

Appendix E – BRUKL Document

Project name

Warrender Primary School

As designed

Date: Thu Sep 22 10:45:52 2016

Administrative information

Building Details

Address: Old Hatch Manor, Ruislip, London, HA4 8QG

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.5

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: Hillingdon Council

Telephone number: Phone

Address: Old Hatch Manor, London, HA4 8QG

Certifier details

Name: Vipul Dudhaiya

Telephone number:

Address: 34 York Way, London, N1 9AB

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	12.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	12.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	9.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.37	1.79	ST000021_W2_0_0
Floor	0.25	0.25	0.25	CT000000_F_3
Roof	0.25	0.25	0.25	CT000000_C_-1
Windows***, roof windows, and rooflights	2.2	1.99	1.99	CT000000_W4-W0
Personnel doors	2.2	2.2	2.2	CR000003_W15-W0
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs.				
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.				
*** Display windows and similar glazing are excluded from the U-value check.				
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Cooling for IT

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	1.25	-	-	-
Standard value	2.5*	1	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Warrender Heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- SYST0000-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.004
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	ID of system type	SFP [W/(l/s)]									HR efficiency	
		A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
ICT Suite / Library		-	-	-	-	-	-	-	-	-	-	N/A
Year 3		-	-	-	-	-	-	-	-	-	-	N/A
Year 4		-	-	-	-	-	-	-	-	-	-	N/A
Year 3		-	-	-	-	-	-	-	-	-	-	N/A
Year 4		-	-	-	-	-	-	-	-	-	-	N/A
Year 6		-	-	-	-	-	-	-	-	-	-	N/A
Year 6		-	-	-	-	-	-	-	-	-	-	N/A
Year 5		-	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency		
	ID of system type	A	B	C	D	E	F	G	H			I
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Year 5	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Store Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Cloak Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Studio Store	-	-	-	-	-	-	-	-	-	-	-	N/A
Studio	-	-	-	-	-	-	-	-	-	-	-	N/A
SRP Studio	-	-	-	-	-	-	-	-	-	-	-	N/A
SRP Ancillary Room	-	-	-	-	-	-	-	-	-	-	-	N/A
SRP Ancillary Room	-	-	-	-	-	-	-	-	-	-	-	N/A
SRP Ancillary Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Plant Room	-	-	-	-	-	-	-	-	-	-	-	N/A
SENco Office	-	-	-	-	-	-	-	-	-	-	-	N/A
Stair Core	-	-	-	-	-	-	-	-	-	-	-	N/A
Stair Core	-	-	-	-	-	-	-	-	-	-	-	N/A
Staircore	-	-	-	-	-	-	-	-	-	-	-	N/A
Staircore	-	-	-	-	-	-	-	-	-	-	-	N/A
Toilets	0.4	-	-	-	-	-	-	-	-	-	-	N/A
Toilets	0.4	-	-	-	-	-	-	-	-	-	-	N/A
SRP Toilets	0.4	-	-	-	-	-	-	-	-	-	-	N/A
ACC WC / Showers	0.4	-	-	-	-	-	-	-	-	-	-	N/A
Corridors	-	-	-	-	-	-	-	-	-	-	-	N/A
Corridors	-	-	-	-	-	-	-	-	-	-	-	N/A
Staff WC / Shower	-	-	-	-	-	-	-	-	-	-	-	N/A
Staff Room	-	-	-	-	-	-	-	-	-	-	-	N/A
Food Science / DT Suite	-	-	-	-	-	-	-	-	-	-	-	N/A
Tech Store	-	-	-	-	-	-	-	-	-	-	-	N/A
Store	-	-	-	-	-	-	-	-	-	-	-	N/A
Office Meeting Room	-	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Zone name				
Standard value	60	60	22	
ICT Suite / Library	463	-	-	81
Year 3	93	-	-	192
Year 4	93	-	-	192
Year 3	93	-	-	190
Year 4	93	-	-	192
Year 6	93	-	-	192
Year 6	93	-	-	192
Year 5	93	-	-	190
Year 5	93	-	-	192
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Store Room	93	-	-	6
Cloak Room	93	-	-	6
Cloak Room	93	-	-	6
Cloak Room	93	-	-	6
Cloak Room	93	-	-	5
Cloak Room	93	-	-	6
Cloak Room	93	-	-	5
Cloak Room	93	-	-	6
Cloak Room	93	-	-	6
Studio Store	93	-	-	11
Studio	93	-	-	261
SRP Studio	93	-	-	217
SRP Ancillary Room	93	-	-	44
SRP Ancillary Room	93	-	-	45
SRP Ancillary Room	93	-	-	62
Plant Room	93	-	-	40
SENco Office	93	-	-	61
Stair Core	-	185	-	22
Stair Core	-	185	-	22
Staircore	-	185	-	23
Staircore	-	185	-	23
Toilets	-	185	-	48
Toilets	-	185	-	48
SRP Toilets	-	185	-	16
ACC WC / Showers	-	185	-	18
Corridors	-	185	-	68

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
Corridors		-	185	-	75
Staff WC / Shower		-	926	-	8
Staff Room		463	-	-	68
Food Science / DT Suite		463	-	-	94
Tech Store		-	926	-	16
Store		463	-	-	16
Office Meeting Room		463	-	-	30

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
ICT Suite / Library	NO (-77.6%)	NO
Year 3	NO (-58.4%)	NO
Year 4	NO (-62.9%)	NO
Year 3	NO (-49%)	NO
Year 4	NO (-53.1%)	NO
Year 6	NO (-58.4%)	NO
Year 6	NO (-62.9%)	NO
Year 5	NO (-49%)	NO
Year 5	NO (-53.1%)	NO
Studio	NO (-69%)	NO
SRP Studio	NO (-66.8%)	NO
SRP Ancillary Room	NO (-65.3%)	NO
SRP Ancillary Room	NO (-66.2%)	NO
SRP Ancillary Room	NO (-63.2%)	NO
SENco Office	NO (-64.3%)	NO
Staff Room	NO (-65.9%)	NO
Food Science / DT Suite	NO (-68.4%)	NO
Office Meeting Room	NO (-71.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1397.6	1397.6
External area [m ²]	2334.4	2334.4
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	958.67	937.43
Average U-value [W/m ² K]	0.41	0.4
Alpha value* [%]	13.49	12.75

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

A1/A2 Retail/Financial and Professional services
A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
B1 Offices and Workshop businesses
B2 to B7 General Industrial and Special Industrial Groups
B8 Storage or Distribution
C1 Hotels
C2 Residential Inst.: Hospitals and Care Homes
C2 Residential Inst.: Residential schools
C2 Residential Inst.: Universities and colleges
C2A Secure Residential Inst.
Residential spaces
D1 Non-residential Inst.: Community/Day Centre
D1 Non-residential Inst.: Libraries, Museums, and Galleries
100 D1 Non-residential Inst.: Education
D1 Non-residential Inst.: Primary Health Care Building
D1 Non-residential Inst.: Crown and County Courts
D2 General Assembly and Leisure, Night Clubs and Theatres
Others: Passenger terminals
Others: Emergency services
Others: Miscellaneous 24hr activities
Others: Car Parks 24 hrs
Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	20.52	16.41
Cooling	0.53	0.36
Auxiliary	1.71	0.87
Lighting	4.04	12.26
Hot water	9.9	8.7
Equipment*	17.45	17.45
TOTAL**	36.71	38.61

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	107.42	130.77
Primary energy* [kWh/m ²]	55.8	71.58
Total emissions [kg/m ²]	9.7	12.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas									
Actual	91.9	26.7	8.7	9.9	0	2.94	0.75	3	1
Notional	50	86.9	5.7	6.7	0	2.43	3.6	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	62.6	44.1	21.2	0	1.8	0.82	0	0.92	0
Notional	50.2	80.2	17	0	0.9	0.82	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.25	CT000000_W4_-1
Floor	0.2	0.25	CT000000_F_3
Roof	0.15	0.25	CT000000_C_-1
Windows, roof windows, and rooflights	1.5	1.99	CT000000_W4-W0
Personnel doors	1.5	2.2	CR000003_W15-W0
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m ² K)]		U _{i-Min} = Minimum individual element U-values [W/(m ² K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m ³ /(h.m ²) at 50 Pa	5	5