

## Exposure limit to magnetic fields



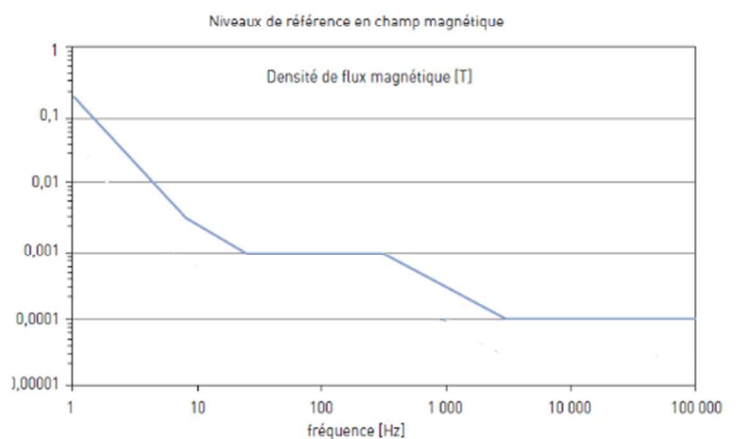
### Regulatory information

The regulatory situation in Europe regarding the exposure of people to electro-magnetic has been more specific for several years. European directive 2004/40/CE was released In April 2004 and was talking about it. Its application, first planned for April 30th 2008, has been postponed many times until the release of directive 2013/35/UE which abrogated directive 2004/40/CE. It is applicated in the French law since August 3th 2016 via the decree 2016-1074. The measures of this decree are applicable since January 1<sup>st</sup> 2017. This additional time allowed, among other things, to establish a new system of maximum time of exposure and reference levels for the frequencies between 0 Hz and 100 kHz. Indeed, the limits stated by directive 2004/40/CE were based on recommendations given in 1998 by the ICNIRP [International Commission on Non-Ionizing Radiation Protection], an organization globally recognized as an authority in the study of the effects of this kind of beam on health. In November 2010, the ICNIRP published new and less restrictive recommendations than the previous ones after review of what had been published since 1998. Much information on this topic can be found on the link below :

<http://www.icnirp.org/en/frequencies/low-frequency/index.html>

### Niveaux de référence pour l'exposition professionnelle à des champs électriques et magnétiques variables dans le temps (valeurs rms en conditions non perturbées)

Domaine de fréquences	Intensité de champ magnétique H (A.m <sup>-1</sup> )	Densité de flux magnétique B (T)
1 Hz - 8 Hz	$1,63 \times 10^9 / f^2$	$0,2 / f^2$
8 Hz - 25 Hz	$2 \times 10^4 / f$	$2,5 \times 10^{-2} / f$
25 Hz - 300 Hz	$8 \times 10^2$	$1 \times 10^{-3}$
300 Hz - 3 kHz	$2,4 \times 10^9 / f$	$0,3 / f$
3 kHz - 10 MHz	80	$1 \times 10^{-4}$





Concretely, as you can see in the board below, for the frequencies used in MPI, the values triggering the action become less restrictive than in directive 2004/40/CE. Moreover, the exposure of body parts is better characterized than before.

Summary of value at 50 Hz

	Directive 2004/40/CE Exposure head and torso (no specification)	Directive 2013/35/UE Exposure head and torso (general)	Directive 2013/35/UE (Exposure head and torso derogatory - cf NB1)	Directive 2013/35/UE Exposure of body parts	Directive 2013/35/UE Exposure of the public
Magnetic induction (mT)	0,5	1	6	18	0.1
Equivalent magnetic field in the air (A/m)	400	800	4800	14400	100

**NB1 : Derogatory conditions**

- You can be exposed longer if this is justified by the process used on working hours;
- Temporary exposure ;
- The employee must be informed of the situation ;
- Measures must be taken if brief symptoms appear.

*NB2 : if magnetic fields with harmonics are used (use of thyristor dimmer) le cas de champs magnétiques présentant des harmoniques (utilisation de gradateurs à thyristors), it will be required to take into account the exposure to multiple frequency fields at the same time. This is what the device EFA200 used by SREM does.*

Kindly note that as stated in article 14 of the directive, you can find non-restrictive practical guides to help putting this into place :

Volume1 (practical guide)

<http://bookshop.europa.eu/fr/guide-non-contraignant-de-bonnes-pratiques-pour-la-mise-en-uvre-de-la-directive-2013-35-ue-champs-lectromagn-tiques--pbKE0415140/>

Volume2 (case study)

<http://bookshop.europa.eu/fr/guide-non-contraignant-de-bonnes-pratiques-pour-la-mise-en-uvre-de-la-directive-2013-35-ue-champs-lectromagn-tiques--pbKE0415141/>

An interesting article from the INRS written in June 2014 makes an assessment of the current situation on directive 2013/35/UE.

<http://www.inrs.fr/dms/inrs/CataloguePapier/HST/TI-DC-5/dc5.pdf>

### Evaluation of SREM's equipments

SREM characterise their equipments in standard practical conditions (maximum power, neutral environment, ... ), which are not necessarily representative of real condition of use. The values are given as a guide and if doubts arise, conducting a study in real conditions of use is advised.

Example of results regarding a demagnetisation equipment



**Conclusion**

It is recommended to respect the following rules to minimize the risks regarding the exposure to magnetic field of low frequency when using a demagnetization or MPI equipment :

- Limit the emission at the source of the magnetic field by working in closed magnetic circuit (do not stop it in the air) or by ensuring the best coupling between the coil and the part. Please avoid using a coil with a big diameter to control a small part.
- If you can't limit the emission at the source, operating from a distance can be efficient to limit the exposure of the operator (defining a zone where there is no exposure for the operator). It can be required to make some operations automatic.
- Measuring the magnetic field by using a coil can easily and locally lead to go over the limit of limbs exposure. Do not put your hand on or close to a spire. if needed, move the probe away from the zone with an extension cable
- Regarding the exposure of hands it is recommended to keep them at 100mm away from any conductor in a magnetization cycle
- Because we do not know the sensitivity of cardiac pacemakers used today it is necessary to avoid exposing workers wearing them and to mark all the equipments generating magnetic fields with the appropriate logo.



It is the end user's responsibility to introduce a program with technical measures or/and organizational measures intended to prevent the exposure from exceeding the maximum value. The emission of magnetic fields is up to the operating conditions, it is necessary to define clear operating conditions and do measures within. In general, only the evaluation of the risk linked to the magnetic field is necessary in MPI and demagnetization (no risk on the electric field).