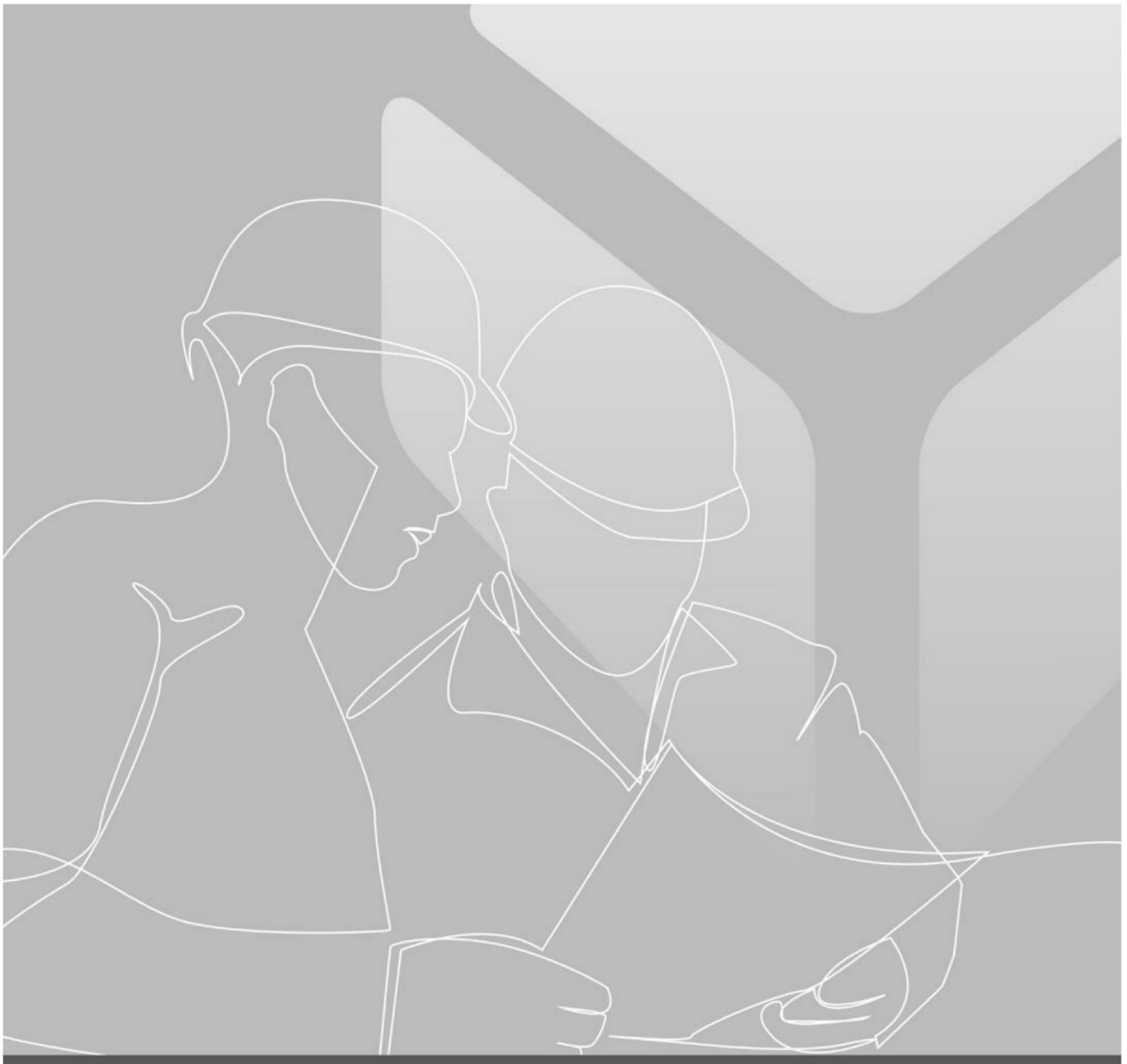

# FHP | Maintenance Strategy for the Air Source Heat Pumps and Solar PVs

Ruspini House

22 Parker Street

London

WC2B 5PH

**February 2023**

FHP ESS

# PARTICULARS

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# CONTENTS

# 1 INTRODUCTION

## 1.1 Background

FHP Engineering Services Solutions have been commissioned by the **Royal Masonic Trust for Girls and Boys**, to provide a site specific lifetime maintenance schedule for the new photo voltaic (PV) panels and high temperature split air source heat pump systems (ASHP) to be newly installed as part of the refurbishment works at **22 Parker Street, London, WC2B 5PH (Ruspini House).**

Ruspini House is being refurbished into 2no. ground floor masionettes, 2no. second floor flats, and 2no. third floor masionettes.

## 1.2 Site Description and Description of Works

The refurbished property is to generate space heating and domestic hot water via a new ASHP system. For each flat this will comprise of:

- Outdoor units from the ERGA range (except for the third floor masionettes which will have ERLA units) as manufactured by Daikin. These outdoor units shall be mounted externally in the external plant space to the rear of of Ruspini House, except the units for the third floor masionettes which will be located on the roof of Ruspini House
- Indoor units from the EHVH range (except for the third floor masionettes which will have EBVH units) as manufactured by Daikin. These units will be located internally within services cupboards as indicated on FHP ESS tender drawings and herein.

The third-floor maisonettes have part of their electrical load requirements provided via PVs mounted on the roof. There will be 14No. panels providing 450 Wp. The PV installation is to be complete with all DC cabling from the PV cells to the system inverters located at roof level, including the PV array DC isolator.

# 2 SITE SPECIFIC MAINTENANCE STRATEGIES

## 2.1 Maintenance Requirements

The ASHP system will require regular maintenance as stipulated herein and by Daikin. It should be noted, Daikin reserve the right to alter maintenance procedures as well as their required intervals. The ASHP will require yearly maintenance for every year across their life span. This is to ensure the ASHP can meet their expected economic life of 15 years (as indicated in CIBSE Guide M: Maintenance Engineering and Management).

The PVs installed on the roof will also require regular maintenance and cleaning to their major components to ensure they can meet their expected economic life of 25 years (as indicated in CIBSE Guide M: Maintenance Engineering and Management).

## 2.2 ASHP System

For each property at Ruspini House maintenance will be required to the ASHP outdoor units, indoor units, and connecting pipework and cabling.

### 2.2.1 Outdoor Units

The outdoor units of the ASHP shall be mounted externally in the external plant area to the rear of Ruspini House, except the units for the third floor masionettes which will be located on the roof of Ruspini House

The outdoor units will require yearly maintenance for every year across their life span. This is to ensure the outdoor units can meet their expected economic life of 15 years (as indicated in CIBSE Guide M: Maintenance Engineering and Management).

The following minimum maintenance checks and procedures shall be conducted on the outdoor units a minimum of once a year.

**Table 1: Minimum Yearly Maintenance Checks and Procedures**

| Checks/Procedures |
|---|
| Inspect fan motor mounting are securely fastened into place |
| Inspect and clean fan impellors |
| Inspect casings, frames, and panelling of units. Wire brush and paint any corrosion to units |
| Check all major components and local pipework for signs of corrosion, and damage. Replace sections as required. |
| Tighten all electrical connections, and inspect for signs of burning |
| Test insulation of compressor ensuring resistance value is more than 1 M ohm. |
| Turn on thermostats within flats to maximum temperature. As well as turn water temperature up to maximum. Measure room temperature, and water temperature ensuring temperatures achieved is as set. |
| Inspect cranckbase heater operation |

| |
|---|
| Check compressor oil level |
| Measure air flow intake into unit recording value, if value does not meet minimum values stipulated by Daikin, replace intake filter. Take new air flow intake measurements and ensure values meet minimum Daikin intake air flow rates. |
| Inspect fan ensuring there is no signs of damage or corrosion. Paint over any minorly corroded sections. Clean fan to ensure it is free of any debris and dirt |
| Clean the units heat exchanger |

### 2.2.2 Connecting Pipework

The ASHP comprising of the outdoor unit and indoor units are connected via insulated copper refrigerant pipework.

The contractor undergoing inspection shall note of the following proposed pipework routes and refer to the record drawings showing the routes:

- Outdoor units serving ground floor masionettes, and 2nd floor flats will have their pipework routing from the external plant space to the rear of of Ruspini House. This pipework then enters below ground in ducts and enters the building through internal risers.
- Outdoor units serving the third floor masinoneets will have their pipework routing from the roof internally through risers into the flats.

**Table 2: Minimum Yearly Maintenance Checks and Procedures for Pipework**

| **Checks/Procedures** |
|---|
| Inspect all accessible[1] pipework for signs of damage, and corrosion. Replace any sections showing moderate damage or corrosion. |
| Inspect all accessible[1] sections of insulated pipework. Where there is any damage to insulation, the section of damaged insulation shall be replaced for new. The section of pipework where the damaged insulation is should also be inspected for any signs of damage or corrosion, and if moderate damage or corrosion is present, section of pipework should be replaced for new. |
| Inspect all accessible[1] pipework. Ensuring all pipework is supported adequately on cable trays via tying by zip ties. All accessible[1] cable trays shall also be inspected, and where sections of cable trays show they are unable to adequately provide support and/or may cause damage to the services they are supporting, these sections should be replaced for new. |

### 2.2.3 Indoor Units

The indoor units of the heat pumps are located within service cupboards located at:

- The third-floor communal landing areas for the indoor units serving the third floor masionettes
- The second-floor communal landing areas for the units serving the second-floor flats
- At ground floor inside the ground floor maisonettes for the units serving the ground floor.

[1] Note, accessible sections of pipework are deemed to be all connecting pipework into and out of the indoor and outdoor units (in the external plant space to the rear of the building, and on the roof) , and pipework in risers.

The following minimum maintenance checks and procedures shall be conducted on the indoor units a minimum of once a year.

**Table 3: Minimum Yearly Maintenance Checks and Procedures for Indoor Units**

| Checks/Procedures |
|---|
| Ensure water pressure within the system is minimum 1 Bar. If less than 1 Bar add water to ensure water pressure is 1 Bar |
| Inspect water filter ensuring no damage. Clean water filter. |
| Ensure water pressure relief valve operates correctly by opening the valve.<br><br>If water flow from relief valve is sufficient and as per minimum outlined by Daikin, no blockage of the valve or in between piping is suspected.<br><br>If water flowing from relief valve is dirty, keep valve open until water discharging no longer contains dirt. After the water runs clear flush the system and install an additional water filter of the magnetic cyclone type |
| Inspect the pressure relief valve hose is positioned correctly to drain any water. |
| The same checks conducted on the pressure relief valve shall be conducted on the relief valve of the field supply. After checks, flush and clean the hot water tank, including piping between relief valve and cold water inlet. |
| Carry out a visual inspection of the switch box ensuring there is no loose connections, or defective wiring.<br><br>Check using Ohm meter that the contactors K1M, K2M, K3M, and K5M operate correctly. Ensure these contacts are in open position when the power is off. |
| Descale the exchanger element. It must be ensured that the water quality remains compliant with EU directive 98/83 EC. |

## 2.3 PV Panels System

The Solar Photovoltaic System will require regular maintenance as stipulated herein and by the manufacturers. It should be noted, the manufacturers reserve the right to alter maintenance procedures as well as their required intervals. The PV System will require yearly maintenance for every year across their life span as indicated on Table 4.

**Table 4: Minimum Yearly Maintenance Checks and Procedures**

| Checks/Procedures |
|---|
| Ensure regular cleaning of PV panels is carried. |
| Carry out a visual inspection of PV panels for signs of damage or corrosion. Also, ensuring they are properly fixed to the steel support. Tightening all supporting elements and replacing as required. |
| Inspect the steel support for signs of damage or corrosion. Also, ensuring they are properly fixed. Tightening all supporting elements and replacing as required. |
| Carry out regular maintenance of all thermal-based components. |
| Carry out a diagnosis and test pertaining to low solar power production. |
| Tighten all electrical connections and inspect for signs of burning. |
| Tracing of IV curves and thermal imaging. |
| Carry out a visual inspection of AC and DC wiring. Replace any cables showing moderate damage or corrosion. |
| Carry out an operational inspection of the DC-AC Inverters |
| Testing all circuits and protection devices, including the DC Isolators |
| Measure of earth value ensuring that the lightning and earthing system. Replacing as required to meet the minimum earth loop value according to BS7671. |

# 3 ACCESS, COMPONENT LIFE CYCLES AND END OF LIFE REMOVAL

## 3.1 Introduction

This section outlines the life spans of key components relating to the ASHPs and solar PVs. Additionally, this section outlines the locations of the ASHPs and solar PVs at Ruspini House and recommended methods and access equipment required to maintain the ASHPs and solar PVs

## 3.2 Access to External Plant

The solar PVs and ASHPs are located in the following locations:

- Ground floor external plant space, which will have have 4No. units arranged in 2No. rows.
- 2no. units units located on roof.
- Solar PVs located on the roof.

For economic life of key components of ASPHs, their locations, and recommended methods of access and access equipment required refer to Appendix A.

Following the refurbishment of Ruspini House, the roof will be accessible via a roof hatch from the third floor leading to the roof. The roof will also have a Mansafe system installed to allow maintenance personnel to safely attached safety lines to minimise risk of falls.

The solar PVs and ASHPs will be in the following locations on the roof.

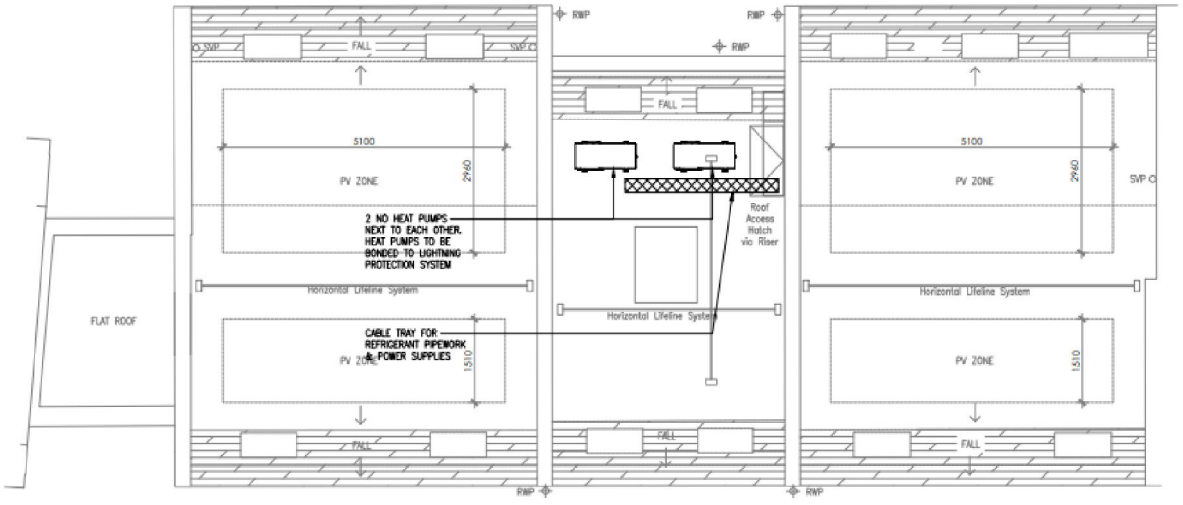


**Figure 1: Drawing Outlining Location of Mansafe System, ASHPs, and PVs**

**Figure 2: Aerial View of Ruspini House Roof (yellow)**

There are a number of components within the ASHPs indoor and outdoor units which may require replacement during their economic life as part of the planned maintenance strategies outlined in section 2. The planned maintenance strategy should reduce the likelihood that during the ASHPs economic life there will be any requirement for reactive maintenance or major maintenance.

## 3.4 Components and End of Life Removal

### 3.4.1 ASHPs

Appendix A outlines the economic life of key components of ASPHs as well as recommended methods to access plant for replacement.

The removal of the ASHPs indoor units (weighing 120 kg) at end of life should only be conducted after all associated pipework has been disconnected and capped and the unit drained of all its water. All the walls where the indoor unit is likely to be carried by should have protective plastic/foamed layering.

The removal of the ASHPs outdoor units should only be conducted when all associated pipework has been disconnected and capped. It shall be ensured that the refrigerant pipework and any removal of refrigerant from site shall:

- Include provision of containers for removal of refrigerant from site, degassing to container storage, removal of refrigerant from site, and safe disposal of redundant refrigerant (including provision of certification of safe disposal).
- The refrigerant gas shall not be discharged to atmosphere, it must be recaptured, contained, removed from the premises, and disposed of in an approved manner in accordance with British Standard, Codes of Practices and BSRIA documentation. Certification of safe disposal and F gas records should be supplied.

Removal of the outdoor units located on the roof should be via a crane, the crane should:

- Have a minimum of two belts, each being a minimum 8 m long.
- Use protectors to prevent belt damage.
- Use a belt sling less than or equal than 20 mm wide that adequately bears the weight of the unit

It is proposed that the crane is parked at 22 Parker Street, as there is only 2No. ASHPs on the roof disruption to the street will be minimal, and their removal take between 10-15 minutes.


**Figure 3: Recommended Location of Crane at For Removal of Outdoor Units Located on the Roof**

Removal of the outdoor units located on the ground floor should be either via careful carrying or their placement on trolleys. The route should be through the external exits at ground floor as shown in the figure below.

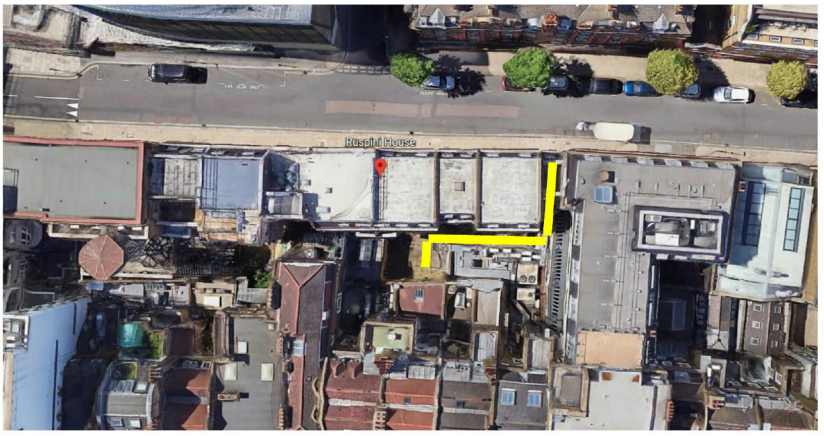


**Figure 4: Recommended Removal Route for Outdoor Units to be Located at Ground Floor**

### 3.4.2 Solar PVs

The removal of the Solar PV Panels at end of life should only be conducted after all associated wiring and protective devices have been disconnected and capped from the Electricity Distribution Network at the Smart Meter point.

Removal of the Solar PV Panels located on the roof should be via a crane, the crane should:

- Have a minimum of two belts, each being a minimum 8 m long.

- Use protectors to prevent belt damage.
- Use a belt sling less than or equal than 20 mm wide that adequately bears the weight of the unit

It is proposed that the crane parks at 22 Parker Street, as the solar panels shall be grouped on piles with a maximum of 5no. PV Panels per pile prior to the crane arriving on-site. In this case, the disruption to the street will be minimal, and their removal take between 30-60 minutes.

# Appendix A ASHP Key Components Life Spans, Accessibility, and Access Equipment Required

| Item No. | Components | Economic Life as Per CIBSE Guide M | Location | Access Equipment Required |
|---|---|---|---|---|
| 1 | Refrigerant pipework (linking outdoor units with indoor units) | 30 | Refrigerant pipework relating to outdoor units located on roof. Accessible via roof hatch.<br><br>Refrigerant pipework relating to outdoor units located in ground floor external plant space. Accessible via main entrance of Ruspini House<br><br>Refrigerant pipework between indoor and outdoor units accessible via openable risers on each floor | Outdoor units located on ground floor external plant space have 4No. units arranged in 2No. rows.<br>Ladder may be required to access components of stacked outdoor units.<br><br>Harnesses required to attach onto Mansafe system on roof<br><br>No other access equipment required. |
| 2 | Valves | 15 | Valves predominantly located internally<br>in indoor and outdoor units<br><br>Outdoor units located on roof. Accessible via roof hatch.<br><br>Outdoor units located in ground floor external plant space. Accessible via main entrance of Ruspini House<br><br>Indoor units located on third-floor communal landing areas for the indoor units serving the third floor masionettes<br><br>Indoor units located on second-floor communal landing areas serving second-floor flats<br><br>Indoor units located on ground floor inside the ground floor maisonettes serving ground floor maisonettes | Same access equipment requirements as Item 1 |
| 3 | Filters (water filters on indoor units, and air filter on intakes and exhausts of outdoor units) | 2 | Same locations as described in Item 1 | Same access equipment requirements as Item 1 |

| | | | | |
|---|---|---|---|---|
| **4** | Integral circulation pump for indoor units<br><br>Integral refrigerant circulation pumps for outdoor units | 20 | Same locations as described in Item 2 | Same access equipment requirements as Item 1 |
| **5** | Heat exchanger element in indoor unit | 15 | Same locations as described in Item 2 | Heat exchanger weighs 18 kg.<br><br>Contractor to carefully carry heat exchanger elements, carrying only one at a time. |
| **6** | Compressor integral to outdoor units | 20 | Outdoor units located on roof. Accessible via roof hatch.<br><br>Outdoor units located in ground floor external plant space. Accessible via main entrance of Ruspini House | Weight of compressor is 44.2 kg<br><br>Any movement of the compressors within the building shall be via mounting on a platform hand trolley. Movement up and down building shall be through the lifts. Walls and lift where trolley is to pass to be provided with protective plastic/foamed layering. |