



Interference with radio communications services caused by heat pumps

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- Heat pumps can interfere with radio communications services, especially if the installer does not follow the manufacturer's installation instructions precisely.
- Installations must therefore be installed in accordance with the recognised engineering practices and meet the legal requirements on electromagnetic compatibility.
- If OFCOM is notified of interference, it carries out measurements. If the legal requirements are not met, the owner must have the installation refitted or, if necessary, switch it off.
- If an installer repeatedly fails to install a heat pump correctly, OFCOM may impose a fine of up to CHF 5,000.

1 Introduction

This factsheet provides information on the undesirable effects of heat pumps on the electromagnetic spectrum, which can lead to interference with radio communications services. It is intended for all current and future owners of heat pumps and the businesses that install and manufacture these systems. It explains the legal requirements in connection with electromagnetic compatibility and what needs to be considered when installing a heat pump. It also describes what action OFCOM takes when a heat pump causes interference and how it carries out inspections. Finally, this factsheet also lists the legislation relating to the electromagnetic compatibility of heat pumps.

2 Fixed installation

From a legal point of view, heat pumps are fixed installations. According to the Ordinance on Electromagnetic Compatibility (OEMC) [1], a fixed installation is 'a particular combination of apparatus and if applicable other appliances that are connected or installed together and which are intended to be used permanently at a predefined location' (Art. 2 let. c OEMC).

As fixed installations, heat pumps must fulfil the following requirements:

- The installation must fulfil the essential requirements. This means that it must not interfere with other installations and must have a sufficient level of immunity to electromagnetic disturbance (Art. 4 OEMC).
- The installation must be built in accordance with the recognised engineering practices. Its components must be installed in accordance with the manufacturer's instructions. The installation must be documented by the installer and this documentation must be retained by the owner for as long as the installation is in operation (Art. 20 OEMC).

3 Interference by heat pumps

Modern heating systems with heat pumps often use frequency inverters. Frequency inverters control the speed of the compressors and generate steep voltage edges. This typically results in the generation of high-frequency electromagnetic emissions that can be emitted via components and inadequately shielded cables. Such emissions can interfere with the electromagnetic spectrum and disrupt radio communication services or other electronic devices.

In practice, various factors can cause EMC interference. The most common reasons are listed below and precautions to avoid them are outlined [5].

1. *Insufficient shielding of frequency inverters and cables*

If the shielding is missing or inadequate, high-frequency interference can escape unhindered.

- ➔ Use metal enclosures with conductive connections; ensure complete shielding with shielded cables. Use 360° shield contacting for shielding motor and control cables, fit EMC seals and ensure a good connection between the filter and the housing.

2. *Missing or incorrect installation of mains filters*

An improperly installed mains filter can aggravate the situation by creating resonant circuits or couplings that generate additional interference.

- ➔ Positioning: The mains filter should be mounted close to the frequency inverter on a shared metal mounting plate.

Cable routing: The connection between the filter and the inverter must be short and run directly on the mounting plate to minimise inductance.

Avoidance of coupling between input and output cables: To avoid feedback, do not run cables upstream and downstream of the filter bundled or in parallel.

3. *Inadequate potential equalisation*

Insufficient grounding and a lack of conductive connections between mechanical components can favour the spread of interference currents.

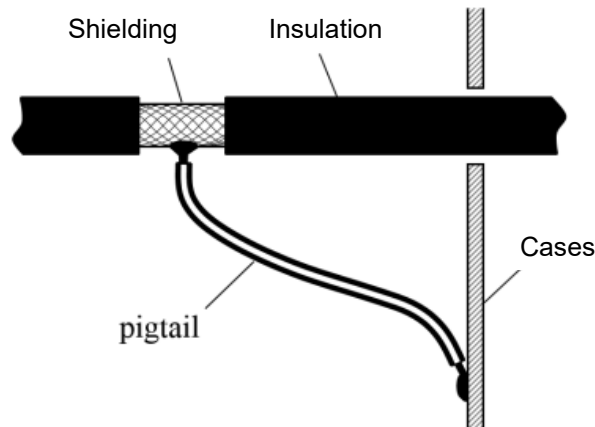
- ➔ Grounding: Instead of a star-shaped grounding, make low-resistance and short connections between all conductive parts to ensure the passage of return currents.

Conductive connections: Mechanical components such as chassis parts, supports and cable ducts should be electrically connected to each other.

Use of toothed washers: In the case of painted surfaces, toothed washers can penetrate the paint and ensure a conductive connection.

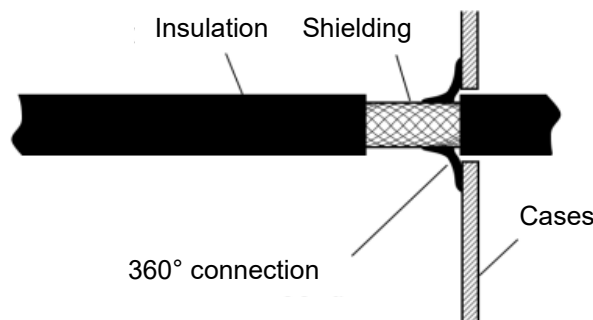
4. Poor shield connections

These long shield connections are known as 'pigtailed'. They have a higher inductance and considerably worsen the EMC properties.



Source: https://www.researchgate.net/figure/The-360-bond-a-where-the-shield-is-shortly-bonded-to-the-enclosure-all-around-its_fig5_320808774

- ➔ 360° connection: Cable shields should be connected to the housings of frequency inverters and motors on both sides and all round (360°).



Source: https://www.researchgate.net/figure/The-360-bond-a-where-the-shield-is-shortly-bonded-to-the-enclosure-all-around-its_fig5_320808774

Minimisation of inductance: Short and large-area connections reduce inductance and improve the shielding effect.

5. Unstructured cabling

Criss-crossing cables without clear separation of signal and power cables can lead to undesirable coupling and interference.

- ➔ Separation of the cables: Route the signal and control cables at a sufficient distance from the power cables or in different cable ducts.

Avoidance of crossings: If cables have to cross each other, this should be done at right angles if possible to minimise coupling.

Use of metallic cable ducts: These provide additional shielding and should be conductively connected to the chassis on both sides.

4 Consequences of incorrect installation

If OFCOM receives a report of interference with a radio communications service, it carries out measurements to establish the source of the interference. OFCOM assesses compliance with the essential requirements of a heat pump based on a recommendation issued by the Electronic Communications Committee ECC (ECC Recommendation (09)02 [2]). If the requirements are not met, the owner or operator must renovate the installation by a fixed deadline. If the installation has not been modified or has been insufficiently modified by the deadline, OFCOM may issue a ruling ordering it to be switched off.

OFCOM charges a fee to the operator of the installation for determining the cause of disturbance (Art. 29 OEMC).

5 Obligations of manufacturers & installers

For fixed installations, the manufacturer must provide the installer with EMC-compliant installation instructions. In those instructions, the manufacturer must request the installer to install the heat pump in such a way that it does not cause any interference.

According to Art. 20 OEMC, the installer of a heat pump is obliged to install it according to the recognised engineering practices. The installer must follow the manufacturer's installation instructions precisely. The installer must also provide the owner of the heat pump with documentation describing the recognised engineering practices applied. The owner must retain these documents for as long as the installation is in operation. The owner must make them available to OFCOM on request.

If an installation causes electromagnetic interference, the installer is informed in writing. If OFCOM establishes that other installations from the same installer are causing interference, it may, after threatening a penalty in accordance with Art. 56 para. 1 of the Federal Act on Weak and Heavy Current Electrical Installations [3], impose a fine of up to CHF 5,000.

6 Inspections

OFCOM monitors the radio frequencies to ensure their interference-free use. For this purpose, it can carry out inspections to ensure, for example, that heat pumps fulfil the technical requirements and do not cause any interference. OFCOM is also entitled to free access to the locations where the installation is located (Art. 24 para. 3 OEMC).

7 Useful links

Links to topics related to this factsheet are provided below.

- [1] Ordinance on Electromagnetic Compatibility (OEMC):
<https://www.fedlex.admin.ch/eli/cc/2016/18/en>
- [2] ECC Recommendation (09)02:
<https://docdb.cept.org/download/1824>
- [3] Electricity Act (ElecA):
https://www.fedlex.admin.ch/eli/cc/19/259_252_257/de
- [4] Telecommunications Act (TCA):
https://www.fedlex.admin.ch/eli/cc/1997/2187_2187_2187/en

8 Recommendation on the topic

The following link leads to a previously published article on this topic.

- [5] EMV-Störungen – und der Betrieb steht still (in German only):
<https://www.electra.ch/elektrotechnik/emv-stoerungen-und-der-betrieb-steht-still>

Note: This factsheet uses terms from the ordinance and the act, the texts of which are authoritative.