows	A	0,00	m²	Results are from the Windows worksheet.	North Windows	
3	East Windows	A	56,50	m²		East Windows	0,798
4	South Windows	A	21,06	m²		South Windows	0,663
5	West Windows	A	6,62	m²		West Windows	0,773
6	Horizontal Windows	A	0,00	m²		Horizontal Windows	
7	Exterior Door	A	50,28	m²	Please subtract area of door from respective building element	Exterior Door	0,900
8	Exterior Wall - Ambient	A	890,55	m²	Window areas are subtracted from the individual areas specified in the "Windows" worksheet.	Exterior Wall - Ambient	0,056
9	Exterior Wall - Ground	B	49,96	m²	Temperature Zone "A" is ambient air.	Exterior Wall - Ground	0,116
10	Roof/Ceiling - Ambient	A	1183,62	m²	Temperature zone "B" is the ground.	Roof/Ceiling - Ambient	0,047
11	Floor Slab	B	1183,62	m²		Floor Slab	0,060
12			0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"		
13			0,00	m²	Temperature zones "A", "B", "P" and "X" may be used. NOT "I"		
14		X	0,00	m²	Temperature zone "X". Please provide user-defined reduction factor ( 0 < f <sub>r</sub> < 1):	Factor for X	
							75 %
						Thermal Bridge Overview	▼ [W/(mK)]
15	Thermal Bridges Ambient	A	183,25	m	Units in m	Thermal Bridges Ambient	-0,010
16	Perimeter Thermal Bridges	P	167,74	m	Units in m; temperature zone "P" is perimeter (see Ground worksheet).	Perimeter Thermal Bridges	0,047
17	Thermal Bridges Floor Slab	B	0,00	m	Units in m	Thermal Bridges Floor Slab	
18	Partition Wall to Neighbour	I	0,00	m²	No heat losses, only considered for the heat load calculation.	Partition Wall to Neighbour	
Total Thermal Envelope			3442,41	m²		Average Therm. Envelope	0,086

Thermal Bridge Inputs											
Nr. of Thermal Bridge	Thermal Bridge Description	Group Nr.	Assigned to Group	Quantity	x (	User Determined Length [m]	-	Subtraction User-Determined Length [m]	=	Length l [m]	Input of Thermal Bridge Heat Loss Coefficient W/(mK)
1	Psi1 dzega	15	Thermal Bridges Ambient	1	x (	164,07	-		) =	164,07	Psi1 dzega
2	Psi2 gala siena	16	Perimeter Thermal Bridges	1	x (	27,57	-		) =	27,57	Psi2 gala siena
1	Cokols	16	Perimeter Thermal Bridges	1	x (	117,09	-		) =	117,09	Cokols
1	PSI 3, starp jumta limesiem	16	Perimeter Thermal Bridges	1	x (	23,08	-		) =	23,08	PSI 3, starp jumta limesiem
2	Termiskais tilts, pieslēgums pie blakus ēkas	15	Thermal Bridges Ambient	2	x (	9,59	-		) =	19,18	
3					x (		-		) =		
4					x (		-		) =		
5					x (		-		) =		
TBend											

Additional Inputs for Radiation Balance				
Exterior Absorptivity	Exterior Emissivity	Deviation from North	Angle of Inclination from the Horizontal	Reduction Factor Shading
These columns serve for considering the radiation balance of exterior, opaque surfaces. Inputs only for those surfaces which are adjacent to ambient air! For consideration of heating in Central European climates no input is required.				

A Tool for Thermal Bridge Conversion To Exterior Dimensions						
Description			Units			
Area I	Ψ Interior Dimensions		W/(mK)			
	Exterior - Interior Dim. I		m			
	U-Value Building Element I		W/(m²K)			
Adjacent Area II	Temperature Diff. ΔT II		K			
	Exterior - Interior Dim. II		m			
	U-Value Building Element II		W/(m²K)			
	Ψ Exterior Dimensions		W/(mK)			

# Passive House Planning

## U - LIST

Compilation of the building elements calculated in the U-Values worksheet and other construction types from databases.

	Type		
Asse mbly No.	Assembly Description	Total Thickness	U-Value
		m	W/(m <sup>2</sup> K)
1	Jumts J1	0,915	0,05
2	Ārsiena ĀS1	0,905	0,06
3	Gridas parsēgums	0,700	0,06
4	Cokola sienas	0,900	0,12
7	Starpsienas term tilts	0,500	1,34
21	Wood24-old	0,275	1,440
22	Solid Brick 38-old	0,415	1,640
23	Framework18-old	0,210	1,800
24	VerticalCoringBrick30-old	0,335	1,230
25	PrecastConcrete-old	0,275	1,300
26	WoodenJoistCeiling-old	0,284	0,990
27	BasementFloor-old	0,242	1,230
28			
29	AW-ALS032-mas: alseco, exterior insulation compound system on masonry	0,500	0,100
30	AW-ALS034/035-mas: alseco, exterior insulation compound system on masonry	0,500	0,110
31	AW-ALS040/041-mas: alseco, exterior insulation compound system on masonry	0,500	0,130
32	AW-ALG032-mas: Alligator, exterior insulation compound system on masonry	0,500	0,100
33	AW-ALG034/035-mas: Alligator, exterior insulation compound system on masonry	0,500	0,110
34	AW-ALG040/041-mas: Alligator, exterior insulation compound system on masonry	0,500	0,130
35	AW-CAP032-mas: Caparol, exterior insulation compound system on masonry	0,500	0,100
36	AW-CAP034/035-mas: Caparol, exterior insulation compound system on masonry	0,500	0,110
37	AW-CAP040/041-mas: Caparol, exterior insulation compound system on masonry	0,500	0,130
38	AW-FGH035-lei: Fingerhaus, wooden beam load-bearing wall with ETICS	0,415	0,100
39	AW-FIN040-lei: Finnforest Merk, FJI-beam	0,404	0,120
40	AW-GPT031-mas: Gisoplan-Therm 375/225, ICF from expanded clay	0,400	0,120
41	AW-GRE050-mas: Greisel, exterior insulation compound system on porous concrete	0,515	0,119
42	AW-HEB045-mas: Hebel, exterior insulation compound system on porous concrete	0,470	0,140
43	AW-HVH035-mas: Heinz von Heiden, exterior insulation compound system on Ytong	0,497	0,101
44	AW-HVH040-lei: Heinz von Heiden, lightweight wall with exterior insulation compound	0,453	0,094
45	AW-ISR035-dws: isorast, insulating concrete form Dickwandstein	0,400	0,140
46	AW-ISR035-sdw: isorast, insulating concrete form Superdickwandstein	0,463	0,110
47	AW-MAR035-mas: Marmorit, ETICS from limestone and PS	0,500	0,110
48	AW-MAR040-mas: Marmorit, ETICS from limestone and MW	0,500	0,130
49	AW-NUS035-mas: Naumann&Stahr, wooden lightweight elements with DokAW-beams	0,423	0,120
50	AW-STO035-mas: Sto, ETICS from limestone and PS 035	0,495	0,110
51	AW-STO040-mas: Sto, ETICS from limestone and PS 040	0,495	0,130
52	AW-WOC250-mas: Wochner, ETICS from porous concrete and PS, 250	0,460	0,130
53	AW-WOC300-mas: Wochner, ETICS from porous concrete and PS, 250	0,510	0,110
54	DA-ALS045-lei: alseco, lightweight roof	0,395	0,140
55	DA-ALS040-Fla: alseco, Flachdach	0,515	0,130
56	DA-ALG045-lei: Alligator, lightweight roof	0,395	0,140
57	DA-ALG040-Fla: Alligator, flat roof	0,515	0,130
58	DA-CAP045-lei: Caparol, lightweight roof	0,395	0,140
59	DA-CAP040-Fla: Caparol, flat roof	0,515	0,130
60	DA-FGH035-lei: Fingerhaus, lightweight roof	0,333	0,130
61	DA-FIN040-lei: Finnforest Merk, lightweight roof	0,344	0,141
62	DA-GIS035-lei: Gisoton, lightweight roof	0,343	0,130
63	DA-GIS035-mas: Gisoton, massive roof	0,510	0,110
64	DA-GRE035-mas: Greisel, flat roof	0,610	0,086
65	DA-GRE035-lei: Greisel, lightweight roof	0,438	0,107
66	DA-HEB045-mas: Hebel, massive roof	0,510	0,130
67	DA-HVH030/040-mas: Heinz von Heiden, lightweight roof	0,393	0,103
68	DA-ISR035-sst: isorast, lightweight roof	0,333	0,120
69	DA-MAR035-lei: Marmorit, lightweight roof	0,308	0,130
70	DA-NUS040-lei: Naumann&Stahr, lightweight roof	0,460	0,100
71	DA-STO040-lei: Sto, lightweight roof	0,325	0,130
72	DA-STO030-mas: Sto, massive roof	0,520	0,100
73	DA-WOC035-lei: Wochner, lightweight roof	0,313	0,140

# Passive House Planning

## U - LIST

Compilation of the building elements calculated in the U-Values worksheet and other construction types from databases.

Asse mbly No.	Type	Total Thickness	U-Value
	Assembly Description		
		m	W/(m <sup>2</sup> K)
74	DA-WOC035-mas: Wochner, massive roof	0,480	0,120
75	BP-ALS035/040-mas: alseco, floor slab	0,620	0,130
76	BP-ALG035/040-mas: Alligator, floor slab	0,620	0,130
77	BP-CAP035/040-mas: Caparol, floor slab	0,620	0,130
78	BP-FGH035-mas: Fingerhaus, floor slab	0,550	0,140
79	BP-FIN040-mas: Finnforest Merk, floor slab	0,429	0,115
80	BP-GIS040-mas: Gisoton, floor slab	0,565	0,150
81	BP-GRE035-mas: Greisel, floor slab	0,495	0,139
82	BP-HEB035-mas: Hebel, floor slab	0,635	0,100
83	BP-HVH025/045/140-mas: Heinz von Heiden, floor slab	0,759	0,125
84	BP-ISQ035-mas: Isoquick, insulated floor trough	0,630	0,100
85	BP-ISR035-mas: isorast, floor slab	0,580	0,160
86	BP-MAR035-mas: Marmorit, floor slab	0,615	0,130
87	BP-N&S040-lei: Naumann&Stahr, floor slab	0,385	0,130
88	BP-STO035-mas: Sto, floor slab	0,520	0,130
89	BP-WOC035-mas: Wochner, floor slab	0,515	0,130
90	KD-ALS040-mas: alseco, basement floor	0,470	0,170
91	KD-ALG040-mas: Alligator, basement floor	0,470	0,170
92	KD-CAP040-mas: Caparol, basement floor	0,470	0,170
93	KD-FGH035-mas: Fingerhaus, basement floor	0,460	0,140
94	KD-FIN040-lei: Finnforest Merk, basement floor	0,369	0,150
95	KD-GIS040-mas: Gisoton, basement floor	0,525	0,130
96	KD-GRE035-mas: Greisel, basement floor	0,645	0,088
97	KD-HEB035-mas: Hebel, basement floor	0,635	0,100
98	KD-HVH035-mas: Heinz von Heiden, basement floor	0,459	0,121
99	KD-ISR035-mas: isorast, basement floor	0,580	0,160
100	KD-MAR035-mas: Marmorit, basement floor	0,565	0,130
101	KD-NUS040-lei: Naumann&Stahr, basement floor	0,385	0,130
102	KD-STO035-mas: Sto, basement floor	0,520	0,130
103	KD-WOC035-mas: Wochner, basement floor	0,515	0,130
104			



# Passive House Planning

## HEAT LOSSES VIA THE GROUND

Ground Characteristics				Climate Data			
Thermal Conductivity	$\lambda$	2,0	W/(mK)	Av. Indoor Temp. Winter	$T_i$	18,0	°C
Heat Capacity	$\rho c$	2,0	MJ/(m³K)	Av. Indoor Temp. Summer	$T_i$	25,0	°C
Periodic Penetration Depth	$\delta$	3,17	m	Average Ground Surface Temperature	$T_{g,ave}$	7,3	°C
				Amplitude of $T_{g,ave}$	$T_{g,\Delta}$	10,8	°C
				Length of the Heating Period	$n$	6,7	months
				Heating Degree Hours - Exterior	$G_e$	98,2	kKh/a

Building Data				Floor Slab U-Value			
Floor Slab Area	$A$	1183,6	m²	Floor Slab U-Value	$U_f$	0,060	W/(m²K)
Floor Slab Perimeter	$P$	133,6	m	Thermal Bridges at Floor Slab	$\Psi_{B,*I}$	0,00	W/K
Charact. Dimension of Floor Slab	$B'$	17,72	m	Floor Slab U-Value incl. TB	$U_f'$	0,060	W/(m²K)
				Eq. Thickness Floor	$d_f$	33,5	m

Floor Slab Type (select only one)				
<input type="checkbox"/>	Heated Basement or Underground Floor Slab		<input type="checkbox"/>	Unheated basement
<input checked="" type="checkbox"/>	Slab on Grade		<input type="checkbox"/>	Suspended Floor

For Basement or Underground Floor Slab							
Basement Depth	$z$		m	U-Value Belowground Wall	$U_{WB}$		W/(m²K)

Additionally for Unheated Basements							
Air Change Unheated Basement	$n$		h⁻¹	Height Aboveground Wall	$h$		m
Basement Volume	$V$		m³	U-Value Aboveground Wall	$U_W$		W/(m²K)
				U-Value Basement Floor Slab	$U_{fB}$		W/(m²K)

For Perimeter Insulation for Slab on Grade				For Suspended Floor			
Perimeter Insulation Width/Depth	$D$	1,10	m	U-Value Crawl Space	$U_{Crawl}$		W/(m²K)
Perimeter Insulation Thickness	$d_n$	0,40	m	Height of Crawl Space Wall	$h$		m
Conductivity Perimeter Insulation	$\lambda_n$	0,038	W/(mK)	U-Value Crawl Space Wall	$U_W$		W/(m²K)
Location of the Perimeter Insulation	horizontal	<input type="checkbox"/>		Area of Ventilation Openings	$gP$		m²
(check only one field)	vertical	<input checked="" type="checkbox"/>		Wind Velocity at 10 m Height	$v$	4,0	m/s
				Wind Shield factor	$f_W$	0,05	-

Additional Thermal Bridge Heat Losses at Perimeter				Steady-State Fraction			
Phase Shift	$\beta$		months	Steady-State Fraction	$\Psi_{P,stat,*I}$	7,871	W/K
				Harmonic Fraction	$\Psi_{P,harm,*I}$	7,871	W/K

Groundwater Correction				Transm. Belowground El. (w/o Ground)			
Depth of the Groundwater Table	$z_W$	1,0	m	Transm. Belowground El. (w/o Ground)	$L_{reg}$	78,56	W/K
Groundwater Flow Rate	$q_W$	0,05	m/d	Relative Insulation Standard	$d/B'$	1,70	-
Groundwater Correction Factor	$G_W$	1,1100546	-	Relative Groundwater Depth	$z_W/B'$	0,06	-
				Relative Groundwater Velocity	$I/B'$	0,05	-

Basement or Underground Floor Slab				Unheated Basement			
Eq. Thickness Floor Slab	$d_f$		m	Steady-State Transmittance	$L_S$		W/K
U-Value Floor Slab	$U_{bf}$		W/(m²K)	Phase Shift	$\beta$		months
Eq. Thickness Basement Wall	$d_w$		m	Exterior Periodic Transmittance	$L_{pe}$		W/K
U-Value Wall	$U_{bw}$		W/(m²K)				
Steady-State Transmittance	$L_S$		W/K				

Slab on Grade				Suspended Floor Above a Ventilated Crawl Space (at max. 0.5 m Below Ground)			
Heat Transfer Coefficient	$U_0$	0,05	W/(m²K)	Eq. Ins. Thickness Crawl Space	$d_g$		m
Eq. Ins. Thickness Perimeter Ins.	$d'$	20,65	m	U-Value Crawl Space Floor Slab	$U_g$		W/(m²K)
Perimeter Insulation Correction	$\Delta\Psi$	-0,02	W/(mK)	U-Value Crawl Space Wall & Vent.	$U_X$		W/(m²K)
Steady-State Transmittance	$L_S$	60,94	W/K	Steady-State Transmittance	$L_S$		W/K

Interim Results							
Phase Shift	$\beta$	1,46	months	Steady-State Heat Flow	$\Phi_{stat}$	735,6	W
Steady-State Transmittance	$L_S$	68,81	W/K	Periodic Heat Flow	$\Phi_{harm}$	65,8	W
Exterior Periodic Transmittance	$L_{pe}$	15,15	W/K	Heat Losses During Heating Period	$Q_{tot}$	3933	kWh

Ground Reduction Factor for "Annual Heat Demand" Sheet **0,510**

### Monthly Average Ground Temperatures for Monthly Method

Month	1	2	3	4	5	6	7	8	9	10	11	12	Average Val
Winter	7,1	6,6	6,6	7,2	8,1	9,2	10,1	10,7	10,6	10,1	9,1	8,1	8,6
Summer	8,0	7,5	7,5	8,1	9,0	10,1	11,0	11,5	11,5	10,9	10,0	8,9	9,5

Design Ground Temperature for Heat Load Sheet

**6,6**

for Cooling Load Sheet

**11,5**

# Passive House Planning

## GLAZING ACCORDING TO CERTIFICATION

for frame types, go to row: 71

Assembly No.	Type	g-Value	U <sub>g</sub> -Value
	Glazing		
			W/(m <sup>2</sup> K)
1	Arcon II - arcon N41-3i	0,500	0,500
2	ACG PLANIBEL TRI	0,610	0,700
3	AGC Glass Europe		
4	GUARDIAN 4/18/4/18/4 95% argon	0,494	0,500

# Passive House Planning

## FRAME TYPE ACCORDING TO CERTIFICATION

for glazings, go to row: 2

	Type	U <sub>f</sub> -Value	Frame Dimensions				Thermal Bridge	Thermal Bridge
Assembly No.	Frame	Frame	Width - Left	Width - Right	Width - Below	Width - Above	$\Psi_{\text{Spacer}}$	$\Psi_{\text{Installation}}$
		W/(m <sup>2</sup> K)	m	m	m	m	W/(mK)	W/(mK)
1	GENEO MD/0	0,86	0,105	0,105	0,135	0,105	0,040	0,030
2	GENEO MD/A	0,86	0,105	0,053	0,135	0,105	0,040	0,030
3	GENEO MD/B	0,86	0,053	0,105	0,135	0,105	0,040	0,030
4	GENEO MD/C	0,86	0,105	0,105	0,053	0,105	0,040	0,030
5	GENEO MD/D	0,86	0,105	0,105	0,053	0,053	0,040	0,030
6	GENEO MD/E	0,86	0,105	0,105	0,135	0,053	0,040	0,030
7								

REDUCTION FACTOR SOLAR RADIATION, WINDOW U-VALUE

Heating Degree Hours:

88,3	
<b>Transmission Losses</b>	<b>Heat Gains Solar Radiation</b>
kWh/a	kWh/a
0	0
3985	1000
1234	469
466	119
0	0
<b>5685</b>	<b>1588</b>

PHPP 2007, Windows

# Passive House Planning

## CALCULATING SHADING FACTORS

Climate: LAT\_Riga\_Kra

Building: Jelgavas 2 intenatpamatskola

Latitude: 56,5 °

Orien-tation	Glazing Area m²	Reduction Factor r <sub>s</sub>
North	0,00	100%
East	39,84	75%
South	16,90	83%
West	4,66	76%
Horizontal	0,00	100%

Quantity	Description	Deviation from North	Angle of Inclination from the Horizontal	Orientation	Glazing Width	Glazing Height	Glazing Area	Height of the Shading Object	Horizontal Distance	Window Reveal Depth	Distance from Glazing Edge to Reveal	Overhang Depth	Distance from Upper Glazing Edge to Overhang	Additional Shading Reduction Factor	Horizontal Shading Reduction Factor	Reveal Shading Reduction Factor	Overhang Shading Reduction Factor	Total Shading Reduction Factor
		Degrees	Degrees		m	m	A <sub>G</sub>	m	m	m	m	m	m	%	%	%	%	%
					w <sub>G</sub>	h <sub>G</sub>		h <sub>Hori</sub>	d <sub>Hori</sub>	Q <sub>Reveal</sub>	d <sub>Reveal</sub>	Q <sub>Over</sub>	d <sub>Over</sub>	r <sub>other</sub>	r <sub>H</sub>	r <sub>R</sub>	r <sub>O</sub>	r <sub>S</sub>
9	L1	46	90	East	1,19	1,16	12,4			0,36	0,500	0,36	0,041		100%	88%	85%	75%
3	L2	46	90	East	0,89	1,16	3,1			0,36	0,360	0,36	0,040		100%	84%	85%	72%
12	L3	46	90	East	0,89	1,76	18,8			0,36	0,400	0,36	0,040		100%	85%	90%	76%
4	L4	46	90	East	1,19	1,16	5,5			0,36	0,353	0,36	0,035		100%	87%	85%	73%
3	L5	46	90	west	0,89	1,16	3,1			0,36	0,643	0,36	0,040		100%	88%	85%	75%
1	L6	46	90	west	0,89	1,76	1,6			0,36	0,643	0,36	0,035		100%	88%	89%	79%
1	V1 Ardurvis	46	90	south	2,54	4,76	12,1			0,36	0,353	0,36	0,040		100%	92%	96%	88%
6	L7	46	90	south	0,69	1,16	4,8			0,36	0,353	0,36	0,040		100%	82%	85%	70%

# Passive House Planning

## VENTILATION DATA

Building: **Jelgavas 2 intonatpamatskola**

Treated Floor Area $A_{TFA}$	m <sup>2</sup>	<b>1180</b>	(Areas worksheet)
Room Height h	m	<b>5,0</b>	(Annual Heat Demand worksheet)
Room Ventilation Volume ( $A_{TFA} \cdot h$ ) = $V_V$	m <sup>3</sup>	<b>5900</b>	(Annual Heat Demand worksheet)

### Ventilation System Design - Standard Operation

Occupancy	m²/P	8				
Number of Occupants	P	150,0				
Supply Air per Person	m³/(P*h)	15				
Supply Air Requirement	m³/h	2250				
Extract Air Rooms		Kitchen	Bathroom	Shower	WC	HVAC
Quantity		2	2	2	2	1
Extract Air Requirement per Room	m³/h	60	40	20	20	4000
Total Extract Air Requirement	m³/h	4280				
Design Air Flow Rate (Maximum)	m³/h	4300				

### Average Air Change Rate Calculation

Type of Operation	Daily Operation Duration h/d	Factors Referenced to Maximum	Air Flow Rate m <sup>3</sup> /h	Air Change Rate 1/h
Maximum	<b>9,0</b>	1,00	4300	0,73
<b>Standard</b>	<b>0,0</b>	<b>0,01</b>	43	0,01
<b>Basic</b>	<b>0,0</b>	<b>0,54</b>	2315	0,39
<b>Minimum</b>	<b>15,0</b>	<b>0,01</b>	43	0,01
<b>Residential Building</b>	<b>Average value</b>	<b>0,38</b>	<b>Average Air Flow Rate (m<sup>3</sup>/h)</b>	<b>Average Air Change Rate (1/h)</b>
			<b>1639</b>	<b>0,28</b>

### Infiltration Air Change Rate according to EN 13790

Wind Protection Coefficients According to EN 13790		
Coefficient e for Screening Class	Several Sides Exposed	One Side Exposed
No Screening	0,10	0,03
Moderate Screening	0,07	0,02
High Screening	0,04	0,01
Coefficient f	15	20

Wind Protection Coefficient, e	for Annual Demand: <b>0,07</b>	for Heat Load: <b>0,18</b>		
Wind Protection Coefficient, f	<b>15</b>	<b>15</b>	Net Air Volume for Press. Test $V_{n50}$	Air Permeability $q_{50}$
Air Change Rate at Press. Test $n_{50}$	1/h <b>0,50</b>	0,50	<b>6982</b> m <sup>3</sup>	<b>1,01</b> m <sup>3</sup> /h

### Type of Ventilation System

<b>x</b> Balanced PH Ventilation	Please Check	for Annual Demand:	for Heat Load:
Pure Extract Air			
Excess Extract Air		1/h <b>0,00</b>	0,00
Infiltration Air Change Rate $n_{V,Res}$		1/h <b>0,041</b>	<b>0,104</b>

### Effective Heat Recovery Efficiency of the Ventilation System with Heat Recovery

<div><div>x</div></div>	Central unit within the thermal envelope.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Effective Heat Recovery Efficiency $\eta_{HR,eff}$	<b>91,1%</b>
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### Effective Heat Recovery Efficiency Subsoil Heat Exchanger

SHX Efficiency $\eta^*_{SHX}$	
Heat Recovery Efficiency SHX $\eta_{SHX}$	<b>0%</b>

**Secondary Calculation:** **$\Psi$ -value Supply or Ambient Air Duct**

Nominal Width	200	mm
Insul. Thickness:	50	mm
Reflective? Please mark with an "x"!		
<input checked="" type="checkbox"/>	Yes	
<input type="checkbox"/>	No	
Thermal Conductivity	0,04	W/(mK)
Nominal Air Flow Rate	1639	m³/h
$\Delta\theta$	20	K
Interior Duct Diameter	0,200	m
Interior Diameter	0,200	m
Exterior Diameter	0,300	m
$\alpha$ -Interior	45,14	W/(m²K)
$\alpha$ -Surface	3,02	W/(m²K)
<b><math>\Psi</math>-value</b>	<b>0,500</b>	<b>W/(mK)</b>
Surface Temperature Difference	3,865	K

**Secondary Calculation:** **$\Psi$ -value Extract or Exhaust Air Duct**

Nominal Width	200	mm
Insul. Thickness:	50	mm
Reflective? Please mark with an "x"!		
<input checked="" type="checkbox"/>	Yes	
<input type="checkbox"/>	No	
Thermal Conductivity	0,04	W/(mK)
Nominal Air Flow Rate	1639	m³/h
$\Delta\theta$	20	K
Interior Duct Diameter	0,20000	m
Exterior Duct Diameter	0,20000	m
Exterior Diameter	0,30000	m
$\alpha$ -Interior	45,14	W/(m²K)
$\alpha$ -Surface	3,02	W/(m²K)
<b><math>\Psi</math>-value</b>	<b>0,500</b>	<b>W/(mK)</b>
Surface Temperature Difference	3,865	K

# Passive House Planning

## SPECIFIC ANNUAL HEAT DEMAND

Climate: **LAT\_Riga\_Kra**  
 Building: **Jelgavas 2 intenatpamatskola**  
 Location:

Interior Temperature: **18,0** °C  
 Building Type/Use: **Sporta zales aka**  
 Treated Floor Area  $A_{TFA}$ : **1179,9** m<sup>2</sup>

Building Element	Temperature Zone	Area m <sup>2</sup>	U-Value W/(m <sup>2</sup> K)	Temp. Factor $f_t$	$G_t$ kWh/a	kWh/a	per m <sup>2</sup> Treated Floor Area
1. Exterior Wall - Ambient	A	890,5	0,056	1,00	88,3	4444	
2. Exterior Wall - Ground	B	50,0	0,116	0,51	88,3	261	
3. Roof/Ceiling - Ambient	A	1183,6	0,047	1,00	88,3	4885	
4. Floor Slab	B	1183,6	0,060	0,51	88,3	3185	
8. Windows	A	84,4	0,763	1,00	88,3	5685	
9. Exterior Door	A	50,3	0,900	1,00	88,3	3997	
10. Exterior TB (length/m)	A	183,3	-0,010	1,00	88,3	-162	
11. Perimeter TB (length/m)	P	167,7	0,047	0,51	88,3	355	
12. Ground TB (length/m)	B			0,51			
Total of All Building Envelope Areas		3442,4					

Transmission Heat Losses  $Q_T$

Total **22650** kWh/(m<sup>2</sup>a)  
**19,2**

Ventilation System:

Effective Heat Recovery Efficiency  
 of Heat Recovery  
 Efficiency of Subsoil Heat Exchanger

Effective Air Volume,  $V_V$

$\eta_{eff}$  **91%**

$\eta_{SHX}$  **0%**

Energetically Effective Air Exchange  $n_v$

$n_{V,system}$   
1/h

$A_{TFA}$   
m<sup>2</sup>

**1179,9**

Clear Room Height  
m

**5,00**

**5899,5** m<sup>3</sup>

$\Phi_{HR}$

**0,91**

$n_{V,Res}$   
1/h

**0,041**

**0,066** 1/h

Ventilation Heat Losses  $Q_V$

$V_V$   
m<sup>3</sup>

**5900**

$n_V$   
1/h

**0,066**

$C_{Air}$   
Wh/(m<sup>3</sup>K)

**0,33**

$G_t$   
kWh/a

**88,3**

**11358** kWh/a

**9,6** kWh/(m<sup>2</sup>a)

Total Heat Losses  $Q_L$

$Q_T$   
kWh/a

**22650**

$Q_V$   
kWh/a

**11358**

Reduction Factor  
Night/Weekend  
Saving

**1,0**

**34009** kWh/a

**28,8** kWh/(m<sup>2</sup>a)

Orientation  
of the Area

Reduction Factor  
See Windows Sheet

g-Value  
(perp. radiation)

Area  
m<sup>2</sup>

Radiation HP

kWh/(m<sup>2</sup>a)

kWh/a

1. North	0,40	0,00	0,00	71	0
2. East	0,43	0,49	56,50	84	1000
3. South	0,54	0,49	21,06	84	469
4. West	0,42	0,49	6,82	84	119
5. Horizontal	0,40	0,00	0,00	225	0

Available Solar Heat Gains  $Q_S$

Total **1588** kWh/(m<sup>2</sup>a)  
**1,3**

Internal Heat Gains  $Q_i$

kh/d

**0,024**

Length Heat. Period  
d/a

**205**

Spec. Power  $q_i$   
W/m<sup>2</sup>

**2,80**

$A_{TFA}$   
m<sup>2</sup>

**1179,9**

**16216** kWh/a

**13,7** kWh/(m<sup>2</sup>a)

Free Heat  $Q_F$

$Q_S + Q_i =$  **17804** kWh/a

**15,1** kWh/(m<sup>2</sup>a)

Ratio of Free Heat to Losses

$Q_F / Q_L =$  **0,52**

Utilisation Factor Heat Gains  $\eta_G$

$(1 - (Q_F / Q_L)^5) / (1 - (Q_F / Q_L)^6) =$  **98%**

Heat Gains  $Q_G$

$\eta_G * Q_F =$  **17463** kWh/a

**14,8** kWh/(m<sup>2</sup>a)

Annual Heat Demand  $Q_H$

$Q_L - Q_G =$  **16545** kWh/a

**14** kWh/(m<sup>2</sup>a)

Limiting Value **15** kWh/(m<sup>2</sup>a)

Requirement met? **Yes** (Yes/No)



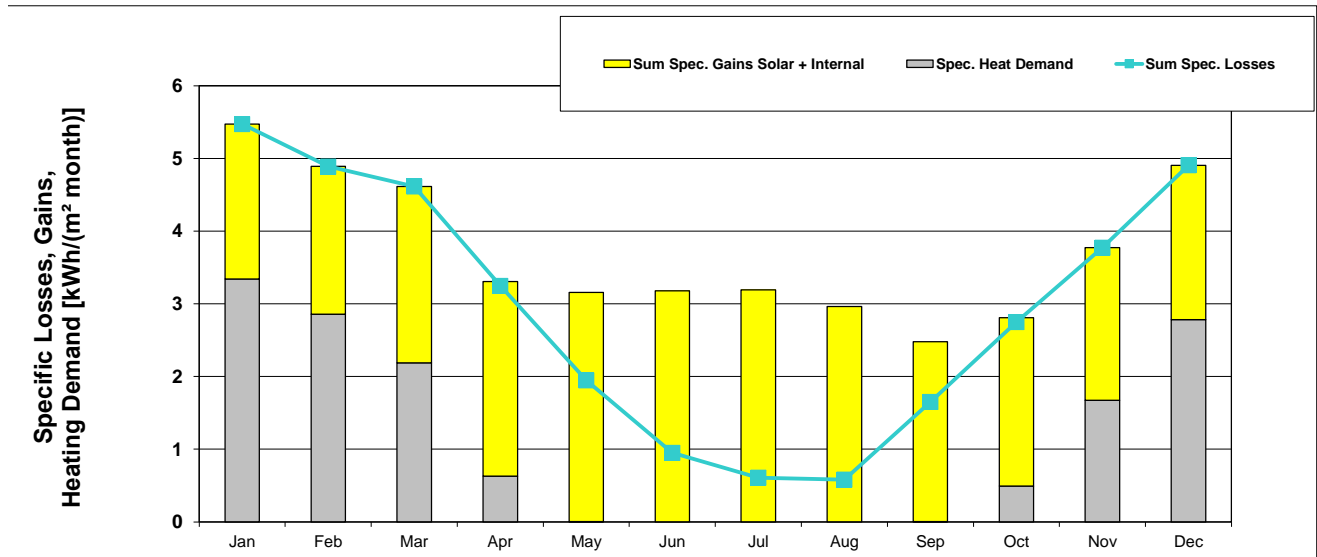
# PASSIVE HOUSE PLANNING

## SPECIFIC ANNUAL HEAT DEMAND MONTHLY METHOD

Climate: **LAT Riga Kra**  
 Building: **Jelgavas 2 intenatpamatskola**  
 Location:

Interior Temperature: **18** °C  
 Building Type/Use: **Sporta zales ēka**  
 Treated Floor Area A<sub>TFA</sub>: **1180** m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating Degree Hours - E	16,9	15,0	13,8	9,3	4,9	1,9	0,8	0,8	4,4	8,0	11,4	15,1	102	kKh
Heating Degree Hours - G	8,1	7,7	8,5	7,8	7,3	5,7	5,2	4,8	5,3	5,9	6,4	7,4	80	kKh
Losses - Exterior	5775	5124	4732	3176	1679	640	280	280	1502	2748	3915	5165	35016	kWh
Losses - Ground	682	645	713	656	619	481	439	406	447	497	538	624	6747	kWh
Sum Spec. Losses	5,5	4,9	4,6	3,2	1,9	0,9	0,6	0,6	1,7	2,8	3,8	4,9	35,4	kWh/m²
Solar Gains - North	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar Gains - East	36	111	256	489	796	866	826	653	339	173	65	29	4639	kWh
Solar Gains - South	17	52	120	229	373	405	387	306	159	81	30	14	2173	kWh
Solar Gains - West	4	13	30	58	95	103	98	78	40	21	8	3	551	kWh
Solar Gains - Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar Gains - Opaque	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Internal Heat Gains	2458	2220	2458	2379	2458	2379	2458	2458	2379	2458	2379	2458	28941	kWh
Sum Spec. Gains Solar +	2,1	2,0	2,4	2,7	3,2	3,2	3,2	3,0	2,5	2,3	2,1	2,1	30,8	kWh/m²
Utilisation Factor	100%	100%	100%	98%	62%	30%	19%	20%	67%	97%	100%	100%	70%	
Annual Heat Demand	3942	3373	2582	745	4	0	0	0	7	582	1973	3285	16491	kWh
Spec. Heat Demand	3,3	2,9	2,2	0,6	0,0	0,0	0,0	0,0	0,0	0,5	1,7	2,8	14,0	kWh/m²



# Passive House Planning

## SUMMER

Climate: **LAT Riga Kra**  
 Building: **Jelgavas 2 intenatpamatskola**  
 Location:   
 Spec. Capacity: **60** Wh/K pro m² TFA  
 Overheating Limit: **25** °C

Interior Temperature: **18** °C  
 Building Type/Use: **Sporta zales ēka**  
 Treated Floor Area A<sub>TFA</sub>: **1179,9** m²

Building Element	Temperature Zone	Area m²	U-Value W/(m²K)	Red. Factor f <sub>T,Summer</sub>	H <sub>Summer</sub> Heat Conductance
1. Exterior Wall - Ambient	A	890,5	0,056	1,00	50,3
2. Exterior Wall - Ground	B	50,0	0,116	1,00	5,8
3. Roof/Ceiling - Ambient	A	1183,6	0,047	1,00	55,3
4. Floor Slab	B	1183,6	0,060	1,00	70,7
5.	A			1,00	
6.	A			1,00	
7.	X			0,75	
8. Windows	A	84,4	0,763	1,00	64,4
9. Exterior Door	A	50,3	0,900	1,00	45,3
10. Exterior TB (length/m)	A	183,3	-0,010	1,00	-1,8
11. Perimeter TB (length/m)	P	167,7	0,047	1,00	7,9
12. Ground TB (length/m)	B			1,00	

Exterior Thermal Transmittance, H<sub>T,e</sub>

Ground Thermal Transmittance, H<sub>T,g</sub>

**213,4** W/K  
**84,3** W/K

Heat Recovery Efficiency  $\eta_{HR}$  **91%** Effective Air Volume V<sub>v</sub> **1179,9** m³ \* Clear Room Height **5,00** m = **5900** m³  
 SHX Efficiency  $\eta_{SHX}$  **0%**

### Summer Ventilation continuous ventilation to provide sufficient indoor air quality

Air Change Rate by Natural (Windows & Leakages) or Exhaust-Only Mechanical Ventilation, Summer: **0,35** 1/h

Mechanical Ventilation Summer: **0,35** 1/h ☒ with HR (check if applicable)

Energetically Effective Airchange Rate n<sub>v</sub> **0,350** 1/h + **0,350** 1/h \* (1 - **0,911**) + **0,000** 1/h = **0,381** 1/h

Ventilation Transm. Ambient H<sub>v,e</sub> **5900** m³ \* **0,381** 1/h \* **0,33** W/(m²K) = **741,8** W/K  
 Ventilation Transm. Ground H<sub>v,g</sub> **5900** m³ \* **0,000** 1/h \* **0,33** W/(m²K) = **0,0** W/K

### Additional Summer Ventilation for Cooling

Temperature Amplitude Summer **0,0** K

Select: ☐ Window Night Ventilation, Manual Corresponding Air Change Rate **0,00** 1/h  
☒ Mechanical, Automatically Controlled Ventilation (for window ventilation: at 1 K temperature difference indoor - outdoor)

Minimum Acceptable Indoor Temperature **22,0** °C

Orientation of the Area	Angle Factor Summer	Shading Factor Summer	Dirt	g-Value (perp. radiation)	Area m²	Portion of Glazing	Aperture m²
1. North	0,9	1,00	0,95	0,00	0,0	0%	0,0
2. East	0,9	0,85	0,95	0,49	56,5	71%	14,3
3. South	0,9	0,91	0,95	0,49	21,1	80%	6,5
4. West	0,9	0,86	0,95	0,49	6,8	68%	1,7
5. Horizontal	0,9	1,00	0,95	0,00	0,0	0%	0,0
6. Sum Opaque Areas							0,0

### Solar Aperture

Total **22,5** m²/m² **0,02**

Internal Heat Gains Q<sub>i</sub> Spec. Power q<sub>i</sub> **2,80** W/m² \* A<sub>TFA</sub> **1180** m² = **3304** W **2,8** W/m²

Frequency of Overheating h<sub>g</sub> ≥ g<sub>max</sub> **0,5%** at the overheating limit g<sub>max</sub> = 25 °C

If the "frequency over 25°C" exceeds 10%, additional measures to protect against summer heat waves are necessary.

Daily Temperature Swing due to Solar Load **40,8** kWh/d \* **1000** 1/k / ( **60** Wh/(m²K) \* **1180** m² ) = **0,6** K

# PASSIVE HOUSE PLANNING

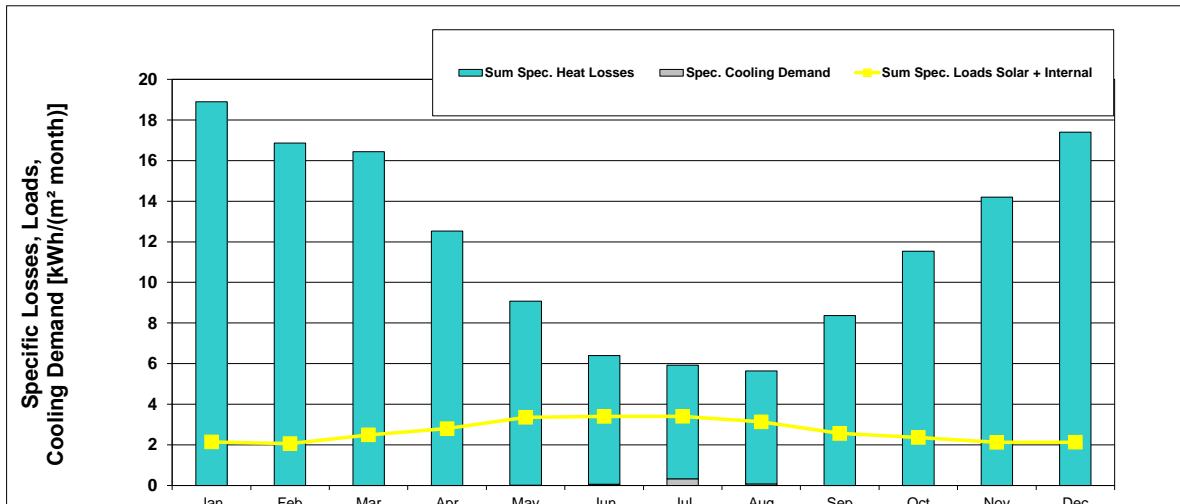
## SPECIFIC USEFUL COOLING DEMAND

### MONTHLY METHOD

Climate: **LAT\_Riga\_Kra**  
 Building: **Jelgavas 2 intenatpamatskola**  
 Location:

Interior Temperature: **25** °C  
 Building Type/Use: **Sporta zales aka**  
 Treated Floor Area  $A_{TFA}$ : **1180** m²

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating Degree Hours - E	22,1	19,7	19,0	14,3	10,1	6,9	6,0	6,0	9,4	13,2	16,5	20,3	164	kKh
Heating Degree Hours - C	13,3	12,4	13,7	12,8	12,5	10,7	10,4	10,0	10,3	11,1	11,4	12,6	141	kKh
Losses - Exterior	21280	18962	18342	13798	9744	6656	5804	5804	9083	12754	15878	19560	157665	kWh
Losses - Ground	1016	945	1045	980	959	821	796	767	791	849	874	964	10807	kWh
Losses Summer Ventilatic	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Sum Spec. Heat Losses	18,9	16,9	16,4	12,5	9,1	6,3	5,6	5,6	8,4	11,5	14,2	17,4	142,8	kWh/m²
Solar Load North	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar Load East	44	134	307	588	957	1040	992	785	408	208	78	35	5575	kWh
Solar Load South	20	61	139	266	432	470	448	355	184	94	35	16	2519	kWh
Solar Load West	5	16	36	69	113	122	117	92	48	24	9	4	656	kWh
Solar Load Horiz.	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Solar Load Opaque	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh
Internal Heat Gains	2458	2220	2458	2379	2458	2379	2458	2458	2379	2458	2379	2458	28941	kWh
Sum Spec. Loads Solar +	2,1	2,1	2,5	2,8	3,4	3,4	3,4	3,1	2,6	2,4	2,1	2,1	31,9	kWh/m²
Utilisation Factor Losses	11%	12%	15%	22%	37%	53%	55%	55%	31%	20%	15%	12%	22%	
Useful Cooling Energy De	0	0	0	1	13	72	384	80	4	1	0	0	556	kWh
Spec. Cooling Demand	0,0	0,0	0,0	0,0	0,0	0,1	0,3	0,1	0,0	0,0	0,0	0,0	0,5	kWh/m²



# Passive House Planning

## HEAT DISTRIBUTION AND DHW SYSTEM

Building:	Jelgavas 2 intenatpamatskola
Location:	
Interior Temperature:	18 °C
Building Type/Use:	Sporta zales aka
Treated Floor Area $A_{TFA}$ :	1180 m²
Occupancy:	150,0 Pers
Number of Residences:	1
Annual Heat Demand $q_{heating}$ :	16491 kWh/a
Length of Heating Period:	205 d
Average Heat Load $P_{ave}$ :	3,4 kW
Marginal Utilisability of Additional Heat Gains:	90%

### Space Heat Distribution

Length of Distribution Pipes	$L_H$ (Project)	
Heat Loss Coefficient per m Pipe	$\Psi$ (Project)	
Temperature of the Room Through Which the Pipes	$\vartheta_X$ Mechanical Room	
Design Flow Temperature	$\vartheta_{dist}$ Flow, Design Value	
Design System Heat Load	$P_{heating}$ (exist/calc.)	
Flow Temperature Control (check)		
Design Return Temperature	$\vartheta_R$	= 0.714 * ( $\vartheta_{dist}$ - 20) + 20
Annual Heat Emission per m of Plumbing	$q^*_{HL}$	= $\Psi \cdot (\vartheta_m - \vartheta_X) \cdot t_{heating} \cdot 0.024$
Possible Utilization Factor of Released Heat	$\eta_G$	
Annual Losses	$Q_{HL}$	= $L_H \cdot q^*_{HL} \cdot (1 - \eta_G)$
Specif. Losses	$q_{HL}$	= $\Sigma Q_{HL} / A_{TFA}$
Utilisation Factor of Space Heat Distribution	$h_{a,HL}$	= $q_H / (q_H + q_{HL})$

Parts			Total
Warm Region	Cold Region		
1	2	3	
300,00			m
0,218			W/(mK)
18			°C
50,0			°C
36,1			kW
x			
41,4			°C
7			Total 1,2,3 kWh/(m·a)
90%			-
195	0	0	195 kWh/a
			kWh/(m²a) 0,2

### DHW: Standard Useful Heat

DHW Consumption per Person and Day (60 °C)	$V_{DHW}$ (Project or Average Value 25 Litres/Person/d)	
Average Cold Water Temperature of the Supply	$T_{DHW}$ Temperature of Drinking Water (10°)	
DHW Non-Electric Wash and Dish	(Electricity worksheet)	

### Useful Heat - DHW

### Specif. Useful Heat - DHW

$Q_{DHW}$		25,0 Litre/Person/d
$q_{DHW}$		7,0 °C
		0 kWh/a
		84151 kWh/a
		kWh/(m²a) 71,3

### DHW Distribution and Storage

Length of Circulation Pipes (Flow + Return)	$L_{HS}$ (Project)	
Heat Loss Coefficient per m Pipe	$\Psi$ (Project)	
Temperature of the Room Through Which the Pipes	$\vartheta_X$ Mechanical Room	
Design Flow Temperature	$\vartheta_{dist}$ Flow, Design Value	
Daily circulation period of operation.	$td_{circ}$ (Project)	
Design Return Temperature	$\vartheta_R$	= 0.875 * ( $\vartheta_{dist}$ - 20) + 20
Circulation period of operation per year	$t_{circ}$	= 365 $td_{circ}$
Annual Heat Released per m of Pipe	$q^*_{Z}$	= $\Psi \cdot (\vartheta_m - \vartheta_X) \cdot t_{circ}$
Possible Utilization Factor of Released Heat	$\eta_{GDHW}$	= $t_{heating} / 365d \cdot \eta_G$
Annual Heat Loss from Circulation Lines	$Q_Z$	= $L_{HS} \cdot q^*_{Z} \cdot (1 - \eta_{GDHW})$
Total Length of Individual Pipes	$L_U$ (Project)	
Exterior Pipe Diameter	$d_{U, Pipe}$ (Project)	
Heat Loss Per Tap Opening	$q_{Individual}$	= $(C_{p, H_2O} V_{H_2O} + C_{p, air} V_{air}) (\vartheta_{dist} - \vartheta_X)$
Occupancy Coefficient	$n_{Tap}$	= $n_{Pers} \cdot 3 \cdot 365 / n_{LU}$
Annual Heat Loss	$Q_U$	= $n_{Tap} \cdot q_{Individual}$
Possible Utilization Factor of Released Heat	$\eta_{G, U}$	= $t_{heating} / 8760 \cdot \eta_G$
Annual Heat Loss of Individual Pipes	$Q_U$	= $Q_U \cdot (1 - \eta_{G, U})$
Average Heat Released From Storage	$P_S$	
Possible Utilization Factor of Released Heat	$\eta_{G, S}$	= $t_{heating} / 8760 \cdot \eta_G$
Annual Heat Losses from Storage	$Q_S$	= $P_S \cdot 8.760 \text{ kh} \cdot (1 - \eta_{G, S})$

Warm Region	Cold Region		Total
1	2	3	
100,0			m
0,050			W/mK
18			°C
50,0			°C
5,0			h/d
46			°C
1825			h/a
2,7			kWh/m·a
50,6%			-
136			136 kWh/a
24,70			m
0,025			m
0,3732			kWh/tap opening
164250			Tap openings per year
61292,6			kWh/a
50,6%			-
30252,1			30252 kWh/a
			Total 1,2,3
			W
			0 kWh/a
			Total 1,2,3
			kWh/a
			kWh/(m²a) 25,8
			73,5%
			114539 kWh/a
			kWh/(m²a) 97,1

### Total Heat Losses of the DHW System

### Specif. Losses of the DHW System

### Utilisation Factor DHW Distrib and Storage

### Total Heat Demand of DHW system

### Total Spec. Heat Demand of DHW System

$Q_{WL}$		$Q_Z + Q_U + Q_S$	30388 kWh/a
$q_{WL}$		$Q_{WL} / A_{TFA}$	kWh/(m²a) 25,8
$\eta_{a, WL}$		$q_{DHW} / (q_{DHW} + q_{WL})$	73,5%
$Q_{gDHW}$		$Q_{DHW} + Q_{WL}$	114539 kWh/a
$q_{gDHW}$		$Q_{gDHW} / A_{TFA}$	kWh/(m²a) 97,1

Secondary Calculation:  $\Psi$ -Values of Plumbing

Nominal Width		mm
Insulation Thickness:		mm
Reflective? Please mark with an "x"!		
Yes		Please check one cell
No		
Thermal Conductivity		W/(mK)
$\Delta\vartheta$	30	K
Interior Pipe Diameter:	0,00000	m
Exterior Pipe Diameter	0,00225	m
Exterior Pipe Diameter	0,00225	m
$\alpha$ -Surface		W/(m <sup>2</sup> K)
<b><math>\Psi</math>-Value</b>		<b>W/(mK)</b>
Surface Temperature Difference	0,000	K

# Passive House Planning

Building: Jelgavas 2 intenatpamatskola

Calculation in Electricity Demand worksheet!  
ELECTRICITY DEMAND

Column Nr.	1	2	3	4	5	6	7	8	8a	9	10	11	12	13	14
Application	Used ? (1/0)	Within the Thermal Envelope? (1/0)	Norm Demand	Utilization Factor	Frequency	Reference Quantity	Useful Energy (kWh/a)	Electric Fraction	Non-Electric Fraction	Electricity Demand (kWh/a)	Additional Demand	Marginal Performance Ratio	Solar Fraction	Non-Electric Demand (kWh/a)	Primary Energy-Demand (kWh/a)
Dishwashing	0	0	0,00 kWh/Use	1,00	65	/(P*a)	0	50%		0					0
DHW Connection								50%							
Clothes Washing	0	0	0,00 kWh/Use	1,00	57	/(P*a)	0	55%		0					0
DHW Connection								45%							
Clothes Drying with:	1	0	0,00 kWh/Use	1,00	57	/(P*a)	0	0%		0					0
Clothesline								0%							0
Energy Consumed by Evaporation	1	0	0,00 kWh/Use	0,00	57	/(P*a)	0	100%		0					0
Refrigerating	0	1	0,00 kWh/d	1,00	365	d/a	0	100%		0					0
Freezing	0	0	0,00 kWh/d	0,90	365	d/a	0	100%		0					0
or Combined Unit	0	1	0,00 kWh/d	1,00	365	d/a	0	100%		0					0
Cooking with:	1	1	0,00 kWh/Use	1,00	500	/(P*a)	18750	100%		18750					50625
Electricity								0%						0	0
Lighting	1	1	60 W	1,00	2,90	kh/(P*a)	26100	100%		26100					70470
Consumer Electronics	1	1	0 W	1,00	0,00	kh/(P*a)	0	100%		0					0
Small Appliances, etc	1	1	50 kWh	1,00	1,00	/(P*a)	7500	100%		7500					20250
Total Aux. Electricity							6819			6819					18413
Other:							0			0					0
							0			0					0
							0			0					0
<b>Total</b>							<b>59169 kWh</b>			<b>59169 kWh</b>				<b>0 kWh</b>	<b>159758</b>
<b>Specific Demand</b>										<b>50,1 kWh/(m²a)</b>				<b>0,0 kWh/(m²a)</b>	<b>135,4</b>
<b>Recommended Maximum Value</b>										<b>18</b>					<b>50</b>

# Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Building: **Jelgavas 2 intenatpamatskola**

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

1		Jumts J1						
Assembly No.		Building Assembly Description						
		Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :		0,10		
				exterior R <sub>se</sub> :		0,04		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width		
						Thickness [mm]		
1.	OSB 3	0,130				15		
2.	Minērālvates siltumizolācija	0,037	Termoprofils, cinkots terauds	17,000		100		
3.	Minērālvates siltumizolācija	0,037	Termoprofils, cinkots terauds	17,000		800		
4.								
5.								
6.								
7.								
8.								
		Percentage of Sec. 2		Percentage of Sec. 3		Total		
		0,1%		0,0%		91,5 cm		
		U-Value:		0,047		W/(m²K)		

2		Ārsiena ĀS1						
Assembly No.		Building Assembly Description						
		Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :		0,13		
				exterior R <sub>se</sub> :		0,04		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width		
						Thickness [mm]		
1.	Cementa smilts apmetums	0,870				30		
2.	Aeroc Ecoterm	0,072				375		
3.	Minērālvate	0,037	koka balķu konstrukcija	0,130		500		
4.								
5.								
6.								
7.					Betona grida			
8.								
		Percentage of Sec. 2		Percentage of Sec. 3		Total		
		5,0%		0,0%		90,5 cm		
		U-Value:		0,056		W/(m²K)		

3		Gridas parségums						
Assembly No.		Building Assembly Description						
		Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :		0,17		
				exterior R <sub>se</sub> :		0,00		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width		
						Thickness [mm]		
1.	Betona grida	1,860				100		
2.	Putupolistiols	0,038				100		
3.	Ekstrudēts putupolistiols	0,036				500		
4.								
5.								
6.								
7.								
8.								
		Percentage of Sec. 2		Percentage of Sec. 3		Total		
						70,0 cm		
		U-Value:		0,060		W/(m²K)		

# Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

Building: **Jelgavas 2 intenatpamatskola**

Assembly No. **4** Building Assembly Description **Cokola sienas**

Heat Transfer Resistance [m<sup>2</sup>K/W] interior R<sub>si</sub> :   
exterior R<sub>se</sub> :

Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1. <b>Dzelzsbetons</b>	<b>1,860</b>					<b>500</b>
2. <b>Ekstrudēts putupolist.</b>	<b>0,036</b>	<b>koka balķu konstrukcija</b>	<b>0,290</b>			<b>400</b>
3.						
4.						
5.						
6.						
7.						
8.						
		Percentage of Sec. 2		Percentage of Sec. 3		Total
		<b>5,0%</b>				<b>90,0</b> cm

U-Value: **0,116** W/(m<sup>2</sup>K)

Assembly No. **5** Building Assembly Description

Heat Transfer Resistance [m<sup>2</sup>K/W] interior R<sub>si</sub> :   
exterior R<sub>se</sub> :

Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
		Percentage of Sec. 2		Percentage of Sec. 3		Total

U-Value:  W/(m<sup>2</sup>K)

Assembly No. **6** Building Assembly Description

Heat Transfer Resistance [m<sup>2</sup>K/W] interior R<sub>si</sub> :   
exterior R<sub>se</sub> :

Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
		Percentage of Sec. 2		Percentage of Sec. 3		Total

U-Value:  W/(m<sup>2</sup>K)



# Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Building: **Jelgavas 2 intenatpamatskola**

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

7		Starpsienas term tilts						
Assembly No. Building Assembly Description		Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :		0,17		
				exterior R <sub>se</sub> :		0,00		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width		
Thickness [mm]								
1. <b>Muris</b>	<b>0,870</b>					<b>500</b>		
2.								
3.								
4.								
5.								
6.								
7.								
8.								
		Percentage of Sec. 2		Percentage of Sec. 3		Total		
						<b>50,0</b>	cm	
				<b>U-Value:</b>		<b>1,343</b>	W/(m²K)	

8								
Assembly No. Building Assembly Description		Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :				
				exterior R <sub>se</sub> :				
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width		
Thickness [mm]								
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
		Percentage of Sec. 2		Percentage of Sec. 3		Total		
							cm	
				<b>U-Value:</b>			W/(m²K)	

9								
Assembly No. Building Assembly Description		Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :				
				exterior R <sub>se</sub> :				
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width		
Thickness [mm]								
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
		Percentage of Sec. 2		Percentage of Sec. 3		Total		
							cm	
				<b>U-Value:</b>			W/(m²K)	

## Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Building: Jelgavas 2 intenatpamatskola

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

10					
Assembly No. Building Assembly Description					
Heat Transfer Resistance [m²K/W]		interior R <sub>si</sub> :			
		exterior R <sub>se</sub> :			
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
Percentage of Sec. 2			Percentage of Sec. 3		Total
					Thickness [mm]
U-Value:					W/(m²K)

11					
Assembly No.		Building Assembly Description			
Heat Transfer Resistance [m <sup>2</sup> K/W]		interior R <sub>si</sub> :			
		exterior R <sub>se</sub> :			
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
Percentage of Sec. 2			Percentage of Sec. 3		
U-Value:			W/(m <sup>2</sup> K)		
Total Width					
Thickness [mm]					
Total					cm

12	
Assembly No.	Building Assembly Description
Heat Transfer Resistance [ $\text{m}^2\text{K}/\text{W}$ ]	
interior $R_{si}$ :	<input style="width: 100px;" type="text"/>
exterior $R_{se}$ :	<input style="width: 100px;" type="text"/>

	Area Section 1	$\lambda$ [ $\text{W}/(\text{mK})$ ]	Area Section 2 (optional)	$\lambda$ [ $\text{W}/(\text{mK})$ ]	Area Section 3 (optional)	$\lambda$ [ $\text{W}/(\text{mK})$ ]	Total Width Thickness [mm]
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							

Percentage of Sec. 2	<input style="width: 100px;" type="text"/>	Percentage of Sec. 3	<input style="width: 100px;" type="text"/>
----------------------	--	----------------------	--

U-Value:	<input style="width: 150px;" type="text"/>	$\text{W}/(\text{m}^2\text{K})$
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# Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Building: **Jelgavas 2 intenatpamatskola**

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

<b>13</b>						
Assembly No.	Building Assembly Description					
Heat Transfer Resistance [m <sup>2</sup> K/W]		interior R <sub>si</sub> :				
		exterior R <sub>se</sub> :				
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Percentage of Sec. 2			Percentage of Sec. 3		Total	
					cm	
U-Value:						W/(m <sup>2</sup> K)

<b>14</b>						
Assembly No.	Building Assembly Description					
Heat Transfer Resistance [m <sup>2</sup> K/W]		interior R <sub>si</sub> :				
		exterior R <sub>se</sub> :				
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Percentage of Sec. 2			Percentage of Sec. 3		Total	
					cm	
U-Value:						W/(m <sup>2</sup> K)

<b>15</b>						
Assembly No.	Building Assembly Description					
Heat Transfer Resistance [m <sup>2</sup> K/W]		interior R <sub>si</sub> :				
		exterior R <sub>se</sub> :				
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Percentage of Sec. 2			Percentage of Sec. 3		Total	
					cm	
U-Value:						W/(m <sup>2</sup> K)

# Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Building: **Jelgavas 2 intenatpamatskola**

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

<b>16</b>						
Assembly No. Building Assembly Description						
Heat Transfer Resistance [ $m^2K/W$ ]						
interior $R_{si}$ :						
exterior $R_{se}$ :						
Area Section 1	$\lambda$ [ $W/(mK)$ ]	Area Section 2 (optional)	$\lambda$ [ $W/(mK)$ ]	Area Section 3 (optional)	$\lambda$ [ $W/(mK)$ ]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Percentage of Sec. 2			Percentage of Sec. 3		Total	
					cm	
U-Value:						$W/(m^2K)$

<b>17</b>						
Assembly No. Building Assembly Description						
Heat Transfer Resistance [ $m^2K/W$ ]						
interior $R_{si}$ :						
exterior $R_{se}$ :						
Area Section 1	$\lambda$ [ $W/(mK)$ ]	Area Section 2 (optional)	$\lambda$ [ $W/(mK)$ ]	Area Section 3 (optional)	$\lambda$ [ $W/(mK)$ ]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Percentage of Sec. 2			Percentage of Sec. 3		Total	
					cm	
U-Value:						$W/(m^2K)$

<b>18</b>						
Assembly No. Building Assembly Description						
Heat Transfer Resistance [ $m^2K/W$ ]						
interior $R_{si}$ :						
exterior $R_{se}$ :						
Area Section 1	$\lambda$ [ $W/(mK)$ ]	Area Section 2 (optional)	$\lambda$ [ $W/(mK)$ ]	Area Section 3 (optional)	$\lambda$ [ $W/(mK)$ ]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Percentage of Sec. 2			Percentage of Sec. 3		Total	
					cm	
U-Value:						$W/(m^2K)$

# Passive House Planning

## U-VALUES OF BUILDING ELEMENTS

Building: **Jelgavas 2 intenatpamatskola**

Wedge Shaped Building Element Layers and  
Still Air Spaces -> Secondary Calculation to the Right

<b>19</b>						
Assembly No. Building Assembly Description						
Heat Transfer Resistance [m <sup>2</sup> K/W]				interior R <sub>si</sub> :		
				exterior R <sub>se</sub> :		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
			Percentage of Sec. 2	Percentage of Sec. 3		Total
						cm
<b>U-Value:</b>				W/(m <sup>2</sup> K)		

<b>20</b>						
Assembly No. Building Assembly Description						
Heat Transfer Resistance [m <sup>2</sup> K/W]				interior R <sub>si</sub> :		
				exterior R <sub>se</sub> :		
Area Section 1	λ [W/(mK)]	Area Section 2 (optional)	λ [W/(mK)]	Area Section 3 (optional)	λ [W/(mK)]	Total Width Thickness [mm]
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
			Percentage of Sec. 2	Percentage of Sec. 3		Total
						cm
<b>U-Value:</b>				W/(m <sup>2</sup> K)		









# Passive House Planning

## AUXILIARY ELECTRICITY

Building: Jelgavas 2 intenatpamatskola

1	Living Area	1180	m <sup>2</sup>	Operation Vent. System Winter			4,91	kh/a	Primary Energy Factor - Electricity			2,7	kWh/kWh
2	Heating Period	205	d	Operation Vent. System Summer			3,85	kh/a	Annual Space Heat Demand			14	kWh/(m <sup>2</sup> a)
3	Air Volume	5900	m <sup>3</sup>	Air Change Rate			0,28	h <sup>-1</sup>	Boiler Rated Power			17	kW
4	Dwelling Units	1	HH	Defrosting HX from				°C	DHW System Heat Demand			114539	kWh/a
5	Enclosed Volume	6198	m <sup>3</sup>						Design Flow Temperature			50	°C

Column Nr.	1	2	3	4	5	6	7	8	9	10	11
Application	Used ? (1/0)	Within the Thermal Envelope? (1/0)	Norm Demand	Utilization Factor	Period of Operation	Reference Size	Electricity Demand (kWh/a)	Available as Interior Heat	Used During Time Period (kh/a)	Internal Heat Source (W)	Primary Energy Demand (kWh/a)
<b>Ventilation System</b>											
Winter Ventilation	1	1	0,40 Wh/m <sup>3</sup>	* 0,28 h <sup>-1</sup>	* 4,9 kh/a	* 5899,5 m <sup>3</sup>	= 3219	considered in heat recovery efficiency			8690
Summer Ventilation	1	1	0,40 Wh/m <sup>3</sup>	* 0,28 h <sup>-1</sup>	* 3,9 kh/a	* 5899,5 m <sup>3</sup>	= 2526	no summer contribution to IHG			6819
Defroster HX	1	1	0 W	* 1,00	* 0,2 kh/a	* 1	= 0	* 1,0	/ 4,91	= 0	0
<b>Heating System</b>											
Controlled/Uncontrolled (1/0)											
Enter the Rated Power of the Pump											
Circulation Pump	1	1	214 W	* 0,7	* 4,9 kh/a	* 1	= 754	* 1,0	/ 4,91	= 154	2037
Boiler Electricity Consumption at 30% Load											
Aux. Energy - Heat. Boiler	0	0	58 W	* 1,00	* 0,00 kh/a	* 1	= 0	* 1,0	/ 4,91	= 0	0
<b>DHW system</b>											
Enter Average Power Consumption of Pump											
Circulation Pump	1	1	43 W	* 1,00	* 7,5 kh/a	* 1	= 321	* 0,6	/ 8,76	= 23	866
Enter the Rated Power of the Pump											
Storage Load Pump DHW	0	0	161 W	* 1,00	* 6,7 kh/a	* 1	= 0	* 1,0	/ 4,91	= 0	0
Boiler Electricity Consumption at 100% Load											
DHW Boiler Aux. Energy	0	0	175 W	* 1,00	* 0,0 kh/a	* 1	= 0	* 1,0	/ 4,91	= 0	0
Enter the Rated Power of the Solar DHW Pump											
Solar Aux Electricity	0	0	129 W	* 1,00	* 1,8 kh/a	* 1	= 0	* 0,6	/ 8,76	= 0	0
<b>Misc. Aux. Electricity</b>											
Misc. Aux. Electricity	0	0	0 kWh/a	* 1,00	* 1,0	* 1 HH	= 0	* 1,0	/ 8,76	= 0	0
<b>Total</b>							6819			176	18413
<b>Specific Demand</b> kWh/(m <sup>2</sup> a)							5,8			15,6	

# Passive House Planning

## EFFICIENCY OF DISTRICT HEATING STATIONS

Building:	Jelgavas 2 intenatpamatskola		
Location:			
Building Type/Use:	Sporta zales ēka		
Treated Floor Area A <sub>TFA</sub> :	1180	m <sup>2</sup>	
Covered Fraction of Space Heat Demand	(PE Value worksheet)	100%	
Annual Heat Demand kWh/a	Q <sub>H</sub>	(DHW+Distribution)	16686 kWh
Solar Fraction for Space Heat	η <sub>Solar, H</sub>	(Separate Calculation)	
<b>Effective Annual Heat Demand</b>	$Q_{H,Wi} = Q_H \cdot (1 - \eta_{Solar, H})$		<b>16686 kWh</b>
Covered Fraction of DHW Demand	(PE Value worksheet)	100%	
DHW Demand	Q <sub>DHW</sub>	(DHW+Distribution)	114539 kWh
Solar Fraction for DHW	η <sub>Solar, DHW</sub>	(SolarDHW worksheet)	0%
<b>Effective DHW Demand</b>	$Q_{DHW,Wi} = Q_{DHW} \cdot (1 - \eta_{Solar, DHW})$		<b>114539 kWh</b>
<b>Heat Source</b>	Gas CGS 70% PHC ▼		
Primary Energy Factor	(Data worksheet)	0,7	kWh/kWh
CO <sub>2</sub> -Emissions factor (CO <sub>2</sub> -Equivalent)	(Data worksheet)	-70	g/kWh
Utilisation Factor Heat Transfer Station	η <sub>a,HX</sub>	70%	
<b>Final Energy Demand Heat Generation</b>	$Q_{final} = Q_{Use} \cdot e_{a,DH}$	kWh/a	kWh/(m <sup>2</sup> a)
<b>Annual Primary Energy Demand</b>		<b>187464</b>	<b>158,9</b>
		<b>131225</b>	<b>111,2</b>
<b>Annual CO<sub>2</sub>-Equivalent Emissions</b>		kg/a	kg/(m <sup>2</sup> a)
		<b>-13122</b>	<b>-11,1</b>

Passive House Planning

CLIMATE DATA

Standard/Regional Climate: Select here.

Regional Climate Data

Select Region Here

User Data

Select regional climate here:

LAT\_Riga\_Kra

Building:

Jelgavas 2 intenatpamatskola

Use Regional Data?

Yes

Climate Building

LAT\_Riga\_Kra

Chosen Method for Annual Heat Demand: Monthly Method

Monthly Data:

LAT\_Riga\_Kra

Annual Data:

Use Annual Climate Data Set

No

Results:

Annual Heat Demand

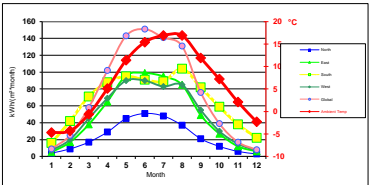
14,0 kWh/(m²a)

Heat Load

14,3 W/m²

Transfer to Annual Method

H <sub>f</sub>	205	d/a
G <sub>i</sub>	98	kKh/a
North	71	kWh/(m²a)
East	149	kWh/(m²a)
South	307	kWh/(m²a)
West	171	kWh/(m²a)
Horizontal	225	kWh/(m²a)



Parameters for PHPP Calculated Ground Temperatures:

Phase Shift Months

Damping

Depth m

Shift of Average Temperature K

Ground Temp

Month	1	2	3	4	5	6	7	8	9	10	11	12	Heating Load		Cooling Load
Days	31	28	31	30	31	30	31	31	30	31	30	31	Weather 1	Weather 2	Radiation
LAT_Riga_Kra	Latitude:	56,5	Longitude ° East	24,1	Altitude m		Daily Temperature Swing Summer (K)		Radiation Data:	kWh/(m²*month)			Radiation: W/m²		W/m²
Ambient Temp	-4,7	-4,3	-0,6	5,1	11,4	15,4	16,9	16,9	11,9	7,2	2,1	-2,3	-20,7	-20,7	25,1
North	4	9	17	29	45	51	48	37	21	12	6	3	4	4	53
East	5	17	38	65	96	99	85	49	27	12	6	5	5	5	96
South	16	42	71	88	95	91	80	104	82	59	38	22	7	7	80
West	7	20	45	69	90	90	83	85	55	30	15	7	5	5	66
Global	9	25	58	102	143	151	141	131	76	39	17	8	9	9	133
Dew Point	-7,5	-8,2	-4,2	0,1	6,2	10,5	12,8	12,2	8,0	3,9	-0,9	-5,3			
Sky Temp	-20,7	-21,8	-15,5	-0,2	5,8	8,9	8,1	2,4	-3,5	-10,5	-17,2				
Ground Temp	7,1	6,6	6,6	7,2	8,1	10,1	11,0	11,5	10,6	10,1	9,1	8,1	6,6	6,6	11,5

# Passive House Planning

## INTERNAL HEAT GAINS

Building:

Utilisation Pattern:   W/m²

Type of Values Used:

Calculation in IHG Non-Dom worksheet!

No Input Required  W/m²

Calculation		Persons		P		Annual Heat Demand		kWh/(m²a)			
Internal Heat Household		Living Area		m²		Heating Period		d/a			
Column Nr.	1	2	3	4		5	6	7	8	9	10
Application	Existing (1/0), or number of people	In the Thermal Envelope (1/0)	Norm Consumption	Utilization Factor		Frequency	Useful Energy (kWh/a)	Included in Electricity Balance?	Availability	Used During Time Period (kh/a)	Internal Heat Source (W)
Dishwashing	0	0	0,0 kWh/Use	1,00		65 /(P*a)	0 *		0,30 /	8,76 =	0
Clothes Washing	0	0	0,0 kWh/Use	1,00		57 /(P*a)	0 *		0,30 /	8,76 =	0
Clothes Drying with: Clothesline	1	0	0,0 kWh/Use	1,00		57 /(P*a)	0 *		1,00 /	8,76 =	0
Energy Consumed by Evaporation	1	0	0,0 kWh/Use	0,00		57 /(P*a)	0 *(1- 0 ) *		1,00 /	8,76 =	0
Refrigerating	0	1	0,0 kWh/d	1,00		365 d/a	0 *		1,00 /	8,76 =	0
Freezing	0	0	0,0 kWh/d	0,90		365 d/a	0 *		1,00 /	8,76 =	0
or Combination	0	1	0,0 kWh/d	1,00		365 d/a	0 *		1,00 /	8,76 =	0
Cooking	1	1	0,0 kWh/Use	1,00		500 /(P*a)	18750 *		0,50 /	8,76 =	1070
Lighting	1	1	60,0 W	1,00		2,9 kh/(P*a)	26100 *		1,00 /	8,76 =	2979
Consumer Electronics	1	1	0,0 W	1,00		0,00 kh/(P*a)	0 *		1,00 /	8,76 =	0
Household Appliances/Other	1	1	50,0 kWh	1,00		1,0 /(P*a)	7500 *		1,00 /	8,76 =	856
Auxiliary Appliances (cf. Aux Electricity Sheet)											
Other Applications (cf. Electricity Sheet)	0	0,0					0 *			8,76 =	0
Persons	150	1	80,0 W/P	1,00		8,76 kh/a	105120 *		0,55 /	8,76 =	6600
Cold Water	150	1	-5,0 W/P	1,00		8,76 kh/a					-750
Evaporation	150	1	-25,0 W/P	1,00		8,76 kh/a	-32850 *		1,00 /	8,76 =	-3750
Total										W	7182
Specific Demand										W/m²	6,09
Heat Available From Internal Sources										204,5 d/a kWh/(m²a)	29,9

# Passive House Planning

## INTERNAL HEAT GAINS Non-domestic Use

Building:

Utilisation Pattern:

Type of Values Used:

2,80 W/m²

No Input Required 4,5 W/m²

Calculation		Persons:	P	Room Temperature:	°C	Internal Heat Gains Aux. Electricity:		W
Internal Heat		TF Area:	m²	Heating Period:	d/a			
Column Nr.								
Persons	Select	Utilisation Pattern	Select	Activity of Persons	Planning with the number of persons or via floor area of utilisation zone (planning via area only if the occupancy is available for this utilisation pattern). Pers./Area (1 / 0)	Number of Occupants	Floor Area of Utilisation Zone (m²)	Average Occupancy (Persons / m²)
Persons A	2	Parejas telpas	1	<= 10 yr., sitting	50	50	209	27
Persons B	1	Sporta zāle	3	>10 yr., standing or light work	100	100	971	9
Persons C				no valid input				18
Persons D				no valid input				0,75
Persons E				no valid input				0,70
Persons F				no valid input				1,00
Persons G				no valid input				1,00
Evaporation (person specific)				no valid input				1,00
Lighting / Equipment / Aux. Electricity								0,70
Lighting								0,70
Office Applications (Within Therm. Envelope)								0,70
Cooking (Within Therm. Envelope)								0,70
Dishwashing (Within Therm. Envelope)								0,70
Cooling (Within Therm. Envelope)								0,70
Other (Within Therm. Envelope)								0,70
Auxiliary Appliances (See Aux Electricity Worksheet)								0,70
Heat Loss Due to Cold Water (calculation from column AJ)	on/off (1 / 0)							
Cold Water Due to Flushing WC	1							
Predominant Utilisation Pattern of Building (Data transferred from Electricity Non-Dom worksheet; input kitchen)								
Number of WCs (user data)								
Number of WCs: Use standard value for schools (X)								
Number of WCs (calculation value)								
ΔT: Cold Water Temp. - Room Temp. [K]								
Occupied Days per Year (d/a)								
Loss Daytime [W]								
Loss Nighttime [W]								
Availability								
Used in Period (d/a)								
Average Power Cold Water								
Total								
Specific Demand								
Heat Available From Internal Sources								