SECTION 13096

RADIO FREQUENCY SHIELDING ENCLOSURE
Magnetic Shielding

Prepared by:

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PART 1 – GENERAL

1.1 GENERAL
A. Drawings and general provisions of the Contract, including Modified General Conditions and other Division 01 through 50 Specification Sections, apply to this Section.

1.2 SCOPE
A. Furnish and install magnetic shielding for Magnetic Resonance Imaging (MRI) exam room as shown on the plans and per requirements of the Imaging Equipment Manufacturer.
B. Work Included: Perform work required for the construction of the shielding as indicated. Such work includes, but is not limited to, the following:
   1. Furnish labor, material, equipment, plant tools, cranes, scaffolding, hoists, and incidental and related items to provide magnetic shielding as indicated on the drawings and specified herein.
   2. Shielding material below floor, on floor and walls.
   3. Methods of attachment of magnetic shielding to support structure.
   4. The magnetic shielding design shall be in strict conformity with the Imaging Equipment Manufacturer's requirements. Any deviations from the dimensional design, construction or material requirements shall have documented approval from the Imaging Equipment Manufacturer, with notification to the Architect. Coordination with the Imaging Equipment Manufacturer and other building and mechanical trades, including equipment suppliers.
C. Work Excluded:
   1. Work in connection with the support structure to receive magnetic shielding.
D. Submittals
   1. Certificates from the manufacturer of metal for magnetic shielding certifying material composition and annealing process.
   2. Coordination instructions for work with other trades.
   3. Shop drawings showing details of construction.

PART 2 – PRODUCTS

0.1 MANUFACTURERS
A. This section is based on products manufactured by Global Partners in Shielding; 90 Dayton Avenue, Unit 4B, Passaic, NJ 07055; Tel: 973-574-9077; Fax: 973-574-9078.
B. Substitutions: Not permitted.

2.2 STEEL SHIELDING

A. For shield installations where attenuation of the MRI magnetic field is required, magnetic shielding (typically M36 silicon steel or C1006 annealed plate steel) will be installed according to precise specifications as to thickness, location, and type of material. These specifications are to be supplied by others (typically the MRI equipment vendor) to the Shield Vendor prior to shield fabrication.

B. M36 Silicon Steel

1. The material for the magnetic shielding shall be Armco Di-Max M36 CR FP, bare, non-oriented electrical steel, or equivalent, with 2.25% maximum silicon content, 0.004% maximum carbon content and 0.65% maximum aluminum content.
2. Steel must meet requirements of ASTM 683 for fully-processed, non-oriented electrical steel.
3. Steel must not be handled with electromagnetic equipment.
4. Each sheet of steel must be flat under its own weight.
5. Material supplier must provide manufacturer’s certification with shipment.

C. C1006 annealed plate steel

1. Fully annealed AST, grade 1006 coarse grain steel (0.08% maximum carbon content, 0.45% maximum manganese content) for plates. Adhere to ASTM specifications.
2. Annealing process
   a. 600° F (316° C) for 1 hour.
   b. Ramp up to 1,000° F (538° C) in hour period.
   c. Hold at 1,000° F (538° C) for 0.5 hour.
   d. Ramp up to 1,550° F (843° C) over 1.5 hour period.
   e. Hold at 1,550° F (843° C) for 4 hours.
   f. Ramp down to 950° F (510° C) in 8 hour period.
   g. Ramp down to 350° F (177° C) in 6 hour period.
   h. Furnace cool
1. The annealing process used must ensure that all plates used in shield construction are exposed to the total annealing process defined above methods of annealing, in which the plates are stacked so that those on the interior are not subjected to the full heat treatment, are not acceptable.
2. Plate sizes should be a minimum size of 1/2 inch (1.3mm) in thickness, 2 feet (600mm) in width, and 8 feet (2,436mm) in length, unless physical dimensions prohibit, such as distances between doors, windows, corners of shield, and other openings in the magnetic shield. Long direction of plates on the sides, top, and bottom should be aligned with bore direction of magnet. Optimum plate sizes are as wide and as long as possible.
3. Steel grain orientation in floor, ceiling, and walls should be parallel to the magnet bore. Grain orientation in shield end-plates is non-critical.
4. Do not handle materials with electromagnetic equipment after annealing.
5. Rolling of magnetic shield plates after annealing, to eliminate warpage, is permitted.
6. all large openings in magnetic shield must be cut prior to annealing
7. Steel plates which are annealed are to be free of loose scale. The most effective method for doing this is sandblasting. Shot blasting is prohibited. Minor amounts of scale can be moved by wire brush. The interior shield surface shall be free to loose scale and steel particles which could become lodged inside the magnet.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation shall be performed by the vendor of the magnetic shielding. Installation shall proceed after structural surfaces are ready to receive magnetic shielding.

B. Silicon Steel Shielding:
   1. Fasten sheets to plywood and steel studs with each layer perpendicular to the previous layer.
   2. Welding is not permitted on silicon steel sheets.

C. The steel to be used for magnetic shielding shall not be handled with electromagnetic equipment after annealing.

D. The steel plates may be rolled or pressed to flatten, if required.

E. Overheating of steel plates shall be minimized. Liquid coolant shall be used during the drilling process.

F. Welding of gaps in excess of 1/8" is not permissible. In this case, lap plates must be used.

G. Shield plates must be rigidly supported to prevent movement resulting from air pressure or other environmentally induced changes which can alter the magnet's homogeneity or system performance.

H. Minimize the need for flame cutting of steel plate after annealing, because the material properties can be altered as a result of the stress induced by this process.

I. All large openings in magnetic shield must be cut prior to annealing.

J. The final shield fabrication drawings shall be sent to the Image Equipment Manufacturer for final approval. This shall be done through the Architect.
3.2 QUALITY ASSURANCE

A. The magnetic shielding vendor shall assist the Imaging Equipment Manufacturer in evaluating the performance of the magnetic shield. It is the responsibility of the magnetic shielding vendor to demonstrate compliance with the specification for material and installation.

B. The magnetic shielding shall be guaranteed for the life of its intended use.

END OF SECTION