

Service instructions

# **Service instructions for handling A2L refrigerants for domestic heat pumps with Genesis control**



Thermia AB is not liable or bound by warranty if these instructions are not adhered to during installation or service.

The English language is used for the original instructions.  
Other languages are a translation of the original instructions.  
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## 1 General service instructions

### 1.1 Checks and preparations

#### Area checks



Compliance with national gas regulations shall be observed.



Service, maintenance and repair such as: breaking into the refrigerant circuit; opening of sealed components; opening of ventilated enclosures, shall be performed as recommended by Thermia and only by competent personnel.



All maintenance staff and others working in the local area shall be instructed on the nature of work being carried out. Work in confined spaces shall be avoided.

#### Warning



In accordance to IEC60335-2-40:2018, prior to installation, the appliance shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance, an operating electric heater or a hot surface with a temperature above 700 °C).

#### Warning



Under no circumstances shall potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) shall not be used. Be aware that refrigerants may not contain an odour. Do not pierce or burn. If a leak is suspected, all naked flames shall be removed/extinguished. If a leakage of refrigerant is found which requires brazing, all of the refrigerant shall be recovered from the system.



Prior to work taking place, the area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks. "No Smoking" signs shall be displayed.



This appliance is charged with R452B, a mildly flammable refrigerant.

Service personnel shall have competence about:

- The explosion potential of flammable refrigerants to show that flammables may be dangerous when handled without care.
- Potential ignition sources, especially those that are not obvious, such as lighters, light switches, vacuum cleaners, electric heaters.
- The different safety concepts (Unventilated, Ventilated enclosure, Ventilated room).
- Refrigerant detectors.

- The concept of sealed components and sealed enclosures according to IEC 60079-15:2010.
- The correct working procedures for commissioning, maintenance, repair, decommissioning and disposal.

Ensure that the area is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.

The following leak detection methods are deemed acceptable for R452B refrigerant:

- Electronic leak detectors may be used to detect refrigerant leaks. (Detection equipment shall be calibrated in a refrigerant-free area.) Ensure that the detector is not a potential source of ignition and is suitable for R452B. Leak detection equipment shall be set at a percentage of the LFL (Lower Flammability Limit) of the refrigerant and shall be calibrated to the refrigerant employed, and the appropriate percentage of gas (25% maximum) is confirmed. (The LFL of R452B is 0,31 kg/m<sup>3</sup>).
- Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine shall be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work.

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire extinguishing equipment shall be available at hand. Have a dry powder or CO<sub>2</sub> fire extinguisher adjacent to the charging area.

For maximum refrigerant charge (mmax), see type plate on heat pump.

## 2 Emptying and filling A2L refrigerant

### 2.1 Preparations before opening the refrigerant circuit

The following instructions are in accordance with Swedish national gas regulations and make no differences between A3, A2 & A2L refrigerants.

Make sure that you use tools and equipment that is suitable for the actual refrigerant and its characteristics. Always have a Class C powder extinguisher nearby when performing the work.


### 2.2 Before emptying the refrigerant

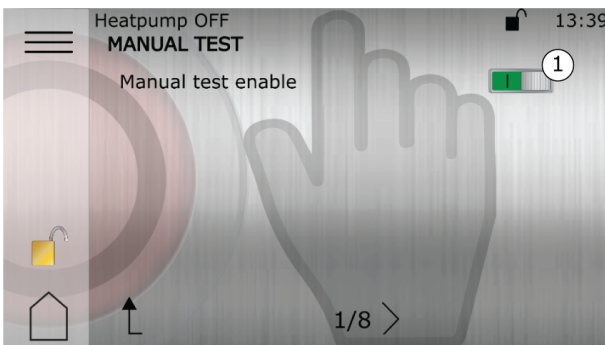
#### Danger



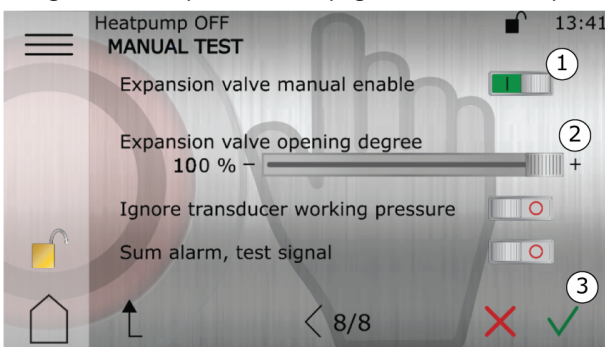
When an HFC/HFO refrigerant burns it will produce the gas Hydrogen Fluoride, which is very corrosive to the skin and when inhaled. The symptoms can be delayed several hours, due to the corrosive nature of the gas, and with any feelings of a burning sensation to the skin, if you have difficulties breathing or other acute symptoms, immediately call your emergency telephone number.


Before starting:

- Make sure the expansion valve is fully open. This is done in the display, in Manual test. Log in and set the opening degree to 100%. This is made to be able to flush the system with Nitrogen gas and also to make it easier to empty and do vacuum suction of the circuit.
- Press Settings  and navigate to MANUAL TEST.
- On the first page, activate MANUAL TEST by pressing/pulling the switch to the right (1), so it turns green and the hand appears.



- Navigate to the expansion valve page. Activate (1) and pull the lever for the opening degree to 100% (2).



- Confirm settings by pressing  (3).

- When the expansion valve is fully open (after about 10 seconds from confirming in the display), remove the stepper motor by pulling it straight out from the valve.



- Cut the power to the heat pump (to be able to connect the gauge manifold with an equipotential bonding). The expansion valve is now open.

The refrigerant circuit should not be open longer than necessary, to avoid air from entering the circuit. Therefore don't open the refrigerant circuit before all the tools and time needed is in place. If the work is aborted, the circuit has to be closed and filled with Nitrogen gas to a small over pressure. The dry filter shall always be exchanged when the circuit has been open.

Additional safety measures:

- Always start the personal leakage detector or electronic leakage detector before entering the work area. Don't turn off the detector before the work is done. The gas detector shall cover and be calibrated to R452B, with an alarm level set to 20% of LFL, or lower.
- Ventilate the work area.
- Eliminate ignition sources and keep a class C powder extinguisher close by.
- If an indirect refrigerating circuit is being used, the secondary circuit shall be checked for the presence of refrigerant.
- Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
- Repair and maintenance to electrical components shall include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then no electrical supply shall be connected to the circuit until it is satisfactorily dealt with. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution shall be used. This shall be reported to the owner of the equipment so all parties are advised.
- That capacitors are discharged: this shall be done in a safe manner to avoid possibility of sparking.
- That no live electrical components and wiring are exposed while charging, recovering or purging the system.
- That there is continuity of earth bonding.

### 2.3 Emptying the refrigerant, step by step

According to IEC 60335-2-40 several of these steps are optional.

1. Check and make sure that the atmosphere is safe before starting the work with a gas detector fulfilling the requirements above mentioned.
2. Place a fan so that a good circulation of the air is achieved at the working area. Connect it to a socket at least 3m away from the point of the circuit being open.
3. Connect the power supply to the emptying unit at least 3m away from the point of the circuit being open.
4. Make sure that the refrigerant cylinder, the refrigerant circuit and the emptying unit are equipotentially bonded.
5. Make sure all valves on the circuit is open, so that any excess refrigerant can be evacuated.
6. Start tapping the refrigerant.
7. Check the connections on the emptying unit and the refrigerant cylinder with a leakage detector during the work procedure, to make sure that there is no leakage that can create a dangerous atmosphere.
8. Empty the system down to 0,6 bar(a) or lower. Empty completely for scrapping.
9. Flush the system with Nitrogen gas for at least 5 minutes, on the low pressure service valve and expansion valve fully **OPEN**, with the pressure set to around 1,0 bar(e).
10. Place the vacuum pump in a well ventilated space or outdoors. Check that any leaking gas from the vacuum pump cannot create a dangerous atmosphere.
11. Set the ON/OFF button on the vacuum pump to ON and connect it to a power source at least 3m from the point of the circuit being open. Start suction to around 0,3 bar(a).

12. Flush the system again with Nitrogen gas for at least 5 minutes, on the low pressure service valve and the expansion valve **CLOSED**, to ensure that the compressor gets thoroughly flushed. In this step, the stepper motor needs to be put back into place with the expansion valve set to 0% opening degree in the display.
13. Before work on the refrigerant circuit, the pressure in the circuit has to get lower still, with more vacuum suction down to a pressure of 2 mBar, before cut off with dry Nitrogen gas. When the recovering unit is emptied, flushed with Nitrogen gas, vacuum sucked and protectively filled with dry Nitrogen gas, can the work on the refrigerant circuit start in a safe manner.

### 2.4 Refilling the refrigerant, step by step

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According to IEC 60335-2-40 several of these steps are optional.

When refilling the refrigerant, be sure not to over fill the circuit. The amount must be weighed according to the amount printed on the manufacturers sign on top of the heat pump or be filled after subcooling (no bubbles in the sight glass).

Prior to recharging the system, it shall be pressure-tested with the appropriate purging gas. The system shall be leak-tested on completion of charging but prior to commissioning. A follow up leak test shall be carried out prior to leaving the site.

1. Place the fan so that sufficient ventilation is achieved at the work area. Then connect the fan to a power supply at least 3m from the point of the circuit being open.
2. Place the refrigerant cylinder on a scale prepared for the refrigerant amount.
3. Connect the refrigerant cylinder and make sure that the refill hose is vacuum suctioned.
4. Make sure the refrigerant cylinder and the refrigerant circuit are equipotentially bonded.
5. Ensure that contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimise the amount of refrigerant contained in them.
6. Cylinders shall be kept in an appropriate position according to the instructions.
7. Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
8. Label the system when charging is complete (if not already).
9. Extreme care shall be taken not to overfill the refrigerating system.
10. Check with a leakage detector to make sure that no leakage is present that can create a dangerous atmosphere.
11. Start filling the R452B refrigerant.
12. Do leakage tracing with spray or soap water or with an electronic leakage detector.
13. Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges or any other adverse environmental effects. Also take into account the effects of aging or continual vibration from sources such as compressors or fans.



### 3 Decommissioning

#### 3.1 Decommissioning

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Prior to the task being carried out, an oil and refrigerant sample shall be taken in case analysis is required prior to re-use of recovered refrigerant. It is essential that electrical power is available before the task is commenced.

1. Become familiar with the equipment and its operation.
2. Isolate system electrically.
3. Before attempting the procedure, ensure that:
  - mechanical handling equipment is available, if required, for handling refrigerant cylinders;
  - all personal protective equipment is available and being used correctly;
  - the recovery process is supervised at all times by a competent person;
  - recovery equipment and cylinders conform to the appropriate standards.
4. Pump down refrigerant system, if possible.
5. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
6. Make sure that cylinder is situated on the scales before recovery takes place.
7. Start the recovery machine and operate in accordance with instructions.
8. Do not overfill cylinders (no more than 80 % volume liquid charge).
9. Do not exceed the maximum working pressure of the cylinder, even temporarily.
10. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
11. Recovered refrigerant shall not be charged into another refrigerating system unless it has been cleaned and checked.

#### Labelling

Equipment shall be labelled stating that it has been de-commissioned and emptied of refrigerant. The label shall be dated and signed. For appliances containing flammable refrigerants, ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

#### Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovered refrigerant and labelled for that refrigerant (i.e. special cylinders for the recovery of refrigerant). Cylinders shall be complete with pressure-relief valve and associated shut-off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of all appropriate refrigerants including, when applicable, flammable refrigerants. In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak-free disconnect couplings and in good condition. Before using the recovery machine, check that it is in satisfactory working order, has been properly maintained and that any associated electrical components are sealed to prevent ignition in the event of a refrigerant release. Consult manufacturer if in doubt.

The recovered refrigerant shall be returned to the refrigerant supplier in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerants in recovery units and especially not in cylinders.

If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The evacuation process shall be carried out prior to returning the compressor to the suppliers. Only electric heating to the compressor body shall be employed to accelerate this process. When oil is drained from a system, it shall be carried out safely.







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