Supplement S3: Technical Sheet of Thermal Insulation Solutions for Upper Horizontal Closure (UHC) and Vertical External Wall (EW)

UHC.05_IE.01.b

UPPER HORIZONTAL CLOSURE UHC.05

Used from 1930 to 1975

Total thickness: 370mm

1 : Terracotta tiles

2 : Cement mortar

3 : Reinforced concrete

4 : Brick-concrete slab

5 : Internal plaster

U 1.82 W/mqk

YIE 1.03 W/mqk

Insulating material

Expanded polyurethane

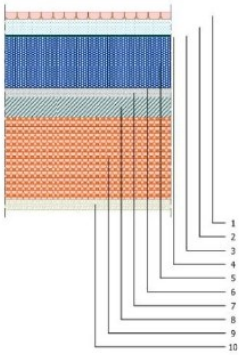
λ : 0.023

Thickness 100 mm

PEI : 80

DISA 90

PREF 70



	Description of the stratigraphic solution	Thickness
	EXTERNAL	(mm)
1	Terracotta tiles	15
2	Weakly ventilated air gap	30
3	Polymer-modified bituminous plastomeric membrane	4
4	Bitumen-impregnated felt	1
5	Rigid expanded polyurethane insulation	100
6	Vapor barrier	1
7	Cement mortar	20
8	Reinforced concrete	40
9	Brick-concrete slab	160
10	Internal plaster	20
	INTERNAL	(mm)
	Spessore tot:	391

THERMOPHYSICAL PROPERTIES OF BUILDING COMPONENTS

LAYER	DESCRIPTION	s [mm]	λ [W/mK]	C [W/m²K]	M [kg/m²]	c [J/kgK]	R [m²K/W]
EXT	**Adduttanza**	0		25.00			0.0400
1	Terracotta tiles	15	0.72	48.00	27.00	1000	0.0208
2	Weakly ventilated air gap	30		18.18	0.04	1000	0.0550
3	Polymer-modified bituminous plastomer	4	0.17	42.50	4.80	1470	0.0235
4	Bitumen-impregnated felt	1	0.23	460.00	0.55	1000	0.0022
5	Rigid expanded polyurethane insulation	100	0.023	0.23	3.40	1442	43478
6	Vapor barrier	1	0.22	440.00	0.14	1700	0.0023
7	Cement mortar	20	1.40	70.00	40.00	1000	0.0143
8	Reinforced concrete	40	0.85	21.25	96.00	1000	0.0471
9	Brick-concrete slab	160		3.70	144.00	1000	0.2700
10	Internal plaster	20	0.70	35.00	28.00	1000	0.286
INT	**Adduttanza**	0		10.00			0.1000

RESULTS

TOTAL TRANSMITTANCE	W/m²K 0.20
SURFACE MASS	kg/m² 315.93
PHASE SHIFT	ore 10.61
ATTENUATION FACTOR	0.14
AREAL HEAT CAPACITY	kJ/m²K 60.80
PERIODIC TRANSMITTANCE	W/m²K 0.03

THERMOHYGROMETRIC VERIFICATIONS

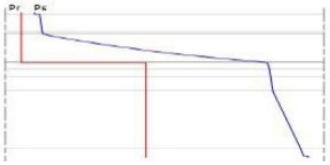
SURFACE CONDENSATION

Minimum temperature factor fRsi = 0.9485,
Maximum critical month temperature factor, fRsi,max = 0.7242,
Critical month = December,
Vapor concentration class = Medium,
Maximum allowable U value = 1.1032 W/m²K.

fRsi ≤ fRsi,max ✓

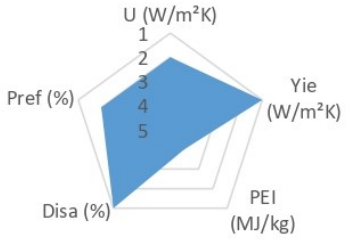
INTERSTITIAL CONDENSATION

Critical Month **December**



Pv ≤ Ps ✓

COMPARATIVE RADAR



LIMIT VALUES VERIFICATION

Winter Mode

Allegato E (UNI EN ISO 6946)

A-B-C	≤	0.27 W/m2*K	☑
D	≤	0.22 W/m2*K	☑
E	≤	0.20 W/m2*K	☐
F	≤	0.19 W/m2*K	☐

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

SAPIENZA UNIVERSITÀ DI ROMA

EXTERNAL INSULATION SYSTEM

EW.05_EI.1

EXISTING WALL EW.05

Used from 1900 to 1950

Total thickness: 25 cm

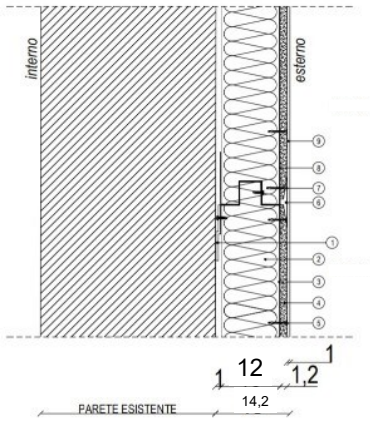
1. External plaster: 2 cm
2. Bricksi: 21 cm
3. Internal plaster: 2 cm

U= 1.95 W/m²K

INSULATING MATERIAL

Synthetic inorganic Mineral wool
Thickness: 0.12 m
λ: 0.032

STRATIGRAPHY OF THE SOLUTION



1. Anchoring structure with galvanized steel profiles (thickness 0.012 m), cross-section 0.05–0.1–0.05 m, spacing 0.6 m, doweled brackets 0.03/0.01 m.
2. Semi-rigid mineral wool insulation panel, 0.12 m thick.
3. Stud
4. High-density calcium silicate board, 0.012 m thick, with a density of 1,200 kg/m³.
5. 4.2×32 mm screw for UR board
6. Rigid two-component joint compound for sealing gaps between UR panels
7. Mesh of 0.05 m for the joints of UR panels, 165 g/m².
8. Lower guide with a "U" or "M" section of 0.1 m.
9. Smoothing

THERMOPHYSICAL PROPERTIES OF BUILDING COMPONENTS

Layer	DESCRIPTION	h W/m²*K	s m	λ W/m*K	R m²K/W	c J/kgK	ρ kg/m³
	INTERNAL						
LIM	Preliminary layer of the internal vertical surface according to UNI 6946	7.70	-	-	0.13		0
1	Gypsum plaster	-	0.02	0.70	0.029	1000	1400
2	Masonry in solid bricks	-	0.21	0.72	0.292	1000	1800
3	Gypsum plaster	-	0.02	0.90	0.022	1000	1800
4	Rigid panels made of water-repellent, low permeability glass wool	-	0.12	0.032	3.75	1030	30
5	Calcium silicate board	-	0.012	0.39	0.031	900	1200
6	Smoothing	-	0.005	0.90	0.006	1000	1800
LIM	Preliminary layer of the external vertical surface (wind < 4 m/s) according to UNI 6946	25.00	-	-	0.04		0
	TOTAL THICKNESS . (m):		38.70				

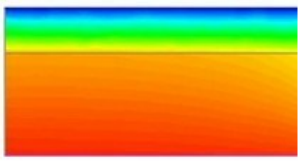
RESULTS

TOTAL TRANSMITTANCE U (W/m²K)	0.233
SURFACE MASS (kg/m²)	469
PHASE SHIFT Φ (h)	11.58
ATTENUATION FACTOR f_a	0.097
AREAL HEAT CAPACITY (kJ/m²K)	62.20
PERIODIC TRANSMITTANCE Yie (W/m²K)	0.023

THERMOHYGROMETRIC VERIFICATIONS

SUERFACE CONDENSATION

Temperature distribution

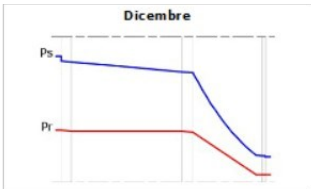


Critical month: December

F Rsi, max ≤ F Rsi ✓

INTERSTITIAL CONDENSATION

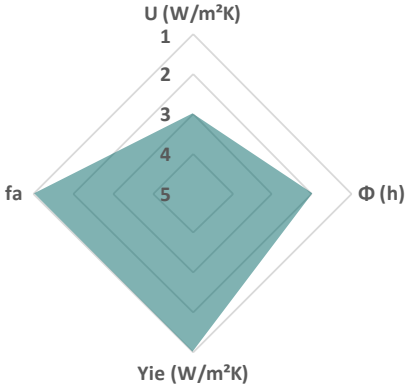
Pressure distribution



Critical month: December

Pv ≤ Ps ✓

COMPARATIVE RADAR



LIMIT VALUES VERIFICATION

WINTER CONDITION

Limit values Ecobonus Requirements Decree 2020	Z.C.
≤0.38 ✓ ✓	A – B
≤0.30 ✓	C
≤0.26	D
≤0.23 ✓	E
≤0.22	F

SUMMER CONDITION

Phase shift Φ (h)	ϕ > 6 ✓
Attenuation factor f_a	Fa<0,60 ✓
Arealheat capacity (kJ/m²K)	Cip≥40 kJ/m²K ✓
Periodic transmittance Yie (W/m²K)	Yie<0,10 ✓