

Project name

The Russell School

As designed

Date: Wed Nov 26 17:22:26 2014

Administrative information

Building Details

Address: Petersham Road, Surrey, TW10 7AH

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: London Borough of Richmond

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO₂ 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	20.6
1.2	Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.6
1.3	Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	17.3
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 -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	00000005:Surf[0]
Floor	0.25	0.14	0.14	00000006:Surf[0]
Roof	0.25	0.12	0.18	11000008:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.28	1.4	04000001:Surf[1]
Personnel doors	2.2	2.2	2.2	0500000B: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 -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	3.24

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

1- UFH + Natural Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0	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					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.					

2- UFH + Mechanical Extract (zonal with remote fan)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0	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					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.					

3- UFH + Mechanical Supply & Extract with HR(80%)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0	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					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.					

4- UFH + Mechanical Supply & Extract with HR(50%)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.94	-	0	0	0.5
Standard value	0.91*	N/A	N/A	N/A	0.45
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.					

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

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.24
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	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
022 ACC WC		-	-	0.5	-	-	-	-	-	-	-	N/A
023 ACC WC		-	-	0.5	-	-	-	-	-	-	-	N/A
028 ACC WC		-	-	0.5	-	-	-	-	-	-	-	N/A
029 ACC WC		-	-	0.5	-	-	-	-	-	-	-	N/A
042GirlsWC		-	-	0.5	-	-	-	-	-	-	-	N/A
043BoysWC		-	-	0.5	-	-	-	-	-	-	-	N/A
058WC		-	-	0.5	-	-	-	-	-	-	-	N/A
061WC		-	-	0.5	-	-	-	-	-	-	-	N/A
063AWC		-	-	0.5	-	-	-	-	-	-	-	N/A
066NurseryToilets		-	-	0.5	-	-	-	-	-	-	-	N/A
074RWC		-	-	0.5	-	-	-	-	-	-	-	N/A
106AWC		-	-	0.5	-	-	-	-	-	-	-	N/A
109GirlsWC		-	-	0.5	-	-	-	-	-	-	-	N/A
110BoysWC		-	-	0.5	-	-	-	-	-	-	-	N/A
119AWC		-	-	0.5	-	-	-	-	-	-	-	N/A
071RWC		-	-	0.5	-	-	-	-	-	-	-	N/A
009 SWC		-	-	0.5	-	-	-	-	-	-	-	N/A
010AWC		-	-	0.5	-	-	-	-	-	-	-	N/A
038VisitorsSWC		-	-	0.5	-	-	-	-	-	-	-	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
005Corridor	-	75	-	0
006 SSpec Store	75	-	-	20
022 ACC WC	-	75	-	49
023 ACC WC	-	75	-	49
024 Store	75	-	-	27
028 ACC WC	-	75	-	49
029 ACC WC	-	75	-	49

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
030 Store		75	-	-	27
036Laundry		-	75	-	110
039clnrs		75	-	-	9
040Corridor		-	75	-	20
042GirlsWC		-	75	-	61
043BoysWC		-	75	-	61
049PEStore		75	-	-	29
049PEStore		75	-	-	0
050ChairAppliancestore		75	-	-	32
050ChairAppliancestore		75	-	-	0
051 Breakout Space 2		-	75	-	0
051 Breakout Space 3		-	75	-	0
057Grouproom		75	-	-	81
058WC		-	75	-	51
059Cloaks		-	75	-	40
060Grouproom		75	-	-	81
061WC		-	75	-	51
062Cloaks		-	75	-	40
063AWC		-	75	-	33
066NurseryToilets		-	75	-	67
067Hygieneroom		-	75	-	29
073Cloaks		-	75	-	22
074RWC		-	75	-	41
101Classroom07		75	-	-	414
102Classroom08		75	-	-	426
103Classroom09		75	-	-	427
104Classroom10		75	-	-	399
105 Circulation 2		-	75	-	291
106AWC		-	75	-	56
107Clnrs		75	-	-	12
107Clnrs		75	-	-	7
108Stairs		-	75	-	57
109GirlsWC		-	75	-	111
110BoysWC		-	75	-	106
111FoodTech		75	-	-	373
113Flexiblemeetingtrainingspace		75	-	-	289
114SENGrouproom		75	-	-	202
115Library		75	-	-	317
117Centralstock		75	-	-	31
119AWC		-	75	-	46
Riser 1		75	-	-	6
Riser 2		75	-	-	11
Riser 3		75	-	-	9

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
		60	60	22	
Riser 4		75	-	-	12
Riser 5		75	-	-	11
Riser 6		75	-	-	10
St 1		75	-	-	6
St 2		75	-	-	6
St 3		75	-	-	6
St 4		75	-	-	6
St 5		75	-	-	6
St 6		75	-	-	6
St 7		75	-	-	6
St 8		75	-	-	6
Store 1		75	-	-	14
Store 2		75	-	-	11
Store 3		75	-	-	11
071RWC		-	75	-	41
072Cloaks		-	75	-	22
013PPARoom		75	-	-	25
009 SWC		-	75	-	37
010AWC		-	75	-	47
011Repro		75	-	-	125
012Instrumentstore		75	-	-	14
047Plantroom		75	-	-	220
048Caretakersoffice		75	-	-	207
008Practiceroom		75	-	-	97
065NurseryKitchen		-	75	-	123
005Corridor		-	75	-	129
016MIRoom		75	-	-	289
017HeadTeacher		75	-	-	281
018Visitingprofesnlsoffice		75	-	-	229
019TherapySpecialist		75	-	-	229
020MobilityEquipmentBay		75	-	-	192
035Hygieneroom		-	75	-	75
037Kitchenette		-	75	-	203
038VisitorsSWC		-	75	-	52
033Sensoryroom		75	-	-	278
034SoftPlay		75	-	-	197
068NurseryClassroom		75	-	-	297
068NurseryClassroom Dimming		75	-	-	94
068NurseryClassroom		75	-	-	290
068NurseryClassroom Dimming		75	-	-	90
070ReceptionClassroom02		75	-	-	289
070ReceptionClassroom02 Dimming		75	-	-	90
007Musicroom		75	-	-	213

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
		60	60	22	
007Musicroom Dimming		75	-	-	69
052Classroom06		75	-	-	278
052Classroom06 Dimming		75	-	-	73
053Classroom05		75	-	-	277
053Classroom05 Dimming		75	-	-	72
054Classroom04		75	-	-	277
054Classroom04 Dimming		75	-	-	72
055Classroom03 Dimming		75	-	-	157
055Classroom03		75	-	-	207
027 Classroom 02 Dimming		75	-	-	130
027 Classroom 02		75	-	-	341
032 Classroom 02		75	-	-	318
032 Classroom 02 Dimming		75	-	-	169
026 Classroom 01 Dimming		75	-	-	169
026 Classroom 01		75	-	-	318
044SmallHall Dimming		-	75	-	460
044SmallHall		-	75	-	288
045MainHall Dimming		-	75	-	798
045MainHall		-	75	-	461
031a Small Group Room		75	-	-	111
031a Small Group Room Dimming		75	-	-	71
031b Small Group Room		75	-	-	111
031b Small Group Room Dimming		75	-	-	71
025a Small Group Room		75	-	-	111
025a Small Group Room Dimming		75	-	-	71
025b Small Group Room Dimming		75	-	-	71
025b Small Group Room		75	-	-	111
002Meeting Room		75	-	-	56
002Meeting Room Dimming		75	-	-	68
001Entrance		-	75	-	14
001Entrance Dimming		-	75	-	17
021 Corridor Dimming		-	75	-	23
021 Corridor		-	75	-	203
021 Corridor Dimming		-	75	-	17
116Cloaks Dimming		-	75	-	29
116Cloaks		-	75	-	32
112Cloaks Dimming		-	75	-	29
112Cloaks		-	75	-	32
118Stairs Dimming		-	75	-	22
118Stairs		-	75	-	86
041Stairs		-	75	-	31
041Stairs Dimming		-	75	-	28
051 Breakout Space 1 Dimming		-	75	-	16

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
051 Breakout Space 1		-	75	-	229
040 Corridor		-	75	-	128
040 Corridor Dimming		-	75	-	12
064 Stairs Dimming		-	75	-	16
064 Stairs		-	75	-	73
105 Circulation 1		-	75	-	45
105 Circulation 1 Dimming		-	75	-	22
003 SeniorManagers		75	-	-	77
003 SeniorManagers Dimming		75	-	-	68
004 HeadTeacher		75	-	-	98
004 Head Teacher Dimming		75	-	-	86
014 Staffroom Dimming		75	-	-	108
014 Staffroom		75	-	-	276
015 GeneralOffice		75	-	-	122
015 GeneralOffice Dimming		75	-	-	106
046 Kitchen Dimming		-	75	-	207
046 Kitchen		-	75	-	543

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?
057 Grouproom	N/A	N/A
060 Grouproom	NO (-99.2%)	NO
101 Classroom07	NO (-41.1%)	NO
102 Classroom08	NO (-53%)	NO
103 Classroom09	NO (-51.2%)	NO
104 Classroom10	NO (-27.8%)	NO
111 FoodTech	YES (+4.6%)	NO
113 Flexible meeting training space	NO (-48.1%)	NO
114 SEN grouproom	NO (-46.2%)	NO
115 Library	NO (-43.7%)	NO
011 Repro	N/A	N/A
048 Caretakers office	N/A	N/A
008 Practiceroom	N/A	N/A
016 MI Room	N/A	N/A
017 HeadTeacher	N/A	N/A
018 Visiting profesnlsoffice	N/A	N/A
019 Therapy Specialist	N/A	N/A
020 Mobility Equipment Bay	NO (-88.4%)	NO
033 Sensory room	NO (-98.8%)	NO
034 Soft Play	NO (-99.6%)	NO
068 Nursery Classroom	NO (-100%)	NO
068 Nursery Classroom Dimming	NO (-70%)	NO
068 Nursery Classroom	NO (-100%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
068NurseryClassroom Dimming	NO (-73%)	NO
070ReceptionClassroom02	N/A	N/A
070ReceptionClassroom02 Dimming	NO (-72.9%)	NO
007Musicroom	NO (-98.3%)	NO
007Musicroom Dimming	NO (-43.9%)	NO
052Classroom06	NO (-99.6%)	NO
052Classroom06 Dimming	NO (-63%)	NO
053Classroom05	NO (-98.7%)	NO
053Classroom05 Dimming	NO (-61.8%)	NO
054Classroom04	NO (-99.6%)	NO
054Classroom04 Dimming	NO (-62.1%)	NO
055Classroom03 Dimming	NO (-65.2%)	NO
055Classroom03	NO (-85.5%)	NO
027 Classroom 02 Dimming	NO (-68.6%)	NO
027 Classroom 02	NO (-99.6%)	NO
032 Classroom 02	NO (-91%)	NO
032 Classroom 02 Dimming	NO (-51.2%)	NO
026 Classroom 01 Dimming	NO (-65.5%)	NO
026 Classroom 01	NO (-97.6%)	NO
044SmallHall Dimming	NO (-55.9%)	NO
044SmallHall	NO (-98.3%)	NO
045MainHall Dimming	NO (-68%)	NO
045MainHall	NO (-97.7%)	NO
031a Small Group Room	N/A	N/A
031a Small Group Room Dimming	NO (-60.2%)	NO
031b Small Group Room	N/A	N/A
031b Small Group Room Dimming	NO (-61.9%)	NO
025a Small Group Room	N/A	N/A
025a Small Group Room Dimming	NO (-60.3%)	NO
025b Small Group Room Dimming	NO (-61.9%)	NO
025b Small Group Room	N/A	N/A
002Meeting Room	NO (-5.5%)	NO
002Meeting Room Dimming	NO (-4.1%)	NO
003SeniorManagers	NO (-45.2%)	NO
003SeniorManagers Dimming	NO (-1.2%)	NO
004HeadTeacher	NO (-37.5%)	NO
004 Head Teacher Dimming	NO (-1.1%)	NO
014Staffroom Dimming	NO (-14.7%)	NO
014Staffroom	NO (-75.6%)	NO
015GeneralOffice	NO (-69.3%)	NO
015GeneralOffice Dimming	NO (-28.3%)	NO

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?	NO
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]	2705.6	2705.6
External area [m ²]	6488.4	6488.4
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	1607.78	0
Average U-value [W/m ² K]	0.25	0
Alpha value* [%]	10.1	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/m²]

	Actual	Notional
Heating	25.69	27.51
Cooling	0	0
Auxiliary	2.74	1.86
Lighting	11.55	14.45
Hot water	59.12	29.83
Equipment*	19.13	19.13
TOTAL**	82.82	73.65

* 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	16.28	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	58.51	85.64
Primary energy* [kWh/m ²]	97.36	118.76
Total emissions [kg/m ²]	17.3	20.6

* 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] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	68.3	0	12.5	0	1.6	0.84	0	0.94	0
Notional	89.4	0	28.7	0	0.8	0.88	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	20	0	3	0	16.6	0.84	0	0.94	0
Notional	41.7	0	13.4	0	17.8	0.86	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	54.3	0	7.8	0	5.8	0.84	0	0.94	0
Notional	215.6	0	69.5	0	5	0.86	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	8.2	0	1.5	0	6.7	0.84	0	0.94	0
Notional	41.3	0	13.3	0	6.3	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-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.2	00000005:Surf[0]
Floor	0.2	0.14	00000006:Surf[0]
Roof	0.15	0.12	00000005:Surf[1]
Windows, roof windows, and rooflights	1.5	0.9	10000000:Surf[2]
Personnel doors	1.5	2.2	0500000B: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-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	3.24