

Static Magnetic Field

What is it?

This is the large magnetic field generated by the magnet at the heart of the MRI scanner

What are the Units:

Magnetic field strength is measured in tesla (T). The most commonly encountered field strengths in clinical MRI are 1.5T and 3T. There are also lower and higher field-strength machines, including a number of 7T machines.

The maximum field strength is achieved at the centre of the magnet and drops off with distance from the scanner – this is known as the fringe field and it is often measured in millitesla (mT) or the old unit of gauss (G). For fringe field measurements note that 0.5mT = 5G.

Why is it important?

MHRA guidelines state that the MR ENVIRONMENT is defined as the region containing the 0.5 mT field line. The general public should not have access to this area and patients should be screened before entering.

As the field strength increases closer to the scanner, ferromagnetic objects will experience both an attractive force and a torque, or twisting, force.

Are there different limits for implants?

Implants that have metallic components may interact with the field of the scanner. Any ferromagnetic component will feel both attractive and torque forces. Typically, implants that are MR conditional will specify field strength as one of the conditions. It is important to check as there are some implants that may be safely scanned at 1.5T but that should not be allowed into a 3T scanner.

The field strength also determines the frequency of electromagnetic RF pulses used by the scanner to create the image. There are some implants where the limiting condition is the frequency of the electromagnetic RF pulse that they can be exposed to and therefore are MR Conditional at a specified field strength.

Further Reading:

MHRA 2016: Safety Guidelines for Magnetic Resonance Equipment in Clinical Use.

<https://www.gov.uk/government/publications/safety-guidelines-for-magnetic-resonance-imaging-equipment-in-clinical-use>

<https://www.sor.org/learning/document-library/safety-magnetic-resonance-imaging/5-static-magnetic-field>