2.1.2 SBEM

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Calder Park

As built

Date: Wed Aug 24 17:52:37 2022

Administrative information

Building Details

Address: Easy Bathrooms, Peel Avenue, Wakefield, WF2 7UA

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.16

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.16

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Max Stephenson

Telephone number: 0113 493 1280

Address: Third Floor, Concordia Works, 30 Sovereign St, Leeds, LS1 4BA

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	20.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	20.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	12.9
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	0.35	0.35	00000023:Surf[6]
Floor	0.25	0.08	0.52	00000013:Surf[0]
Roof	0.25	0.23	0.23	00000023:Surf[331]
Windows***, roof windows, and rooflights	2.2	1.22	1.3	00000023:Surf[305]
Personnel doors	2.2	1.6	1.8	00000023:Surf[2]
Vehicle access & similar large doors	1.5	1.2	1.3	00000023:Surf[32]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* 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	0.93

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	>0.95

1- HVAC 03_EPH NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- HVAC 02_EPH EV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

3- HVAC 01a_VRF MVHR 01 (LHS)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	6.7	0	-	0.84
Standard value	2.5*	2.6	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 all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

4- HVAC 01b_VRF MVHR 03 (Hub)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.1	6.2	0	-	0.75
Standard value	2.5*	2.6	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 all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

5- HVAC 01b_VRF MVHR 02 (RHS)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.1	6.2	0	-	0.84
Standard value	2.5*	2.6	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 all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- DHW 01_Electric Heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.063
Standard value	1	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
00.04 GF Male Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
00.07 GF Disabled Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
00.08 GF Female Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
00.13 Reception / Meeting	-	-	-	1.5	-	-	-	-	-	-	N/A
00.14 Open Plan Office	-	-	-	1	-	-	-	-	-	-	N/A
00.17 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
00.18 WC	-	-	0.4	-	-	-	-	-	-	-	N/A
01.02 FF Male Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
01.06 FF Female Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
01.13 Open Plan Office	-	-	-	1.2	-	-	-	-	-	-	N/A
02.02 SF Male Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
02.06 SF Female Toilet	-	-	0.7	-	-	-	-	-	-	-	N/A
02.11 SF Meeting / Break Out	-	-	-	1.8	-	-	-	-	-	-	N/A
01.01 Open Plan Office (RHS)	-	-	-	1.8	-	-	-	-	-	-	N/A
01.01 Open Plan Office (LHS)	-	-	-	1.5	-	-	-	-	-	-	N/A
02.01 Open Plan Office (RHS)	-	-	-	1.8	-	-	-	-	-	-	N/A
02.01 Open Plan Office (LHS)	-	-	-	1.8	-	-	-	-	-	-	N/A
01.05 FF Acc WC	-	-	0.7	-	-	-	-	-	-	-	N/A
02.05 SF Acc WC	-	-	0.7	-	-	-	-	-	-	-	N/A
01.11 FF Meeting / Break Out Tea Point	-	-	-	1.5	-	-	-	-	-	-	N/A
01.11 FF Meeting / Break Out	-	-	-	1.5	-	-	-	-	-	-	N/A
03.01 Open Plan Office	-	-	-	1.8	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Excluded from calculation?
00.00 Warehouse	NO
00.01 GF Fire Escape Stairs	NO
00.02 GF Cleaners Cupboard	NO
00.03 Warehouse Undercroft	NO
00.04 GF Male Toilet	NO
00.05 GF Male Lobby	NO
00.07 GF Disabled Toilet	NO
00.08 GF Female Toilet	NO

Shell and core configuration

Zone	Excluded from calculation?
00.09 GF Female Lobby	NO
00.10 Circulation	NO
00.12 Store	NO
00.13 Reception / Meeting	NO
00.14 Open Plan Office	NO
00.15 Stairs	NO
00.16 Store	NO
00.17 WC	NO
00.18 WC	NO
01.00 GF Fire Escape Stairs	NO
01.02 FF Male Toilet	NO
01.03 FF Male Lobby	NO
01.06 FF Female Toilet	NO
01.07 FF Female Lobby	NO
01.08 Circulation	NO
01.08 Circulation	NO
01.12 Stairs	NO
01.13 Open Plan Office	NO
02.00 GF Fire Escape Stairs	NO
02.02 SF Male Toilet	NO
02.03 SF Male Lobby	NO
02.06 SF Female Toilet	NO
02.07 SF Female Lobby	NO
02.08 Circulation	NO
02.08 Circulation	NO
02.11 SF Meeting / Break Out	NO
03.00 GF Fire Escape Stairs	NO
03.02 Circulation	NO
03.02 Circulation	NO
01.01 Open Plan Office (RHS)	NO
01.01 Open Plan Office (LHS)	NO
02.01 Open Plan Office (RHS)	NO
02.01 Open Plan Office (LHS)	NO
01.05 FF Acc WC	NO
02.05 SF Acc WC	NO
01.11 FF Meeting / Break Out Tea Point	NO
01.11 FF Meeting / Break Out	NO
03.01 Open Plan Office	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00.00 Warehouse	100	-	-	120282
00.01 GF Fire Escape Stairs	-	124	-	39
00.02 GF Cleaners Cupboard	100	-	-	10

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00.03 Warehouse Undercroft	100	-	-	2640
00.04 GF Male Toilet	-	114	-	47
00.05 GF Male Lobby	-	114	-	7
00.07 GF Disabled Toilet	-	117	-	24
00.08 GF Female Toilet	-	114	-	44
00.09 GF Female Lobby	-	114	-	7
00.10 Circulation	-	124	-	116
00.12 Store	100	-	-	9
00.13 Reception / Meeting	124	-	-	147
00.14 Open Plan Office	127	-	-	477
00.15 Stairs	-	124	-	64
00.16 Store	100	-	-	5
00.17 WC	-	114	-	18
00.18 WC	-	114	-	18
01.00 GF Fire Escape Stairs	-	124	-	43
01.02 FF Male Toilet	-	114	-	47
01.03 FF Male Lobby	-	114	-	7
01.06 FF Female Toilet	-	114	-	44
01.07 FF Female Lobby	-	114	-	7
01.08 Circulation	-	124	-	60
01.08 Circulation	-	114	-	39
01.12 Stairs	-	124	-	39
01.13 Open Plan Office	127	-	-	605
02.00 GF Fire Escape Stairs	-	124	-	43
02.02 SF Male Toilet	-	114	-	47
02.03 SF Male Lobby	-	114	-	7
02.06 SF Female Toilet	-	114	-	44
02.07 SF Female Lobby	-	114	-	7
02.08 Circulation	-	124	-	60
02.08 Circulation	-	114	-	39
02.11 SF Meeting / Break Out	133	-	-	138
03.00 GF Fire Escape Stairs	-	124	-	43
03.02 Circulation	-	124	-	71
03.02 Circulation	-	114	-	35
01.01 Open Plan Office (RHS)	127	-	-	1441
01.01 Open Plan Office (LHS)	127	-	-	1333
02.01 Open Plan Office (RHS)	127	-	-	1441
02.01 Open Plan Office (LHS)	127	-	-	1333
01.05 FF Acc WC	-	117	-	24
02.05 SF Acc WC	-	117	-	24
01.11 FF Meeting / Break Out Tea Point	133	-	-	26
01.11 FF Meeting / Break Out	133	-	-	116
03.01 Open Plan Office	100	-	-	4029

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?
00.00 Warehouse	NO (-15.7%)	NO
00.03 Warehouse Undercroft	NO (-51.4%)	NO
00.13 Reception / Meeting	NO (-66.9%)	NO
00.14 Open Plan Office	NO (-79.2%)	NO
01.13 Open Plan Office	NO (-81.8%)	NO
02.11 SF Meeting / Break Out	NO (-77.5%)	NO
01.01 Open Plan Office (RHS)	NO (-57.4%)	NO
01.01 Open Plan Office (LHS)	NO (-71.5%)	NO
02.01 Open Plan Office (RHS)	NO (-57.4%)	NO
02.01 Open Plan Office (LHS)	NO (-71.5%)	NO
01.11 FF Meeting / Break Out Tea Point	NO (-81.9%)	NO
01.11 FF Meeting / Break Out	NO (-77%)	NO
03.01 Open Plan Office	NO (-64.4%)	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]	30841.3	30841.3
External area [m^2]	70722.2	70722.2
Weather	LEE	LEE
Infiltration [m^3/hm^2@ 50Pa]	1	3
Average conductance [W/K]	18790.8	22534.9
Average U-value [W/m^2K]	0.27	0.32
Alpha value* [%]	9.97	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
100	**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
	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	0.97	0.84
Cooling	0.37	0.63
Auxiliary	0.54	0.29
Lighting	19.05	35.27
Hot water	4.65	5
Equipment*	43.37	43.37
TOTAL**	**25.57**	**42.02**

* Energy used by equipment does not count towards the total for consumption or 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]	11.46	12.19
Primary energy* [kWh/m^2]	76.55	115.05
Total emissions [kg/m^2]	12.9	20.2

* 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] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	170.3	0	47.3	0	0	1	0	1	0
	Notional	121.1	0	39	0	0	0.86	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	93.8	0	26.1	0	11.8	1	0	1	0
	Notional	45.2	0	14.6	0	10	0.86	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	20.3	95.4	1.3	5.6	7.1	4.5	4.76	4.5	6.7
	Notional	15.8	118.5	1.7	8.7	3.6	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	16	98.9	1.1	5.8	7.4	4.1	4.76	4.1	6.2
	Notional	10.2	136.8	1.1	10	3.6	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	116.9	26.1	7.9	1.5	4.7	4.1	4.76	4.1	6.2
	Notional	94.7	76.4	10.3	5.6	3.6	2.56	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	0.35	0000000A:Surf[13]
Floor	0.2	0.07	00000023:Surf[0]
Roof	0.15	0.23	00000023:Surf[331]
Windows, roof windows, and rooflights	1.5	1	00000003:Surf[6]
Personnel doors	1.5	1	00000003:Surf[37]
Vehicle access & similar large doors	1.5	1.1	00000023:Surf[1]
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	0.93