

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 13 49 23 – RADIOFREQUENCY SHIELDING FOR MRI

PART 1 – GENERAL

1.1 DEFINITIONS

- .1 Hereinafter “Radiofrequency shielding” is also called “Faraday cage”, “RF enclosure” or “RF shielding”.
- .2 MRI supplier may vary for each RF enclosure and is defined outside of this section.
- .3 Hereinafter “Owner” refers to the individual or corporation or its designated representative who orders the work. Also, hereinafter “General Contractor” refers to the individual or corporation responsible for the execution of all the works. Finally, hereinafter “Contractor” refers to the individual or corporation responsible for the shielding work.

1.2 SCOPE OF WORK

- .1 Supply and install RF shielding to allow the use of MRI equipment. The shielding must be continuous on the walls, the floor and above the finished ceiling of the MRI room.
- .2 Supply and install MRI machine seismic anchors through RF shield floor.
- .3 Supply and install penetration systems for electrical and mechanical services through the walls of the RF shield.
- .4 Provide all elements required for the installation, finishing and good performance of the RF shielding.
- .5 Provide shielded doors, windows and hatches as shown on the architectural drawings.

1.3 SUBMITTALS

- .1 Submit a data sheet for each of the products prescribed in accordance with the prescriptions of the General Conditions of the contract. Data sheets for the following products must be provided in particular :
 - .1 RF Shield main enclosure materials;
 - .2 RF shielded foors and windows with their hardware;
 - .3 All filters (electrical, ventilation, medical gases and others);
 - .4 Supports and anchor points used for interior finishing and electromechanical services inside RF shielding.

1.4 WARRANTY

- .1 Provide a written, joint and combined guarantee from the manufacturer and the installer (Contractor), signed and issued in the name of the Owner, for materials and labour, certifying that :
 - .1 For RF shielding, the parts and labor warranty is for a minimum period of 15 years.
 - .2 The warranty shall apply from the date of provisional acceptance by the General Contractor.

PART 2 – PRODUCTS

2.1 PRODUCTS AND INSTALLATION REQUIREMENTS

- .1 The RF shielding must respect the space provided on the layout plans regarding the parent walls. Any deviation from this constraint must be validated and confirmed by the contractor.
- .2 The shielding must include the doors, windows and access opening of the MRI as shown on the layout plans.
- .3 Doors and windows must provide adequate sound insulation to ensure noise reduction from the MRI. Doors should have an STC (Sound Transmission Class) of at least 39 and windows an STC of at least 41.
- .4 The door must be of the pneumatic type, the force required to open the door must not exceed 5 lbs (22N).
- .5 The finished floor level inside the RF shielding and the door thresholds at the entrance to it must allow the free movement of personnel and patients on foot or on rolling equipment (stretcher, wheelchair, etc) compatible for use in MRI.
- .6 An MRI access panel must be included. This panel must be removable and allows, once the construction of the RF shielding is completed, to enter the MRI in the exam room. This panel, once put back in place, must ensure the radiofrequency sealing of the exam room. The size of this panel must respect the minimum dimensions required by the manufacturer of the MRI.
- .7 The Contractor must indicate the dimensions and positions of the rough openings to be provided in the parent wall as well as the dimensions of the parent wall.
- .8 Installations adjacent to exterior walls must allow adequate air circulation between the two structures. This circulation must make it possible to avoid dead zones where the accumulation of humidity would cause damage to the structures.
- .9 The RF enclosure must contain the interior walls' tracks to allow the installation of interior walls without risk of damaging the RF enclosure.
- .10 The RF shielding floor must be protected by a protective layer ready to receive the finished floor covering.
- .11 RF shielding panels (wall, floor and ceiling) can be made of various materials or composites, including copper, galvanized steel, an alloy of several metals or other.
 - .1 Points of contact between two shielded panels must not be subject to galvanic corrosion.
 - .2 Hardware used to join, compress or connect shielding panels shall not be subject to galvanic corrosion in contact with RF shielding materials.
 - .3 The attenuation performance of the shielding material alone must exceed 110 dB of attenuation in the operating range of MRI 1.5T and 3.0T from 50 MHz to 150 MHz as tested according to MIL-STD-285.

2.2 STRUCTURE

- .1 RF shielding must be designed to meet the seismic requirements of the national building code.
- .2 The ceiling of the RF shield must be able to support a load of 63.5 kg per m² (13 pounds per square foot) for the various electromechanical and interior finishing elements that will be attached to it. These elements are suspended on specific anchors in the ceiling of the RF shield.
- .3 The RF shielding must contain the anchors and support plates necessary for the MRI components and other accessories such as positioning lasers.
- .4 Ceiling height of RF shielding to be as shown on layout drawings. In the event that no height is specified, a standard height of 3048mm (10 feet) is to be expected.

2.3 ELECTROMECHANICAL

- .1 RF shielding must include a sufficient number of input filters for electromechanical services as described in the mechanical plans provided by the Contractor.
- .2 The RF Shielding must include the filter for the evacuation of helium (Quench) according to the recommendations of the MRI supplier.
- .3 RF shielding must allow for the addition of filters in the future.
- .4 RF shielding must include a single ground serving all electrical services and equipment in the MRI environment.

2.4 RF SHIELDING PERFORMANCE REQUIREMENTS

- .1 Each RF shield must meet the performance criteria as described in the MRI supplier's final site preparation documents for all elements directly or indirectly connected to the RF shield. These criteria include, but are not limited to:
 - .1 Criteria related to radiofrequency protection;
 - .2 The criteria related to the anchors and support plates required for the components of the MRI system and the other accessories;
 - .3 The reservation for the MRI supplier's penetration panels;
 - .4 Criteria related to floor leveling and straightness;
 - .5 Criteria with respect to isolation of RF shield from ground.

PART 3 – EXECUTION**3.1 ANCHORS AND DRILLINGS**

- .1 Any anchoring in the concrete slab must be carried out without drilling or damaging the reinforcing bars.
- .2 In the event that a rebar is located at the planned location of an anchor, it is the responsibility of the General Contractor to put in place compensatory or corrective measures to ensure the structural integrity of the slab.

3.2 RF SHIELDING CERTIFICATION

- .1 The radiofrequency attenuation performance of the RF shield must be validated by the Contractor after the assembly of the RF shield is completed but before the interior finishing. The RF shielding must meet the performance criteria as described in section 2.4 of this specification. A test report must be provided by the Contractor. Testing for certification must be done according to the MIL-STD-285 standard.
- .2 A second validation of the radiofrequency attenuation performance of the RF shielding must be carried out following the installation of the MRI and the closing of the MRI access panel. The RF shielding must meet the performance criteria as described in section 2.4 of this specification. A test report must be provided by the Contractor.

3.3 MAINTENANCE

- .1 The Contractor must describe the recommended maintenance program for the RF shielding including, but not limited to:
 - .1 The type and a brief description of the maintenance to be performed as well as its frequency;
 - .2 Certifications or inspections required to confirm RF shielding performance and frequency.

END OF SECTION