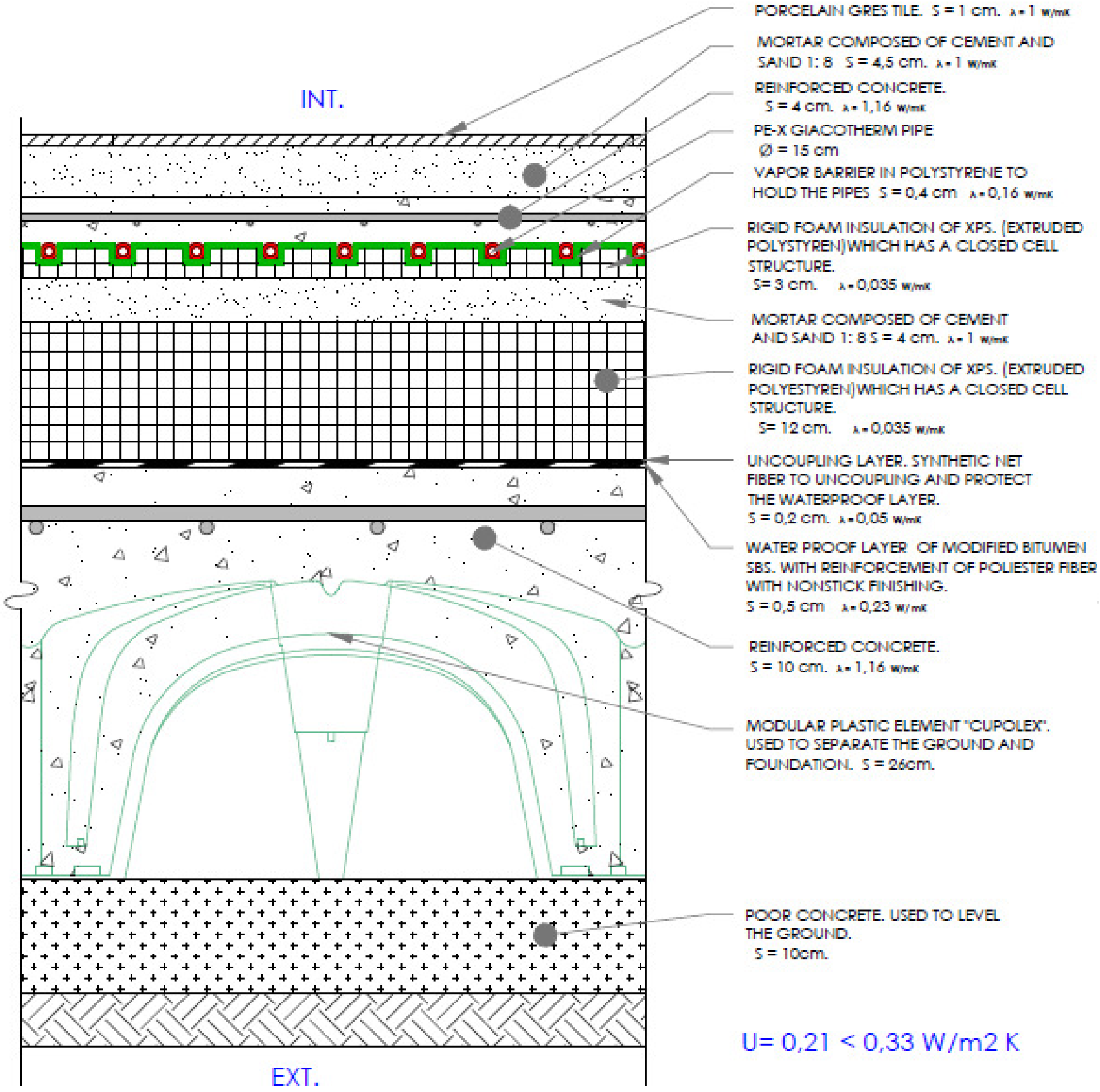
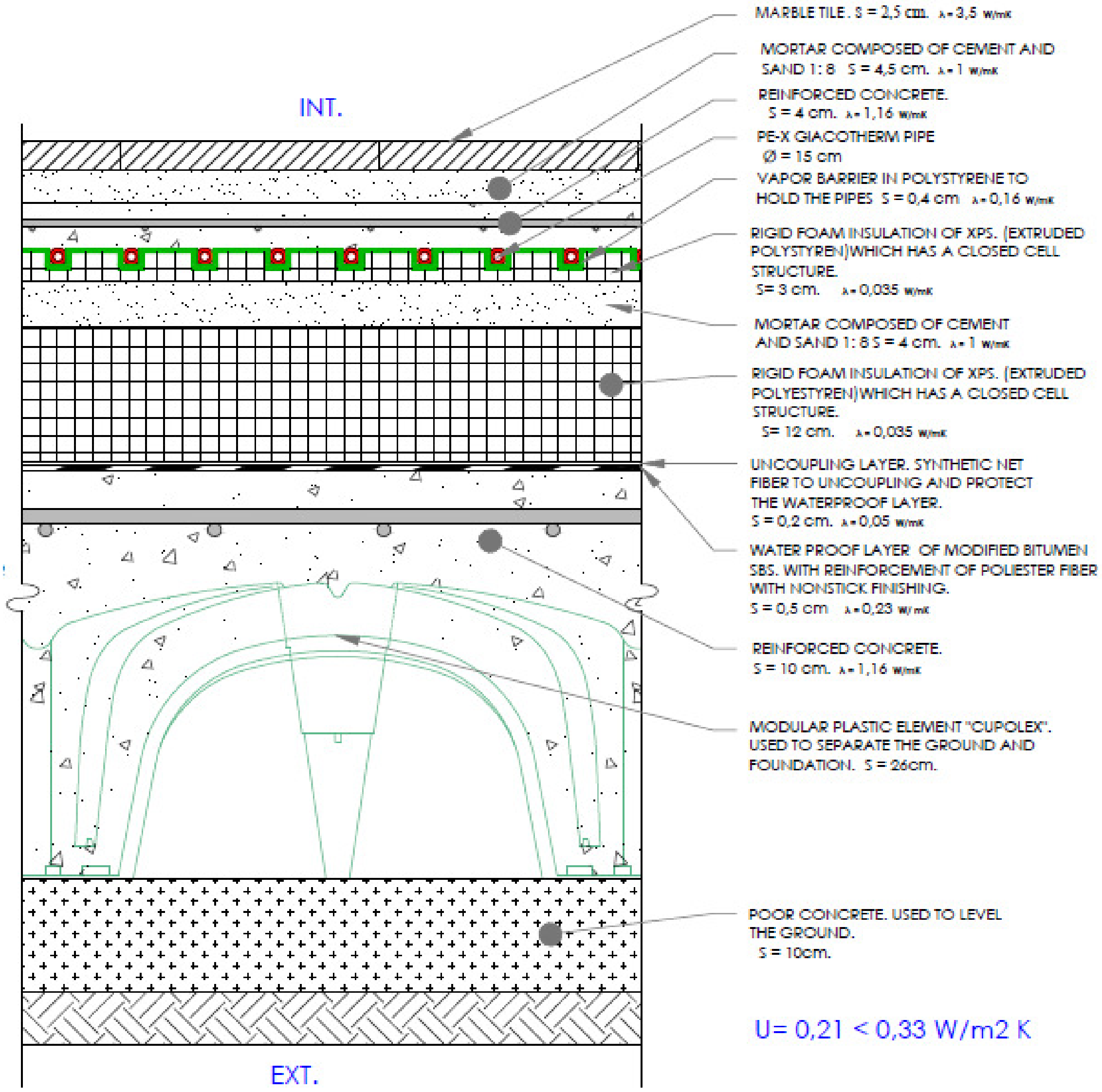
"U" Values:

Floor Type 1:



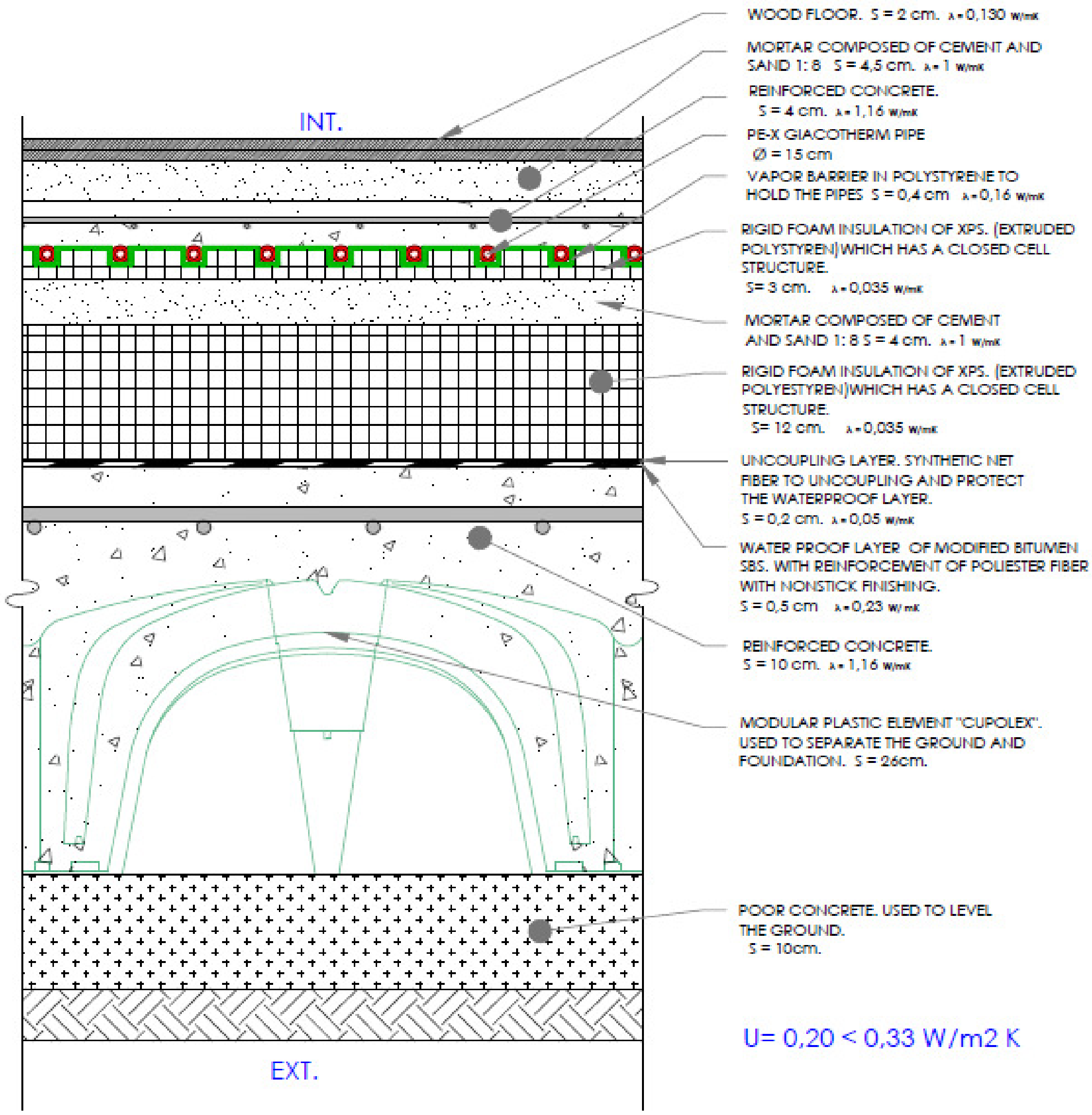
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}002}{0{,}05}+\frac{0{,}12}{0{,}035}+\frac{0{,}04}{1}+\frac{0{,}03}{0{,}035}+\frac{0{,}004}{0{,}16}+\frac{0{,}04}{1{,}16}+\frac{0{,}045}{1}+\frac{0{,}01}{1}+0{,}04} = \frac{1}{4{,}76} = 0{,}21 \; < 0{,}33\; W/m^2K$$

Floor Type 2:



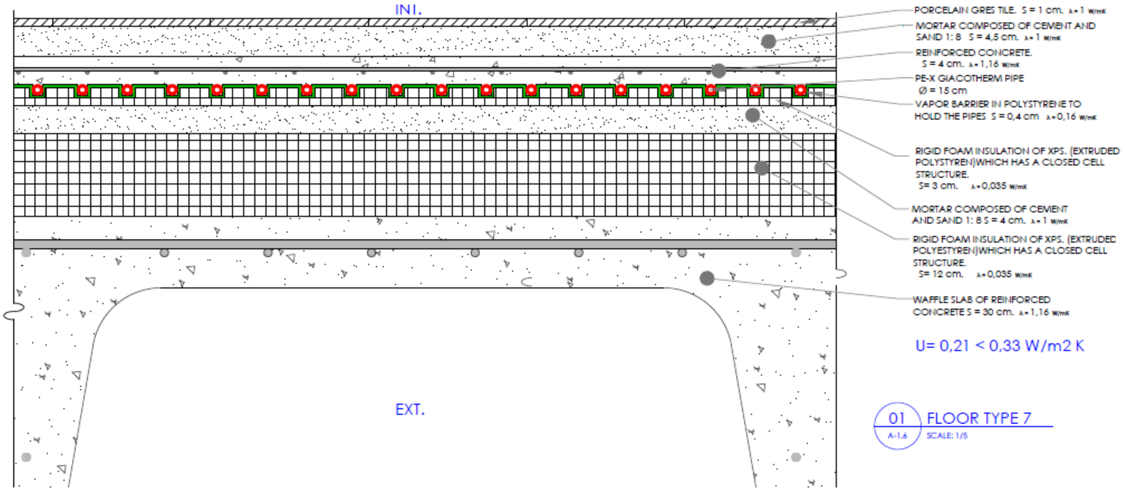
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}002}{0{,}05}+\frac{0{,}12}{0{,}035}+\frac{0{,}04}{1}+\frac{0{,}03}{0{,}035}+\frac{0{,}004}{0{,}16}+\frac{0{,}04}{1{,}16}+\frac{0{,}045}{1}+\frac{0{,}025}{3{,}5}+0{,}04} = \frac{1}{4{,}74} = 0{,}21 \; < 0{,}33 \; W/m^2K$$

Floor Type 3:



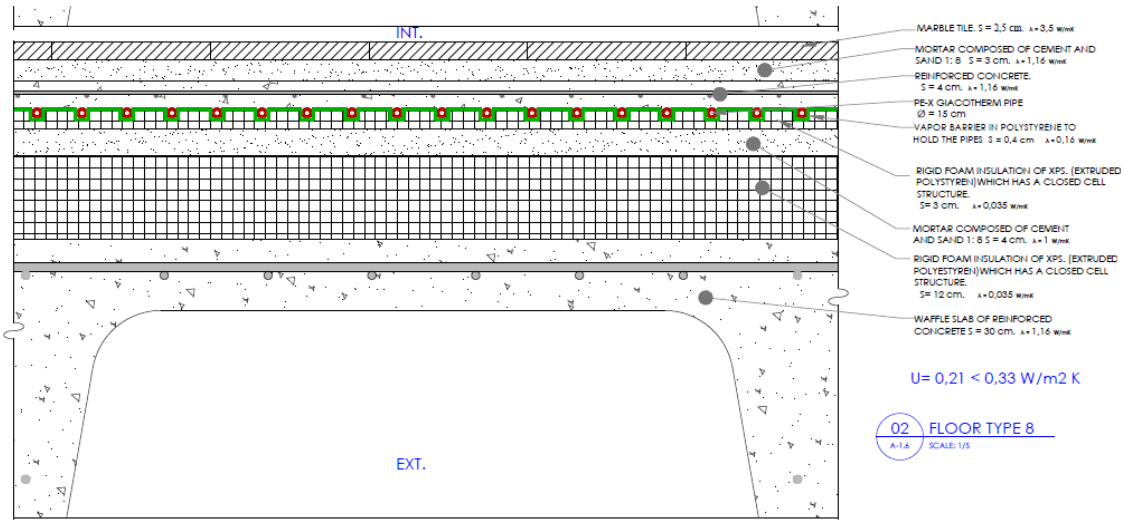
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}002}{0{,}05}+\frac{0{,}12}{0{,}035}+\frac{0{,}04}{1}+\frac{0{,}03}{0{,}035}+\frac{0{,}004}{0{,}16}+\frac{0{,}04}{1{,}16}+\frac{0{,}045}{1}+\frac{0{,}02}{0{,}1}+0{,}04} = \frac{1}{4{,}94} = 0{,}20 \ < 0{,}33\ W/m^2K$$

Floor Type 7:



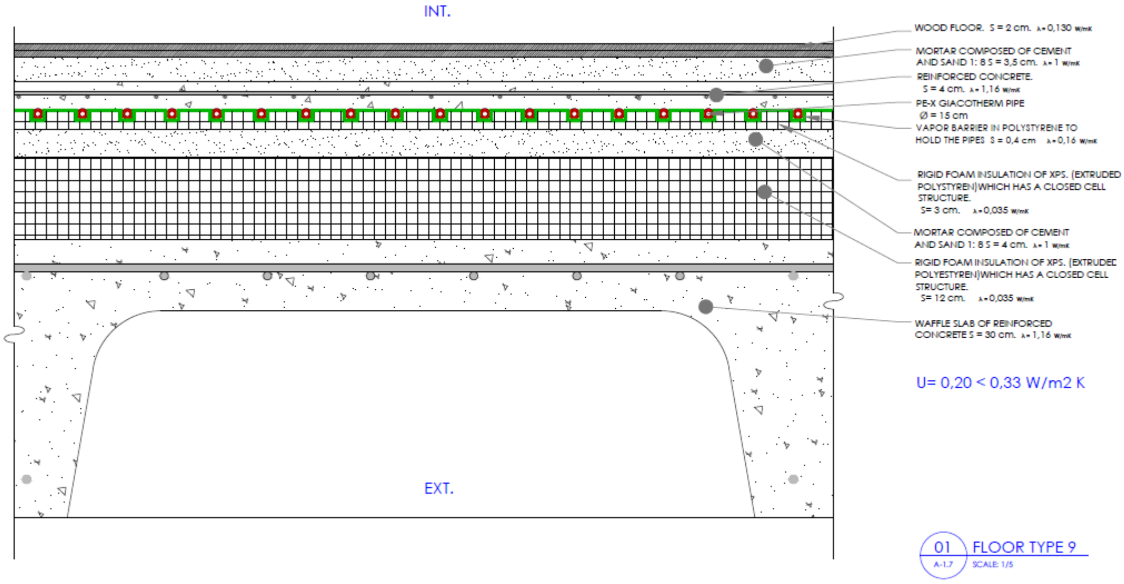
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}12}{0{,}035}+\frac{0.04}{1}+\frac{0{,}03}{0{,}035}+\frac{0{,}004}{0{,}16}+\frac{0{,}04}{1{,}16}+\frac{0{,}045}{1}+\frac{0{,}01}{1}+0{,}04} = \frac{1}{4{,}74} = 0{,}21 \ < 0{,}33\ W/m^2K$$

Floor Type 8:



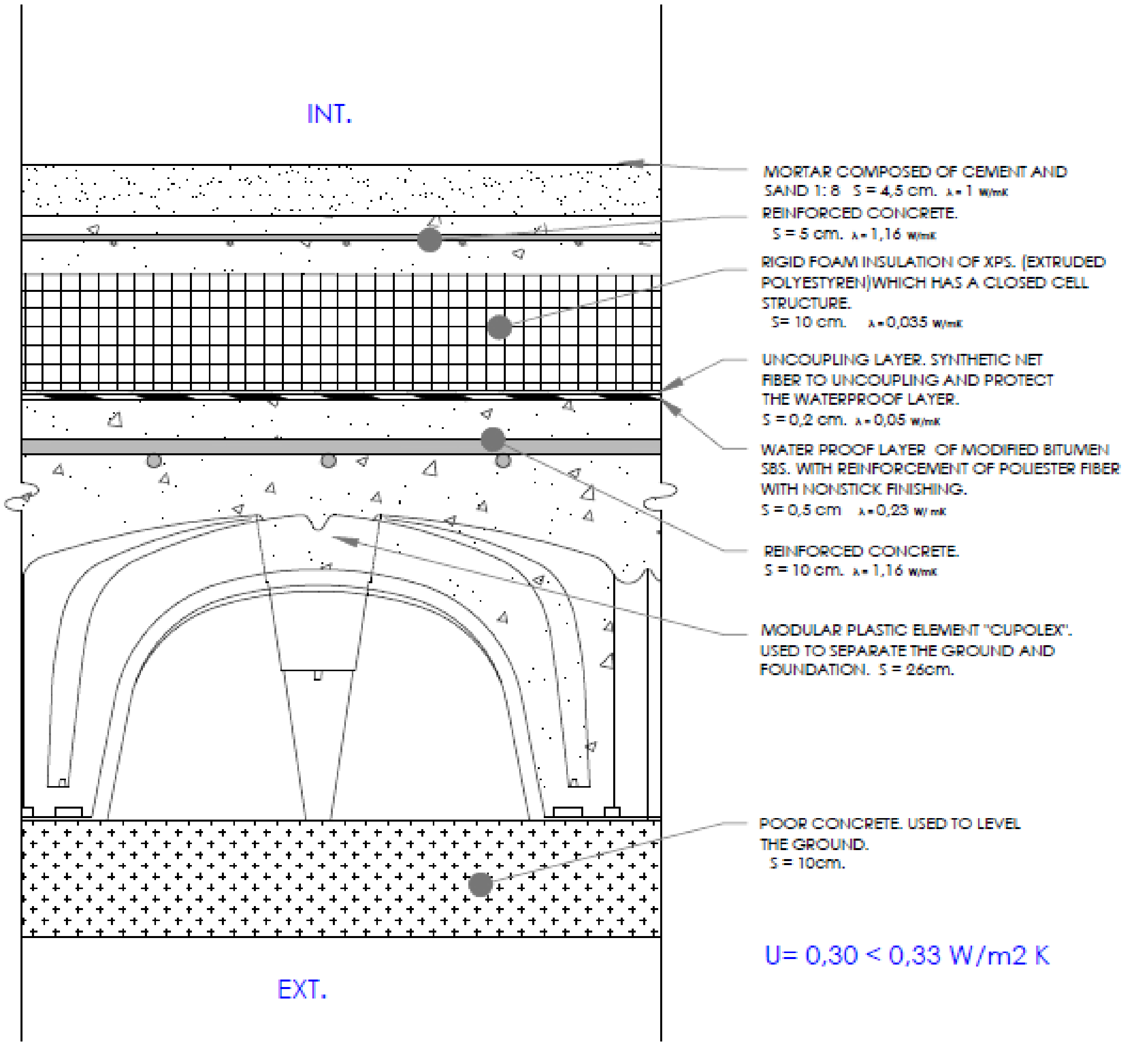
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}12}{0{,}035}+\frac{0.04}{1}+\frac{0{,}03}{0{,}035}+\frac{0{,}004}{0{,}16}+\frac{0{,}04}{1{,}16}+\frac{0{,}045}{1}+\frac{0{,}025}{3{,}5}+0{,}04} = \frac{1}{4{,}73} = 0{,}21 \ < 0{,}33\ W/m^2K$$

Floor Type 9:



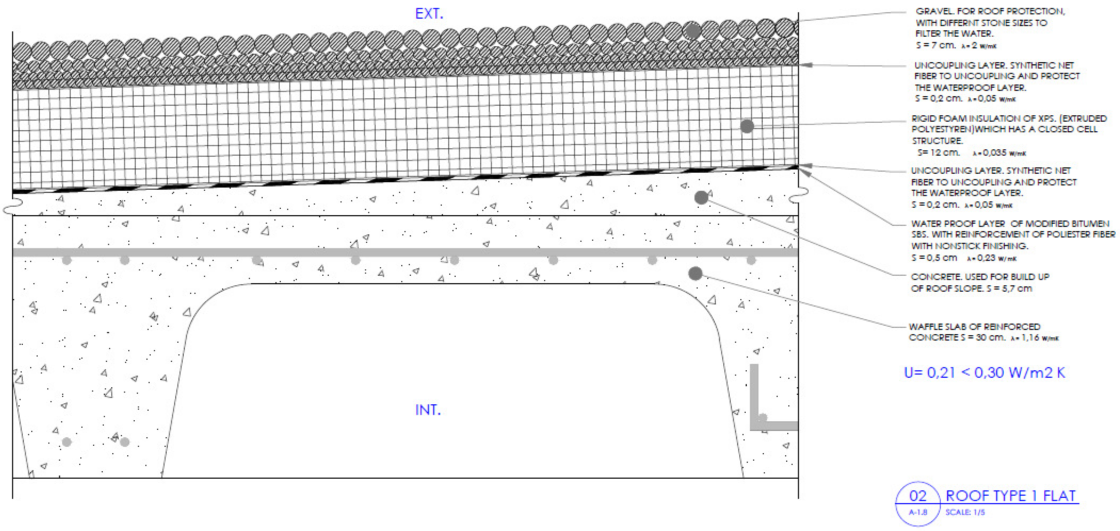
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}12}{0{,}035}+\frac{0.04}{1}+\frac{0{,}03}{0{,}035}+\frac{0{,}004}{0{,}16}+\frac{0{,}04}{1{,}16}+\frac{0{,}045}{1}+\frac{0{,}02}{0{,}1}+0{,}04} = \frac{1}{4{,}93} = \ 0{,}20 \ < 0{,}33 \ W/m^2K$$

Floor Type 10:



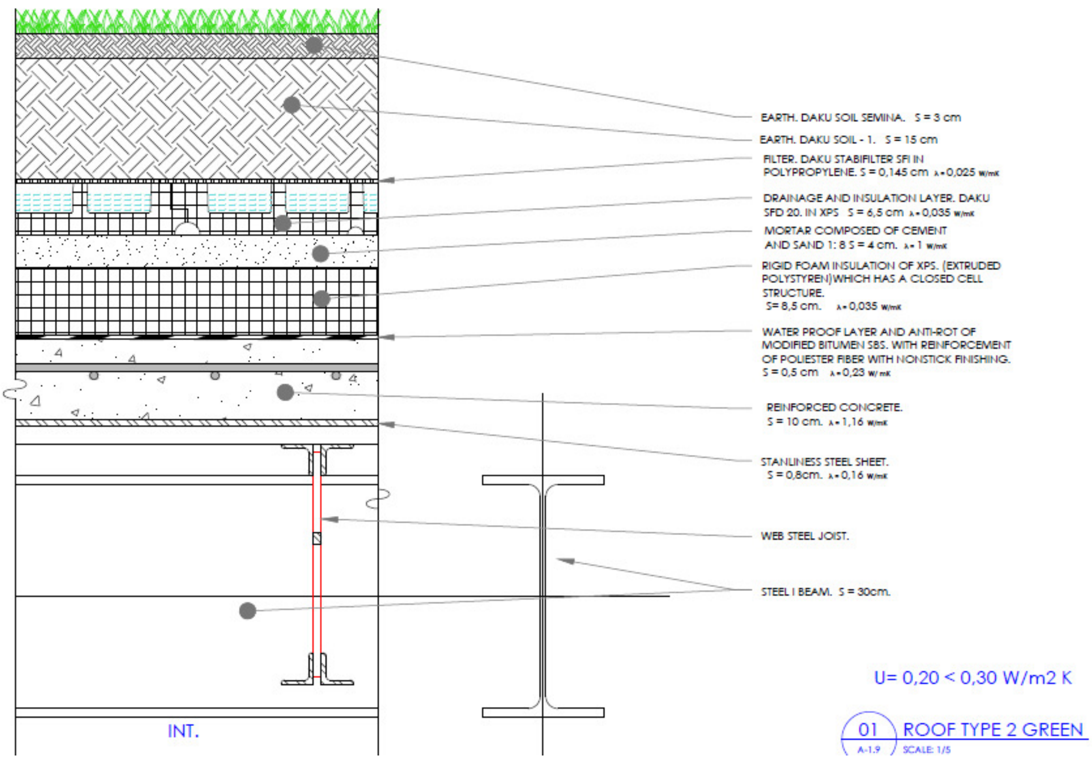
$$U = \frac{1}{0{,}17+\frac{0{,}1}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}002}{0{,}05}+\frac{0{,}10}{0{,}035}+\frac{0{,}05}{1{,}16}+\frac{0{,}04}{1}+0{,}04} = \frac{1}{3{,}29} = 0{,}30 \ < 0{,}33\, W/m^2K$$

Flat Roof.



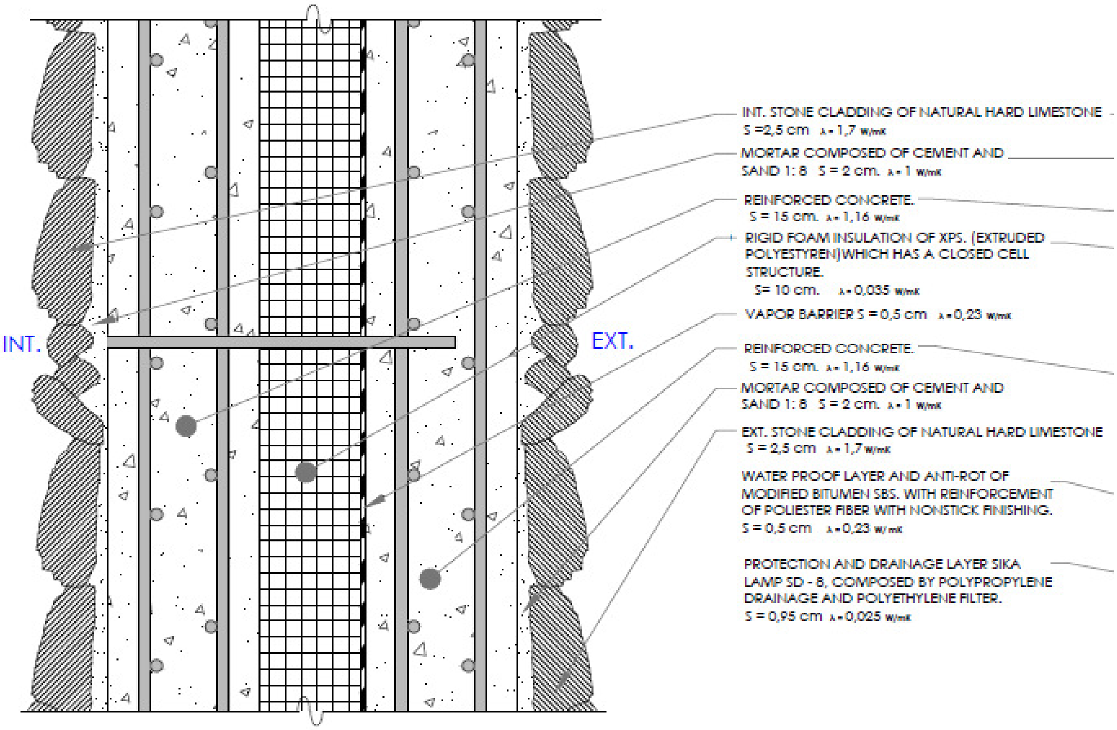
$$U = \frac{1}{0{,}10+\frac{0{,}1}{1{,}16}+\frac{0{,}057}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}002}{0{,}05}+\frac{0{,}15}{0{,}035}+\frac{0{,}002}{0{,}05}+\frac{0{,}07}{2}+0{,}04} = \frac{1}{4{,}70} = \ 0{,}21 \ < 0{,}30\ W/m^2K$$

Green Roof.



$$U = \frac{1}{0{,}10+\frac{0{,}008}{17}+\frac{0{,}1}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}085}{0{,}035}+\frac{0{,}04}{1}+\frac{0{,}065}{0{,}035}+\frac{0{,}00145}{0{,}22}+\frac{0{,}15}{0{,}52}+\frac{0{,}03}{0{,}52}+0{,}04} = \frac{1}{4{,}93} = \ 0{,}20 \ < 0{,}30\ W/m^2K$$

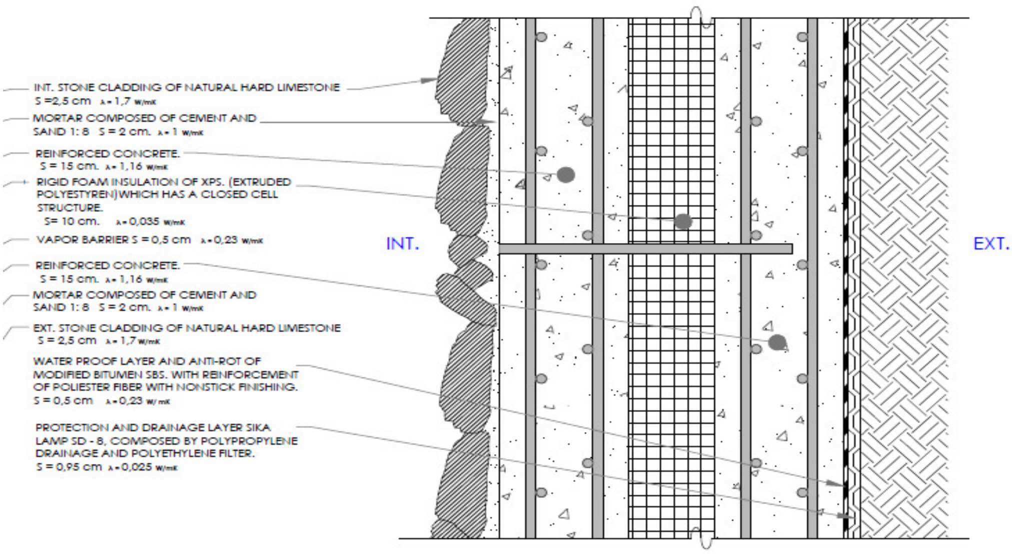
<u>EXTERNAL WALL 1 :</u>



U= 0,29 < 0,34 W/m2 K

$$U = \frac{1}{0{,}13+\frac{0{,}025}{1{,}7}+\frac{0{,}02}{1}+\frac{0{,}15}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}10}{0{,}035}+\frac{0{,}15}{1{,}16}+\frac{0{,}02}{1}+\frac{0{,}025}{1{,}7}+0{,}04} = \frac{1}{3{,}38} = 0{,}29 \ < 0{,}34\ W/m^2K$$

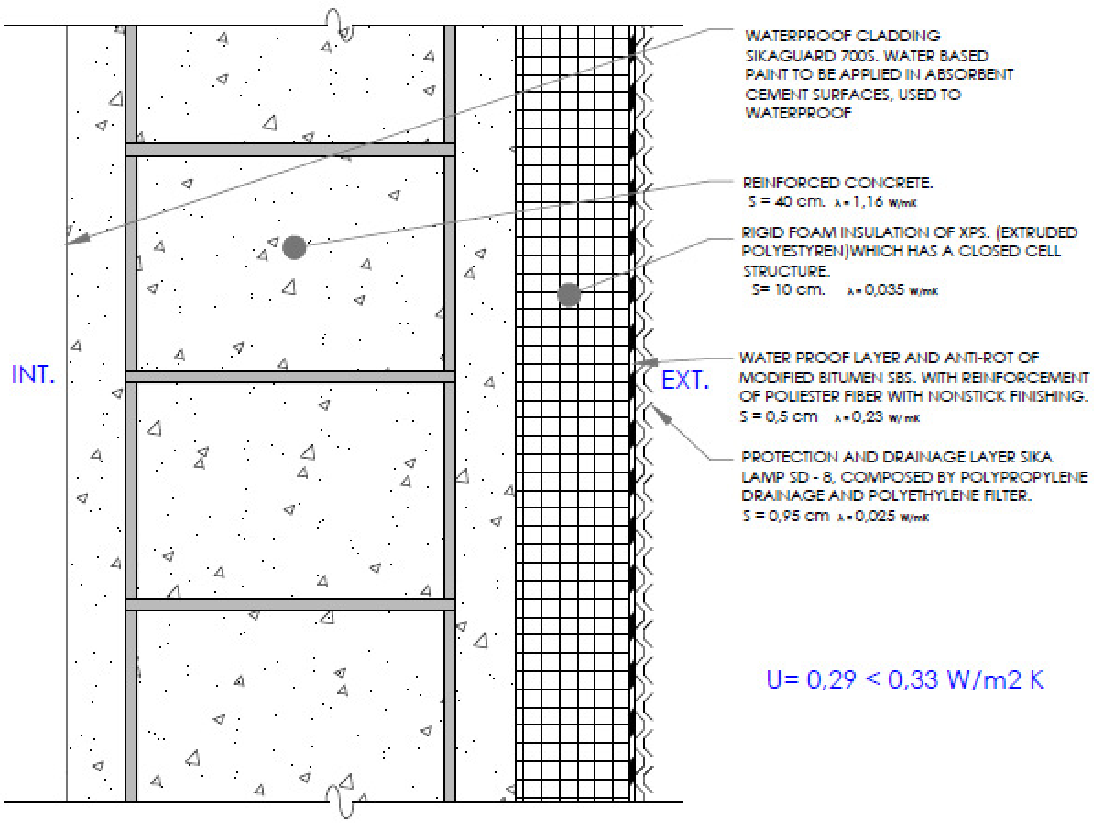
<u>EXTERNAL WALL 5 :</u>



U= 0,29 < 0,33 W/m2 K

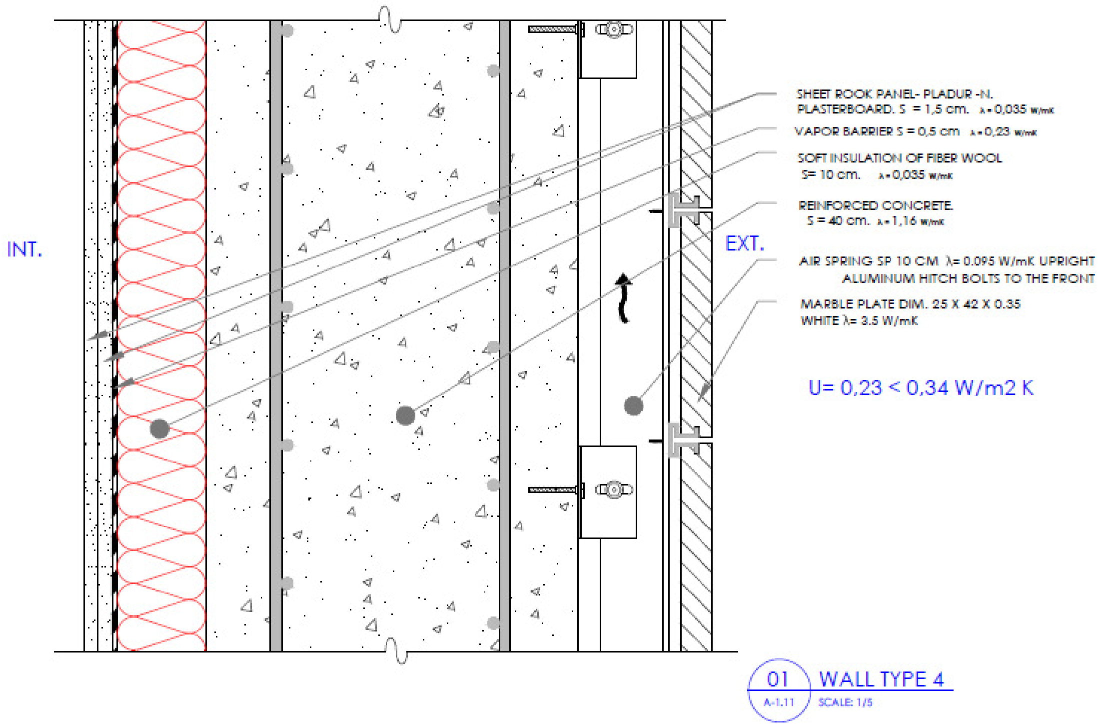
$$U = \frac{1}{0{,}13+\frac{0{,}025}{1{,}7}+\frac{0{,}02}{1}+\frac{0{,}15}{1{,}16}+\frac{0{,}10}{0{,}035}+\frac{0{,}15}{1{,}16}+\frac{0{,}005}{0{,}23}+\frac{0{,}006}{0{,}5}+\frac{0{,}00083}{0{,}22}+0{,}04} = \frac{1}{3{,}38} = 0{,}29 \ < 0{,}34\ W/m^2K$$

EXTERNAL WALL 5 :



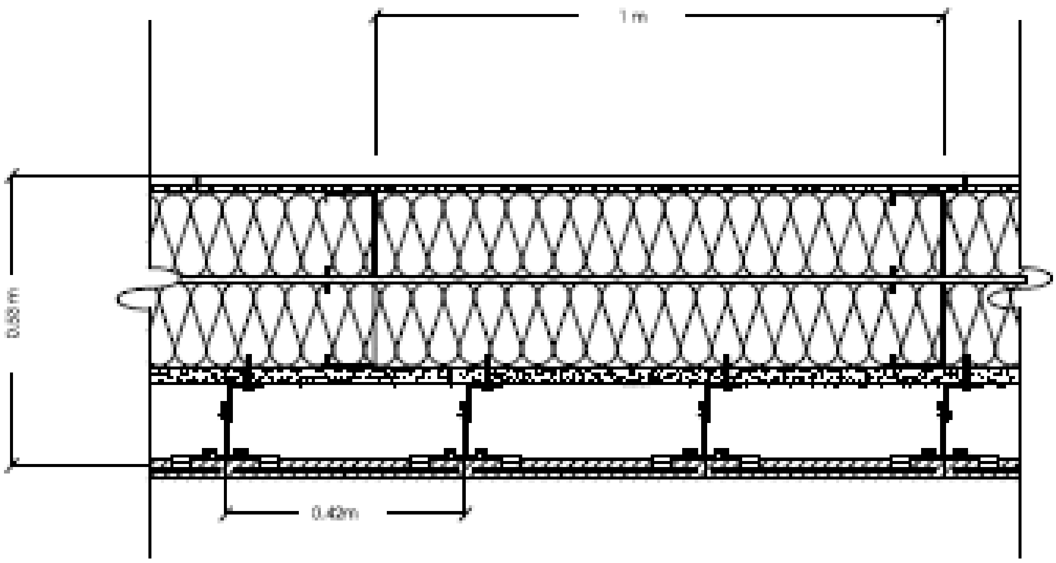
$$U = \frac{1}{0{,}13+\frac{0{,}40}{1{,}16}+\frac{0{,}10}{0{,}035}+\frac{0{,}005}{0{,}23}+\frac{0{,}006}{0{,}5}+\frac{0{,}00083}{0{,}22}+0{,}04} = \frac{1}{3{,}4} = 0{,}29 < 0{,}34\ W/m^2K$$

EXTERNAL WALL 4:



$$U = \frac{1}{0{,}13+\frac{0{,}40}{1{,}16}+\frac{0{,}10}{0{,}035}+\frac{0{,}15}{0{,}035}+\frac{0{,}015}{0{,}035}+\frac{0{,}005}{0{,}23}+0{,}04} = \frac{1}{4{,}25} = 0{,}23 \; < 0{,}34 \; W/m^2K$$

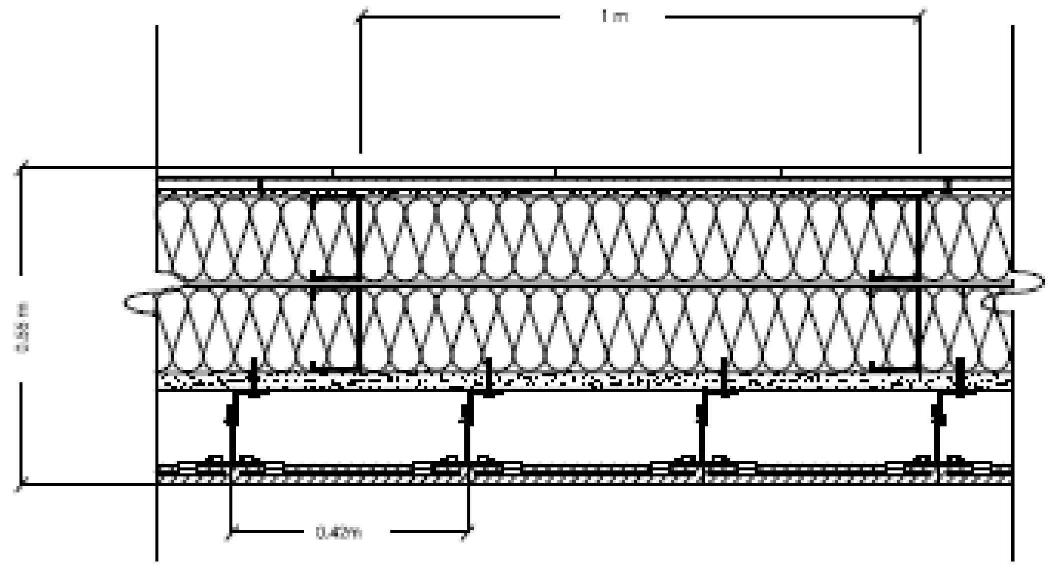
EXTERNAL WALL 2:



04 EW3. EXTERIOR WALL IN FIBROCEMENT HORIZONTAL SECTION

$$U = \frac{1}{0{,}13+\frac{0{,}015}{0{,}035}+\frac{0{,}015}{0{,}74}+\frac{0{,}15}{0{,}035}+\frac{0{,}15}{0{,}0{,}035}+\frac{0{,}03}{0{,}0{,}035}*\frac{0{,}002}{0{,}16}*\frac{0{,}1}{0{,}0{,}95}*\frac{0{,}035}{3{,}5}+0{,}04} = \frac{1}{11{,}14} = 0{,}097 \quad < 0{,}34\ W/m^2K$$

EXTERNAL WALL 3:

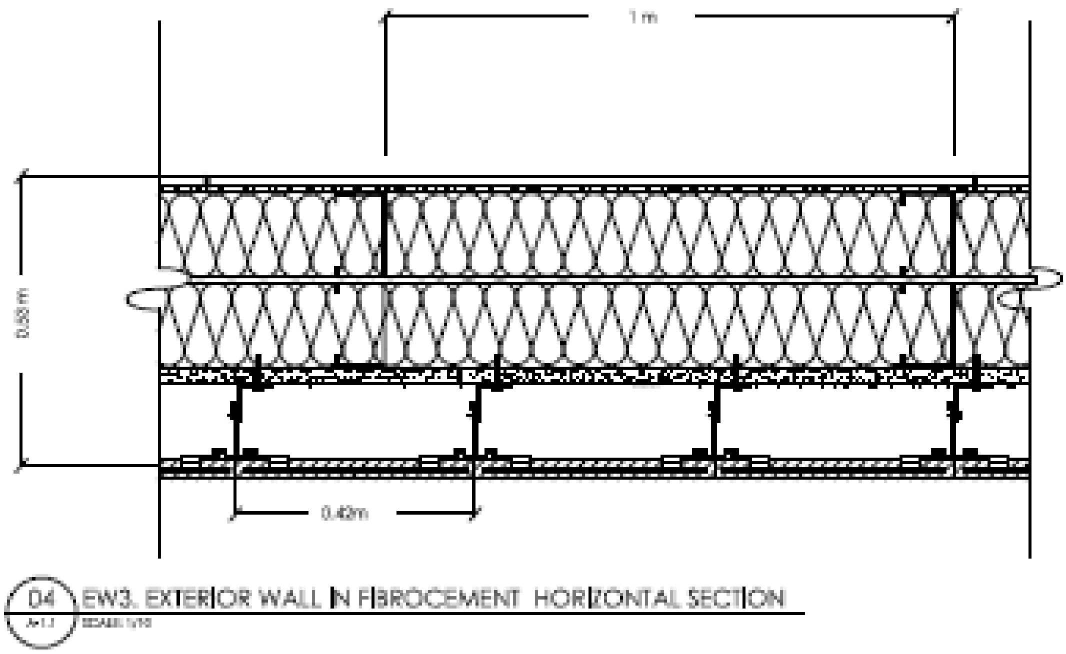


03 EW3. EXTERIOR WALL IN FIBROCEMENT/BATHROOM HORIZONTAL SECTION

$$U = \frac{1}{0{,}13+\frac{0{,}015}{1}*\frac{0{,}015}{0{,}035}+\frac{0{,}015}{0{,}74}+\frac{0{,}15}{0{,}035}+\frac{0{,}15}{0{,}0{,}035}+\frac{0{,}03}{0{,}0{,}035}*\frac{0{,}002}{0{,}16}*\frac{0{,}1}{0{,}0{,}95}*\frac{0{,}035}{3{,}5}+0{,}04} = \frac{1}{10{,}99} = 0{,}097 \quad < 0{,}34\ W/m^2K$$

Vapour Layer (Glaser diagram):

EXTERNAL WALL 2:



LAYER	THICKNESS	λ	Ri
Rse	---	---	0,13
Plasterboard	0,015	0,035	0,42
Cement Board	0,015	0,74	0,02
KENAF	0,15	0,035	4,29
KENAF	0,15	0,035	4,28
Cement Board	0,03	0,74	0,04
Polypropylene	0,002	0,16	0,1
Air Chamber	0,1	0,095	1,05
Marble	0,035	3,5	0,01
Rsi	---	---	0,04

Total Resistance. Rt = ∑ Ri = 11,12 m^2K/W

LAYER	Ri / Rt	%
Rse	0,011	1,1
Plasterboard	0,038	3,8
Cement Board	0,0018	0,18
KENAF	0,39	39
KENAF	0,39	39
Cement Board	0,0036	0,36
Polypropylene	0,0090	0,9
Air Chamber	0,094	9,4
Marble	0,00090	0,09

Rsi	0.0036	0,36

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	T9	Te
20	19,68	18,65	18,60	8,20	-2,20	-2,29	-2,33	-4,88	-4,9	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Pse
2334	2289	2146	2139	1087	520	516	515	425	425	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps   Were Ψi = 50%   and   Ψe = 90%

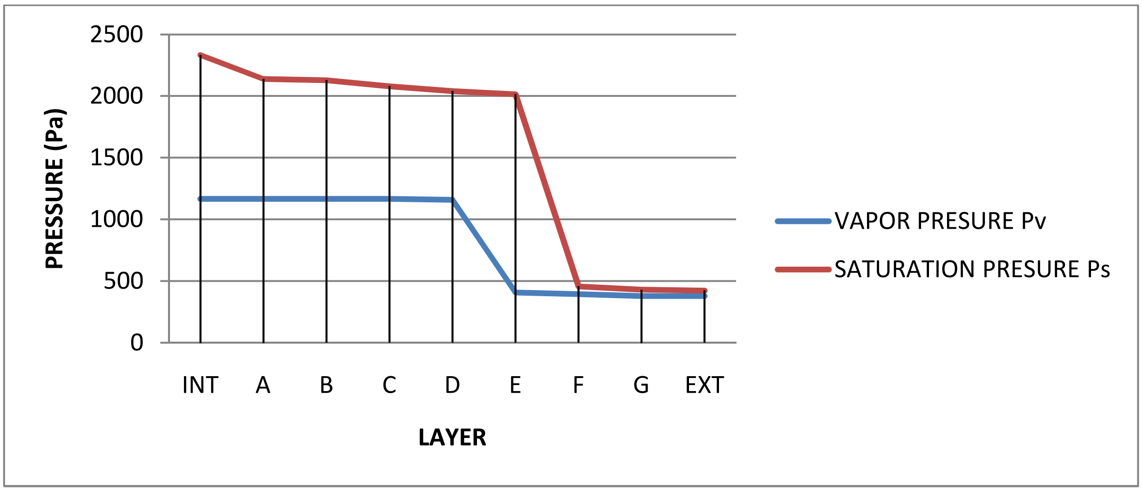
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	μ		
Plasterboard	0,015	10	0,15	0,0048
Cement Board	0,015	10	0,15	0,0048
KENAF	0,15	100	15	0,48
KENAF	0,15	100	15	0,48
Cement Board	0,03	10	0,3	0,0096
Polypropylene	0,002	10	0,02	0,00064
Air Chamber	0,1	1	0,1	0,0032
Marble	0,035	10	0,35	0,011

Rvt = ∑ Rvi = 31,21

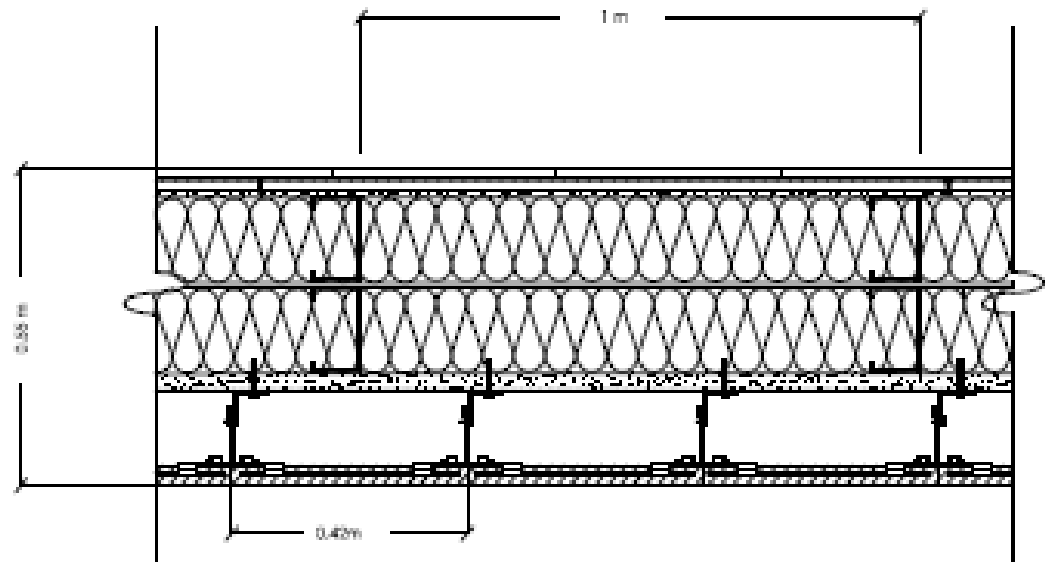
Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pve
1167	1167	1163,2	1159,4	779,2	398,9	391,3	390,8	388,3	379,4	379



From the Glaser Diagram, we obtain that we don’t need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

EXTERNAL WALL 3:



03 EW3. EXTERIOR WALL IN FIBROCEMENT/BATHROOM HORIZONTAL SECTION

LAYER	THICKNESS	λ	Ri
Rse	---	---	0,13
Ceramic	0,015	1	0,015
Plasterboard	0,015	0,035	0,42
Cement Board	0,015	0,74	0,02
KENAF	0,15	0,035	4,28
KENAF	0,15	0,035	4,28
Cement Board	0,03	0,74	0,04
Polypropylene	0,002	0,16	0,1
Air Chamber	0,1	0,095	1,05
Marble	0,035	3,5	0,01
Rsi	---	---	0,04

Total Resistance. Rt = ∑ Ri = 10,15 m^2K/W

LAYER	Ri / Rt	%
Rse	0,013	1,3
Ceramic	0,0015	0,15
Plasterboard	0,041	4,1
Cement Board	0,00197	0,197
KENAF	0,42	42
KENAF	0,42	42
Cement Board	0,0985	9,85
Polypropylene	0,0090	0,9
Air Chamber	0,1	10
Marble	0,000985	0,0985
Rsi	0.0039	0,39

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Te
20	20	19,96	18,91	18,86	8,30	-2,25	-2,35	-2,38	-4,98	-5	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Ps10	Pse
2334	2234	2329	2181	2174	1094	518	514	513	422	422	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps Were Ψi = 50% and Ψe = 90%

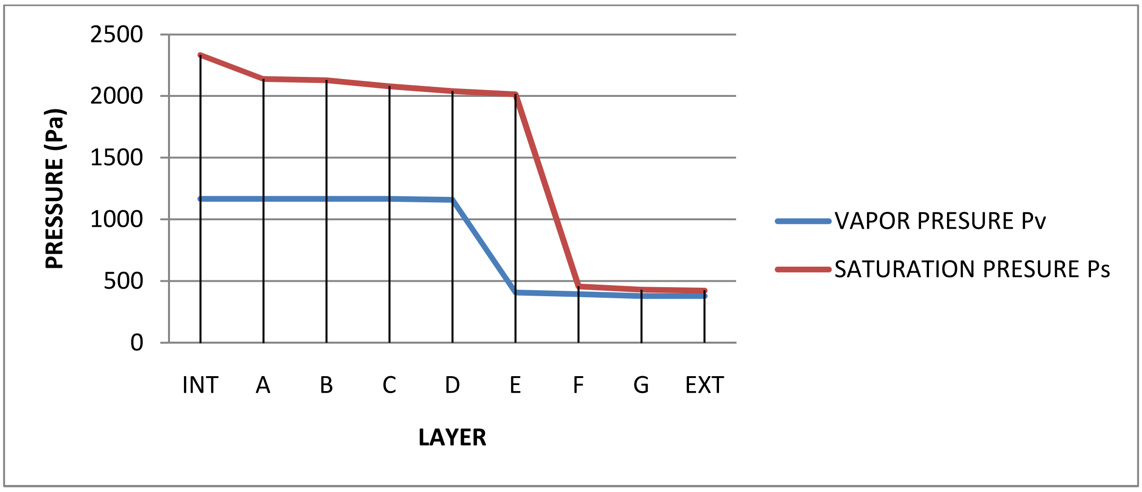
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	μ		
Ceramic	0,015	100	1,5	0,046
Plasterboard	0,015	10	0,15	0,0046
Cement Board	0,03	10	0,15	0,0046
KENAF	0,15	100	15	0,46
KENAF	0,15	100	15	0,46
Cement Board	0,03	10	0,3	0,0092
Polypropylene	0,002	10	0,02	0,00064
Air Chamber	0,1	1	0,1	0,0031
Marble	0,035	10	0,35	0,010

Rvt = ∑ Rvi = 32,57

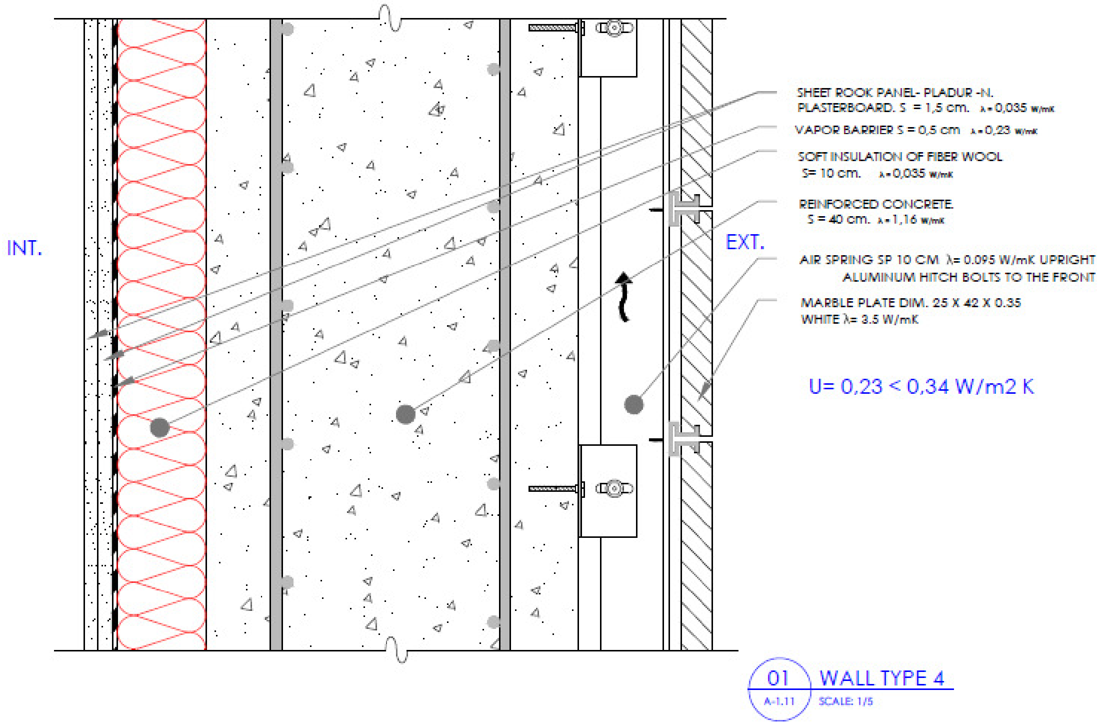
Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pv10	Pve
1167	1167	1130,7	1127,1	1123,5	760,7	398,0	390,8	390,3	387,9	379,4	379



From the Glaser Diagram, we obtain that we don’t need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

EXTERNAL WALL 4:



LAYER	THICKNESS	λ	Ri
RSi	---	---	0,13
Sheet Rook Panel	0,015	0,035	0,43
Sheet Rook Panel	0,015	0,035	0,43
Rigid Foam Insulation XPS	0,10	0,035	2,86
Reinforced Concrete	0,4	1,16	0,34
RSe	---	---	0,04

Total Resistance. Rt = ∑ Ri = 4,23 m^2K/W

LAYER	Ri / Rt	%
RSi	0,03	3
Sheet Rook Panel	0,1	10
Sheet Rook Panel	0,1	10
Rigid Foam Insulation XPS	0,67	67
Reinforced Concrete	0,08	80
RSe	0,009	0,9

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	Te
20	19,23	16,70	14,16	-2,73	-4,76	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Pse
2334	2225	1898	1614	500	429	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps Were Ψi = 50% and Ψe = 90%

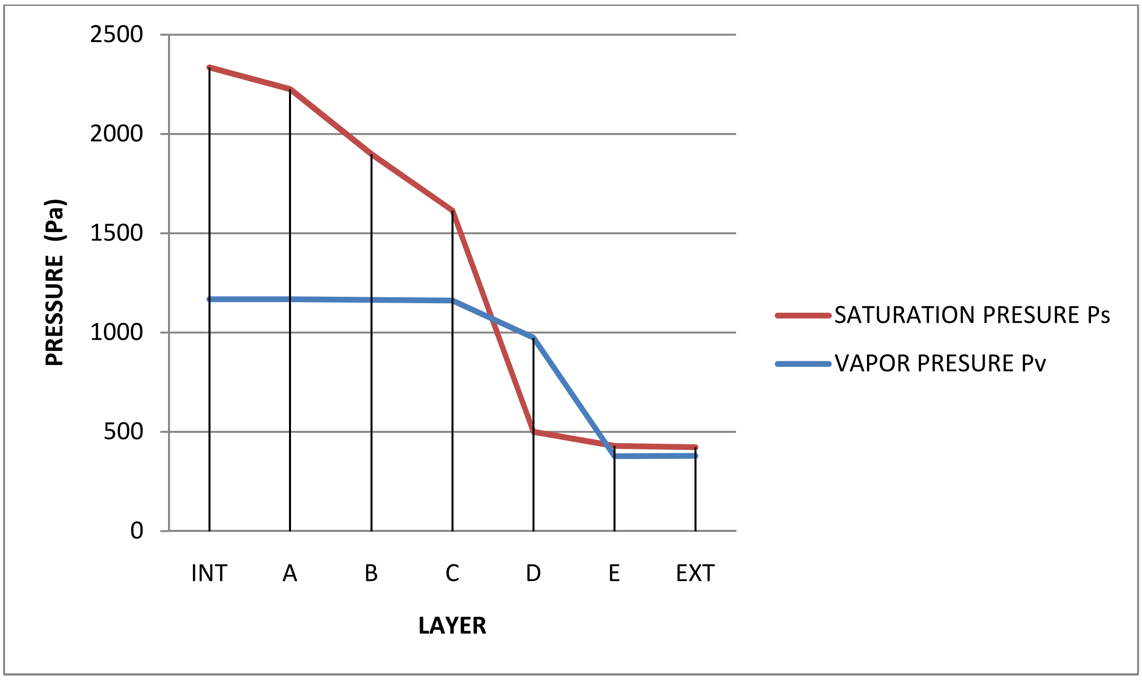
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	μ		
Sheet Rook Panel	0,015	10	0,15	0,0035
Sheet Rook Panel	0,015	10	0,15	0,0035
Rigid Foam Insulation XPS	0,10	100	10	0,23
Reinforced Concrete	0,4	80	32	0,76

Rvt = ∑ Rvi = 42,15

Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pve
1167	1167	1164	1161,4	974,5	376,6	379



From the Glaser Diagram, we obtain that we need to put a Vapor barrier, for prevent the condensations in the layer number 4, between the insulation layer and the reinforced concrete layer, put it on the hotter side of the insulation layer.

The Vapor Barrier must do a pressure fall in the Pv2 lower to Ps3.

Pv2 = Pvi = 1167 Pa

The pressure Fall that the Vapor barrier must do is:

Pv2 – Ps3 = 1167– 500 =667 Pa

That in Fraction terms means:

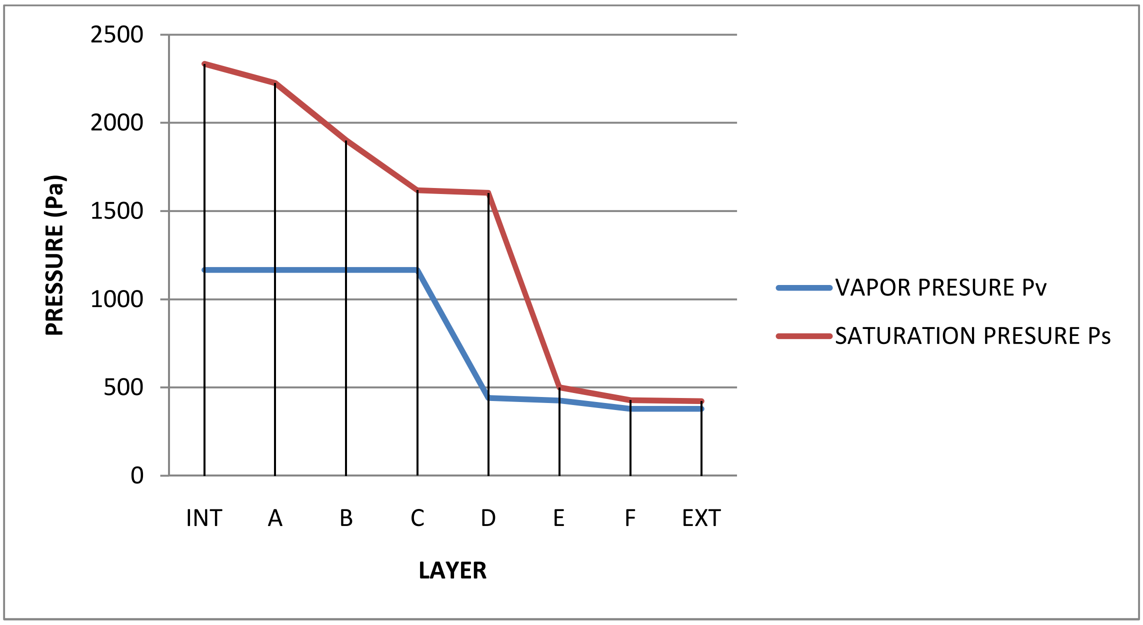
fBV = (1167 – 500)/788,1 = 0,84

In the same way that before for the Saturation pressures we can determinate the resistance that Vapor barrier may guarantee:

fBV = RBV / (RBV + RVT) → RBV = (fBV * RVT) / (1 - fBV) = (0,84 * 42,15* 10^10) / (1 – 0,84) = 221,2* 10^10 m²sPa/kg

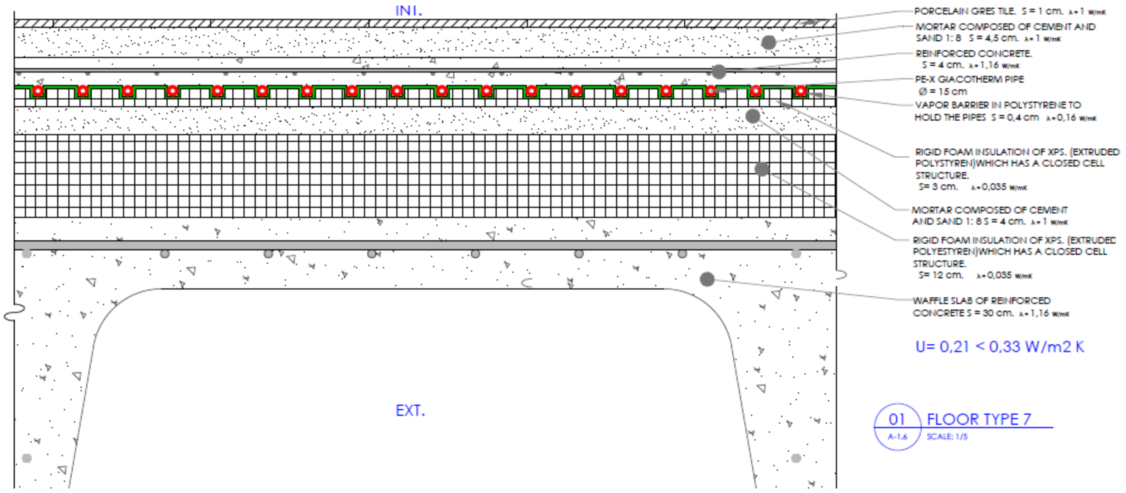
Now what we may do is put a vapor barrier about 0,2 cm. thick, n polietilini, and recalculate the Saturation Pressure and the Vapor Pressure with the new layer, like we did before:

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Pse
2334	2226	1900	1617	1604	500	429	422
Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pve
1167	1167	1166,8	1166,6	440,2	425,7	379,2	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

Floor Type: Porcelain Gres.



LAYER	THICKNESS	λ	Ri
Rse	---	---	0,04
Reinforced Concrete	0,1	1,16	0,09
Insulation layer	0,12	0,035	3,43
Mortar	0,04	1	0,04
Insulation layer	0,03	0,035	0,86
Vapor Barrier	0,004	0,16	0,03
Reinforced Concrete	0,04	1,16	0,03
Mortar	0,045	1	0,045
Porcelain Gres Tile	0,01	1	0,01
Rsi	---	---	0,17

Total Resistance. Rt = ∑ Ri = 4,74 m^2K/W

LAYER	Ri / Rt	%
Rse	0,0084	0,84
Reinforced Concrete	0,018	1,8
Insulation layer	0,70	70
Mortar	0,0084	0,84
Insulation Layer	0,18	18
Vapor Barrier	0,0063	0,63
Reinforced Concrete	0,0063	0,63
Mortar	0,0094	0,94
Porcelain Gres Tile	0,0021	0,21
Rsi	0,035	3,5

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	T9	Te
20	19,10	19,05	18,81	18,63	18,50	13,97	13,76	-4,33	-4,79	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Pse
2334	2208	2200	2168	2144	2126	1594	1572	443	428	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps Were Ψi = 50% and Ψe = 90%

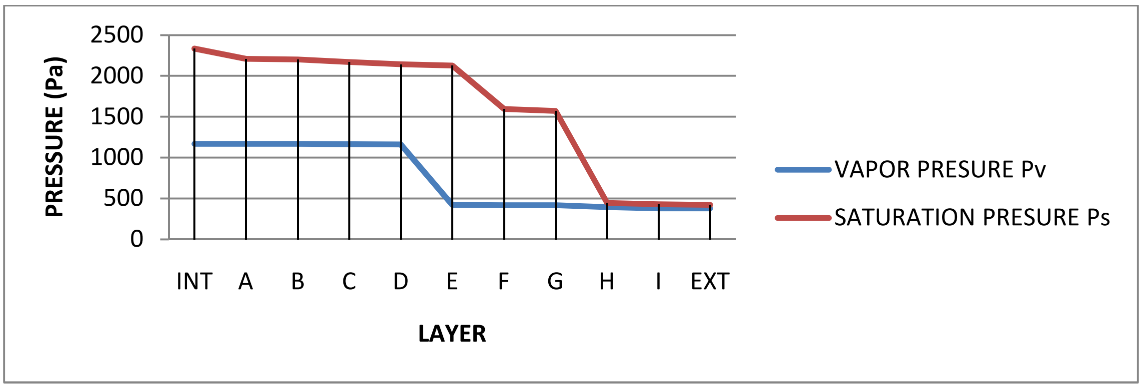
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	µ		
Reinforced Concrete	0,1	80	8	0,018
Insulation layer	0,12	100	12	0,028
Mortar	0,04	10	0,4	0,00093
Insulation layer	0,03	100	3	0,007
Vapor Barrier	0,004	100000	400	0,93
Reinforced Concrete	0,04	80	3,2	0,0074
Mortar	0,03	10	0,45	0,001
Porcelain Gres Tile	0,01	30	0,3	0,0007

Rvt = ∑ Rvi = 427,35

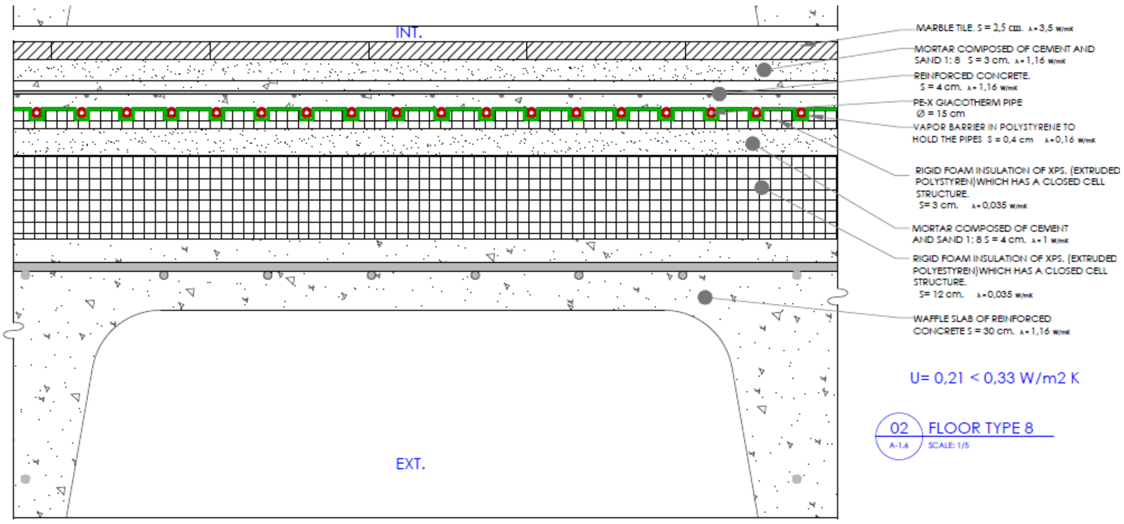
Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pve
1167	1167	1166,4	1165,6	1159,7	422,5	417	416,3	394,1	379	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

__Floor Type:__ Marble.



LAYER	THICKNESS	λ	Ri
Rse	---	---	0,04
Reinforced Concrete	0,1	1,16	0,09
Insulation Layer	0,12	0,035	3,43
Mortar	0,04	1	0,04
Insulation Layer	0,03	0,035	0,36
Vapor Barrier	0,004	0,16	0,03
Reinforced Concrete	0,04	1,16	0,03
Mortar	0,03	1	0,03
Marble Tile	0,025	3,5	0,01
Rsi	---	---	0,17

Total Resistance. Rt = ∑ Ri = 4,73 m^2K/W

LAYER	Ri / Rt	%
Rse	0,0084	0,84
Reinforced Concrete	0,019	1,9
Insulation Layer	0,72	72
Mortar	0,0084	0,84
Insulation Layer	0,076	7,6
Vapor Barrier	0,0063	0,63
Reinforced Concrete	0,0063	0,63
Mortar	0,0063	0,63
Marble Tile	0,0021	0,21
Rsi	0,035	3,5

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	T9	Te
20	19,10	19,06	18,90	18,72	18,59	14,05	13,83	-4,33	-4,79	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Pse
2334	2207	2202	2180	2156	2138	1601	1580	443	428	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps Were Ψi = 50% and Ψe = 90%

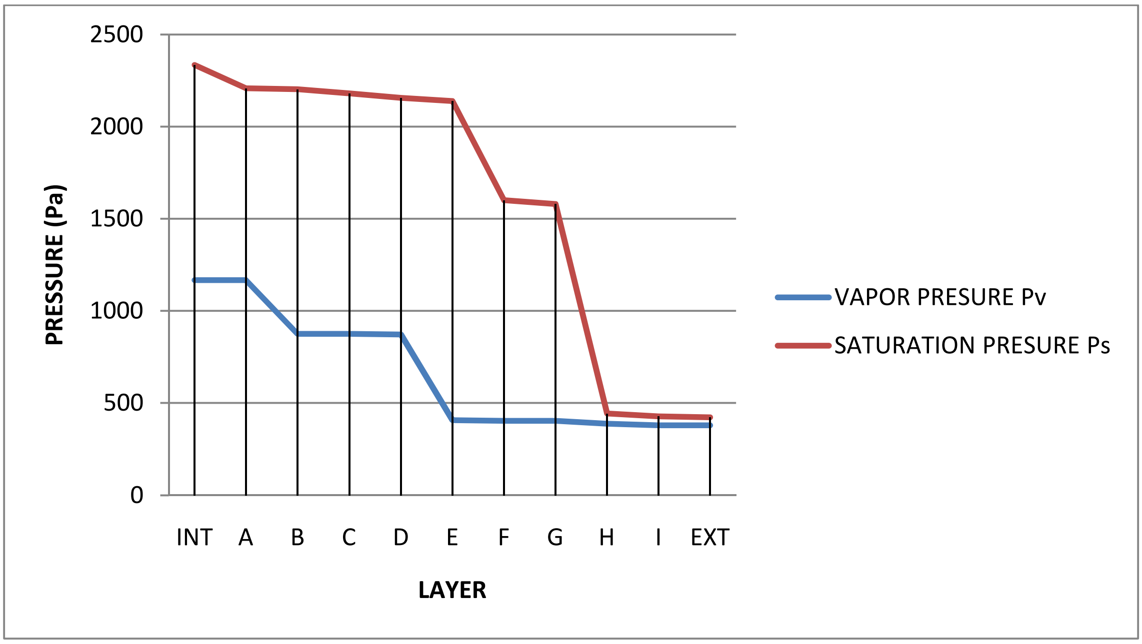
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	μ		
Reinforced Concrete	0,1	80	8	0,011
Insulation Layer	0,12	100	12	0,017
Mortar	0,04	10	0,4	0,0006
Insulation Layer	0,03	100	3	0,0044
Vapor Barrier	0,004	100000	400	0,59
Reinforced Concrete	0,04	80	3,2	0,0047
Mortar	0,03	10	0,3	0,00044
Marble Tile	0,025	10.000	250	0,36

Rvt = ∑ Rvi = 676,9

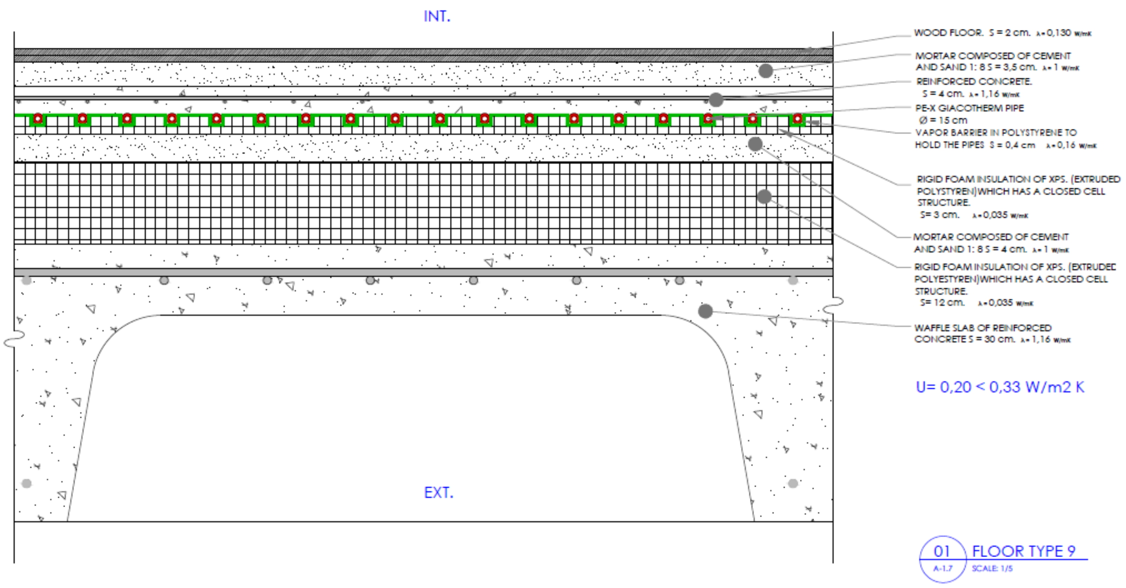
Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pve
1167	1167	876,1	875,8	872	406,6	403,1	402,7	388,7	379	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

Floor Type: Wood.



LAYER	THICKNESS	λ	Ri
Rse	---	---	0,04
Reinforced Concrete	0,1	1,16	0,09
Insulation Layer	0,12	0,035	3,43
Mortar	0,04	1	0,04
Insulation Layer	0,03	0,035	0,86
Vapor Barrier	0,004	0,16	0,03
Reinforced Concrete	0,04	1,16	0,03
Mortar	0,035	1	0,035
Wood Pavement	0,02	0,1	0,20
Rsi	---	---	0,17

Total Resistance. Rt = ∑ Ri =4,92 $m^2 K/W$

LAYER	Ri / Rt	%
Rse	0,0081	0,81
Reinforced Concrete	0,018	1,8
Insulation Layer	0,69	69
Mortar	0,0081	0,81
Insulation Layer	0,17	17
Vapor Barrier	0,0061	0,61
Reinforced Concrete	0,0061	0,61
Mortar	0,0071	0,71
Wood Pavement	0,04	4
Rsi	0,03	3

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	T9	Te
20	19,14	18,12	17,94	17,77	17,64	13,28	13,08	-4,36	-4,80	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Pse
2334	2212	2076	2053	2030	2014	1524	1504	443	428	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps   Were Ψi = 50%   and   Ψe = 90%

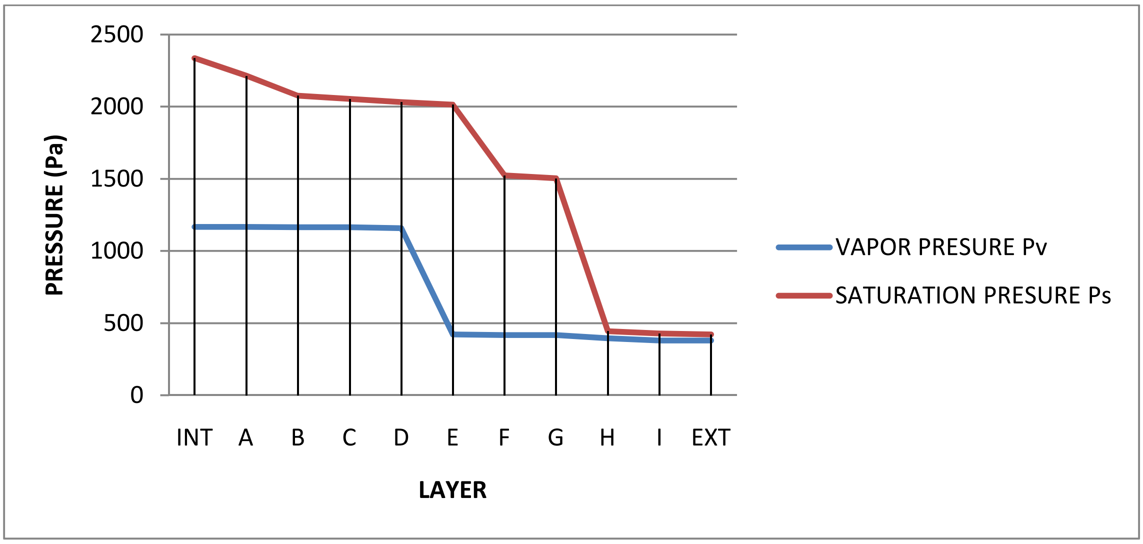
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	µ		
Reinforced Concrete	0,1	80	8	0,018
Insulation Layer	0,12	100	12	0,028
Mortar	0,04	10	0,4	0,00093
Insulation Layer	0,03	100	3	0,007
Vapor Barrier	0,004	100000	400	0,93
Reinforced Concrete	0,04	80	3,2	0,0074
Mortar	0,035	10	0,35	0,0008
Wood Pavement	0,02	50	1	0,0023

Rvt = ∑ Rvi = 427,95

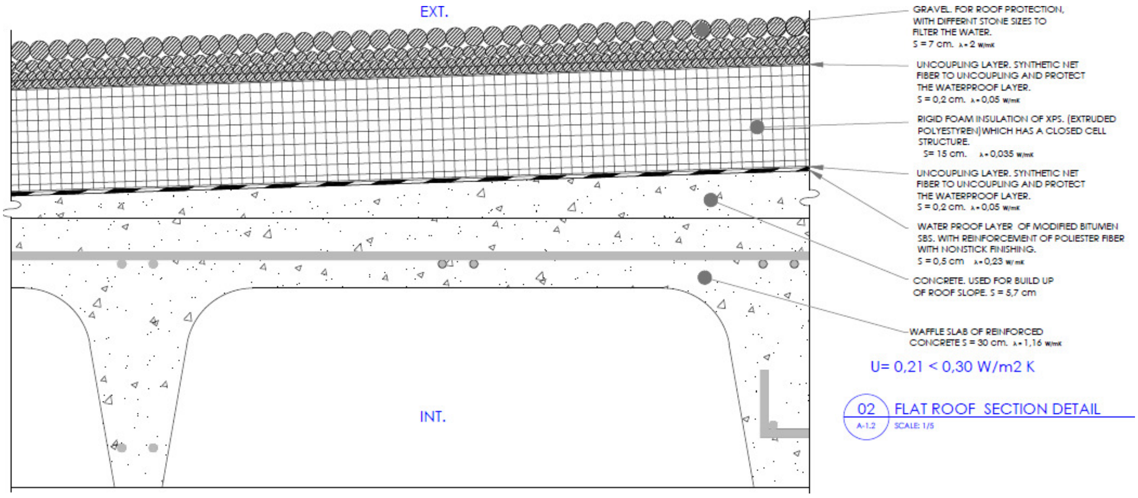
Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pve
1167	1167	1165,2	1164,5	1158,6	422,5	416,9	416,2	394,1	379	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

Flat roof.



LAYER	THICKNESS	λ	Ri
Rsi	---	---	0,10
Reinforced Concrete	0,1	1,16	0,09
Concrete	0,057	1,16	0,05
Waterproof layer	0,005	0,23	0,02
Uncoupling layer	0,002	0,05	0,04
Insulation layer	0,15	0,035	4,29
Uncoupling layer	0,002	0,05	0,04
Gravel	0,07	2	0,04
Rse	---	---	0,04

Total Resistance. Rt = ∑ Ri = 4,70 m^2K/W

LAYER	Ri / Rt	%
Rsi	0,021	2,1
Reinforced Concrete	0,019	1,9
Concrete	0,01	1
Waterproof layer	0,0042	0,42
Uncoupling layer	0,0085	0,85
Insulation layer	0,91	91
Uncoupling layer	0,0042	0,42
Gravel	0,0042	0,42
Rse	0,0042	0,42

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8º	Te
20	19,47	19,01	18,75	18,63	18,42	-4,39	-4,60	-4,79	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Pse
2334	2258	2195	2159	2144	2115	442	435	428	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps Were Ψi = 50% and Ψe = 90%

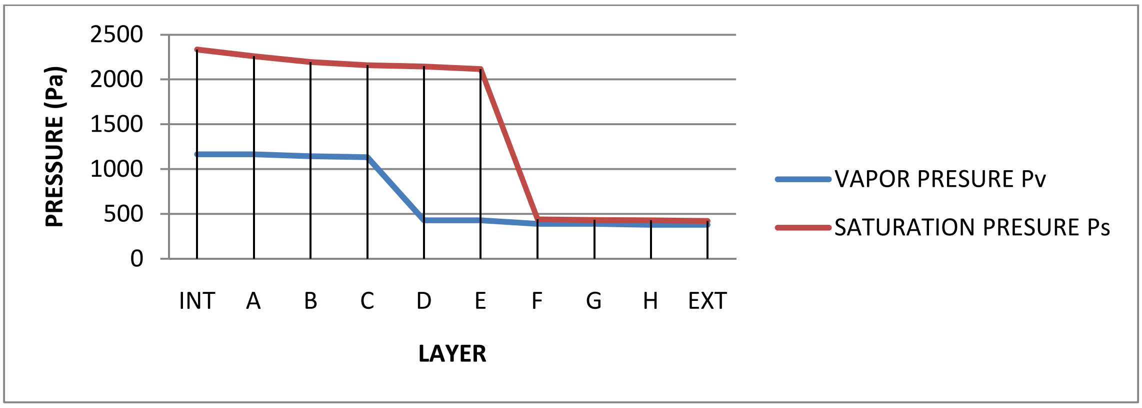
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	µ		
Reinforced Concrete	0,1	80	8	0,028
Concrete	0,057	80	4,56	0,016
Waterproof layer	0,005	50.000	250	0,88
Uncoupling layer	0,002	15	0,03	0,0001
Insulation layer	0,15	100	15	0,053
Uncoupling layer	0,002	15	0,03	0,0001
Gravel	0,07	50	3,5	0,012

Rvt = ∑ Rvi = 281,12

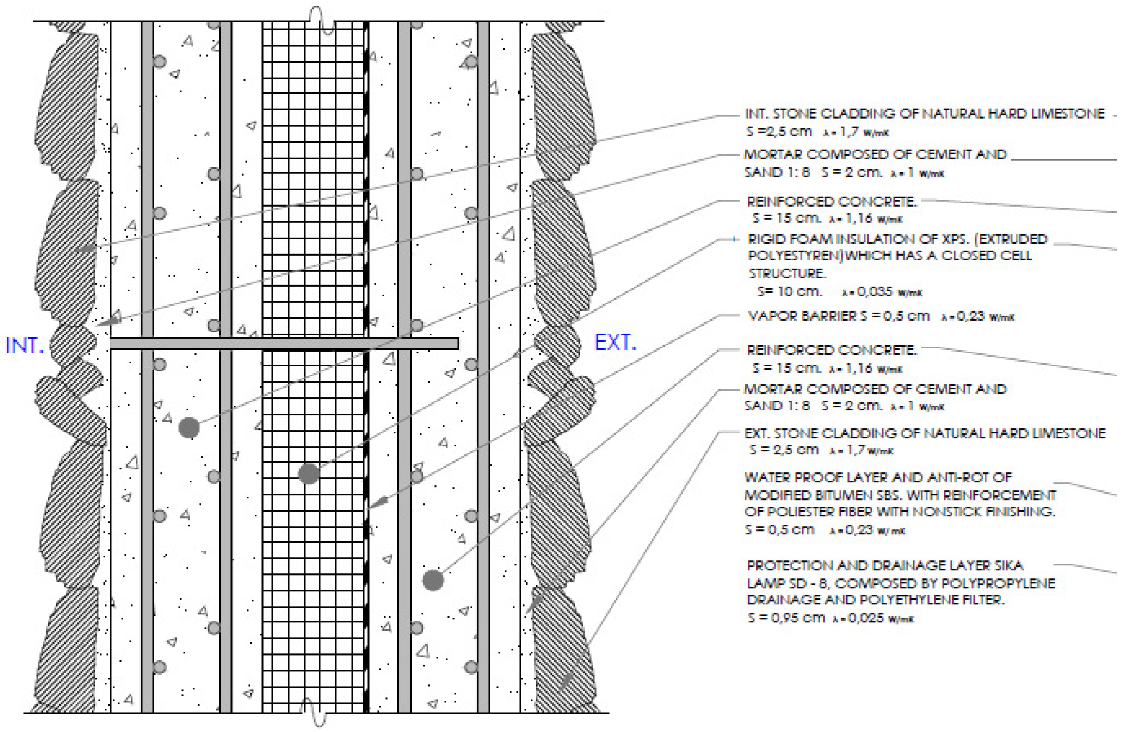
Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pve
1167	1167	1144,6	1131,8	431,4	431,3	389,3	389,2	379	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

External Wall 1: Stone Wall.



U= 0,29 < 0,34 W/m2 K

LAYER	THICKNESS	λ	Ri
Rse	---	---	0,04
Ext. Stone Cladding	0,025	1,7	0,015
Mortar	0,02	1	0,02
Reinforced Concrete	0,15	1,16	0,13
Rigid Foam Insulation	0,10	0,035	2,86
Reinforced Concrete	0,15	1,16	0,13
Mortar	0,02	1	0,02
Int. Stone Cladding	0,025	1,7	0,015
Rsi	---	---	0,13

Total Resistance. Rt = ∑ Ri =3,36 m^2K/W

LAYER	Ri / Rt	%
Rse	0,012	1,2
Ext. Stone Cladding	0,0044	0,44
Mortar	0,006	0,6
Reinforced Concrete	0,038	3,8
Rigid Foam Insulation	0,851	85,1
Reinforced Concrete	0,038	3,8
Mortar	0,006	0,6
Int. Stone Cladding	0,0044	0,44
Rsi	0,038	3,8

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	Te
20	19,03	18,92	18,77	17,81	-3,48	-4,44	-4,59	-4,70	-5

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Pse
2334	2198	2183	2163	2036	473	440	435	431	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps Were Ψi = 50% and Ψe = 90%

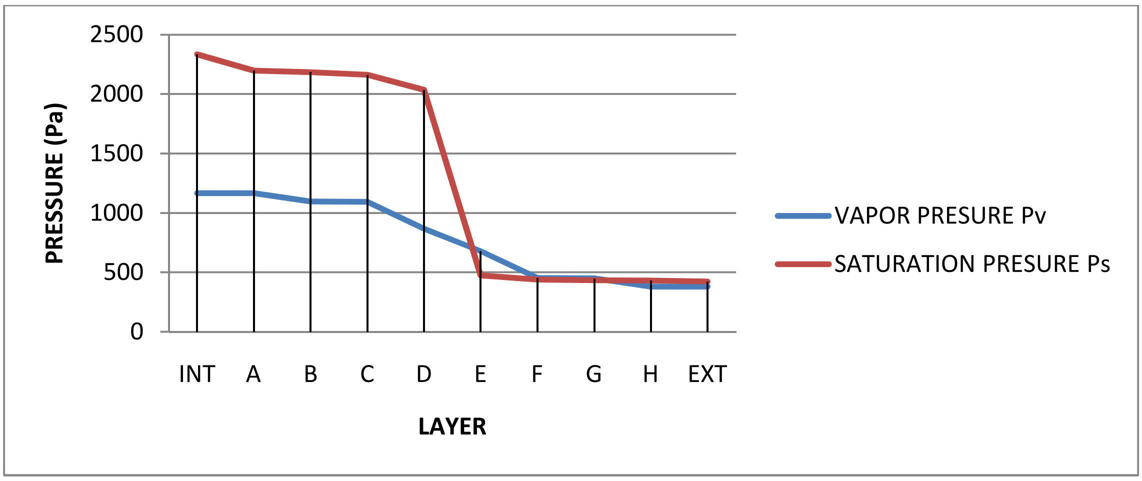
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	SPESSOR	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	μ		
Ext. Stone Clading	0,025	150	3,75	0,089
Mortar	0,02	10	0,2	0,0047
Reinforced Concrete	0,15	80	12	0,28
Rigid Foam Insulation	0,1	100	10	0,23
Reinforced Concrete	0,15	80	12	0,28
Mortar	0,02	10	0,2	0,0047
Int. Stone Clading	0,025	150	3,75	0,089

Rvt = ∑ Rvi = 41,9

Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pve
1167	1167	1096,5	1092,8	867,2	679,2	453,6	449,9	379,4	379



From the Glaser Diagram, we obtain that we need to put a Vapor barrier, for prevent the condensations in the layer number 5, between the insulation layer and the reinforced concrete layer, put it on the hotter side of the insulation layer.

The Vapor Barrier must do a pressure fall in the Pv2 lower to Ps3.

Pv4 = Pvi = 1167 Pa

The pressure Fall that the Vapor barrier must do is:

Pv4 – Ps5 = 1167 – 473 = 694 Pa

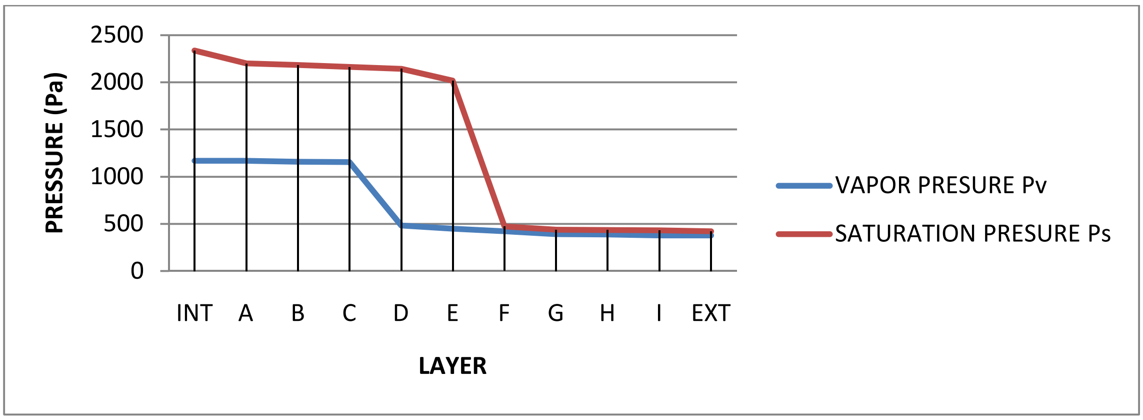
That in Fraction terms means:

fBV = (1167 – 473)/788,1 = 0,88

In the same way that before for the Saturation pressures we can determinate the resistance that Vapor barrier may guarantee:

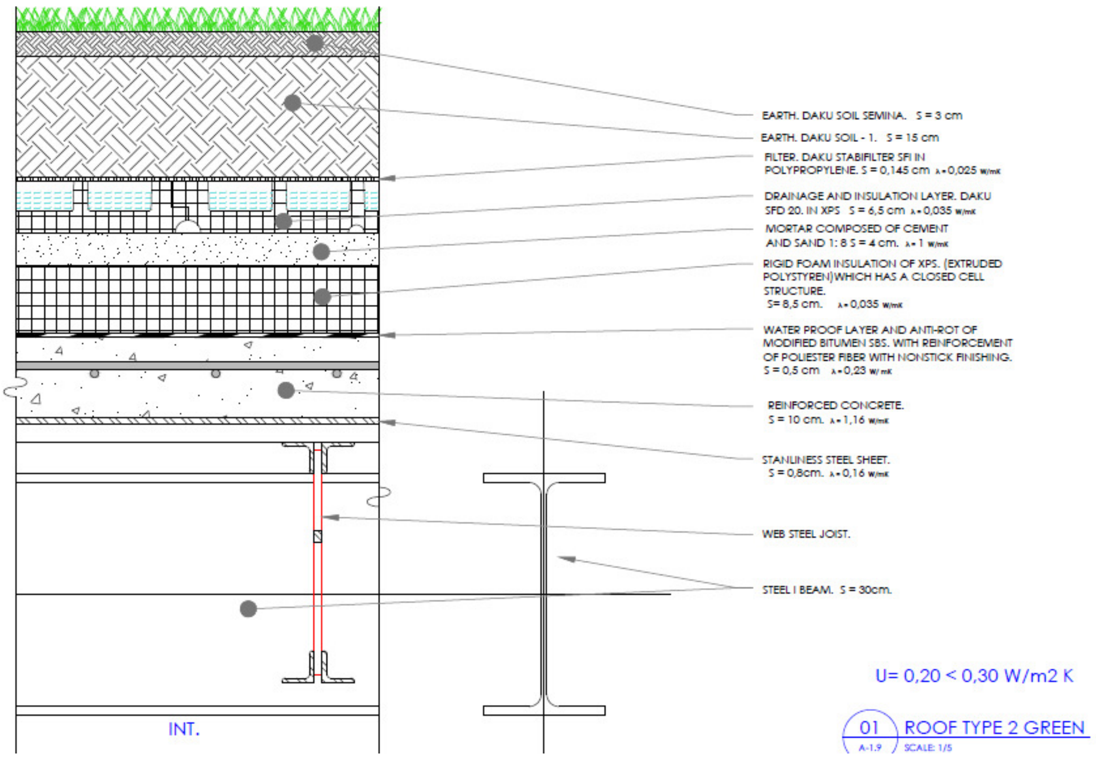
fBV = RBV / (RBV + RVT) → RBV = (fBV * RVT) / (1 - fBV) = (0,88*41,9* 10ˆ10) / (1 –0,88) = 307,26* 10ˆ10 m²sPa/kg

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Pse
2334	2199	2184	2164	2142	2017	472	440	435	431	422
Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pve
1167	1167	1156,9	1156,3	481,8	449,4	422,4	390,1	389,5	379,4	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.

Green Roof.



LAYER	THICKNESS	λ	Ri
Rsi	---	---	0,1
Stanliness Steel Shet	0,008	17	0,00047
Reinforced Concrete	0,1	1,16	0,0862
Waterproof layer	0,005	0,23	0,02
Drainage & Insulation Layer	0,085	0,035	2,43
Mortar	0,04	1	0,04
Drainage & Insulation Layer	0,065	0,035	1,86
Filter	0,00145	0,22	0,01
Earth	0,15	0,52	0,29
Earth	0,03	0,52	0,06
Rse	---	---	0,04

Total Resistance. Rt = ∑ Ri = 4,93 m^2K/W

LAYER	Ri / Rt	%
Rsi	0,02	2
Stanliness Steel Shet	0,000095	0,0095
Reinforced Concrete	0,017	1,7
Waterproof layer	0,004	0,4
Drainage & Insulation Layer	0,5	50
Mortar	0,0081	0,81
Drainage & Insulation Layer	0,37	37
Filter	0,002	0,2
Earth	0,058	5,8
Earth	0,012	1,2
Rse	0,0081	0,81

T layer = T layer prec. – (Ti – Te) * Ri/Rt

Ti	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	Te
20	19,49	19,49	19,05	18,94	6,62	6,42	-3,01	-3,04	-4,50	-4,80	**-5**

In this point you may calculate the Saturation pressure. Ps :

2 ways: 1º with the formula: Ps = 6.11 *10.0^(7,5 * t /(237.7 + t))

2º Whit the Psychometric chart. Here you may take the same temperature for each bulb.

Psi	Ps1	Ps2	Ps3	Ps4	Ps5	Ps6	Ps7	Ps8	Ps9	Ps10	Pse
2334	2262	2262	2201	2186	976	962	490	488	438	428	422

After you may calculate the Vapor Pressure. Pv :

Pv = Ψ * Ps   Were Ψi = 50%   and   Ψe = 90%

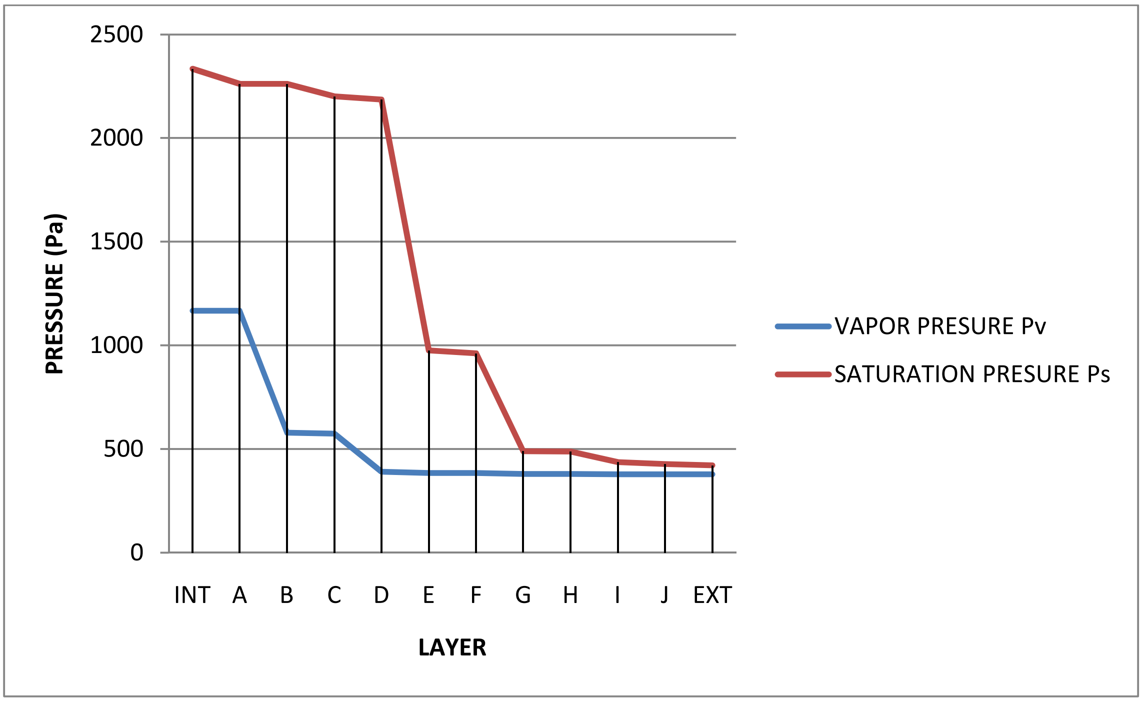
Pvi	Pve	ΔP
1167	378.9	788.1

LAYER	THICKNESS	VAPOR RESISTIVITY	Rvi	Rvi/Rvt
	m	µ		
Stanliness Steel Shet	0,008	100000	800	0,74
Reinforced Concrete	0,1	80	8	0,0074
Waterproof layer	0,005	50000	250	0,23
Drainage & Insulation Layer	0,085	100	8,5	0,008
Mortar	0,04	10	0,4	0,0004
Drainage & Insulation Layer	0,065	100	6,5	0,006
Filter	0,00145	10	0,0145	0,000013
Earth	0,15	1	0,15	0,00013
Earth	0,03	1	0,03	0,000028

Rvt = ∑ Rvi = 1073,6

Pv layer = Pv layer prec. – (ΔP * Rvi/Rvt)

Pvi	Pv1	Pv2	Pv3	Pv4	Pv5	Pv6	Pv7	Pv8	Pv9	Pv10	Pve
1167	1167	580,1	574,2	390,8	384,6	384,3	379,5	379,5	379,4	379,4	379



From the Glaser Diagram, we obtain that we don't need to put a Vapor barrier, because the vapor pressure is not superior to the Saturation pressure.