

Project Information

Reference IS211
 Date 10 May 2006
 Client Scottsdale Steel UK Project Proposed Details for
 500 Chiswick High Road BRE Approval
 Centre 500 Suite 35
 W4 5RG

Construction type

Element : Wall - IS211 - 90mm studs 0.75mm thick @ 400 with render
 External wall insulation
 Internal surface emissivity : High External surface emissivity : High
 Light steel-frame construction - Cold frame or Hybrid type:-
 Stud depth, d : 90.0 mm Stud spacing, s (mm) : 400.0 mm
 Flange width : not exceeding 50mm p : 0.547

Construction

	Thickness (mm)	Thermal Conductivity (W/mK)	Thermal Resistance (m ² K/W)	Vapour Resistivity (MNs/gm)	Vapour Resistance (MNs/g)
Outside surface resistance	-	-	0.040	-	-
Render (BS5250)	5.0	0.800	0.006	100.00	0.50
Expanded polystyrene (BS5250)	40.0	0.035	1.143	300.00	12.00
20mm drainage cavity	-	-	0.180	-	0.00
Bitrock	22.0	0.050	0.440	51.00	1.12
Mineral Wool Insulation	50.0	0.038	1.316	5.90	0.30
Polythene, 1000 gauge (0.25mm) (BS5250)	-	-	-	-	500.00
Lafarge Firecheck	12.5	0.250	0.050	60.00	0.75
Inside surface resistance	-	-	0.130	-	-

U-value - 0.35W/m²K

U-value, Combined Method : 0.35 W/m²K (upper/lower limit 3.301 / 2.322 m²K/W, dUf 0.0000, dUg 0.0000, dUp0.0000, dUr0.0000)

(Correction for mechanical fasteners, Delta Uf = 0.000W/m²K)

(Correction for air gaps, Delta Ug = 0.000W/m²K)

(Based on the combined method for determining U-values of structures containing repeating thermal bridges.)

Detailed U-value Calculation Results

Construction includes 1 bridged layer.

Non-bridged layers

Outside surface resistance	0.040 m ² K/W
Render (BS5250)	0.006 m ² K/W
Expanded polystyrene (BS5250)	1.143 m ² K/W
20mm drainage cavity	0.180 m ² K/W
Bitrock	0.440 m ² K/W
Lafarge Firecheck	0.050 m ² K/W
Inside surface resistance	0.130 m ² K/W
Resistance of non-bridged layers, R _{NB} =	<u>1.989 m²K/W</u>

Bridged layer

Mineral Wool Insulation (L1) bridged by Steel studs (B1)

Path 1 - Mineral Wool Insulation

Path 2 - Steel studs

Resistance and fraction of heat flow paths

$$R_{P1} = R_{NB} + R_{L1} = 1.989 + 1.316 = 3.305 \text{ m}^2\text{K/W} \quad F_{P1} = 99.813\%$$

$$R_{P2} = R_{NB} + R_{L2} = 1.989 + 0.001 = 1.990 \text{ m}^2\text{K/W} \quad F_{P2} = 0.187\%$$

Upper resistance limit

$$R_{upper} = 1 / \left(\frac{F_{P1}}{R_{P1}} + \frac{F_{P2}}{R_{P2}} \right)$$
$$R_{upper} = 1 / \left(\frac{0.998}{3.305} + \frac{0.002}{1.990} \right) = 3.301 \text{ m}^2\text{K/W}$$

Lower resistance limit

$$R_{lower} = R_{NB} + 1 / \left(\frac{F_{L1}}{R_{L1}} + \frac{F_{B1}}{R_{B1}} \right)$$
$$R_{lower} = 1.989 + 1 / \left(\frac{0.998}{1.316} + \frac{0.002}{0.001} \right) = 2.322 \text{ m}^2\text{K/W}$$

Total resistance of wall

Light steel-frame construction - Cold frame or Hybrid type

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$$R_T = (p \times R_{upper} + (1 - p) \times R_{lower}) = (0.547 \times 3.301 + (1 - 0.547) \times 2.322) = 2.86 \text{ m}^2\text{K/W}$$

Correction for mechanical fasteners, Delta U_f = 0.000W/m²K. Correction for air gaps, Delta U_g = 0.000W/m²K

(Delta U_f + Delta U_g + Delta U_p) is less than 3% of (1 / R_t) so U = (1 / R_t) + (Delta U_r) = 0.35 W/m²K

Condensation Risk Analysis (no account taken of thermal bridges)

2 - Offices, Shops

Jan (worst)	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20.0C 49.8%	20.0C 48.9%	20.0C 49.5%	20.0C 50.6%	20.0C 55.2%	20.0C 60.4%	20.0C 65.9%	20.0C 66.4%	20.0C 62.9%	20.0C 58.0%	20.0C 52.4%	20.0C 50.9%
3.5C 86.0%	3.8C 82.5%	5.7C 80.0%	8.0C 77.0%	11.3C 77.0%	14.4C 76.0%	16.5C 76.5%	16.1C 78.5%	13.8C 81.5%	10.7C 84.0%	6.4C 85.5%	4.5C 86.5%

	Interface Temp. °C	Dewpoint Temp. °C	Vapour Pressure (kPa)	Saturated V.P. (kPa)	Worst Cond. (g/m ²)	Peak Buildup (g/m ²)	Condensation
1 Outside surface resistance							
2 Render (BS5250)	3.7	1.4	0.67	0.80			No
3 Expanded polystyrene (BS5250)	3.7	1.4	0.68	0.80			No
4 20mm drainage cavity	9.4	1.6	0.69	1.18			No
5 Bitrock	10.3	1.6	0.69	1.26			No
6 Mineral Wool Insulation	12.5	1.6	0.69	1.45			No
7 Polythene, 1000 gauge (0.25mm) (BS5250)	19.1	1.7	0.69	2.21			No
8 Lafarge Firecheck	19.1	9.2	1.16	2.21			No
9 Inside surface resistance	19.4	9.2	1.16	2.24			No

Worst case internal / external conditions for graph : 20.0°C @ 49.8%RH / 3.5°C @ 86.0%RH

