Heat Pump Service Procedure

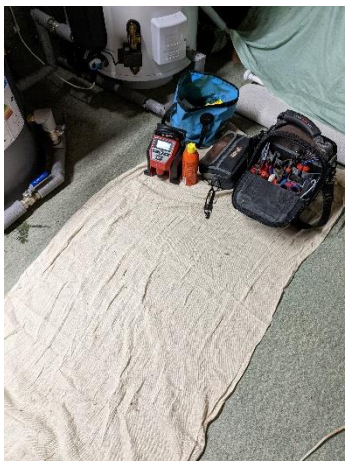
Tools required

- Hand tools
- Safety gloves
- Multi meter
- Clamp meter
- Clamp temperature sensors
- Fin comb
- Hand pressure washer
- Brush
- Hand pump or electric pump
- Dust Sheet
- Refractometer
- pH meter
- Working platform
- Coil cleaner (ASHP)
- Facia cleaner (ASHP)

Contents

1. Initial Assessment

Before starting any work, you must undertaken a dynamic risk assessment. Assess the work surroundings to ensure it is safe and check you have adequate space to complete all tasks. Please make sure you protect the clients property by using a dust sheet (Pic.1) and overshoes where necessary.



Pic.1 – Example work area with dust sheet

Familiarise yourself with the system before taking any information. Heat pump type, collector type, thermal storage, DHW storage, distribution and control system. Ask the customer how the whole system has been working and any problems, i.e. comfort levels, running costs or noise problems.

Check the unit runs. If it does not run, please inform the customer and office that the unit is not functioning and cannot be serviced. If the client and office are happy for you to proceed as a breakdown, then proceed. If not, then clear site and note any works undertaken.

1.1. Different Heat Pump types

- Air Source Heat Pump (ASHP) monobloc
    - The most commonly installed unit. This will include all refrigeration components in the outdoor unit
- ASHP split
    - The refrigeration components are split between the indoor and outdoor units. The outdoor unit will include the compressor, evaporator, filter drier, expansion valve and 4 way valve. There would then be a gas (small pipe) and liquid pipe (bigger pipe) to the indoor unit which would include the condenser.
- Ground Source Heat Pump (GSHP)
    - Indoor only unit which is connected to a ground array for its source energy. The array is either a horizontal or vertical collector.
- Water Source Heat Pump (WSHP)
    - Indoor only unit which is connected to a water source for its source energy. This can be closed or open loop.

    - Closed loop – a heat exchanger which is submersed in water but has no direct contact with the source
    - Open loop – when the water source is pumped to the heat pump (or via a internal PHE), energy extracted and discharged.
- Exhaust Air Heat Pump (EAHP)
    - Indoor only unit which has a system 3 (extract only) or 4 (heat recovery) ventilation system connected to the unit. It uses the extracted air as the source energy with an internal immersion for backup.

2. Servicing the appliance

2.1. Heat Pump setup and control

Find out how the system is currently setup. This will give you a starting point to help make any system adjustments and provide any advice to the consumer

Weather compensation or Fixed flow?

- Weather compensation maximises the heat pump efficiency and internal comfort. However the setup is critical for it to work effectively.
- If weather compensation has adaptive compensation activated, please deactivate if there is thermal storage and/or is an older home with higher heat loads.
- Fixed flow will not adjust flow temperatures so will provide a faster heat up time but will reduce system performance and internal comfort. Not recommended, but some units do not come with weather comp.

Third party thermostats

- If third party thermostats are installed on a weather comp system, ideally they should be setup as temperature limiters rather than temperature control. This means your weather compensation is providing optimum performance.
- The stats should be a programmable thermostat with a maximum setback of 3°C. This reduces load for heat up time.

Unheated rooms

- Its recommended not to turn off unheated rooms as this can effect system comfort and performance. This should only be done if it can be sealed from the rest of the building and system performance isn't effected.

Electrical tariffs

- Running cost of the heat pump will depend on the system efficiency but this won't matter if the client is on a high electrical tariff. Ensure the customer is shopping around for the best price. I always recommend a tariff with a slightly higher standing charger and lower p/kWh.

Product details

- Input all asset details onto SimPro. This includes the following;
    - A/GSHP – Manufacturer, model, serial no, refrigerant gas and charge weight
    - Buffer Vessel - Manufacturer, model, serial no

  - DHW Cylinder - Manufacturer, model, serial no
  - HP Controls - Manufacturer, model, serial no
  - Water Treatment (Elysator) - Manufacturer, model, serial no
- Please upload photos of the assets onto SimPro and any other relevant information

2.2. Heat Pump readings

Make note of all system readings on your service sheet. By doing this you will have a base to assess any changes and ensure the unit is in good working order.

- Max flow temp
  - This shouldn't be higher than 55°C but can be lower depending on emitters
- Min flow temp
  - This can be as low as 15°C if setup with **NO** thermal storage or third party control. Otherwise I recommend 25°C.
- Heat curve
  - Check manufacturers literature for curve parameters.
- Heat stop
  - The heating will stop when the outdoor temperature exceeds this temp. There is normally a hysteresis and/or time delay before it activates.
  - Recommend between 17°C to 21°C
- Compressor start – degree minutes
  - This is the control logic to start the compressor for heating production. It looks at the actual supply temp and required temp and subtracts one from the other every minute. When the figure reaches the set point the heat pump will turn on and run until it reaches 0 or a hysteresis of 12°C over target temp (the hysteresis is editable on some units)
  - Recommended compressor start setting -60 single phase and -100 three phase units
- DHW stop
  - Hot water stop temperature
  - Recommend between 50°C - 55°C
  - Some older units can only reach late 40°C and will use a auxiliary to top up to the designated stop temp
- DHW start / DHW Hysteresis
  - This is the temp when the hot water starts recharging
  - Recommend 6K – 10K below start temp
- DHW pasteurisation
  - Discuss with the client regarding legionella pasteurisation as it is there responsibility
  - Min temp for pasteurisation is 55°C for 2hrs
  - 60°C for 1hr
  - 65°C for 30min
- HP ground collector temperatures
  - We recommend a 2K to 5K ΔT
  - If out of these parameters check strainers and pump speed
- HP supply & return temperatures
  - We recommend a 5K to 10K ΔT
  - If out of these parameters check strainers and pump speed

2.3. Refrigeration readings

- Condensation temp
  - 0.5K – 1.5K over supply line temp
- Evaporation temp
  - 7K – 8K lower than incoming expansion line
- Superheat
  - 4K – 8K
- Sub cooling
  - 4K – 8K without sub cooler
  - 1K – 2K with sub cooler

Please note: it can take up to 20mins for refrigeration settings to settle

2.4. Maintenance

Now you've ascertained that the heat pump is working, you can now check over the appliance. Use the information taken from 2.2 & 2.3 to assess how you will approach the service and possible issues. Please note down any changes and anything which is not within parameters on your service sheet.

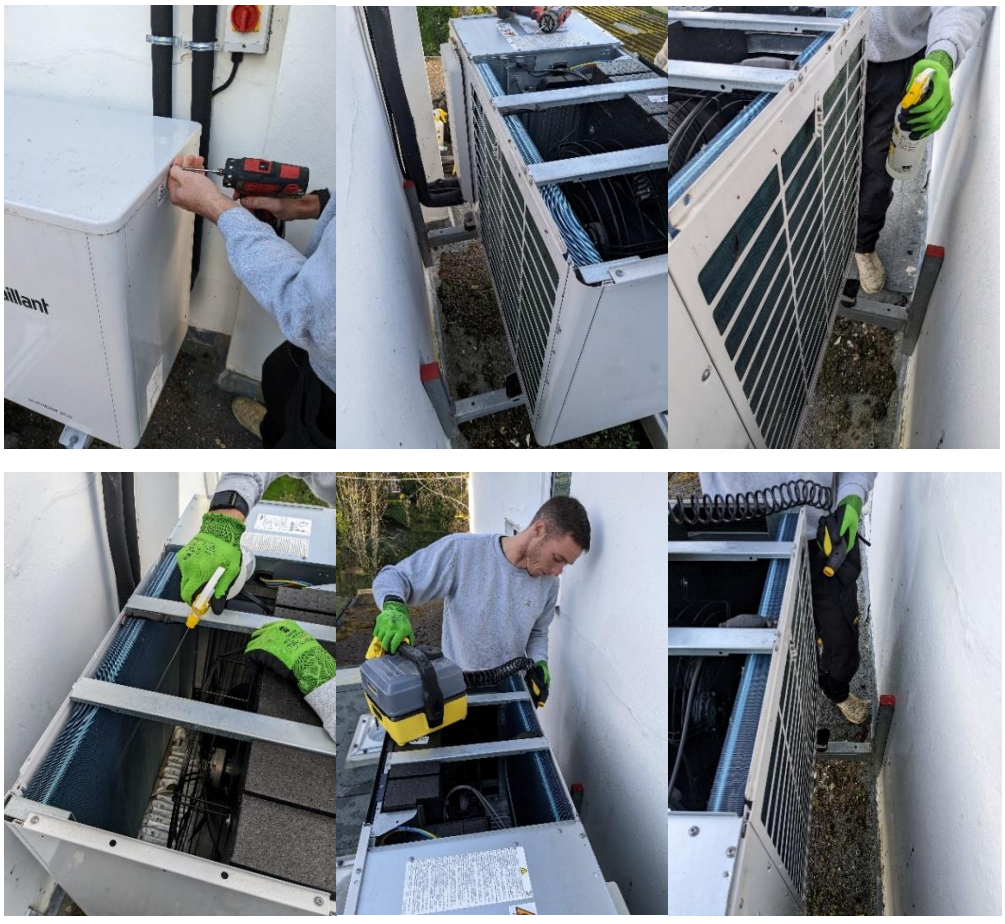
2.4.1. External unit (ASHP)

Isolate power to the heat pump system before undertaking any maintenance work

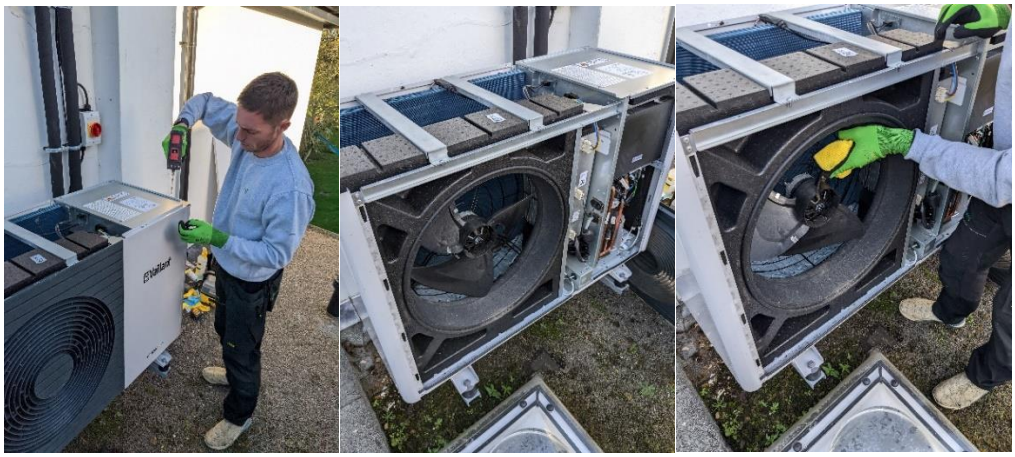
- Visual check of evaporator
  - Check fin condition – straighten fins with fin comb if necessary
- Clean evaporator
  - Any reduction of air flow and/or heat transfer will effect product performance
  - Remove top cover and spray evaporator with coil foam cleaning. Leave for 5mins and then spray off with a medium pressure sprayer – Refer to Pic.2
- Visually check condition of fan
  - Remove front cover and clean fan of dirt and debris if necessary – refer to Pic.3.
  - If in good condition, please just note on the service sheet
- Clean outdoor unit facia
  - Use foam facia cleaning and damp cloth – refer to Pic.4
- Confirm outdoor unit clearances
  - Typically 200mm to 300mm from back of wall to obstruction
  - Typically 1000mm in front of unit to obstruction
  - 125mm from ground to unit
  - No more than 4 surfaces
- Clear HP strainer
  - Clear strainer and make note of system condition on service report. See Pic.5
- Freeze protection (monobloc units only)
  - The system water requires freeze protection to stop possible damage to the condenser. There are 3 types of freeze protection
    - Caleffi anti-freeze valve – this should be installed at the lowest point into the unit.

  - HP anti-freeze setting – Nibe and Stiebel Eltron do not require anti-freeze protection as they have an inbuilt setting which will run there circulation pump to stop possible freezing
  - Glycol – If none of the above are applicable then a concentration of glycol will need to provide freeze protection down to -10°C. If lower, then it should be noted as an advisory on the service report.
  - Glycol pH value
    - Greater than 7.5 – Good
    - 7.5 - 7.0 – Ok but requires monitoring
    - Less than 7.0 – Poor and advise changing
- Adequate drainage for condensation/defrost
  - All units will start defrosting when the outdoor temp gets down to circa 2°C and could produce up to 10 litres of water in one defrost. To ensure this excess water does not cause a slip hazard, there should be drainage to accommodate this.
- Pipework insulation
  - All pipework should be insulated in its entirety (incl. valves) using an O class insulation (Armaflex or similar) and UV resistant.

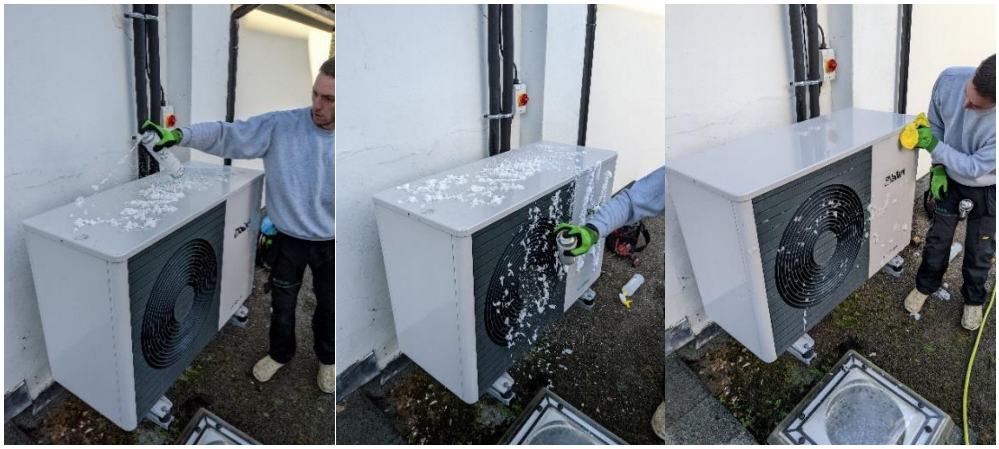
Pic.2 – Example Vaillant aroTHERM Plus unit evaporator clean



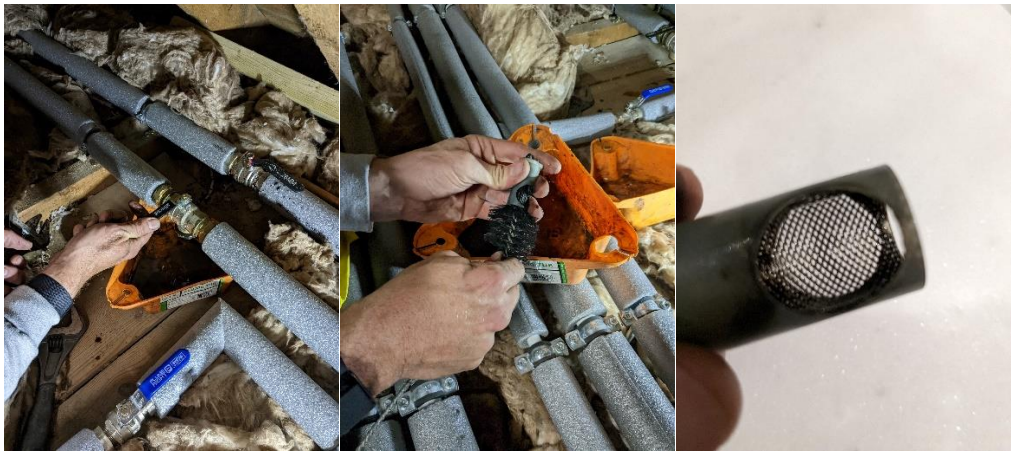
Pic.3 – Removal of front cover to inspect fan



Pic.4 – Cleaning of outdoor unit facia



Pic.5 – Cleaning strainer

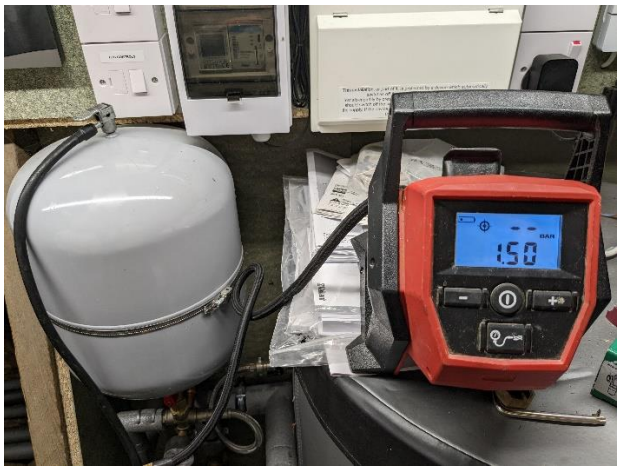


2.4.2. Internal unit (GSHP)

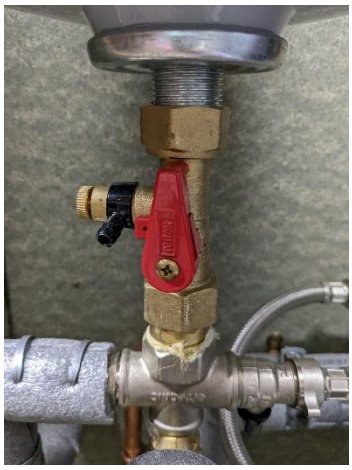
Isolate power to the heat pump system before undertaking any maintenance work. Before starting, note down collector details, if information is not available, ask the client for details on the collector type and size.

- Clean collector strainer – see Pic.5
- Thermal Transfer Fluid (TFF) make and type
    - Concentration percentage – this should provide min -10°C freeze protection
    - TFF pH value
        - Greater than 7.5 – Good
        - 7.5 - 7.0 – Ok but requires monitoring
        - Less than 7.0 – Poor and advise changing
- Collector pressure
    - Between 1.0 and 2.0 bar
- Collector expansion vessel charge
    - 0.1 bar lower than set collector pressure – recommend 1.5 bar. See Pic.5
    - Only check if expansion vessel can be isolated safely using an service valve. See Pic. 6. Recommend if not installed for future maintenance.
    - Check Schrader valve is not leaking using leak detector spray. See Pic. 7
    - If Schrader valve fails, replace Schrader and note on service report. See Pic.8
- Collector pipework insulation
    - Ensure all pipework is insulated. Possible condensation issues on pipework or valves uninsulated. Advisory only

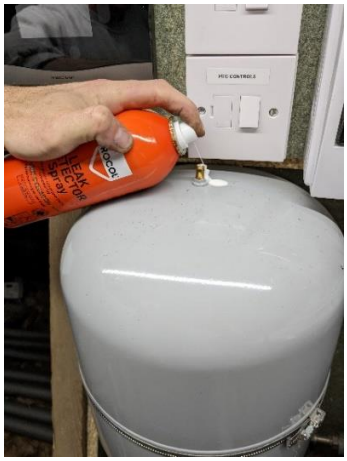
Pic.5 – Exp. Vessel testing



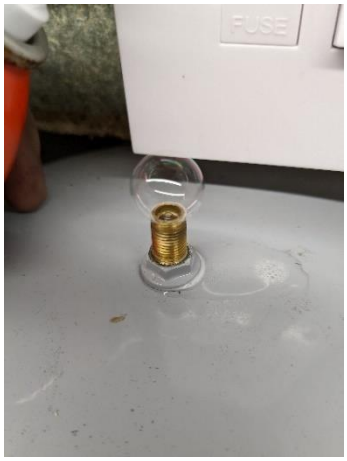
Pic.6 – Exp. Vessel service valve



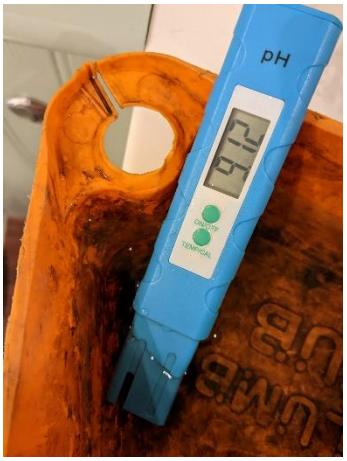
Pic.7 – Testing Schrader valve



Pic.8 – Failed Schrader valve



Pic.9 – Heating system pH test



2.4.3. Heating system checks

Isolate power to the heat pump system before undertaking any maintenance work.

- Heating system pressure
  - Between 1.0 and 2.0 bar
- Heating system expansion vessel charge
  - 0.1 bar lower than set heating system pressure – recommend 1.5 bar. See Pic.5
  - Only check if expansion vessel can be isolated safely using an service valve. See Pic. 6. Recommend if not installed for future maintenance.
  - Check Schrader valve is not leaking using leak detector spray. See Pic. 7
  - If Schrader valve fails, replace Schrader and note on service report. See Pic.8
- Clean any strainers – refer to Pic.5
- Check heating system pH – refer to Pic.9
  - Heating system pH value
    - 10.0 - 8.2 – Good
    - 8.1 - 7.5 – Ok but requires monitoring
    - Less than 7.5 – Poor and corrosion taking place
      - Note issue on service sheet and inform customer. Recommend Elysator products

Once ***2.4.4 Electrical checks*** are complete and system is powered up. Check the following;

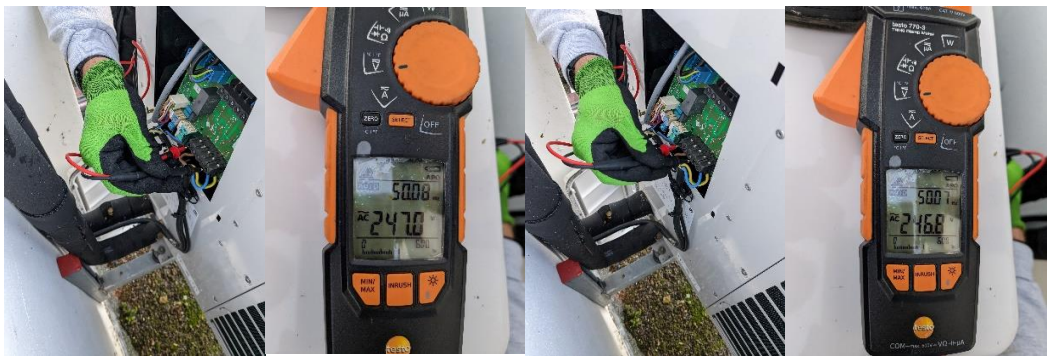
- Emitters are heating the home as expected
  - Check with customer if any issues and note on service report
- Heating delta T is between 5K – 10K
  - If 5K or less than, then slow down heating circ pump speed
  - If 10K or higher, then increase pump speed
    - Also ensure there is no restrictions in the system which could slow down flow rate
- Check setup of heating controls – refer to ***2.1 Heat Pump setup and control***

2.4.4. Electrical checks

Prior to undertaking any electrical checks, you must follow the safe isolation procedure to ensure the appliance is safely isolated from the mains power supply.

- Confirm type of electrical supply – Three Phase or Single Phase
- Safe procedure to isolate equipment
    - Identify local isolator and inform client that you will be turning the supply off
    - Isolate supply
        - If you leave the area of the isolator while working, you must fit safety locks or repeat procedure
    - Confirm supply is dead at equipment
        - Use voltage tester
    - Undertake work
- Resistance to earth test
    - With power isolated, test resistance between Live and Earth
    - This is to ensure no live conductors are in contact with the appliance or Earth cable
    - Recommended reading – greater than 2MΩ
    - If lower, then further investigation required by a competent Electrician.
- Short circuit test
    - With power isolated, test resistance between Live and Neutral
    - This is to ensure that no circuits in the system are overloaded
    - Recommend reading – greater than 50Ω
    - If lower, then further investigation required on system components.
- Turn on power and test incoming voltage
    - Single phase readings should be between 216V – 253V (Pic.10)
        - Anything out of this range should be noted on the service report and the client should notify their local Distribution Network Operator (DNO)
    - Three phase readings should be between 376V – 440V
        - Anything out of this range should be noted on the service report and the client should notify their local Distribution Network Operator (DNO)
    - Reading between Neutral and Earth
        - Less than 2V – if larger there could be an overloading issue. Recommend a competent Electrician to investigate
- Visual condition of electrical install
    - Please note visual condition of the electrical install on the service report.

Pic.10 – Electrical checks on ASHP (L-E & L-N)

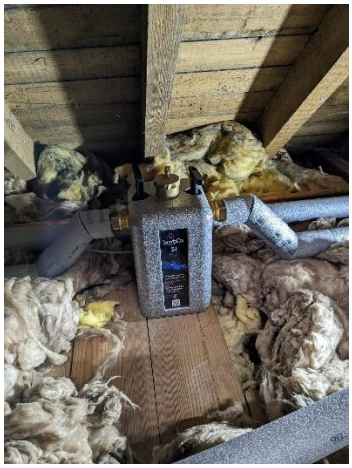


2.4.5. Elysator product checks

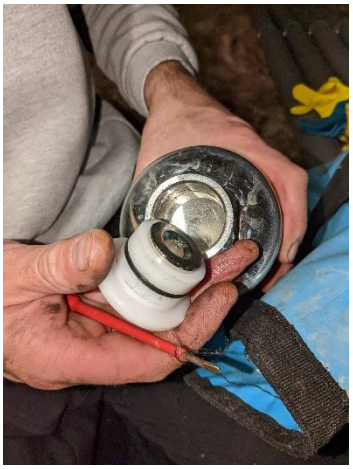
If an Elysator Sorbox or Trio has been installed onsite, the unit will need to be cleaned and there are a few checks required to ensure the units anode hasn't completely deteriorated.

- Isolate valves on Sorbox, remove insulation block and collection chamber – Pic.11
- Remove magnet on collection chamber – Pic.12
- Clean collection chamber if required – note any fouling or magnetite on service sheet – Pic.13
- Remove anode and test using multimeter – Pic.14
    - Connect probes either side of anode and set multimeter to VDC
    - Reading parameters
        - 1.0 - 0.5 – anode good
        - 0.5 - 0.3 – Needs monitoring
        - Less than 0.3 – requires changing

Pic.11 – Sorbox Si unit isolated

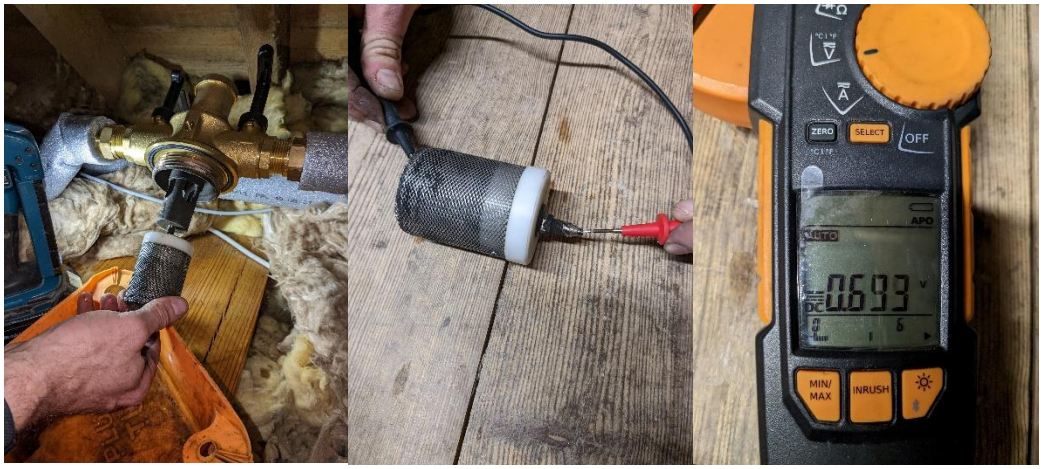


Pic.12 – Removing magnet



Pic.13 – Inside chamber

Pic.14 – Sorbox Si anode test

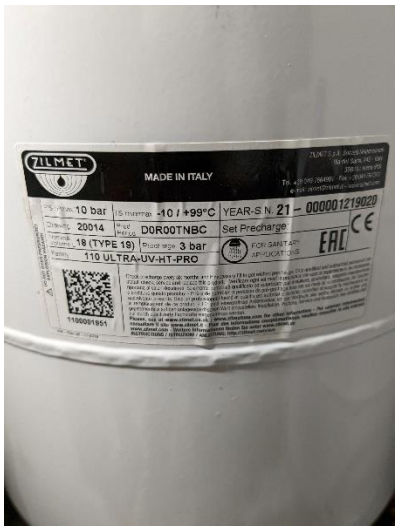


2.4.6. DHW Cylinder

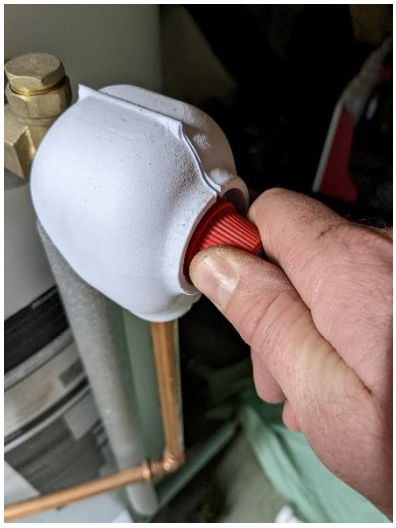
Domestic Hot Water (DHW) cylinders require annual maintenance. See checks below

- Visual check of cylinder and pipework
  - Notes any defects of the service sheet
- Check flow rate
  - Min flow rate of 15l/min
  - If flow rate has decreased then check strainer in combi valve and clean if necessary
- Check incoming water pressure
  - Between 1.0 and 10.0 bar
  - Pressure Reducing Valve (PRV) recommended setting – 3 bar
- DHW expansion vessel charge
  - 0.1 bar lower than PRV setting – recommend 2.9 bar. See Pic.5
  - Check Schrader valve is not leaking using leak detector spray. See Pic. 7
  - If Schrader valve fails, replace Schrader and note on service report. See Pic.8
- Test T&PR and Expansion Valves
  - Open valves to ensure they are discharging safely
  - If they do not reseat, then new valve will be required
- Ensure discharges are installed correctly
- Check immersion continuity
  - If 3kW it should be circa 20Ω

Pic.15 – Check exp. Vessel precharge



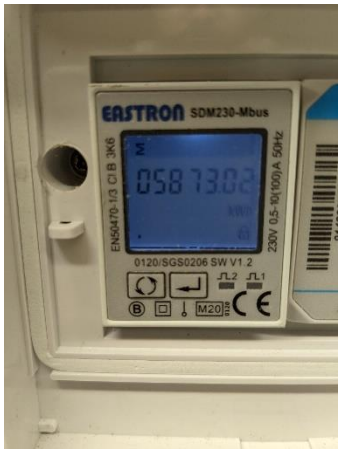
Pic.16 – Check T&PR Valve



2.5. kWh and Heat meters

Any MCS installs post 2020 should have a kWh meter (Pic.17) fitted. This meter records the electrical consumption of the heat pump installation and should be recorded annually. Please record this figure on any service report and also any other meters fitted, incl. heat meters (Pic.18).

Pic.17 – kWh meter



Pic.18 – Heat meter