# NATIONAL TRUST

# AIR SOURCE HEAT PUMP

# SMALL CAPACITY SPACE HEATING SYSTEMS

# LET ESTATE

# PERFORMANCE SPECIFICATION

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Low Carbon Consultant

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## SECTION 1 INTRODUCTION

### 1.1 General

a) This Document describes the performance requirements for small scale Air Source Heat Pumps for the National Trust Let Estate.

b) The performance requirements are to be read in conjunction with the National Trust ASHP Property Requirements Schedule which includes particular information.

c) The National Trust ASHP Property Particular Requirements Schedule shall include (but not limited to) the following information: -

i) Property Address, location.

ii) Location exposure.

iii) Current use of property, occupancy and if any changes are proposed.

iv) General description of the property together with any drawings (if available).

v) EPC or Draft EPC.

vi) Type of consent required (Planning / LBC).

vii) Indicative location of outdoor and indoor ASHP equipment.

viii) ASHP Outdoor unit screening / Indoor Unit formation of cupboard.

ix) Existing electrical incoming power supply Authorised Capacity.

x) If underfloor heating is required and if so which areas.

### 1.2 Employers Requirements

To comply with the National Trust General Requirements for Building Works as appended to this specification,

To design and supply an efficient heat pump system suitable for meeting the heat demand of the property, with an appropriate control strategy to suit the properties requirements.

Install new wet system or upgrade existing system in the properties to provide effective heating and Domestic Hot Water (DHW) (if appropriate) from the heat pump system.

Provide drawings suitable to support planning or listed building consent application where needed.

Provide a comprehensive warranty and maintenance package with suitable repair response times to satisfy the operational requirements of National Trust.

To obtain for Boiler Upgrade Scheme (BUS) (or successor funding scheme if known) where possible.

The Contractor shall assess fully the requirements, including design, procurement, manufacture, construction, commissioning, testing and BUS application to ensure that

the Programme can be achieved. This shall consider issues such as equipment lead times, winter maintenance periods, peak seasons and bank holiday weekends and potential restrictions to working out of hours as indicated by the NT Project Manager.

The details included in this document are indicative and not restrictive. Omission from this list of any element necessary for the construction and proper operation of the equipment does not release the Contractor from its obligation to supply a complete ASHP System in accordance with the accepted rules of good workmanship.

Where the Contractor requires additional information from the Employer in order to comply with the specification, such as the General Requirements for Building and/or Building Retrofit plan, they are to notify the Employer at the earliest opportunity with an Information Requirement Schedule inclusive of target delivery dates to achieve the programme.

## 1.3 Site Visit

The Contractor **shall** visit the site before tendering and ascertain all local conditions and restrictions likely to affect the execution of the Works. No claims arising from failure to do so will be considered.

**Site visits will be by appointment.**

## SECTION 2 PARTICULAR

### 2.1 General

The Contractor shall be MCS certified and the ASHP system shall be designed, installed and commissioned in accordance with MCS Standard MCS MIS 3005-D Issue 1.0 and MIS 3005-1 Issue 1.0 or other later amendments.

### 2.2 Heat Loss Calculation

To determine the capacity of the ASHP system, a site survey is required to establish the construction and thermal performance of the existing structure.

Heat loss calculations shall be carried out using the MCS Heat Pump Heat Loss Calculator or other approved method. A separate calculation shall be carried out to include the proposed fabric thermal improvements.

Calculations shall be provided with the Contractors Tender Submission.

### 2.3 Fabric Thermal Improvement

Refer to appended Building Retrofit Plan and/or subsequent detailed specification.

### 2.4 Temperature Design Criteria

Ambient design temperatures shall be assessed by the Contractor based upon the location of the property using CIBSE Guide A Table 2.4 to specify peak winter requirements as follows: -

| Weather Station Location | Reference Altitude (m) | A (°C DB) | B (°C DB) |
|---|---|---|---|
| Belfast | 68 | -1.5 | -3.2 |
| Birmingham | 96 | -3.2 | -5.1 |
| Cardiff | 67 | -1.5 | -3.1 |
| Edinburgh | 35 | -3.2 | -5.4 |
| Glasgow | 5 | -3.5 | -5.9 |
| London | 25 | -1.7 | -3.0 |
| Manchester | 75 | -2.7 | -4.5 |
| Plymouth | 27 | -0.2 | -1.5 |

These temperatures shall be reduced by 0.6°C for every complete 100m by which the altitude of the site exceeds that of the reference altitude.

If the property is designated as being in an exposed location, then column B shall be used.

Internal design temperatures shall be as follows: -

| Room | °C DB |
|---|---|
| Living | +21 |
| Dining | +21 |
| Bedsit | +21 |
| Bedroom | +18 |
| Hall and Landing | +18 |
| Kitchen | +18 |
| Bath / shower | +22 |
| WC | +18 |

## 2.5 Existing Heating and Hot Water Systems

Where properties space heating and domestic hot water which use grid electricity as the primary heating source, then this shall be completely removed and replaced by a ASHP wet heating and domestic hot water system or if appropriate local electric water heaters.

Where properties have an existing oil or LPG wet radiator heating and domestic hot water system, the boiler, cylinder, flue and associated fuel storage / pipework etc. shall be completely removed. Additionally, if the existing heating system is of the open vented type, then the feed and expansion tank, cold feed and open vent pipework shall be completely removed including the MCWS connection to the feed and expansion tank. Removal of existing redundant MCWS pipework shall leave no dead leg.

Following site survey, the suitability of existing radiator, underfloor heating and distribution pipework shall be reviewed including thermal imaging where appropriate. However it is expected that due to the lower ASHP water operating temperatures, it is expected that existing radiators will need to be replaced with new that have a larger heating surface area. If space for larger radiators is not possible then fan assisted radiators which fit within the available space shall be provided including associated power supplies.

It is accepted that at tender stage the soundness of existing concealed heating pipework may be unknown. The Contractor shall therefore include for all new heating pipework. If reuse of the existing heating pipework is proposed, then an optional price shall be indicated in the Tender Summary based upon reusing the existing. This optional price must include for testing the existing pipework to a minimum of 3 bar for a period of 1 hour together with certification upon completition of the pressure test.

## 2.6 ASHP Outdoor Unit Location

The National Trust ASHP Property Particular Requirements Schedule shall indicate a proposed location of the ASHP Outdoor Unit.

The Contractor shall verify in their Tender that the proposed location is satisfactory in terms of performance, noise nuisance, safe installation, maintenance and future removal at the end of the equipment's useful life in accordance with CDM Regulations. The Contractor is at liberty to offer alternative locations within their Tender but must clearly state the reasoning for this alternative proposal including any cost adjustments to their Tender price.

The ASHP Outdoor Unit shall be free standing and provided with an appropriate hard standing base and raised to keep free from snow and ice and installed on rubber mounting / anti vibration blocks together with flexible pipework connections to isolate the equipment from the property.

Adequate provision should be made to prevent condensation from collecting around the outdoor unit.

The National Trust ASHP Property Particular Requirements Schedule shall indicate if screening is required and the construction material.

Services penetration from the ASHP Outdoor Unit into the Building shall be carefully and sympathetically considered with proposed routes causing the least disturbance to the existing structure. Where subject to Listed Building Consent (LBC), penetration details and routes shall be fully detailed.

## 2.7 ASHP Indoor Unit Location

The National Trust ASHP Property Particular Requirements Schedule shall indicate a proposed location of the ASHP Indoor Unit.

The Contractor shall verify in their Tender that the proposed location is satisfactory in terms of performance, safe installation, maintenance and future removal at the end of the equipment's useful life in accordance with CDM Regulations. The Contractor is at liberty to offer alternative locations within their Tender but must clearly state the reasoning for this alternative proposal including any cost adjustments to their Tender price.

The National Trust ASHP Property Particular Requirements Schedule shall indicate if a sperate services cupboard is required to be built to contain the ASHP Indoor Unit. The construction materials and decoration of the cupboard shall be stated by NT.

Where ASHP Indoor units are proposed to be located on suspended floors, the structural integrity of the floor shall be verified by a professional engineer engaged by NT. The ASHP Contractor shall to advise the operating weight of the ASHP indoor unit and hot water cylinder to NT.

## 2.8 ASHP Electrical Power

The existing connected electrical load of the property shall be ascertained and reviewed with the Authorised Capacity of the incoming supply to determine if there is capacity available for ASHP. Where the spare capacity is considered marginal, load shedding shall be included such as replacing electric showers or water heaters with domestic hot water systems heated by the ASHP system.

The ASHP Contractor shall liaise with the DNO and obtain permission prior to commencement of the ASHP installation.

## 2.9 ASHP Equipment

The ASHP should be selected to provide 100% of the calculated heat loss taking into consideration the flow temperature at the heat pump and without input from any supplementary electric heater.

Performance data from both the heat pump manufacturer and the emitter system design shall be provided to support the heat pump selection to the NT Project Manager.

The ASHP system shall be able to maintain the internal design temperatures across multiple defrost cycles.

The selection of high temperature ASHP should be avoided unless the application requires flow temperatures in excess of 55°C.

The minimum NT acceptable SCOP rating for the ASHP system is 3 to 1 upon Practical Completition and at the end of the Defects Liability Period.

The ASHP power requirement shall be compatible with the available capacity of the existing incoming supply. In most cases the existing incoming power supply shall be single phase 50Hz.

For a neater and more compact indoor installation, the preference is for a combination system such as the Mitsubishi Electric Ecodan FTC6 Pre-Plumbed Cylinder or Packaged Unit.

ASHP equipment shall be intelligent and compact inverter-controlled units manufactured by either Mitsubishi Electric, NIBE or Vaillant (or equal and approved) and installed in accordance with the manufacturers requirements.

Where the buffer vessel is not integral to the ASHP indoor unit, a separate buffer vessel shall be provided in accordance with the ASHP manufacturers requirements. The buffer vessel capacity shall be a minimum of 100 litres.

Where circulating pumps are not integral to the indoor unit Pre-Plumbed Cylinder or Package Unit then these shall be ErP Directive for energy efficiency compliant manufactured either by Grundfos or Wilo.

## 2.10 Heating Pipework

ASHP heating systems shall be of the sealed type and provided with manual quick fill make up valves and suitable expansion vessel. The manual quick fill must be disconnected following commissioning. Expansion vessels shall be provided in accordance with BS EN12828.

New heating pipework shall be installed in concealed locations wherever practical to provide a neat appearance. Allowance should be made for lifting floorboards for example if pipework can be routed through floor voids.

New heating pipework shall be sized to suit the Δt of the ASHP system and where copper pipework is utilised the maximum design velocity shall not exceed 1m/s or a pressure loss of 300pa/m.

Copper pipes shall be of copper to BS EN 1057, R250 with dimensions to BS EN 1057 table 3 and shall bear the British Standard Institutions Certification “Kitemark”. Pipework shall have plain ends and shall be uncoated.

**Under no circumstances shall carbon steel pipework be provided.**

Pipework fittings shall be by Geberit Mapress (or equal and approved).

**Hot work is not permitted.**

Valves shall be manufactured by Peglar (or equal and approved).

Drain cocks shall be provided at all low points and air vents at all high points.

Pipework shall be supported in accordance with the manufacturer’ recommendations and in any event at intervals not exceeding the following table utilising proprietary brackets: -

| Pipe Bore | Copper Pipe (m) | |
|---|---|---|
| nom. | horiz | vert |
| 15 | 1.2 | 1.8 |
| 22 | 1.4 | 2.1 |
| 28 | 1.5 | 2.4 |
| 35 | 1.8 | 3.0 |

Pipework shall be installed in accordance with BS EN 12828, 14336 and pressure tested to twice the working pressure.

## 2.11 Heating Radiators

New Radiators shall be sized using the manufacturers heat output data corrected to the ASHP Δt system operating temperatures.

New Radiators shall be to BS EN 442 and carry the BS Kitemark and be manufactured by either Stelrad or Myson (or equal and approved).

Where radiators are being replaced then the new radiators shall be securely fixed to the structure including additional fixings or adaptations if required due to the new radiator being larger and heavier than the original. Floor brackets should be provided as supplementary support if required.

Radiators shall have valves provided in a TBOE arrangement and be complete with a TRV manufactured by either Danfoss, Drayton, Honeywell or Peglar (or equal and approved) together with matching LSV.

Generally retaining old steel panel radiators is uneconomic. However, the retention and reuse of original cast iron radiators is to be encouraged and these must be independently flushed and pressure tested to 3 bar for 1 hour before being re-incorporated.

Where spatial limitations restrict the use of traditional steel panel radiators, low water content fan assistance radiators may be used such as Smiths Eco Powered Fan Convectors or Jaga DBE (or equal and approved).

Auto bypass valve shall be provided to maintain minimum flow in the event of all TRV's closing.

## 2.12 Underfloor Heating

The ASHP Property Particular Requirements Schedule will state if any rooms are to be provided with underfloor heating and the proposed construction build-up of the floor including floor finish and if for example the floor is to be a Limecrete.

Underfloor heating shall be provided in accordance with BSRIA BG4/2011.

## 2.13 Pipework Thermal Insulation

All new and existing heating and domestic hot and cold water services pipework where concealed and at high level shall be thermally insulated.

Thermal insulation shall be provided in accordance with Approved Document Building Conservation of Fuel and Power Part L2B: 2021 Edition.

The whole of the thermal insulation shall be carried out by an approved specialist contractor appointed by the Contractor and shall comply with BS5970.

Self-adhesive flow arrows, service and colour identification bands shall be fitted to all insulated pipework in accordance with BS1710 and BS4800.

## 2.14 Controls

The ASHP system shall be provided with an intelligent integrated controller which is easy to understand and simple to use such as the Mitsubishi Electric Ecodan MELCloud including wi-fi interface (or equal and approved). However, not every property is connected to the internet and the following is the minimum functionality that shall be provided: -

Control
i) On/off
ii) Mode
iii) Heating setpoint
iv) Hot water boost.
v) 2 zone control
vi) Holiday mode
vii) Timer
viii) Frost protection
ix) Pasteurisation cycle.

Monitor
i) Mode
ii) Heating setpoint
iii) Tank Temperature
iv) Tank target temperature
v) Outside temperature
vi) Fault code
vii) Consumed electrical energy
viii) Produced heat energy.

The location of remote devices shall be carefully considered in terms of operational efficiency and being located sympathetically to the interior of the property. Controls cabling shall be installed flush unless agreed with NT.

## 2.15 Domestic Hot and Cold Water

Ideally and if not already, the existing domestic hot and cold-water system shall be converted to be directly connected to the incoming water main. This may not be possible if the property suffers from poor mains water pressure and there is an existing cold water storage tank in the loft.

During the Contractors site survey, the incoming water main capacity and pressure shall be assessed to establish if the domestic water system can be converted from tank to all direct mains. Based upon these findings, the Contractor shall provide a new indirect vented or indirect unvented hot water cylinder heated by the ASHP.

To minimise water consumption, particularly hot water, all existing taps, mixers, showers etc. are to be replaced with water saving fittings.

Where unvented hot water cylinders are provided then these shall be installed in accordance with Approved Document G3.

Electric immersion heaters shall be provided to the new hot water heater for the pasturisation cycle.

Minimum recommended domestic hot water cylinder sizes are as follows: -

| Hot Water Demand | Bedrooms | Cylinder Size (litre) ASHP 3 to 6KW | Cylinder Size (litre) ASHP 10 to 15KW + |
|---|---|---|---|
| 1 Bath or Shower | 1 | 150 | 90 |
| | 2-3 | 180 | 120 |
| | 3-4 | 210 | 150 |
| 1 Bath and Ensuite | 2-3 | 210 | 150 |
| | 3-4 | 210 | 150 |
| | 4-5 | 250 | 180 |
| 2 Bath | 2-3 | 210 | 180 |
| | 3-4 | 210 | 180 |
| | 4-5 | 250 | 210 |
| 3 Bath | 3-4 | 300 | 250 |
| | 4-5 | 300 | 250 |
| | 5-6 | 300 | 300 |

Existing domestic water services pipework shall be adapted to suit the location of the new hot water cylinder.

New domestic water services pipework shall be copper to BS EN 1057, R250 with dimensions to BS EN 1057 table 3 and shall bear the British Standard Institutions Certification “Kitemark”. Pipework shall have plain ends and shall be uncoated.

Pipework fittings shall be by Geberit Mapress (or equal and approved).

**Hot work is not permitted.**

Valves shall be manufactured by Peglar (or equal and approved).

Drain cocks shall be provided at all low points.

Pipework shall be supported in accordance with the manufacturer’ recommendations utilising brass Munson rings and backplates in exposed locations and at intervals not exceeding the following table utilising proprietary brackets: -

| Pipe Bore | Copper Pipe (m) | |
|---|---|---|
| nom. | horiz | vert |
| 15 | 1.2 | 1.8 |
| 22 | 1.4 | 2.1 |
| 28 | 1.5 | 2.4 |
| 35 | 1.8 | 3.0 |

Domestic water services pipework shall be installed in accordance with Water Regulations 1999:2021 Edition, HSEG274 and L8 control of legionella and pressure tested to twice the working pressure.

## 2.16 Water Treatment

Isolation and flushing valves must be provided for the ASHP primary and secondary circuits. Note that flushing of existing systems shall only be carried out of old existing systems following consultation with NT.

Primary and secondary circuits shall be pre-commissioned cleaned in accordance with BSRIA Guide BG29/2021.

Water treatment shall be provided to both the primary and secondary circuits in accordance with the manufacturer's recommendations and BSRIA Guide BG 50/2013.

Pipeline filtration shall be provided in accordance with the ASHP manufacturers recommendations.

Adequate provision should be made to protect pipework from freezing as recommended by the ASHP manufacturer. A minimum of 25% glycol dosage of the primary ASHP circuit shall be provided.

If the ASHP is adjacent to a water course then the glycol shall be low toxicity mono propylene glycol such as Cooltrans Plus CTL-NSF (HT1) or equal and approved.

The complete domestic water services system shall be disinfected in accordance with BS 8558.

## 2.17 Electrical

The Contractor shall provide all power and controls wiring associated with the ASHP System.

The electrical works shall be in accordance with BS 7671:2018+A2 2022 and carried out by an approved NICIEC contractor.

All newly installed circuits should be tested and recorded on an Electrical Installation Certificate and any existing circuits altered will require a Minor Works Certificate.

Types of newly installed wiring and accessories should be appropriate for the environment and in keeping with the existing installation.

All newly installed electrical equipment should have clearly labeled local isolation

Containment shall be prided which shall be white PVC conduit or trunking.

## 2.18 Energy Metering

All systems must be fitted with an electrical input meter and heat output meter. These should be separate from any integrated meters in the heat pumps controller. This is to allow for accurate measurement of COP and SCOP for performance evaluation. BUS/successor scheme compliant heat metering to be provided where necessary. Heat meters shall be MID Class 2 or 3. Where practical and feasible; all new meters to have remote access.

## 2.19 Drawings

The Contractor shall provide plan layout and elevation drawings at appropriate scales detailing the location of the ASHP outdoor and indoor unit, building penetrations, radiator positions, pipework and cable routes, along with other relevant information about the installation.

## 2.20 Builders Work in Connection (BWIC)

The Contractor shall include all BWIC, forming of plant cupboards and making good.

The Contractor shall also include for engaging structural engineers to provide advice on the suitability of the existing floors to suit the weight of the ASHP indoor unit / thermal storage vessel etc and any penetrations through or under existing structures.

Where required to meet the Fire Strategy of the property, service penetrations must be fire stopped to achieve 1-hour rating and should be in accordance with the Association for Specialist Fire Protection “Red Book” latest edition and carried out by an approved specialist.

During and post installation work, the property will need to be restored to the same level of finish prior to the works, internally and externally. This may include:

Replacement and repair of damaged floorboards when removed.

Making good damage to walls and woodwork, plasterwork, wallpaper, painting, repairs etc.

Burying or boxing in pipes and cables in walls, making good plasterwork.

Making good the marks left after removing equipment, marks on walls, floors, carpets etc.

Refitting or replacement of carpets, floor coverings where holes left by the legs of night store heaters.

Decoration of newly formed ASHP indoor unit cupboard.

Due to the nature of these properties – the quality of the finish is generally high - making good works will need to be agreed before works begin. The aesthetic finish of any making good works needs to be carefully considered.

Photos of the working areas prior to the commencement of work must be supplied to NT’s project manager before work can begin.

## 2.21 Reinstatement

All parts of the property and site disturbed or affected by the works must be reinstated to existing standard before the works commenced, or higher.

Landscaping, top-soil, turf and raised flower beds must be reinstated to match existing. Where necessary, reseeding should be carried out at appropriate time of year which may be within the defect’s liability period – additional reseeding may be required if growth is considered deficient.

## 2.22 Maintenance Space

New plant **must** be provided with the manufacturers recommended maintenance spacing. Where new cupboards are formed for the ASHP indoor unit and hot water cylinder, not only must there be adequate space around the equipment but suitable doors shall be provided to allow proper access for maintenance and future removal.

## 2.23 Testing and Commissioning

ASHP system shall be tested and commissioned in accordance with MIS 3005-1 Issue 1.0

Water systems shall be balanced in accordance with CIBSE Commissioning Code W.

Unvented hot water cylinders are to be commissioned by a suitably qualified engineer to Approved Document G3.

Electrical installation shall be tested in accordance with BS 7671:2018+A2 2022.

The above items will be carried out during the commissioning period and may be witnessed by the Employer and/or their appointed representative.

The operational performance of the ASHP will be monitored over the Defects Liability period and the operational SCOP verified.

Following completition of the final commissioning tests and acceptance, the Contractor shall arrange for a competent person to attend site to give one period of instruction to the Employer on the practical operation and maintenance procedures associated with the installation.

## 2.24 Operating and Maintenance Manual

The Contractor shall provide an Operating and Maintenance Manual in electronic copy. A draft manual shall be submitted to the CA no later than 2 weeks prior to practical completition for comment.

The Operating and Maintenance Manual shall be custom written and be clear and concise for the project and shall specifically contain the following sections: -

a) Description of the Works.
b) Description of the Operation.
c) Preventative Maintenance Schedule.
d) NT Helpline.
e) Equipment schedule / asset register.
f) Manufacturer's Literature.
g) As Fitted Drawings
h) Testing and commissioning certification
i) A printed and laminated simple user guide for retention within the Property
j) Manufacturer warranty details.

## 2.25 Aftercare

The property may be a holiday cottage or residential let. Attendance to reported faults is obviously critical throughout the year including bank holidays. The Contractor shall in their Tender Return state their maximum response time to attend site.

The Defects Liability Period is 24 months from date of Practical Completition.

## 2.26 Funding

Where eligible, all works and equipment are required to be in compliance with the Boiler Upgrade Scheme, including the supply and installation of a MID Class 2 Accuracy compliant heat meter and provision of all related certification and documentation at commissioning stage. Any pipe work that can be considered external is required to be properly insulated according to Ofgem guidelines.

## APPENDIX 1

| Item | Description | Information |
|---|---|---|
| 1 | Site address | |
| 2 | Location exposure, is the property sheltered from prevailing winds by trees, other properties etc. | |
| 3 | Current property usage and if any changes are proposed, is the property being converted, change of use etc. | |
| 4 | General description of the property, age, construction, no of storeys, | |
| 5 | Are drawings of the building available? | |
| 6 | Draft EPC | |
| 7 | Type of consent required, conservation, LBC etc. | |
| 8 | Indicative location of outdoor and indoor ASHP equipment | |
| 9 | ASHP Outdoor Unit screening / Indoor Unit formation of cupboard | |
| 10 | Existing electrical incoming power supply Authorised Capacity | |
| 11 | If underfloor heating is required and if so which areas | |

## APPENDIX 2

| Item | Description | Information |
|---|---|---|
| 1 | NT Retro Fit Plan | |