BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Parliament Hill School Camden - Teaching Block

As designed

Date: Mon Sep 11 16:31:12 2017

Administrative information

Building Details

Address: Highgate Road, London, NW5 1RL

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.7

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.7

BRUKL compliance check version: v5.3.a.0

Owner Details

Name: Parliament Hill School

Telephone number: 020 74 857 077

Address: Highgate Road, London, NW5 1RL

Certifier details

Name: Troup Bywaters + Anders

Telephone number: 028 90 687 955

Address: 49 Malone Road, Belfast, BT9 6RY

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	19.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	19.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	11.7
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 fixed building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.13	0.13	LG000028:Surf[1]
Floor	0.25	0.13	0.13	LG000013:Surf[0]
Roof	0.25	0.11	0.11	R0000002:Surf[8]
Windows***, roof windows, and rooflights	2.2	1.19	1.2	LG000022:Surf[1]
Personnel doors	2.2	1.8	1.8	R0000002:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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	3

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Radiator Heating - Natural Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	-	0.2	0	-
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					YES
* 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.					

2- Changing AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	-	0.2	0	0.67
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* 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.					

3- Sports Hall AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	-	0.2	1.5	0.67
Standard value	0.91	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

4- Classroom MVHRs

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	-	0.2	0	0.8
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* 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.					

5- Server Room AC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	4	0	0	-
Standard value	0.91*	3.2	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 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.					

6- IT Classrooms AC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	4	0	0	-
Standard value	0.91*	3.2	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 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.					

"No HWS in project, or hot water is provided by HVAC system"

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.29
Standard value	Not provided	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	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
r004 acc wc	-	-	-	1.5	-	-	-	-	-	-	N/A
r006 student reception	-	-	-	1.5	-	-	-	-	-	-	N/A
r010 wc	-	-	-	1.5	-	-	-	-	-	-	N/A
r012 pupil chng	-	-	-	1.5	-	-	-	-	-	-	N/A
r013 acc wc chng	-	-	-	1.5	-	-	-	-	-	-	N/A
r015 acc wc chng	-	-	-	1.5	-	-	-	-	-	-	N/A
r018 wc	-	-	-	1.5	-	-	-	-	-	-	N/A
r019 pupil chng	-	-	-	1.5	-	-	-	-	-	-	N/A
r103 food technology	-	-	-	1.5	-	-	-	-	-	-	N/A
r104 food prep	-	-	-	1.5	-	-	-	-	-	-	N/A
r106 wc suite	-	-	-	1.5	-	-	-	-	-	-	N/A
r107 wc suite	-	-	-	1.5	-	-	-	-	-	-	N/A
r108 acc wc	-	-	-	1.5	-	-	-	-	-	-	N/A
r213 care (hygiene)	-	-	-	1.5	-	-	-	-	-	-	N/A
r214 therapy / mi	-	-	-	1.5	-	-	-	-	-	-	N/A
r216 wc suite	-	-	-	1.5	-	-	-	-	-	-	N/A
r218 prep room	-	-	-	1.5	-	-	-	-	-	-	N/A
r221 lab 1	-	-	-	1.5	-	-	-	-	-	-	N/A
r222 lab 2	-	-	-	1.5	-	-	-	-	-	-	N/A
r224 sp lab 1	-	-	-	1.5	-	-	-	-	-	-	N/A
r227 sp lab 2	-	-	-	1.5	-	-	-	-	-	-	N/A
r228 lab 3	-	-	-	1.5	-	-	-	-	-	-	N/A
r229 lab 4	-	-	-	1.5	-	-	-	-	-	-	N/A
r230 sp lab 3	-	-	-	1.5	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
lg morant stair	-	36	-	259

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
lg west stair	-	37	-	187
r001 entrance	-	266	-	26
r002 student services	117	-	-	99
r003 pe dance food	118	-	-	96
r004 acc wc	-	26	-	167
r006 student reception	-	176	15	47
r007 sports hall	-	63	-	5236
r008 pe store	134	-	-	32
r009 com st	202	-	-	5
r010 wc	-	28	-	367
r011 cl st	105	-	-	7
r012 pupil chng	-	52	-	170
r012 pupil chng lobby	-	82	-	30
r013 acc wc chng	-	49	-	58
r014 circulation	-	136	-	326
r015 acc wc chng	-	54	-	45
r018 wc	-	27	-	466
r019 pupil chng	-	51	-	166
r019 pupil chng lobby	-	102	-	21
r020 re	108	-	-	250
r021 re	108	-	-	246
r022 history	108	-	-	250
r023 history	108	-	-	246
r024 history	108	-	-	250
r025 history	108	-	-	246
r027 team (humanities)	118	-	-	218
r028 geography	108	-	-	248
r029 geography	108	-	-	247
r030 geography	108	-	-	246
r031 citizenship	108	-	-	249
r032 citizenship	108	-	-	247
r035 circulation	-	160	-	144
r103 food technology	-	137	-	762
r104 food prep	-	154	-	101
r105 circulation	-	142	-	165
r106 wc suite	-	26	-	523
r107 wc suite	-	26	-	523
r108 acc wc	-	31	-	120
r109 rm prep	110	-	-	301
r110 design eng	120	-	-	703
r111 server room	200	-	-	17
r112 comp sc	123	-	-	273
r113 comp sc	124	-	-	244

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
r114 healthcare / early years	118	-	-	177
r116 store	73	-	-	16
r117 maths seminar	118	-	-	180
r118 maths seminar	118	-	-	177
r119 store	98	-	-	13
r120 maths	114	-	-	235
r121 maths	115	-	-	232
r122 west stair	-	37	-	187
r123 circulation	-	152	-	196
r124 team maths / csci	118	-	-	218
r125 maths	115	-	-	233
r126 maths	115	-	-	232
r127 maths	115	-	-	231
r128 maths	115	-	-	234
r129 store	98	-	-	11
r130 ash & dh	135	-	-	120
r131 atl 9 & 10	126	-	-	93
r136 stairwell	-	36	-	345
r201 stairwell	-	36	-	337
r203 circulation	-	156	-	196
r204 wellbeing team	135	-	-	122
r205 sendco	124	-	-	93
r206 sen rb	141	-	-	102
r207 circulation	-	161	-	58
r208 sen study	120	-	-	121
r209 study room	130	-	-	80
r210 study room	128	-	-	83
r211 study room	104	-	-	168
r213 care (hygiene)	-	72	-	113
r214 therapy / mi	138	-	-	102
r215 store	118	-	-	8
r216 wc suite	-	27	-	523
r217 chem st	171	-	-	6
r218 prep room	127	-	-	919
r219 science studio 1	123	-	-	267
r220 circulation	-	165	-	148
r221 lab 1	117	-	-	955
r222 lab 2	117	-	-	955
r223 science studio 2	126	-	-	263
r224 sp lab 1	116	-	-	1037
r225 west stair	-	38	-	187
r226 team (science)	121	-	-	218
r227 sp lab 2	116	-	-	1032

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
r228 lab 3	117	-	-	955
r229 lab 4	117	-	-	955
r230 sp lab 3	116	-	-	1044

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?
r002 student services	NO (-63.6%)	YES
r003 pe dance food	NO (-50.2%)	YES
r006 student reception	N/A	N/A
r007 sports hall	NO (-81.9%)	NO
r020 re	NO (-11.4%)	YES
r021 re	NO (-8.3%)	YES
r022 history	NO (-9.3%)	YES
r023 history	NO (-8%)	YES
r024 history	NO (-9.3%)	YES
r025 history	NO (-5.8%)	YES
r027 team (humanities)	NO (-69.9%)	YES
r028 geography	NO (-38.3%)	YES
r029 geography	NO (-40.2%)	YES
r030 geography	NO (-39.9%)	YES
r031 citizenship	NO (-41.7%)	YES
r032 citizenship	NO (-41.9%)	YES
r109 rm prep	N/A	N/A
r110 design eng	NO (-56.7%)	YES
r111 server room	N/A	N/A
r112 comp sc	NO (-11.7%)	YES
r113 comp sc	NO (-48.3%)	YES
r114 healthcare / early years	NO (-8%)	YES
r117 maths seminar	NO (-9.2%)	YES
r118 maths seminar	NO (-7.9%)	YES
r120 maths	NO (-9.1%)	YES
r121 maths	NO (-5.6%)	YES
r124 team maths / csci	NO (-69.9%)	YES
r125 maths	NO (-38.2%)	YES
r126 maths	NO (-39.9%)	YES
r127 maths	NO (-39.4%)	YES
r128 maths	NO (-41.2%)	YES
r130 ash & dh	NO (-39.4%)	YES
r131 atl 9 & 10	NO (-42.9%)	YES
r204 wellbeing team	NO (-78.9%)	YES
r205 sendco	NO (-57.8%)	YES
r206 sen rb	NO (-77.3%)	YES
r208 sen study	NO (-79.5%)	YES

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
r209 study room	NO (-89.3%)	YES
r210 study room	NO (-80.1%)	YES
r211 study room	NO (-83.6%)	YES
r214 therapy / mi	N/A	N/A
r218 prep room	NO (-85.8%)	YES
r219 science studio 1	NO (-45.5%)	YES
r221 lab 1	NO (-8.6%)	YES
r222 lab 2	NO (-7.6%)	YES
r223 science studio 2	NO (-6.5%)	YES
r224 sp lab 1	NO (-8.9%)	YES
r226 team (science)	NO (-71.9%)	YES
r227 sp lab 2	NO (-39.9%)	YES
r228 lab 3	NO (-39.2%)	YES
r229 lab 4	NO (-39.9%)	YES
r230 sp lab 3	NO (-62.3%)	YES

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]	5063.5	5063.5
External area [m^2]	6884.1	6884.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	4
Average conductance [W/K]	1708.01	2686.77
Average U-value [W/m^2K]	0.25	0.39
Alpha value* [%]	10.04	10

* 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 Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
100	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: 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/m^2]

	Actual	Notional
Heating	15.08	15.02
Cooling	0.55	0.3
Auxiliary	3.82	2.09
Lighting	9.64	13.77
Hot water	48.61	36.68
Equipment*	19.11	19.11
TOTAL**	**64.81**	**67.87**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	5.07	0
Wind turbines	0	0
CHP generators	12.88	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	47.27	50.72
Primary energy* [kWh/m^2]	81.18	111.48
Total emissions [kg/m^2]	11.7	19.3

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36.6	0	6.9	0	1.2	0.86	0	0.92	0
	Notional	38.8	0	12.5	0	4.7	0.86	0	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	2.9	0	0.4	0	5.5	1.02	0	0.92	0
	Notional	50.6	0	16.3	0	0.9	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	56.7	0	9	0	9.2	0.86	0	0.92	0
	Notional	79.6	0	25.7	0	4	0.86	0	----	----
[ST] Central heating using water: convectors, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	73.2	0	13.6	0	10.3	0.86	0	0.92	0
	Notional	20.2	0	6.5	0	4	0.86	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	77.6	119.9	23.9	10.5	0	0.9	3.18	0.92	4.26
	Notional	86.9	72.1	28	5.3	0	0.86	3.79	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0.1	1155.5	0	100.8	0	0.9	3.18	0.92	4.26
	Notional	0.6	811.7	0.2	59.5	0	0.86	3.79	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	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 Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.13	LG000028:Surf[1]
Floor	0.2	0.13	LG000013:Surf[0]
Roof	0.15	0.11	R0000002:Surf[8]
Windows, roof windows, and rooflights	1.5	0.9	R0000002:Surf[7]
Personnel doors	1.5	1.8	R0000002:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3