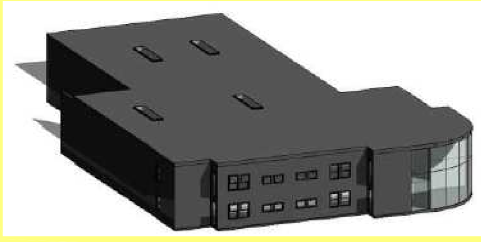
ENERGY DESING AND ANALISIS OF AN INDUSRIAL BUILDING IN HORSENS

1. INTRODUCTION

This study has for purpose to value and compare different energetic systems usually used in Europeans building construction. Currently, more the a half of the total energy production is spend for building´s energetic demand. In valuation of the economic and environmental world context it's necessary to save the earth resources. There is several kind of strategies for try to save energy, the main aim here is to determine which are the more sustainable solutions to take care at the environment without losses too much of money. For find some solutions elements it´s can be efficient to take a specific example. The adaptation of these results in some different countries and conditions will be discussed at the end. The building chooses in this rapport it´s design for a wood company it must be situated in Denmark and take in count at the local requirements. It's particularly interesting because it's contains two main area the first one is an office and the second one is a storage place. That's why it´s must to associate two different requirements for find the more suitable solution in this case. An economical study will be done also for find the commercial product which can be according at this specific need

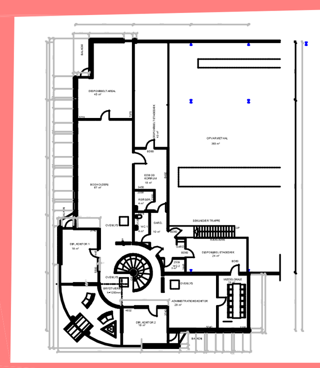


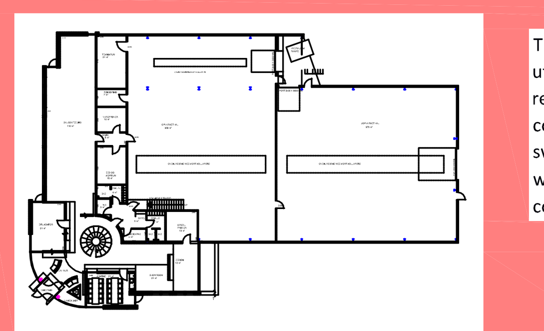
2. BUILDING DESCRIPTION

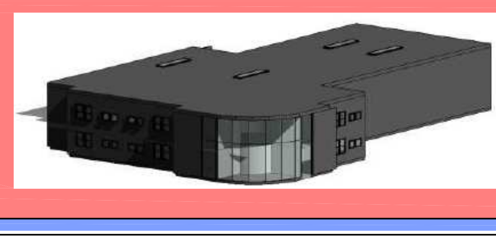
DESCRIPTION

The ground floor of the office area is about 390m² that makes ~ 780m² in both stories. The storing area of the building is about 770m². It's built in a steel structure. One suitable materials' envelope must to be finding for each part inside and outside.

The office area is going to be developed to taking in account the comfort in all its rooms. And it must be according with the Danish employments requirements. The external walls are going to be thicker and will contain more insulation in order to avoid heat losses and create an airtight area. The first floor must to be done for receive many guest around 50 persons during some presentation. At the same time in the second floor many employers need to work in good conditions. The storing area will be used for agriculture products. There will be working around 15 persons. It's also divided in two parts: The first one is for the storage off the products principally wood straw and the second one is for store the agricultural machine.

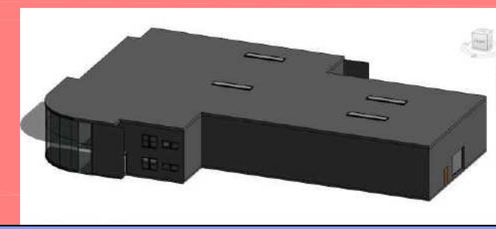






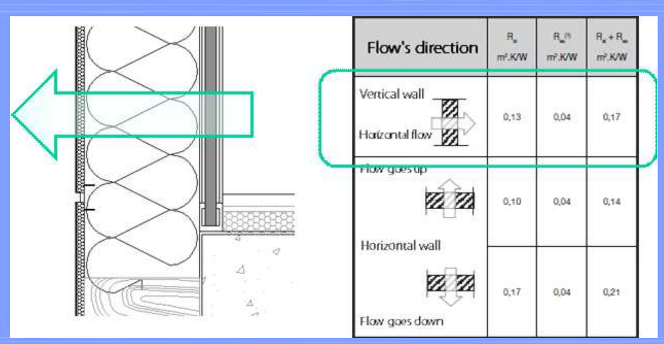
LOCATION

The Building is going to be located in Denmark. Specifically the place it will be in the outskirts of Horsens. The future utilization of this building can be generating some eventual noise. So, the place can´t be situated just near at some residential houses. For the employers and guest accommodations the building must to be easily reachable with common transportations and have an area for park cars.The climate conditions are cold in winter around 0°C and sweet in summer the temperature rarely exceed 25°C. In this place the energetic demand increase a lot during winter when the duration of the day is particularly short only 7 hours. The average speed of the wind is 15 km/h it´s count in the heat calculation transfer.



3. BUILDING PHYSICS

EXTERNAL WALL OFFICE AREA



Calculate the Thermal Resistance and U-Value of the wall. As this wall has got a non-homogeneous layer it has to be calculated by Lower limit and Upper limit.In order to have a better U-Value, it has been added 25 mm of insulation.

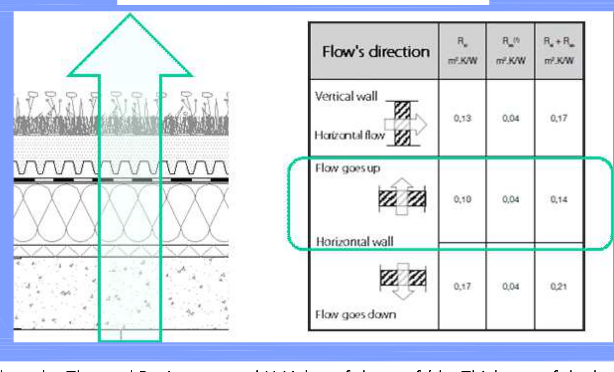
	R (m²K /W)	A (m²)	Total A (m²)	%	R% (m²K /W)	R_t (m²K /W)
Timber Fr	1,000	0,041	0,600	0,069	0,069	4,843
Insulation	5,128	0,559		0,931	4,774	

Upper Limit	Total A (m²)	A (m²)	R (m²K /W)	A/R	Ru (m²K /W)
Timber	0,600	0,041	3,783	0,011	6,920
Insulation		0,559	7,373	0,076	

Lower Limit	Total A (m²)	A (m²)	R (m²K /W)	A/R	Ra (m²K /W)	RL (m²K /W)
Timber	0,600	0,041	1,538	0,027	4,417	6,662
Insulation		0,559	5,128	0,109		

OFFICE WALL	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Lacquered Aluminium	0,0002	237,000	8,43882E-07	
Polyurethane	0,0450	0,023	1,957	
Polyethylene	0,0002	0,550	0,000	
Timber Frames	0,2000	0,130	1,538	
Insulation: Sheep Wool	0,2000	0,039	5,128	
Gypsum board	0,0200	0,170	0,118	
Rsi			0,130	
Rse			0,040	
			6,748	0,148

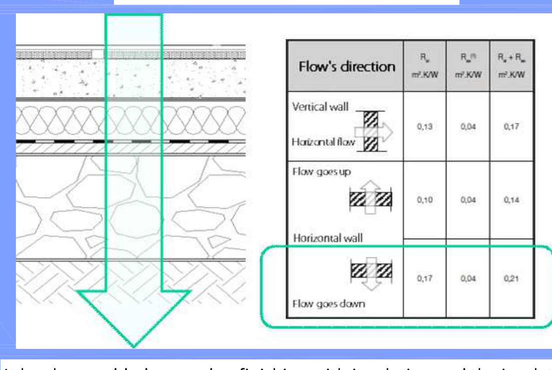
GREEN ROOF OFFICE AREA



Calculate the Thermal Resistance and U-Value of the roof.(d = Thickness of the layer). In order to get better U-Value on the green roof it has been added a 50 mm layer of Polyurethane and the thickness of the sheep wool insulation is changed to 250 mm

OFFICE ROOF	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Reinforced concret	0,300	1,630	0,184	
Insulation: Polyurethane	0,050	0,023	2,174	
Insulation: Sheep wool	0,250	0,039	6,410	
Geotextil layer	0,001	0,035	0,029	
Waterproof layer	0,001	0,029	0,034	
Drainage layer	0,070	0,950	0,074	
Rsi			0,100	
Rse			0,040	
			9,045	0,111

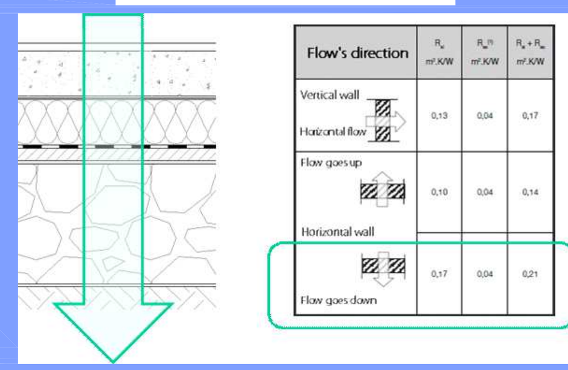
FIRST SLAB OFFICE AREA



It has been added a wooden finishing with insulation and the insulation layer is now 200 mm instead of 175 and that allows getting better U-Value as the table shows

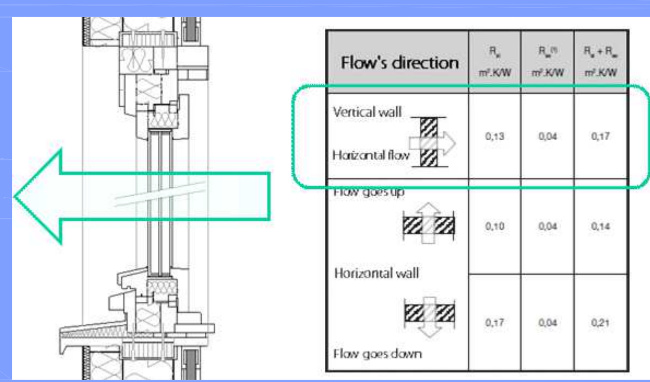
FOUNDATION	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Gravel	0,300	1,210	0,248	
Concrete	0,050	1,630	0,031	
Waterproof layer	0,001	0,029	0,034	
Insulation: Sheep Wool	0,200	0,039	5,128	
Geotextil layer	0,001	0,035	0,029	
Reinforced Concrete	0,200	1,630	0,123	
Polyurethane	0,040	0,023	1,739	
Rsi			0,170	
Rse			0,040	
			7,542	0,133

FIRST SLAB STORE AREA



STORAGE FOUNDATION	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Gravel	0,300	1,210	0,248	
Concrete	0,050	1,630	0,031	
Waterproof layer	0,001	0,029	0,034	
Insulation: Sheep Wool	0,200	0,039	5,128	
Geotextil layer	0,001	0,035	0,029	
Reinforced Concrete	0,200	1,630	0,123	
Rsi			0,170	
Rse			0,040	
			5,803	0,172

WINDOW AND GLASS FACADE OFFICE AREA



Choose which kind of glazing fits better to the weather conditions where the building is located. At the appendix it's possible to look at all the characteristics of the window because it has been calculated with an special program that allows mixing different kind of glasses and cavities.

Triple glazed windows perfect unit is 4 + 20 +4 + 20 +4 = **52mm**

Position	Product	Process	Thickness (nominal) mm	Weight kg/m²
Glass 1	Pilkington Optitherm GS	Annealed	4	10
Cavity 1	Air		20	
Glass 2	Pilkington Optifloat Clear	Annealed	4	10
Cavity 2	Argon (90%)		20	
Glass 3	Pilkington Optitherm GS	Annealed	4	10
Product Code	4GS-20-4-20Ar-GS4		52	30

Sound Reduction	R_w dB (C;C_{tr})	NPD
Thermal Transmittance	W/m²K	0.69

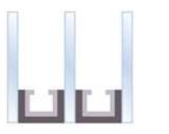
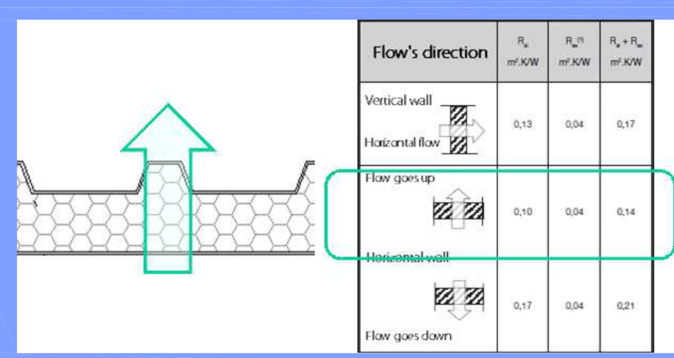


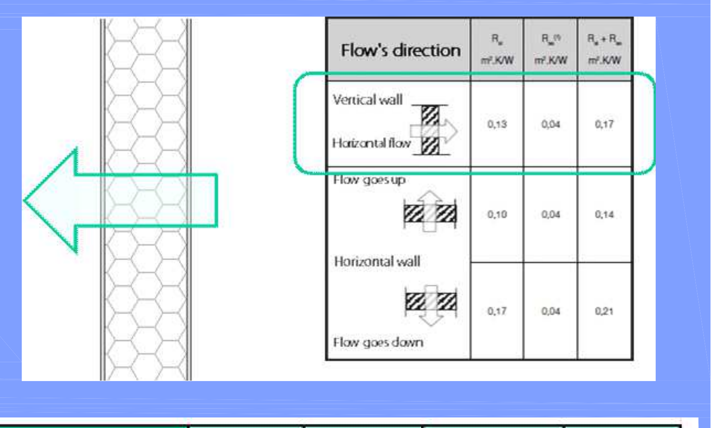
Fig. XX. Glass window choice
Pilkington

ROOF STORE AREA



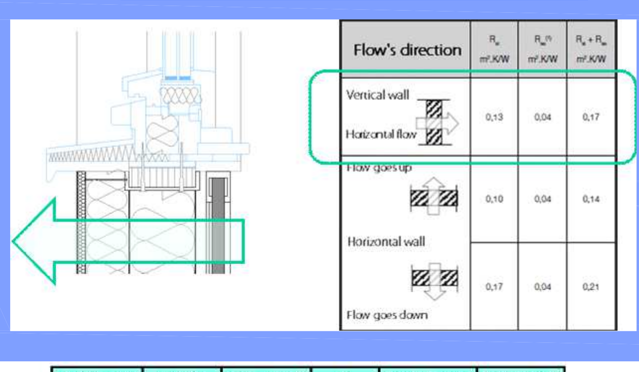
STORAGE ROOF	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Steel	0,0004	16,000	2,50E-05	
Glass Wool	0,1000	0,021	4,830	
Steel	0,0004	16,000	2,50E-05	
Rsi			0,100	
Rse			0,040	
			4,970	0,201

WALL STORE AREA



STORAGE WALL	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Steel	0,0004	16,000	2,50E-05	
Glass Wool	0,1000	0,021	4,830	
Steel	0,0004	16,000	2,50E-05	
Rsi			0,130	
Rse			0,040	
			5,000	0,200

WINDOW WALL PART OFFICE AREA



	R (m²K /W)	A (m²)	Total A (m²)	%	R% (m²K /W)	R_t (m²K /W)
Steel Profile	16,0000	0,003	0,600	0,005	0,084	0,123
Insulation	0,039	0,597		0,995	0,039	

Upper Limit	Total A (m²)	A (m²)	R (m²K /W)	A/R	Ru (m²K /W)
Steel Profile	0,600	0,003	2,257	0,001	6,663
Insulation		0,597	6,732	0,089	

Lower Limit	Total A (m²)	A (m²)	R (m²K /W)	A/R	RX (m²K /W)	RL (m²K /W)
Steel Profile	0,600	0,003	0,013	0,251	1,562	3,806
Insulation		0,597	4,487	0,133		

WINDOWS STRUCTURE OFFICE	d (m)	λ (W/mK)	R (m²K /W)	U (W/ m²K)
Aluminium Lacado	0,0002	237,000	8,44E-07	
Polyurethane	0,0450	0,023	1,957	
Polyethylene	0,0002	0,550	0,000	
Steel Profile	0,2000	16,000	0,013	
Insulation: Sheep Wool	0,1750	0,039	4,487	
Gypsum board	0,0200	0,170	0,118	
Rsi			0,130	
Rse			0,040	
			4,758	0,200

4. HEATING SYSTEM

VENTILATION

DESING CRITERIA

Type of building/space	Occupancy [pers./m²]	Ventilation rate [l/s/m²] Category A	Category B	Category C
Single office	0,1	2,0	1,4	0,8
Landscaped office	0,07	1,7	1,2	0,7
Conference room	0,5	6,0	4,2	2,4
Auditorium	1,5	16,0	11,2	6,4
Restaurant	0,7	8,0	5,6	3,2
Classroom	0,5	6,0	4,2	2,4
Kindergarten	0,5	7,1	4,9	2,8
Department store	0,15	4,2	3,0	1,6

Type of building/space	Ventilation rate [l/s/m²] floor area	Ventilation rate [l/s]
Office		
Module office		15 – 20/person
Landscaped office		20/person
Conferenceroom		15 – 30/person
Management room		15/person
Auditorium		10 – 15/person
Staff canteen		15 – 20/person

Room	Air change times per hour
Accumulator room	4 - 8
Bath room	5 - 10
Bar room	10 - 15
Library	3 - 5
Safe-deposit box room	3 - 6
Dye-works	5 - 15
Shops	4 - 8
Meeting-halls	5 - 8
Garage with more than 4 cars	4
Garage with taxis, vans and busses	6
Cloakrooms	3 - 5
Hotel rooms	4 - 8
Offices	3 - 8
Kitchens (big), lower air change for small kitchens	10 - 30
Laboratories, physical	5 - 15
Laboratories, chemical	10 - 30
Storage rooms	1 - 2
Changing rooms	8 - 10
Operating room	4 - 8
Scullery	20 - 40
Restaurants	8 - 12
Classrooms	3 - 5
Spray-painting rooms	20 - 60
Department store	3 - 6
Foundries without extraction systems	10 - 20
Sickrooms	4 - 6
Toilets	5 - 15
Swimming baths	3 - 5
Laundries	5 - 15
Workshops	1 - 4

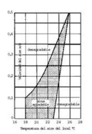
Nº	m2	Pers/m2	Cat A	Air supply m3/h	Air supply m3/s	Extractor m3/h	Extractor m3/s	Air changes v3	Air changes Nº
6	110	11	220	796,78	0,22133	788,4	0,219	297	6
7	21	2,1	42			151,2	0,042	56,7	8
8	7	0,7	14			25,2	0,007	18,9	2
9	10	1	20						
10	5	0,5	10						
11	15	1,5	30			16,56	0,0046	40,5	2
12	6	0,6	12			40	0,01111	16,2	15
13	3	0,3	6			40	0,01111	8,1	15
14	8	0,8	16						
15	4	0,4	8			40	0,01111	10,8	15
16	7	0,7	14			40	0,01111	18,9	15
17	12	1,2	24	86,4	0,024	86,4	0,024	0	2
18	87	8,7	174	706,4	0,19622	626,4	0,174	234,9	6
19	21	2,1	42	604,8	0,168	604,8	0,168	56,7	18
20									15
21	21	2,1	42	151,2	0,042	151,2	0,042	56,7	6
22	761	76,1	1522	5788,8	1,608	5524,12	1,53448	2068,2	4
23	18	1,8	36	129,6	0,036	129,6	0,036	48,6	6
24	18	1,8	36	129,6	0,036	129,6	0,036	48,6	6
25	18	1,8	36	388,8	0,108	388,8	0,108	48,6	8
26	4	0,4	8			40	0,01111	10,8	2
27	18	1,8	36			19,44	0,0054	48,6	2
28	43	4,3	86	308,88	0,0858	212,76	0,0591	116,1	2
29	3	0,3	6			40	0,01111	8,1	15
30	10	1	20						
31	4	0,4	8			40	0,01111	10,8	15
32	67	6,7	134	482,4	0,134	482,4	0,134	180,9	6
33	45	4,5	90	324	0,09	324	0,09	121,5	6
34	24	2,4	48	172,8	0,048	172,8	0,048	64,8	2
36	28	2,8	56	326,52	0,0907	283,2	0,07867	75,6	6

HEATING BY VENTILATION

FUERZA	m/s	Kn (nudos)	Km/h	English
F0	0 - 0.2	- de 1	0 - 2	calm
F1	0.3 - 1.5	1 - 3	2 - 6	light air
F2	1.6 - 3.3	4 - 6	7 - 11	light breeze
F3	3.4 - 5.4	7 - 10	12 - 19	gentle
F4	5.5 - 7.9	11 - 16	20 29	moderate
F5	8.0 - 10.7	17 - 21	30 - 39	fresh breeze

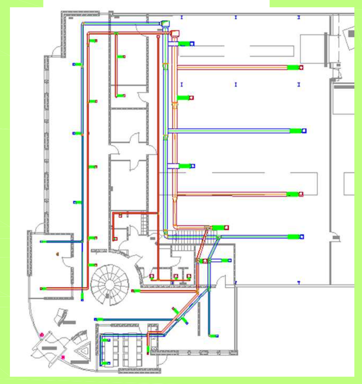
Airspeed agains persons	Temperature feeling
0,1 m/s	0° C
0,3 m/s	1° C
0,7 m/s	2° C
1 m/s	3° C
1,6 m/s	4° C
2,2 m/s	5° C
3 m/s	6° C
4,5 m/s	7° C
6,5 m/s	8° C

Uptake mouths	m/s
Hotels room	1,2 - 2
Comercial areas	3,0 - 4,0
Near to sitting people	2,0 - 3,0
Industrial area	5,0 - 10,0
Impulsion mouths	**m/s**
Hotels room	2,5 - 3
Homes	2,5 - 2,5
Office	2,5 - 4
Restaurants	5,0 - 7,0

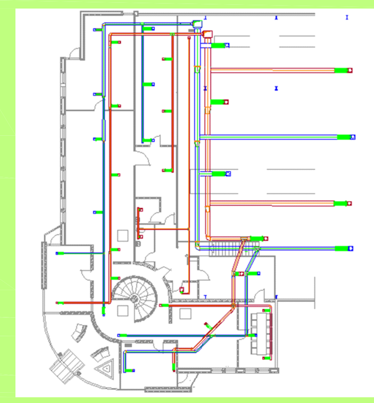


Air velocity m/s	
Main duct	3
Branch duct	1,5
Connection duct	1,5

GROUND FLOOR

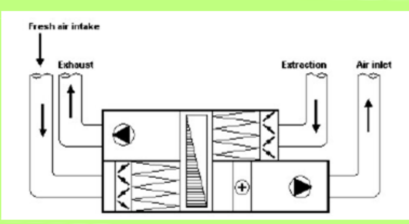


FIRST FLOOR



HEAD LOSSES

ROTARY HEAT EXCHANGE

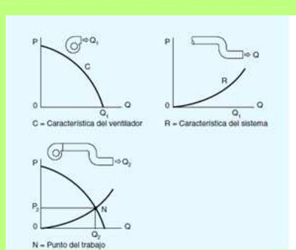


VEX280-1

1. AIR HANDLING UNIT DATA

Air handling unit data	
Min. airflow	1730 m³/h
Max. airflow	14600 m³/h
Power consumption	11,3 kW
Electrical Supply	3 x 400 V + N + PE 50 Hz
Max. phase current	28,3 A
Weight of operational air handling unit	1070 kg
Weight of air handling unit for transport	Fan sections: 2 x 226 kg, Rotor section: 221 kg
Motor data (per unit):	
Voltage (delta/star)	3 x 230 V / 400V
Current (delta/star)	3 x 10,6 A / 6,1 A
Power supplied	3,0 kW
CEMEP-class	EFF1
Rotor pinion - stepper motor:	
Voltage	230 V
Phase current	0,2 A
Power consumption	45 W
Overcurrent protection	Built in
Control (built in rotation monitor)	Infinitely variable from 0 to 10 rpm on the rotor

FAN / VENTILATIOR



HCH		HCT	45-4T-0,5	1450	2,07	1,20	0,37	7100	68	15	24
HCH		HCT	45-4M-0,5	1450	3,10		0,37	7100	68	15	24
HCH				950	1,47	0,85	0,25	4750	55	14	
HCH				950	1,30		0,25	4750	55	15	
		HCT	50-4T-0,75	1450	3,00	1,73	0,55	10300	70		28
HCH	HFT	HCT	56-4T-0,75	1450	3,12	1,80	0,55	11000	72	21	33

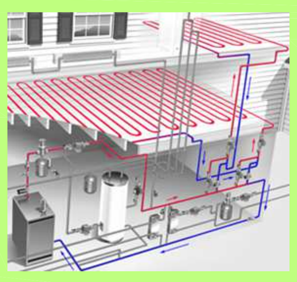
DEMAND CONTROLLED VENTILATION

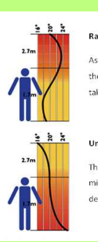
ENERGY CONSUMPTION

	Td	air supply	ρ	c	t1	t2		Qv inlet
September	275	2,88	1,2	1	0,4167	0,7142	0,85	42,42687
October	354	2,88	1,2	1	0,4167	0,7142	0,85	54,61496
November	424	2,88	1,2	1	0,4167	0,7142	0,85	65,41453
December	656	2,88	1,2	1	0,4167	0,7142	0,85	101,2074
January	600	2,88	1,2	1	0,4167	0,7142	0,85	92,56772
February	568	2,88	1,2	1	0,4167	0,7142	0,85	87,63078
March	662	2,88	1,2	1	0,4167	0,7142	0,85	102,1331
April	422	2,88	1,2	1	0,4167	0,7142	0,85	65,10597
May	214	2,88	1,2	1	0,4167	0,7142	0,85	33,01582
June	191	2,88	1,2	1	0,4167	0,7142	0,85	29,46739
July	105	2,88	1,2	1	0,4167	0,7142	0,85	16,19935
August	97	2,88	1,2	1	0,4167	0,7142	0,85	14,96512
								704,7489

HEATING FLOOR

INSTALATION





Radiators Curve:

As the picture shows, the warmest area is located on the top of the room so this heating system doesn't take the most of itself.

Fig. 2. Radiators and Floor heating curve
www.greenspec.co.uk

Underfloor Heating Curve:

The warmest part of the room is located in the middle down part of the area. Then it starts decreasing until the ceiling.

PIPPING LENGHTS CALCULATION

Groundfloor Rooms	# Room	Area (m²)	e (m)	L_t (m)	dtr (m)	df (m)	dc (m)	D (m)	L (m)	Num. Of Circuits	Total L (m)	Each circuit (m)
Office	6	110	0,3	366,7	13	0	0	0	366,7	4	366,7	91,7
Technical Equipment	7	21	-	-	2	3	0	6	-	-	-	
Storage	8	7	0,3	23,3	4	0	0	0	23,3	1	23,3	
Storage	9	10	0,3	33,3	6	0	0	0	33,3	1	33,3	
Corridor	10	5	0,3	16,7	10	0	1	2	18,7	1	18,7	
Copy	11	15	0,3	50,0	11	0	3	6	56,0	1	56,0	
Changin Room	12	6	0,3	20,0	13	0	1	2	22,0	1	22,0	
WC	13	3	0,3	10,0	15	3	0	6	16,0	1	16,0	
Cloak Room	14	8	0,3	26,7	17	0	1	2	28,7	1	28,7	
WC	15	4	0,3	13,3	19	3	0	6	19,3	1	19,3	
Changin Room	16	7	0,3	23,3	20	0	1	2	25,3	1	25,3	
Storage	17	12	0,3	40,0	22	0	2	4	44,0	1	44,0	
Forum	18	75	0,3	250,0	20	0	1	2	252,0	3	258,0	86,0
Canteen	19	21	0,3	70,0	20	0	3	6	76,0	1	76,0	
Entrance	20	20	0,3	66,7	20	0	4	8	74,7	1	74,7	
Boss Office2	21	21	0,3	70,0	19	0	3	6	76,0	1	76,0	
Hall	22.1	383	0,3	1276,7	15	0	2	4	1280,7	13	1280,7	98,5
Amount of underfloor heating pipes (Lineal meters)											2052,0	

1st Floor	1st F Rooms	Area (m²)	e (m)	L_t (m)	dtr (m)	df (m)	dc (m)	D (m)	L (m)	Num. Of Circuits	Total L (m)	Each circuit (m)
Boss Office 3	23	18	0,3	60,0	19	0	3	6	66,0	1	66,0	
Boss Office 4	24	18	0,3	60,0	23	0	3	6	66,0	1	66,0	
Meeting Room	25	18	0,3	60,0	27	0	4	8	68,0	1	68,0	
Cleaning	26	4	0,3	13,3	5	0	1	2	15,3	1	15,3	
Storage	27	18	0,3	60,0	2	0	2	4	64,0	1	64,0	
Office	28	43	0,3	143,3	0	0	1	2	145,3	2	145,3	72,7
WC	29	3	0,3	10,0	18	0	0	0	10,0	1	10,0	
Cloak Room	30	10	0,3	33,3	17	0	1	2	35,3	1	35,3	
WC	31	4	0,3	13,3	7	0	0	0	13,3	1	13,3	
Office	32	67	0,3	223,3	4	0	2	4	227,3	2	227,3	113,7
Office	33	45	0,3	150,0	1	0	1	2	152,0	2	152,0	76,0
Storage	34	24	0,3	80,0	25	0	2	4	84,0	1	84,0	
Office	36	28	0,3	93,3	21	0	1	2	95,3	1	95,3	
Forum	37	41	0,3	136,7	15	0	2	4	140,7	2	140,7	70,3
Amount of underfloor heating pipes (Lineal meters)											1182,7	
Amount of ALL underfloor heating pipes (Lineal meters)											3234,7	

FLOWS CALCULATION

FLOW CALCULATIONS - First Floor

# Room	Energy Demand	Energy Demand (Kcal/h)	Flow (l/h)	Flow (l/s)	dtr (m)	Ø (mm)	Pressure Loss (Kpa/m)
6	2829	2432,5	243,25	0,0676	13	16	0,35
7	478	411,0	-	-	2	-	
8	40	34,4	3,44	0,0010	4	16	0
9	44	37,8	3,78	0,0011	6	16	0
10	32	27,5	2,75	0,0008	10	16	0
11	63	54,2	5,42	0,0015	11	16	0
12	318	273,4	27,34	0,0076	13	16	0,01
13	11	9,5	0,95	0,0003	15	16	0
14	46	39,6	3,96	0,0011	17	16	0
15	13	11,2	1,12	0,0003	19	16	0
16	384	330,2	33,02	0,0092	20	16	0,015
17	69	59,3	5,93	0,0016	22	16	0
18	1086	933,8	93,38	0,0259	20	16	0,065
19	1072	921,8	92,18	0,0256	20	16	0,063
20	2617	2250,2	225,02	0,0625	20	16	0,034
21	730	627,7	62,77	0,0174	19	16	0,035
22.1	20759	17849,5	1784,95	0,4958	15	16	0,2
Total but 22.1	9354	8043,0	804,30	0,2234			0,537

FLOW CALCULATIONS - Groundfloor

# Room	Energy Demand	Energy Demand	Flow (l/h)	Flow (l/s)	dtr (m)	Ø (mm)	Pressure Loss (Kpa/m)
23	730	627,7	62,77	0,0174	19	16	0,035
24	712	612,2	61,22	0,0170	23	16	0,035
25	636	546,9	54,69	0,0152	27	16	0,029
26	47	40,4	4,04	0,0011	5	16	0,002
27	232	199,5	19,95	0,0055	2	16	0,005
28	1098	944,1	94,41	0,0262	0	16	0,065
29	35	30,1	3,01	0,0008	18	16	0,000
30	141	121,2	12,12	0,0034	17	16	0,000
31	98	84,3	8,43	0,0023	7	16	0,000
32	1881	1617,4	161,74	0,0449	4	16	0,180
33	1258	1081,7	108,17	0,0300	1	16	0,083
34	344	295,8	29,58	0,0082	25	16	0,010
36	749	644,0	64,40	0,0179	21	16	0,040
37	441	379,2	37,92	0,0105	15	16	0,015
Total	8402	7224,4	722,4420	0,2007			0,499

Total					
Total	Office side	17756	15267,41	1526,7	0,4241	1,036
	Hall side	20759,0	17849,53	1785,0	0,4958	0,2
Total	All Areas	38515,0	33116,94	3311,7	0,9199	1,236

FLOW (m³/h)	3,31

PUMP

Altura edificio / Height of building / Hateur immeuble (m)	Caudal / Flow / Débit (l/h)	Modelo / Model / Modèle	Bomba / Pump / Pompe	Volúmen depósito / Tank volume / Volume réservoir: Membrana / Membrane	Galvanizado / Galvanized / Galvanisé	Potencia / Power / Puissance (CV)
10	3600	GDB-VIENA 5.3 T	VIENA 5.3 T	25 - 250	100 - 750	0,8 + 0,8
		GDB-IOO T	HT-100	25 - 250	100 - 750	1 + 1
		GDB-ROMA 5.4 T	ROMA 5.4 T	25 - 250	100 - 750	1 + 1
15		GDB-VIENA 5.4 T	VIENA 5.4 T	25 - 250	100 - 750	1 + 1
		GDB-ROMA 5.5 T	ROMA 5.5 T	25 - 250	100 - 750	1,3 + 1,3
20		GDB-VIENA 5.5 T	VIENA 5.5 T	25 - 250	100 - 750	1,2 + 1,2
		GDB-ROMA 5.5 T	ROMA 5.5 T	25 - 250	100 - 750	1,3 + 1,3
25		GDB-VIENA 5.5 T	VIENA 5.5 T	25 - 250	100 - 750	1,2 + 1,2
		GDB-200 T	HT-200	25 - 250	100 - 750	2 + 2
30		GDB-200 T	HT-200	25 - 250	100 - 750	2 + 2
		GDB-BARI IO.5 T	BARI 10.5 T	25 - 250	100 - 750	2 + 2
40		GDB-BARI IO.6 T	BARI 10.6 T	25 - 250	100 - 750	3 + 3
		GDB-ROMA IO.6 T	ROMA 10.6 T	25 - 250	100 - 750	3 + 3

BUDGET

BUDGET - Groundfloor

# Room	Area (m²)	Total L (m)	Price of m² (Dkk/m²)	Price (Dkk)	Thermostat controller	Unit Price	Room Price (Dkk)
6	110	16,0	267	kr. 29.370	Yes	kr. 700	kr. 30.070
7	21	-	267	kr. -	-	kr. 700	kr. -
8	7	8,0	267	kr. 1.869	Yes	kr. 700	kr. 2.569
9	10	9,0	267	kr. 2.670	Yes	kr. 700	kr. 3.370
10	5	10,0	267	kr. 1.335	-	kr. 700	kr. 1.335
11	15	11,0	267	kr. 4.005	-	kr. 700	kr. 4.005
12	6	12,0	267	kr. 1.602	Yes	kr. 700	kr. 2.302
13	3	13,0	267	kr. 801	-	kr. 700	kr. 801
14	8	14,0	267	kr. 2.136	-	kr. 700	kr. 2.136
15	4	15,0	267	kr. 1.068	-	kr. 700	kr. 1.068
16	7	16,0	267	kr. 1.869	Yes	kr. 700	kr. 2.569
17	12	17,0	267	kr. 3.204	Yes	kr. 700	kr. 3.904
18	75	18,0	267	kr. 20.025	Yes	kr. 700	kr. 20.725
19	21	19,0	267	kr. 5.607	Yes	kr. 700	kr. 6.307
20	20	20,0	267	kr. 5.340	Yes	kr. 700	kr. 6.040
21	21	21,0	267	kr. 5.607	Yes	kr. 700	kr. 6.307
22.1	383	22,1	267	kr. 102.261	Yes	kr. 700	kr. 102.961
Price							kr. 196.469

BUDGET - First Floor

# Room	Area (m²)	Total L (m)	Price of m² (Dkk/m²)	Price (Dkk)	Thermostat controller	Unit Price	Room Price (Dkk)
23	18	66	267	kr. 4.806	Yes	kr. 700	kr. 5.506
24	18	66,0	267	kr. 4.806	Yes	kr. 700	kr. 5.506
25	18	68,0	267	kr. 4.806	Yes	kr. 700	kr. 5.506
26	4	15,3	267	kr. 1.068	-	-	kr. 1.068
27	18	64,0	267	kr. 4.806	Yes	kr. 700	kr. 5.506
28	43	145,3	267	kr. 11.481	Yes	kr. 700	kr. 12.181
29	3	10,0	267	kr. 801	-	-	kr. 801
30	10	35,3	267	kr. 2.670	-	-	kr. 2.670
31	4	13,3	267	kr. 1.068	-	-	kr. 1.068
32	67	227,3	267	kr. 17.889	Yes	kr. 700	kr. 18.589
33	45	152,0	267	kr. 12.015	Yes	kr. 700	kr. 12.715
34	24	84,0	267	kr. 6.408	Yes	kr. 700	kr. 7.108
36	28	95,3	267	kr. 7.476	Yes	kr. 700	kr. 8.176
37	41	140,7	267	kr. 10.947	Yes	kr. 700	kr. 11.647
Price							kr. 98.047

Budget	Floor	Area	Quantity	Units	U Price	Total
Underfloor Piping System	1st Floor / Groundfloor	341 / 707	1048	m²	267	kr. 279.816
Thermostat controllers	1st Floor / Groundfloor	10 / 11	21	Units	700	kr. 14.700,0
Heat pump	1st Floor / Groundfloor	-	2	Units	112180	kr. 224.360,0
TOTAL						kr. 518.876,0

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