156 West End Lane, West Hampstead
Planning Conditions 21 & 22

14 March 2022

Air Source Heat Pump (ASHP) & Gas Boiler details

Inspiring Built Environments

MEP
Sustainability
Building Physics

	Description	Prepared by	Reviewed by	Authorised by	Date
01	Draft issue for comment	Nathan Town	Kirk Buxton	James Taylor	04/11/21
02	Incorporates manufacturers Energy Calculations	Nathan Town	Kirk Buxton	James Taylor	09/11/21
03	Comments incorporated	Nathan Town	David Porter	James Taylor	03/12/21
04	Comments incorporated	James Taylor	Kirk Buxton	James Taylor	14/03/22

Audit Sheet

Contents

Introduction

Purpose of this report and overview of supplied information

The approved regeneration of 156 West End Lane (2019/4140/P) comprises 180 mixed tenure residential dwellings (use Class C3), flexible non-residential use (Class A1-A3, D1, D2), employment floorspace (Use Class B1) and community space (Use Class D1) in buildings ranging from 3 to 7 storeys. New vehicular access from West End Lane and the provision of accessible car parking spaces, in addition to new public open space, the widening of Potteries Path and associated cycle parking and landscaping.

The original parent permission (2015/6455/P) was approved on 23rd June 2017 and two pre-commencement planning conditions (Conditions 21 and 22), dealing with the details of the combined heat and power unit (CHP), emission standards and the air inlets were discharged in March 2020 (2019/6364/P).

In advance of a construction start on site, a detailed technical design review of the approved schemes has been undertaken by the applicant, Astir Living. A key element has focused on the approved energy scheme and the changes in both policy and direction that have taken place in energy and sustainability practices since the application was first approved in 2017.

The new London Plan (2021) recognises that the carbon savings from gas engine CHP are now declining as a result of national grid electricity decarbonising, and there is increasing evidence of adverse air quality impacts (paragraph 9.3.3). Therefore, FHPP has been working on improving the approved Energy Strategy (also submitted with this application) and now propose the use of more efficient Air Source Heat Pumps (ASHP) with a supplementary gas boiler to provide the heating and hot water production to the development. The ASHP and gas boiler will be located within the approved plant room, in the lower ground floor of the East building.

It is proposed that the wording of the relevant conditions within planning permission 2019/4140/P will be amended via an application made under S73 of the Town and Country Planning Act and this report has been prepared as the detail to discharge Conditions 21 and 22 in this respect.

This report provides the following information:

Appendix A:

- Manufacturers information on the proposed ASHP units: 5 No. Mitsubishi Electric CAHV-P500YB-HPB have been selected.
- Manufacturers information on the proposed gas boilers: 1 No. Hoval Ultragas 600D has been selected.

Appendix B:

- Manufacturers information on the ASHP and gas boilers highlighting the energy usage and how they meet the Mayor's Sustainable Design and Construction SPG (Condition 21).

Appendix C:

- Gas boiler flue route and location relative to air-inlet locations (Condition 22).

Overview of the ASHP/Gas boiler strategy

FHP has prepared an Energy Strategy (0001-L-FHP-DES-058-0001 Rev-P7 March 22) to support the proposals for the change from CHP to ASHP. When compared to the regulatory baseline scenario as set out in the GLA guidance and Part L 2012, the Energy Strategy concludes that the use of ASHP's alongside the supplementary gas boilers, and PVs on the roofs of both buildings reduce carbon emissions by 59% in the case of residential dwellings, and 43% in the case of non-residential areas.

The proposed ASHP units: 5 No. “Mitsubishi Electric CAHV-P500YB-HPB” (Please refer to Appendix A) will produce 40kWt thermal (each). The emissions produced from these units is less than that stated in Mayor’s Sustainable Design and Construction SPG (Please refer to Appendix B – Section 4.0 Primary Energy Comparison).

The proposed gas boilers: 1 No. “Hoval Ultragas 600D” (Please refer to Appendix A) will produce 603kWt thermal (each). The emissions produced from this unit is less than that stated in Mayor’s Sustainable Design and Construction SPG (Please refer to Appendix B).

The ASHP units will be located within within the approved plant room at lower ground floor level within the east building (Please refer to Appendix C).

The gas boiler will be located in the within the approved plant room at lower ground floor level within the east building (Please refer to Appendix C) and the flue associated with this unit will discharge at roof level of the third floor in the east building (link building). The flue will discharge between 1.5m and 2.5m above roof level (depending on a detailed flue design by a flue specialist) There are no air inlets located on the roof, eliminating the risk of the flue gasses contaminating any ventilation intakes.

Appendix A – ASHP & Gas Boiler Information

PROJECT NO. 11410
PROJECT NAME - 156 West End Lane
DOCUMENT REF - 0001-M-FHP-PLE-011-0001
SCHEDULE - BOILER SCHEDULE
REVISION - P02 | ISSUE DATE - 12.05.2021 | BY/CHECK - NT/BD

BOILER SCHEDULE

REFERENCE	BLR 01
No OF	1
MANUFACTURER/MODEL	Hoval Ultragas 600D
TYPE	Floor Mounted Modular
LOCATION	East Block Basement Boiler
HEATING CAPACITY (kW) @ 80/60)	603
WATER CONTENT (L)	529
DESIGN WATER OULET TEMP. (°C)	65
DESIGN WATER RETURN TEMP. (°C)	56
PRESSURE DROP (mbar)	10
% EFFICIENCY (SEASONAL GROSS)	98.3
FUEL	Natural Gas
GAS FLOW RATE (kW)	614
MINIMUM GAS PRESSURE (MBAR)	17.4
WEIGHT - DRY (KG)	1303
ELECTRICAL DETAILS	
VOLTS/PHASE/HERTZ	230V/1/50Hz
POWER (W)	1030
DIMENSIONS	
HEIGHT	1923
WIDTH	1880
DEPTH	1790
COMMENT	600D Boiler comes in transit as 2 boiler and is then Joined.

PROJECT NO. 11410
PROJECT NAME - 156 West End Lane
DOCUMENT REF - 0001-M-FHP-PLE-011-0005
SCHEDULE - ASHP SCHEDULE
REVISION - P02 | ISSUE DATE - 12.05.2021 | BY/CHECK - NT/BD

ASHP SCHEDULE

REFERENCE	**ASHP**
No OF	5
MANUFACTURER/MODEL	Mitsubishi Electric / CAHV-P500YB-HPB
TYPE	ASHP
LOCATION	East Block
HEATING CAPACITY (kW)	40
SPACE HEATING FLOW RATE (L/s)	2.1
TEMPERATURE FLOW & RETURN (°C) Summer	51-30
TEMPERATURE FLOW & RETURN (°C) Winter	56-35
PRESSURE DROP (kPa)	20.4
DIMENSIONS (mm)	1979mm(w) X 159mm (d) X 1650mm (H)
WEIGHT - DRY (KG)	526
SEASONAL COP	2.94 Minimum
	ELECTRICAL DETAILS
VOLTS/PHASE/HERTZ	230V/1/50Hz
MAX RUNNING CURRENT (AMPS)	52.9

Appendix B – CO^2 emissions

Heat Pump Sizing Assessment

Project Ref	**SAV/HP/114544/RS(MD)/09 Nov 2021**
Project Name	**West End Lane 156 (Rev 5)**
Proposal	**5no CAHV 43kW Heat Pump + Gas Boiler**
Assessor	**Megan De Nysschen**

Headlines

Source of emission factors:

SAP 10.1

Project Region:

1 Thames

Annual Heat Demand

746,039 kWh

Site Temperatures

Flow: 60°C

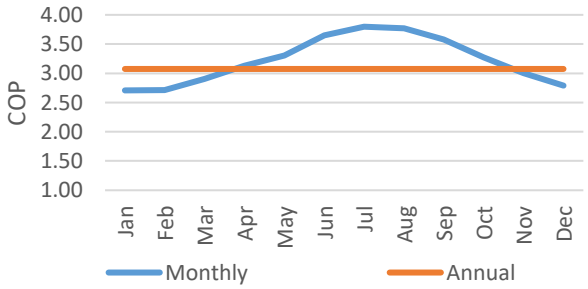
Return: 30°C

Heat Pump Max Outlet Temperature

51°C

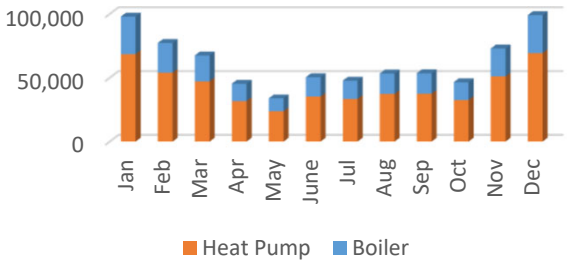
COP & SCOP

SCOP = 3.1



Heat Pump Share

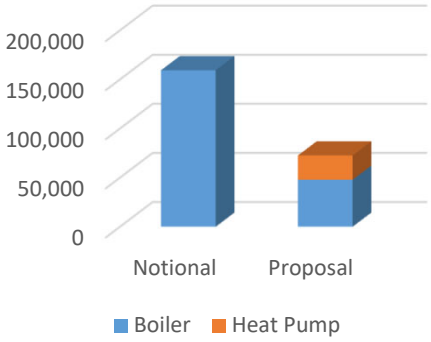
70%



Comparison with Notional Building

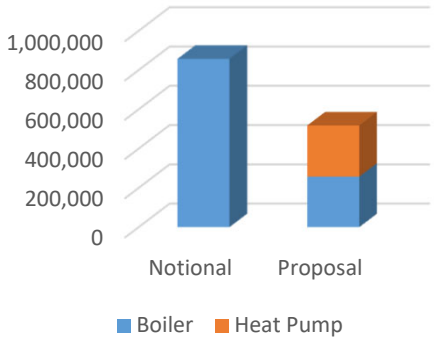
Carbon Footprint (kg/CO_2)

-54%



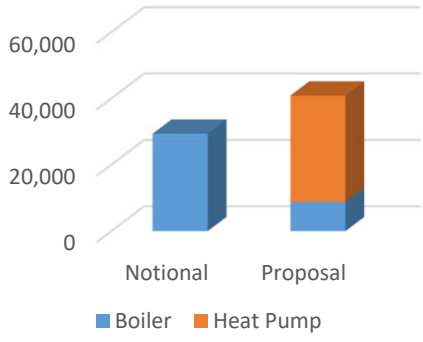
Primary Energy kWh

-40%



Operating Cost (£)

+39%



* Notional building with gas boiler

Report

NOTE: This assessment is specific to the CAHV Heat Pump only - As supplied by SAV Systems

Number of 43 kW CAHV heat pumps	5
Minimum HP Thermal Store Capacity	2000 litres
Type of Building	Multi-residential & Mixed Commercial
Data reference	BRUKL & SAP data from FHP Energy Strategy - Appendices dated October 2021 Ref 0001-L-FHP-DES-058-0001 Rev 4-P4. Data taken from 'Be Green' iterations of BRUKL & SAP

1.0 Summary of Usage:

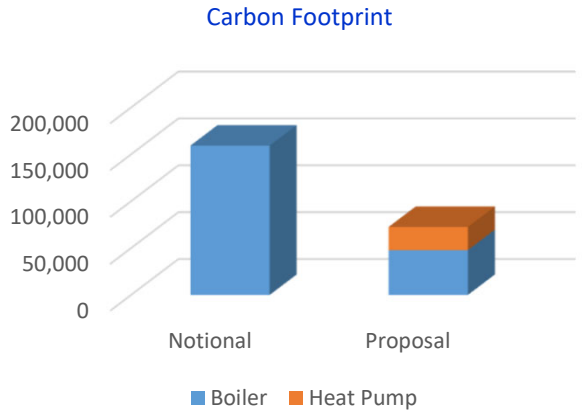
Annual heat demand	746,039 kWh	See Appendix Table 1
Site flow temperature	60°C	
Site return temperature	30°C	
Heat pump flow temperature	51°C	
Gas tariff	3.87 p/kWh	As PCDB Fuel prices (From January 2021)
Electricity tariff	18.9 p/kWh	As PCDB Fuel prices (From January 2021)

1.1 CO2 Emission Factors used:

Source of emission factors used	SAP 10.1
CO_2 Emmission Factor for Gas	0.210 kg CO2/kWh
CO_2 Emission factor for Grid Electricity	0.146 kg CO2/kWh

2.0 Carbon Footprint Comparison:

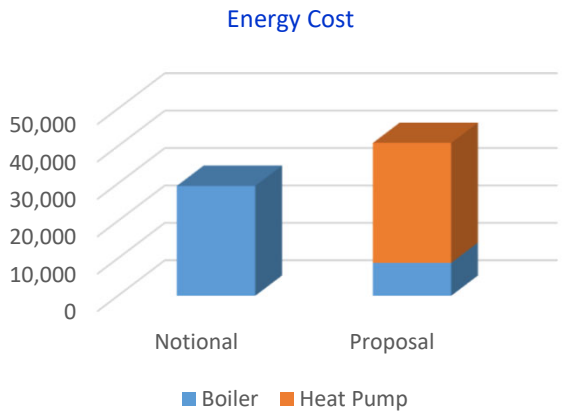
Notional Building (Gas Boiler)	159,378 kg CO_2 pa (See Appendix Table 6)
Heat Pump Solution	72,529 kg CO_2 pa (See Appendix Table 3)
Reduction	86,849 kg CO_2 pa



Carbon reduction due to proposed Heat Pump:	87 tonnes (compared with notional building)
	86,849 / 159,378 = 54% reduction

3.0 Energy Cost Comparison:

Notional Building (Gas Boiler)	£29,371 (See Appendix Table 6)
Heat Pump Solution	£40,868 (See Appendix Table 4)
Increase	£11,497

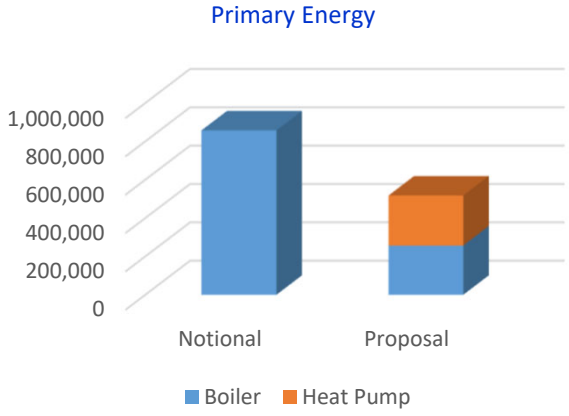


Energy cost increase due to proposed Heat Pump:

£11,497 (compared with notional building)
£11,497 / £29,371 = 39% increase

4.0 Primary Energy Comparison:

Notional Building (Gas Boiler)	857,603 kWh pa (See Appendix Table 6)
Heat Pump Solution	518,307 kWh pa (See Appendix Table 5)
Reduction	339,297 kWh pa

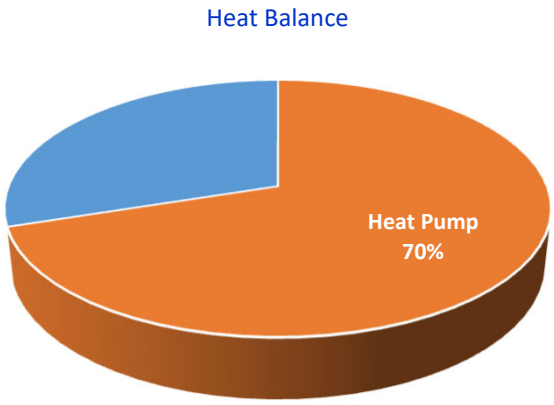


Primary Energy reduction due to proposed Heat Pump:

339,297 kWh (compared with notional building)
339,297 / 857,603 = 40% reduction

5.0 Heat Pump Share Of Heat

Building Heat Demand	746,039 kWh pa
Heat Pump Output	522,227 kWh pa (See Appendix Table 2)
Boiler Heat Output	223,812 kWh pa (See Appendix Table 2)
Heat Pump Share	**70.0%**
Boiler Heat Share	30.0%



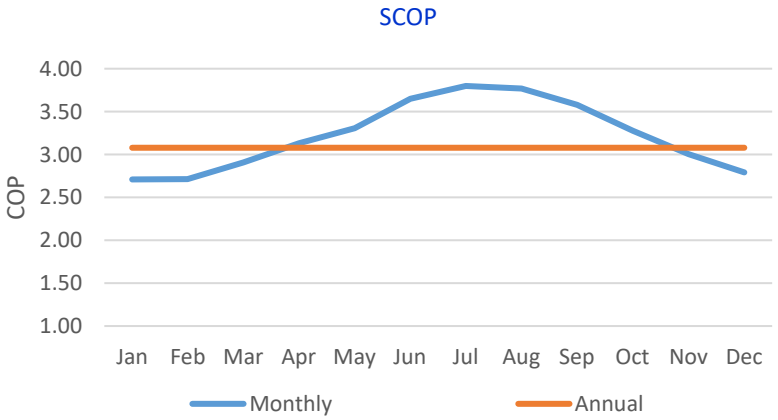
6.0 Seasonal Coefficient of Performance - SCOP

Heat Pump SCOP	**3.08** See Appendix Table 2

COP = Instantaneous
= Power In / Power Out

SCOP* = Seasonal
= Energy In / Energy Out

* or SPF - Seasonal Performance Factor



7.0 Appendix

TABLE 1 - Heating & DHW Demands

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Project Space Heating Demand	kWh	35,218	31,086	32,754	29,510	29,027	26,091	25,204	27,454	27,343	30,593	32,163	34,420	360,864
Project DHW Demand	kWh	62,765	46,251	34,787	15,875	4,892	24,375	22,587	25,919	26,228	15,980	40,809	64,707	385,175
Total Heat Demand	kWh	97,983	77,338	67,541	45,385	33,919	50,465	47,791	53,373	53,571	46,573	72,972	99,127	746,039

TABLE 2 - Heat Pump / Boiler Share

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Project Heat Demand	kWh	97,983	77,338	67,541	45,385	33,919	50,465	47,791	53,373	53,571	46,573	72,972	99,127	746,039
Heat Pump Heat Output	kWh	68,588	54,136	47,279	31,770	23,743	35,326	33,453	37,361	37,500	32,601	51,081	69,389	522,227
COP		2.71	2.71	2.91	3.13	3.30	3.65	3.80	3.77	3.58	3.27	3.00	2.79	3.08
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
Supplimentary Boiler Heat Output	kWh	29,395	23,201	20,262	13,616	10,176	15,140	14,337	16,012	16,071	13,972	21,892	29,738	223,812
Boiler Efficiency		98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
Share Of Heat From Heat Pump		70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
Share Of Heat From Boiler		30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%

TABLE 3 - CO_2 Calculations

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
CO_2 Factor Electric		0.163	0.160	0.153	0.143	0.132	0.120	0.111	0.112	0.122	0.136	0.151	0.163	0.146
Carbon Emission for Heat Pump	kg CO_2	4,124	3,195	2,490	1,451	948	1,162	978	1,110	1,278	1,354	2,570	4,055	24,716
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
CO_2 Factor Gas		0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Carbon Emission for Gas Boilers	kg CO_2	6,280	4,957	4,329	2,909	2,174	3,234	3,063	3,421	3,433	2,985	4,677	6,353	47,813
Carbon Emission for Proposal	kg CO_2	10,404	8,151	6,819	4,360	3,122	4,396	4,040	4,531	4,712	4,339	7,247	10,408	72,529

TABLE 4 - Energy Cost Calculations

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
Fuel Tariff for Heat Pump Electric	p/kWh	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90	18.90
Heat Pump Energy Cost		£4,782	£3,774	£3,076	£1,918	£1,358	£1,830	£1,664	£1,874	£1,980	£1,882	£3,217	£4,702	£32,057
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
Fuel Tariff for Boiler Gas	p/kWh	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
Boiler Energy Cost		£1,157	£913	£798	£536	£401	£596	£564	£630	£633	£550	£862	£1,171	£8,811
Energy Cost for Proposal		£5,939	£4,687	£3,873	£2,454	£1,758	£2,426	£2,229	£2,504	£2,613	£2,432	£4,079	£5,873	£40,868

TABLE 5 - Primary Energy Calculations

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Heat Pump Energy Input (Electric)	kWh	25,300	19,967	16,274	10,149	7,184	9,683	8,806	9,914	10,478	9,957	17,020	24,877	169,611
Primary Energy Factor Electric		1.602	1.593	1.568	1.530	1.487	1.441	1.410	1.413	1.449	1.504	1.558	1.604	1.539
Primary Energy Input for Heat Pump	kWh	40,531	31,807	25,517	15,528	10,683	13,953	12,417	14,009	15,183	14,976	26,518	39,903	261,026
Boiler Energy Input (Gas)	kWh	29,903	23,603	20,613	13,851	10,352	15,401	14,585	16,289	16,349	14,214	22,270	30,252	227,682
Primary Energy Factor Gas		1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130
Primary Energy Input for Gas Boilers	kWh	33,791	26,671	23,293	15,652	11,697	17,404	16,481	18,406	18,475	16,061	25,165	34,185	257,281
Primary Energy for Proposal	kWh	74,322	58,478	48,810	31,180	22,381	31,356	28,898	32,415	33,657	31,037	51,683	74,089	518,307

TABLE 6 - Notional Building

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Boiler Heat Output	kWh	97,983	77,338	67,541	45,385	33,919	50,465	47,791	53,373	53,571	46,573	72,972	99,127	746,039
Boiler Efficiency		98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Boiler Energy Input Gas	kWh	99,678	78,675	68,710	46,170	34,506	51,338	48,617	54,296	54,497	47,379	74,234	100,841	758,941
CO_2 Factor Gas		0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
Carbon Emission for Boilers	kg CO_2	20,932	16,522	14,429	9,696	7,246	10,781	10,210	11,402	11,444	9,950	15,589	21,177	159,378
Fuel Tariff for Boiler Gas	p/kWh	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
Boiler Energy Cost		£3,858	£3,045	£2,659	£1,787	£1,335	£1,987	£1,881	£2,101	£2,109	£1,834	£2,873	£3,903	£29,371
Primary Energy Factor Gas		1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.130	1.13
Primary Energy Input for Boilers	kWh	112,636	88,903	77,642	52,172	38,992	58,012	54,937	61,355	61,582	53,538	83,885	113,951	857,603

8.0 References

Total DHW

Quantity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total DHW
180	35,217.96	31,086.47	32,754.48	29,510.31	29,026.69	26,090.77	25,204.05	27,454.48	27,342.78	30,593.29	32,162.94	34,420.27	360,864.48

Total Heating

Quantity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total DHW
180	62,765.39	46,251.14	34,786.98	15,874.90	4,892.49	0.00	0.00	0.00	0.00	15,980.04	40,809.23	64,706.61	286,066.78

Appendix C – Gas Boiler Flue Requirements and Location Details

Lower Ground East Block Plantroom Location:

This drawing is based on:
0001-A-CTA-MO3-01-00-5500
0001-L-FAB-M03-ZZ-ZZ-0001
0001-S-IES-MO3-00-XX-5500

General Mechanical Notes

1. The drawings are to be read in conjunction with all other accompanying FHP drawings, schedules & specification documents.
2. All dimensions in millimetres unless otherwise noted.
3. The drawings are not to be scaled from.
4. All routes are to be checked on site prior to the commencement of works.
5. All pipework, ductwork & plant to be installed in accordance with the manufacturer's recommendations and guidelines.
6. All services routes are to be agreed between the design team and client prior to installation and to be checked on site prior to the commencement of works.

Lightwell above open to atmosphere

Louvered opening

Boiler Plant

Boiler Flue travels up to 3rd floor roof level from this point

5x ASHP c/w 760mm x 750mm Fresh Air & Exhaust Ductwork. 1500(L) x 750(H) x 760(W)Attenuators

80mmø LTHW F&R Drop to LL and Stack to serve ASHPs

15mmø Bib Tap

All external Heating Pipework shall be trace heated and insulated

350mmø Boiler Flue at HL

100mmø LTHW R at LL

100mmø LTHW F + R at HL

AIR & DIRT SEPERATOR

1200mm AFFL DOSING POT

1000L Vessel

65mmø GAS

125mmø incoming Gas Supply MDPE

Pumps installed on wall in vertical

P/ASHP

2x 2500 Litre Vessels

2500L Vessel

2500L Vessel

P/02

28mmø LTHW ... serve Buffer Vessels & Pressurisation Unit

Floor Mounted horizontal pipework

MECHANICAL CONTROL PANEL

MDB-PLANT

20mmøLTHW F+R & 28mmø BCWS Pipework at HL to serve Apartment

65mmø LTHW F+R to Below Ground

65ø LTHW F

65ø LTHW R

15mmø Bib Tap

28mmø CAT5 Pipework to Below Ground

28mmø CAT5 Pipework drops to CAT 5 Tank

108mmø BCWS Pipework drops to CAT 5 Tank

CAT5 TANK

MDB-LS

SPRINKLER PUMP SET

ENERGY CENTRE & TANK ROOMS
SCALE: 1 : 50

Electrical BMS Panel (BMS)

Mechanical Control Panel (MCCP)

80ø LTHW F

80ø LTHW R

108mmø BCWS Pipework at HL

28mmø CAT5 Pipework at HL

80mmøLTHW F+R Pipework at HL to serve Plant Room

108mmø BCWS Pipework from underground Storage Tank enters Plant Room at HL

32mmøLTHW F+R & 28mmø BCWS Pipework at HL to s... Riser

15mmø Bib Tap

28mmø BCWS Pipework at HL to Serve Apartment

20mmøLTHW F+R & 28mmø BCWS Pipework at HL to serve Apartment

28mmø CAT5 Pipework at HL

108mmø BCWS Pipework at HL

80mmøLTHW F+R Pipework at HL

65mmø LTHW F+R Pipework drop to Below ground see External Services Drawing. 50mmø LTHW F+R Pipework Rise to serve Floors Above

35mmø BCWS Pipework to Meter to serve Manifold
76mmø BCWS Pipework from Below Ground Rises to serve Floors Above

28mmø CAT5 Supply Pipework drop to Below Ground see External Services Drawing

0 1 2 3 4 5m
SCALE BAR

Rev	Date	Description	Drn	Chck
P05	06/12/21	Plantroom Revised	KW	DP
P04	12/05/21	Stage 4 Issue	KW	BD / DC
P03	07/05/21	Stage 4 Issue	KW	BD / DC
P02	12/02/21	Generator added	CT	BD / DC
P01	13/11/20	Preliminary Issue	CT	BD / DC

Client: astr.

Job Title: West End Lane

FHP
1a Brewery Place, Brewery Wharf, Leeds, LS10 1NE
Tel: 01132350860 Email: admin@fhpp.com

Drawing Title: Combined Services Plantroom Co-ordination Layout

Scale As indicated @ A1

FHP Job Number 11410

Stage 4 | S2

Drawing Number 0001-B-FHP-DRG-25-ZZ-5502

Revision P05

East Block Roof Level - Flue Termination:

This drawing is based on:
0001-A-CTA-MO3-01-00-5500
0001-L-FAB-MO3-ZZ-ZZ-0001
0001-S-IES-MO3-00-XX-5500

General Notes:

1. The drawings are to be read in conjunction with all other accompanying FHP drawings, schedules & specification documents.
2. All dimensions in millimetres unless otherwise noted.
3. The drawings are not to be scaled from.
4. All routes are to be checked on site prior to the commencement of works.
5. All heating and domestic hot water plant to be installed in accordance with the manufacturer's recommendations and guidelines.
6. All services routes are to be agreed between the design team and client prior to installation and to be checked on site prior to the commencement of works.

Heating Notes:

1. The contractor shall make adequate provision for expansion bellows & loops with all associated brackets, guides & anchors. Expansion bellows to be confirmed by specialist.
2. All pipework to be sleeved & fire stopped to BS 476 (1hr minimum) where passing through fire wall/cavity barriers/floors. Sleeves to be flush with services where pipework exposed.
3. Although not shown, include for AV's at all high points & drain cocks at all low points on the system.
4. All radiators to be fitted with TRV's & LST's
5. Radiator connections to be 8/6OE.
6. All main plant shall be installed with isolating valves & unions.
7. All pipework to be pressure tested prior to the application of insulation.
8. For final valve arrangement refer to relevant service schematic.

Legend

Symbol	Description
- - - -	Denotes Pipework within Ceiling Void
⋈	Isolation Valve
- SET	Denotes change in level

Rev	Date	Description	Drn	Chck
P03	12/05/21	Stage 4 Issue	KW	BD
P02	12/03/21	Stage 4 Issue	CT	BD
P01	06/11/20	Preliminary Issue	CT	BD

Client: astir.

Job Title: West End Lane

FHP
1a Brewery Place, Brewery Wharf, Leeds, LS10 1NE
Tel: 01132350860 Email: admin@fhpp.com

Drawing Title: East Block
Third Floor
Heating Services

Scale 1 : 100 @ A0

FHP Job Number: 11410

Stage 4 | S2

Drawing Number: 0001-M-FHP-DRG-56-03-5501

Revision: P03

SCALE BAR
0 1 2 3 4 5 6 7 8 9 10m