

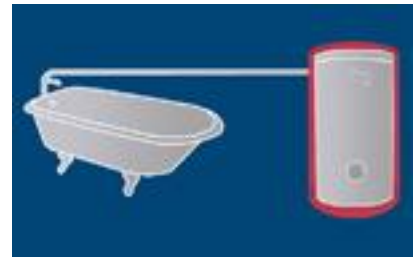


Electric water heaters

Date:

27 October 2016

Electric water heaters are fixed appliances for hot water production. When in operation, i.e. during the heat-up phase, they are the source of low-frequency magnetic fields. These fields occur in immediate proximity to the appliance and diminish rapidly with increasing distance.



It is not known whether the long-term impact of low-frequency magnetic fields presents a health risk. No effects are expected from short-term exposure to low-frequency emissions from electric water heaters.

Nevertheless, the following precautions will help to minimise exposure to the magnetic fields generated by electric water heaters:

- A minimum distance of 50 cm should be maintained between the electric water heater and sleeping places or spaces occupied for longer periods.

NB

- Adjust the heater such that the water is heated up to a temperature of 60 °C at least once a day in order to prevent the formation of pathogens (Legionella). In this regard take note of the FOPH recommendations
- Particular cantonal specifications may exist for electric heaters. Before installing a new individual heat storage unit enquire about them with the relevant cantonal energy departments



[Information to Legionella](#)



[Cantonal energy departments](#)



1 Technical data

Voltage: 230 V / 400 V
Output: up to approx. 10 kW
Frequency: 50 Hz

Electric water heaters comprise an insulated water cylinder, made from steel, austenitic stainless steel or copper alloy sheet, with an integrated electric heating system. Depending on the size of the cylinder, the heating system may incorporate one or more heating elements. Heat is generated by the flow of electric current through heating wires in the heating elements. This current generates a low-frequency magnetic field around the heating wires.

The water temperature can be manually set to up to around 80°C, the recommended setting being 60°C. Higher temperatures promote scaling, corrosion and heat loss [1]. The water should be heated up to a temperature of 60°C at least once a day to prevent the proliferation of pathogenic agents (Legionella bacteria). Further information on Legionella bacteria (German only) is provided on the following FOPH webpage:

[Legionellose](#)

To minimise heat loss from pipe runs, electric water heaters tend to be placed near the hot-water draw-off points (kitchen and bathrooms), i.e. within the living environment. Depending on their storage capacity and the electricity provider's tariff system, the heaters may be run only on nighttime off-peak electricity or may need topping up during the daytime with on-peak or flat-tariff energy. The heat-up times, which depend on the water temperature, water quantity and heat output, can last up to several hours.

2 Exposure to low-frequency magnetic fields

A survey commissioned by the FOPH (Federal Office of Public Health) set out to measure the magnetic fields generated by five different electric water heaters. The magnetic fields were observed to diminish rapidly with increasing distance from the appliance and, at 50 cm, are negligible. (Figure 1)

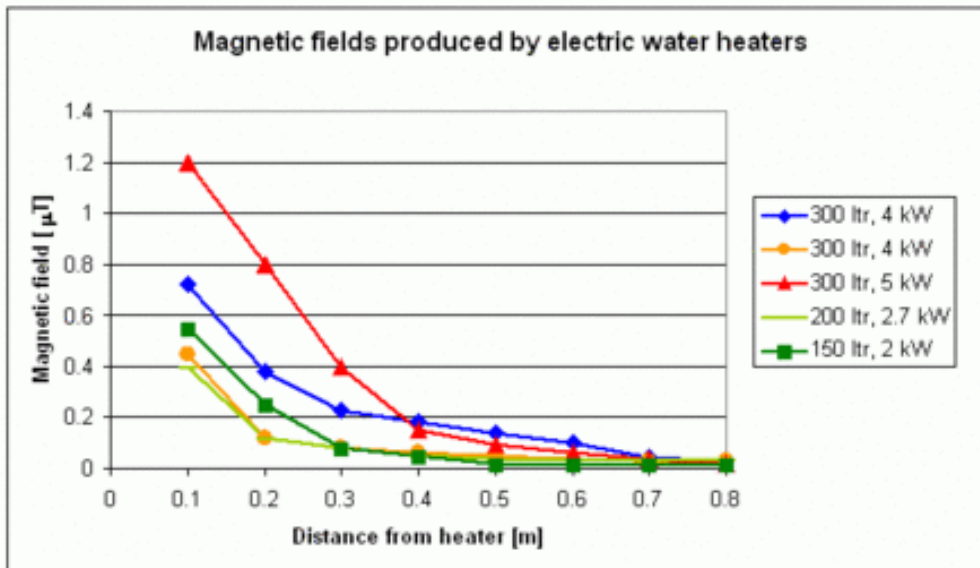


Figure 1: Magnetic fields generated by water heaters as a function of distance from the appliance: Measurements taken in front of four floor-mounted models (capacity: 200-300 ltr, power: 2.7-5 kW) and one wall-mounted model (capacity: 150 ltr, power: 2 kW)

3 Impact on health

Low-frequency magnetic fields can penetrate and induce electric current within the human body. When these currents exceed a certain value the central nervous system can be directly excited. The European threshold values for magnetic fields have therefore been set such that the current flowing in the body is at most one-fiftieth of the excitation threshold [2]. The magnetic fields (maximum 1.2 μT) from electric water heaters are much smaller than the threshold value of 100 μT . No effects are expected from short-term exposure as the present threshold values preclude acute damage.

In 2002 the International Agency for Research on Cancer (IARC) classified static and low-frequency magnetic fields as possibly carcinogenic (Group 2B) [3]. This was based on epidemiological studies that suggest that long-term and durable exposure to magnetic fields in the low-dosage area of 1 μT or even lower ($< 0.4 \mu\text{T}$) could increase the risk of Alzheimer's disease [4,5] or of childhood leukaemia [6,7]. Magnetic fields of 0.4 μT or more occur at a distance of up to 30 cm around electric water heaters. The possible risk can be eliminated by keeping 50 cm away from the appliance.



4 Regulation in law

Electrical central storage heaters are classed as low-voltage products and governed, in Switzerland, by the Ordinance on Low-Voltage Electrical Products [8]. This ordinance requires that low-voltage products - both when used properly and, wherever possible, in predictable cases of misuse or in the event of foreseeable malfunctions - pose no danger to either persons or property. Only low-voltage products that meet the essential health and safety requirements specified by the European Low-Voltage Directive (2006/95/EC) may be brought into circulation.

At the time any such a product is brought into circulation, the relevant manufacturer is required to issue a Declaration of Conformity confirming that the product complies with the essential requirements. The essential requirements for specific products are detailed in technical standards; electromagnetic fields produced by household appliances are covered by standard SN EN 62233 [9]. The conformity criteria set out here reflect the thresholds recommended by the EU [2]

The manufacturers themselves are responsible for ensuring that their products comply with the conformity criteria. While Switzerland has no comprehensive system of market controls, the Swiss Inspectorate for High Current Installations (www.esti.admin.ch) carries out random conformity checks on marketed products.



5 Literature

1. Borstelmann P, Rohne P. Handbuch der elektrischen Raumheizung. Heidelberg: Hüthig, 1993
2. RECOMMENDATION OF THE COUNCIL of 12 July 1999 on limiting the exposure of the population to electromagnetic fields (0 Hz - 300 GHz) (1999/519/EC)(1999/519/EC)
3. IARC. 2002. Non-ionizing radiation, Part 1: Static and extremely low-frequency (ELF) electric and magnetic fields. IARC Monographs on the evaluation of carcinogenic risks to humans, Volume 80. Lyon, France: International Agency for Research on Cancer.
4. Huss et al. Residence near power lines and mortality from neurodegenerative diseases: longitudinal study of the Swiss population. *American Journal of Epidemiology*. 169(2):167-75. 2009
5. Kheifets et al. Future needs of occupational epidemiology of extremely low frequency electric and magnetic fields: review and recommendations. *Occupational and Environmental Medicine*. 66(2):72-80. 2009
6. Kheifets et al. Pooled analysis of recent studies on magnetic fields and childhood leukaemia. *British Journal of Cancer*. 103(7):1128-35. 2010
7. Ahlbom et al. Review of the epidemiologic literature on EMF and Health; ICNIRP (International Commission for Non-Ionizing Radiation Protection) Standing Committee on Epidemiology. *Environmental Health Perspectives*. 109 Suppl 6:911-33. Review. 2001[1]
8. SR 734.26: Ordinance of 9 April 1997 on low-voltage electrical equipment (LVEO).
9. EN SN 62233 "Household and similar electrical appliances - Electromagnetic fields - Methods for evaluation and measurement"

Specialist staff

Federal Office of Public Health FOPH
emf@bag.admin.ch