

BRUKL Output Document

Compliance with Wales Building Regulations Part L 2014



Project name

UWTSD Phase 1 Library

As designed

Date: Mon Sep 26 17:13:07 2016

Administrative information

Building Details

Address: UWTSD Phase 1 Library, Swansea, SA1

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

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

Owner Details

Name: UWTSD

Telephone number: Phone

Address: Street Address, Swansea, Postcode

Certifier details

Name: Troup Bywaters and Anders

Telephone number: Phone

Address: 3 Park Place, Cardiff, CF10 3DP

Criterion 1: The calculated BER and BPEC for the building should not exceed the targets

Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	17
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.7
Building Primary Energy Consumption (BPEC), kWh/m ² .annum	137.8
Target Primary Energy Consumption (TPEC), kWh/m ² .annum	146.54
Do the building's emissions and primary energy consumption exceed the targets?	BER =< TER BPEC =< TPEC

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	0.14	0.49	1_000001:Surf[3]
Floor	0.25	0.22	0.3	21000000:Surf[4]
Roof	0.25	0.15	0.15	HF000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.5	1.5	GF000001:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	1.49	1.49	HF000000:Surf[2]
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	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- Rads & mech vent WC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	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- Rads & nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	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.					

3- FCU Heating/Cooling mech vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	5.5	0	1.6	0.65
Standard value	0.91*	2.55	N/A	1.6^	0.45
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.					
^ 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- Cooling Server

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	2.5	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"

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/(I/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		
1 IT Build	-	-	-	-	-	-	-	0.4	-	-	N/A
HF Entrance	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Learning Studio 1 30 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Learning Studio 1 30 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Learning Studio 1 30 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Teaching Room 24 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Teaching room 2 30 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 PC Desks 1 4 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Seating 1 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Main Stairs	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Reception	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Copying	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Seating 2 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Teaching Resources	-	-	-	-	-	-	-	0.4	-	-	N/A
0 Circ 1	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Group 1 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Group 3 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Group 2 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Group 4 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Help Desk 2 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Circ 1	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Laptop Charge 50	-	-	-	-	-	-	-	0.4	-	-	N/A
1 PC Desks 2 18pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Seating 4 16 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Seating 3 12 perss	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Circ 2	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Circ 3	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Seating 2 17 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Meeting 1 4 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Server	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Seating 1 16 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
1 Techno booths 3 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Seating 5	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Circ 1	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Seating 3	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Seating 1	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Books 1	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Books 2	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Seating 2	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Seating 14 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Books 3	-	-	-	-	-	-	-	0.4	-	-	N/A
2 PC desk 6 pers	-	-	-	-	-	-	-	0.4	-	-	N/A
2 Multimedia Workroom	-	-	-	-	-	-	-	0.4	-	-	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
2 Circ 2		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Office open		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Meeting 1 2pers		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Books 4		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Seating 4		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Circ 4		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Circ 3		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Quiet 2		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Quiet 1		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Meeting 2 4 pers		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Office cell 1pers		-	-	-	-	-	-	-	0.4	-	-	N/A
2 Office cell 1 pers		-	-	-	-	-	-	-	0.4	-	-	N/A
1 Learning Commons 2		-	-	-	-	-	-	-	0.4	-	-	N/A
1 PC Desks 1 4 pers		-	-	-	-	-	-	-	0.4	-	-	N/A
1 Seating 4 24 pers		-	-	-	-	-	-	-	0.4	-	-	N/A
1 Learning Commons 1 18 pers		-	-	-	-	-	-	-	0.4	-	-	N/A
1 PC Desks 6 pers		-	-	-	-	-	-	-	0.4	-	-	N/A
0 Seating 3 12 pers		-	-	-	-	-	-	-	0.4	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
0.0 WC		-	75	-	129
0.02 Stairs		-	75	-	78
0.01 Stairs		-	75	-	78
0.01 Cleaner		75	-	-	17
0.0 WC		-	75	-	129
1.02 Stairs		-	75	-	78
0.01 Stairs		-	75	-	78
1 IT Build		75	-	-	17
HF Entrance		-	75	-	14
HF Entrance		-	75	-	14
2.01 Server		75	-	-	185
2.0 WC		-	75	-	110
2.02 Stairs		-	75	-	64
2.01 Stairs		-	75	-	64
0 Learning Studio 1 30 pers		75	-	-	411
0 Learning Studio 1 30 pers		75	-	-	431
0 Learning Studio 1 30 pers		75	-	-	397
0 Teaching Room 24 pers		75	-	-	315
0 Teaching room 2 30 pers		75	-	-	410
0.01 Plant		75	-	-	208
0.02 Goods		75	-	-	32

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
0 Plant		75	-	-	36
0 PC Desks 1 4 pers		75	-	-	246
0 Pantry		75	-	-	94
0 Seating 1 6 pers		-	75	-	57
0 Main Stairs		-	75	-	116
0 Reception		-	75	-	186
0 Copying		75	-	-	121
0 Seating 2 6 pers		-	75	-	35
0 Teaching Resources		-	75	-	38
0 Circ 1		-	75	-	241
1 Group 1 6 pers		75	-	-	202
1 Group 3 6 pers		75	-	-	210
1 Group 2 6 pers		75	-	-	205
1 Group 4 6 pers		75	-	-	200
1 Help Desk 2 pers		-	75	-	58
1 Circ 1		-	75	-	108
1 Laptop Charge 50		75	-	-	249
1 PC Desks 2 18pers		75	-	-	501
1 Seating 4 16 pers		-	75	-	93
1 Seating 3 12 perss		-	75	-	81
1 Circ 2		-	75	-	119
1 Circ 3		-	75	-	114
1 Seating 2 17 pers		75	-	-	326
1 Meeting 1 4 pers		75	-	-	103
1 Server		75	-	-	117
1 Seating 1 16 pers		75	-	-	490
1 Techno booths 3 pers		75	-	-	143
2 Seating 5		-	75	-	61
2 Circ 1		-	75	-	63
2 Seating 3		-	75	-	49
2 Seating 1		75	-	-	189
2 Books 1		75	-	-	503
2 Books 2		75	-	-	381
2 Seating 2		75	-	-	253
2 Seating 14 pers		-	75	-	86
2 Books 3		-	75	-	124
2 PC desk 6 pers		75	-	-	113
2 Multimedia Workroom		75	-	-	156
2 Library Store		75	-	-	19
2 Circ 2		-	75	-	165
2 Office open		75	-	-	1008
2 Meeting 1 2pers		-	75	-	18
2 Books 4		-	75	-	33

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
2 Seating 4		-	75	-	60
2 Circ 4		-	75	-	26
2 Circ 3		-	75	-	117
2 Quiet 2		75	-	-	75
2 Quiet 1		75	-	-	62
2 Meeting 2 4 pers		-	75	-	24
2 Office cell 1pers		75	-	-	113
2 Office cell 1 pers		75	-	-	90
2 Multimedia Store		75	-	-	10
1 Learning Commons 2		-	75	-	85
1 PC Desks 1 4 pers		75	-	-	96
1 Seating 4 24 pers		75	-	-	465
1 Learning Commons 1 18 pers		75	-	-	390
1 PC Desks 6 pers		75	-	-	205
0 Seating 3 12 pers		-	75	-	82
0 Vending		75	-	-	68

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?
1 IT Build	N/A	N/A
HF Entrance	NO (-98.2%)	NO
2.01 Server	NO (-75.3%)	NO
0 Learning Studio 1 30 pers	NO (-21.3%)	NO
0 Learning Studio 1 30 pers	NO (-25.3%)	NO
0 Learning Studio 1 30 pers	NO (-18.7%)	NO
0 Teaching Room 24 pers	NO (-25.3%)	NO
0 Teaching room 2 30 pers	NO (-7.3%)	NO
0 PC Desks 1 4 pers	YES (+4.4%)	NO
0 Seating 1 6 pers	NO (-95.1%)	NO
0 Main Stairs	NO (-36.2%)	NO
0 Reception	NO (-80.8%)	NO
0 Copying	NO (-79%)	NO
0 Seating 2 6 pers	NO (-73.9%)	NO
0 Teaching Resources	NO (-76.4%)	NO
0 Circ 1	NO (-17.1%)	NO
1 Group 1 6 pers	NO (-78.1%)	NO
1 Group 3 6 pers	NO (-79.2%)	NO
1 Group 2 6 pers	NO (-58.6%)	NO
1 Group 4 6 pers	N/A	N/A
1 Help Desk 2 pers	N/A	N/A
1 Circ 1	NO (-83.1%)	NO
1 Laptop Charge 50	N/A	N/A
1 PC Desks 2 18pers	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 Seating 4 16 pers	N/A	N/A
1 Seating 3 12 perss	NO (-4.4%)	NO
1 Circ 2	NO (-59.9%)	NO
1 Circ 3	NO (-78.3%)	NO
1 Seating 2 17 pers	NO (-15.4%)	NO
1 Meeting 1 4 pers	NO (-58.2%)	NO
1 Server	N/A	N/A
1 Seating 1 16 pers	NO (-63.9%)	NO
1 Techno booths 3 pers	NO (-46%)	NO
2 Seating 5	NO (-46.6%)	NO
2 Circ 1	NO (-41.6%)	NO
2 Seating 3	NO (-62%)	NO
2 Seating 1	NO (-59.4%)	NO
2 Books 1	NO (-13.2%)	NO
2 Books 2	YES (+1.8%)	NO
2 Seating 2	NO (-44.3%)	NO
2 Seating 14 pers	NO (-84%)	NO
2 Books 3	NO (-80.8%)	NO
2 PC desk 6 pers	NO (-83.8%)	NO
2 Multimedia Workroom	NO (-69.9%)	NO
2 Circ 2	YES (+305.9%)	NO
2 Office open	NO (-70%)	NO
2 Meeting 1 2pers	NO (-99.5%)	NO
2 Books 4	NO (-22.5%)	NO
2 Seating 4	NO (-49.8%)	NO
2 Circ 4	YES (+17.1%)	NO
2 Circ 3	NO (-65.5%)	NO
2 Quiet 2	N/A	N/A
2 Quiet 1	NO (-73.3%)	NO
2 Meeting 2 4 pers	NO (-82.2%)	NO
2 Office cell 1pers	NO (-73.5%)	NO
2 Office cell 1 pers	NO (-83.7%)	NO
1 Learning Commons 2	NO (-53.3%)	NO
1 PC Desks 1 4 pers	NO (-56.6%)	NO
1 Seating 4 24 pers	NO (-42.5%)	NO
1 Learning Commons 1 18 pers	NO (-76.3%)	NO
1 PC Desks 6 pers	NO (-35.7%)	NO
0 Seating 3 12 pers	NO (-44.2%)	NO

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

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]	2604.8	2604.8
External area [m ²]	3731.5	3731.5
Weather	CAR	CAR
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	1809.23	0
Average U-value [W/m ² K]	0.48	0
Alpha value* [%]	11.46	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
100 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
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	26.05	23.97
Cooling	4.15	2.85
Auxiliary	20.38	19.97
Lighting	9.64	15.34
Hot water	3.05	2.51
Equipment*	45.48	45.48
TOTAL **	63.28	64.65

* 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	12.61	6.36
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]	133.38	113.24
Primary energy* [kWh/m ²]	137.8	146.54
Total emissions [kg/m ²]	17	21.7

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	79.6	61.1	25.9	4.8	24	0.85	3.53	0.95	4.5
	Notional	71.1	44.8	22.9	3.3	23.5	0.86	3.79	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	105.4	135.6	31.4	11.2	0	0.93	3.36	0.95	4.5
	Notional	123.9	114.2	39.9	8.4	0	0.86	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	191.1	0	59.5	0	1.9	0.89	0	0.95	0
	Notional	204.9	0	66	0	1.9	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	39	0	12.1	0	3.2	0.89	0	0.95	0
	Notional	31.4	0	10.1	0	5.6	0.86	0	----	----
[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
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