MRI Shielded Rooms
RFI – The first choice for MRI Shielded Rooms

RFI Industries Pty Ltd of Melbourne, Australia, has supplied nearly all of Australia’s MRI Shielded Rooms and rooms throughout SE Asia, since Nuclear Magnetic Resonance Imaging commenced in 1985.

RFI has been the first choice of all MRI magnet suppliers because each RFI MRI Shielded Room is designed to suit:-

- the technical requirements of the particular MRI magnet to be installed
- the personality and budget of the clinic which will own / operate the room

RFI is Australia’s and Asia’s leading RF Shielding designer and manufacturer and EMC Testing laboratory

MRI

Magnetic resonance radiography utilises pulse shape high-frequency magnetic fields with high amplitude to excite nuclear spin.

The pulses generated are normally in the frequency range of 1-100 MHz.

The exciting frequency is equal to the precession frequency of the nuclear spin, resulting in nuclear magnetic resonance.

After excitation, induced signals resulting from the nuclear spin are generated, detected and evaluated by computer. The frequency of this induced signal corresponds to the precession frequency of the nuclear spin.

Protection from RF Interference

The local environment has to be shielded from radio frequency interference during the transmit phase which generates the “excitation pulse”.

And the magnet’s sensitive instrumentation has to be shielded from any local environment high frequency interference during the receiving ie measurement phase of the induced signals resulting from the nuclear spin.

Radio and TV station, power equipment, motors, fluorescent lights, motor vehicles, household appliances, computers and other medical equipment can create these environment of interfering signals or background radio frequency noise.

Level of Protection

Manufacturers of MRI systems specify their own particular level of shielding protection.

Attenuation levels of about 100 dB from 2 MHz to 100 MHz is usually required.

1.5T generated image of a female patient USING 5mm slice thickness and a partial saturation pulse sequence.
**Shielding Materials**

Non-magnetic – stainless steel, copper, brass or aluminium - for MRI Systems that produce large unenclosed magnetic fields

Magnetic – carbon steel - for MRI systems that have low magnetic fields or enclosed magnets that contain the magnetic field

**Enclosure Types**

**RFI Modular S900 series**

The preferred enclosure when accurate start and finish dates are required and on site time is to be limited to a few days.

RFI’s installation and test teams travels to all installations, worldwide.

All architectural shapes and finishes can be accommodated.

The RFI Modular S900 series can be supplied in steel or in copper and brass or a combination of steel and copper such as steel walls and ceiling with a copper floor.

The enclosure is fully demountable, prefabricated panel construction, capable of being erected or disassembled entirely from its interior without special tools.

The panels are joined by a framing system designed to provide electrically conductive joints between panels and provide the attenuation specified.

The finished installation is rigid in construction and free standing.

**Insitu**

Or shielding can be incorporated during the clinic’s or hospital’s building phase by RFI’s technicians attending on site and laying up copper or aluminium foil on walls, floors and ceilings which are framed and boarded by others.

The copper or aluminium foil is fixed and seamed in a specific manner to achieve high RF shielding integrity.

All doors, vents, windows and penetrations are factory manufactured from copper or brass and fixed in place on site and these items maintain non-ferrous continuity.

Finishes which may be of plasterboard, chipboard, wallpaper, floor tiles, acoustic materials are then applied over the foil, generally by the contracted building trades, in a manner so as not to puncture or otherwise jeopardise the electrical integrity of the shield.

**Non-Magnetic - Modular**

**RFI Modular S900 series**

Panels and framing is made from Stainless Steel sheet and Stainless Steel framing or Panels are made from copper sheet and brass extruded framing.

**Non-Magnetic - Insitu**

Insitu enclosures are invariably composed of non-magnetic materials.
Panels and Framing
The walls, floor and ceiling of RFI Modular 900 series Shielded Rooms consist of RFI’s copyrighted shielded panels held in place by RFI’s copyrighted framing system.

Doors, windows, waveguide vents and other penetrations are factory assembled into the relevant panels. Panel sizes are generally 1.2m x 2.4m or 1.5m x 3.0m. Larger panels, infill sizes and folded panels permit virtually unlimited architectural room geometry.

Panels
The panels consist of a 0.5mm sheet of steel or copper laminated top and bottom to a 12mm sheet of high moisture resistant medium density fibreboard.

Copper laminate has a natural surface finish. Steel laminate has an electroplated zincalume surface finish. The finished panel may be assembled as is or with an additional decorative coating of 2 coats of high quality enamel paint.

Panels are joined and supported by specially designed framing that clamp the edges and provide continuous, uniform and constant pressure contact against the shielding elements of the panels. Walls are self-supporting from floor to ceiling with no bracing against the parent room construction. The ceiling may be self-supporting or held by hangers from a host roof structure.

Framing
RFI’s unique framing system consists of four framing sections; M, U, hat and flat.

M and U sections mate to form the 90 degree panel joints. The hat and flat sections mate to form the panel lap joints. Jig manufactured assemblies of M, U, hat and flats form corners and junctions.

The panel and framing system has been tested to up to 105dB RF attenuation up to 40GHz frequency. The system is designed to provide 80dB attenuation at 60GHz.

Bolting
The mating straights, corners and junctions of Ms, Us, hats, and flats are locked together by a system of 6mm bolts and nutserts. The sections are slightly convexed to provide a positive spring tension which ensure long-term RF intimacy. RFI’s system is superior to others because bolting provides superior long-term fastening than self-tapping fasteners in common use elsewhere.

Materials
For non-magnetic modular rooms framing is of heavy brass extrusions and brass or stainless steel fasteners.

For magnetic modular rooms framing is of zinc electroplated 3mm thick steel die rolled to the required contour. The rolling provides additional work hardening which provides RFI’s superior springing action for long-term clamping intimacy. Fasteners are electroplated steel rolled and upset bolts and nutserts.

Ventilation
RFI’s MRI Shielded Rooms are equipped with waveguide vents, designed to permit maximum airflow for cooling, heating and ventilation without degrading the shielding efficiency of the enclosure.

RFI waveguide vents provide a head loss of a maximum of 2mm of water at 8m per sec air velocity.

Waveguide vents for MRI rooms consist of a 6mm octagon honeycomb 25mm long (thick) made of tin coated brass RF sealed into a flanged rectangular or circular unit sized to suit it intended use, which is RF sealed into the relevant wall or ceiling panel.
Section – Wall & Ceiling – Panel/Frame lap joint

- Counter sunk set screw
- Inner joint section
- 3mm packer
- Outer joint section

Section – Floor – Panel/Frame lap joint

Section – Wall & Ceiling – Panel/Frame lap joint

RFI's Panel and Frame system

Honeycomb Waveguide Vent
Architectural Freedom

RFI’s Panel and Frame System provides maximum architectural freedom

Typical RFI MRI Shielded Rooms
Services

Air-conditioning and ventilation is provided through honeycomb waveguide vent inserts.

Helium venting if required is provided by special penetration piping interfaces.

Power requirements are provided through special RF filters.

Signal and CCTV requirements likewise require special filters.

Fire sprinklers, and smoke detection are provided through special penetrations.

The magnet manufacturer’s penetration panel fits to a purpose designed and properly gasketed opening

Architectural Finishes

Interior finishes are virtually unlimited in scope, design, materials, colour or lighting

In-situ rooms are generally finished by others

Modular rooms are finished by RFI’s installation team in the manner and to the standard required by the room purchaser.

Most magnet manufacturers have their own finish standard which they prefer to maintain for continuity

RFI’s interior designers can provide concepts, designs, finishing materials and pricing at request.

RFI has a number of standard finishes and lighting arrangements.

RFI’s MRI Shielded Room commercial proposal always nominates the finishes and lighting to be provided for the quoted price

Clear View Windows

The RFI window lays the stainless steel mesh in a manner which eliminates the moire effects. Windows are glazes both sides

Design, Management

RFI offers a complete design service. RFI also offers a complete Project Management service to manage and expedite all items and trades required for the realisation of your MRI installation
Installation and Testing
RFI’s Installation and Testing teams travel worldwide to meet its exacting shielding installation and testing standards.

Versatile, Reliable
RFI Modular S900 series has been conceived to provide versatility and reliability and to encompasses the complete range of installation requirements and to suit all MRI systems.

RFI Modular S900 series shielded rooms are guaranteed for 15 years

RFI Modular S900 series shielded rooms are fully demountable and can be extended, re-shaped or relocated when owners trade or upgrade MRI magnets
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