BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Hampstead Secondary School

As designed

Date: Tue Mar 29 08:30:52 2016

Administrative information

Building Details

Address: Hampstead Secondary School, ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.2

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.2

BRUKL compliance check version: v5.2.b.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Nathan Evans

Telephone number: 01423 855 971

Address: Hornbeam House, Hornbeam Park, Hookstone Road, Harrogate, HG2 8QT

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

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	24.7
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	24.7
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	21.2
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	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 which do not meet standards in the 2013 Non-Domestic Building Services Compliance Guide are displayed in red.

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.19	0.19	0C000000:Surf[7]
Floor	0.25	0.16	0.16	0C000000:Surf[0]
Roof	0.25	0.13	0.13	0D000001:Surf[13]
Windows***, roof windows, and rooflights	2.2	1.48	1.48	0C000000:Surf[1]
Personnel doors	2.2	2.2	2.2	0C000000:Surf[2]
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	5

2.b 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- HVAC1: HTG NV

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.3	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- HVAC2: HTG EV

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.3	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.

3- HVAC3: HTG Hybrid

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.3	0	0.81
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.

4- HVAC5B: UFH Hybrid

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.3	0	0.81
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- HVAC4: Split Cooling

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.5	3.5	0	0	-
Standard value	2.5*	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 all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

6- SH HVAC2: HTG EV

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.96	-	0.3	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.

7- SH HVAC3: HTG Hybrid

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0.29	0	0.81
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.

8- SH HVAC 1: HTG NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0.3	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.

9- HVAC5: UFH

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0.3	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.

1- DHW1: General

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.003
Standard value	0.8	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
0 - CIRCULATION 01	-	70	-	283
0 - CIRCULATION 02	-	70	-	130
0 - CIRCULATION 03	-	70	-	109
0 - CLEANER STORE	70	-	-	13
0 - DINING	-	70	-	926
0 - DRAMA STUDIO	70	-	-	690
0 - EXTERNAL PE STORE	70	-	-	20
0 - KITCHEN/SERVERY	-	70	-	1403
0 - MAIN HALL	70	-	-	1949
0 - MUSIC CLASSROOM 01	70	-	-	409
0 - MUSIC CLASSROOM 02	70	-	-	407
0 - MUSIC CLASSROOM 03	70	-	-	387
0 - MUSIC PRACTICE 01	70	-	-	104
0 - MUSIC PRACTICE 02	70	-	-	91
0 - MUSIC PRACTICE 03	70	-	-	87

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
0 - MUSIC PRACTICE 04	70	-	-	88
0 - MUSIC PRACTICE 05	70	-	-	104
0 - MUSIC PRACTICE 06	70	-	-	142
0 - MUSIC PRACTICE 07	70	-	-	93
0 - MUSIC PRACTICE 08	70	-	-	93
0 - MUSIC PRACTICE 09	70	-	-	95
0 - OFFICE 01	70	-	-	145
0 - PLANT	70	-	-	165
0 - RECEPTION	-	70	22	84
0 - STAFF SOCIAL	70	-	-	641
0 - STAIRS	-	70	-	82
0 - STAIRS 02	-	70	-	81
0 - STAIRS 03	-	70	-	82
0 - STORE 01	70	-	-	17
0 - STORE 02	70	-	-	12
0 - STORE 03	70	-	-	11
0 - STORE 04	70	-	-	7
0 - STORE 05	70	-	-	20
0 - STORE 05	70	-	-	0
0 - STORE 06	70	-	-	20
0 - STORE 06	70	-	-	0
0 - WC 01	-	70	-	50
0 - WC 02	-	70	-	240
0 - WC 03	-	70	-	71
1 - CIRCULATION 01	-	70	-	553
1 - CLASSROOM 01	70	-	-	387
1 - CLASSROOM 02	70	-	-	384
1 - CLASSROOM 03	70	-	-	369
1 - CLASSROOM 04	70	-	-	369
1 - CLASSROOM 05	70	-	-	369
1 - CLASSROOM 06	70	-	-	370
1 - CLASSROOM 07	70	-	-	369
1 - CLASSROOM 08	70	-	-	369
1 - CLASSROOM 09	70	-	-	368
1 - CLASSROOM 10	70	-	-	369
1 - CLASSROOM 11	70	-	-	369
1 - CLASSROOM 12	70	-	-	387
1 - OFFICE	70	-	-	104
1 - REPROGRAPHICS	70	-	-	297
1 - STAFF WORK 02	70	-	-	365
1 - STAFF WORK ROOM	70	-	-	225
1 - STAIRS 01	-	70	-	82
1 - STAIRS 02	-	70	-	130

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1 - STAIRS 03	-	70	-	82
1 - STORE 01	70	-	-	13
1 - STORE 04	70	-	-	9
1 - STORE 05	70	-	-	15
1 - STORE 05	70	-	-	15
1 - WC 01	-	70	-	239
1 - WC 02	-	70	-	50
1 - WC 03	-	70	-	62
2 - CHEMICAL STORE	70	-	-	14
2 - CIRCULATION 01	-	70	-	523
2 - LAB 01	70	-	-	527
2 - LAB 02	70	-	-	530
2 - LAB 03	70	-	-	541
2 - LAB 04	70	-	-	525
2 - LAB 05	70	-	-	534
2 - LAB 06	70	-	-	524
2 - LAB 07	70	-	-	573
2 - LAB 08	70	-	-	716
2 - LAB 09	70	-	-	573
2 - LAB 10	70	-	-	531
2 - LAB 11	70	-	-	552
2 - SERVER	70	-	-	45
2 - STAFF WORK ROOM	70	-	-	323
2 - STAIRS 01	-	70	-	82
2 - STAIRS 02	-	70	-	129
2 - STAIRS 03	-	70	-	82
2 - STORE 01	70	-	-	13
2 - WC 01	-	70	-	236
2 - WC 02	-	70	-	49
SPORTS - FEMALE WC	-	70	-	129
SPORTS_activity store	70	-	-	30
SPORTS_activity studio	-	70	-	1013
SPORTS_clnrs store	70	-	-	18
SPORTS_community store	70	-	-	10
SPORTS_corridor	-	70	-	162
SPORTS_ex store	70	-	-	30
SPORTS_office / recep	-	70	22	93
SPORTS_other pupil wcs	-	70	-	94
SPORTS_pe store	70	-	-	42
SPORTS_pupil changing	-	70	-	162
SPORTS_pupil changing	-	70	-	161
SPORTS_sports hall	-	70	-	4067
SPORTS_staff change	-	70	-	33

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
SPORTS_store	70	-	-	56
SPORTS_wc	-	70	-	58

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?
0 - DINING	NO (-20.9%)	NO
0 - DRAMA STUDIO	NO (-40.8%)	NO
0 - MAIN HALL	NO (-49.1%)	NO
0 - MUSIC CLASSROOM 01	NO (-54.3%)	NO
0 - MUSIC CLASSROOM 02	NO (-47.2%)	NO
0 - MUSIC CLASSROOM 03	NO (-56.5%)	NO
0 - MUSIC PRACTICE 01	N/A	N/A
0 - MUSIC PRACTICE 02	N/A	N/A
0 - MUSIC PRACTICE 03	N/A	N/A
0 - MUSIC PRACTICE 04	N/A	N/A
0 - MUSIC PRACTICE 05	N/A	N/A
0 - MUSIC PRACTICE 06	NO (-65.2%)	NO
0 - MUSIC PRACTICE 07	NO (-39.1%)	NO
0 - MUSIC PRACTICE 08	NO (-56.2%)	NO
0 - MUSIC PRACTICE 09	NO (-42.1%)	NO
0 - OFFICE 01	NO (-70.3%)	NO
0 - RECEPTION	N/A	N/A
0 - STAFF SOCIAL	NO (-61.5%)	NO
1 - CLASSROOM 01	NO (-69.2%)	NO
1 - CLASSROOM 02	NO (-72.9%)	NO
1 - CLASSROOM 03	NO (-33.8%)	NO
1 - CLASSROOM 04	NO (-33.4%)	NO
1 - CLASSROOM 05	NO (-36.4%)	NO
1 - CLASSROOM 06	NO (-41.4%)	NO
1 - CLASSROOM 07	NO (-41.2%)	NO
1 - CLASSROOM 08	NO (-41.2%)	NO
1 - CLASSROOM 09	NO (-41%)	NO
1 - CLASSROOM 10	NO (-41.2%)	NO
1 - CLASSROOM 11	NO (-42.6%)	NO
1 - CLASSROOM 12	NO (-72.9%)	NO
1 - OFFICE	N/A	N/A
1 - REPROGRAPHICS	NO (-20.2%)	NO
1 - STAFF WORK 02	NO (-45.7%)	NO
1 - STAFF WORK ROOM	NO (-40.1%)	NO
2 - LAB 01	NO (-63.6%)	NO
2 - LAB 02	NO (-32.3%)	NO
2 - LAB 03	NO (-41.1%)	NO
2 - LAB 04	NO (-36.7%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
2 - LAB 05	NO (-62.7%)	NO
2 - LAB 06	NO (-68.2%)	NO
2 - LAB 07	NO (-43%)	NO
2 - LAB 08	NO (-40.1%)	NO
2 - LAB 09	NO (-45.2%)	NO
2 - LAB 10	NO (-44.6%)	NO
2 - LAB 11	NO (-66%)	NO
2 - SERVER	N/A	N/A
2 - STAFF WORK ROOM	NO (-30.7%)	NO
SPORTS_activity studio	NO (-18.3%)	NO
SPORTS_office / recep	N/A	N/A
SPORTS_sports hall	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the 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]	5344.9	5344.9
External area [m^2]	8765	8765
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	4
Average conductance [W/K]	2380.02	3292.17
Average U-value [W/m^2K]	0.27	0.38
Alpha value* [%]	10.01	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 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/m^2]

	Actual	Notional
Heating	12.04	26.98
Cooling	0.27	0.16
Auxiliary	5.84	5.43
Lighting	9.55	10.42
Hot water	49.39	49.74
Equipment*	18.38	18.38
TOTAL**	**77.08**	**92.74**

* 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	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	41.99	85.98
Primary energy* [kWh/m^2]	121.81	141.56
Total emissions [kg/m^2]	21.2	24.7

* 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	44.3	0	13.6	0	2.1	0.9	0	0.96	0
	Notional	45.5	0	14.7	0	1	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	21.9	0	6.8	0	21.7	0.9	0	0.96	0
	Notional	26.4	0	8.5	0	16.7	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	57.8	0	17.8	0	2.2	0.9	0	0.96	0
	Notional	57.9	0	18.7	0	1.1	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	17.9	0	5.5	0	5.6	0.9	0	0.96	0
	Notional	84.5	0	27.2	0	6.5	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	72.1	0	22.2	0	23.7	0.9	0	0.96	0
	Notional	75	0	24.2	0	18.3	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	1.1	1096.4	0.1	101.9	0	3.43	2.99	3.5	4
	Notional	1.9	842.2	0.2	61.7	0	2.56	3.79	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	70.3	0	21.7	0	10.8	0.9	0	0.96	0
	Notional	102.4	0	33	0	9.6	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	99.8	0	30.7	0	5.2	0.9	0	0.96	0
	Notional	190.5	0	61.4	0	4.7	0.86	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	79.1	0	24.4	0	6.5	0.9	0	0.96	0
	Notional	201.5	0	64.9	0	5.3	0.86	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	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.19	0K000000:Surf[8]
Floor	0.2	0.16	0C000000:Surf[0]
Roof	0.15	0.13	0D000001:Surf[13]
Windows, roof windows, and rooflights	1.5	1.45	SP000001:Surf[2]
Personnel doors	1.5	2.2	0C000000:Surf[2]
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	5